Appendix B3

Construction Noise and Vibration Management Plan

The Northern Road Upgrade –
Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park

October 2018

NSW GOVERNMENT

Document control

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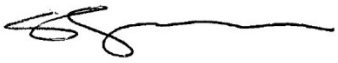
Approval and authorisation

Plan reviewed by:	Plan reviewed by:	Plan endorsed by:
		
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Revision history

Revision	Date	Description
0	08/06/2018	Draft for consultation
1	29/08/2018	Updated in response to DP&E, ER and consultation comments Issued for DP&E approval
2	27/09/2018	Final updated in response to DP&E comments
3	12/10/2018	Final updated in response to DP&E comments

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Glossary/ Abbreviations

Term	Expanded text
AFMP	Ancillary Facilities Management Plan
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
ANZECC	Australian and New Zealand Environment and Conservation Council
Attenuation	The reduction in the level of sound or vibration
CCS	Community Communication Strategy
CEMP	Construction Environmental Management Plan
CoA	Condition of approval
Compliance audit	Verification of how implementation is proceeding with respect to an OACEMP (which incorporates the relevant approval conditions)
CNVMP	Construction Noise and Vibration Management Plan
CSSI	Critical State Significant Infrastructure
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear
DEC	Department of Environment and Conservation (NSW) (former)
DECC	Department of Environment and Climate Change (NSW) (former)
DECCW	Department of Environment, Climate Change and Water (NSW) (former)
DEOH	Defence Establishment Orchard Hills
DoEE	Commonwealth Department of the Environment and Energy
DP&E	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
EMS	Environmental management system
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects
Environmental incident	An unexpected event that has, or has the potential to, cause harm to the environment and requires some action to minimise the impact or restore the environment
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve
Environmental Representative (ER)	A suitably qualified and experienced person independent of project design and Construction personnel employed for the duration of Construction. The principal point of advice in relation to all questions and complaints concerning environmental performance

Term	Expanded text
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives
EPA	NSW Environment Protection Authority
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*
EPL	NSW Environment Protection Licence under the *Protection of the Environment Operations Act 1997*
ERG	Environmental Review Group
EWMS	Environmental Work Method Statements
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
Federal-CoA	Condition of the Federal Department of the Environment and Energy Approval Decision
Hold point	Is a verification point that prevents work from commencing prior to approval from Roads and Maritime Services
ICNG	ICNG Interim Construction Noise Guideline
$LAeq_{(15min)}$	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the Construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community
$LA_{(max)}$	The A-weighted maximum noise level only from the Construction works under consideration, measured using the fast time weighting on a sound level meter
MP	Monitoring Program
NCA	Noise Catchment Area
NCG	Noise Criteria Guideline
NML	Noise Management Level
Non-compliance	Failure to comply with the requirements of the Project approval or any applicable licence, permit or legal requirements
Non-conformance	Failure to conform to the requirements of Project system documentation including this OACEMP or supporting documentation
NSW-CoA	Condition of the NSW DP&E Infrastructure Approval
NSW Infrastructure Approval	The Infrastructure Approval for the Northern Road Upgrade issued by the New South Wales Government on 30 May 2018
OACEMP	Overarching Construction Environmental Management Plan

Term	Expanded text
OEH	NSW Office of Environment and Heritage
OOHW	Out of hours works
POEO Act	*Protection of Environment Operations Act 1997*
Principal, the	NSW Roads and Maritime Services
Project, the	The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
REMM	Revised Environmental Management Measure as provided in the Final EIS / SPIR
RNP	NSW Road Noise Policy
Roads and Maritime, RMS	NSW Roads and Maritime Services
SEARs	Secretary's Environmental Assessment Requirements
Secretary	Secretary of the NSW Department of Planning and Environment, or delegate
SPIR	Submissions and Preferred Infrastructure Report
SPL	Sound Pressure Level
SWP	Sound Power Level
TNR	The Northern Road

1 Introduction

1.1 Context

This Construction Noise and Vibration Management Plan (CNVMP) forms part of the Overarching Construction Environmental Management Plan (OACEMP) for The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park (the Project).

This CNVMP has been prepared to address the requirements of:

- the NSW Minister's Infrastructure Approval dated 30 May 2018 and Federal Minister for the Environment and Energy's Approval dated 25 June 2018
- the environmental management measures listed in *The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park NSW Environmental Impact Statement / Commonwealth Draft Environmental Impact Statement* (EIS) (prepared by Jacobs for Roads and Maritime, 2017) as amended by *The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park Submissions and Preferred Infrastructure Report* (SPIR) (prepared by Jacobs for Roads and Maritime, 2017)
- Environment Protection Licence (EPL) conditions
- Roads and Maritime specifications
- all applicable legislation.

Construction of the Project will be undertaken in three stages:

- Stage 4 - Mersey Road, Bringelly, to Eaton Road, Luddenham
- Stage 5 - Littlefields Road, Luddenham, to Glenmore Parkway, Glenmore Park
- Stage 6 - Littlefields Road, Luddenham to Eaton Road, Luddenham

An overview of the Project, including the extent of the Project stages, is shown on Figure 1-1 and Figure 1-2.

Each stage will be delivered in a separate Construction package that will include all activities needed to complete the stage. Details of the proposed Project staging, including Construction activities and submission of corresponding environmental plans, strategies and protocols, is documented in the Project Staging Report.

The Construction Contractors will develop stage-specific environmental management documentation to address the operational control requirements outlined in the OACEMP that apply to the stages that they are delivering. Stage specific CNVMPs will be updated, tailored and finalised by the Contractors. Roads and Maritime will review the Contractors' stage-specific CNVMPs for compliance with the approved OACEMP.

It should be noted that the CNVMP is also referred to in the Project environmental documents as:

- Noise and vibration CEMP Sub-plan
- Noise and Vibration Management Plan

A full list of alternative and interchangeable sub-plan names is included in Appendix A5 of the OACEMP.

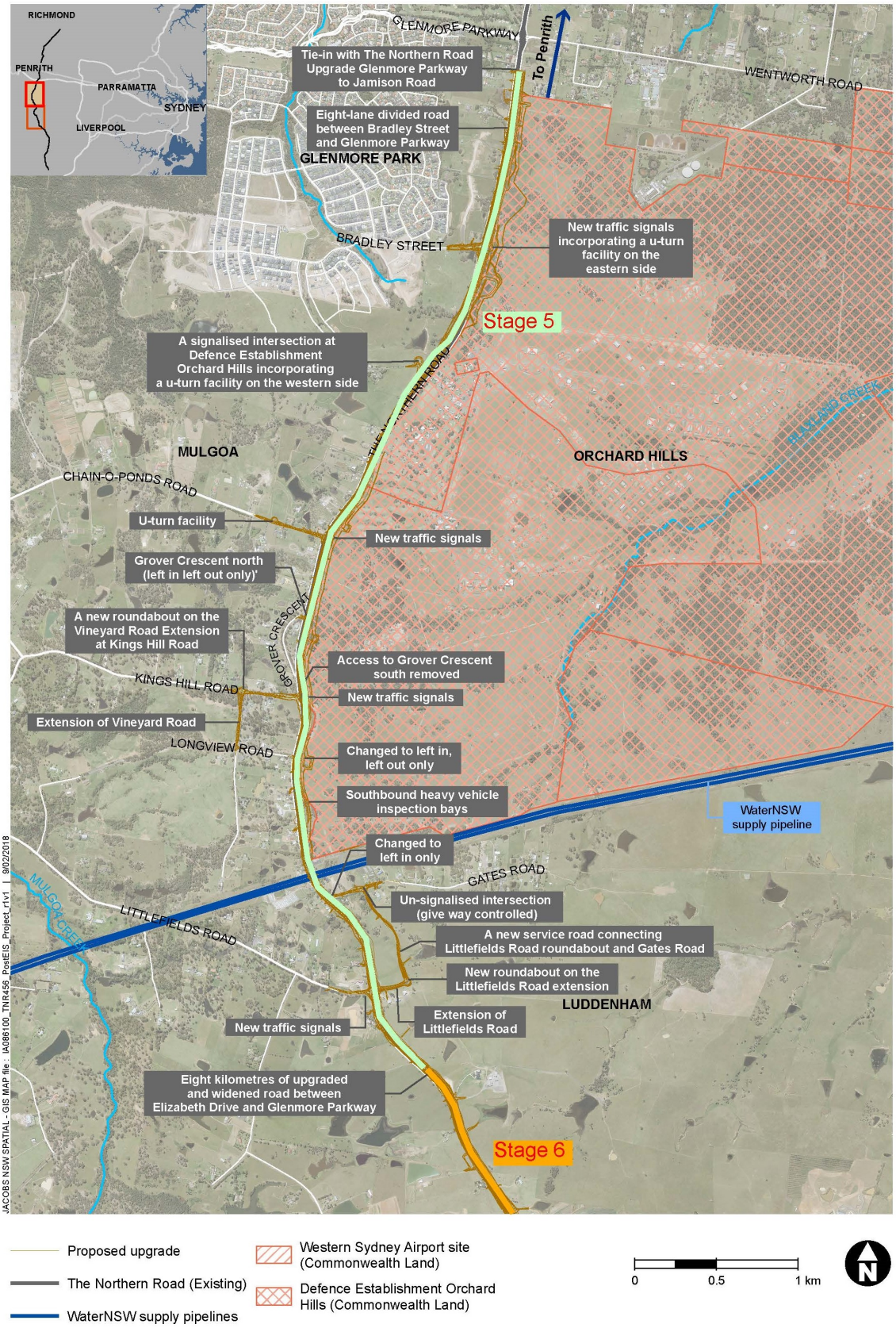


Figure 1-1: Overview of the Project (northern section)

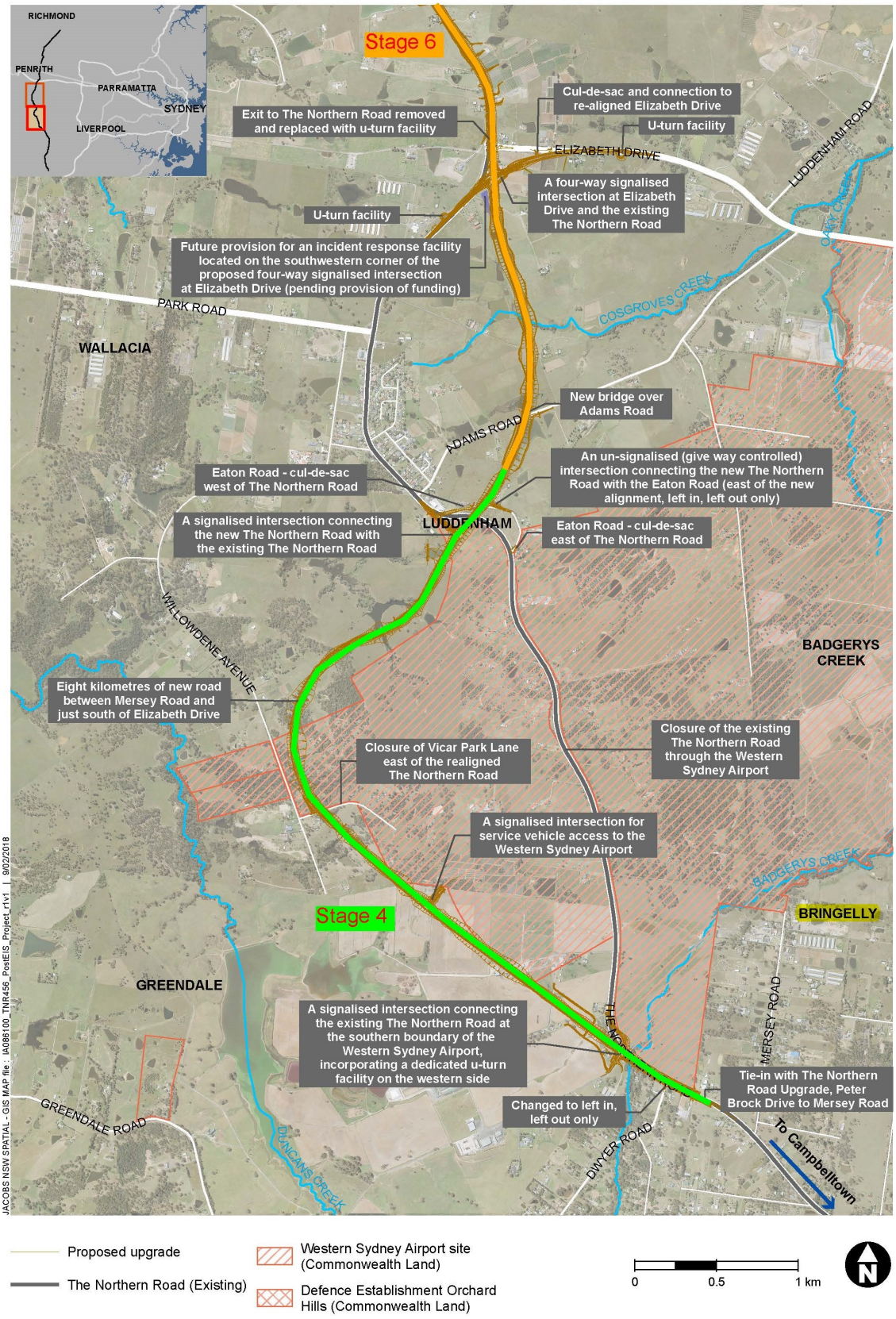


Figure 1-2: Overview of the Project (southern section)

1.2 Background

The EIS assessed noise and vibration impacts on sensitive receivers and structures from Construction of the Project.

As part of EIS development, a detailed construction noise and vibration assessment was prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DP&E) and the Commonwealth EIS Guidelines issued by the Federal Department of the Environment and Energy (DoEE). The noise and vibration assessment was included in the EIS as Appendix H.

Further assessment of noise and vibration was undertaken subsequent to exhibition of the EIS. This assessment was included in the SPIR as Appendix B. Additional noise and vibration information in response to submissions was included in the SPIR as Appendix A. Revised environmental management measures (REMMs) were provided within the SPIR. Where applicable, the REMMs from the SPIR have been included in this CNVMP.

1.3 Environmental management system overview

The overarching Environmental Management System (EMS) for the Project is described in Section 3 of the OACEMP. The Contractors delivering the Project will have certified EMSs consistent with the overarching EMS described in the OACEMP. The Contractors will develop stage-specific CNVMPs in accordance with the OACEMP, the EPL and their EMS.

This overarching CNVMP forms part of the environmental management framework for the Project, as described in Section 3.3 of the OACEMP.

The Contractors will be required to develop, as part of their stage-specific CNVMPs, detailed plans and procedures to address specific requirements of the conditions of approval and REMMs identified in this overarching CNVMP. The purpose of these environmental management documents in regard to minimisation and management of noise and vibration impacts associated with the Project is outlined in Section 8 of this CNVMP.

Templates and guidance information for the environmental documentation to be prepared by the Contractors are provided in the following annexures to this overarching CNVMP:

- Annexure B: Construction Noise and Vibration Monitoring Program
- Annexure C: Template Out of Hours Work Procedure

The Contractors will complete the preparation of the documentation contained in the annexures with stage specific information and include the updated annexures in their CNVMPs. Where appropriate, the Contractors may provide Roads and Maritime with an alternative equivalent plan or procedure that meets the requirements identified in this CNVMP and the relevant Roads and Maritime specifications. Roads and Maritime will review the Contractors' documentation to confirm consistency with the requirements of this CNVMP and specifications.

Management measures identified in this CNVMP may also be incorporated into site or activity specific Environmental Work Method Statements (EWMS). EWMS incorporate appropriate mitigation measures and controls and identify key procedures to be used

concurrently with the EWMS. A template EWMS for use by the Contractors is provided in Appendix A9 of the OACEMP.

EWMS will be prepared by the Contractor Environmental Site Representatives and reviewed by the Roads and Maritime Environmental Manager (or delegate) and independent Environmental Representative (ER) prior to the commencement of the Construction activities to which they apply. Construction personnel undertaking a task governed by an EWMS will undertake the activity in accordance with the mitigation and management measures identified in the EWMS.

Used together, the OACEMP, strategies, procedures and EWMS form management guides that clearly identify required environmental management actions for reference by Roads and Maritime and its Contractors.

The review and document control processes for this CNVMP are described in Section 6.7 and 6.8 of the OACEMP.

1.3.1 CNVMP preparation, endorsement and approval

This overarching CNVMP has been prepared to satisfy the NSW and Federal conditions of approval (CoA) in relation to noise and vibration management during Construction of the Project. This CVNMP includes a Construction Noise and Vibration Monitoring Program (Annexure B) to satisfy the requirements of NSW-CoA C9(b).

This CNVMP and Construction Noise and Vibration Monitoring Program will be reviewed by the Roads and Maritime Senior Project Manager and the Senior Environment Officer (or delegate) and endorsed by the ER prior to submission to the Secretary of the Department of Planning and Environment (DP&E) for approval in accordance with NSW-CoA C7 and C12.

This CNVMP and Construction Noise and Vibration Monitoring Program will be submitted to the Secretary for approval no later than one month prior to commencement of Construction of the Project, or as otherwise agreed by the Secretary.

In accordance with NSW-CoA C8 and C13, Construction of the Project will not commence prior to approval by the Secretary of the CNVMP and the Construction Noise and Vibration Monitoring Program, and all relevant noise and vibration baseline data for the Project has been collected.

Copies of the final CNVMP will be provided to Penrith City Council and Liverpool City Council.

1.4 Consultation

1.4.1 Consultation for preparation of the CNVMP

This CNVMP has been developed in consultation with Penrith City Council and Liverpool City Council as required by NSW-CoA C4(b). The draft CNVMP was provided to Penrith City Council and Liverpool City Council in June 2018.

In accordance with NSW-CoA A8, where a CoA requires consultation with identified parties, details of the consultation undertaken, matters raised by the parties, and how the matters were considered will be documented in the relevant sub plan. The evidence of the

consultation undertaken for the preparation of this CNVMP, including documentation of the engagement with the parties and a summary of issues raised and responses, is provided in Annexure A. Appendix A8 to the OACEMP documents all consultation undertaken for the preparation of the OACEMP.

1.4.2 Ongoing consultation during Construction

Ongoing consultation between Roads and Maritime and its Contractors, and stakeholders, the community and relevant agencies regarding the management of noise and vibration impacts will be undertaken during the Construction of the Project as required. The process for the consultation will be documented in the Community Communication Strategy (CCS).

In accordance with NSW-CoA E25, the Contractors will consult with receivers identified as being subject to levels that exceed the Highly Noise Affected criteria (refer to Section 8.1.2) with the objective of determining appropriate hours of respite unless an agreement is reached with those receivers.

During Construction of the Project, it may be necessary for the Contractors to undertake work outside standard hours of work in the circumstances described in NSW-CoA E26. On becoming aware of the need for works in accordance with NSW-CoA E26, the Contractors will notify the ER and the Environment Protection Authority (EPA) of the need for such works. Prior to carrying out such works, the Contractors will use their best endeavours to notify all affected sensitive receivers of the likely impact and duration of the works, as required by NSW-CoA E27.

In accordance with NSW-CoA E29, prior to scheduling the Construction works, the Contractors will consult with potentially affected community, religious, educational institutions and noise and vibration-sensitive businesses to identify periods during which they would be adversely affected by noise generating works. The Contractors will not schedule works during the periods identified by the stakeholders, unless Roads and Maritime and the Contractors, and the sensitive receiver, have made other arrangements (at no cost to the affected receiver), or the Secretary has otherwise approved the works.

Roads and Maritime and the Contractors will ensure that all Project Construction works are coordinated with utility works, including works undertaken by third parties, to minimise cumulative impacts of noise and vibration and to maximise respite for affected sensitive receivers, as required by NSW-CoA E30.

In accordance with NSW-CoA E35, a heritage specialist will be engaged to provide advice on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures impacted by the Project.

Roads and Maritime will consult with identified receivers to agree the specific form of at-property treatments to be applied. The consultation for at-property and temporary noise mitigation measures will be undertaken in accordance with the CCS. The program for implementation of at-property treatments will be developed in consultation with the identified receivers. Roads and Maritime will confirm the details of the agreed at-property treatments, evidence of consultation with the identified receivers, and a schedule for the timing for the delivery of the treatments in the Operational Noise Mitigation Report to be prepared for each stage of the Project, in accordance with NSW-CoA E36.

Specific consultation requirements under the EIS and SPIR for management of noise and vibration identified in the REMMs are provided in Table 1-1.

Table 1-1: Consultation requirements identified in the EIS and SPIR

REMM	Consultation requirements identified in the EIS and SPIR
NV-1	Construction Noise and Vibration Management Plan (CNVMP) would be prepared during the detailed design stage of the project and applied to all Construction processes throughout the project. The CNVMP would be prepared in accordance with the requirements in the ICNG and RMS CNVG. The CNVMP would nominate: • Protocols for engaging with and notifying residents of any work processes that may impact them
CI-1	Consultation would be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the project.
CI-2	Where relevant, consultation would be undertaken with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts

2 Purpose and objectives

2.1 Purpose

The purpose of this CNVMP is to describe how noise and vibration impacts will be managed during Construction of the Project.

2.2 Objectives

The key objective of the CNVMP is to ensure that impacts to the local community and the built environment from noise and vibration are minimised. To achieve this objective, the Contractors will:

- identify sensitive receivers and ensure appropriate environmental controls and procedures are implemented during Construction activities
- limit the impact of Construction related noise both within and outside standard construction hours
- take reasonable and feasible measures to minimise potential impacts and to achieve the noise goals stated in this CNVMP for Construction works outside standard construction hours
- notify potentially affected property owners and occupants at least seven calendar days in advance as to the scale, extent and duration of Construction works
- ensure appropriate measures are implemented to address the requirements of the conditions of approval outlined in Table 3-1 and the revised environmental management measures detailed in Table 8-1
- ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this CNVMP.

2.3 Targets

Targets for the management of noise and vibration impacts during the Project include:

- achieving full compliance with relevant legislative requirements and the conditions of approval
- implementation of feasible and reasonable noise mitigation measures with the aim of achieving the construction noise management levels detailed in the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009)
- minimising impacts on, and complaints from, the community and stakeholders.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation and regulatory requirements

Legislation and regulations relevant to noise and vibration management includes:

- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Protection of the Environment Operations (Noise Control) Regulation 2008*.

Relevant provisions of the above legislation are identified in the register of legal requirements included in Appendix A1 of the OACEMP.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this CNVMP include:

- Roads and Maritime QA Specification G1 – Job Specific Requirements for The Northern Road Upgrade
- Roads and Maritime QA Specification G36 – Environmental Protection (Management System)
- *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime, 2016)
- *Noise Criteria Guideline* (Roads and Maritime, 2015)
- *Noise Mitigation Guideline* (Roads and Maritime, 2016)
- *Model Validation Guideline* (Roads and Maritime, 2016)
- *Environmental Noise Management Manual* (Roads and Maritime, 2001)
- *Procedure: Preparing an operational traffic and construction noise and vibration assessment report* (Roads and Traffic Authority, 2011)
- *Calculation of Road Traffic Noise* (UK Department of Transport, 1988)
- *NSW Industrial Noise Policy* (EPA, 1999)
- *Noise Policy for Industry* (EPA, 2017)
- *Construction Noise and Vibration Strategy* (TfNSW, 2018)
- *Interim Construction Noise Guideline* (ICNG) (NSW Department of Environment and Climate Change, 2009)
- *NSW Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water (DECCW), 2011)
- *Assessing Vibration – a technical guideline* (Department of Environment and Conservation (DEC), 2006)
- *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (Australian and New Zealand Environment and Conservation Council (ANZECC), 1990)
- *Australian Standard AS1055 Acoustics - Description and measurement of environmental noise* (Standards Australia, 1997)

- *Australian Standard AS IEC 61672.1—2004 - Electroacoustics—Sound level meters, Part 1: Specifications* (Standards Australia, 2004)
- *Australian Standard AS 2659.1 - 1998: Guide to the use of sound measuring equipment - Portable sound level meters*
- *Australian Standard 2187.2 – 2006: Explosives – Storage and use – Use of explosives*
- *British Standard 7385: Part 2-1993 Evaluation and measurement of vibration in buildings Part 2* (BSI, 1993)
- *German Standard DIN4150 Part 3-1999 Structural vibration - Effects of vibration on structures* (Deutsches Institute fur Normung, 1999).

Roads and Maritime specifications are a key source of environmental protection management processes relevant to this CNVMP. The specifications set out environmental protection requirements, including Hold Points that must be complied with by the Construction Contractors during Construction of the Project. Hold Points are verification points that prevent the Contractors from commencing work prior to receipt of approval from Roads and Maritime.

3.2 Conditions of approval

This overarching CNVMP provides a consistent approach to address the requirements of both the State and Federal approvals in the one document. The Project is located on both NSW and Federal (Stages 4 and 5 only) land. However, the NSW Infrastructure Approval conditions apply to both NSW and Federal land within the Project. The Federal approval conditions also apply to both NSW and Federal land within the Project. The extent of Federal land located in the vicinity of the Project is shown on Figure 1-1 and Figure 1-2.

The State (NSW-CoA) and Federal (Federal-CoA) conditions of approval relevant to this CNVMP and their applicability to each stage of the Project are listed in Table 3-1. A cross reference is also included to indicate where the condition is addressed in this CNVMP or other project management documents.

Table 3-1: Conditions of approval relevant to the CNVMP

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
Federal conditions of approval							
Federal-CoA 1	The approval holder must undertake the action, including those parts of the action that occur on Commonwealth Land, in accordance with all conditions in the NSW Infrastructure Approval.	✓	✓	✓	✓	✓	This CNVMP
Federal-CoA 11	The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement all management plans required by this approval, and make them available upon request to the DoEE. Such records may be subject to audit by the DoEE or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the DoEE's website. The results of audits may also be publicised through the general media.	✓	✓	✓	✓	✓	Section 9.8
State conditions of approval							
NSW-CoA A8	Where the conditions of this approval require consultation with identified parties, details of the consultation undertaken, matters raised by the parties, and how the matters were considered must accompany the strategies, plans, programs, reviews, audits, protocols and the like submitted to the Secretary.	✓	✓	✓	✓	✓	Section 1.4 Annexure A
NSW-CoA C4(b)	The following **CEMP Sub-plans** must be prepared in consultation with the relevant government agencies identified for each **CEMP Sub-plan** and be consistent with the **CEMP** referred to in **Condition C1**:						
	Noise and vibration: Relevant Councils	✓	✓	✓	✓	✓	This CNVMP

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA C5	The **CEMP Sub-plans** must state how:						
	(a) the environmental performance outcomes identified in the documents listed in **Condition A1**, as modified by these conditions, will be achieved;	✓	✓	✓	✓	✓	Section 5
	(b) the mitigation measures identified in the documents listed in **Condition A1** as modified by these conditions will be implemented;	✓	✓	✓	✓	✓	Section 8
	(c) the relevant terms of this approval will be complied with;	✓	✓	✓	✓	✓	Section 8
	(d) the identification of the relevant environmental specific training and induction processes for construction personnel; and	✓	✓	✓	✓	✓	Section 9.4
	(e) issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.	✓	✓	✓	✓	✓	Section 8 OACEMP Section 4.3.2 OACEMP Appendix A2
NSW-CoA C6	The **CEMP Sub-plans** must be developed in consultation with relevant government agencies identified in **Table 3** of **Condition C4.** Where an agency(ies) request(s) is not included, the Proponent must provide the Secretary justification as to why. Details of all information requested by an agency to be included in a **CEMP Sub-plan** as a result of consultation**,** including copies of all correspondence from those agencies, must be provided with the relevant **CEMP Sub-Plan**.	✓	✓	✓	✓	✓	Section 1.4 Annexure A
NSW-CoA C7	Any of the **CEMP Sub-plans** may be submitted to the Secretary along with, or subsequent to, the submission of the **CEMP** but in any event, no later than one (1) month before commencement of construction.	✓	✓	✓	✓	✓	Section 1.3.1
NSW-CoA C8	Subject to the provisions in this condition relating to staging Construction must not commence until the **CEMP** and all **CEMP Sub-plans** have been approved by the Secretary. The **CEMP** and **CEMP Sub-plans**, as approved by the Secretary, including any minor amendments approved by	✓	✓	✓	✓	✓	Section 1.3.1

CoA no.	Condition requirement	Applicability					Reference
		Stage 4 Cth	Stage 4 NSW	Stage 5 Cth	Stage 5 NSW	Stage 6 NSW	
	the ER must be implemented for the duration of Construction. Unless otherwise agreed by the Secretary where the CSSI is being staged, construction of a stage is not to commence unless the CEMP and the CEMP Sub-plans referred to above cover those stages or the Secretary has approved a specific CEMP and sub-plans for that stage.						
NSW-CoA C16	Where a relevant **CEMP Sub-plan** exists, the relevant **Construction Monitoring Program** may be incorporated into that **CEMP Sub-plan.**	✓	✓	✓	✓	✓	Annexure B
NSW-CoA E23	Works must only be undertaken during the following standard construction hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 1:00pm Saturdays; and (c) at no time on Sundays or public holidays.	✓	✓	✓	✓	✓	Section 8.1
NSW-CoA E24	Except as permitted by an EPL, highly noise intensive works that results in an exceedance of the applicable noise management level at the same receiver must only be undertaken: (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block. For the purposes of this condition, 'continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.	✓	✓	✓	✓	✓	Section 8.1
NSW-CoA E25	The Proponent must identify and consult with receivers identified as being subject to levels that exceed the Highly Noise Affected criteria with the objective of determining appropriate hours of respite unless an agreement is reached with those receivers.	✓	✓	✓	✓	✓	Section 1.4.2

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA E26	Notwithstanding **Condition E23** works associated with the CSSI may be undertaken outside the specified hours in the following circumstances: (a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or (b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or (c) where it causes $L_{Aeq(15\ minute)}$ noise levels: i. no more than 5 dB(A) above the rating background level at any residence in accordance with the *Interim Construction Noise Guideline* (DECC, 2009), and ii. no more than the noise management levels specified in Table 3 of the *Interim Construction Noise Guideline* (DECC, 2009) at other sensitive land uses, and iii. continuous or impulsive vibration values, measured at the most affected residence are no more than those for human exposure to vibration, specified in Table 2.2 of *Assessing Vibration: a technical guideline* (DEC, 2006), and iv. intermittent vibration values measured at the most affected residence are no more than those for human exposure to vibration, specified in Table 2.4 of *Assessing Vibration: a technical guideline* (DEC, 2006); or (d) no more than 15 dB(A) above the night time rating background level at any residence during the night time period, when measured using the $L_{Aeq(1\ minute)}$ noise descriptor; or (e) where different hours are permitted or required under an EPL in force in respect of the works, in which case those hours must be complied with.	✓	✓	✓	✓	✓	Section 8.1 Annexure C

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA E27	On becoming aware of the need for emergency works in accordance with **Condition E26** the Proponent must notify the ER and the EPA (if an EPL applies) of the need for those works. The Proponent must also use its best endeavours to notify all affected sensitive receivers of the likely impact and duration of those works.	✓	✓	✓	✓	✓	Section 8.1 Annexure C
NSW-CoA E28	Construction vehicles arriving at the project site and construction compounds outside the standard construction hours described in **Condition E23** must not queue with idling engines.	✓	✓	✓	✓	✓	Sections 8.1, 8.3
NSW-CoA E29	The Proponent must consult with potentially affected community, religious, educational institutions and noise and vibration-sensitive businesses to identify periods during which they would be adversely affected by noise generating works, and must not schedule those works during those periods unless the Proponent and the potentially affected institution or business have made other arrangements (at no cost to the affected receiver), or the Secretary has otherwise approved the works.	✓	✓	✓	✓	✓	Sections 1.4.2, 9.2
NSW-CoA E30	The Proponent must ensure that all works for the delivery of the CSSI are coordinated with utility works, including those works undertaken by third parties, to minimise cumulative impacts of noise and vibration and to maximise respite for affected sensitive receivers.	✓	✓	✓	✓	✓	Section 1.4.2
NSW-CoA E31	Temporary acoustic barriers (2.4 metres high) are to be installed as soon as site establishment works at the ancillary facility are completed and before undertaking any works which are required to be conducted at the facility. The schedule for installing and removing the acoustic barriers, and justification for not installing acoustic barriers in certain locations, must be described in the Ancillary Facilities Management Plan for the project prepared in accordance with Condition A16. Acoustic barriers must be inspected and maintained to remain effective throughout the use of the construction compound.	✓	✓	✓	✓	✓	Sections 7.2.2, 8 Appendix A4, Ancillary Facilities Management Plan

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA E32	The CSSI must be constructed with the aim of achieving the following construction vibration goals: (a) for structural damage to heritage structures, the vibration limits set out in the German Standard *DIN 4150-3: Structural Vibration – Part 3 Effects of vibration on structures*; (b) for damage to other buildings and/or structures, the vibration limits set out in the British Standard *BS 7385-1:1990 – Evaluation and measurement of vibration in buildings—Guide for measurement of vibration and evaluation of their effects on buildings* (and referenced in Australian Standard 2187.2 – 2006 *Explosives – Storage and use – Use of explosives*); and (c) for human exposure, the acceptable vibration values set out in *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006).	✓	✓	✓	✓	✓	Section 5
NSW-CoA E33	The Proponent must ensure that vibration from construction activities does not exceed the vibration limits set out in the British Standard BS 7385-2:1993 *Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.*	✓	✓	✓	✓	✓	Section 5
NSW-CoA E34	The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.	✓	✓	✓	✓	✓	Section 5.5.2
NSW-CoA E35	The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures.	✓	✓	✓	✓	✓	Section 5.5.2

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA E37	Operational noise mitigation measures as identified in **Condition E36** (such as at-property architectural treatments) that will not be affected by construction works must be implemented within six (6) months of the commencement of Construction which would affect the identified receivers or within another timeframe agreed with the Secretary. These measures, and a schedule that outlines the timing for their delivery, must be detailed in the **Noise and Vibration CEMP Sub-plan** for the CSSI required by **Condition C4(b)**. Where early implementation of noise mitigation measures is not proposed, the Proponent must submit to the Secretary a report providing justification as to why, along with details of temporary measures that would be implemented to reduce construction noise impacts, until such time that the operational noise mitigation measures identified in **Condition E36** are implemented. The report must be provided to the Secretary for approval prior to the commencement of Construction which would affect the identified receivers.	✓	✓	✓	✓	✓	Sections 1.4.2, 8.2

3.3 Environment protection licence

The Project is subject to a number of EPLs as a Scheduled Activity for extractive activities and road construction. The EPLs prescribe noise and vibration management requirements that must be complied with. These requirements will be managed by the planned management measures specified in Table 7-1 and the Construction Noise and Vibration Monitoring Program (refer Annexure B).

The EPL conditions relevant to the management of noise and vibration are provided in Table 3-2. The EPL conditions relevant to the monitoring of noise and vibration are provided in Annexure B.

The EPL also prescribes requirements for complaints handling, reporting and record keeping. These requirements will be implemented in accordance with the incident and complaints reporting outlined in Section 9 of this CNVMP and Section 5.3 of the OACEMP.

Table 3-2: EPL requirements relevant to the management of noise and vibration

Ref.	Relevant requirement	Reference
L3	**Noise Limits**	
L3.1	The licensee must implement all feasible and reasonable noise and vibration abatement measures at the premises during construction work, to minimise noise and vibration impacts on nearby noise sensitive receivers. This must include, but is not limited to:	
	(f) implementing noise and vibration mitigation measures as outlined in The Northern Road Upgrade Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park NSW Environmental Impact Statement / Commonwealth Draft Environmental Impact Statement Volume 1: Main Report June 2017; and	Table 8-1
	(g) implementing further noise mitigation measures as may be necessary throughout the period of construction work to minimise significant exceedances of Noise Management Levels (NMLs) at nearby noise sensitive receivers; and	Table 8-1
	(h) consideration of the Interim Construction Noise Guidelines (DECC, 2009).	Sections 3.1.2, 5
L4	**Hours of operation**	
L4.1	Unless permitted by another condition of this licence, construction works and activities must: (a) only be undertaken between the hours of 0700 and 1800 Monday to Friday; and (b) only be undertaken between the hours of 0800 and 1300 Saturday; and (c) not be undertaken on Sundays or Public Holidays.	Section 8.1.1
L4.2	**Exemptions to standard construction hours in exceptional circumstances** (a) The licensee may undertake works outside of standard construction hours if any of the following applies: (i) emergency works is required to avoid the loss of lives or property, or to prevent material harm to the environment;	Section 8.1.3

Ref.	Relevant requirement	Reference
	(ii) the delivery of oversized plant or structures has been 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 construction work under this Condition notify the EPA's Environment Line as soon as practicable and submit a report to the EPA by 2 pm on the next business day after the emergency works commenced that describes: 1. the cause, time and duration of the emergency; and 2. action taken by or on behalf of the licensee in relation to the emergency; and 3. 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.	
L4.3	**Exemptions to standard construction hours for low noise impact works** The following works and activities may be carried out outside of the hours specified in Condition L4.1 if the works and activities do not cause, when measured at the boundary of the most affected noise sensitive receiver: (a) LAeq(15 minute) noise levels greater than 5 dB above the day, evening and night rating background level (RBL) as applicable; and (b) LA1(1 minute) or LAmax noise levels greater than 15dB above the night RBL for night works; and (c) continuous or impulsive vibration values greater than those for human exposure to vibration, set out for residences in Table 2.2 in "Environmental Noise Management - Assessing Vibration: a technical guideline" (DEC, 2006); and (d) intermittent vibration values greater than those for human exposure to vibration, set out for residences in Table 2.4 in "Environmental Noise Management - Assessing Vibration: a technical guideline" (DEC, 2006). Note: For the purposes of this Condition, the RBLs are those contained in an environmental assessment for the scheduled activity subject to this licence prepared under the EPA Act 1979. Alternatively, the licensee may use another RBL determined in accordance with the "NSW Noise Policy for Industry" (EPA, 2017) and provided to the EPA prior to carrying out any works or activities under this Condition.	Section 8.1.3
L4.4	**High Noise Impact Works** Any high noise impact works and activities must only be undertaken: 1. Between 08:00am – 06:00pm Monday to Friday; 2. Between 08:00am – 01:00pm Saturday. Note: For the purposes of this Condition, 'continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work that is the subject of this Condition.	Section 8.1.2

Ref.	Relevant requirement	Reference
L4.5	**Community Agreements** The licensee may undertake works outside of standard construction hours if agreement between the licensee and a substantial majority of noise sensitive receivers has been reached. Note: This Condition applies to out-of-hours works that have not been approved by another Condition of this licence.	Section 8.1.5
L4.6	Any agreement(s) between the licensee and noise sensitive receivers referred to in Condition L4.5 must be: (a) submitted to the EPA for approval prior to any works that are the subject of the agreement being undertaken; and (b) prepared in writing and a copy of the agreement(s) kept on the premises by the licensee for the duration of this licence; and (c) kept on the licensee's project website for the duration of the agreement (personal details of residents must be omitted); and (d) prepared and implemented in accordance with Condition E1.	Section 8.1.5
L4.7	**Works outside of standard construction hours – Notification** The licensee must notify potentially affected noise sensitive receivers of works outside of standard construction hours not less than 5 calendar days and not more than 14 calendar days before those works are to be undertaken. (a) The notification must be: ◦ undertaken by letterbox drop or email; and ◦ be detailed on the project website. (b) The notification required by this Condition must: ◦ clearly outline the reason that the work is required to be undertaken outside the hours specified in Condition L4.1; ◦ include a diagram that clearly identifies the location of the proposed works in relation to nearby cross streets and local landmarks; ◦ include details of relevant time restrictions that apply to the proposed works; ◦ clearly outline in plain English, the location, nature, scope and duration of the proposed works; ◦ detail the expected noise impact of the works on noise sensitive receivers; ◦ clearly state how complaints may be made and additional information obtained; and ◦ include the number of the telephone complaints line required by condition M6.1, an after hours contact phone number specific to the works undertaken outside the hours specified in Condition L4.1, and the project website address.	Section 5 of Annexure C OOHW Procedure
M6	**Telephone complaints line**	
M6.5	**Noise and Vibration Complaints** (a) The licensee must investigate noise and vibration complaints: (i) within two hours of the complaint being made; or (ii) in accordance with any documented complaint management agreement between the licensee and the complainant. (b) The licensee must ensure that any investigation referred to in this	Section 9.3

Ref.	Relevant requirement	Reference
	Condition that identifies works or activities being undertaken on the licenses premises as the likely source of the complaint, includes an offer to the complainant to undertake attended noise or vibration monitoring at their premises. (c) If the occupant of the dwelling or management personnel of a noise sensitive receiver other than a dwelling accepts the offer of attended noise or vibration monitoring the licensee must undertake that attended monitoring: (i) As soon as practicable; or (ii) At a time agreed with the complainant.	
E1	**Community Agreements**	
E1.1	**Requirements for community agreements** Any community agreement to permit works to be undertaken outside of standard construction hours (OOHW) under Condition L4.5 must: (a) be prepared and implemented in accordance with the relevant sections of the "Interim Construction Noise Guidelines" (DEC 2009), the "Noise Policy for Industry" (EPA, 2017) and AS2346-2010 "Guide to noise and vibration control on construction, demolition and maintenance sites"; (b) detail the following: 1. the actual works proposed; 2. any expected impacts in clear, simple English based on noise modelling; 3. the expected duration of the works; 4. any expected benefits for receivers; 5. any other concurrent OOHW that will be occurring; and 6. any other OOHW that will be occurring on the nights preceding and following the proposed works or, if the proposed work precedes or follows a weekend period, any other OOHW that will be occurring on the weekend. (c) demonstrate that the noise sensitive receivers party to the agreement understand the nature of the works and any predicted impacts; and (d) be kept for the duration of the agreement and made available to an EPA authorised officer on request.	Section 8.1.5
E1.2	**Consultation and Engagement** In relation to consulting and engaging with noise sensitive receivers for a community agreement, the following applies: (a) all noise sensitive receivers predicted by modelling to be impacted by noise greater than 5 dB(A) above RBL must be consulted on any proposed community agreement. This includes noise sensitive receivers that have declined to participate in previous agreements; and (b) all proposed agreements must include details for interpreting services for languages other than English where required; and (c) If a licensee is unable to contact a noise sensitive receiver after three attempts during the time of day that the proposed works would be undertaken, including leaving "sorry I missed you" cards explaining the reason for the visit and requesting a return phone call, then the licensee will note that the receiver could not be contacted and the receiver will not be considered to have either agreed or disagreed; and (d) records of the attempts to contact the receiver will be kept by the	Section 8.1.5

Ref.	Relevant requirement	Reference
	licensee.	
E1.3	**Agreement Thresholds** (a) The EPA will consider agreements reached between the licensee and a substantial majority of both: 1. noise sensitive receivers predicted by the licensee to be impacted by noise levels exceeding those specified in Condition L4.3(a) and L4.3(b); and 2. noise sensitive receivers predicted to by the licensee to be impacted by noise levels above a highly noise affected level of 75 dB(A).	Noted
E1.4	**Community agreements attained by phone** Where a community agreement has been reached with noise sensitive receivers over the phone, the following applies: (a) the phone script used to describe the proposed agreement (including information required under Condition E1.1(b)) is to be provided to the EPA with the community agreement for approval; and (b) the script must include a clear question requesting receiver agreement to the proposal; and (c) detailed records are to be maintained by the licensee of all community agreement phone conversations and must be maintained for the duration of the community agreement; and (d) any noise sensitive receiver who requests a copy of the phone agreement must be supplied with one.	Contractor's CNVMP and Community Liaison Plan
E1.5	**Notification** All noise sensitive receivers must be advised of any community agreement that has been attained in writing within seven days of the agreement being finalised and must: (a) include a website link to the project website, specifically to a summary of the approved project agreement; and (b) include details of the licensees complaints line as required by Condition M6; and (c) include details of the EPA's Environment Line. The notification requirements in Condition L4.6 apply to community agreements.	Section 8.1.5
E1.6	**Monitoring** Validation monitoring must be undertaken for any works that are the subject of a community agreement and must: (a) be performed by a suitably qualified and experienced person; and (b) be performed on at least the first 2 nights where OOHW will be undertaken.	Section 8.1.5
E1.7	If validation monitoring undertaken under Condition E1.6 shows that noise levels are higher than those predicted by any noise modelling undertaken as part of the community agreement, work practices must be modified so that measured noise levels do not exceed predicted levels.	Section 8.1.5
E1.8	A validation monitoring plan must be submitted to the EPA for approval as part of the community agreement documentation prior to any OOHW occurring.	Section 8.1.5

4 Existing environment

The following section summarises the existing noise and vibration conditions within and adjacent to the Project corridor, based on information contained in the EIS. The information provided below comprises the baseline data to be used for the overarching Construction Noise and Vibration Monitoring Program (Annexure B). It is considered that the baseline data obtained during the EIS is sufficiently comprehensive that no further baseline data will be required to be collected by the Contractors.

4.1 Sensitive receivers

The Project is situated within the Liverpool City Council and Penrith City Council local government areas (LGA) and traverses the primarily residential communities of Orchard Hills, Bringelly, Luddenham and Glenmore Park. Portions of the Project area extend through commonwealth defence land, along with rural and agricultural land uses and natural woodland areas.

The noise and vibration assessment in the EIS and SPIR identified and considered potential noise and vibration impacts for each habitable dwelling or park along the Project alignment and within 600 m either side of the new or existing road centre line. Receivers were classified using a combination of recent aerial and ground photography, web-based information sources, cadastral data and site surveys.

A total of 1,349 noise sensitive receivers were identified in the Project area, including:

- 1,306 residential properties
- 23 commercial properties
- 10 education buildings
- four places of worship
- four outdoor recreational areas
- two industrial buildings.

Sensitive receivers potentially affected by the Project are concentrated in Glenmore Park at the northern end of the Project area and within Luddenham in the south. The central sections of the Project area are mainly semi-rural properties with few residences.

The location of noise sensitive receivers within the Project area are shown in Figure 4-1, Figure 4-2 and Figure 4-3.

4.2 Noise catchment areas

Noise catchment areas (NCAs) that reflect land uses and the nature and types of receivers within each NCA were established as part of the noise assessment. The land use characteristics within each NCA are described in Table 4-1. Figure 4-1, Figure 4-2 and Figure 4-3 shows the locations and extents of the NCAs.

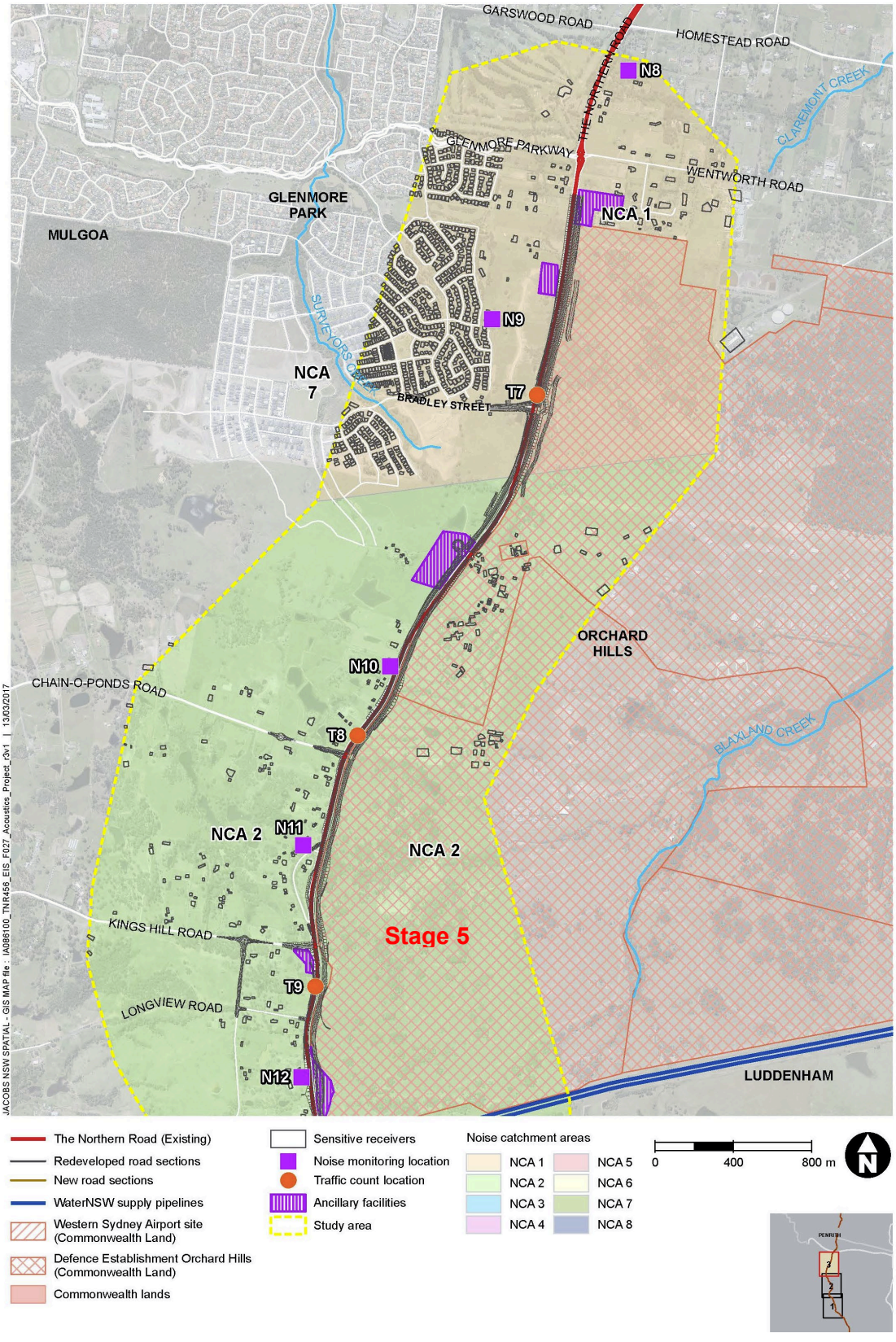


Figure 4-1: Location of noise catchments areas, noise and vibration sensitive receivers and noise monitoring locations (northern section)

Source: EIS (Roads and Maritime, 2017)

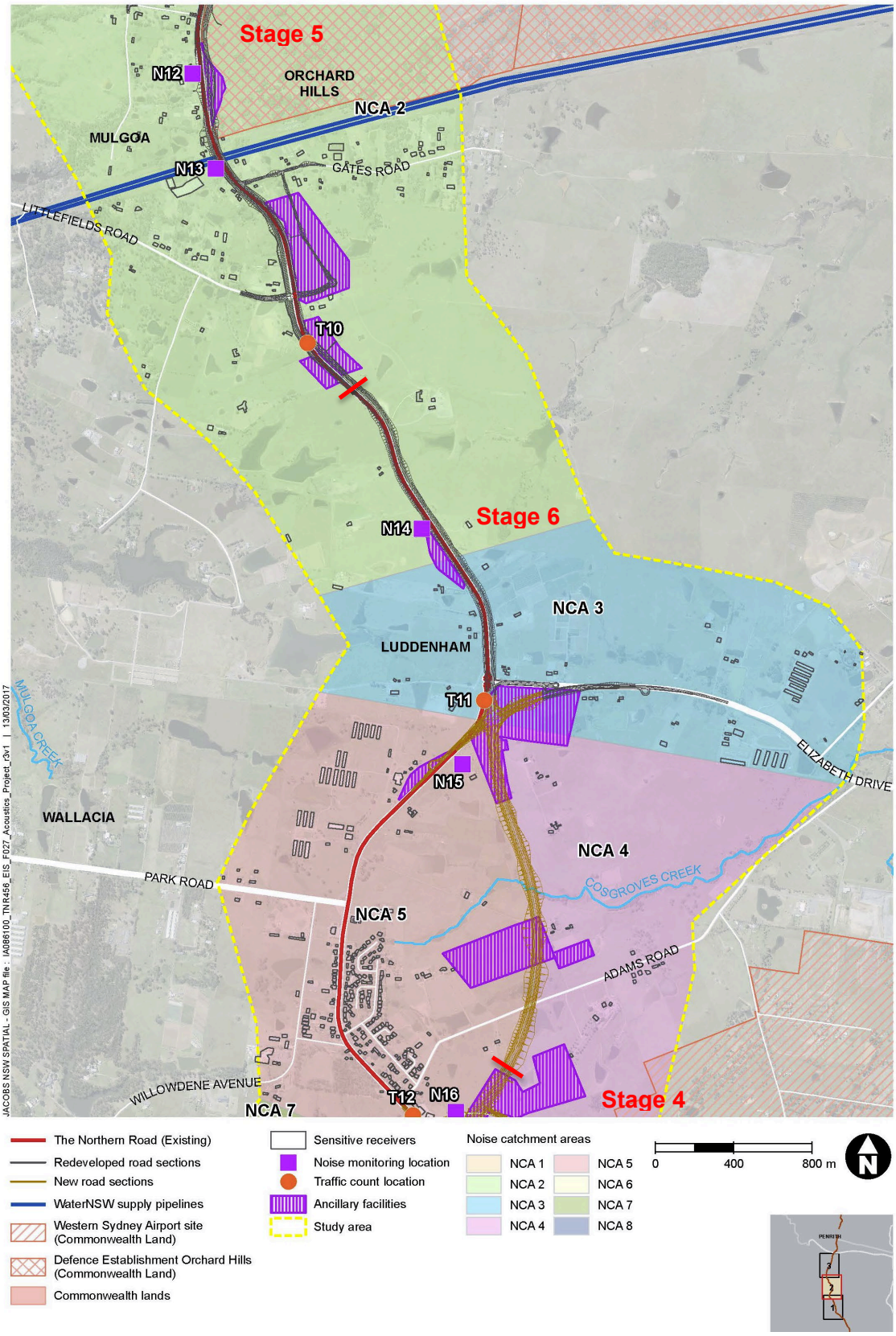


Figure 4-2: Location of noise catchments areas, noise and vibration sensitive receivers and noise monitoring locations (middle section)

Source: EIS (Roads and Maritime, 2017)

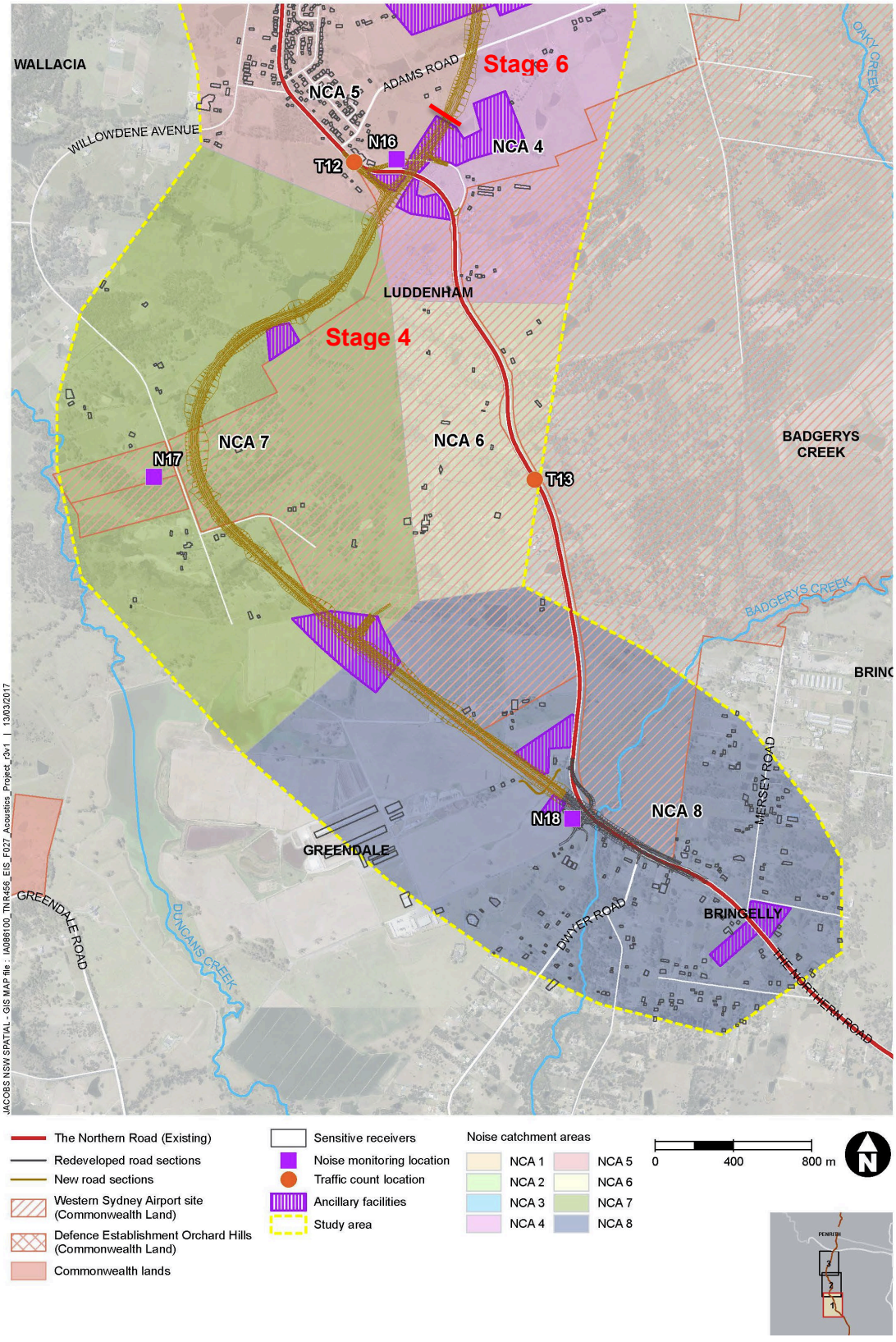


Figure 4-3: Location of noise catchments areas, sensitive receivers and noise monitoring locations (southern section)

Source: EIS (Roads and Maritime, 2017)

Table 4-1: Noise catchment areas

NCA	Project Stage	Description
NCA 1	5	Properties in suburban Glenmore Park and semi-rural Orchard Hills (north) at which background noise is determined by traffic conveyed on The Northern Road, Glenmore Parkway and the M4 Motorway
NCA 2	5, 6	Semi-rural properties located between Bradley Street, Glenmore Park and Elizabeth Drive, Luddenham at which background noise is determined by traffic on The Northern Road
NCA 3	6	Semi-rural properties located near the junction between The Northern Road and Elizabeth Drive in Luddenham, at which background noise is determined by traffic on The Northern Road and Elizabeth Drive
NCA 4	4, 6	Semi-rural properties east of Luddenham, presently removed from major roads. Background noise is determined by rural noise sources
NCA 5	4, 6	Properties in suburban Luddenham and its semi-rural surrounds. Existing background noise to these receivers results from traffic on The Northern Road
NCA 6	4	Semi-rural properties in Badgerys Creek at which background noise is determined by traffic on The Northern Road
NCA 7	4	Semi-rural properties located adjacent to new section of the project with minimal exposure to traffic noise on The Northern Road
NCA 8	4	Semi-rural properties in Greendale and Bringelly at which background noise is determined by traffic on The Northern Road

4.3 Ambient noise

The main contributor to ambient noise in the Project area is road traffic noise, including heavy vehicles, along the existing The Northern Road and on adjoining roads such as the M4 Western Motorway and Elizabeth Drive.

Long term unattended noise surveys in the Project area were conducted as part of the EIS in 2016. The unattended noise monitoring was undertaken to provide background noise levels and to establish appropriate Construction noise assessment criteria. Monitoring sites were selected according to the noise sources affecting the site (eg, traffic and/or other ambient sources) and included all receivers potentially affected by the Project. The locations in which background noise monitoring surveys were carried out are shown on Figure 4-1, Figure 4-2 and Figure 4-3.

The *Interim Construction Noise Guideline* requires that the level of background and ambient noise be assessed separately for the day, evening and night periods which are defined as follows:

- Day: 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays and Public Holidays
- Evening: 6:00pm to 10:00pm, Monday to Sunday
- Night: 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays.

The rating background level (RBL) is used to determine the appropriate noise management level (NML). The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

A summary of the noise monitoring results and adopted RBLs is provided in Table 4-2.

Table 4-2: Ambient noise monitoring results (dbA)

Location	Project Stage	Day			Evening			Night		
		L_{Amax}	L_{Aeq}	RBL	L_{Amax}	L_{Aeq}	RBL	L_{Amax}	L_{Aeq}	RBL
N9	5	64	55	48	62	55	49	60	54	44
N10	5	75	61	46	72	58	44	71	58	33
N11	5	69	55	47	65	55	43	61	50	36
N12	5	74	62	48	72	58	43	68	56	38
N13	5	76	61	48	73	58	44	71	56	36
N14	6	72	61	46	68	56	46	67	54	35
N15	6	67	54	37	56	43	35	53	45	36
N16	6	70	56	42	68	57	43	66	55	34
N17	4	65	47	37	59	45	38	54	46	37
N18	4	72	59	48	68	58	47	67	54	42

5 Noise and vibration criteria

The EPA recommends noise and vibration management levels and goals be adopted for assessing construction noise and vibration in accordance with:

- *Interim Construction Noise Guideline* (ICNG) (DECC, 2009)
- *Assessing Vibration: A Technical Guideline* (DEC, 2006).

Relevant elements of these documents are summarised and discussed in this section.

5.1 Construction noise assessment objectives

The ICNG provides guidelines for the assessment and management of construction noise. The ICNG focuses on applying a range of work practices to minimise construction noise impacts rather than focusing on achieving numeric noise levels.

The main objectives of the ICNG are to:

- identify and minimise noise from construction works
- focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts
- encourage construction during the recommended standard hours only, unless approval is given for works that cannot be undertaken during these hours
- reduce time spent dealing with complaints at the project implementation stage
- provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

5.2 Construction noise criteria

Construction noise assessment goals presented in the ICNG are referenced to noise management levels (NML) for residential, sensitive land uses and commercial/ industrial premises.

5.2.1 Residential land use

Table 5-1 (reproduced from Table 2 of the ICNG) sets out the NMLs for residences and how they are to be applied.

The RBL is used as the basis for determining NMLs. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the *Noise Policy for Industry* (EPA, 2017).

Table 5-1: Residential noise management levels

Time of day	NML $L_{Aeq\ (15\ min)}$ *	How to apply
Standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

5.2.2 Other sensitive land uses

Other sensitive land uses, such as schools and offices, typically find noise from Construction to be disruptive when the properties are being used (such as during work and school times). Table 5-2 presents NML for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed. Contractors will undertake consultation with noise sensitive land use occupants likely to be affected by noise from the Project to schedule Construction activities and work hours to achieve a reasonable noise outcome.

The NML in Table 5-2 are 5 dB above the corresponding road traffic noise levels in the *Environmental Criteria for Road Traffic Noise* (EPA 1999) (and the 'maximum' levels in the *NSW Industrial Noise Policy* (EPA 2000) for commercial and industrial uses) to account for the variable and short-term nature of construction noise.

Table 5-2: Non-residential sensitive land uses noise management levels

Land use	Noise assessment location	NML ($L_{Aeq,15min}$)
Classrooms at schools and other educational institutions	Internal	45
Places of worship		
Passive recreation areas[1]	External	60
Active recreation areas[2]	External	65
Industrial premises	External	75
Office, retail outlets	External	70

Notes: [1] Passive recreation areas characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion.

[2] Active recreation areas are characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

5.3 Adopted Project construction noise management levels

The adopted Project construction NMLs for each NCA have been determined based on the measured noise levels described in Section 4.3.

For work during standard construction hours:

- the 'noise affected level' represents the point above which there may be some community reaction to noise. The noise affected level is calculated by adding 10 dB(A) to the RBL
- the 'highly noise affected level' represents the point above which there may be strong community reaction to noise. The ICNG specifies that the highly noise affected level is 75 dB(A).

Considering the possibility of work outside standard construction hours, additional Project construction NMLs for these times have also been determined.

For work outside standard construction hours, the construction NML is calculated by adding 5 dB(A) to the RBL. The NML for sleep disturbance is based on a maximum internal noise level of 55 dB(A) L_{Amax} as recommended by the RNP and a 10 dB(A) reduction in noise from outside the building. The RNP acknowledges that one or two noise events per night with maximum external noise levels of 75 to 80 dB(A) are unlikely to substantially affect health and wellbeing.

The adopted Project construction NMLs and sleep disturbance screening criterion for residential receivers are provided in Table 5-3. As a conservative measure, the lowest of all RBLs within any one NCA has been used to determine the NML. Table 5-4 sets out the adopted Project construction NMLs for non-residential receivers.

Table 5-3: Construction NMLs and sleep disturbance screening criteria at residences

NCA	Stage	NML ($L_{Aeq(15min)}$ (dBA))				Sleep disturbance screening criterion L_{Amax} (dBA)
		Standard working hours	Out of hours*			
		Day	Day	Evening	Night	
1	5	58	56	54	49	59
2	5, 6	57	53	48	41	51
3	6	56	58	51	40	50
4	4, 6	47	43	43	42	52
5	4, 6	52	49	48	39	49
6	4	52	49	48	39	49
7	4	47	43	43	42	52
8	4	58	58	52	47	57

** Out of hours periods refers to Saturday 1:00 pm-6:00 pm*

Table 5-4: Construction NMLs for non-residential receivers

Non-residential receiver	No. of buildings	Land use	NCA	Stage	NML* $L_{Aeq(15\ minute)}$ dB(A)
Penrith Anglican College	4	Educational	1	5	45 (Internal)
Luddenham Public School	5	Educational	5	6	45 (Internal)
Holy Family Catholic Primary School	1	Educational	5	6	45 (Internal)
St James Anglican Church	1	Place of Worship	5	6	45 (Internal)
Sacred Heart Parish	1	Place of Worship	5	6	45 (Internal)
Luddenham Uniting Church	2	Place of Worship	5	6	45 (Internal)
Glenmore Ridge Dr Park	N/A	Active Recreation	1	5	65
Sales Park	N/A	Active Recreation	5	6	65
Willmington Reserve	N/A	Active Recreation	5	6	65
Luddenham Showground	N/A	Active Recreation	5	6	65
Penrith Golf and Recreation Club	3	Commercial	1	5	70
Produce Direct and Pet Care	3	Commercial	1	5	70
Orchard Hills Veterinary Hospital	1	Commercial	1	5	70
Horse N Around	3	Commercial	2	5	70
The Honey Shed	1	Commercial	3	6	70

Non-residential receiver	No. of buildings	Land use	NCA	Stage	NML* $L_{Aeq(15\ minute)}$ dB(A)
Sydney Society of Model Engineers	1	Commercial	3	6	70
Caltex Service Station	2	Commercial	5	6	70
Quality Meats Butcher	1	Commercial	5	6	70
2903 The Northern Road, Luddenham	1	Commercial	5	6	70
Luddenham Auto Repairs	1	Commercial	5	6	70
Al's Bakery	1	Commercial	5	6	70
Shell Service Station	1	Commercial	5	6	70
IGA	3	Commercial	5	6	70
David's Stall Fruit and Veg	1	Commercial	5	6	70
Luddenham Progress Hall	1	Commercial	5	6	70
Board my Paws	1	Commercial	8	4	70
Water Filtration Plant	1	Industrial	1	4	75
Power Station 2552 The Northern Road	1	Industrial	2	5	75

** When in use*

5.4 Construction vibration assessment objectives

The following construction vibration goals apply for the Project:

- for structural damage to heritage structures, the vibration limits set out in the German Standard *DIN 4150-3: Structural Vibration - effects of vibration on structures*
- for damage to other buildings and/or structures, the vibration limits set out in the British Standard *BS 7385-1:1990 - Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings*
- for human exposure, the acceptable vibration values set out in *Assessing Vibration: A Technical Guideline* (DEC, 2006).

Further detail is provided in the following sections.

5.5 Vibration criteria

Effects of ground vibration on buildings resulting from construction can be classified as follows:

- human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed
- effects on building contents – vibration where the building contents may be affected

- effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

5.5.1 Disturbance to building occupants

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with *Assessing Vibration: A Technical Guideline* (DEC, 2006). The guideline provides criteria which are based on the British Standard *BS 6472-1992 Evaluation of human exposure to vibration in buildings (1-80Hz)*. Sources of vibration are defined as either 'continuous', 'impulsive' or 'intermittent':

- continuous vibration – from uninterrupted sources, e.g. machinery, steady road traffic, continuous construction activity
- impulsive vibration – up to three instances of sudden impact per monitoring period e.g. occasional dropping of heavy equipment, occasional loading and unloading
- intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously.

Maximum and preferred values for continuous and impulsive vibration are defined in Table 5-5. Application of the continuous and impulsive vibration criteria considers the level, duration of exposure, time of day, and varies for land uses.

Table 5-5: Continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

Location	Assessment period[1]	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night- time	0.04	0.029	0.080	0.058
Impulsive vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night- time	0.64	0.46	1.28	0.92

Notes: [1] Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am
[2] Such as hospital operating theatres or precision laboratories.

Intermittent vibration impact is assessed using vibration dose values (VDVs). The VDV method is more sensitive to peaks in the acceleration waveform and makes corrections to the criteria based on the duration of the source's operation. The acceptable VDVs for intermittent vibration are defined in Table 5-6.

Table 5-6: Acceptable intermittent vibration dose values (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Critical areas[2]	0.10	0.20	0.10	0.02
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: [1]Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am

[2]Includes operating theatres, precision laboratories and other areas where vibration sensitive activities may occur.

5.5.2 Structural damage

The standards by which building damage from construction-induced vibration is assessed are British Standard *BS 7385 Part 2 Evaluation and measurement of vibration in buildings* (BS 7385) and the German Standard *DIN 4150: Part 3 – 1999 Effects of Vibration on Structure* (DIN 4150-3) (DIN, 1999).

British Standard

BS 7385 is used as a guide to assess the likelihood of building damage from ground vibration. BS 7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur, where the categories of structural damage are defined as:

- cosmetic - the formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/ concrete block construction
- minor - the formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks
- major - damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.

The levels for structural damage outlined in the standard refer to non-continuous vibration sources and are considered 'safe limits' up to which no damage due to vibration effects are expected to occur for the various building types. Where vibration is continuous these levels may be reduced by up to 50% and additional assessment against the standard would be necessary.

BS 7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4 to 250 Hz, being the range usually encountered in buildings. Table 5-7 sets out the BS 7385 criteria for cosmetic, minor and major damage.

Table 5-7: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity[1] (mm/s)		
			4 – 15 Hz	15 – 40Hz	≥40Hz
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50	50	50
		Minor[2]	100	100	100
		Major[2]	200	200	200
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 - 20	20 - 50	50
		Minor[2]	30 - 40	40 - 100	100
		Major[2]	60 - 80	80 - 200	200

Notes: [1] Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

[2] Minor and major damage criteria established based on BS 7385 Part 2 (1993) Section 7.4.2

German Standard

DIN 4150-3 provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be more stringent criteria. DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure.

Where heritage structures are impacted, DIN 4150-3 vibration criteria will be applied. The criteria applicable to heritage buildings are identified in Table 5-8. Based on DIN 4150-3, a measured value exceeding those listed in Table 5-8 will not necessarily lead to damage if it is significantly exceeded, however, further investigations may be necessary.

A heritage specialist will be engaged throughout the Project to provide Roads and Maritime and its Contractors with advice on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures.

Table 5-8: DIN 4150-3 vibration guidelines for heritage buildings

Type of structure	Guideline values for vibration velocity (mm/s)			
	Vibration at the foundation at a frequency of			Vibration at the horizontal plane of the highest floor at all frequencies
	1 - 10 Hz	10 - 50 Hz	50 - 100 Hz[1]	
Heritage buildings	3	3 - 8	8 - 10	8

Notes: [1]At frequencies above 100 Hz the values given in this column may be used as minimum values.

5.5.3 Safe working distances

Where vibration intensive plant such as rock breakers and vibratory rollers are used, vibration must be managed to minimise disturbance to building occupants and to avoid damage to buildings and other structures. Table 5-9 indicates the safe working distances recommended by the CNVG for typical items of vibration intensive plant that must be complied with unless otherwise approved by Roads and Maritime.

Table 5-9: Safe working distances for vibration intensive plant (TfNSW 2013)

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (British Std 7385)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t) <100 kN (typically 2-4 t) <200 kN (typically 4-6 t) <300 kN (typically 7-13 t) >300 kN (typically 13-18 t) >300 kN (> 18 t)	5 m 6 m 12 m 15 m 20 m 25 m	15 m to 20 m 20 m 40 m 100 m 100 m 100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

The safe working distances presented in Table 5-9 are indicative and will vary depending on the item of plant (particularly its power rating) and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive such as heritage items, more stringent conditions may be applicable and will be considered individually by the Contractor. A heritage specialist (built structures) will be engaged by the Contractor to provide advice on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures in accordance with NSW-CoA E35.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment will be undertaken by the Contractor where the human response criteria are exceeded.

6 Environmental aspects and impacts

6.1 Environmental aspects

The Project will involve a range of activities incorporating various heavy machinery, plant and equipment that will operate in a number of locations across the Project. In order to assess the level of potential impact on noise and vibration sensitive receivers, the broad categories of Construction activity likely to interact with these receivers include:

- site establishment
- clearing and grubbing
- demolition
- utility relocation
- earthworks and drainage
- materials haulage
- concrete batching
- bridgeworks (piling)
- paving and concrete saw cutting
- ancillary facilities
- finishing works such as landscaping
- road furnishing.

In accordance with NSW-CoA E37, operational noise mitigation measures as identified in NSW-CoA E36 (such as at-property architectural treatments) that will not be affected by Construction works must be implemented within six months of the commencement of Construction which would affect the identified receivers or within another timeframe agreed with the Secretary.

6.2 Environmental impacts

The potential for noise and vibration impacts on sensitive receivers or structures will depend on a number of factors including:

- the type of equipment in use
- the number of equipment simultaneously in use
- ground condition
- topography and other physical barriers
- proximity to sensitive receivers
- the condition of sensitive receivers
- hours/duration of Construction works
- proximity of heavy traffic areas.

Relevant aspects and the potential for related impacts have been considered in a risk assessment provided in Appendix A2 of the OACEMP.

Noise and vibration impacts attributable to the Project are anticipated. Section 8 of this CNVMP provides a suite of mitigation measures that will be implemented to avoid or minimise noise and vibration impacts on the receiving community and/or built environment.

7 Construction noise and vibration assessment

A range of plant and equipment will be required to undertake activities associated with the Project. A summary of anticipated Construction scenarios and predicted noise and vibration levels is provided in the sections below.

7.1 Construction activities

Table 7-1 provides a summary of the Project Construction phases, associated plant and equipment required and the range of sound power levels (SWLs) for the plant and equipment anticipated to be used for the phase.

Table 7-1: Construction phases, and associated plant and equipment and sound power levels

Construction phase	Typical plant and equipment required	SWL range (dBA)
Early Works	Truck mounted crane, Light vehicles, Excavator, Generator, Bobcat, Dump trucks	88-111
Earthworks	Excavator, Dump trucks, Vibratory roller (20-30T), Light vehicles, Bulldozer, Grader, Water cart, Bobcat	88-114
Road work	Excavator, Bulldozer, Water cart, Grader, Dump truck, Spray sealing equipment, Concrete truck and pump, Asphalt paver (plus truck), Concrete saw, Vibratory roller (20-30T), Franna crane, Slip-forming machine	99-114
Bridge construction	Excavators, Light vehicles, Generator, Rock breaker, Concrete trucks and pump, Welding equipment, Mobile crane, Impact piling, Oxy-cutting equipment	88-126
Drainage work	Excavator, Light vehicles, Generator, Jackhammer, Concrete truck and pump, Truck mounted crane, Vibratory roller (20-30T),* Bored piling, Bobcat,	88-118
Paving	Excavator, Light vehicles, Generator, Asphalt paver (plus truck), Concrete trucks and pump, Concrete saw, Vibratory roller (20-30T), Slip-forming machine, Truck mounted crane	88-109
Utility Relocation	Excavator, Bored piling, Light vehicles, Truck mounted crane, Generators, Dump trucks, Plate compactor, Concrete trucks and pump	88-112
Finishing work	Excavator, Generator, Light vehicles, Dump trucks, Concrete trucks and pump, Hydromulching equipment, Truck mounted crane, Water cart, Vibratory roller(20-30T), Bobcat, Road marking machine, Welding equipment	88-116
Ancillary Facilities (concurrently operating)	Front end loader, Excavator, Road truck, Compressor, Welding equipment, Light vehicles, Generator, Pugmill	88-112

7.2 Construction noise impacts

7.2.1 General construction noise impacts

A summary of the predicted range of LA_{eq} noise levels and potential impacts to receivers at each NCA from standard hours (daytime) and out-of-hours construction scenarios are presented in Table 7-2 and Table 7-3 respectively. The tables present the predicted numbers of impacted residences for the various construction scenarios.

The construction impacts presented in Table 7-2 and Table 7-3 are based on representative worst-case noise construction scenarios assuming all equipment / ancillary facilities operate concurrently, that there are minimal offset distances between equipment and receivers and using reference equipment sound power levels in accordance with the CNVG.

The Construction Contractors will develop stage specific construction scenarios, timings, offset distances, equipment and identify concurrent / overlapping activities. The Construction Contractors will re-assess all construction noise and vibration impacts in accordance with the ICNG and CNVG and describe the construction impacts and the necessary noise, vibration and management mitigation measures which will be implemented in the Contractors' CNVMPs.

Activities that are predicted to exceed the NMLs in Table 5-3 and Table 5-4 and the requirements of NSW-CoA E26 will only occur in accordance with the EPL. Generally, Construction work will be undertaken in standard construction hours whenever practicable and in compliance with the day time NMLs. Some activities, such as bridgeworks, paving and operation of ancillary facilities may occur during out of hours in accordance with the requirements of NSW-CoA E26 and the EPL.

Table 7-2: Summary of predicted worst case Construction noise impacts during standard hours

NCA			NML (Standard Hours)	Number of exceedances for Construction phase: Early works	Earthworks	Roadwork-	Bridge work	Drainage	Paving	Utility Relocation	Finishing Works	Ancillary Facilities only
1	**Range of predicted noise levels LAeq (dB(A))**			**34-77**	**38-82**	**40-84**	**30-63**	**39-83**	**40-84**	**36-80**	**39-83**	**27-63**
	Number of Residences	Complying		1194	1179	1164	1204	1175	1164	1188	1175	1204
		0-10 dBA above NML		16	27	41	7	31	41	20	31	7
		10-20 dBA above NML	58	1	4	5		4	5	2	4	
		20+ dBA above NML			1	1		1	1	1	1	
		≥75 dBA (highly affected)		1	1	1		1	1	1	1	
2	**Range of predicted noise levels (dB(A))**			**39-78**	**44-83**	**46-85**	**34-61**	**45-84**	**46-85**	**42-81**	**45-84**	**34-61**
	Number of Residences	Complying		63	47	39	128	44	39	55	44	128
		0-10 dBA above NML		39	30	34	9	32	34	32	32	9
		10-20 dBA above NML	57	33	50	50		49	50	46	49	
		20+ dBA above NML		2	10	14		12	14	4	12	
		≥75 dBA (highly affected)		4	15	25		17	25	10	17	
3	**Range of predicted noise levels (dB(A))**			**43-73**	**48-78**	**50-80**	**43-61**	**49-79**	**50-80**	**46-76**	**49-79**	**35-61**
	Number of Residences	Complying		10	6	4	20	4	4	7	4	20
		0-10 dBA above NML		5	8	7	3	10	7	8	10	3
		10-20 dBA above NML	56	8	7	9		7	9	8	7	
		20+ dBA above NML			2	3		2	3		2	
		≥75 dBA (highly affected)			2	6		3	6	1	3	
4	**Range of predicted noise levels (dB(A))**			**49-63**	**50-68**	**52-67**	**52-65**	**51-66**	**52-67**	**50-63**	**51-66**	**46-60**
	Number of Residences	Complying										1
		0-10 dBA above NML		13	9	8	6	8	8	10	8	14
		10-20 dBA above NML	47	3	6	7	10	8	7	6	8	1
		20+ dBA above NML			1	1			1			
		≥75 dBA (highly affected)										

NCA			NML (Standard Hours)	Number of exceedances for Construction phase								
				Early works	Earthworks	Roadwork-	Bridge work	Drainage	Paving	Utility Relocation	Finishing Works	Ancillary Facilities only
5	**Range of predicted noise levels (dB(A))**			**39-83**	**43-88**	**45-90**	**45-72**	**44-89**	**45-90**	**41-86**	**44-89**	**38-69**
	Number of Residences	Complying	52	177	146	117	23	131	117	162	131	211
		0-10 dBA above NML		33	54	75	199	69	75	44	69	12
		10-20 dBA above NML		10	19	23	1	18	23	13	18	1
		20+ dBA above NML		4	5	9	1	6	9	5	6	
		≥75 dBA (highly affected)		4	5	5		5	5	4	5	
6	**Range of predicted noise levels (dB(A))**			**40-48**	**44-53**	**46-55**	**43-51**	**45-54**	**46-55**	**42-51**	**45-54**	**39-47**
	Number of Residences	Complying	52	14	12	11	14	12	11	14	12	14
		0-10 dBA above NML			2	3		2	3		2	
		10-20 dBA above NML										
		20+ dBA above NML										
		≥75 dBA (highly affected)										
7	**Range of predicted noise levels (dB(A))**			**43-64**	**48-69**	**50-71**	**40-49**	**49-70**	**50-71**	**46-67**	**49-70**	**40-49**
	Number of Residences	Complying	47	4			17			1		17
		0-10 dBA above NML		12	8	5	2	6	5	14	6	2
		10-20 dBA above NML		3	10	13		12	13	4	12	
		20+ dBA above NML			1	1		1	1		1	
		≥75 dBA (highly affected)										
8	**Range of predicted noise levels (dB(A))**			**41-69**	**46-74**	**48-76**	**41-66**	**47-75**	**48-76**	**44-72**	**47-75**	**41-66**
	Number of Residences	Complying	58	83	78	72	93	74	72	80	74	93
		0-10 dBA above NML		20	16	22	12	20	22	17	20	12
		10-20 dBA above NML		2	11	11		11	11	8	11	
		20+ dBA above NML										
		≥75 dBA (highly affected)				2		1	2		1	

Table 7-3: Summary of predicted worst case Construction noise impacts during out of hours (OOH)

NCA			Number of exceedances of Night NML				Number of exceedances of sleep disturbance criterion			
			NML (Night)	Bridge work	Paving	Ancillary Facilities only	Sleep Disturbance Screening Criterion	Bridge work	Paving	Ancillary Facilities only
	Range of predicted noise levels (dB(A))			**30-63**	**35-79**	**27-63**		**33-66**	**39-83**	**30-66**
1	Number of Residences	Complying	49	1,138	1,034	1,138	59	1,199	1,178	1199
		0-5 dBA above criteria		57	137	57		10	21	10
		5-15 dBA above criteria		16	35	16		2	11	2
		15-25 dBA above criteria			4				1	
		≥25 dBA above criteria			1					
	Range of predicted noise levels (dB(A))			**34-61**	**41-80**	**34-61**		**37-64**	**45-84**	**37-64**
2	Number of Residences	Complying	41	22	1	22	51	79	15	79
		0-5 dBA above criteria		44	11	44		39	24	39
		5-15 dBA above criteria		60	43	60		19	34	19
		15-25 dBA above criteria		11	32	11			50	
		≥25 dBA above criteria			50				14	
	Range of predicted noise levels (dB(A))			**35-61**	**45-75**	**35-61**		**38-64**	**49-79**	**38-64**
3	Number of Residences	Complying	40	6		6	50	12	2	12
		0-5 dBA above criteria		6		6		4	2	4
		5-15 dBA above criteria		7	7	7		7	7	7
		15-25 dBA above criteria		4	8	4			9	
		≥25 dBA above criteria			8				3	
	Range of predicted noise levels (dB(A))			**46-60**	**50-62**	**46-60**		**49-63**	**53-68**	**49-63**
4	Number of Residences	Complying	42				52	1		1
		0-5 dBA above criteria		1		1		11	8	11
		5-15 dBA above criteria		14	11	14		4	7	4
		15-25 dBA above criteria		1	5	1			1	
		≥25 dBA above criteria								

NCA			Number of exceedances of Night NML				Number of exceedances of sleep disturbance criterion			
			NML (Night)	Bridge work	Paving	Ancillary Facilities only	Sleep Disturbance Screening Criterion	Bridge work	Paving	Ancillary Facilities only
	Range of predicted noise levels (dB(A))			**38-69**	**40-85**	**38-69**		**41-72**	**44-89**	**41-72**
5	Number of Residences	Complying	39	1		1	49	125	44	126
		0-5 dBA above criteria		60	18	62		84	109	83
		5-15 dBA above criteria		151	159	150		14	48	14
		15-25 dBA above criteria		11	33	10		1	18	1
		≥25dBA above criteria		1	14	1			5	
	Range of predicted noise levels (dB(A))			**39-47**	**41-50**	**39-47**		**42-50**	**45-54**	**42-50**
6	Number of Residences	Complying	39				49	12	8	12
		0-5 dBA above criteria		12	6	12		2	6	2
		5-15 dBA above criteria		2	8	2				
		15-25 dBA above criteria								
		≥25dBA above criteria								
	Range of predicted noise levels (dB(A))			**40-49**	**45-66**	**40-49**		**43-51**	**49-70**	**43-51**
7	Number of Residences	Complying	42	9		9	52	19	4	19
		0-5 dBA above criteria		8	3	8			2	
		5-15 dBA above criteria		2	13	2			12	
		15-25 dBA above criteria			3				1	
		≥25dBA above criteria								
	Range of predicted noise levels (dB(A))			**41-66**	**43-71**	**41-66**		**44-71**	**47-75**	**44-71**
8	Number of Residences	Complying	47	34	20	34	57	76	63	76
		0-5 dBA above criteria		31	34	31		21	22	21
		5-15 dBA above criteria		36	37	36		8	13	8
		15-25 dBA above criteria		4	14	4			7	
		≥25dBA above criteria								

Exceedances of the NML from work during standard hours are predicted at the following non-residential receivers:

- Power Station - minor exceedances of up to 2 dB(A)
- Horse N Around – moderate exceedances of up to 11 dB(A) at the most affected building
- Shell Service Station – moderate exceedances of up to 17 dB(A)
- IGA Luddenham – moderate exceedances of up to 12 dB(A)
- Luddenham Public School - minor exceedances of up to 4 dB(A)
- St James Anglican Church - moderate exceedances of up to 11 dB(A)
- Luddenham Uniting Church – minor exceedances of up to 2 dB(A).

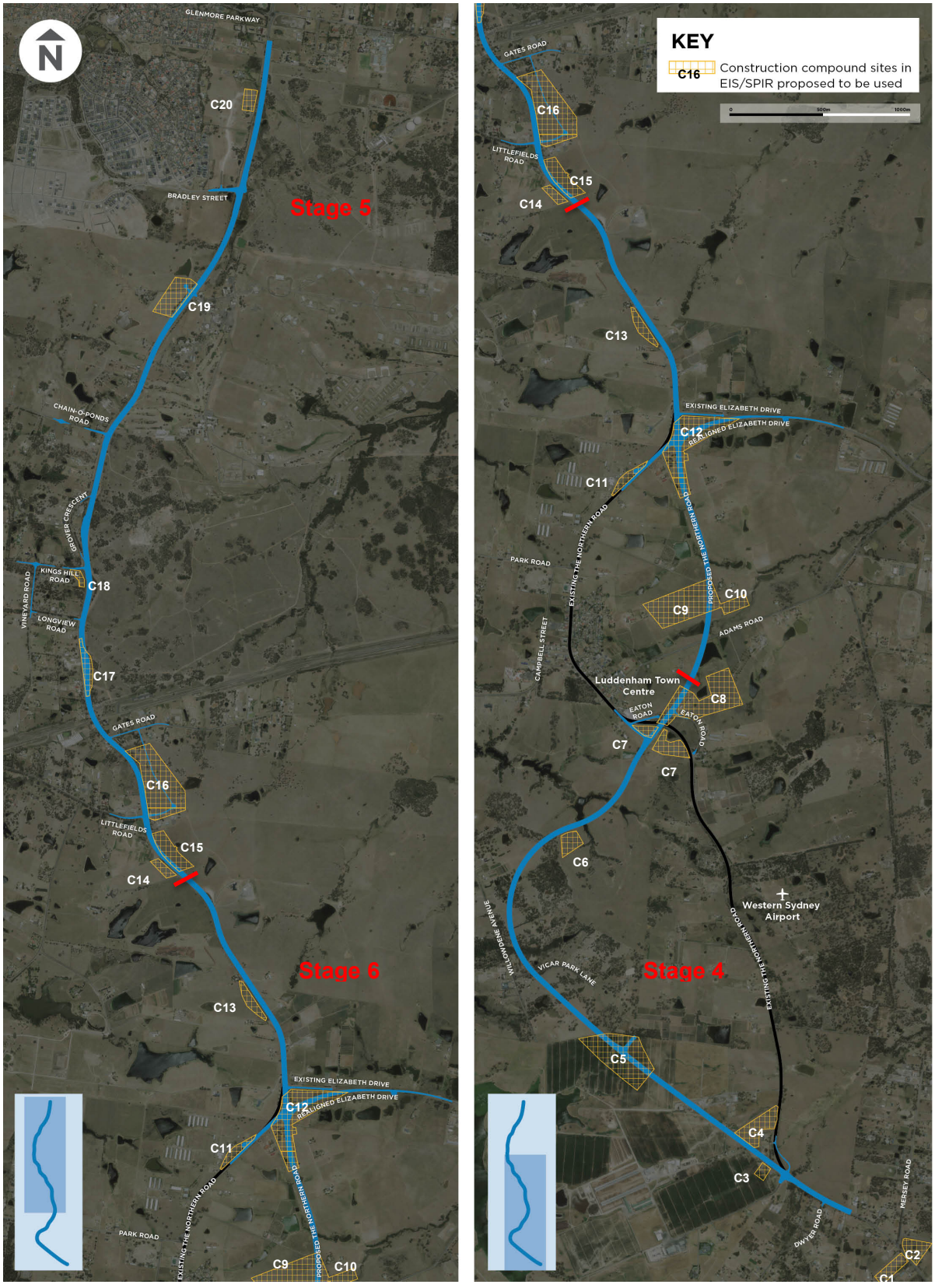
Construction Contractors may develop stage-specific NMLs, Construction scenarios, timings, offset distances, equipment and concurrent / overlapping activities consistent with this overarching NVMP. Contractors will re-assess Construction noise and vibration impacts in accordance with the ICNG and Roads and Maritime CNVG and prepare stage-specific CNVMPs, which will describe the Construction impacts and the noise, vibration and management mitigation measures which will be implemented during Construction of the applicable Project stage. The Contractors' CNVMPs will address the requirements of any EPL conditions relevant to Construction noise.

Where NMLs cannot be satisfied, Construction noise impacts will be mitigated using reasonable and feasible noise and management mitigation measures as per the ICNG and Roads and Maritime CNVG. Where appropriate, the Contractors will develop these measures in consultation with affected residents, businesses and community, religious and educational institutions. Consultation will be undertaken in accordance with the principles and procedures outlined in the CCS.

7.2.2 Ancillary facility operation (including access)

Temporary ancillary facilities required for the Project will include compounds and laydown areas. The locations of the ancillary facilities assessed in the EIS are shown in Figure 7-1. The compounds and ancillary facilities will accommodate a range of activities, plant and equipment including, but not limited to:

- offices and meeting rooms
- staff amenities
- light vehicle parking and access
- plant and equipment maintenance workshops
- materials laydown and storage areas
- perimeter fencing, including visual screening
- equipment storage
- a pug mill at either ancillary facility location C5 or C8.



Note: extent of stages is indicative only

Figure 7-1: Indicative ancillary facility locations and access routes for the Project

Not all ancillary facilities will serve the same purpose and may include one or more of the activities listed above. Table 7-4 summarises the likely combination of activities, plant and equipment anticipated at the Project ancillary facilities. The predicted noise levels from the ancillary facilities are provided in Table 7-2 and Table 7-3.

Table 7-4: Project ancillary facilities and associated attributes

Facility reference no.	Proposed use
C1	Storage of pits, pipes and culvert material. No stockpiling of earthworks.
C2	Storage of pits, pipes and culvert material. No stockpiling of earthworks.
C3	Outpost site office (secondary compound). The site would consist of a shed, lunch room, portable toilets and parking.
C4	Outpost site office (secondary compound). The site would consist of a shed, lunch room, portable toilets and parking. Storage of items such as concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C5	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials. Possible pug mill site.
C6	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C7	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C8	Main compound. The site would consist of office facilities for the Contractor and Roads and Maritime. It would include toilets, amenities, car parking, a shed and lunch room. Storage of concrete pits, pipes and culverts. Stockpile of topsoil and mulch and drainage backfill materials. Possible pug mill site.
C9	Secondary compound. The site would consist of a shed, lunch room, portable toilets and parking facilities.
C10	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C11	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C12	Main compound. The site would consist of office facilities for the Contractor and Roads and Maritime, toilets, amenities, tool sheds and car parking.
C13	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.

Facility reference no.	Proposed use
C14	Alternative site compound or small site office shed with amenities and car parking, and storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C15	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C16	Main compound site. Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C17	Stockpile site early in Construction. However, once the new southbound carriageway is completed, it is unlikely to be used further as a stockpile site.
C18	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C19	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.
C20	The site would consist of office facilities for the Contractor and Roads and Maritime, toilets, amenities, tool sheds and car parking.
C21	Storage of concrete pits, pipes and culverts. Could be used to stockpile topsoil, mulch and drainage backfill materials.

The final type, location and number of ancillary facilities (except for minor ancillary facilities) will be identified in the Contractors' Ancillary Facilities Management Plans (AFMP), prepared in accordance with NSW-CoA A16. The AFMPs will be prepared prior to the establishment of any ancillary facility (other than minor ancillary facilities) and included as part of the Contractors' CEMPs. The AFMPs will detail all sites intended for use as ancillary facilities for the Project. Any additional ancillary facilities identified for the Project that have not been assessed in the EIS or SPIR will be assessed in accordance with the criteria in NSW-CoAs A15 and A17, using the ancillary facilities assessment provided in Appendix A4 of the OACEMP. The assessment will be reviewed by Roads and Maritime and included within the AFMP. Ancillary facilities which do not meet the criteria under NSW-CoAs A15 and A17 require approval by the Secretary. The ER can assess minor ancillary facilities (refer Appendix A4 of the OACEMP for further details).

The Contractors will develop the AFMPs in consultation with the EPA and Liverpool City Council and Penrith City Council. The Contractors will confirm the plant and equipment required at each ancillary facility and undertake an assessment of noise impacts resulting from ancillary facilities for the stage of the Project that they are responsible for delivering.

The Contractors' AFMPs will include management measures to minimise noise impacts, including installation of acoustic barriers. Temporary acoustic barriers (2.4 metres high) will be installed as soon as site establishment works at the ancillary facilities are completed and before undertaking any works which are required to be conducted at the facility, as required by NSW-CoA E31. The AFMPs will include a schedule for installing and removing acoustic barriers, justification for not installing acoustic barriers in certain locations, and an inspection and maintenance schedule to ensure installed acoustic barriers remain effective throughout the period of use of the ancillary facility.

The AFMPs will be approved by the Secretary prior to installation of ancillary facilities. Minor ancillary facilities will be assessed by the ER.

7.2.3 Construction traffic noise impacts

Construction traffic will access Construction sites using only designated heavy vehicle routes such as the M4 Motorway, Elizabeth Drive and The Northern Road. The assessment of Construction traffic noise in the EIS and SPIR indicated that Construction traffic will not increase existing traffic noise levels by more than 2 dB. The assessment also concluded that the increase in traffic noise levels at receivers adjacent to the Project arising from the addition of peak Construction traffic volumes to existing traffic volumes will be less than 0.5 dB. The assessment concluded that mitigation measures for Construction traffic noise impacts are not required.

7.3 Construction vibration impacts

7.3.1 Construction vibration impacts

Vibration impacts to residents and buildings are expected during Construction of the Project. The main sources of Construction vibration include:

- vibratory rollers
- rock breaking
- hydraulic hammers
- vibratory pile drivers
- pile boring
- jackhammers

The greatest vibration impacts are expected due to:

- vibratory rollers during earthworks, bridge construction and other stages
- jack hammers during drainage works
- impact piling and rock breaking during bridgeworks.

Based on the safe working distances to preserve the structural integrity of dwellings recommended in Table 5-9, structural damage criteria will be complied with where vibratory rolling or rockbreaking is operated 22 m or closer to any dwelling or sensitive structure.

Impact piling required for bridge works will not occur within 190 m to the nearest residence, and is not predicted to cause structural damage.

In accordance with NSW-CoA E32(b) and E33, the Contractors will implement management measures to ensure that vibration impacts from Construction activities do not exceed the vibration limits for damage to buildings and structures set out in BS 7385 and *Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives).*

Vibratory rolling is expected to be undertaken within 100 m of residences for various stages of works (refer Table 7-1) and so may impact human comfort within those residences. In these cases, the procedures outlined in Appendix C of the CNVG (reproduced in Section 4 of

Annexure C to this CNVMP) are to be followed in order to mitigate any such potential impacts. These measures include notification strategies, vibration monitoring, offering of periods of respite and offering of alternative accommodation. These management measures would be identified and actioned at the detailed design stage.

Residential receivers may be impacted by Construction vibration. Table 7-5 indicates the number of vibration-sensitive receivers expected to be situated within the 22 m (preservation of structural integrity of buildings) and 100 m (protection of human comfort) safe working distances. Additional assessment will be undertaken where the human response criteria are exceeded. The Construction Contractors will confirm the number and location of residential receivers and mitigation measures to minimise vibration impacts in the stage-specific CNVMP. The mitigation measures implemented will avoid exceedances of the acceptable vibration values set out in *Assessing Vibration: A Technical Guideline* (DEC, 2006), as required by NSW-CoA E32(c).

Table 7-5: Indicative count of receivers within safe working distances of vibration-intensive works

NCA	Number of receivers within Safe Working Distance for…					
	Preservation of structural integrity of buildings (22 m buffer zone)			Protection of human comfort (100 m buffer zone)		
	Residential	Commercial	Military	Residential	Commercial	Military
1	1	-	-	8	-	-
2	20	2	35	63	3	44
3	-	-	-	6	1	-
4	-	-	-	1	-	-
5	4	2	-	15	3	-
6	-	-	-	-	-	-
7	-	-	-	1	-	-
8	2	-	-	12	-	-
Total	**27**	**4**	**35**	**106**	**7**	**44**

Detailed heritage assessments carried out for the Project as part of the EIS identified four heritage items as being potentially impacted by vibration:

- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (CHP) including the Chaffey Brothers Irrigation Scheme Canal (Stage 5) - vibration is unlikely to impact the canal due to the structural nature of the canal and vegetation on the canal.
- Item 3: Warragamba Dam to Prospect Reservoir pipeline (Stage 5) - vibration impacts unlikely due to its depth below ground and due to the application of the measures outlined in *The Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines* (Sydney Catchment Authority, 2012) and the guidelines and associated safe working distances to be adhered to for heritage structures as outlined in Table 5-9 above

- Item 9: Miss Lawson's Guesthouse site (Stage 4) - this heritage item will be salvaged prior to construction so no impacts due to vibration anticipated
- Item 10: Lawson's Inn Site (Stage 4) - this heritage item will be salvaged prior to construction so no impacts due to vibration anticipated.

In accordance with NSW-CoA E34, vibration testing will be carried out by the Contractors prior to and during Construction activities that have the potential to generate vibration impacts that may impact on heritage items. The purpose of the vibration testing is to identify minimum working distances to prevent cosmetic damage to heritage items. Where vibration testing and monitoring indicates that the preferred values for vibration are likely to be exceeded (refer to Table 5-8), the Contractors will review the Construction methodology and, if necessary, implement additional mitigation measures. The Contractors will engage a heritage specialist (built structures) to provide advice on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures in accordance with NSW-CoA E35.

Vibration impacts to heritage structures due to the Construction of the Project will be managed to achieve the vibration limits set out in DIN 4150-3 for structural damage to heritage structures (refer to Table 8-1), in accordance with NSW-CoA E32(a).

8 Environmental mitigation and management measures

A range of environmental requirements and management measures are identified in the EIS and SPIR, the conditions of approval and relevant Roads and Maritime documents.

Specific measures and requirements to address noise and vibration impacts are outlined in Table 8-1. Construction working hours are addressed in Section 8.1.

Table 8-1: Noise and vibration revised environmental management measures

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
NV-1	Construction Noise and Vibration Management Plan (CNVMP) would be prepared during the detailed design stage of the project and applied to all construction processes throughout the project. The CNVMP would be prepared in accordance with the requirements in the ICNG and RMS CNVG. The CNVMP would nominate:	Pre-Construction Construction	Contractor Environmental Site Representative / Contractor Construction Manager	✓	✓	✓	✓	✓	This CVNMP
	• Noise goals at all sensitive receivers	Pre-construction	Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Section 5.3
	• Restrictions on the hours of construction activity including an out-of-hours work procedure	Pre-construction	Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Section 8.1
	• Works programming that has the aim of minimising impacts on sensitive receivers	Pre-construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.1
	• Noise and vibration mitigation measures consistent with the RMS CNVG	Pre-Construction Construction	Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Section 7.2, Annexure C – OOHW Procedure
	• The project's commitments to noise and vibration monitoring and reporting including: ◦ vibration monitoring of work in the vicinity of the Warragamba Dam pipeline ◦ safe working distances for vibration intensive plant to be adopted in proximity to the Warragamba Dam pipeline	Construction	Contractor Environmental Site Representative			✓	✓		Section 5.5, Annexure B – Construction Monitoring Program

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
	• Protocols for engaging with and notifying residents of any work processes that may impact them	Construction	Contractor Community Relations Manager	✓	✓	✓	✓	✓	Section 9.2 Annexure C Community Communication Strategy
	• Describe an out-of-hours work procedure (with proforma) to be applied to all construction assessments, which is consistent with the applicable Environmental Protection Licence (EPL) for the project.	Construction	Contractor Construction Manager / Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Annexure C
	• A complaints mechanism so that residents may contact the project manager	Construction	Contractor Community Relations Manager	✓	✓	✓	✓	✓	Section 9.3 Community Communication Strategy
	• A protocol to enable the project to respond quickly to non-compliances	Construction	Contractor Construction Manager / Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Section 9.8
NV-2	Viable mitigation measures that would be expected to be deployed by the construction contractor once the final construction sequencing and scheduling is known include:			✓	✓	✓	✓	✓	
	• Restricting works to standard construction hours as far as practicable, considering safety and traffic management requirements	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.1

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
	• Selecting quieter plant and equipment	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.3
	• Erecting temporary acoustic hoarding to reduce noise from works within a confined area	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.3
	• Deploying mobile hoardings (eg, acoustic screen curtains mounted on a wheeled trailer) to track moving, but tightly-contained processes	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.3
	• Maximising offset distances between receivers and noisy plant or activities	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.3
	• Orientating plant and processes away from residences, where reasonably practicable	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.3
	• Scheduling works for times outside of heightened sensitivity for the impacted receiver, eg, outside of school hours	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.1 Section 9.2 Construction program
	• Scheduling respite periods for noise intensive processes undertaken near receivers, eg limiting operation of pavement sawing to three hours at a time	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.1 Annexure C Construction program
	• Planning any OOHW so that noisier works are carried out in the earlier part of the evening or night-time	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Annexure C

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
	• Minimising the number of consecutive nights of works adjacent to any particular set of receivers	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.1 Section 9.2 Annexure C Construction program
	• Restricting heavy vehicle movements, heavy deliveries and loading and unloading processes to daytime periods and to areas well away from receivers	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.3
	• Regularly maintaining and monitoring plant and equipment to ensure that their noise emissions are not excessive	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Annexure B
	• Minimising the annoyance from reversing alarms by either fitting closed circuit monitors or non-tonal reversing alarms (“quackers”) on vehicles or deploying ‘spotters’ to oversee reversing movements	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Section 8.3
	• Reducing throttle settings and switching off equipment when it is not being used.	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Section 8.3
	• Hoarding (2.4 metres) to be installed at the perimeter of all ancillary facilities except where it can be justified that the acoustic benefit of the hoarding is not warranted	Construction	Contractor Foreman	✓	✓	✓	✓	✓	AFMP
	• Haulage routes will be located as far away as possible from residential receivers, where this is reasonable and feasible	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Appendix B1 – Construction Traffic Management

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
									Plan
	• Where it has been identified as necessary (eg in response to community complaints), noise monitoring will be undertaken to check that the noise mitigation measures are effective	Construction	Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Section 9.5 Annexure B
	• Static noise sources, such as generators, pumps and lighting towers, will be located as far as possible from sensitive receivers	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Section 8.3
	• Loading and unloading will be carried out away from sensitive receivers, where practicable	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Section 8.3
	• Ensure all deliveries occur during standard construction hours where reasonable and feasible.	Construction	Contractor Foreman	✓	✓	✓	✓	✓	Section 8.3
NV-3	Implement operational noise mitigation early in the construction program, where possible, to minimise construction noise impacts	Construction	Contractor Construction Manager / Roads and Maritime Project Manager	✓	✓	✓	✓	✓	Section 8.2
CI-2	Where relevant, consultation would be undertaken with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts	Construction	Contractor Construction Manager / Contractor Community Relations Manager	✓	✓	✓	✓	✓	Community Communication Strategy Contractor's CNVMP

8.1 Working hours

8.1.1 Hours of work

In accordance with NSW-CoA E23 and the EPL, work will be undertaken during standard construction hours:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 1:00 pm
- Sundays and public holidays: no work

8.1.2 High noise impact activities and works

As required by NSW-CoA E24, except as permitted by an EPL, highly noise intensive works that result in an exceedance of the applicable NML at the relevant receiver must only be undertaken:

- Monday to Friday: between 8:00 am to 6:00 pm
- Saturday: between 8:00am to 1:00pm
- Sundays and public holidays: no work

Work with impulsive or tonal noise emissions will be carried out in continuous blocks not exceeding three hours each, with a minimum respite of at least one hour between ceasing and recommencing each block of work.

'Continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing the work.

The EIS assessed the potential Construction noise impacts to residents based on the predicted worst case Construction noise levels. This assumed that construction of all three stages of the Project occurs concurrently, with all 21 ancillary facilities operating simultaneously, for the entire duration of the Construction program. The construction noise modelling undertaken for the assessment identified a number of sensitive receivers as being subject to levels that exceed the Highly Noise Affected criteria (>75 dB(A)). Appendix L of the Technical working paper: Noise and vibration (refer to Appendix H of the EIS) provides a detailed prediction of Construction noise at sensitive receivers.

The Contractors will confirm the Construction noise levels for the Project in the Contractors' CNVMPs once the Construction program and staging of works is confirmed. In accordance with NSW-CoA E25, the Contractors will consult with receivers identified as being subject to noise levels exceeding the Highly Noise Affected criteria with the objective of determining appropriate hours of respite, unless an agreement is reached with those receivers.

All conditions relating to construction hours outlined in the Project EPL will be complied with.

8.1.3 Variation to hours of work

Works outside of the standard construction hours identified in Section 8.1.1 may be undertaken in the following circumstances:

- for the delivery of materials required by the NSW Police Force or other authority for safety reasons or
- where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm or
- where the works generate noise that is:
    - $L_{Aeq(15\ min)}$ noise levels no more than 5 dB(A) above rating background level at any residence in accordance with the ICNG (DECC, 2009) and
    - $L_{Aeq(15\ min)}$ noise levels no more than the noise management levels specified in Table 3 of the ICNG (DECC, 2009) at other sensitive receivers and
    - continuous or impulsive vibration values, measured at the most affected residence, that are no more than those for human exposure to vibration, specified for residences in Table 2.2 of *Assessing Vibration: a technical guideline* (DEC, 2006) and
    - intermittent vibration values, measured at the most affected residence, that are no more than those for human exposure to vibration, specified for residences in Table 2.4 of *Assessing Vibration: a technical guideline* (DEC, 2006) or
- no more than 15 dB(A) above the night time rating background level at any residence during the night time period, when measured using the $L_{Aeq(1\ minute)}$ or L_{Amax} noise descriptors
- where different hours are permitted or required under an EPL in force in respect of the works, in which case those hours must be complied with.

On becoming aware of the need for emergency works, the Contractor will notify the Roads and Maritime Project Manager, the ER and the EPA of the need for the emergency works. The Contractor will use its best endeavours to notify all affected sensitive receivers of the likely impact and duration of the emergency works.

The Contractor will submit a report to the EPA by 2 pm on the next business day after the emergency works commenced that describes:

- the cause, time and duration of the works
- action taken by or on behalf of the EPL licensee in relation to the works
- details of any measures taken or proposed to be taken by the Contractor to prevent or mitigate against a recurrence of the requirements for works in accordance with the above.

8.1.4 Out of hours work

OOHW will only occur in accordance with the requirements of NSW-CoA E26 and the EPL. OOHW with predicted noise levels exceeding the requirements of NSW-CoA E26 will only occur if there is a community agreement in place in accordance with EPL Conditions L4.5, L4.6 and E1.1 to E1.8 (refer Section 8.1.5).

The Contractors will prepare and implement a stage-specific Out of Hours Work (OOHW) Procedure prior to commencement of Construction in accordance with the *Construction Noise and Vibration Guidelines* (Roads and Maritime, 2016), Roads and Maritime specifications, and the template OOHW Procedure provided in Annexure C of this CNVMP. The OOHW Procedure will be prepared to address the requirements of NSW-CoA E26 and

E27 and the EPL and will be included in the Contractor's CNVMP. The purpose of the OOHW Procedure is to assess, approve and manage OOHW for the Project.

The OOHW Procedure will include, but not be limited to:

- the process for obtaining Roads and Maritime agreement for OOHW
- the details to be provided to the Roads and Maritime Environmental Manager (or delegate) and Roads and Maritime Project Manager in any OOHW application, including information on the nature and need and justification for activities to be conducted during the varied construction hours
- requirements for consultation with the EPA, potentially affected receivers and local Councils, and the evidence of the consultation to be provided to the Roads and Maritime Environmental Manager (or delegate) and Roads and Maritime Project Manager.

The Contractors' OOHW Procedures will be reviewed by Roads and Maritime for consistency with the requirements of this overarching CNVMP, the CoA, EPL and the REMMS and appended to the Contractors' CNVMPs. Approvals for any changes to the construction hours outlined in Section 8.1.1 above will be attached to the Contractors' CEMPs.

8.1.5 Community agreements for works outside of standard construction hours

Works outside of standard construction hours that do not meet the circumstances listed in Section 8.1.3 above may be undertaken if agreement between the Contractor and a substantial majority of noise sensitive receivers has been reached in accordance with the EPL. Any agreement between the Contractor and noise sensitive receivers must be:

- submitted to the EPA for approval prior to any works that are the subject of the agreement being undertaken
- prepared in writing and a copy of the agreement kept on the premises by the Contractor for the duration of the EPL
- kept on the Project website for the duration of the agreement (personal details of residents will be omitted).

Any community agreement to permit works to be undertaken outside of standard construction hours will:

- be prepared and implemented in accordance with the relevant sections of the ICNG (DEC, 2009), the *NSW Industrial Noise Policy* (EPA, 1999) and *AS2346-2010 Guide to noise and vibration control on construction, demolition and maintenance sites*
- detail:
    - the actual works proposed
    - any expected impacts in clear, simple English based on noise modelling
    - the expected duration of the works
    - any expected benefits for receivers
    - any other concurrent OOHW that will be occurring
    - any other OOHW that will be occurring on the nights preceding and following the proposed works or, if the proposed work precedes or follows a weekend period, any other OOHW that will be occurring on the weekend.

- demonstrate that the noise sensitive receivers party to the agreement understand the nature of the works and any predicted impacts
- be kept for the duration of the agreement and made available to an EPA authorised officer on request.

In relation to consulting and engaging with noise sensitive receivers for a community agreement, the following applies:

- all noise sensitive receivers predicted by modelling to be impacted by noise greater than 5 dB(A) above RBL must be consulted on any proposed community agreement, including noise sensitive receivers that have declined to participate in previous agreements
- all proposed agreements must include details for interpreting services for languages other than English where required
- if the Contractor is unable to contact a noise sensitive receiver after three attempts during the time of day that the proposed works would be undertaken, including leaving "sorry I missed you" cards explaining the reason for the visit and requesting a return phone call, then the Contractor will note that the receiver could not be contacted and the receiver will not be considered to have either agreed or disagreed
- records of the attempts to contact the receiver will be kept by the Contractor.

All noise sensitive receivers will be advised of any community agreement that has been attained in writing within seven calendar days of the agreement being finalised. The written notification will include:

- a link to the Project website, specifically to a summary of the approved agreement
- details of the Project telephone number
- details of the EPA's Environment Line.

Validation monitoring will be undertaken for any works that are the subject of a community agreement. The monitoring will be performed by a suitably qualified and experienced person on at least the first two nights when OOHW will be undertaken.

If the validation monitoring shows that noise levels are higher than those predicted by any noise modelling undertaken as part of the community agreement, work practices will be modified and/or additional mitigation measures implemented so that measured noise levels do not exceed predicted levels.

The Contractor will submit a validation monitoring plan to the EPA for approval as part of the community agreement documentation prior to any OOHW occurring.

In the event of an inconsistency between the requirements relating to community agreements in this CNVMP and the EPL, the conditions of the EPL prevail to the extent of the inconsistency.

8.2 At-property noise mitigation treatments

At-property treatments will be required for the noise mitigation receivers identified in the Appendix B of the SPIR. The objective of at-property treatments is to reduce internal traffic noise to levels that would have prevailed had the external traffic noise criteria been able to be achieved. At-property treatments will comply with the criteria outlined in the *NSW Road*

Noise Policy (DECCW, 2011). Potential at-property treatments, as outlined in the *Noise Mitigation Guideline* (Roads and Maritime, 2016), include:

- installation of courtyard screen walls
- fresh air ventilation systems that meet Building Code of Australia requirements
- upgraded windows and glazing and solid core doors on the exposed facades of masonry structures only
- upgrading window and door seals and treatment of sub floor ventilation
- sealing of wall vents
- sealing of the underfloor below the bearers
- sealing of eaves.

The specific form of at-property treatment applied will be considered on a case by case basis and will depend on the existing construction of the dwelling. Roads and Maritime will consult with the identified receivers to agree the specific form of at-property treatment to be applied. The consultation for at-property and temporary noise mitigation measures will be undertaken in accordance with the CCS.

The program for implementation of at-property treatments will be confirmed once the Construction program and staging is confirmed, however it is expected that at-property treatments will be commence with receivers within Stage 4 of the Project, followed by Stage 5 and Stage 6 in accordance with the indicative Project timeframe shown in Figure 2-3 of the OACEMP. The program for implementation of at-property treatments will be developed in consultation with the identified receivers.

Roads and Maritime will confirm the details of the agreed at-property treatments, evidence of consultation with the identified receivers, and a schedule for the timing for the delivery of the treatments in the Operational Noise Mitigation Report to be prepared in accordance with NSW-CoA E36. Operational Noise Mitigation Reports will be progressively prepared for each stage of the Project and submitted to the DP&E for approval prior to the commencement of Construction, as outlined in the Project Staging Report. Approval by the DP&E of the Operational Noise Mitigation Report for Stage 4 of the Project was provided on 25 July 2018.

At-property treatments will be installed within six months of the commencement of Construction which will affect the identified receivers or within another timeframe agreed with the Secretary. Where early implementation of noise mitigation measures is not proposed, Roads and Maritime will include in the Operational Noise Mitigation Report a justification as to why, along with details of temporary measures that will be implemented to reduce construction noise impacts, prior to the at-property treatments being installed.

8.3 Plant and equipment

Noise impacts from Construction activities will be reduced by implementing measures to control noise at the source. Methods to minimise noise resulting from the use of plant and equipment during Construction of the Project (as identified in the ICNG (DECC, 2009) and Roads and Maritime specifications) include:

- ensure construction plant and equipment used are fitted with properly maintained noise suppression devices in accordance with the manufacturer's specifications
- ensure construction plant and equipment are maintained in an efficient condition
- train site personnel to operate construction plant and equipment in a proper and efficient manner
- use alternatives to diesel and petrol engines and pneumatic units where feasible and reasonable
- select less noisy plant and equipment for Construction activities
- avoid vehicle movements at night
- reduce plant throttle settings and turn off equipment when not in use
- avoid or use less irritating alternatives to audible reversing and movement alarms or configure the construction site/haulage routes to minimise the need for reversing of heavy vehicles and mobile plant
- use dampening materials where relevant
- erect temporary noise barriers at site boundaries and ancillary facilities, and/or use mobile hoardings to reduce noise transmission to sensitive receivers
- position stockpiles and temporary buildings within site layouts to effectively act as acoustic barriers
- avoid the positioning and use of vehicle parking areas and unloading/loading zones near residences and other sensitive land uses
- avoid positioning multiple plant near residences and other sensitive land uses
- restrict areas where mobile plant can operate so that it is away from residences and other sensitive land uses at particular times
- locate site access points away from residences and other sensitive land uses
- ensure drivers are aware of nominated vehicle routes and parking areas
- locate electrical generators away from residences and other sensitive land uses
- construction vehicles arriving at the Project site and construction compounds outside the standard construction hours described in Section 8.1.1 will not queue with idling engines.

The Contractors will make all efforts to implement the measures outlined above during Construction of the Project. The Contractors will prepare construction programs and construction site layouts to minimise noise impacts from Construction activities. Regular inspections, including spot inspections of plant and equipment, will be carried out to by the Contractors' Construction Manager and Foremen to monitor the Contractors' compliance with these requirements.

9 Compliance management

9.1 Roles and responsibilities

The Project organisational structure and overall roles and environmental responsibilities are outlined in Section 5.1 of the OACEMP. Specific responsibilities for the implementation of noise and vibration management are detailed in Section 8 of this CVNMP.

A heritage specialist (built structures) will be engaged by the Contractor to provide advice on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures in accordance with NSW-CoA E35.

9.2 Communication

Roads and Maritime will prepare and implement a Community Communication Strategy (CCS) in accordance with the requirements of NSW-CoA B1 to document the approach to stakeholder and community communications for the Project. The CCS will identify opportunities and tools for providing information and consulting with the community and stakeholders during the Construction of the Project. The Contractors will support the delivery of the CCS.

Noise and vibration management information will be communicated to the community and stakeholders in accordance with the principles and procedures outlined in the CCS and the *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016). Roads and Maritime and its Contractors will adhere as a minimum to the following principles and procedures relevant to noise and vibration management:

- good engagement with the community will be maintained to facilitate effective Project delivery with consideration of community impact, including procedures for notifying residents, business owners and other sensitive receivers, of any noise- or vibration-intensive Construction activities likely to affect their amenity
- the community will be informed of the dates for the intended works, sequencing, timing and levels of noisy or vibration intensive events at least seven calendar days in advance of the activity being undertaken
- minimising Construction noise and vibration will be viewed as a continuous improvement exercise that is inclusive of stakeholders
- site personnel and the community will be informed of the effort and methods undertaken to reduce noise and vibration impacts for the Project
- potentially affected community, religious, educational institutions and noise and vibration-sensitive businesses will be consulted prior to scheduling the Construction works to identify periods during which they would be adversely affected by noise generating works. Works will not be scheduled during the periods identified by the stakeholders unless Roads and Maritime, the Contractor and the sensitive receiver have made other arrangements (at no cost to the affected receiver) or the Secretary has otherwise approved the works.

Consultation will be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the Project.

The CCS provides details on the requirements for coordination and communication between the Contractors working on the Project stages which will include:

- liaison meetings
- mailing list for all communications (including Community Updates)
- email communication
- Project briefings.

Where relevant, the Roads and Maritime Community and Stakeholder Engagement Advisor and the Contractor CRMs will undertake consultation with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts.

Further detail about the CCS is provided in Section 5.5.3 of the OACEMP. Community consultation methods relating to OOHW are contained in the template OOHW Procedure (Annexure C).

9.3 Complaints management

Roads and Maritime will develop a Complaints Management System (CMS) to document the overall approach to complaints management for the Project. The Contractors will adopt the requirements of the CMS, including reporting requirements. The CMS will include a Complaints Register which will record the details of all complaints relating to the Project.

Further detail about the CMS is provided in Section 5.5.3 of the OACEMP.

In accordance with EPL conditions M6.5 and M6.6, the Contractors will investigate noise and vibration complaints:

- within two hours of the complaint being made or
- within another timeframe agreed with the complainant.

If the investigation identifies Construction works or activities being undertaken as the likely source of the complaint, the Contractor will make an offer to the complainant to undertake attended noise or vibration monitoring at their premises. If the offer to undertake attended noise or vibration monitoring is accepted, the Contractor will undertake the monitoring:

- as soon as practicable or
- at a time agreed with the complainant.

The Contractor will advise each complainant of the results of its investigation of their complaint and any proposed remedial action.

9.4 Training

To ensure that this CNVMP is effectively implemented, all site personnel (including sub-contractors) will undergo site induction training that includes construction noise and vibration management issues prior to Construction commencing. The induction training will address elements related to noise and vibration management, including:

- existence and requirements of this overarching CNVMP, the Contractor's CNVMP and all plans and procedures prepared under the CNVMPs

- relevant legislation, regulations and EPL conditions
- incident response, management and reporting
- standard construction hours
- the process for seeking approval for out of hours works, including consultation
- noise management measures during night works
- location of noise sensitive areas
- complaints response and reporting
- general noise and vibration management controls
- specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in noise and vibration management or those undertaking an activity with a high risk of environmental impact. Site personnel will undergo refresher training at not less than six monthly intervals.

The ER will review and approve the induction and training program prior to the commencement of Construction and monitor implementation.

Daily pre-start meetings conducted by the Contractor Foreman will inform the site workforce of any environmental issues relevant to noise and vibration that could potentially be impacted by, or impact on, the day's activities.

Further details regarding staff induction and training are provided in Section 5.3 of the OACEMP.

9.5 Monitoring and inspections

9.5.1 Monitoring

An overarching Construction Noise and Vibration Monitoring Program has been prepared in accordance with NSW-CoA C9(b) and is provided in Annexure B.

Monitoring will include, but not be limited to:

- monthly noise monitoring at sensitive receivers
- spot checks of noise intensive plant
- attended vibration monitoring
- continuous vibration monitoring
- dilapidation surveys of buildings and structures.

9.5.2 Inspections

Regular inspections of sensitive areas and activities will occur for the duration of the Project. The Contractor Environmental Site Representatives will carry out weekly site inspections. Roads and Maritime will also conduct independent inspections to confirm the Contractors' compliance with noise and vibration management requirements.

Weekly and other routine inspections by the Roads and Maritime Environmental Manager (or delegate), Environmental Review Group (ERG) representatives and the ER will occur throughout Construction. Detail on the nature and frequency of these inspections are documented in Section 6.1 of the OACEMP.

9.6 Incident planning and response

Responses to incidents will be undertaken as described in Section 5.6 of the OACEMP and in accordance with the Environmental Incident Classification and Reporting Procedure (refer to Appendix A7 of the OACEMP).

9.7 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of noise and vibration management measures, compliance with this CNVMP, conditions of approval and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 6.4 of the OACEMP.

9.8 Non-conformances

A non-conformance is the failure or refusal to comply with the requirements of project system documentation, including this CNVMP. Any member of the Contractors' Project team may raise a non-conformance or improvement opportunity.

Where a non-conformance is detected or monitoring results directly attributable to the Project exceed the target set in the Construction Noise and Vibration Monitoring Program, the process described in the Monitoring Program and Section 6.6 of the OACEMP will be implemented. The Contractor's Quality Plan will describe the process for managing non-conforming work practices and initiating corrective / preventative actions or system improvements in accordance with the process outlined in Section 6.6.1 of the OACEMP.

9.9 Reporting

Reporting requirements and responsibilities are documented in Section 6.5 of the OACEMP.

The Construction Contractors will report on noise and vibration monitoring in accordance with the Construction Noise and Vibration Monitoring Program provided in Annexure B.

The Contractors will be required to maintain accurate records substantiating all Construction activities associated with the Project or relevant to the conditions of approval, including measures taken to implement this CNVMP. Records will be made available to the DP&E and DoEE upon request, within the timeframe nominated in the request.

10 Review and improvement

10.1 Continuous improvement

Continuous improvement of this CNVMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- identify areas of opportunity for improvement of environmental management and performance
- identify environmental risks not already included in the risk register
- determine the cause or causes of non-conformances and deficiencies
- develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- verify the effectiveness of the corrective and preventative actions
- document any changes in procedures resulting from process improvement
- make comparisons with objectives and targets.

The Contractors will be responsible for ensuring Project environmental risks are identified and included in the risk register and appropriate mitigation measures implemented throughout the Construction of the Project as part of the continuous improvement process.

The Contractors will hold environmental risk assessment workshops prior to the commencement of Construction to identify high noise and vibration risk activities and representative sensitive receivers that will require monitoring during Construction, as outlined in Section 4.1 of the monitoring program (refer to Annexure B of this CNVMP).

The process for continuous identification and analysis of new risks associated with noise and vibration that may arise during Construction will be facilitated by the program of noise and vibration monitoring (as outlined in Annexure B of this CNVMP), regular inspections of sensitive areas and activities and observations by site personnel (Section 9.5.2), and through revision of this CNVMP and the Contractor's CNVMP and/or noise and vibration management measures as required in response to community complaints or requests from regulatory agencies, the ER or the Secretary. This continuous risk analysis approach will ensure prompt identification of new risks and ensure efficient mitigation through implementation of appropriate management measures, as outlined in Section 8.

10.2 CNVMP update and amendment

The processes described in Section 6.8 of the OACEMP may result in the need to update or revise this CNVMP. This will occur as needed.

Any revisions to this CNVMP will be in accordance with the process outlined in Sections 1.6 and 6.8 of the OACEMP.

A copy of the updated CNVMP and changes will be distributed to all relevant stakeholders, including Penrith City Council and Liverpool City Council, in accordance with the approved document control procedure (refer to Section 1.5 of the OACEMP).

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Annexure A – Consultation correspondence

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1 Introduction

Consultation with relevant stakeholders and Government agencies was undertaken as part of the development of this CNVMP in accordance with the requirements of the Infrastructure Approval. The agencies required to be consulted under the Infrastructure Approval are listed in Table 1-1.

Table 1-1: Consultation requirements under the Infrastructure Approval

NSW CoA	Relevant OACEMP Sub-plan / procedure	Agency to be consulted	Reference
C4(b)	Noise and vibration CEMP Sub-plan	Penrith City Council, Liverpool City Council	This CNVMP

The consolidated evidence of the consultation undertaken and comments relevant to the preparation of this CNVMP is provided in this annexure. This annexure includes:

- documentation of the engagement with the parties identified in Table 1-1 that occurred prior to submitting the document to the Secretary for approval (Section 2)
- a log of the points of engagement or attempted engagement with the identified parties (Section 2) and a summary of the issues raised by them (Section 3)
- documentation of the follow-up with the identified parties where feedback has not been provided to confirm that they have no feedback or have failed to provide feedback after repeated requests (Section 2)
- an outline of the issues raised by the identified parties, a summary of how they have been addressed and a cross reference to the section of the CNVMP where the issue has been addressed (Section 3)
- a description of the outstanding issues raised by the identified parties and the reasons why they have not been addressed (Section 4)
- copies of all consultation correspondence relevant to this CNVMP (Attachment 1).

2. Documentation and log of the engagement and follow up

Table 2-1: Requests for comment from Roads and Maritime

Organisation	Contact	Date	Correspondence Type	Description
Liverpool City Council	Charles Wiafe	26/06/2018	Letter and email	Request from Roads and Maritime for comment on the CNVMP
		11/07/2018	Follow up phone call, voicemail and email	
		26/07/2018	Follow up phone call and voicemail	
		27/07/2018	Follow up email	

Organisation	Contact	Date	Correspondence Type	Description
		02/08/2018	Follow up phone call in which LCC agreed to respond by 09/08/2018	
		14/08/2018	Follow up phone call and voicemail	
Penrith City Council	Kristy Johnson	26/06/2018	Letter and email	Request from Roads and Maritime for comment on the CNVMP
		12/07/2018	Follow up phone call	

Table 2-2: List of responses

Organisation	Contact	Date	Correspondence Type	Description
Liverpool City Council	-	-	-	No response provided
Penrith City Council	Ari Fernando Major Projects & Design Coordinator	20/7/2018	Email	Comment on the CNVMP

3. Summary of issues raised and responses

Table 3-1: Summary of issues raised and Roads and Maritime responses

Summary of agency comment	Roads and Maritime responses
Liverpool City Council	
No comments provided	
Penrith City Council	
Council's Environmental Health Section has noted that the Draft Noise Mgt Plan is comprehensive. However, in Section 8 it should be noted that any variation of hours of work or Out of hours work should have Penrith City Council agreement.	Section 8.1.4 of the CTMP and Section 5 of the OOHW Procedure requires the Contractor to consult with local Councils prior to undertaking any OOHW. The Contractor will evidence of the consultation undertaken for the OOHW to Roads and Maritime.
A copy of the final CNVMP should be provided to Council.	Section 1.3.1 amended to state that copies of the final CNVMP will be provided to PCC and LCC. Section 10.2 amended to state that updates to the CNVMP will be provided to PCC and LCC.

4. Outstanding issues

There are no outstanding issues to be resolved arising from the consultation on the CNVMP.

Attachment 1: Copies of consultation correspondence

Alison Tourle (Sydney)

Subject: FW: The Northern Road Upgrade - NSW and Federal Approvals & comments on CEMP Sub Plans

---

From: Ari Fernando [mailto:ari.fernando@penrith.city]
Sent: Friday, 20 July 2018 5:21 PM
To: GRAHAM Suzette E
Cc: TNR4 Correspondence File
Subject: RE: The Northern Road Upgrade - NSW and Federal Approvals & comments on CEMP Sub Plans

Hi Suzette

I have now collated comments received for the sub plans attached and is noted as below.

1. **Construction Traffic Management Plan**

Section 5 - Construction Traffic Management Sub Plan did not recognise Grover's Cr as a local road accessed by both construction and light vehicles and should be included.
Whether programmed night works are undertaken for utility installation is not noted. Our experience is some work will be required.
Where bus stops are relocated for construction, safe crossing points for bus commuters will need to be provided with sufficient lighting for changed locations.

A dilapidation report will be required for the local roads to be accessed/ upgraded.

Minor comment – Section 6.11 (Emergency Services notification – should be Nepean Local Area Command (As Penrith/St Marys have amalgamated).

There should be notations included that Local Roads not be included in any TMP's for State Road traffic detours.

2. **Construction Noise & Vibration Management Plan**

Council's Environmental Health Section has noted that the Draft Noise Mgt Plan is comprehensive.

However, in Section 8 it should be noted that any variation of hours of work or Out of hours work or should have Penrith City Council agreement be noted.

A copy of the final CNVMP should be provided to Council.

3. **Construction Soil & Water Management Plan**

The draft CSWMP is considered to be comprehensive and no further comments.

4. **Water & Soil Contamination Management Plan**

The draft WSCMP is considered to be comprehensive and no further comments.

5. No further comments on Construction Contamination Land Management Plan.

6. I am awaiting some further comments from Aboriginal Liaison Officer with respect to Aboriginal Heritage component of the Construction Heritage Management Plan.

Regards

Ari Fernando
Major Projects & Design Coordinator

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From: GRAHAM Suzette E [mailto:Suzette.GRAHAM@rms.nsw.gov.au]
Sent: Thursday, 28 June 2018 5:38 PM
To: Ari Fernando <ari.fernando@penrith.city>
Cc: TNR4 Correspondence File <TNR4S@rms.nsw.gov.au>
Subject: The Northern Road Upgrade - NSW and Federal Approvals

Hi Ari,

Here are the NSW and Federal Approvals for The Northern Road Project to assist with the CEMP Sub-plan reviews.

Thanks,

Kind regards,

Suzette Graham
Senior Environment Officer, WSPO
Environment **|** Stakeholder and Community Engagement
M 0476 828 524 **PH:** (02) 8849 2618
www.rms.nsw.gov.au
Every journey matters
Roads and Maritime Services
27 Argyle Street, Parramatta NSW 2150

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Annexure B – Construction Noise and Vibration Monitoring Program

A template for the proposed structure and content for the Contractors' Construction Noise and Vibration Monitoring Program is provided in this Annexure. The Contractor will prepare a stage specific Construction Noise and Vibration Monitoring Program as part of the Contractor's CNVMP in accordance with the legislation, guidelines and standards identified in Section 3 of the overarching CNVMP and consistent with this overarching Construction Noise and Vibration Monitoring Program.

Where appropriate, the Contractors may supply a Construction Noise and Vibration Monitoring Program with an alternative structure provided it meets the requirements identified in this CNVMP and the relevant Roads and Maritime specifications. Roads and Maritime will review the Contractors' documentation to confirm compliance with the applicable requirements.

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Contents

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1 Introduction

1.1 Purpose and scope

This overarching Construction Noise and Vibration Monitoring Program (MP) has been developed in accordance with NSW-CoA C9(b). It describes the environmental noise and vibration monitoring activities to be undertaken by Construction Contractors for the Project. The purpose of this MP is to:

- provide a procedure to monitor noise and vibration impacts during Construction of the Project
- meet the requirements of the conditions of approval for the Project
- meet any relevant legal and other requirements and any conditions of the Environment Protection Licence (EPL) for the Project.

The Contractors will develop a detailed stage specific Construction Noise and Vibration MPs in accordance with this overarching Noise and Vibration MP. The Contractors will supplement this overarching MP with stage specific information and include the updated Monitoring Program in their CNVMPs.

1.2 Responsibilities

Site personnel or sub-contractors with suitable experience and qualifications will undertake the monitoring outlined in this MP.

The Contractors' Construction Managers are responsible for ensuring that all legal and other requirements described in this MP are met.

1.3 Approval, review and modification

This MP will be endorsed by the ER and submitted to the Secretary for approval at least one month before commencement of Construction or within another timeframe agreed with the Secretary. Construction will not commence until the Secretary has approved the required MP and all relevant baseline data for the specific Construction activity has been collected. The MP will be implemented for the duration of Construction and for any longer period set out in this MP or specified by the Secretary, whichever is the greater.

This MP will be reviewed annually by Roads and Maritime in consultation with the Construction Contractors. Minor amendments to this MP may be approved by the ER. Any amendments to the MP will be documented in subsequent revisions of this MP. A copy of the updated MP and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure outlined in the Contractors' CEMPs. Site personnel with responsibilities relevant to noise and vibration monitoring will be informed of any amendments to the MP and training provided where required.

Roads and Maritime will review the Contractors' MPs to confirm compliance with the requirements of the CNVMP and specifications.

1.4 Consultation

No consultation under the NSW Minister's Infrastructure Approval was required for the preparation of this MP.

1.5 Conditions of approval

The State (NSW-CoA) and Federal (Federal-CoA) conditions of approval relevant to this Noise and Vibration MP and their applicability to each stage of the Project are listed in Table 1-1. A cross reference is also included to indicate where the condition is addressed in this MP or other project management documents.

Table 1-1: Conditions of approval relevant to the Noise and Vibration Construction Monitoring Program

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA C9 (b)	The following **Construction Monitoring Programs** must be prepared in consultation with the relevant government agencies identified for each **Construction Monitoring Program** to compare actual performance of construction of the CSSI against performance predicted performance.						This MP
	Noise and vibration Nil	✓	✓	✓	✓	✓	Section 1.4
NSW-CoA C10	Each Construction Monitoring Program must provide:	✓	✓	✓	✓	✓	
	(a) details of baseline data available	✓	✓	✓	✓	✓	Section 2
	(b) details of baseline data to be obtained and when	✓	✓	✓	✓	✓	Section 2
	(c) details of all monitoring of the project to be undertaken	✓	✓	✓	✓	✓	Section 4
	(d) the parameters of the project to be monitored	✓	✓	✓	✓	✓	Section 4
	(e) the frequency of monitoring to be undertaken	✓	✓	✓	✓	✓	Section 4
	(f) the location of monitoring	✓	✓	✓	✓	✓	Section 4
	(g) the reporting of monitoring results	✓	✓	✓	✓	✓	Section 5
	(h) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory and	✓	✓	✓	✓	✓	Section 6
	(i) any consultation to be undertaken in relation to the monitoring programs.	✓	✓	✓	✓	✓	Section 1.4

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA C11	The **Construction Monitoring Programs** must be developed in consultation with relevant government agencies as identified in **Condition C9** of this approval and must include, to the written satisfaction of the Secretary, information requested by an agency to be included in a **Construction Monitoring Programs** during such consultation. Details of all information requested by an agency including copies of all correspondence from those agencies, must be provided with the relevant **Construction Monitoring Program**.	✓	✓	✓	✓	✓	Section 1.4
NSW-CoA C12	The **Construction Monitoring Programs** must be endorsed by the ER and then submitted to the Secretary for approval at least one (1) month before commencement of construction or within another timeframe agreed with the Secretary.	✓	✓	✓	✓	✓	Section 1.3
NSW-CoA C13	Construction must not commence until the Secretary has approved all of the required **Construction Monitoring Programs**, and all relevant baseline data for the specific construction activity has been collected.	✓	✓	✓	✓	✓	Section 1.3 Section 2
NSW-CoA C14	The **Construction Monitoring Programs**, as approved by the Secretary including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Secretary, whichever is the greater.	✓	✓	✓	✓	✓	Section 1.3
NSW-CoA C15	The results of the **Construction Monitoring Programs** must be submitted to the Secretary, and relevant regulatory agencies, for information in the form of a **Construction Monitoring Report** at the frequency identified in the relevant **Construction Monitoring Program**.	✓	✓	✓	✓	✓	Section 5

1.6 Environment protection licence

The EPL conditions relevant to the monitoring of noise and vibration are provided in Table 1-2.

Table 1-2: EPL requirements relevant to the monitoring of noise

Ref.	Relevant requirement	Reference
M1	**Monitoring Records**	
M1.1	The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.	Section 5.2
M1.2	All records required to be kept by this licence must be: (a) in a legible form, or in a form that can readily be reduced to a legible form; (b) kept for at least 4 years after the monitoring or event to which they relate took place; and (c) produced in a legible form to any authorised officer of the EPA who asks to see them.	Section 5.2
M1.3	The following records must be kept in respect of any samples required to be collected for the purposes of this licence: (a) the date(s) on which the sample was taken; (b) the time(s) at which the sample was collected; (c) the point at which the sample was taken; and (d) the name of the person who collected the sample.	Section 5.2
M7	**Noise Monitoring**	
M7.1	All noise monitoring must be undertaken in accordance with Australian Standard AS 2659.1 – 1998: "Guide to the use of sound measuring equipment – portable sound level meters", or any revisions of that standard which may be made by Standards Australia, and the compliance monitoring guidance provided in the "NSW Noise Policy for Industry" (EPA, 2017).	Section 4.1
M7.2	All vibration monitoring must be undertaken in accordance with the technical guidance provided in the "Environmental Noise Management - Assessing Vibration: a technical guideline" (DEC, 2006). All vibration monitoring results may be assessed and reported against the acceptable values of human exposure to vibration set out in Tables 2.2 and 2.4 of the guideline.	Section 4.2
M7.3	The licensee must undertake noise and vibration monitoring as directed by an authorised officer of the EPA.	Sections 4.1, 4.2
R4	**Other reporting conditions**	
R4.2	**Noise and Vibration Reports** (a) Upon request of an authorised officer of the EPA, the licensee must submit a Preliminary Investigation Report to the EPA in respect of any noise or vibration monitoring undertaken in accordance with the requirements of Condition M6.5. (b) The Preliminary Investigation Report must be submitted to the EPA by 4.30 pm of the afternoon of the next business day following any noise or vibration monitoring.	Section 5.4

Ref.	Relevant requirement	Reference
	(c) The Preliminary Investigation Report must: (i) include numerical and/or graphical representation of the noise and vibration monitoring results; and (ii) highlight any detected exceedance of noise goals or limits specified in: 1. this licence; 2. relevant noise guidelines; and 3. relevant noise modelling.	
R4.3	In the event of any exceedance of noise limits or noise management levels, the licensee must: (a) Modify activities and implement all reasonable and feasible measures to prevent a recurrence of the exceedance; and (b) Submit a Follow-Up Investigation Report to the EPA within 5 business days of any noise or vibration monitoring having been undertaken (unless otherwise approved by the EPA). (c) The Follow-Up Investigation Report must include: 1. Confirmation of whether noise monitoring has been undertaken in accordance with AS2659 and the compliance monitoring guidance provided in the INP; and 2. Confirmation of whether vibration monitoring has been undertaken in accordance with the guidance provided in the "Environmental Noise Management - Assessing Vibration: a technical guideline" (DEC, 2006); and 3. Details of the prevailing meteorological conditions during the period when the monitoring was undertaken; and 4. A map of each noise and vibration monitoring location in relation to the noise source, including relevant distances; and 5. Numerical and graphical representation of the noise and vibration monitoring results; and 6. An analysis of the noise and vibration monitoring results; and 7. Details of any remedial action taken in relation to the matter; and 8. In cases not the subject of remedial action, detailed justification of the decision not to undertake remedial action.	Section 5.4

2 Baseline data

2.1 Noise and vibration sensitive receivers

The noise and vibration assessment in the EIS and SPIR identified and considered potential noise and vibration impacts for each habitable dwelling or park along the Project alignment and within 600 m either side of the new or existing road centre line. A total of 1,349 noise sensitive receivers were identified in the Project area, including:

- 1,306 residential properties
- 23 commercial properties
- 10 education buildings
- four places of worship
- four outdoor recreational areas
- two industrial buildings.

The location of noise and vibration sensitive receivers within the Project area are shown in Figure 2-1, Figure 2-2 and Figure 2-3.

2.2 Existing noise environment (baseline data)

The locations in which background noise monitoring surveys were carried out are shown on Figure 2-1, Figure 2-2 and Figure 2-3. A summary of the noise monitoring results and adopted RBLs and management levels (NML) are provided in Table 2-1. It is considered that the baseline data outlined below is sufficiently comprehensive to characterise the existing noise environment and therefore no further baseline data will be required to be collected by the Contractors prior to the commencement of Construction.

Table 2-1: Ambient noise monitoring results (dbA)

Location	Project Stage	Day[1]			Evening[2]			Night[3]		
		L_{Amax}	L_{Aeq}	RBL	L_{Amax}	L_{Aeq}	RBL	L_{Amax}	L_{Aeq}	RBL
N9	5	64	55	48	62	55	49	60	54	44
N10	5	75	61	46	72	58	44	71	58	33
N11	5	69	55	47	65	55	43	61	50	36
N12	5	74	62	48	72	58	43	68	56	38
N13	5	76	61	48	73	58	44	71	56	36
N14	6	72	61	46	68	56	46	67	54	35
TN15	6	67	54	37	56	43	35	53	45	36
N16	6	70	56	42	68	57	43	66	55	34
N17	4	65	47	37	59	45	38	54	46	37
N18	4	72	59	48	68	58	47	67	54	42

Notes: [1]Day: 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays and Public Holidays

[2]Evening: 6:00pm to 10:00pm, Monday to Sunday

[3]Night: 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays.

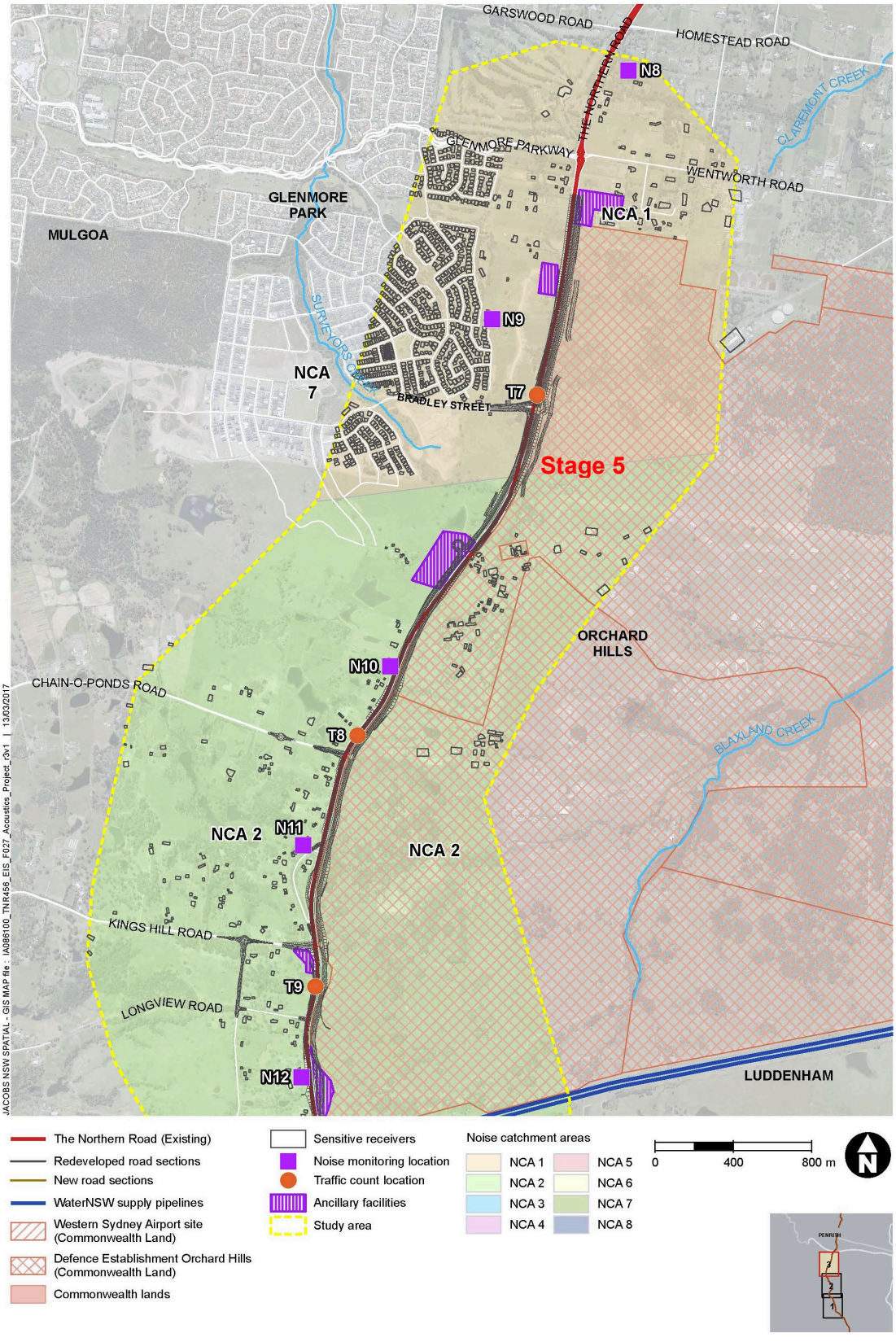

Figure 2-1: Location of noise catchments areas, noise and vibration sensitive receivers and noise monitoring locations (northern section)

Source: EIS (Roads and Maritime, 2017)

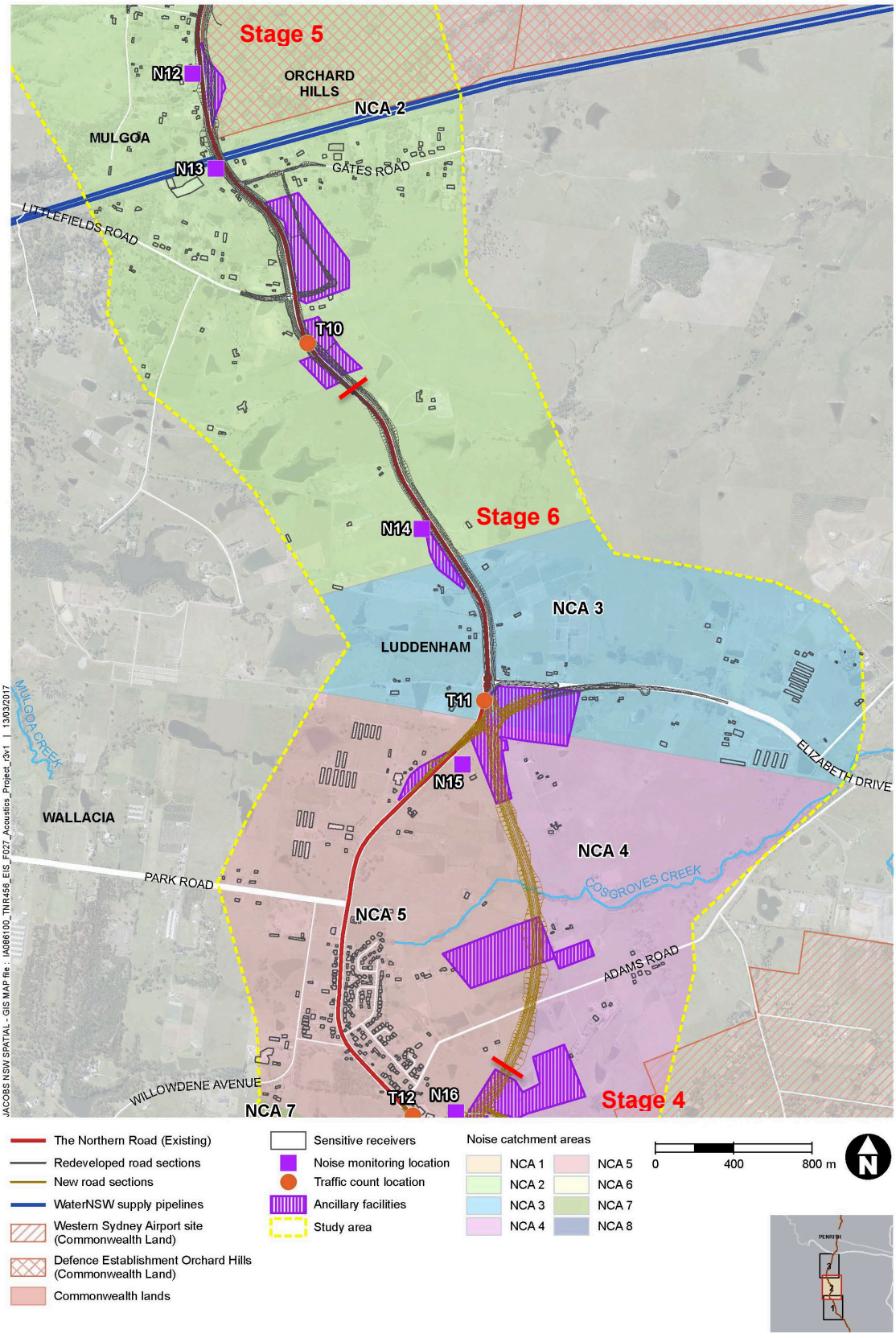

Figure 2-2: Location of noise catchments areas, noise and vibration sensitive receivers and noise monitoring locations (middle section)

Source: EIS (Roads and Maritime, 2017)

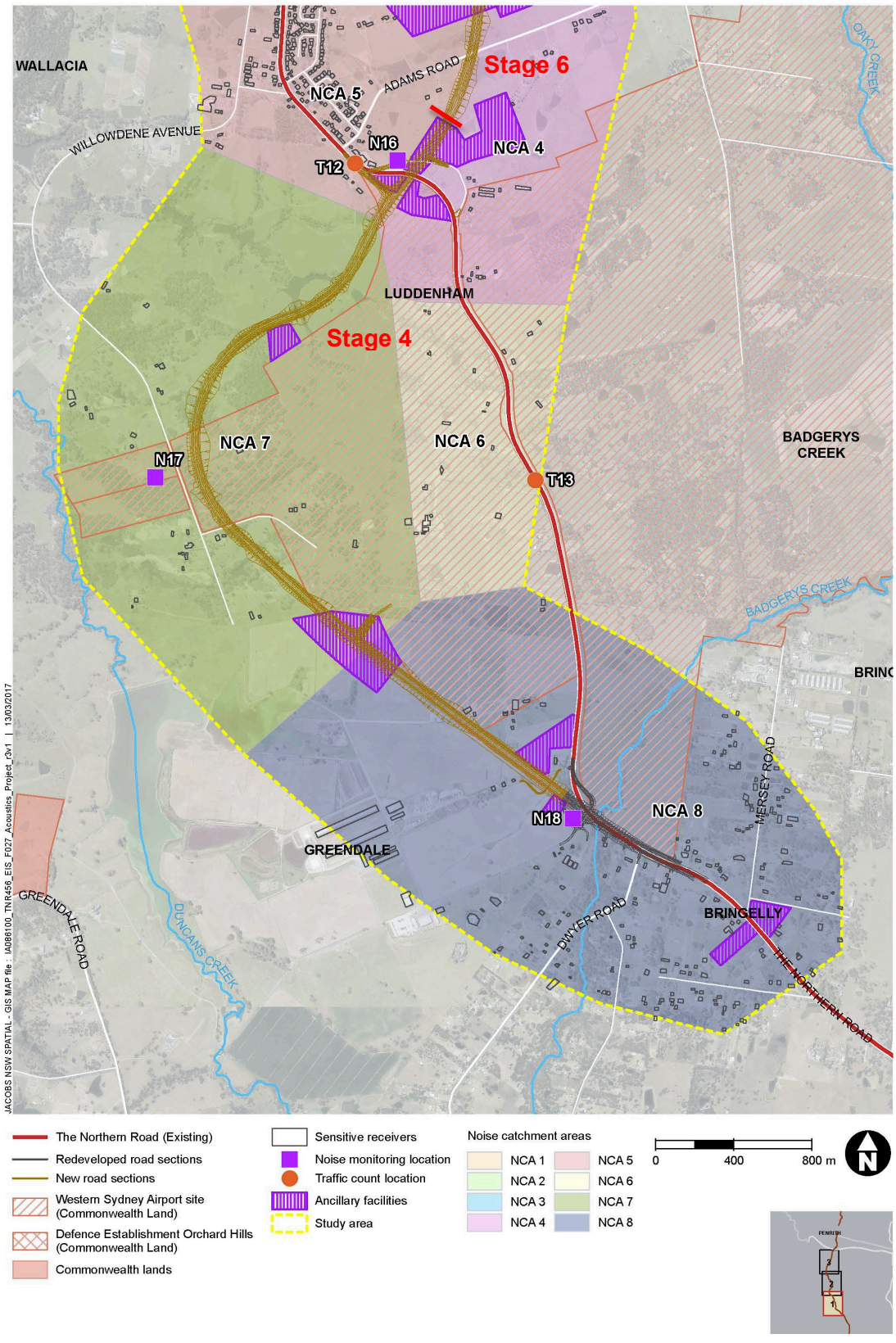

Figure 2-3: Location of noise catchments areas, sensitive receivers and noise monitoring locations (southern section)

Source: EIS (Roads and Maritime, 2017)

3 Noise and vibration criteria

3.1 Construction noise criteria

The noise criteria adopted for the Project are set out in Table 3-1 and Table 3-2.

Table 3-1: Construction Noise Management Levels (NMLs) and sleep disturbance screening criteria at residences

NCA	Stage	NML ($L_{Aeq(15min)}$ (dBA))				Sleep disturbance screening criterion L_{Amax} (dBA)
		Standard working hours	Out of hours*			
		Day	Day	Evening	Night	
1	5	58	56	54	49	59
2	5, 6	57	53	48	41	51
3	6	56	58	51	40	50
4	4, 6	47	43	43	42	52
5	4, 6	52	49	48	39	49
6	4	52	49	48	39	49
7	4	47	43	43	42	52
8	4	58	58	52	47	57

** Out of hours periods refers to Saturday 1:00 pm-6:00 pm*

Table 3-2: Construction NMLs for non-residential receivers

Non-residential receiver	No. of buildings	Land use	NCA	Stage	NML* $L_{Aeq(15\ minute)}$ dB(A)
Penrith Anglican College	4	Educational	1	5	45 (Internal)
Luddenham Public School	5	Educational	5	6	45 (Internal)
Holy Family Catholic Primary School	1	Educational	5	6	45 (Internal)
St James Anglican Church	1	Place of Worship	5	6	45 (Internal)
Sacred Heart Parish	1	Place of Worship	5	6	45 (Internal)
Luddenham Uniting Church	2	Place of Worship	5	6	45 (Internal)
Glenmore Ridge Dr Park	N/A	Active Recreation	1	5	65
Sales Park	N/A	Active Recreation	5	6	65
Willmington Reserve	N/A	Active Recreation	5	6	65

Non-residential receiver	No. of buildings	Land use	NCA	Stage	NML* $L_{Aeq(15\ minute)}$ dB(A)
Luddenham Showground	N/A	Active Recreation	5	6	65
Penrith Golf and Recreation Club	3	Commercial	1	5	70
Produce Direct and Pet Care	3	Commercial	1	5	70
Orchard Hills Veterinary Hospital	1	Commercial	1	5	70
Horse N Around	3	Commercial	2	5	70
The Honey Shed	1	Commercial	3	6	70
Sydney Society of Model Engineers	1	Commercial	3	6	70
Caltex Service Station	2	Commercial	5	6	70
Quality Meats Butcher	1	Commercial	5	6	70
2903 The Northern Road, Luddenham	1	Commercial	5	6	70
Luddenham Auto Repairs	1	Commercial	5	6	70
Al's Bakery	1	Commercial	5	6	70
Shell Service Station	1	Commercial	5	6	70
IGA	3	Commercial	5	6	70
David's Stall Fruit and Veg	1	Commercial	5	6	70
Luddenham Progress Hall	1	Commercial	5	6	70
Board my Paws	1	Commercial	8	4	70
Water Filtration Plant	1	Industrial	1	4	75
Power Station 2552 The Northern Road	1	Industrial	2	5	75

** When in use*

3.2 Construction vibration criteria

3.2.1 Disturbance to building occupants

Maximum and preferred values for continuous and impulsive vibration for the Project are defined in Table 3-3. The acceptable vibration dose values (VDV) for intermittent vibration for the Project are defined in Table 3-4.

Table 3-3: Continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

Location	Assessment period[1]	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night- time	0.04	0.029	0.080	0.058
Impulsive vibration					
Critical areas[2]	Day or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night- time	0.64	0.46	1.28	0.92

Notes: [1] Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am
[2] Such as hospital operating theatres or precision laboratories.

Table 3-4: Acceptable intermittent vibration dose values (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Critical areas[2]	0.10	0.20	0.10	0.02
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: [1]Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am

[2]Includes operating theatres, precision laboratories and other areas where vibration sensitive activities may occur.

3.2.2 Structural damage

BS 7385 has been adopted as a guide to assess the likelihood of building damage from ground vibration. BS 7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage. Table 3-5 sets out the BS 7385 criteria for cosmetic, minor and major damage. Where heritage structures are impacted, DIN 4150-3 vibration criteria will be applied. The criteria applicable to heritage buildings is identified in Table 3-6.

Table 3-5: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity[1] (mm/s)		
			4 – 15 Hz	15 – 40Hz	≥40Hz
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50	50	50
		Minor[2]	100	100	100
		Major[2]	200	200	200
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 - 20	20 - 50	50
		Minor[2]	30 - 40	40 - 100	100
		Major[2]	60 - 80	80 - 200	200

Notes: [1] Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

[2] Minor and major damage criteria established based on BS 7385 Part 2 (1993) Section 7.4.2

Table 3-6: DIN 4150-3 vibration guidelines for heritage buildings

Type of structure	Guideline values for vibration velocity (mm/s)			
	Vibration at the foundation at a frequency of			Vibration at the horizontal plane of the highest floor at all frequencies
	1 - 10 Hz	10 - 50 Hz	50 - 100 Hz[1]	
Heritage buildings	3	3 - 8	8 - 10	8

Notes: [1]At frequencies above 100 Hz the values given in this column may be used as minimum values.

3.2.3 Safe working distances

Where vibration intensive plant such as rock breakers and vibratory rollers are used, vibration must be managed to minimise disturbance to building occupants and to avoid damage to buildings and other structures. Table 3-7 indicates the safe working distances recommended by the CNVG for typical items of vibration intensive plant that must be complied with unless otherwise approved by Roads and Maritime.

Table 3-7: Safe working distances for vibration intensive plant (TfNSW 2013)

Plant item	Rating/description	Safe working distance	
		Cosmetic damage (British Std 7385)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t) <100 kN (typically 2-4 t) <200 kN (typically 4-6 t) <300 kN (typically 7-13 t) >300 kN (typically 13-18 t) >300 kN (> 18 t)	5 m 6 m 12 m 15 m 20 m 25 m	15 m to 20 m 20 m 40 m 100 m 100 m 100 m
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m	n/a
Jackhammer	Hand held	1 m	Avoid contact with structure

The safe working distances presented in Table 3-7 are indicative and will vary depending on the item of plant (particularly its power rating) and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites. Where structures are more sensitive such as heritage items, more stringent conditions may be applicable and will be considered individually by the Contractor.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment will be undertaken where the human response criteria are exceeded.

4 Monitoring procedures

4.1 Noise monitoring

The overarching noise monitoring procedure to be adopted for the Project is provided in Table 4-1. Noise monitoring will be undertaken by the Contractor Environmental Site Representatives.

All noise monitoring will be undertaken in accordance with Australian Standard AS 2659.1 – 1998: "Guide to the use of sound measuring equipment – portable sound level meters", or any revisions of that standard which may be made by Standards Australia, and the compliance monitoring guidance provided in the "NSW Noise Policy for Industry" (EPA, 2017). The Contractor will undertake noise monitoring as directed by an authorised officer of the EPA.

Environmental risk assessment workshops will be held prior to the commencement of each stage of the Project by the Contractors responsible for that stage of the Project. The risk workshops will identify high noise and vibration risk activities. The outcomes of the risk workshops will inform the identification of representative sensitive receivers where monitoring will be undertaken or activities that will require noise monitoring. This may include:

- identification of sensitive residential receivers predicted to be highly noise affected from work in standard hours
- identification of sensitive residential receivers with predicted NML exceedances (refer Appendix H of the EIS)
- identification of non-residential sensitive receivers predicted to be affected by moderate exceedances (refer Section 7.2.1 of the CNVMP)
- locations for installation of temporary acoustic barriers or hoardings
- activities or combinations of activities that are highly likely to generate exceedances of NMLs or sleep disturbance, such as:
    - standard hours of work: road works, paving works
    - OOHW: bridge construction, paving works, operation of ancillary facilities.

Table 4-1: Noise monitoring procedure

Monitoring details	Frequency	Test procedure
Noise monitoring at sensitive receivers identified in Section 2 of this MP	Monthly	The testing method includes: • sound level meter configured for “Fast” time weighting and “A” frequency weighting • the test environment will be free from reflecting objects where possible. Where the noise monitoring is conducted within 3.5 metres of large walls or a building facade, then a reflection correction of up to -2.5 dBA will be applied to remove the effect of increased noise due to sound reflections from such structures • tests will not be carried out during rain or when the wind speed at the test site exceeds 5 m/s • conditions such as wind velocity, wind direction,
OOHW noise monitoring at sensitive receivers identified in Section 2 of this MP	As required during OOHW	
Where a complaint is received and monitoring is	As required	

Monitoring details	Frequency	Test procedure
considered an appropriate response to determine if noise levels exceed predicted 'worst case' Construction noise levels documented in this CNVMP		temperature, relative humidity and cloud cover will be recorded. These may be obtained from the nearest Bureau of Meteorology monitoring station or on-site weather station/observations • the monitoring period should be sufficient such that the measured noise levels are representative of the noise over a 15-minute period • at a minimum Leq, Lmax, L10 and L90 levels will be measured and reported The observations of the person undertaking the measurements will be reported including audibility of Construction noise, other noise in the environment and any discernible Construction activities contributing to the noise at the receiver.
Monitoring to confirm noise levels are no more than 15 dB(A) above night time RBL levels using the $L_{Aeq\ (1min)}$ descriptor for works undertaken in accordance with NSW CoA E26(d)	During works undertaken in accordance with NSW-CoA E26(d)	In addition to the procedure outlined above, the monitoring period should be sufficient to ensure that the measured noise levels are representative of the noise over a 1-minute period.
Spot checks of noise intensive plant where it is required to check the noise emission from the plant against manufacturer's specifications	Monthly for Construction activities with predicted noise levels greater than 65 dBA at receiver locations	The test procedure for construction plant will follow the stationary test procedures according to Australian Standard AS 2012.1. • sound level meter configured for "Fast" time weighting and "A" frequency weighting • the test environment will be free from reflecting objects • tests will not be carried out during rain or when the wind speed at the test site exceeds 5 m/s • in accordance with AS 2012.1, a minimum of 3 measurement points will be defined at locations on the hemispherical surface around the plant with the radius determined by the basic length (L) of the machine • the A-weighted Leq background noise at the measurement locations will be at least 6 dB and preferably 10 dB below the level with the plant operating • Leq and L10 levels will be measured and reported
Where required for the purposes of refining Construction methods or techniques to reduce noise levels	As required	

Where actual noise levels exceed the predicted worst case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers.

Details of site activity and equipment usage will be noted during construction noise monitoring.

4.1.1 Noise monitoring equipment

The Contractors will identify the noise monitoring equipment to be used and a maintenance / calibration program for the equipment. Details will be provided in the Contractors' Noise and Vibration MPs.

Acoustic instrumentation employed in the noise monitoring surveys will carry current manufacturer conformance certificates and comply with *AS 2659.1 - 1998: Guide to the use of sound measuring equipment - Portable sound level meters*. All environmental monitoring equipment will be maintained and calibrated in the field prior to and following the noise measurements according to manufacturer's specifications and appropriate records kept.

4.2 Vibration monitoring

The overarching vibration monitoring procedure to be adopted for the Project is provided in Table 4-2. Vibration monitoring will be undertaken by the Contractor Environmental Site Representatives. Dilapidation surveys will be the responsibility of the Contractor Construction Managers.

All vibration monitoring will be undertaken in accordance with the technical guidance provided in the "Environmental Noise Management - Assessing Vibration: a technical guideline" (DEC, 2006). Vibration monitoring results may be assessed and reported against the acceptable values of human exposure to vibration set out in Tables 2.2 and 2.4 of the guideline.

The Contractor will undertake vibration monitoring as directed by an authorised officer of the EPA.

Table 4-2: Vibration monitoring procedure

Monitoring details	Frequency	Test procedure
At the commencement of vibratory compaction work within 50 m of residential buildings	As required	Attended vibration monitoring will be undertaken when checking the safe working distances from construction plant or in response to a complaint. The testing method includes: • transducer to be affixed to ground or building in general accordance with AS 2775- 2004 • monitoring to be conducted for at least three distances from the plant, including a representative distance for the nearest sensitive structures and/or receivers • the testing will be conducted at each location to obtain a suitable representation of the range of vibration levels that would occur from the tested plant • the plant will be tested in the settings in which it is expected to operate. For vibratory rollers this may include both "High" and "Low" settings • peak (PPV) vibration levels and the dominant frequency of the vibration will be recorded for assessment against the structural and cosmetic damage criteria. In situations in which human comfort is also of concern then the rms
Where a complaint is received in relation to human exposure to vibration levels and monitoring is considered an appropriate response	As required	
Where a complaint is received in relation to suspected property damage due to vibration impacts and monitoring is considered an appropriate response	As required	

Monitoring details	Frequency	Test procedure
Where an activity may occur within safe working distances for cosmetic damage for no more than one day continuously	As required	vibration level should also be recorded
Where required for the purposes of refining Construction methods to reduce vibration levels	As required	
Where an activity may occur within safe working distances for cosmetic damage for a period of more than one day continuously	As required	Continuous vibration monitoring will be undertaken in situations where there is a risk that vibration from a particular Construction activity may exceed the cosmetic damage criteria at a sensitive structure. This will be where activities may occur within the safe working distances for cosmetic damage identified in Section 3.2 of this MP. The testing method includes: • transducer to be affixed to ground or building in general accordance with AS 2775- 2004 • vibration logger to continuously measure vibration levels while the relevant works are occurring within the safe working distance for cosmetic damage • measurement to be conducted as close as possible to the sensitive structure. • a warning system will be implemented with the monitoring system including one or both of the following: ◦ audible and/or visual warning alarm ◦ SMS and/or email alerts to site personnel
Dilapidation surveys of buildings and structures where Construction works occurs within the safe working distance for cosmetic damage	Prior to that work being undertaken and post-Construction	At a minimum, dilapidation surveys and reports will comprise: • a visual inspection of the structure, including all internal and external walls, ground level floors and external pavements, all connections of other structures above ground level and their connection at ground level and any exposed foundations • full written building Condition Survey Report outlining the condition of the internal and external components of each property • a series of photographs of each identified defect/crack • a sketched floor plan showing the exact location of each defect and measurements of crack width/defect size • identification of any condition changes relative to Pre-Construction and the likely cause of the change (Post-Construction only)

Where vibration is found to exceed safe levels, impacts will be reduced by changing work methods and / or equipment, or through the provision of building protection measures where possible. In the event that a complaint relating to property damage is received, an inspection of the property will be undertaken and an interim building condition survey prepared.

Attended vibration monitoring will be undertaken to determine site-specific minimum working distances for structural damage and human response. Site-specific minimum working distances will be determined whenever significant vibration generating plant will be working close to or within the recommended minimum working distances listed in Table 4-3.

Details of site activity and equipment usage will be noted during monitoring.

The structural damage minimum working distances will apply for vibration-generating activities that have the potential to impact the Warragamba Dam to Prospect Reservoir pipeline. Although vibration due to the Project is unlikely to impact the pipeline, due to its local heritage value more stringent minimum working distances may be applied if determined by attended vibration monitoring. In addition, the German Standard DIN 4150-3 recommended maximum levels of vibration levels for heritage buildings (refer Section 3.2 of this MP) apply to the pipeline. The Contractor will engage a heritage specialist to advise on methods and locations for installing equipment used for vibration, movement and noise monitoring of the pipeline.

Table 4-3: Recommended minimum working distances for vibration intensive plant

Activity / equipment	Rating description	Minimum working distance (m)	
		Cosmetic damage	Human response
Vibratory Roller[1]	< 50 kN (Typically 1-2 tonnes)	5	15 - 20
	< 100 kN (Typically 2-4 tonnes)	6	20
	< 200 kN (Typically 4-6 tonnes)	12	40
	< 300 kN (Typically 7-13 tonnes)	15	100
	> 300 kN (Typically 13-18 tonnes)	20	100
	> 300 kN (Typically > 18 tonnes)	25	100
Pile Boring[1]	≤ 800 mm	2 (nominal)	N/A
Jackhammer[1]	Hand held	1 (nominal)	Avoid contact with structure
Compactors[2]	-	15	100
Grader[2]	≤ 20 tonne	2 (nominal)	10
Excavators[2]	≤ 30 tonne (travelling/ digging)	10	15
Truck Movements[2]	-	-	10

Notes: [1] *TCA Construction Noise Strategy (Rail Projects) November 2011*

[2] Renzo Tonin & Associates project files, databases and library

4.2.1 Vibration monitoring equipment

The Contractors will identify the vibration monitoring equipment to be used and a maintenance/calibration program to ensure equipment is implemented. Monitoring methods and instrumentation employed in the vibration monitoring surveys will comply with *AS2775.2004 Mechanical vibration and shock—Mechanical mounting of accelerometers* and *AS2670.1 Evaluation of human exposure to whole body vibration*. Details will be provided in the Contractors' Noise and Vibration MPs.

4.3 Noise and vibration monitoring locations

The locations of noise and vibration sensitive receivers are shown in Figure 2-1, Figure 2-2 and Figure 2-3. The Contractors will review and identify the locations for monthly noise and vibration monitoring in the risk assessment workshop to be held prior to the commencement of Construction (refer Section 4.1) and confirm the locations for noise and vibration monitoring in their Noise and Vibration MPs.

Noise monitoring locations will be consistent with the noise monitoring locations identified in Figure 2-1, Figure 2-2 and Figure 2-3 as a minimum. Noise monitoring locations will include representative sensitive receivers in each NCA relevant to the Project stage. Noise monitoring will also be undertaken for non-sensitive receivers predicted to be impacted by moderate exceedances of the NML from work in standard hours, including Horse N Around, Shell Service Station, IGA Luddenham and St James Anglican Church (refer Section 7.2.1 of the CNVMP.)

Vibration monitoring will be undertaken at vibration sensitive locations within the 'minimum working distances' established for each item of plant during the commencement of use of each plant on site.

Attended noise and vibration monitoring locations will include Construction sites where the commencement of operation for each new plant or activity on site has the potential to generate significant noise or vibration levels. This may also include specific attended noise and/or vibration monitoring of significant plant items, such as earthmoving plant.

5 Reporting

5.1 Monthly Environmental Report

The Contractors will prepare Monthly Environmental Reports for the duration of the Project for incorporation in Project Monthly Reports and submission to the Roads and Maritime Environmental Manager (or delegate) for review. Information to be detailed in the reports includes:

- results summary and analysis of the environmental monitoring
- performance of this MP
- summary of complaints received that are related to noise and vibration.

5.2 Noise and Vibration Construction Monitoring Report

In accordance with NSW-CoA C15, the Contractors will prepare Noise and Vibration Monitoring Reports detailing the results of the monitoring undertaken in accordance with this MP for inclusion in the six monthly construction compliance reporting required under NSW-CoA A32 for submission to the Secretary and to relevant regulatory agencies for information. Reports will be prepared six monthly for the duration of Construction of the Project. Reports will include, but not be limited to, the following information:

- the date(s) and time at which the monitoring was undertaken
- the locations and description of monitoring undertaken
- the name of the person who undertook the monitoring
- tabulations of monitoring data
- compliance monitoring results with the criteria identified in Section 3 of this MP
- identification of exceedances of the nominated criteria and descriptions of the causes of these exceedances
- details of any alteration to the MP
- summary of any complaints received regarding noise and vibration.

Monitoring records will be:

- kept in a legible form, or in a form that can readily be reduced to a legible form
- kept for at least four years after the monitoring or event to which they relate took place
- produced in a legible form to any authorised officer of the DP&E, DoEE or EPA upon request, within the timeframe nominated in the request.

The Contractors will maintain accurate records of all noise and vibration monitoring activities.

Monitoring results may be made available on the EPA website.

5.3 Reporting on non-conformances and exceedances

In the event that the criteria identified in Section 3 of this MP are exceeded, the Contractor will report the exceedance to the Roads and Maritime Project Manager, Environmental Manager (or delegate) and the ER within seven days of identification of the exceedance.

Details of exceedances will be provided in the Monthly Environmental Reports and six monthly Monitoring Reports.

Where an exceedance has caused, is causing or is likely to cause, material harm to the environment, community or a member of the community, the environmental incident notification and reporting procedures detailed in Section 5.6 of the OACEMP and the Environmental Incident Classification and Reporting Procedure (refer to Appendix A7 of the OACEMP) will apply. The Contractor Environmental Site Representatives are responsible for reporting on incidents.

The Contractor will immediately notify the Roads and Maritime Project Manager, Environmental Manager (or delegate) and the EPA (via the EPA environmental line) of any exceedance that has caused, is causing or is likely to cause, material harm to the environment. Roads and Maritime will notify the Secretary within 24 hours of notification of the event being provided to the EPA, as required by NSW-CoA A43. The notification will include the time, date and details of the incident and identify any non-compliance with the Infrastructure Approval.

The Contractor will provide a written report of the event to the EPA within seven days of the date on which the event occurred. The report will identify:

- the cause, time and duration of the event
- the type, volume and concentration of every pollutant discharged as a result of the event
- the name, address and business hours telephone number of the Contractor's personnel who witnessed the event
- the name, address and business hours telephone number of other witnesses to the event
- action taken by the Contractor in relation to the event, including any follow-up contact with any complainants
- details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event and
- any other relevant matters.

The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the Contractor. The Contractor will provide such further details to the EPA within the time specified in the request. The Contractor will also complete an incident form for submission to the Roads and Maritime Project Manager and/or Environmental Manager (or delegate) within three business days of the occurrence of the event.

Notification of incidents other than those relating to the POEO Act, will be provided to Secretary as soon as practicable and within 24 hours of the incident, in accordance with NSW-CoA A40.

Any notifications made under NSW-CoA 40 or 43 will also be provided to the Minister for DoEE.

5.4 EPL reporting

The Contractor Environmental Site Representatives will prepare a summary of noise and vibration monitoring program results, including a statement of compliance with the relevant EPL conditions, and a summary of complaints received related to noise and vibration issues, for inclusion in the annual EPL return. EPL annual returns will be prepared for each stage of the Project for which there is an EPL and submitted to the EPA within 60 days of the anniversary of the EPL for the duration of Construction.

5.4.1 Investigation reports

In addition to the annual reporting, noise and vibration reporting in response to any complaints in accordance with EPL Condition M6.5 comply with the following:

- upon request of an authorised officer of the EPA, the Contractor will submit a Preliminary Investigation Report to the EPA in respect of any noise or vibration monitoring undertaken in accordance with the requirements of EPL Condition M6.5
- the Preliminary Investigation Report will be submitted to the EPA by 4.30 pm of the afternoon of the next business day following any noise or vibration monitoring
- the Preliminary Investigation Report will:
    - include numerical and/or graphical representation of the noise and vibration monitoring results and
    - highlight any detected exceedance of noise goals or limits specified in the EPL, relevant noise guidelines and relevant noise modelling

In the event of any exceedance of noise limits or noise management levels, the Contractor will:

- modify activities and implement all reasonable and feasible measures to prevent a recurrence of the exceedance and
- submit a Follow-Up Investigation Report to the EPA within five business days of any noise or vibration monitoring having been undertaken (unless otherwise approved by the EPA).
- the Follow-Up Investigation Report will include:
    - confirmation of whether noise monitoring has been undertaken in accordance with AS2659 and the compliance monitoring guidance provided in the INP
    - confirmation of whether vibration monitoring has been undertaken in accordance with the guidance provided in the "Environmental Noise Management - Assessing Vibration: a technical guideline" (DEC, 2006)
    - details of the prevailing meteorological conditions during the period when the monitoring was undertaken
    - a map of each noise and vibration monitoring location in relation to the noise source, including relevant distances
    - numerical and graphical representation of the noise and vibration monitoring results

- an analysis of the noise and vibration monitoring results
- details of any remedial action taken in relation to the matter
- in cases not the subject of remedial action, detailed justification of the decision not to undertake remedial action.

5.5 Building Condition Survey Reports

Prior to commencement of any works, a suitably qualified person will undertake building and structure condition surveys of all buildings and structures identified as being located where Construction works occur within the safe working distance for cosmetic damage. The results of the surveys will be documented in a Building Condition Survey Report for each building and structure surveyed. Copies of Building Condition Survey Reports will be provided to the landowners of the buildings and structures surveyed and, if agreed by the landowner, the relevant Council within three weeks of completing the surveys, and no later than one month prior to the commencement of Construction.

5.6 Complaints management and reporting

Recording and reporting of complaints will be undertaken in accordance with the Complaints Management System for the Project (refer to Section 5.5.3 of the OACEMP).

The Contractor will submit a report to the EPA that provides details of all complaints received in relation to Construction activities regulated by the Contractor on the telephone complaints line or through any other means by 2:00 pm each business day. The report will:

- be submitted to the email address nominated by the EPA
- include a unique identifier number for each complainant
- include date and time as reported by the complainant of the event that is the subject of the complaint
- include an outline of the work or activity that is the subject of the complaint
- any assessments required by EPL Conditions L4.2, L4.3, or L4.4, unless previously provided to the EPA, and details of how the requirements of these conditions have been met.

The Contractor is not required to submit a report for any reporting period during which no complaints have been received.

6 Adaptive management

Should noise and vibration monitoring results directly attributable to the Project exceed the criteria set out in Section 3 of this MP, the following steps will be undertaken:

- analysis of the results by the Contractor Environmental Site Representatives in more detail with a view of determining possible causes for the exceedance, including identifying the Project stage (or stages) responsible for the issue
- site inspection by the Contractor Environmental Site Representatives
- advising relevant personnel of the problem
- identifying and agreeing on actions and/or additional mitigation measures to resolve or mitigate the exceedance
- implementing actions to rectify or mitigate the exceedance, including stop work arrangements where necessary or if directed by the ER
- identifying and implementing additional mitigation measures.

Where actual noise levels are found to exceed the predicted worst case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers.

Where vibration is found to exceed safe levels, impacts will be reduced by changing work methods and / or equipment, or through the provision of building protection measures where possible. In the event a complaint relating to property damage is received, an inspection of the property will be undertaken and an interim building condition survey prepared.

Mitigation measures and preventative / corrective actions will be developed in accordance with Roads and Maritime specifications and the procedure for dealing with non-compliance with environmental management controls outlined in Section 6.6 of the OACEMP. The Contractors will be required to verify and document the effectiveness of any management measures or preventative / corrective actions implemented to avoid further exceedances.

The timing for any improvement will be agreed between the relevant Contractor Project Engineer/Superintendent and Roads and Maritime Project Manager and Environmental Manager (or delegate) based on the level of risk or reoccurrence of the exceedance (e.g. a significant risk will require immediate action).

The Contractors will communicate regularly with other high risk Construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and cumulative noise and vibration impacts are minimised.

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Annexure C – Template Out of Hours Work Procedure

A template for the proposed structure and content for the Contractors' Out of Hours Work (OOHW) Procedure is provided below. The Contractors will prepare an OOHW Procedure as part of the Contractors' CNVMPs in accordance with the legislation, guidelines and standards identified in Section 3 of the overarching CNVMP and consistent with this template OOHW Procedure.

Where appropriate, the Contractors may supply an OOHW Procedure with an alternative structure provided it meets the requirements identified in this CNVMP and the relevant Roads and Maritime specifications. Roads and Maritime will review the Contractors' documentation to confirm consistency with the applicable requirements.

Contents

1 Introduction

This OOHW Procedure applies to any work associated with Construction of the Project that is proposed by the Contractor to be carried out outside the standard hours of work defined in the conditions of approval and EPL (refer Section 8.1 of the NVMP). OOHW will only occur in accordance with the requirements of NSW-CoA E26 and the EPL.

1.1 Induction / training

All site personnel (including sub-contractors) will be inducted on the control measures to be implemented to minimise impacts of OOHW on the community and environment and this OOHW Procedure. Training will include inductions, toolbox talks, pre-starts and targeted training as required.

1.2 Roles and responsibilities

The Contractor Site Environmental Representative will seek approval from Roads and Maritime for any works that need to occur outside the standard hours of work. OOHW approval requests will be reviewed by the Roads and Maritime Environmental Manager (or delegate) and approved by the Roads and Maritime Project Manager.

The Contractor CRM will be responsible for ensuring that notification and consultation has occurred with community stakeholders, in accordance with contractual requirements, on the likely impacts of OOHW activities.

The Contractor Environmental Site Representative will implement and oversee the noise monitoring program for OOHW to assess compliance with the CoA, the EPL and the OOHW Procedure.

The Contractor Environmental Site Representative is responsible for notifying the ER, the Roads and Maritime Project Manager and Roads and Maritime Environmental Manager (or delegate) of any noise exceedances or complaints during OOHW.

2 Justification for OOHW

The Contractors will conduct Construction activities within the approved standard construction hours. However, certain activities may need to be carried out outside of standard construction hours. Where requirements of the CoA and EPL are satisfied Roads and Maritime may permit the Contractors to carry out OOHW. The Contractors will provide the Roads and Maritime Environmental Manager (or delegate) and Roads and Maritime Project Manager with details of the nature and need for activities to be conducted during the varied construction hours.

Contractors will provide justification of the need for OOHW in accordance with the ICNG or where OOHW is required:

- for technical considerations (such as the need to meet particular quality specifications)
- to maintain the safety of road users or Construction personnel
- where a road occupancy license will not be provided during standard times
- for delivery of materials for safety reasons
- where a utility service operator has advised that the works undertaken during standard hours will result in a high risk to the operation or integrity of the network.

Construction activities that may require scheduled OOHW include, but are not limited to:

- paving works
- asphalting
- concrete pours
- ancillary facility operation
- traffic management, traffic switches or road tie-in work
- utility/service relocations

Construction activities that may be required or proposed to be undertaken outside of standard working hours will be assessed in accordance with the process outlined in this OOWH Procedure.

OOHW will only occur in accordance with the requirements of NSW-CoA E26 and the EPL. OOHW with predicted noise levels exceeding the requirements of NSW-CoA E26 will only occur if there is a community agreement in place in accordance with EPL Conditions L4.5, L4.6 and E1.1 to E1.8.

3 OOHW noise and vibration assessment

Prior to undertaking any OOHW, the Contractor will undertake a noise and (if applicable) vibration assessment to assess the noise and vibration impacts for any activities proposed outside standard construction hours. The assessment will include details of the work to be undertaken, plant and equipment required, scheduling and duration of the work, predicted impacts on sensitive receivers, their location and proposed mitigation measures.

The assessment will be prepared to take into account the risk factors listed in the *Construction Noise and Vibration Strategy* (TfNSW, 2018) as shown in Table 3-1 below.

Table 3-1: OOHW risk factors

Low risk factors:	Medium risk factors:	High risk factors:
• no sleep disturbance • 1800 – 2200 weekdays • 1300 – 2200 Saturdays • 0800 – 1800 Sunday and Public Holiday nights • one or two occurrences • no impulsive or tonal noise vibration	• Sleep disturbance risk • 2200 – 0700 weekday nights • 2200 – 0800 Saturday nights • 1800 – 0700 Sunday and Public Holiday nights	• Prolonged work (i.e. >1 week) • Sleep disturbance possible • Impulsive noise and vibration likely (e.g. vibratory rolling or rock breaking)

OOHW applications with medium or high risk factors must be supported by a construction noise and vibration impact statement.

Noise

The assessment will determine the extent of noise impact the Construction activities will have on sensitive receivers. The assessment will identify the exceedances of Construction scenarios against the NMLs adopted for each Noise Catchment Area (NCA) or other sensitive land uses (refer Section 5.3 of the CNVMP).

Vibration

An assessment will be required for out of hours vibration intensive works within the safe working distances for human comfort (refer Section 5.5 of the CNVMP) for the nominated plant and equipment required for the OOHW. Prior to undertaking an assessment, all other feasible and reasonable options to use less vibration intensive equipment will be investigated and exhausted.

4 Additional mitigation measures

Prior to undertaking any OOHW, the Contractor will identify any additional mitigation measures, consistent with the Roads and Maritime CNVG (2016), that are proposed to manage OOHW noise impacts from the Project. Additional mitigations measures will be implemented where reasonable and feasible and will relate directly to the risk factor (Table 4-1) of the proposed OOHW.

Attachment 2 to this OOHW Procedure outlines the approach for the application of standard and additional mitigation measures to minimise impacts of OOHW.

Where additional mitigation measures are proposed, the Contractor's CRM will consult with affected sensitive receivers to ensure that their personal circumstances have been taken into account to identify the most appropriate mitigation measures.

In accordance with the requirements of NSW-CoA E29, the Contractor will consult with potentially affected community, religious, educational institutions and noise and vibration-sensitive businesses to identify periods, including outside of standard hours, during which they would be adversely affected by noise generating works. The Contractor will not schedule those works during the identified periods unless Roads and Maritime and the potentially affected institution or business have made other arrangements (at no cost to the affected receiver), or the Secretary has otherwise approved the works.

Further details of the range of possible additional mitigation measures are provided below.

Stakeholder notifications

Stakeholder notifications will detail work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and a contact telephone number. Notifications will be issued a minimum of seven calendar days prior to the start of works.

Specific notifications will be letterbox dropped (or equivalent) to identified stakeholders no later than seven calendar days ahead of Construction activities that are likely to exceed the noise objectives. The specific notification provides additional information to more highly affected receivers than covered in general letterbox drops.

Stakeholders will also be consulted to identify periods during which they would be adversely affected by noise generating works in accordance with NSW-CoA E29.

Phone calls

Phone calls detailing relevant information will be made to identified/affected stakeholders within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the resident cannot be telephoned then an alternative form of engagement will be used.

Individual briefings

Individual briefings will be used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. The Contractor's CRM will visit identified stakeholders at least 48 hours ahead of potentially disturbing Construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. Where the resident cannot be met with individually then an alternative form of engagement will be used

Respite Offers

Respite Offers will be considered where there are high noise and vibration generating activities near receivers to provide residents with respite from an ongoing impact.

Respite Periods

Out of hours construction noise in out of hours Period 1 (defined in Attachment 2 of this Procedure) will be limited to no more than three consecutive evenings per week except where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and no more than six evenings per month.

Night time construction noise in out of hours Period 2 (defined in Attachment 2 of this Procedure) will be limited to two consecutive nights except for where there is a Duration Respite. For night work these periods of work will be separated by not less than one week and six nights per month. Where possible, high noise generating works will be completed before 11 pm.

Duration Respite

Respite Offers and Respite Periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration Respite so that the Project can be completed more quickly.

The Contractor's CRM will engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite.

Where there are few receivers above the NML each of these receivers will be visited to gain support for Duration Respite.

Alternative accommodation

Alternative accommodation options may be offered to residents living in close proximity to Construction works who that are likely to experience highly intrusive noise levels. Aspects for consideration include whether the highly intrusive activities occur throughout the night or before midnight.

5 Consultation and notification

Prior to undertaking OOHW, the Contractor will consult with, as appropriate:

- potentially affected sensitive receivers
- Roads and Maritime Project Manager
- Roads and Maritime Environmental Manager (or delegate)
- Penrith City Council and Liverpool City Council (as applicable)
- the ER
- EPA.

The Contractor CRM will notify the potentially affected noise sensitive receivers of upcoming OOHW in accordance with the Community Communication Strategy (CCS). Notification will occur not less than seven calendar days and not more than 14 calendar days before commencement of any OOHW or activities. The notification will:

- be undertaken by letterbox drop or email
- be detailed on the project website.
- clearly outline the reason that the work is required to be undertaken outside the hours specified in EPL Condition L4.1
- include a diagram that clearly identifies the location of the proposed works in relation to nearby cross streets and local landmarks
- include details of relevant time restrictions that apply to the proposed works
- clearly outline in plain English, the location, nature, scope and duration of the proposed works
- detail the expected noise impact of the works on noise sensitive receivers;
- clearly state how complaints may be made and additional information obtained and
- include the number of the telephone complaints line required by EPL Condition M6.1, an after hours contact phone number specific to the works undertaken outside the hours specified in EPL Condition L4.1, and the project website address.

The Contractor will provide the Roads and Maritime Project Manager and Roads and Maritime Environmental Manager (or delegate) evidence of the consultation undertaken for the OOHW.

5.1 Community agreements for works outside of standard construction hours

Works outside of standard construction hours that do not meet the circumstances listed in NSW-CoA E26 may be undertaken if agreement between the Contractor and a substantial majority of noise sensitive receivers has been reached in accordance with the EPL as described in Section 8.1.5 of the CNVMP. The consultation requirements for community agreements are outlined in Section 8.1.5.

6 Approval of OOHW

The Contractors will seek agreement from Roads and Maritime for proposed OOHW that meet the circumstances outlined in NSW-CoA E26 and the EPL.

The Contractor will provide Roads and Maritime with sufficient information to assess the likely impacts on sensitive receivers of the proposed OOHW (Section 3 of this Procedure) and specify the proposed mitigation measures (Section 4) as well as provide evidence of the consultation undertaken (Section 5).

The template OOHW approval request form provided at Attachment 1 of this OOHW Procedure will be completed by the Contractor and submitted to Roads and Maritime for review by the Environmental Manager (or delegate) and approval by the Roads and Maritime Project Manager. The Contractor may supply an alternative OOHW approval request form provided it meets the requirements identified in this OOHW Procedure.

Where the OOHW request is due to a requirement for emergency works, notification will be provided to the ER and EPA (as the work will be carried out under an EPL). The Contractor will also use its best endeavours to notify all affected sensitive receivers of the likely impact and duration of those works.

The Contractor will comply with the approval requirements of the EPL for OOHW. Any community agreements between the Contractor and noise sensitive receivers referred to in EPL Condition L4.5 must be submitted to the EPA for approval prior to any works that are the subject of the agreement being undertaken. A validation monitoring plan must be submitted to the EPA for approval as part of the community agreement documentation prior to any OOHW occurring.

The Contractor will not commence any OOHW until the written agreement of Roads and Maritime has been received.

7. Monitoring and auditing

7.1 Monitoring for OOHW

The Contractor Environmental Site Representatives will ensure the following noise and vibration monitoring is undertaken for all OOHW:

- attended noise monitoring at representative sensitive receivers
- attended vibration monitoring at representative sensitive receivers
- additional noise and vibration monitoring and review if complaints about the activity are received.

All OOHW monitoring will be carried out by an appropriately trained person in the measurement and assessment of construction noise and vibration.

Validation monitoring will be undertaken for any works that are the subject of a community agreement under the EPL and will be performed by a suitably qualified and experienced person on at least the first two nights where OOHW will be undertaken. If validation monitoring shows that noise levels are higher than those predicted by any noise modelling undertaken as part of the community agreement, work practices will be modified so that measured noise levels do not exceed predicted levels. The validation monitoring plan will be submitted to the EPA for approval as part of the community agreement documentation prior to any OOHW occurring.

7.2 Complaints management

Complaints received as a result of the OOHW will be managed in accordance with the Project Complaints Management Strategy and EPL condition M6.5. On receipt of any complaints, an investigation will be carried out in accordance with EPL conditions R4.2 and R4.3, and changes will be made to the works to address the source of the complaint if reasonable and feasible. Alternatively, monitoring will be undertaken to confirm compliance with the noise levels identified in NSW-CoA E26 and predicted vibration levels.

7.3 Exceedances / non-conformances

Where monitoring identifies any exceedances of the levels predicted in the OOHW assessments, a review of OOHW activities will be carried out to determine where noise or vibration levels can be further reduced. Where monitored noise or vibration levels are found to exceed the relevant criteria, the exceedance will be managed in accordance with the procedures outlined in Section 9.8 of the CNVMP.

7.4 Records

The Contractors will maintain accurate records of all OOHW applications and noise and vibration monitoring undertaken during OOHW for the duration of the Project.

Attachment 1 - OOHW approval request form

Out of hours work approval request form			
No:	**Notification date:**	**Approval date:**	**Project:**
A. Contact details	**Name**	**Mobile number**	**Email**
Contractor Environmental Site Representative			
Contractor Construction Manager			
Contractor Foreman			
Contractor Project Engineer			

B. Details of work: Include a map showing location of work extent and nearest sensitive receivers	Location (Chainage):	
	NCA/s:	
	Description of works:	
	Machinery/ plant to be used	
	Traffic control measures required:	
	Lighting required:	
	Proposed mitigation measures:	
	Proposed dates:	
	Proposed timings:	
	Justification (Why does work need to occur outside of standard construction hours?):	
	EPL condition satisfied:	
C. Risk factor category (low, medium, high):	Low Medium High Comments	
D. Details of noise or vibration assessment completed:	Comments:	

Out of hours work approval request form			
No:	**Notification date:**	**Approval date:**	**Project:**
E. Review/ Endorsements			
Roads and Maritime Environmental Manager (or delegate)	Agreed mitigation measures:		
	Have the works been reviewed and endorsed? Yes / No		
	Name:	Signature:	Date:
	Comments:		
Contractor Community Relations Manager	Community notified		Date:
	Additional consultation requirements:		
	Have the works been reviewed and endorsed? Yes / No		
	Name:	Signature:	Date:
	Comments:		
F. Approvals EPA (if required)	EPA notification required? (emergency works only) Yes / No		
	Date EPA notified:		
Roads and Maritime Project Manager	Are the works approved? Yes / No		
	Name:	Signature:	Date:
	Comments:		

Attachment 2 – Application of OOHW mitigation measures

OOHW period	dB(A)	Mitigation measures
OOHW period 1 Monday–Friday: 6 pm – 10 pm Saturday: 7 am - 8 am and 1 pm – 10pm Sunday and Public Hol.: 8 am – 6 pm	0-5 dB(A) above NML	**Standard mitigation measures:** • Behavioural practices on site • Equipment selection / Maintaining and monitoring plant • Use and siting of plant and hoardings • Site inductions • Use of non-tonal reversing alarms • Notification • Planning noisier work to be carried out earlier in the period
	5-15 dB(A) above NML	**Standard mitigation measures:** • Standard measures as above. **Additional mitigation measures:** • Notification • Respite offer period 1 • Duration respite
	15-25 dB(A) above NML*	**Standard mitigation measures:** • Standard measures as above. **Additional mitigation measures:** • Notification • Verification • Respite offer period 1 • Duration respite
	>25 d(B)A above NML*	**Standard mitigation measures:** • Standard measures as above. **Additional mitigation measures:** • Notification • Verification • Individual briefing • Respite offer period 1 • Duration respite • Phone calls • Specific notifications

OOHW period	dB(A)	Mitigation measures
OOHW period 2 Monday– Friday: 10 pm – 7 am Saturday: 10 pm - 8 am Sunday and Public Hol. 6 pm – 7 am	0-5 dB(A) above NML	**Standard mitigation measures:** • Behavioural practices on site • Equipment selection / maintaining and monitoring plant • Use and siting of plant and hoardings • Site inductions • Use of non-tonal reversing alarms • Notification • Planning noisier work to be carried out earlier in the period
	5-15 dB(A) above NML	**Standard mitigation measures:** • Standard measures as above. **Additional mitigation measures:** • Notification • Verification • Respite offer period 2 • Duration respite
	15-25 dB(A) above NML*	**Standard mitigation measures:** • Standard measures as above **Additional mitigation measures:** • Notification • Verification • Individual briefing • Respite offer period 2 • Duration respite • Phone calls • Specific notifications
	>25 d(B)A above NML*	**Standard mitigation measures:** • Standard measures as above. **Additional mitigation measures:** • Notification • Verification • Individual briefing • Respite offer period 2 • Duration respite • Phone calls • Specific notifications • Alternative accommodation

* *exceedances greater than 15 dB(A) above the NML are only allowable if there is a community agreement in place in accordance with EPL conditions L4.5, L4.6 and E1.1 to E1.8 (refer Section 8.1.5 of the CNVMP)*


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