COFFS HARBOUR BYPASS

Construction Noise and Vibration Management Plan

CHBPW-FGJV-NWW-NV-PLN-000001- Revision J - Coffs Harbour Bypass

FERROVIAL GAMUDA JOINT VENTURE

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DOCUMENT DETAILS

Document Title	Construction Noise and Vibration Management Plan
Project Name	Coffs Harbour Bypass
Client	Transport for New South Wales
Application No.	SSI-7666
Document Reference No.	CHBPW-FGJV-NWW-NV-PLN-000001
Principal Contractor	Ferrovial Gamuda Joint Venture

DOCUMENT AUTHORISATION

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DOCUMENT CONTROL

Revision	Date	Description	Approval
Draft	16/03/2021	Issued for TfNSW, AA and ER discussion	
A	19/03/2021	Issued for TfNSW, AA and ER review following updated comments	
B	05/05/2021	Issued for DPE review following updates to address review comments	
C	22/07/2022	TfNSW updated following DPE Review FGJV update to incorporate FGJV System and close outstanding comments, for TfNSW review.	
D	10/10/2022	Updated to address TfNSW comments, for external consultation	
E	27/10/2022	Updated to address external consultation comments	
F	20/12/2022	Updated to address ER/AA comments	
G	17/01/2023	Updated to address ER/AA comments	
H	16/02/2023	Updated to address DPE comments	
I	28/02/2023	Updated to address DPE comments	
J	11/04/2023	Issued to ER/AA as minor update	

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GLOSSARY/ABBREVIATIONS

Abbreviation	Expanded Text
AA	The Acoustics Advisor for the CSSI approved by the Planning Secretary
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.
ABL	Assessment Background Level - A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background LA90 noise levels – i.e. the measured background noise is above the ABL 90% of the time.
Attenuation	The reduction in the level of sound or vibration.
Continuously	Includes any period during which there is less than one hour between ceasing and recommencing any of the work.
Council	Coffs Harbour City Council
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
dB(A)	Decibels using the A-weighted scale which is accepted as being representative of the frequency response of the human ear.
DPE	Department of Planning and Environment
DPE, EESG	Department of Planning and Environment, Environment, Energy and Science Group
EIS	Environmental Impact Statement
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 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	Environmental Planning and Assessment Act 1979 (NSW)
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
ER	Environmental Representative
EWMS	Environmental work method statement
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.
FGJV	Ferrovial Gamuda Joint Venture
Highly Noise affected	As defined in the Interim Construction Noise Guideline (DECC, 2009) as noie levels above 75 dbA and represents the point above which there may be strong community reaction to noise. When respite periods may be required by restricting hours very noisy activities can occur.
Highly noise intensive works / particularly annoying	Works which are defined as annoying under the Interim Construction Noise Guideline (DECC, 2009) including: (a) use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work (b) grinding metal, concrete or masonry (c) rock drilling (d) line drilling (e) vibratory rolling (f) bitumen milling or profiling

	(g) jackhammering, rock hammering or rock breaking impact piling
ICNG	Interim Construction Noise Guideline (DECC, 2009)
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.
MCoA	Minister's Conditions of Approval
NCA	Noise Catchment Area
NML	Noise Management Level
NVMP	Noise and Vibration Monitoring Program
OOHW	Out of Hours works
PPV	Peak Particle Velocity (PPV) is the peak vector vibration velocity used to assess the risk of damage to structures from ground borne vibration. This is generally evaluated at the building footings.
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)
REMMs	Revised Environmental Management Measures
Sensitive receiver	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), childcare centres, passive recreation areas (including outdoor grounds used for teaching), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces), and others as identified by the Planning Secretary.
SWL	Sound Power Level
SPL	Sound Pressure Level
TfNSW	Transport for NSW
VDV	Vibration Dose Value (VDV) is the overall vibration exposure assessed over the daytime or night-time period to assess human response to intermittent vibration and calculated as described in DECC *Assessing Vibration: a technical guideline*.

1 INTRODUCTION

1.1 CONTEXT

This Construction Noise and Vibration Management Plan (CNVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Coffs Harbour Bypass (the Project).

This CNVMP has been prepared to address the requirements of the Minister's Conditions of Approval (MCoA), the mitigation and management measures listed in the Coffs Harbour Bypass Environmental Impact Statement (EIS), the Submissions Report, Amendment Report and all applicable legislation.

1.2 BACKGROUND AND PROJECT DESCRIPTION

The Coffs Harbour Bypass EIS (Chapter 9) and subsequent Submissions and Amendment Reports considered the potential noise and vibration impacts during the construction of the project.

The project includes a 14-kilometre bypass of Coffs Harbour, including a 12-kilometre new build from south of England's Road to Korora Hill in the north and a two-kilometre upgrade of the existing highway between Korora Hill and Sapphire. The project would provide a four-lane divided highway that bypasses Coffs Harbour, passing through the North Boambee Valley, Roberts Hill and then traversing the foothills of the Coffs Harbour basin to the west and north to Korora Hill.

The Coffs Harbour Bypass EIS (Chapters 4A, 4B and 4C) considered the potential noise and vibration impacts on sensitive receivers during the construction of the project. Construction noise and vibration impacts have been modelled based on the indicative construction activities and durations described in the EIS, and confirmed construction, however, the EIS concluded that providing that identified mitigation measures are implemented, any residual impacts can be suitably managed.

1.3 ENVIRONMENTAL MANAGEMENT SYSTEMS OVERVIEW

The CEMP describes the overall system for environmental management of the project being delivered by Ferrovial Gamuda Joint Venture (FGJV).

The CNVMP has been developed in response to MCoA C4, C5 and C10 and provides practical management measures and actions that will be put in place to avoid or minimise noise and vibration impacts during construction of the Project.

Where relevant, the CNVMP environmental management and mitigation measures will be incorporated into location or activity-specific environmental work method statements (EWMS). EWMS will be developed and approved by environment and management representatives prior to associated works and construction personnel will be required to undertake works in accordance with the identified requirements and associated mitigation measures.

Used together, the CEMP and EWMS form management guides that clearly identify the required environmental management actions that will be referenced by all personnel and contractors on the project.

This plan will be subject to the review and improvement processes described in the CEMP (refer to Section 9 and Section 10 of the CEMP).

2 PURPOSE AND OBJECTIVES

2.1 PURPOSE

The purpose of this CNVMP is to describe how potential noise and vibration impacts will be managed during construction of the project.

Blasting will be addressed by a Blast Management Strategy which will be prepared separately in accordance with CoA E59 and appended to this document upon completion.

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.

Specific objectives include:

- Identifying sensitive receivers and ensure appropriate environmental controls and procedures
- are implemented during construction activities.
- Minimising potential adverse noise and vibration impacts to the environment and community.
- Managing impacts if they occur through a systematic analysis of mitigation strategies.
- Ensure appropriate measures are implemented to comply with all relevant MCoA, legislation and other requirements as described in Section 3 of this CNVMP.

2.3 TARGETS

The following targets have been established for the management of noise and vibration impacts during the project:

- To achieve full compliance with the relevant legislative requirements, MCoA and environmental management measures detailed in the EIS, Submissions and Amendment Reports.
- Implement feasible and reasonable noise mitigation measures with the aim of achieving the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009)
- That blasting activities are only undertaken at designated times and remain within established/agreed criteria
- Complaints from the community and stakeholders are minimised.

The potential for a corrective action or other consequence as a result of any failing to achieve one of the above targets will be specific to the target which has not been met and will be determined by the compliance processes described in the CEMP.

2.4 ENVIRONMENTAL PERFORMANCE OUTCOMES

The EIS outlined a set of performance outcomes in Section 29-4. The performance outcome related to construction noise and vibration are viewed in Table 1 below.

TABLE 1 PERFORMANCE OUTCOMES IN RELATION TO CNVMP

Desired Performance Outcome	Project Outcome	References
Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity. **Increases in noise emissions affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and wellbeing of the community.**	• Mitigation measures will be implemented in accordance with the relevant criteria from the Construction Noise and Vibration Guideline (Roads and Maritime, 2016a) and Noise Criteria Guideline (Roads and Maritime, 2015c); • Road traffic noise is minimised at nearby sensitive receivers; • Operational noise mitigation measures are implemented early during the construction phase; and • Construction noise and vibration including out of hours work is effectively managed in accordance with relevant guidelines, and the affected community is informed and consulted.	Section 5, Section 7, & Section 8,
Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. **Increases in noise emissions and vibration affecting environmental heritage as defined in the Heritage Act 1977 during operation of the project are effectively managed.**	• Old Coast Road timber beam bridges are not damaged by construction vibration; • Vibration impacts will be managed in accordance with relevant standards and guidelines; and • Blasting is managed in accordance with relevant standards and guidelines and the affected community and property owners are consulted.	Section 7, & Section 9

3 ENVIRONMENTAL REQUIREMENTS

3.1 RELEVANT LEGISLATION AND GUIDELINES

3.1.1 LEGISLATION

Legislation 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 explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

This CNVMP will be updated when the Environmental Protection License has been granted.

3.1.2 GUIDELINES

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

- RMS Construction Noise and Vibration Guideline (Roads and Maritime 2016)
- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Noise Policy for Industry, Environment Protection Authority 2017
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1- 80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN4150-2016 Structural vibration Part 3: Effects of vibration on Structures

3.2 MINISTERS CONDITIONS OF APPROVAL

The MCoA relevant to this Plan are listed Table 2 below. A cross reference is also included to indicate where the condition is addressed in this Plan or other project management documents.

TABLE 2 MINISTER'S CONDITION OF APPROVAL RELEVANT TO THE NVMP

<table>
<tr><th>MCoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>C4</td><td><table><tr><th></th><th>Required CEMP Sub Plan</th><th>Relevant government agencies to be consulted for each CEMP Sub plan</th></tr><tr><td>(e)</td><td>Noise and Vibration</td><td>EPA, Council</td></tr></table></td><td>EPA and Council Consultation Record provided with DPE Submission</td></tr>
<tr><td rowspan="2">C5</td><td></td><td>Section 3
Section 10, Table 19</td></tr>
<tr><td>(b) the mitigation measures identified in the documents listed in Condition A1 will be implemented;</td><td>Section 10, Table 19</td></tr>
</table>

MCoA No.	Condition Requirements	Document Reference
	(c) the relevant terms of this approval will be complied with; and	Section 3
	(d) issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.	Section 8 Section 9 Section 10.7 Section 12.1
C10		Section 4.2
E32		Section 5.2
E33		Sections 5.4
E34		Sections 5.4
E35		Sections 5.4

MCoA No.	Condition Requirements	Document Reference
E36		Section 5.3 OOHW Protocol (Appendix 9)
E37		OOHW Protocol (Appendix 9)
E38		Sections 5.5

MCoA No.	Condition Requirements	Document Reference
E39		OOHW Protocol (Appendix 9)
E40		OOHW Protocol (Appendix 9)

MCoA No.	Condition Requirements	Document Reference
E41		Section 10
E42		Section 10
E43		Section 10,
E44		Section 10

MCoA No.	Condition Requirements	Document Reference
E47		Section 10.6
E48		Section 10.6
E54		Blast Management Strategy (to be prepared)

<table>
<tr><th>MCoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>E55</td><td>
<table>
<tr><th>Receiver</th><th>Type of Blasting Operations</th><th>Airblast Overpressure Limit</th></tr>
<tr><td>Sensitive site</td><td>Blasting operations lasting more than 12 months or more than 20 blasts</td><td>115 dBL for 95% of blasts per year
120 dBL maximum limit</td></tr>
<tr><td>Sensitive Site</td><td>Blasting operations lasting less than 12 months or less than 20 blasts in total</td><td>120 dBL for 95% of blasts per year
125 dBL maximum limit</td></tr>
<tr><td>Occupied non-sensitive sites, such as factories and commercial premises</td><td>All blasting</td><td></td></tr>
</table>
Source – Table J5.4 – AS 2187.2 – 2006
</td><td>Blast Management Strategy (to be prepared)</td></tr>
</table>

<table>
<tr><th>MCoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>E56</td><td>
<table>
<tr><th>Receiver</th><th>Type of Blasting Operations</th><th>Peak component particle velocity (mm/s)</th></tr>
<tr><td>Sensitive site</td><td>Blasting operations lasting more than 12 months or more than 20 blasts</td><td>5 mm/s for 95% of blasts per year</td></tr>
<tr><td></td><td></td><td>10 mm/s maximum limit</td></tr>
<tr><td>Sensitive Site</td><td>Blasting operations lasting less than 12 months or less than 20 blasts in total</td><td>10 mm/s maximum limit</td></tr>
<tr><td>Occupied non-sensitive sites, such as factories and commercial premises</td><td>All Blasting</td><td></td></tr>
</table>
Source – Table J4.5(A) – AS 2187.2 – 2006
<table>
<tr><th>Receiver</th><th>Type of Blasting Operations</th><th>Peak component particle velocity (mm/s)</th></tr>
<tr><td>Sensitive site</td><td>Blasting operations lasting more than 12 months or more than 20 blasts</td><td>5 mm/s for 95% of blasts per year</td></tr>
<tr><td></td><td></td><td>10 mm/s maximum limit</td></tr>
<tr><td>Sensitive Site</td><td>Blasting operations
lasting less than 12 months or less than 20 blasts in total</td><td>10 mm/s maximum limit</td></tr>
<tr><td>Occupied non-sensitive sites, such as factories and commercial premises</td><td>All Blasting</td><td></td></tr>
</table>
Table 12: Ground vibration limits for control of damage to structures (cont.)
</td><td>Blast Management Strategy (to be prepared)</td></tr>
</table>

MCoA No.	Condition Requirements	Document Reference
E57		Blast Management Strategy (to be prepared)
E58		Blast Management Strategy (to be prepared)
E59		Blast Management Strategy (to be prepared)
E60	The **Blast Management Strategy** must be endorsed by a suitably qualified and experienced person	Blast Management Strategy (to be prepared)
E61	The **Blast Management Strategy** must be prepared in accordance with relevant guidelines and in consultation with the EPA, in order to ensure that all blasting and associated activities are carried out so as not to generate unacceptable noise and vibration impacts or pose a significant risk to sensitive receivers.	Blast Management Strategy (to be prepared)
E62	The **Blast Management Strategy** must be submitted to the Planning Secretary for information no later than one month before the commencement of blasting. The Strategy as submitted to the Planning Secretary, must be implemented for all blasting activities.	Blast Management Strategy (to be prepared)
E71	**Condition Survey** Before the commencement of any work that may cause damage to buildings, structures, utilities and the like that are identified in the documents listed in Condition A1 as being at risk of damage, a condition survey of those buildings, structures, utilities must be undertaken by an appropriately qualified independent professional. The results of the surveys must be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports must be provided to the owners of the items surveyed prior to the work commencing.	Sections 5, Section 10 - NMR24
E72	After completion of construction, condition surveys of all items for which condition surveys were undertaken in accordance with Condition E71 of this approval must be undertaken by an appropriately qualified independent professional. The results of the surveys must be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports must be provided to the owners of the items surveyed, and no later than three (3) months following the completion of construction.	Sections 5, Section 10 - NMR25

MCoA No.	Condition Requirements	Document Reference
E73		Sections 5

3.3 REVISED ENVIRONMENTAL MANAGEMENT MEASURES

Relevant Revised Environmental management Measures (REMMs) derived from Chapter 6 of the CHB Submissions Report are listed Table 3 below. This includes reference to required outcomes, the timing of when the commitment applies, relevant documents or sections of the environmental assessment influencing the outcome and implementation.

TABLE 3 REVISED ENVIRONMENTAL MANAGEMENT MEASURES RELEVANT TO THIS NVMP

REMM Ref #	Outcome	Commitment	Timing	Document Reference
NVO1	Construction noise and vibration management		Construction	This NVMP
		• All potential significant noise and vibration generating activities associated with the activity	Construction	Sections 5
		• Measures to be implemented during construction to	Construction	Section 10
		• A monitoring program to assess performance against relevant noise and vibration criteria	Construction	Appendix 7, Construction Noise and Vibration Monitoring Program
		• Process for the implementation of respite periods to provide residents with respite from ongoing impact	Construction	Section 10
		• Arrangements for consultation with affected receivers, including notification and complaint handling procedures	Construction	Section 10
		• Contingency measures to be implemented in the event of noncompliance with noise and vibration criteria.	Construction	Appendix 7, Construction Noise and Vibration Monitoring Program
NV02	Construction noise and vibration impacts		Prior to Construction	Section 9.2

REMM Ref #	Outcome	Commitment	Timing	Document Reference
NV03	Construction noise and vibration impacts		Prior to Construction	Section 5, Section 10
NV04	Construction noise and vibration impacts		During Construction	Section 10, Appendix 7, Construction Noise and Vibration Monitoring Program
NV05	Construction noise and vibration impacts		Prior to Construction	Section 10
NV06	Impacts from out of hours works		During Construction	OOHW Protocol (Appendix 9)
NV07	Construction noise and vibration impacts		Prior to construction / During construction	Section 10
NV08	Construction noise impacts from ancillary facilities		During construction	Section 7 Section 10

REMM Ref #	Outcome	Commitment	Timing	Document Reference
NV09	Construction traffic noise impacts		During construction	Section 10
NV10	Blasting		During construction	Blast Management Strategy

4 EXISTING ENVIRONMENT

4.1 OVERVIEW

Figure 1 below shows the project alignment passes through predominantly green field rural areas around the western outskirts of Coffs Harbour, tie-in locations to the existing Pacific Highway are within developed residential areas at the northern extent of the project and commercial and light industrial area at the southern connection to the existing highway.

As shown in Figure 1, the topography of Coffs Harbour is formed such that the bulk of the township is surrounded by steep hills aligning the west and northwest.

The existing Pacific Highway travels through central Coffs Harbour and passes Coffs Harbour Airport that is located close to the eastern coastline. The North Coast train line also crosses the proposed bypass, aircraft and train movements both contributing to the overall soundscape.

The existing sound environment is characteristic of rural or suburban areas for most of the project alignment with the Pacific Highway having a significant influence on the prevailing soundscape at the tie-in locations to the existing Highway. Depending on proximity to the existing highway, overall daytime ambient noise levels are generally higher than night-time noise levels. This is due to daytime levels being driven up by the volume of light vehicles but significantly reduced during the night-time. The volume of long-haul road freight vehicles becomes proportionally more significant during the night-time period and hence the determinant of road traffic noise disturbance. The ambient noise environment away from the existing Pacific Highway is dominated by local residential activity and natural sounds, background noise levels are low especially in the night-time period.

Figure 1 General Features of The Project.

4.2 SENSITIVE RECEIVERS

A total of 2310 noise sensitive receivers were included in the EIS noise and vibration model for the project. Of the total number of receivers, 2295 are residential and 15 are other noise sensitive receivers out of which 5 are outdoor recreational spaces. Non-residential receiver locations have been summarised in Table 4.

The Amendment Report also considered approved development applications for the following residential subdivisions:

- Elements Estate, near the Englands Road Interchange
- Highlands Estate, near North Boambee Road
- The Lakes Estate, near North Boambee Road
- Sunset Ridge Estate, near Shephards Lane
- Pacific Bay Eastern Lands, near James Small Drive
- Korora Residential Subdivision, near Opal Boulevard.

Where noise-sensitive receivers are within the study area they are shown on the maps in Appendix 1. These estates may not yet have sensitive receivers however have been included as a worst case scenario; as their construction progresses mitigation measures associated with construction noise and vibration impacts will be assessed based on the current occupied residences at that time. Refer to Section 8 for information regarding the process of construction noise assessment.

Prior to construction, and as required by TfNSW G36, a map will be developed via noise-risk mapping and ground-truthing, to identify all occupied noise and vibration sensitive receivers. This information will be used as input to the NoiseCheck tool (refer Sections 8, 9 and Appendix 4) and may include additional receivers to those identified for the EIS.

There are 29 Noise Catchment Area's (NCA's) identified along the Project alignment. The number and type of sensitive receivers within each NCA is detailed in Table 17. Additionally, mapping of sensitive receivers within NCAs is included in Appendix 1.

To assist with identification, building IDs have also been provided in Table 4 for cross reference.

TABLE 4 NON-RESIDENTIAL SENSITIVE RECEIVERS

Receiver Type	Description	Building ID	Address
Education	Kororo Public School	NCA26.SCH.0001.01	3 Korora School Road, Korora NSW 2450
	Bishop Druitt College	NCA06.SCH.0001.01	111 N Boambee Road, North Boambee Valley NSW 2450
	Coffs Harbour Montessori Preschool	NCA26.SCH.0002.01	27 James Small Dr, Korora NSW 2450
	NSW School of Natural Medicine[1]	NCA08.SCH.0008.01	202 North Boambee Road, North Boambee Valley NSW 245
Health	Coffs Harbour Health Campus	NCA05.HOS.0001.01	345 Pacific Hwy, Coffs Harbour NSW 2450
	Coffs Harbour GP Super Clinic	NCA03.HOS.0001.01	51 Stadium Drive, Coffs Harbour NSW 2450
Places of Worship	The Foursquare Church Australia	NCA05.POW.0001.01	10/12 Elswick Pl, North Boambee Valley NSW 2450
	Bishop Druitt School Chapel	NCA06.POW.0001.01	111 North Boambee Road, North Boambee Valley NSW 2450

Receiver Type	Description	Building ID	Address
Active recreation	Coffs coast sport and leisure field	NCA03.ARA.0001.01 To NCA03.ARA.0004.01	111 North Boambee Road, North Boambee Valley NSW 2450
	Boambee equestrian Centre (Outdoor grassed riding area)	NCA02.ARA.0001.01	Stadium Drive, Coffs Harbour NSW 2450
	Pacific Bay Resort Golf Course	NCA22.ARA.0001.01	Cnr Pacific Hwy and Bay Drive, Coffs Harbour NSW 245
	Elite Training Centre Pacific Bay Resort	NCA21.ARA.0001.01	Lot 5 DP 820652, West Korora Road, Coffs Harbour NSW 2450
Passive Recreation	Kororo Nature Reserve	NCA23.PAS.0001.01	Korora NSW 2450
Childcare Facilities	Petit Early Learning Journey Coffs Harbour	NCA05.CCF.0001.01	1 Kiddell Pl, North Boambee Valley NSW 2450
	Cow & Koala Professional Childcare	NCA05.CCF.0001.01	15 William Sharp Dr, Coffs Harbour NSW 2450
Heritage Structures	Old Coast Road Bridge No. 1, Old Coast Road Bridge No. 2, and The North Coast Railway crossing the construction area near Shephard's Lane	Located on Old Coast Road and Shepard's Lane.	

4.3 UTILITIES

There are utilities that exist within and adjacent to the construction footprint, the majority of utilities are being relocated as part of the Project to minimise impact to the ongoing operation. These consist of sewer, telecommunications, electricity and water, which are not anticipated to be sensitive to vibration due to location and construction materials. The locations of utilities in relation to construction activities will be reviewed through ongoing risk analysis during construction planning to ensure impacts are minimised.

4.4 EXISTING NOISE

Noise monitoring was undertaken as part of the EIS to determine background noise levels to aid with establishing construction noise criteria for areas of sensitive receivers along the alignment. Locations were selected to be representative of receivers that would experience potential noise impacts from the existing highway and/or the project and allocated unique Noise Catchment Area identification numbers (NCA).

The EIS noise monitoring data has been supplemented by more recent data collected in June and October/November 2021 as reported in Coffs Harbour Bypass Additional Noise Monitoring report prepared by Renzo Tonin & Associates dated 29 July 2022. The data collected is considered representative of the current noise environment and is applicable for the purposes of the noise assessment.

Results of the above noise surveys have been processed to derive the Rating Background Level (RBL) and L_{Aeq} noise levels for the time periods defined for the assessment of operational noise (in accordance with the NSW Road Noise Policy (RNP)) and construction noise (in accordance with the Roads and Maritime Construction Noise Vibration Guideline (CNVG)).

A summary of the monitoring results for both the EIS and supplementary monitoring is provided in Table 5.

TABLE 5 BACKGROUND NOISE MONITORING RESULTS

Logger Number	Measured Noise Level (db(A))								
EIS Monitoring (undertaken in 2016)									
		CNVG Defined Time Periods						RNP Time Periods[1]	
	Property Address	RBL			LAeq			LAeq	
		Day	Evening	Night	Day	Evening	Night	Day	Night
1	498c-498d Pacific Highway, Boambee, NSW 2450	47	45	39	55	53	51	54	51
2	North Boambee Road, North Boambee Valley, NSW 2450	32	32	31	54	45	44	53	44
3	170 North Boambee Road, North Boambee, NSW 2450	42	40	38	54	57	46	56	51
4	12 Tamora Close, Coffs Harbour, NSW 2450	39	32	27	60	56	52	59	52
5	20 Bennetts Road, Coffs Harbour, NSW, NSW 2450	37	31	30	48	43	42	47	41
6	263c Shepards Lane, Coffs Harbour, NSW 2450	28	28	28	47	47	47	47	47

7	191 Mackays Road, Coffs Harbour, NSW 2450	28	39	28	46	40	38	45	40
8	Opal Shop, 429a-429b Pacific Highway North, Coffs Harbour, NSW 2450	66	59	40	75	74	71	75	71
9	16 Fern Tree Place, Korora, NSW 2450	48	40	34	57	56	54	57	54
10	1 Coachmans Close, Sapphire Beach, NSW 2450	60	50	42	68	67	64	68	65
11	539 Pacific Highway, Boambee, NSW 2450	58	51	39	65	64	61	65	61
12	19 Gillon Street, Coffs Harbour, NSW 2450	28	30	30	44	43	42	45	42
13	14 Jenson Close, Coffs Harbour, NSW 2450	31	31	29	48	45	48	48	48
14	Paradise Palms, 675 Pacific Highway, Korora, NSW 2450	55	51	42	65	65	62	65	63
15	Kororo Public School, 3 Korora School Road, Korora, NSW 2450	52	46	37	59	59	55	59	56

16	23 Rigoni Crescent Coffs Harbour, NSW 2450	27	27	25	51	51	53	52	53
17	170 West Korora Road, Coffs Harbour, NSW 2450	30	37	30	55	45	42	49	42
18	111 Bruxner Park Road, Coffs Harbour, NSW 2450	43	38	34	51	47	46	50	45
19	133b Mackays Road, Coffs Harbour, NSW 2450	26	29	28	56	37	45	54	45
20	20 Anniversary Place, Coffs Harbour, NSW 2450	31	30	30	44	38	39	45	39
21	Bishop Druitt College, 111 N Boambee Road, North Boambee Valley, NSW 2450	41	38	35	58	62	52	60	56
Additional noise monitoring (Renzo Tonin, 2021)									
L1	10 McAlpine Way, Boambee, NSW 2450	41	39	34	48	45	45	50	47
L2	11 Wallace Circuit, North Boambee Valley, NSW 2450	39	37	35	54	48	45	56	48

L3	2 Loaders Lane, Coffs Harbour, NSW 2450	44	33	26	68	64	61	70	63
L4	15 Ceanothus Close, Coffs Harbour, NSW 2450	33	30	28	48	40	40	48	41
L5	21 Safrano Place, Coffs Harbour, NSW 2450	37	31	26	52	48	45	54	48
L6	15 Safrano Place, Coffs Harbour, NSW 2450 (rear yard)	43	38	35	59	55	52	61	54
L7	15 Safrano Place, Coffs Harbour, NSW 2450 (front yard)	37	30	26	44	39	39	54	42
L8	12 Tamora Close, Coffs Harbour, NSW 2450	40	33	30	57	52	49	58	51
L9	26 Brennan Circuit, Coffs Harbour, NSW 2450	34	35	29	49	46	46	51	47
L10	21 Perry Drive, Coffs Harbour, NSW 2450	38	35	31	49	49	43	51	45
L11	49 West Korora Road, Coffs Harbour, NSW 2450	45	47	40	54	54	51	57	54
L12	6 Meadowlands Crescent, Coffs Harbour, NSW 2450	42	38	36	49	49	46	51	49

L13	1 Breaker Way, Korora, NSW 2450	48	48	45	54	52	50	56	53
L15	122B Old Coast Road, Korora, NSW 2450	51	51	44	57	57	55	59	57

[1] Monday to Saturday, Day, 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 7.00am
Sundays & Public Holidays, Day 8.00am - 6.00pm; Evening 6.00pm - 10.00pm; Night 10.00pm - 8.00 am.

5 CONSTRUCTION

5.1 PROGRAM AND ACTIVITIES

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. An indicative construction program based on a four-year construction period is shown in Table 6.

TABLE 6 INDICATIVE CONSTRUCTION PROGRAM

Principal Activities	Year 1				Year 2				Year 3				Year 4			
Preliminary activities and site establishment																
Site preparation and bulk earthworks																
Drainage and structures																
Bridges																
Tunnels																
Road work and road surfacing																
Finishing work																

Expected typical construction scenarios, are provided in Table 7.

TABLE 7 PROPOSED CONSTRUCTION ACTIVITIES

Phases	Typical activity
Preconstruction and site establishment	• Property acquisition and adjustments, including property access changes • Detailed investigations and survey work including investigative drilling, contamination • Condition surveys and dilapidation assessments • General site clearance, site establishment work, fencing and signage • Establishment of temporary ancillary facilities and compound sites including the site office • Temporary traffic management arrangements including construction of minor access roads • Progressive installation of environmental controls including temporary or permanent fencing, and erosion and sediment control measures • Construction of temporary drainage controls including temporary creek crossings • Clearing and removal of vegetation (nonthreatened species) • Threatened flora translocation • Heritage area investigation and salvage • Relocation and/or protection of utilities.

Phases	Typical activity
Site preparation and bulk earthworks	• Clearing and grubbing of vegetation • Mulching of vegetation for re-use in landscaping activities, where possible • Stripping topsoil and stockpiling it for reuse in landscaping • Excavation of cuttings, including processing, stockpiling or haulage of material, and • stabilisation of batters • Drilling of blast holes • Establishment of crushing plant • Crushing and screening excavated material • Hauling materials from excavated cuttings, borrow sites and external sources to fill embankment locations • Construction of fill embankments and earth mounds, including foundation drainage • Benching and stabilising cut and fill batter slopes
Drainage and structures	• Construction of drainage, including kerb and gutter (where required) • Installation of cross-drainage, including culverts and inlet and outlet work, such as • channel diversions and scour protection • Installation of longitudinal and vertical drainage in cuttings and embankments • Construction of diversion and catch drains along the formation and sedimentation control • basins or swales (where required) • Construction of subsurface drainage • Construction of any retaining walls • Installation of fauna connectivity structures
Tunnel Works	• Establishment of portal sites in preparation for tunnel excavation, including provision of • temporary tunnel services • Excavation of tunnel portals • Excavation of mined tunnels using drilling and blasting equipment for hard rock • Excavation of cross passages • Finishing works in tunnel and provision of permanent tunnel services • Test tunnel plant and equipment
Demolition	• Demolition of bridges (Luke Bowen footbridge and northbound carriageway bridge over Pine Brush Creek) • Demolition of buildings (properties and sheds).
Road work and road surfacing	• Construction of temporary local traffic management • diversions • Construction of base and select layers of materials • Paving works • Construction of road surface drainage, including kerb and gutter (where required) • Construction of concrete barriers, wire rope fencing and guardrails • Installation of traffic lights, road markings, signposting, roadside furniture and lighting • Progressive landscaping and tree planting.
Finishing work	• Remove temporary work • Restoration and landscaping of temporary sites • General site clean-up • Restoration of topsoil and revegetation of batters • Removal of temporary environmental controls • Site clean-up and demobilisation, including restoration of ancillary sites and construction access roads (where required).

Phases	Typical activity
Operation of Ancillary Facilities Refer to Appendix 2 for locations	• Office accommodation • Staff amenities • Light vehicle parking • A plant and equipment maintenance workshop • Material and chemical storage. • Crib sheds and minimal office accommodation • Concrete and asphalt batching plants • Equipment storage • Material storage • Materials processing such as crushing and screening, mulching of vegetation and Acid Sulfate Soil treatment

Due to the nature of construction activities, the activities listed above may occur in isolation or simultaneously at any time during each phase of work.

This break down of construction activities will be utilised to prepare the construction noise and vibration assessments, in order to determine potential impacts and identify appropriate mitigation measures.

5.2 STANDARD CONSTRUCTION HOURS

In accordance with MCoA E32, work (except for works undertaken in accordance with Conditions E33 and E40) 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.

5.3 OUT OF HOURS WORKS

For works that are required to be undertaken outside standard construction hours and not permitted by any other MCoA, an OOHW Permit (Appendix 9) will be required. The permit provides the necessary additional assessment and approval criteria to allow works to proceed with appropriate approvals and management and mitigation measures in place. Works will either be approved under the OOHW Protocol (Appendix 9) or EPL. In all cases, a Permit will be required to be prepared and approved by the Environmental Manager at a minimum.

5.4 TUNNELLING AND TUNNELLING SUPPORT

The MCoA provides approval to facilitate conditional 24 hour operation relating to tunnelling (excluding cut and cover tunnelling) at the three tunnel sites:

MCoA E33:

The following work may be undertaken 24 hours per day, seven days per week at the Roberts Hill, Shephards Lane and Gatelys Road tunnel sites once portal acoustic sheds and/or acoustic curtains have been installed:

a) tunnelling (does not include cut and cover tunnelling);
b) work within an acoustic shed/curtain; and
c) tunnel fit out work.

MCoA E34:

Surface work associated with tunnelling that is undertaken outside the acoustic shed/curtains at the tunnel portals must only be undertaken in accordance with the requirements of Conditions E32 and E36.

MCoA E35:

Delivery of material and spoil haulage associated with tunnelling is not permitted between the hours of 10.00pm and 7.00am, unless in accordance with Condition E36.

The above conditions provide opportunity to undertake works outside of standard construction hours, noting that surface works or works outside of the acoustic sheds and/or curtains are subject to standard construction hours, unless specific approval is sought under condition E36 or E40.

5.5 HIGHLY NOISE INTENSIVE WORKS

The Project MCoA prescribe conditions on certain activities which are Highly Noise Intensive Works, defined as annoying under the Interim Construction Noise Guideline (DECC, 2009) including:

a) use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work
b) grinding metal, concrete or masonry
c) rock drilling
d) line drilling
e) vibratory rolling
f) bitumen milling or profiling
g) jackhammering, rock hammering or rock breaking
h) impact piling

Limitations are placed on the above activities by MCoA E38 which states:

Except as permitted by an EPL, highly noise intensive work that result in an exceedance of the applicable NML at the same receiver must only be undertaken:

a) between the hours of 8:00am to 6:00pm Monday to Friday;
b) between the hours of 8:00am to 1:00pm Saturday; and
c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour.

For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.

Planning of works involving the above activities must be undertaken to ensure compliance.

Highly noise intensive works which are defined as annoying under the Interim Construction Noise Guideline (DECC, 2009) will include a 5dBA penalty in all noise assessments.

6 NOISE CRITERIA

6.1 PROJECT NMLS

The EPA recommends management levels and goals when assessing construction noise as outlined in the NSW Interim Construction Noise Guideline (Department of Environment and Climate Change 2009) (the ICNG).

The ICNG provides an approach for determining the construction NMLs for residential receivers based on the measured RBL. This approach establishes “Noise affected” and “Highly noise affected” NMLs to guide appropriate management to minimise noise impacts.

Table 8 summarises the ICNG standard NML criteria for residential receivers for the respective periods relating to approved construction hours. Investigations into the use of ‘shoulder periods’ may also be undertaken, to assess viability of additional construction hours without impacting sensitive receivers. Where this is pursued, NMLs would be updated with agreement from the ER and the AA.

TABLE 8 CONSTRUCTION NMLS FOR RESIDENTIAL RECEIVERS

Period	Construction NMLs[1] $LA_{eq\ (15\ min)}$	How to apply
Standard Construction Hours: • Monday to Friday 7am to 6pm • Saturday 8am to 1pm • No work on Sundays or public holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (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 75dB(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 (consent, determining or regulatory) 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 Standard Construction Hours	Noise affected RBL + 5dB	• 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 5dB(A) above the noise affected level, the proponent should negotiate with the community. • The process for justification, assessment and approval for OOHW is detailed in the OOHW Protocol and/or the EPL.

Notes:

[1] 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.

The ICNG method has been used to develop project specific NMLs to be implemented for the management of construction noise, using the RBLs obtained as described in Section 6. Where multiple monitoring locations were applicable to a single NCA a conservative approach has been taken by adopting the lower of the measured RBLs for the purpose of establishing NMLs. Table 9 summarises the calculated NMLs for corresponding periods for each NCA.

Refer to Appendix 1 for the mapped Noise Catchment Areas.

TABLE 9 NMLS FOR THE PROJECT NOISE CATCHMENT AREAS

Location	Logger ID	RBL, dB(A) [1]			Construction NMLs, $dBL_{Aeq\ 15minute}$					Sleep Disturbance dBL_{Amax}	
					Standard Construction Hours[3]		Outside Standard Construction Hours				
		Daytime	Evening	Night time	Noise Affected (RBL + 10dB)	Highly Noise Affected	Noise affected (RBL + 5dB)			Screening criterion RBL + 15	Max
							Day[4]	Evening[4]	Night time [4]		
Residential											
NCA 1											65
NCA 2	1	47	45	39	57	75	52	50	44	54	65
NCA 3	1	47	45	39	57	75	52	50	44	54	65
NCA 4	1	47	45	39	57	75	52	50	44	54	65
NCA 5	2	32	32	31	42	75	37	37	36	46	65
NCA 6	2	32	32	31	42	75	37	37	36	46	65
NCA 7	3	42	40	38	52	75	47	45	43	53	65
NCA 8	3	42	40	38	52	75	47	45	43	53	65
NCA 9	20	35	30	30	45	75	40	35	35	45	65
NCA 10	20	35	30	30	45	75	40	35	35	45	65
NCA 11	4	39	32	30	49	75	44	37	35	45	65
NCA 12	5	37	31	30	47	75	42	36	35	45	65
NCA 13	4	39	32	30	49	75	44	37	35	45	65
NCA 14	12	35	30	30	45	75	40	35	35	45	65
NCA 15	6	35	30	30	45	75	40	35	35	45	65
NCA 16	16	35	30	30	45	75	40	35	35	45	65
NCA 17	19	35	30	30	45	75	40	35	35	45	65

NCA 18	13-7	35	31	30	45	75	40	36	35	45	65
NCA 19	19	35	30	30	45	75	40	35	35	45	65
NCA 20	13-7	35	31	30	45	75	40	36	35	45	65
NCA 21	8	66	59	40	76	75	71	64	45	55	65
NCA 22	L12	42	38	36	52	75	47	43	41	51	65
NCA 23	18	43	38	34	53	75	48	43	39	49	65
NCA 24	L13	48	48	45	58	75	53	53	50	60	65
NCA 25	9	48	40	34	58	75	53	45	39	49	65
NCA 26	15	52	46	37	62	75	57	51	42	52	65
NCA 27	L15	51	51	44	61	75	56	56	49	59	65
NCA 28	10	60	50	42	70	75	65	55	47	57	65
NCA 29	L15	51	51	44	61	75	56	56	49	59	65
Commercial	-	Use Hours			-	70				-	-
Educational	-	Use Hours			-	55				-	-
Hospital	-	Use Hours			-	45				-	-
Place of worship	-	Use Hours			-	55				-	-
Childcare facilities	-	Use Hours			-	45				-	-

1: The RBLs have been adjusted in accordance with the Noise Policy for Industry (EPA 2017) definition of minimum RBLs (daytime – 35 dB(A), Evening – 30 dB(A), Night-time – 30 dB(A))
2: Minimum of monitoring location 7 and 13
3: Standard Construction Hours – 07:00-18:00 Monday to Friday, 08:00-13:00 Saturday
4: Outside Standard Construction Hours – Day 13:00-18:00 Saturday, 08:00-18:00 Sunday
Outside Standard Construction Hours – Evening: 18:00-22:00 Monday to Sunday
Outside Standard Construction Hours – Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays.

6.2 SLEEP DISTURBANCE CRITERIA

For the assessment of noise disturbance that could potentially cause awakening reaction during OOHW, the ICNG recommends that where construction works are planned to extend over more than two consecutive nights, maximum noise levels should be considered.

As per the ICNG, further guidance is taken from the *Environmental Criteria for Road Traffic Noise* (EPA 2011), which describes sleep disturbance assessment with a screening level of LAmax ≤ LA90(15min) + 15 dB(A).

Where there are noise events found to exceed the initial screening level, further analysis is made to identify:

- The likely number of events that might occur during the night assessment period, and
- Whether events exceed an 'awakening reaction' level of LAmax 55 dB(A) (internal), which equates to NML of 65 dB(A) (assuming open windows).

Table 9 above includes the calculated Sleep Disturbance Criteria for each NCA.

6.3 GROUND BORNE NOISE

Ground borne noise is generated from vibration-intensive works which may be transmitted through the ground into a building structure. This is a potential impact of the works involved in the construction of tunnels. The CNVG establishes criteria for ground borne construction noise which is presented in Table 10. Note that this criterion applies only during evening and night periods where internal ground borne noise is louder than airborne noise and is considered to be a low risk for the project.

TABLE 10 GROUND-BORNE NOISE CRITERIA

Time of Day	Ground borne noise objectives LAeq (15minute)
Daytime 7:00 am to 6:00 pm	Human comfort vibration objectives
Evening 6:00 pm to 10:00 pm	40 dB(A) – Internal
Night-time 10:00 pm to 7:00 am	35 dB(A) – Internal

7 VIBRATION CRITERIA

The EPA recommends management levels and goals when assessing construction vibration. These are outlined in:

- Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- The ANZECC, Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.

Impacts of ground borne vibration may be defined into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building structures (structural damage) – where vibration can compromise the integrity of the building or structure itself.

Blast management will be included in the Blast Management Plan, which will be prepared separately prior to blasting commencing.

7.1 HUMAN COMFORT

Vibration relating specifically to the human comfort are defined in the AVTG as either:

- Continuous
- Impulsive
- Intermittent

Table 11 provide the full description and examples of each category, and further details on each are provided in the sections below.

TABLE 11 DEFINITION OF VIBRATION TYPES

Type of Vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers, crushing. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

7.1.1 CONTINUOUS AND IMPULSIVE VIBRATION

Table 12 reproduces the ‘Preferred’ and ‘Maximum’ values for continuous and impulsive vibration from Table 2.2 of the AVTG, which are adopted as assessment criteria for the Project.

TABLE 12 PREFERRED AND MAXIMUM VIBRATION ACCELERATION LEVELS FOR HUMAN COMFORT (M/S2, 1-80HZ)

Location	Assessment period[1]	Preferred values		Maximum values	
		z axis	X and y axis	z axis	X and y axis
Continuous vibration (weighted RMS acceleration, m/s2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.101	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
Workshop	Day- or night	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s2, 1-80Hz)					
	Day- or night-time	0.005	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
Workshop	Day- or night	0.64	0.46	1.28	0.92

1 *Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am*
2 *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Alternative criteria are outside the scope of the policy and other guidance documents should be referred to.*

7.1.2 INTERMITTENT VIBRATION

Table 13 reproduces the 'Preferred' and 'Maximum' values for intermittent vibration from Table 2.4 of the Guideline which are adopted as assessment criteria for the project. VDV is a cumulative value, which increases with measurement duration. It is assessed considering the total time of exposure. The acceptable VDV apply within the most affected habitable room.

TABLE 13 ACCEPTABLE VIBRATION DOSE VALUES (VDV) FOR INTERMITTENT VIBRATION (M/S1.75)

Location	Daytime[1]		Night time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
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
Workshop	0.80	1.60	0.80	1.60

1 *Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am*

7.2 STRUCTURAL DAMAGE

7.2.1 BUILDINGS

Most commonly specified 'safe' structural vibration limits are designed to minimise the risk of threshold or cosmetic surface cracks, and are set well below the levels that have potential to cause damage to the main structure.

In terms of the most recent relevant vibration damage goals, Australian Standard AS 2187: Part 2-2006 'Explosives - Storage and Use - Part 2: Use of Explosives' recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2- 1993 'Evaluation and measurement for vibration in buildings Part 2' as they "are applicable to Australian conditions".

The Standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (e.g. compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The recommended limit (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 14.

TABLE 14 TRANSIENT VIBRATION GUIDE VALUES – MINIMAL RISK OF COSMETIC DAMAGE

Group	Type of Structure	Peak component particle velocity in frequency range of predominant pulse, mm/s[1]		
		4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 (at 4 Hz and above)		
2	Un-reinforced or light framed structures residential or light commercial type buildings	15 to 20	20 to 50	50

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. The guide values in Table 14 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low rise buildings. Where the dynamic loading caused by continuous vibration from activities such as vibratory rolling and impact piling is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 14 may need to be reduced by up to 50%.

Fatigue considerations are also addressed in AS2187 and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the guide values in Table 14 would not be reduced for fatigue considerations.

For most construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receiver type is provided as follows and corresponds to 50% of the minimum guide values presented in Table 14:

- Industrial and heavy commercial buildings: 25.0 mm/s
- Residential or light commercial buildings: 7.5 mm/s

In order to assess the likelihood of cosmetic damage, AS2187 specifies that vibration would be measured at the base of the building and the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) would be compared with the guidance provided in Table 14.

AS2187 also states that:

> *"Some data suggests that the probability of damage tends towards zero at 12.5mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK."*

And:

> *"A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

Heritage buildings or structures will be assumed to be structurally unsound and a more conservative cosmetic damage criteria of 2.5 mm/s peak component particle velocity (from DIN 4150-3:2016-12) will apply, unless the structure is assessed by a suitably qualified structural engineer and the structure is deemed to be sound, in this circumstance the structural engineer would nominate the applicable criteria for that structure.

7.2.2 BURIED SERVICES

DIN 4150-3:2016-12 sets out guideline values for vibration effects on buried pipework and reproduced in Table 15. Consultation will be undertaken with buried asset owners to confirm acceptable vibration limits, with consideration given to the existing condition of the asset as well as duration and nature of the vibration-generating activities.

TABLE 15 GUIDELINE VALUES FOR SHORT-TERM VIBRATION IMPACTS ON BURIED PIPEWORK

	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, prestressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Note: For gas and water supply pipes within 2m of buildings, the levels given in Table 14should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

7.3 VIBRATION CRITERIA FOR OPERATING THEATRES AND PRECISION LABORATORIES

The nearest sensitive receiver likely to contain sensitive equipment described below is the Baringa Private Hospital on Mackays Road. This sensitive receiver is approximately 700m from the nearest construction activity.

Where it has been identified that vibration sensitive scientific and/or medical instruments are likely to be in use inside the premises of an identified vibration sensitive receiver, objectives for the satisfactory operation of the instrument would be sourced from manufacturer's data. Where manufacturer's data is not available, generic vibration criterion (VC) curves as published by the Society of Photo-Optical Instrumentation Engineers (Colin G. Gordon - 28 September 1999) may be adopted as vibration goals. These generic VC curves are provided in Figure 2 with notes on their application and interpretation provided in Table16.

FIGURE 2 – GENERIC VIBRATION CURVES FOR VIBRATION SENSITIVE EQUIPMENT

TABLE 16 APPLICATION AND INTERPRETATION OF THE GENERIC VIOBRATION CRITERION (VC) CURVES

Criterion curve	Max Level[1] micrometers/sec, rms	Detail size[2] microns	Description of use
Operating theatre (ISO)	100	25	Vibration not feelable. Suitable for sensitive sleep areas. Suitable in most instances for microscopes to 100X and for other equipment of low sensitivity.
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.

[1]As measured in one-third octave bands over the frequency range 8 to 100

[2]The detail size refers to the line widths for microelectronics fabrication, the particle (cell) size for medical and pharmaceutical research, etc. The values given take into account the observation that the vibration requirements of many items depend upon the detail size of the process.

8 NOISE IMPACT ASSESSMENT

The ICNG provides guidelines for the assessment and management of construction noise, focusing on the application 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.

Potential noise impacts have been identified through environmental risk analysis during detailed design and construction planning. These impacts are identified in the following sub sections and will be revised throughout construction as required through ongoing environmental risk analysis.

8.1 AIRBORNE NOISE

An assessment of the key construction activities from Table 7 has been undertaken to provide an initial understanding on potential noise impacts, with outcomes tabulated and mapped in Appendix 6.

The scenarios assessed are shown in Table .

TABLE 16 SCENARIOS ASSESSED FOR PRELIMINARY NOISE ASSESSMENT

Activity	Plant and Equipment assessed
Bulk Earthworks	• 1 x Backhoe • 1 x D9 Dozer • 1 x Compactor • 1 x Drill (Hydraulic) • 1 x Excavator (tracked) 35t • 1 x Excavator (tracked) 35t + Hydraulic hammer • 1 x Grader • 1 x Pneumatic hammer • 1 x Scraper 651 • 1 x Dump truck • 1 x Water cart
Bridge works	• 1 x Compressor • 1 x Concrete Pump • 1 x Concrete Truck • 1 x Crane (Franna - 20t) • 1 x Piling Rig - Bored • 1 x Power Generator
Tunnelling[1]	• 2 x Excavator (tracked) 35t + Hydraulic hammer • 2 x Telehandler • 1 x Explosives Charging Unit • 2 x Ventilation Fans (2 x 55 kW) • 2 x Power Generator
Ancillary sites	• 1 x Compressor • 1 x Front End Loader (23t) • 3 x Light Vehicles • 1 x Power Generator • 1 x Dump truck

Activity	Plant and Equipment assessed
Road works	• 1 x Asphalt truck and sprayer • 1 x Profiler • 1 x Smooth drum roller • 1x Compactor • 1 x Delivery truck (6 wheeler) • 1X Lighting tower

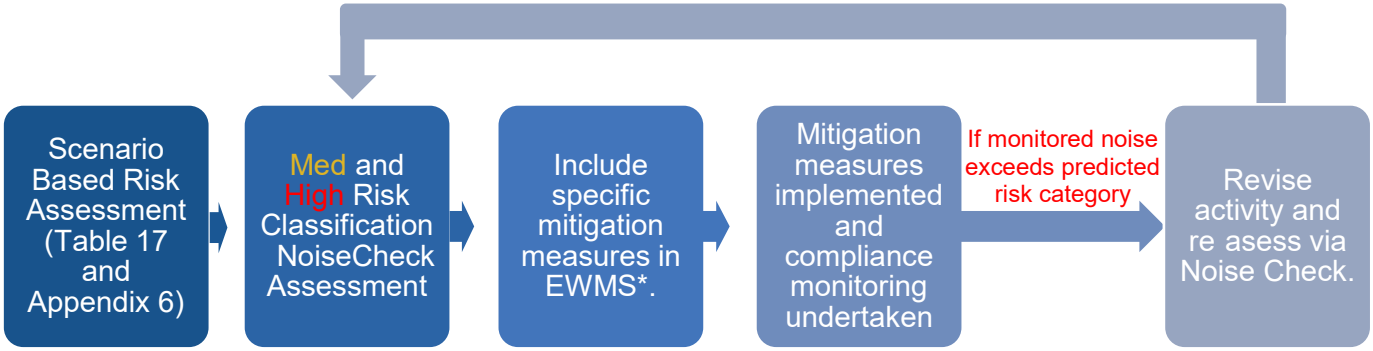
Note 1: This is utilised as the worst case scenario of the proposed stages of tunnelling activity.

An adaptive management approach will be applied to the implementation of mitigation measures to ensure impacts on the community are minimised as far as practicable. Worst case noise scenario modelling was used to generate a risk ranking for each of the construction scenarios, noise modelling from the EIS/Amendment Report has been used in this risk assessment.

In order to allocate a risk rating to each NCA, the NML exceedances identified in the Updated Noise and Vibration Assessment (Appendix B to the Amendment Report) were reviewed and a Risk Classification of **Low** (<10dB(A) exceedance of NML), **Medium** (10 dB(A) to 20dB(A) exceedance of NML) and **High** (>20dB(A) exceedance of NML) was applied.

The risk rating reflected for each NCA in Table 18 is based on the worst effected sensitive receiver, for example NCA07 has one residential receiver identified as experiencing a >20dB(A) exceedance of NML in the Amendment Report for Bulk Earthworks and as such, the entire NCA is categorised as high risk.

The outcomes of this ranking are provided in Table . Where the initial assessment indicates a risk category of 'Medium' or 'High', a NoiseCheck assessment will be undertaken as shown in Figure 2.



*EWMS to be developed and approved by TfNSW prior to the activity being undertaken.

FIGURE 2: CONSTRUCTION NOISE IMPACT PROCESS

Should the outcome of the NoiseCheck assessment confirm an exceedance of daytime NML by >20dBA or greater than Highly Noise Affected, a review of construction activities will be undertaken to identify potential changes to methodology and additional mitigation measures which can be implemented. Where additional mitigations measures are identified, this will be included in the relevant Environmental Works Method Statement (EWMS), as applicable.

A description of 'Noise Check' can be found in Section 10.4.

Table 17 Preliminary Risk Assessment

Risk Classification Key: **Low** =<10dB(A) exceedance of NML, **Medium** = 10 dB(A) to 20dB(A) exceedance of NML, **High** = >20dB(A) exceedance of NML

Risk Category Worst Case Residential Receivers							
NCA	Chainage	East or West of alignment	Bulk Earthworks	Tunnelling	Ancillary Sites	Roadworks	Bridge Works
1	9500-9800	East	Low	Low	Low	Low	Low
2	9350 - 10150	West	Medium	Low	Low	Medium	Low
3	9900-10650	East	Low	Low	Low	Low	Low
4	10450-11050	West	Low	Low	Low	Low	Low
5	10750-11700	East	Low	Low	Low	Low	Low
6	12050-13400	East	High	Low	Medium	Medium	Low
7	11250-11600	West	High	Low	High	Medium	Medium
8	12000-12750	West	Medium	Low	High	Medium	Medium
10	13400-13700	East	High	Low	Low	Medium	Low
11	13850-14600	East	Medium	Low	Low	Low	Low
12	14200-15400	West	High	Low	Low	High	Low
13	14600-15250	East	High	Low	High	High	Low
14	15350-16250	East	High	Low	High	Medium	Low
15	15450- 16750	West	High	Low	High	Medium	Medium
16	16250-17650	East	High	Low	Low	Medium	Low
17	16800-17700	West	Medium	Low	Low	Medium	Low
18	17650-19950	East	High	Low	High	Medium	Medium
19	17700-19950	West	High	Low	High	High	Medium
20	19950-20850	East	Medium	Low	High	Medium	Medium
21	19950-20550	East	Low	Low	Low	Low	Low
22	19950-21000	East	Low	Low	Low	Low	Low
23	20100-22250	West	Medium	Low	Medium	Medium	Low
24	21000-21450	East	Low	Low	Low	Low	Low
25	21450-22100	East	Medium	Low	Low	Medium	Low
26	22000-22750	East	High	Low	Low	Medium	Low
27	22250-23150	West	Medium	Low	Low	Low	Low
28	22950-23650	East	Low	Low	Low	Low	Low
29	23150-23650	West	Medium	Low	Low	Low	Low

8.2 GROUND-BORNE NOISE

Noise generated from tunnelling activities associated with the Project will vary depending on the excavation methodology used. Based upon the current methodology, a ground borne noise assessment has been prepared and is included in Appendix 10, which shows no major impacts generated from the proposed worst case tunneling scenario. This assessment predicts GBN to be less than 35dB at distances greater than 80m from the source. The nearest sensitive receivers to each tunnell constructio area are sumarised below:

- Roberts Hill Tunnel: 127m
- Shepherds Lane Tunnel: 263m
- Gatleys Road Tunnel: 109m

The algorithms used in ground-borne noise (GBN) modelling have been developed from measurement data obtained from various Sydney projects, including the Cross City Tunnel (CCT), Lane Cove Tunnel (LCT), Epping to Chatswood Rail Link (ECRL) and North West Rail Link (NWRL).

8.3 OOH WORKS

The Project will require works to be completed outside the standard construction hours listed in section 5 above. Where these works are required, assessed and approved under the OOH Works Protocol or EPL, noise impacts would be identified and mitigated in accordance with the ICNG. Areas of the Project that are more likely to require OOH works are those that have direct interface with the operational Pacific Highway, other works may be required in areas away from these locations, however it is anticipated that they would be less frequent.

8.4 CUMULATIVE NOISE

Construction will include the delivery of concurrent works within sections of the Project that impact the same NCAs. Based on the nature of the construction works, the cumulative noise impact of two worksites within the same noise catchment is conservatively estimated to be an increase of around 3 dB. Accordingly, and with respect to noise, it is necessary to consider the cumulative impact of interfacing construction packages to ensure that appropriate mitigation measures are identified and implemented.

The noise assessment provided in this document for standard construction hours are considered a worst case scenario and are based on all listed plant operating simultaneously, which is not likely. As such, the modelling provided is likely to be consistent with the additional cumulative noise resulting from two adjacent work activities.

OOHW will be modelled to address all concurrent activities, for each required OOHW Permit. The OOHW Permit (Appendix 9) prescribes that Permit applicants must consider the nature and timing of interfacing works and discuss with CHB accordingly. This permit also allows for focussed attended noise monitoring at source and receivers to be a condition of permit approval. Further detail on OOHW and the OOHW Permit is included in Section 5.3)

Noise assessment outcomes will be confirmed with noise monitoring, which is described in the Noise and Vibration Monitoring Program. Adjustments to the noise model will occur where the outcomes of monitoring show routine inconsistencies against the predicted noise levels.

With regards to cumulative noise impacts from additional noise generated outside the Project (i.e. by non-Project related noise sources or activities), these will be considered on a case by case scenario as they are identified, and coordination undertaken with the applicable parties (e.g. Council, utilities providers, etc) to the greatest extent reasonable.

8.5 CONSTRUCTION TRAFFIC NOISE ASSESSMENT

When trucks and other vehicles are operating within the boundary of a construction site, road vehicle noise contributions are included in the overall predicted LAeq(15minute) construction site noise emissions. When construction-related traffic moves onto the public road network a different noise assessment methodology is

appropriate, as vehicle movements would be regarded as ‘additional road traffic’ rather than as part of the construction site.

The EIS (Appendix G, Section 5.2.5) provides an indicative traffic model, however notes that a detailed construction traffic noise impact assessment would be carried out during detailed design, based on a more detailed understanding of haulage routes, staging and scheduling, and specific construction traffic volumes. This process will be finalised prior to the commencement of construction and will be updated on approval of additional local roads for heavy vehicle use.

The ICNG refers to the NSW Road Noise Policy (RNP) for the assessment of noise from construction traffic on public roads. In line with the RNP and the Construction Noise and Vibration Guideline (Roads and Maritime 2016), the Project will adopt the following approach for assessing and managing construction traffic noise impact:

- Complete an initial screening test to evaluate whether traffic noise levels increase by more than 2 dB(A) as a result of construction traffic within 600m of the Project sites.
  - Where increases are 2 dB or less than the corresponding ‘without construction traffic’ scenario, no further assessment is required.
  - Where the road traffic noise levels are predicted to increase by more than 2 dB as a result of construction traffic, consider the total road traffic noise levels (i.e. existing road traffic plus additional construction traffic)
- Review the total road traffic noise levels and whether these levels comply with the following road traffic noise criteria in the RNP:
  - 60 dB LAeq(15hour) day and 55 dB LAeq(9hour) night for existing freeway/arterial/subarterial roads, and
  - 55 dB LAeq(1hour) day and 50 dB LAeq(1hour) night for existing local roads.

Where total road traffic noise levels are less than or equal to RNP noise criteria, no further assessment is required.

Where total road traffic noise levels are above the RNP noise criteria, feasible and reasonable noise mitigation measures would be applied to reduce the potential noise impacts and preserve acoustic amenity. This may include consideration of alternative truck routes or potential reduction of truck movements, at receiver treatment, or temporary barriers.

Refer to Section 10.3 for noise and vibration management and mitigation measures for construction related road traffic noise.

8.6 CONSTRUCTION FATIGUE

Throughout delivery of the Project, it is possible that the neighbouring community may be impacted by construction fatigue associated with the ongoing noise and vibration impacts associated with the construction of the Coffs Harbour Bypass.

Due to the scale and nature of construction of the bypass, nearby sensitive receivers will be impacted by construction noise at varying levels throughout the construction period, during standard construction hours and during Out of Hours works.

Respite for noise and vibration sensitive receivers will be and implemented as required by the OOH Works Protocol and the EPL (to be issued).

9 VIBRATION ASSESSMENT

Vibration risk assessments are detailed in sections 9.1 and 9.2 below, throughout construction vibration risks will be covered in ongoing environmental risk analysis with a key focus on complying with safe working distances and specific vibration criteria applied to heritage structures (where applicable).

9.1 SAFE WORKING DISTANCES

All activities using construction plant items that generate vibration level that have potential to exceed the vibration criteria for human response and structural and cosmetic impact to structures need to be considered in planning of works and implementation of appropriate mitigation measures.

The CNVG provides, as a guide, minimum working distances from sensitive receivers for typical items of vibration intensive plant used in compaction during fill placement and road surfacing works, piling at bridge structures, demolition of properties and structures and drilling and extractive activities in cuttings and tunnels.

The minimum recommended working distances for typical vibration plant items are reproduced in Table and have been used in the preparation of Appendix 5, which shows vibration impact scenarios for the Project alignment.

TABLE 18 RECOMMENDED MINIMUM WORKING DISTANCES FOR VIBRATION INTENSIVE PLANT

Plant Item	Rating/Description	Safe working distance	
		Cosmetic Damage (BS 7385)	Human Response (NSW EPA Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2t)	5m	15 m to 20 m
	< 100 kN (Typically 2-4t)	6m	20m
	< 200 kN (Typically 4-6t)	12m	40m
	< 300 kN (Typically 7-13t)	15m	100m
	< 300 kN (Typically 13-18t)	20m	100m
	< 300 kN (Typically >18t)	25m	100m
Small Hydraulic Hammer	300 kg - 5 to 12t excavator	2m	7m
Medium Hydraulic Hammer	900 kg - 12 to 18t excavator	7m	23m
Large Hydraulic Hammer	1600 kg - 18 to 34t excavator	22m	73m
Vibratory Pile Driver	Sheet piles	2m to 20m	20m
Pile Boring	≤ 800 mm	2m (nominal)	4m
Jackhammer	Handheld	1m (nominal)	2m

The minimum working distances for cosmetic damage should be complied with at all times. Because the minimum working distances in Table are indicative only and will vary depending on the particular item of plant and local geotechnical conditions, vibration monitoring will be undertaken to confirm the minimum

working distances at specific sites with specific geotechnical conditions as described in the Noise and Vibration Monitoring Program, Appendix 7. Mitigation will need to be considered where measurement indicates likely exceedance at sensitive receiver locations.

In relation to human comfort (response), the minimum working distances in Table relate to continuous vibration. For most construction activities, vibration emissions are intermittent in nature and for this reason higher vibration levels, occurring over shorter periods are considered allowable. A conservative approach will be adopted and the safe working distances in Table will be adhered to for intermittent activities unless otherwise agreed by the Environment Manager. Where these safe working distances cannot be achieved, an activity specific vibration assessment will be undertaken using NoiseCheck, based upon the type and duration of impact.

As shown in Appendix 5, the following areas of the Project are identified as having a higher potential impact associated with intermittent vibration sources, based on the safe working distances in Table 19:

- Residential properties east of the Project alignment at the southern tie in to the Pacific Highway, South of Englands Road
- Residential properties east of the alignment at Coramba Road, within Roselands Estate
- Residential properties east of the alignment in the vicinity of Shepherds Lane and Rovere Drive
- Residential properties east of the alignment from Charlesworth Bay Road north to the northern tie at Sapphire Beach

Vibration impacts to other species (e.g. horses at the Boambee Equestrian Centre) have been considered under the same criteria as that established for human comfort. These are not expected to result in adverse impacts provided that horses are being kept/trained outside of the human response buffer zone in Table 12.

9.2 HERITAGE STRUCTURES

There are two heritage structures in the vicinity of the project alignment:

- Two timber bridges located on Old Coast Road and located adjacent to the construction footprint
- The North Coast Railway crossing the construction area near Shephard's Lane.

No other heritage buildings have been identified in the vicinity of the project.

It is noted that while the North Coast Railway has been identified as a heritage item, it is not considered sensitive to potential vibration damage; vibration created by operation of trains are likely to be greater than vibration created by construction works.

The timber bridges are likely to be impacted by vibration activities due to their proximity to the construction works. Vibration from vehicles traversing the bridges is likely to generate a more significant vibration impact than those created by construction works.

Notwithstanding, heritage structures are to be considered on a case-by-case basis, and detailed inspections of heritage listed structures will be undertaken for each potentially affected heritage structure prior to the commencement of works in accordance with REMM NV02.

The structural integrity of the heritage structures should be confirmed at detailed design by a suitably qualified structural engineer and results from inspection will be used to verify the applicable vibration criteria and associated impacts, and potentially feasible and reasonable mitigation options to be implemented. The results from inspection will be documented and used to verify the applicable vibration criteria, construction vehicle restrictions and any feasible and reasonable mitigation measures to be implemented. A copy of the report will be provided to City of Coffs Harbour.

Following inspection, this section of the CNVMP will be updated. Until such risk assessment is complete, no vibration intensive work will be undertaken within a safe working distance criteria of 2.5mm/s.

10 ENVIRONMENTAL MITIGATION AND MANAGEMENT MEASURES

10.1 STANDARD MITIGATION MEASURES

Specific measures and requirements to meet the objectives of this CNVMP and the required procedures, management measures, performance criteria and mitigation measures prescribed in the Project EIS, Submissions and Amendment Reports, Conditions of Approval to address construction noise and vibration impacts are outlined in Table . TfNSW Construction Noise and Vibration Guidelines additional mitigation measures are detailed in Section 10.2, for consideration in circumstances where predicted noise impacts following application of standard mitigation measures still results in exceedance of Noise Management Levels.

TABLE 20 NOISE AND VIBRATION MANAGEMENT AND MITIGATION MEASURES

ID	Measure / Requirement	Timing / Frequency	Responsibility	Reference	Relevant Management Document or Process
NMR01		Preconstruction / Construction	Environment and Operations Lead/ Environmental Advisor	MCoA E41, Good Practice	CNVMP and associated EWMS
NMR02		Preconstruction / Construction	Environment and Sustainability Manager	CCS, EIS, CNVG	CCS and OOHW Protocol
NMR03		Construction	Environment and Operations Lead/ Environmental Advisor/ Site Supervisor	MCoA - E32	CNVMP and associated EWMS

ID	Measure / Requirement	Timing / Frequency	Responsibility	Reference	Relevant Management Document or Process
NMR04		Construction	Environment and Operations Lead/ Environmental Advisor/ Site Supervisor	Amendment Report MCoA E38, E43, E39	OOHW Protocol (Appendix 9) and EWMS
NMR05	• All project specific and relevant standard noise and vibration mitigation measures • License and approval conditions • Permissible hours of work • Any limitations on high noise generating activities • Location of nearest sensitive receivers • Employee parking areas • Designated loading/unloading areas • Site opening and closing times • Environmental incident procedures • Scheduling of vehicle movements during less sensitive time periods where possible • Avoidance of the use of engine compression brakes • Driver behaviour	Pre-construction/ Construction	Environment and Sustainability Manager	Good Practice, NV09	Training and briefing content, EWMS
NMR06		Pre-construction/ Construction	Environment and Operations Lead/ Environmental Advisor/ Site Supervisor	Good Practice	Ancillary site Establishment Management Plan, EWMS

ID	Measure / Requirement	Timing / Frequency	Responsibility	Reference	Relevant Management Document or Process
NMR07		Construction	Environment and Sustainability Manager	NV08	Ancillary site Establishment Management Plan,
NMR08		Pre-construction/ Construction	Environment and Operations Lead/ Environmental Advisor/ Site Supervisor	Good Practice	Construction Traffic and Transport Management Plan, EWMS
NMR09		Construction	Site Supervisor/ Environmental Advisor	MCoA B25	EWMS
NMR10		Construction	Environment and Operations Lead/ Environmental Advisor/ Site Supervisor	MCoA E89, CTTMP	Construction Traffic and Transport Management Plan, EWMS
NMR11	Equipment will be maintained in efficient working order.	Construction	Site Supervisor	Good Practice	EWMS
NMR12		Construction	Site Supervisor/ Environmental Advisor	Good Practice	EWMS
NMR13		Construction	Site Supervisor/ Environmental Advisor	EIS, Good Practice	OOHW Protocol (Appendix 9), EWMS
NMR14		Construction	Site Supervisor/ Environmental Advisor	Amendment Report	Construction Traffic and Transport Management Plan
NMR15	The use of temporary noise shielding will be used at locations where reasonable and feasible	Construction	Site Supervisor/ Environmental Advisor	Amendment Report	EWMS
NMR16		Construction	Site Supervisor/ Environmental Advisor	Good Practice Amendment Report	EWMS

ID	Measure / Requirement	Timing / Frequency	Responsibility	Reference	Relevant Management Document or Process
NMR17		Construction	Site Supervisor/ Environmental Advisor	Amendment Report	EWMS
NMR18	Truck movements will be kept to a minimum, ie trucks will be sufficiently utilised for each trip.	Construction	Site Supervisor/ Environmental Advisor	Good practice	Construction Traffic and Transport Management Plan, EWMS
NMR19		Construction	Site Supervisor/ Environmental Advisor	Good practice	Construction Traffic and Transport Management Plan, EWMS
NMR20	Plant, machinery and equipment will be switched off when not required.	Construction	Site Supervisor/ Environmental Advisoror	Good practice	EWMS
NMR21		Construction	Site Supervisor/ Environmental Advisor	Good practice	EWMS
NMR22		Pre-construction	TfNSW / Environment and Sustainability Manager	EIS NV07, MCoA E48	Detailed design, ONR, CNVMP Section 10 & Appendix 8 – Operational Noise Mitigation Measures
NMR23		Construction	Site Supervisor/ Environmental Advisor	Good practice	EWMS, OOHW Protocol (Appendix 9)

ID	Measure / Requirement	Timing / Frequency	Responsibility	Reference	Relevant Management Document or Process
NMR24	• Blasting operations – within 500 m • Pile driving – within 250 m • Excavating by hammering or ripping – within 100 m • Vibrating compaction > 7 tonne plant – within 50 m • Vibrating compaction < 7 tonne plant – within 25 m • Demolition of structures – within 50 m.	Pre-construction / Construction	Environment and Operations Lead	MCoA E71, E72, E73 EIS NV03	Blast Management Strategy
NMR25		Construction	Site Supervisor/ Environmental Advisor	Good practice	Noise and Vibration Monitoring Program, Appendix 5– Vibration Safe Working Distances
NMR26		Pre-construction / Construction	Environment and Operations Lead/ Environmental Advisor	EIS NV05	Detailed design, CCS
NMR27		Pre-construction / Construction	Environment and Operations Lead/ Environmental Advisor	MCoA E43	CNVMP Appendix 5 - Vibration Safe Working Distances, CCS, EWMS

ID	Measure / Requirement	Timing / Frequency	Responsibility	Reference	Relevant Management Document or Process
NMR28		Pre-construction / Construction	Environment and Operations Lead/ Environmental Advisor	MCoA E44	Noise and Vibration Monitoring Program
NMR29		Pre-construction	Environment and Operations Lead/ Environmental Advisor	EIS NV02	CNVMP, EWMS
NMR30	Appropriately sized equipment will be selected to minimise vibration emissions, where required	Construction	Environment and Operations Lead/ Environmental Advisor	Good Practice	EWMS
NMR31		Construction	Environment and Operations Lead/ Environmental Advisor	Good practice	EWMS
NMR32		Post Construction	Environment and Operations Lead/ Environmental Advisor	MCoA E72	Post construction property condition surveys
NMR33		During and Post Construction	TfNSW/ FGJV	MCoA E73	Post construction property condition surveys

10.2 ADDITIONAL MITIGATION MEASURES

The TfNSW Construction Noise and Vibration Guideline provides additional mitigation measures for consideration in circumstances where predicted noise impacts following application of standard mitigation measures still results in exceedance of Noise Management Levels. The CNVG directs that the Project should consider implementing the additional mitigation measures such as

- Notification (letterbox drop or equivalent) detailing work activities, time periods of which these will occur, impacts and mitigation measures;
- Specific notifications, which provide additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops;
- Phone calls, which detail relevant information to identified/affected stakeholders and provide personalised contact, tailored advice and the opportunity to comment on the proposed work;
- Individual briefings, which inform stakeholders about the impacts of high noise activities and mitigation measures, and provide personalised contact, tailored advice and the opportunity to comment on the proposed work;
- Respite offers, to provide residents with respite from an ongoing impact:
  - Respite period 1, where out-of-hours construction noise in OOHW Period 1 is generally limited to no more than three consecutive evenings per week
  - Respite period 2, where night-time construction noise in OOHW Period 2 is generally limited to two consecutive nights
  - Duration respite, which is where the work duration, number of evenings and/or nights is increased so that the Project can be completed more quickly
- Alternative accommodation; and/or
- Verification, including measurement of the background noise level and construction noise.

The CNVG provides triggers for review of reasonable and feasible mitigation measures for air borne noise, ground borne noise and vibration. Air borne noise criteria for additional mitigation is shown below in Table . (CNVG Table C.1). Ground borne noise criteria for additional mitigation is shown in Table (CNVG Table C.2). Vibration criteria for additional mitigation is shown in Table (CNVG Table C.3).

TABLE 19 CNVG TRIGGERS FOR ADDITIONAL MITIGATION MEASURES - AIRBORNE NOISE

Predicted airborne $L_{Aeq(15min)}$ noise level at receiver			Additional mitigation measures	
Perception	dB(A) above RBL	dB(A) above NML	type[1]:	Mitigation Levels[2]:
All hours				
75dBA or greater			N, V, PC, RO	HA
Standard Hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)				
Noticeable	5 to 10	0	-	NML
Clearly Audible	10 to 20	< 10	-	NML
Moderately intrusive	20 to 30	10 to 20	N, V	NML+10
Highly intrusive	> 30	> 20	N, V	NML+20
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)				
Noticeable	5 to 10	< 5	-	NML
Clearly Audible	10 to 20	5 to 15	N, R1, DR	NML+5
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR	NML+15
Highly intrusive	> 30	> 25	V, IB, N, R1, DR, PC, SN	NML+25
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)				
Noticeable	5 to 10	< 5	N	NML
Clearly Audible	10 to 20	5 to 15	V, N, R2, DR	NML+5
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR	NML+15
Highly intrusive	> 30	> 25	AA, V, IB, N, PC, SN, R2, DR	NML+25

Notes (refer to detailed descriptions):

1 AA = Alternative Accommodation
V = Verification
IB = Individual briefings
N = Notification
R2 = Respite Period 2
DR = Duration Respite
R1 = Respite Period 1
PC = Phone calls
SN = Specific notifications
Perception = relates to level above RBL

2 NML = Noise Management Level
HA = Highly Affected (> 75 dB(A) - applies to residences only)

TABLE 20 TRIGGERS FOR ADDITIONAL MITIGATION MEASURES - GROUND-BORNE NOISE

Predicted $L_{Aeq(15min)}$ noise level at receiver perception	dB(A) above GB NML	Additional mitigation measures type[1]:	apply to[2]:
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)			
Clearly Audible	< 10	N	All
Moderately intrusive	10 to 20	V, N, R1, DR SN	All
Highly intrusive	> 20	V, IB, N, PC, SN, R1, DR	All
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)			
Clearly Audible	< 10	V, N, SN	All
Moderately intrusive	10 to 20	AA, V, IB, N, PC, RP, SN, R2, DR	All
Highly intrusive	> 20	AA, V, IB, N, PC, RP, SN, R2, DR	All

Notes:

1 AA = Alternative accommodation
V = Validation of predicted noise levels
IB = Individual briefings
N = Notification box drops
R2 = Respite Period 2
DR = Duration Respite
R1 =Respite Period 1
PC = Phone calls
SN = Specific notifications

2 All affected receivers

TABLE 21 TRIGGERS FOR ADDITIONAL MITIGATIONS MEASURES - VIBRATION

Predicted Vibration at receiver Trigger	Additional mitigation measures type[1]:	apply to[2]:
Standard Hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)		
Predicted Vibration Exceeds Maximum levels	V, N, RP	All
OOHW Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Pub Hol (8am – 6pm)		
Predicted Vibration Exceeds Maximum levels	V,IB,N,RO,PC, RP,SN	All
OOHW Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Hol (6pm – 7am)		
Predicted Vibration Exceeds Maximum levels	AA, V, IB, N, PCV, RP, SN	All

Notes:

1 AA = Alternative accommodation
V = Validation of predicted noise levels
IB = Individual briefings
N = Notification box drops
R2 = Respite Period 2
DR = Duration Respite
R1 =Respite Period 1
PC = Phone calls
SN = Specific notifications

2 All affected receivers

10.3 CONSTRUCTION TRAFFIC NOISE

Management of construction related traffic or traffic reroutes should consider the following:

- Scheduling and routing of vehicle movements
- Speed of vehicles
- Driver behaviour and avoidance of the use of engine compression brakes
- Ensuring vehicles are adequately silenced before allowing them to access the site

Consideration must be given to the following measures where feasible and reasonable:

- temporary noise barriers
- at-receiver noise mitigation

Feasible and reasonable considerations should also include:

- time of day of the noise increase
- time of use/occupation of affected receiver locations
- how many decibels the noise levels are expected to increase above the existing traffic noise
- how long the mitigation will provide benefit to the receiver during the project

10.4 NOISE CHECK ASSESSMENT

NoiseCheck has been developed for the purpose of assisting with managing impacts from specific sets of local area and utility works associated with the construction of the Project. It allows:

- Flexibility in assessing specific scenarios of local area and utility works,
- Assessment at a variety of locations, and
- Multiple combinations of equipment that may be used during each stage of works in the environment that would be encountered.

NoiseCheck will be used to predict daytime and OOHW construction noise levels which will be compared against the NML for each receiver. Appropriate mitigation and management measures can then be adopted, as required by this CNVMP.

It performs three-dimensional topographic modelling and incorporates digital ground contours and built environment spatial grids. The model adopts the ISO 9613-2:1996 method to predict noise. All noise sensitive receivers defined in this CNVMP are incorporated into the NoiseCheck tool, receiver information will be updated throughout construction as new or changed land uses are identified. Plant and equipment used to undertake the task and adjacent concurrent tasks to be modelled are selected in the tool. NoiseCheck contains sound power levels for each item of plant selected. The work areas for each task are then defined in the tool. The tool then models noise level predictions for all sensitive receivers which can be viewed in a tabular or GIS format.

Verification and adjustment of the NoiseCheck tool will occur throughout construction via monitoring. Noise and vibration monitoring data will be collected in accordance with the FGJV Noise and Vibration Monitoring Program (refer to Appendix 7). This feedback loop will ensure that NoiseCheck is verified and adjusted as required to ensure accuracy across the various sections of the Project alignment.

Further information on the NoiseCheck tool can be found in Appendix 4.

10.5 EWMS

To ensure that the specific management and mitigation measures identified in a noise and vibration assessment are implemented appropriately, the required actions are to be included in the EWMS prepared for the relevant activities prior to commencement of works in accordance with requirements detailed in section 4.1.3 of the CEMP.

The EWMS will include the following information if triggered:

- Identification of reasonable and feasible mitigation measures to be implemented in accordance with Section 8 of this Plan and the NoiseCheck;
- Community and stakeholder consultation processes in accordance with the Additional Mitigation Measures;
- Monitoring of noise and vibration during the activity to verify predictions in accordance with the Noise and Vibration Monitoring Program; and
- A trigger for further investigation into additional potential mitigation and management actions monitoring indicates significant exceedances and /or where community complaints are received in relation to construction activities.

10.6 OPERATIONAL NOISE MITIGATION

In accordance with CoA E48, construction noise impacts will be minimised by implementing operational noise mitigation measures identified in the Project's Operational Noise Review (ONR), within six months of the commencement of construction near the impacted receiver, where operational noise mitigation measures will not be physically affected by works.

The required mitigations will be identified through the preparation of Operational Noise Review (ONR) based upon the final design of the Project, and in consultation with the ER, AA, EPA. The ONR will:

a) confirm the appropriate operational noise objectives and levels for surrounding sensitive receivers

based on modelling undertaken under Condition E45;

b) confirm the operational noise daytime LAeq,15 hour and night-time LAe, 9 hour traffic noise contours for receivers;
c) review the suitability of the operational noise mitigation measures identified in the Amendment Report with the objective of achieving the noise criteria outlined in the NSW Road Noise Policy (DECCW, 2011) and NSW Noise Policy for Industry (EPA, 2017),
d) include a consultation strategy to seek feedback from directly affected landowners on the noise mitigation measures; and
e) include procedures for the management of operational noise complaints.
f) be verified by an independent acoustic expert or the AA and submitted to the Planning Secretary for approval before the implementation of the at source operational noise mitigation measures. The ONR will be made publicly available following approval.

Where operational noise mitigation measures are unable to be implemented in accordance with CoA E48, A report will be prepared and submitted to the Planning Secretary providing justification and details of temporary measures to reduce construction noise impacts until operational measures can be implemented. The report will be endorsed by the ER and AA and submitted to the Planning Secretary prior to the commencement of construction which would affect the identified sensitive receivers.

In the absence of an ONR required under Condition E47, the at-property operational noise mitigation measures will be consistent with the measures (Appendix 8 of this CNVMP). and the properties identified in Appendix 2 of the Amendment Report.

10.7 ASSESSMENT OF CONSTRUCTION CHANGES

Consistent with Condition C5 d), where significant new/additional activities and/or significant changes to site layout are proposed, additional noise and vibration assessments will be undertake following the steps in Table .

In some cases the below process may be undertaken as part of application for additional approvals, such as a Consistency Assessment or an Out of Hours Permit.

TABLE 22 PROCESS FOR ASSESSMENT OF CONSTRUCTION CHANGES

Step:	Process:
1. Establish nature and scale of activity to be assessed	Determine • Construction activities • Site location • Date, time and duration of activity • Equipment type, number and size • Concurrent works that are in the vicinity of the site to ensure that cumulative impacts are managed (note, may be appropriate to group activities together, or separate into stages).
2. Determine noise and vibration objectives	• Identify noise and vibration sensitive receivers • Identify the applicable noise and vibration criteria

	Noise • Establish sound power level for plant and equipment and relevant site data for input into NoiseCheck. Establish noise predictions for the activity, which should include: - Location of noise sources and receivers - Attenuation including distance and structural or topographical screening - Standard noise mitigation measures - Calculate LAeq,15 minute noise levels for sensitive receivers • For night activities, calculate LAmax noise levels and compare with sleep disturbance criteria (done as part of Our of Hours Permit). **Vibration** - Establish the location of all vibration intensive plant and equipment relative to all potentially sensitive receivers • Determine plant and equipment would operate within safe working distances of any sensitive receivers (also consider heritage items) • Where within safe working distances, testing and monitoring would be required to determine actual vibration levels at receivers to prevent exceedance of objectives • Identify key hours of impact for affected receivers • Implement appropriate mitigation measures in accordance with Section 8 of the CNVMP
4. Management of Impacts	• Describe all reasonable and feasible Standard safeguards and controls • Describe any site-specific controls to be implemented based on the assessment, such as layout, screening, consultation and programming • Describe any additional mitigation measures to be applied in accordance with the CNVG based on NML exceedance • Ensure that all management and mitigation measures are included in relevant Environmental Works Method Statement for the activity.

11 COMPLIANCE

11.1 NOISE AND VIBRATION MONITORING

Noise and vibration monitoring will be used to assess compliance with this CNVMP. The Noise and Vibration Monitoring Program is included as Appendix 7 of this CNVMP.

11.2 COMPLIANCE MANAGEMENT

Compliance, and non-conformance management will be undertaken in accordance with section 8.5 of the Construction Environmental Management Plan.

12 REVIEW AND IMPROVEMENT

12.1 CONTINUOUS IMPROVEMENT

Continuous improvement of this plan 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:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any nonconformances 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.

As outlined in of the CEMP, this sub-plan will be reviewed within 12 months following the commencement of construction (being the approval of the CEMP and all associated sub plans) and every 12 months thereafter, or within two months of an incident triggering notification under the Planning Approval. The complete process of review and improvement to be implemented throughout the Project is outlined in the CEMP.

Updates to this plan may also be undertaken:

- To address exceedances or non-compliances if investigations determine changes are required to prevent reoccurrences;
- To take into account changes to the environment or generally accepted environmental management practices, new risks to the environment, any hazardous substances, contamination or changes in law;
- Where requested or required by the NSW Department of Planning and Environment or any other Authority; or
- In response to internal or external audits.

12.2 CNVMP UPDATE AND AMENDMENT

The processes described in Section 1.5 and Section 9 of the CEMP may result in the need to update or revise this Plan. This will occur as needed and any revisions to the CNVMP will be in accordance with the process outlined in these sections of the CEMP.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure. Refer to section 1.3 and 1.4 of the CEMP.

APPENDICES

APPENDIX 1 SENSITIVE RECEIVER MAP

Legend

- Construction footprint
- Alignment
- Bridge
- Tunnel
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

Building Classification

- Active Recreation
- Passive Recreation
- Child care facility
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coffs Harbour Bypass

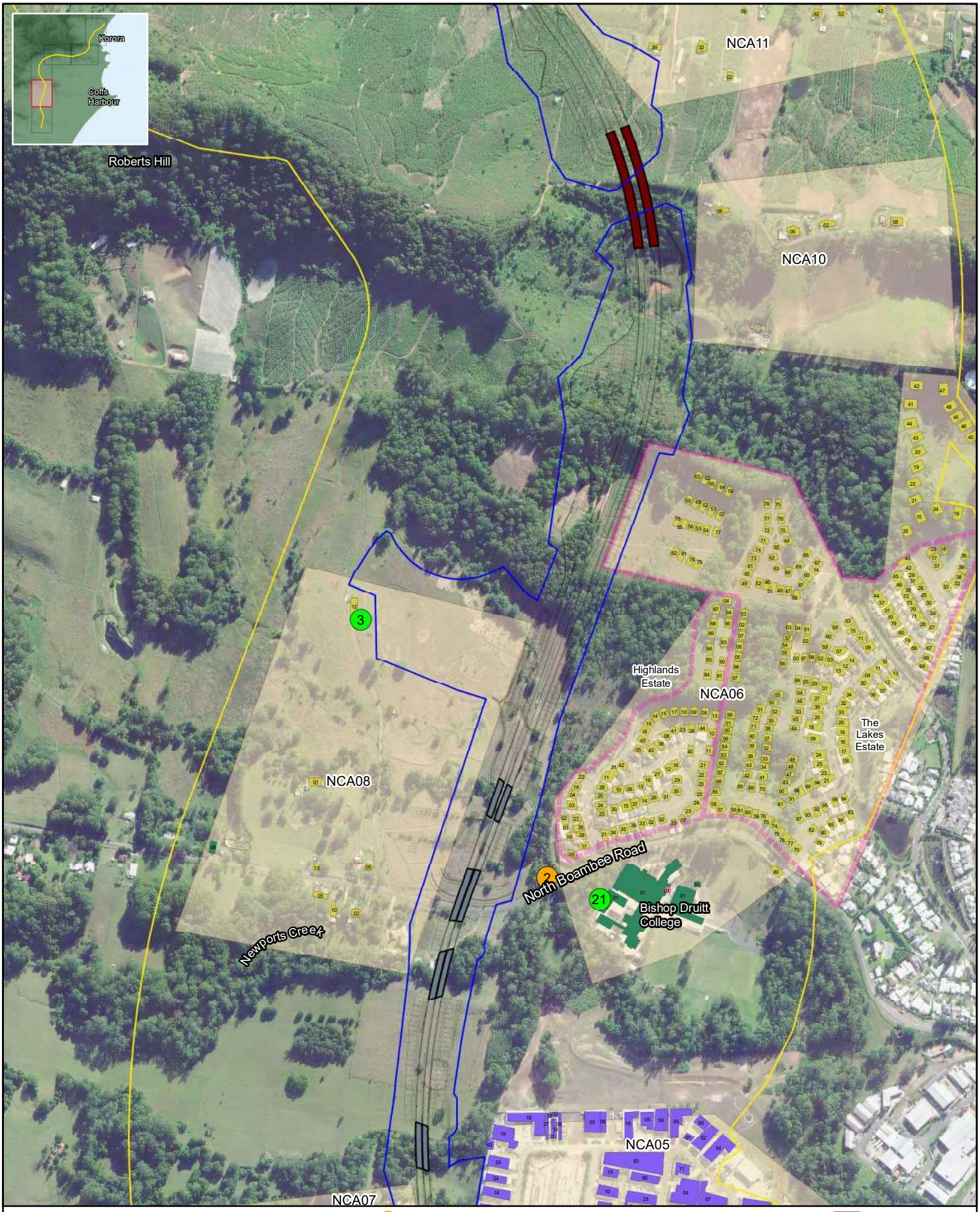
Noise catchment areas, sensitive land uses and noise monitoring locations

Map page - 01

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N



Legend

- Construction footprint
- Alignment
- Bridge
- Tunnel
- Study Area
- Noise catchment area
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- Noise monitoring location (validation)
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Building Classification

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- Passive Recreation
- Child care facility
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coffs Harbour Bypass

Noise catchment areas, sensitive land uses and noise monitoring locations

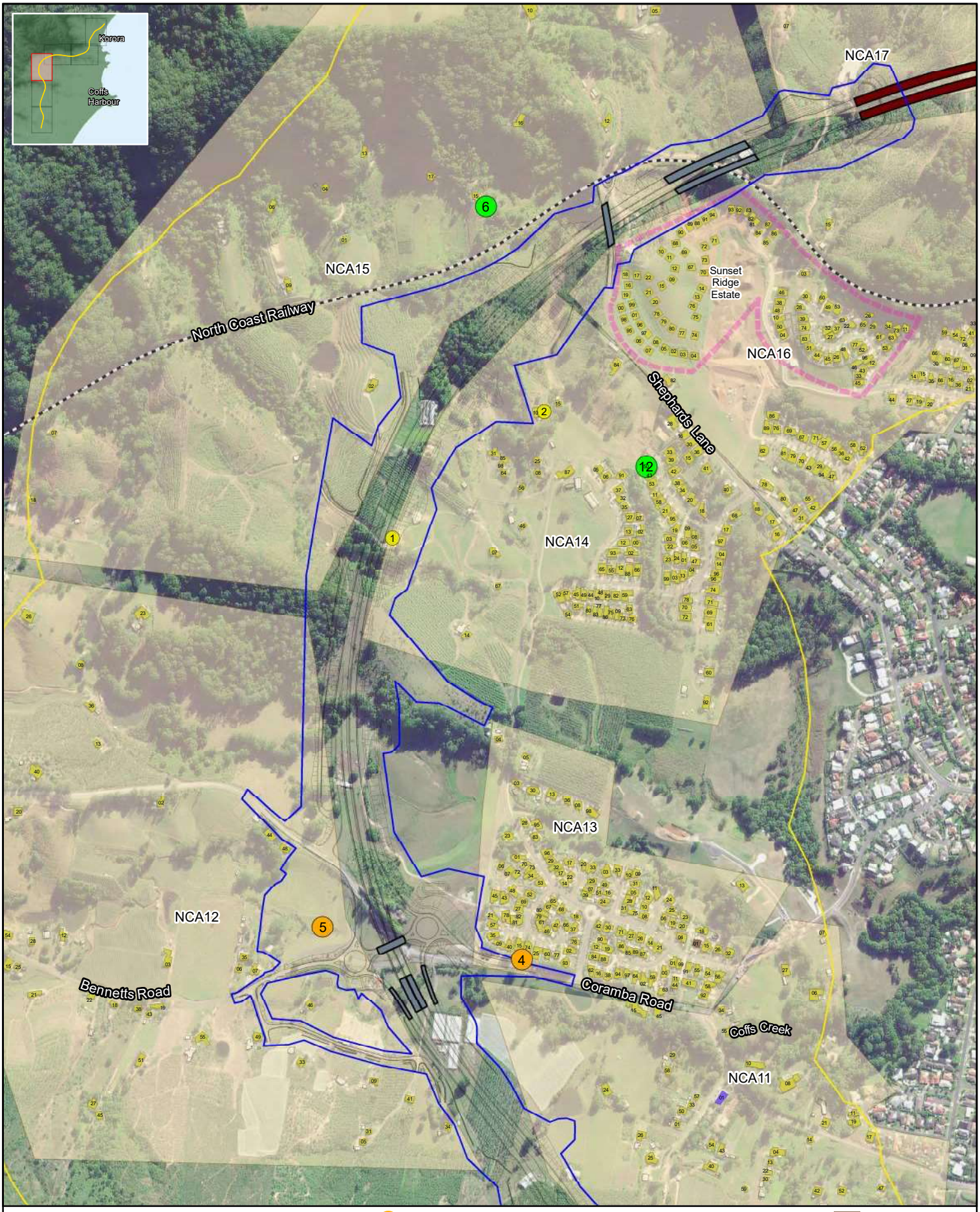
Map page - 02

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000

GDA 1994 MGA Zone 56

N



Legend

- Construction footprint
- Alignment
- Bridge
- Tunnel
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

Building Classification

- Active Recreation
- Passive Recreation
- Child care facility
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coffs Harbour Bypass

Noise catchment areas, sensitive land uses and noise monitoring locations

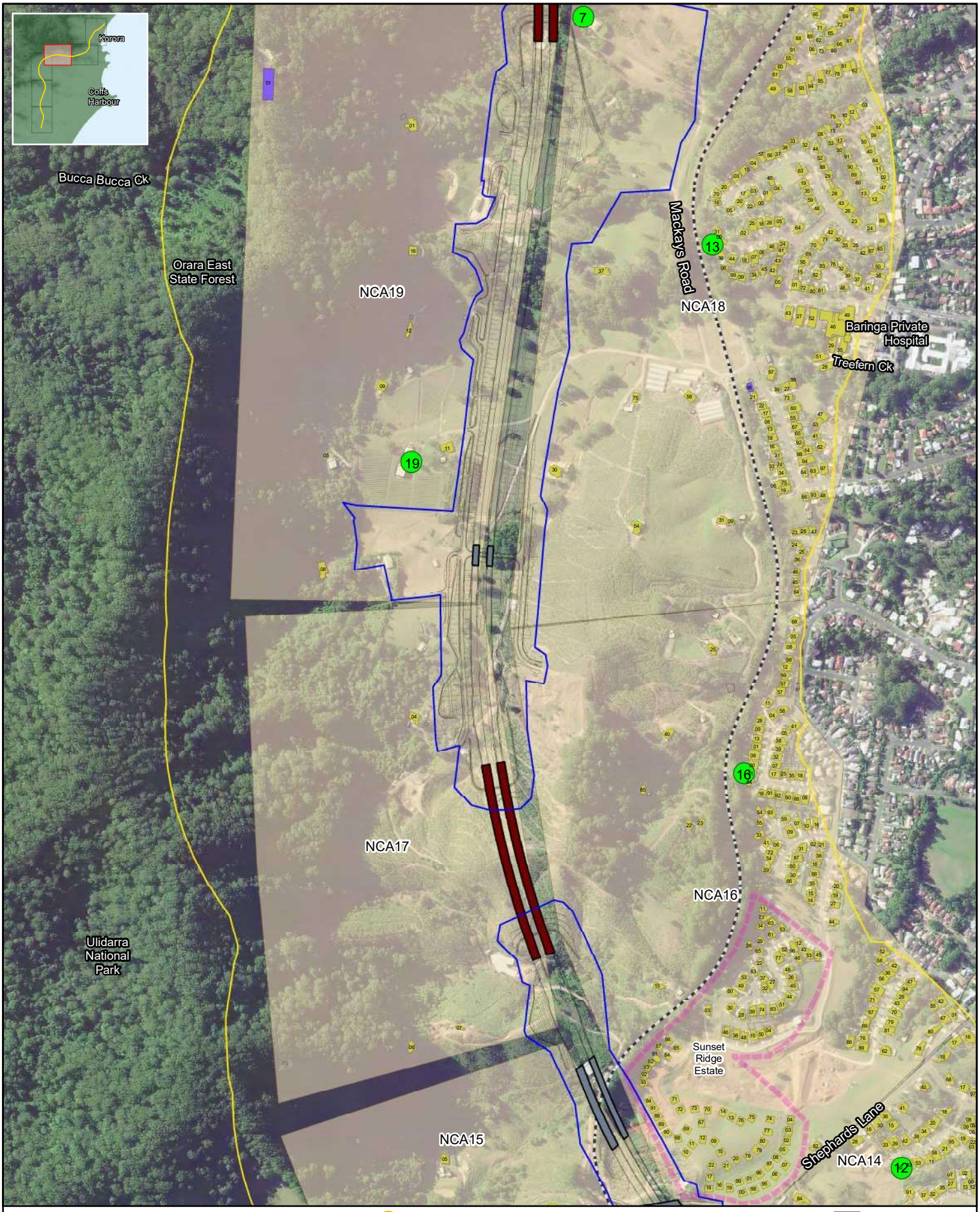
Map page - 03

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000

GDA 1994 MGA Zone 56

N



Legend

- Construction footprint
- Alignment
- Bridge
- Tunnel
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

Building Classification

- Active Recreation
- Passive Recreation
- Child care facility
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coffs Harbour Bypass

Noise catchment areas, sensitive land uses and noise monitoring locations

Map page - 04

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

Legend

- Construction footprint
- Alignment
- Bridge
- Tunnel
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

Building Classification

- Active Recreation
- Passive Recreation
- Child care facility
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coffs Harbour Bypass

Noise catchment areas, sensitive land uses and noise monitoring locations

Map page - 05

0 0.1 0.2 0.3 km

N

Scale @A4: 1:10,000

GDA 1994 MGA Zone 56

Legend

- Construction footprint
- Alignment
- Bridge
- Tunnel
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

Building Classification

- Active Recreation
- Passive Recreation
- Child care facility
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coffs Harbour Bypass

Noise catchment areas, sensitive land uses and noise monitoring locations

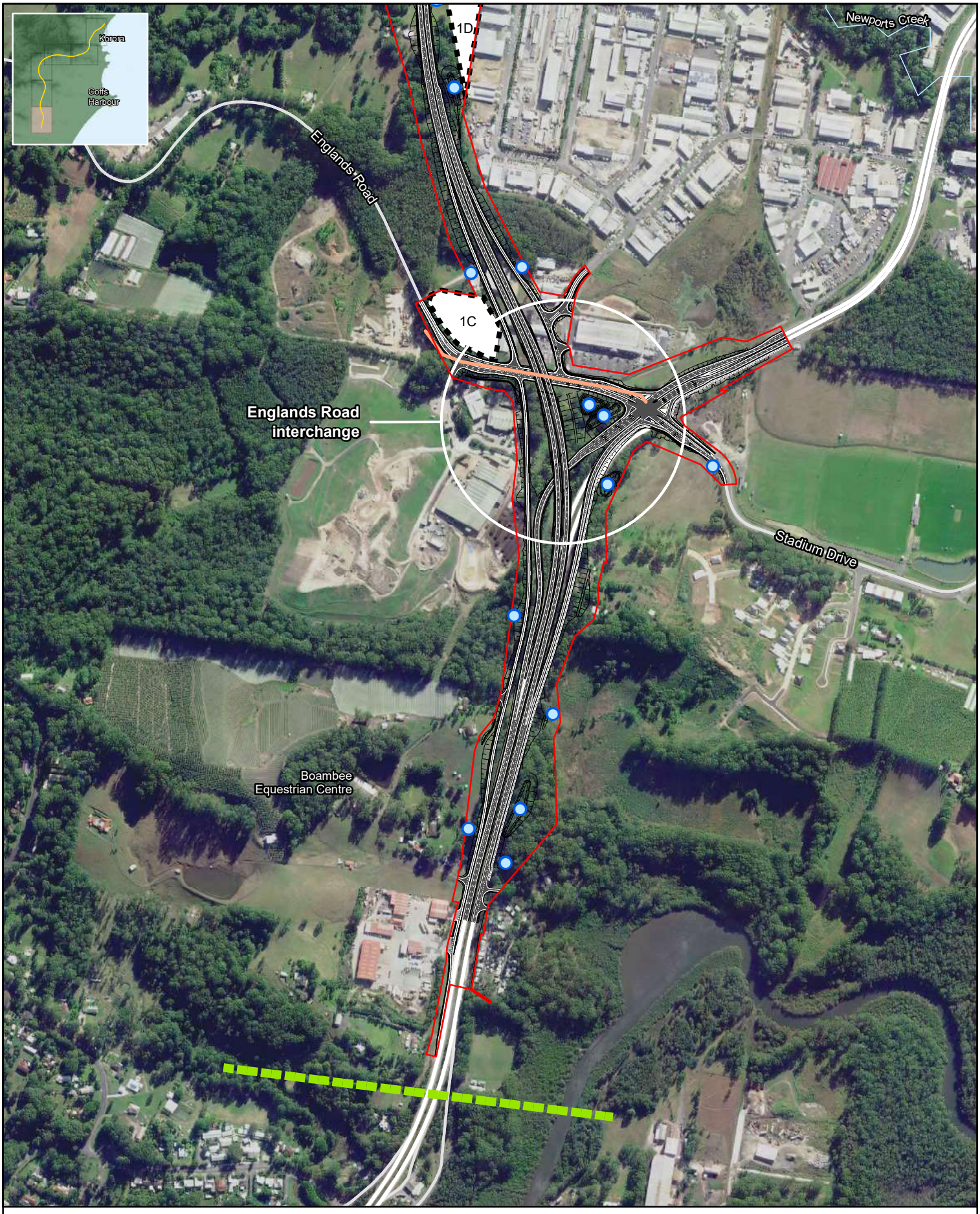
Map page - 06

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N

APPENDIX 2 LOCATION OF POTENTIAL ANCILLARY SITES



Legend

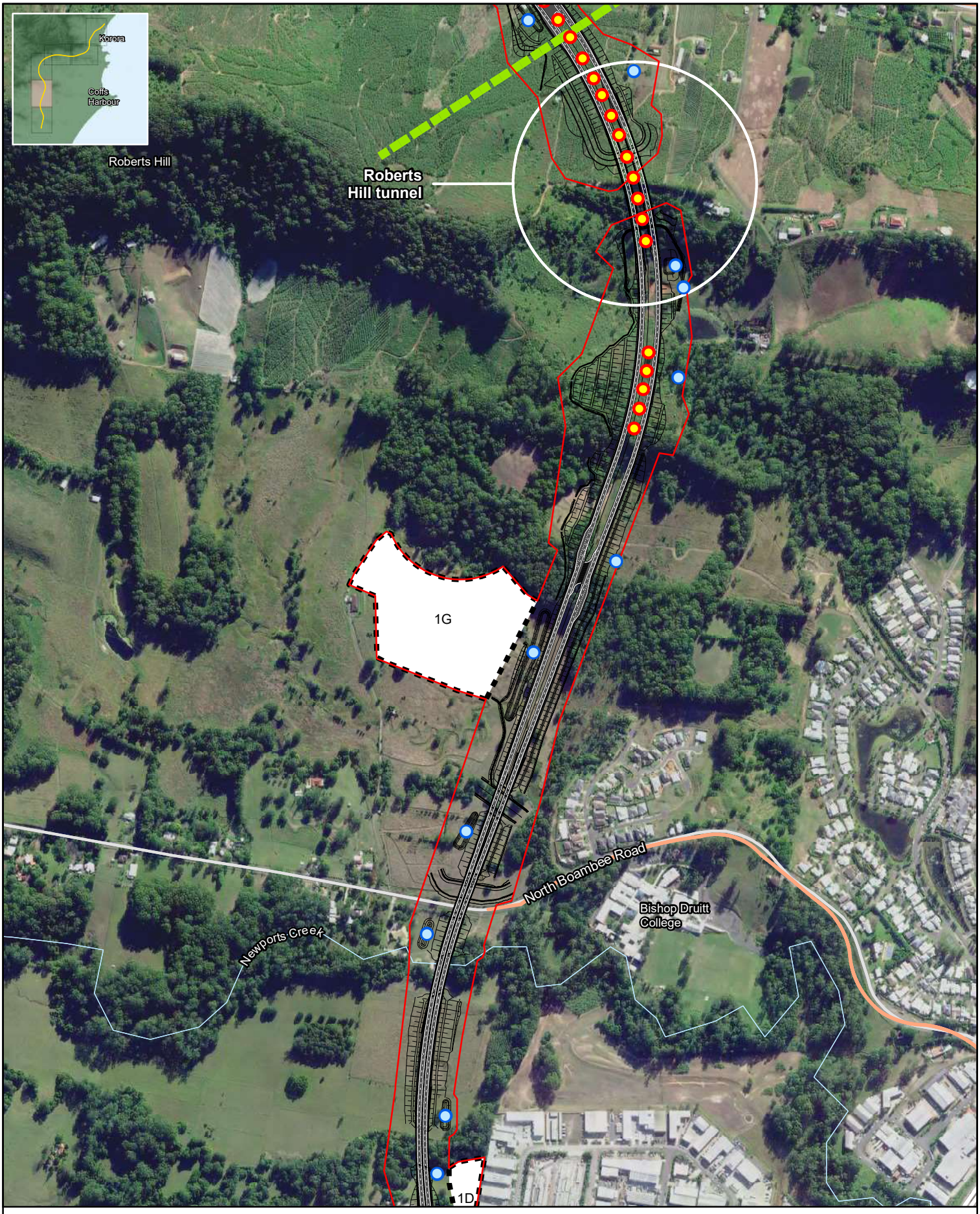
- Construction footprint
- Alignment
- Construction zone
- Potential construction access
- Potential anciliary sites
- Potential controlled blasting sites
- North Coast Railway
- Watercourse
- Indicative construction sediment basin location

Coffs Harbour Bypass
Construction Zone 1 (Map 1)
Figure 12

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N



Legend

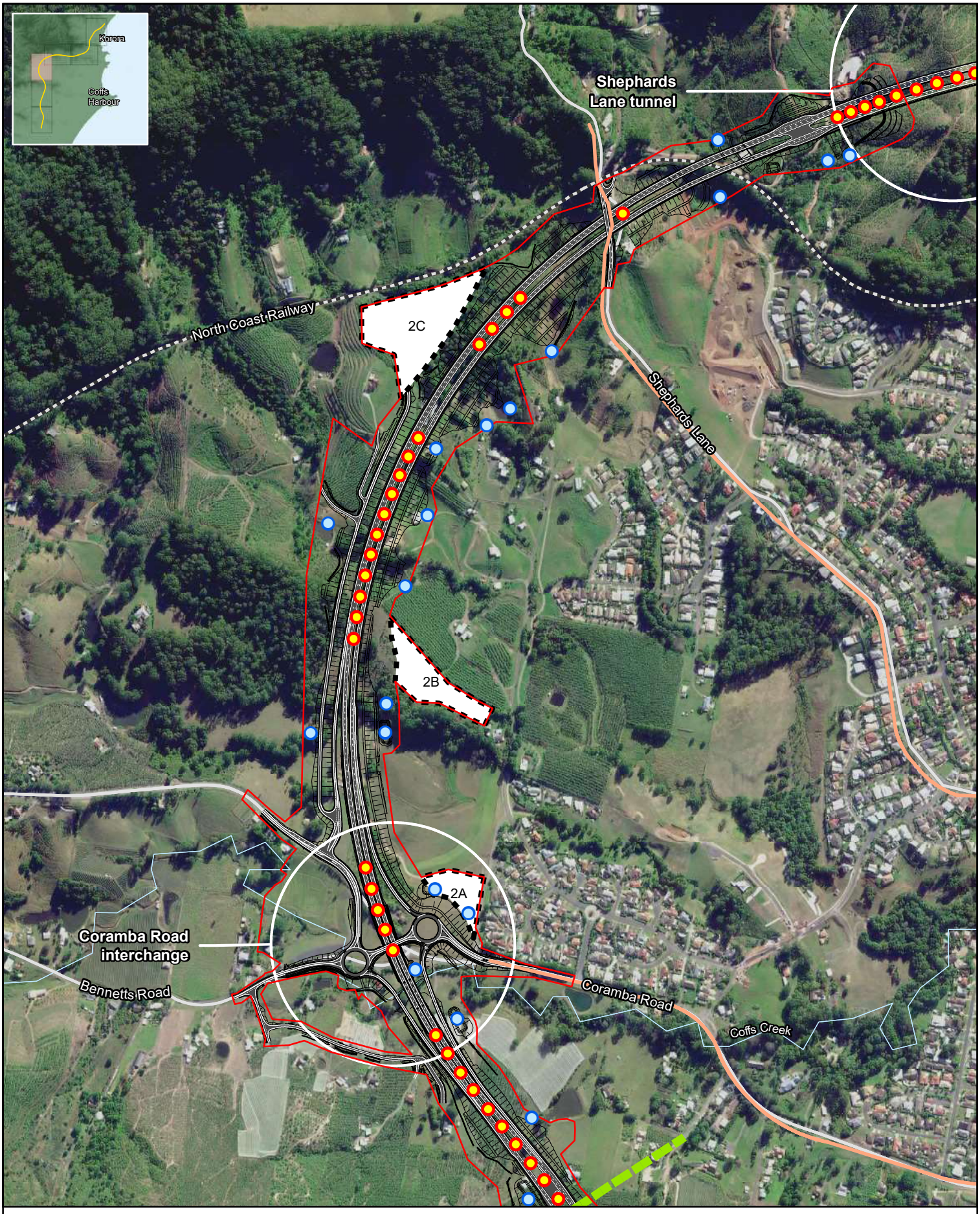
- Construction footprint
- Alignment
- Construction zone
- Potential construction access
- Potential anciliary sites
- Potential controlled blasting sites
- North Coast Railway
- Watercourse
- Indicative construction sediment basin location

Coffs Harbour Bypass
Construction Zone 1 (Map 2)
Figure 13

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N



Legend

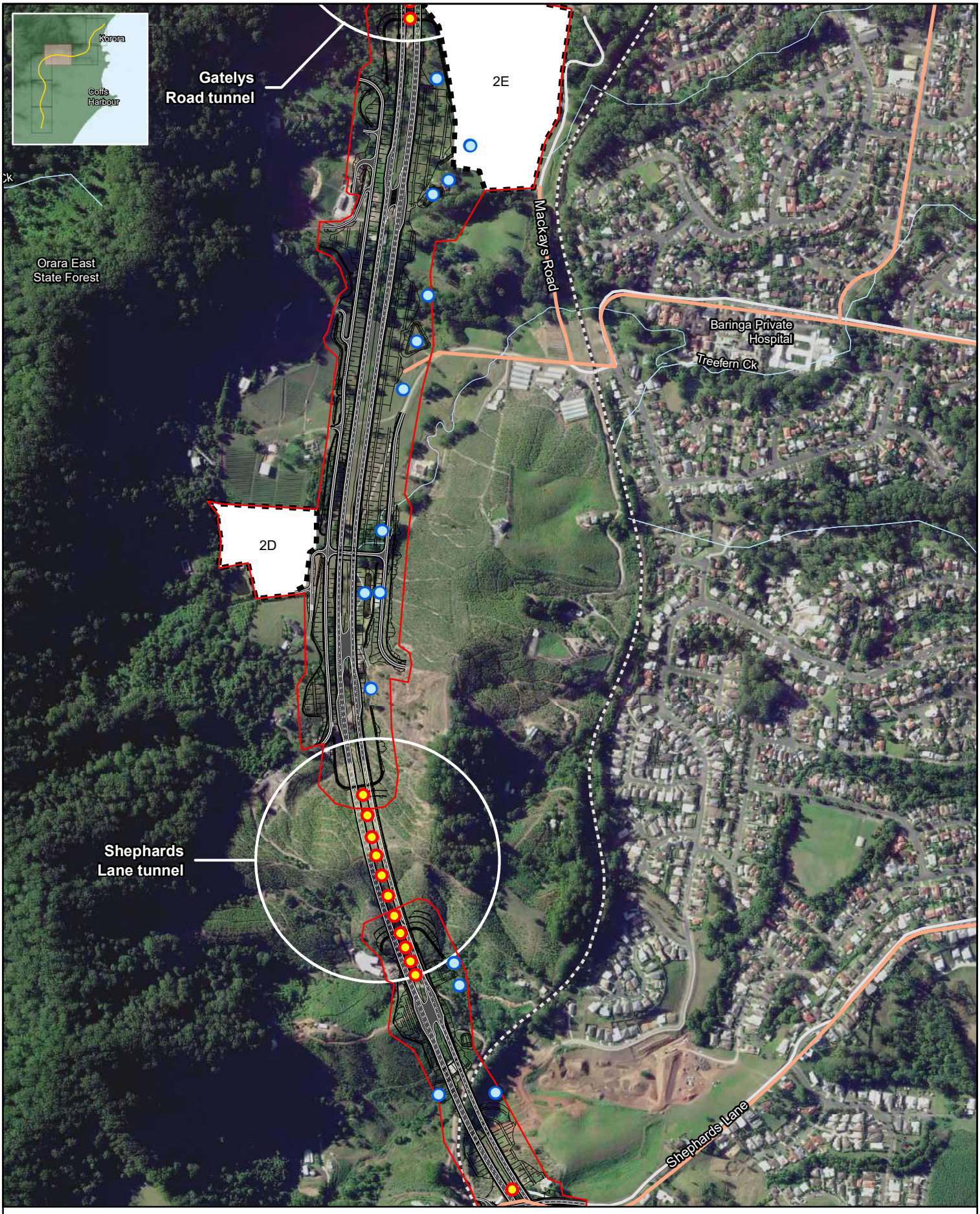
- Construction footprint
- Alignment
- Construction zone
- Potential construction access
- Potential anciliary sites
- Potential controlled blasting sites
- North Coast Railway
- Watercourse
- Indicative construction sediment basin location

Coffs Harbour Bypass
Construction Zone 2 (Map 1)
Figure 14

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N



Legend

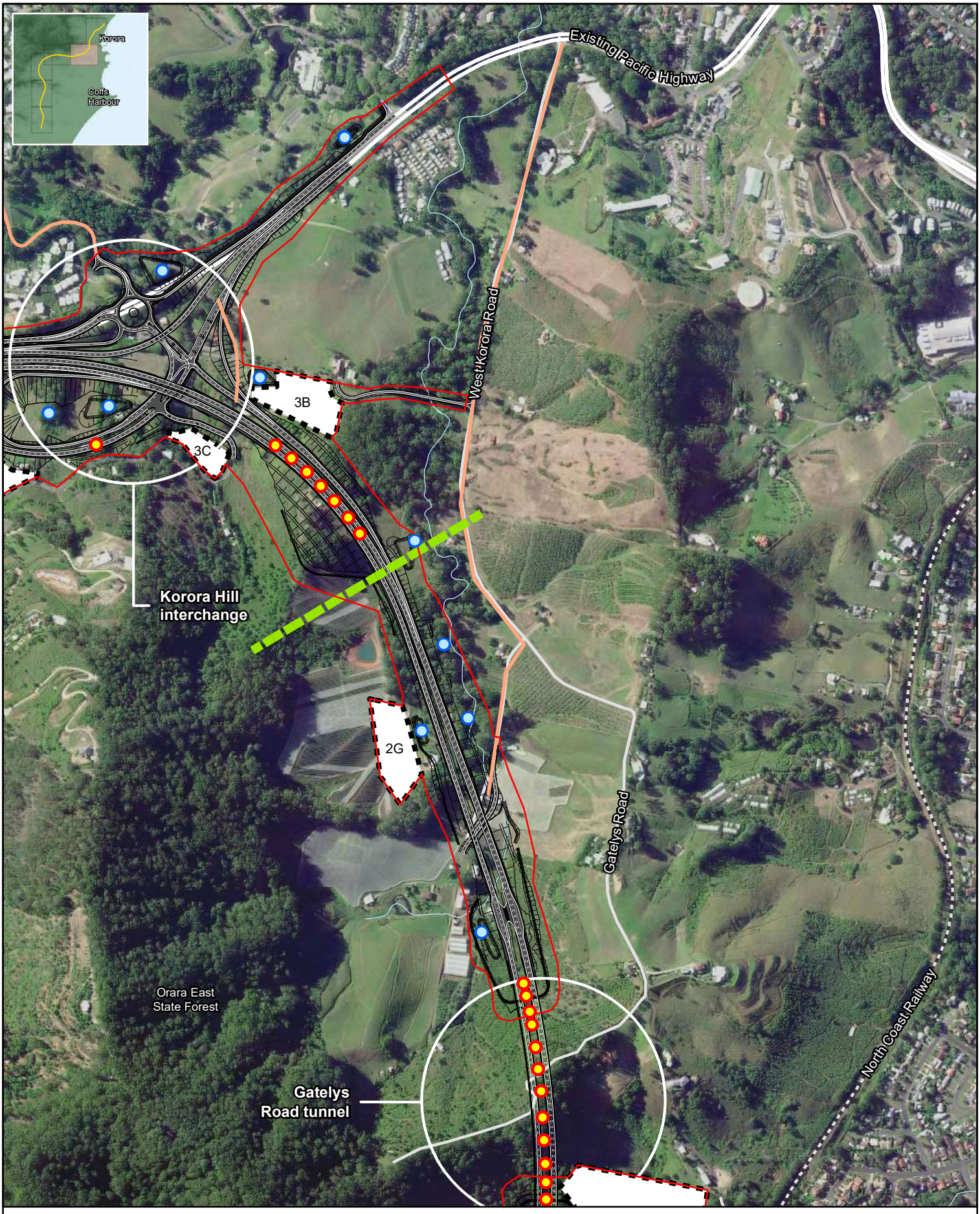
- Construction footprint
- Alignment
- Construction zone
- Potential construction access
- Potential anciliary sites
- Potential controlled blasting sites
- North Coast Railway
- Watercourse
- Indicative construction sediment basin location

Coffs Harbour Bypass
Construction Zone 2 (Map 2)
Figure 15

0 0.1 0.2 0.3 km

N

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56



Legend

- Construction footprint
- Alignment
- Construction zone
- Potential construction access
- Potential anciliary sites
- Potential controlled blasting sites
- North Coast Railway
- Watercourse
- Indicative construction sediment basin location

Coffs Harbour Bypass
Construction Zone 2 (Map 3) / Construction Zone 3 (Map 1)
Figure 16

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

Legend

- Construction footprint
- Alignment
- Construction zone
- Potential construction access
- Potential anciliary sites
- Potential controlled blasting sites
- North Coast Railway
- Watercourse
- Indicative construction sediment basin location

Coffs Harbour Bypass
Construction Zone 3 (Map 2)
Figure 17

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N

APPENDIX 3 LIST OF EQUIPMENT AND CORRESPONDING INDIVIDUAL SOUND POWER LEVELS

Source - Updated Noise and Vibration Assessment Report: Appendix B to the Amendment Report

Table 48: Construction activities and equipment

Plant and equipment	Plant and equipment characteristics			Construction Activities																
				Preliminary activities and site establishment/Earthworks				Bulk earthworks			Drainage and structures		Bridge works		Tunnel works		Demolition	Road work and road surfacing			Finishing works
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				Mobilisation and Site Establishment	Utility, Property, service adjustment	Corridor Clearing	Construction Compound Site Establishment	Bulk Earthworks	Rock Crushing	Compounds	Drainage Infrastructure	Retaining walls/Noise walls	Bridge Works	Compounds	Tunnel works	Compounds	Demolition	Paving/asphalting (incl. concrete sawing)	Re-surfacing works	Compounds	Road Furniture Installation
	Plant item SWL, dB(A)	% of use in a 15-minute period1	Plant Item Max SWL, dB(A)	Installing construction boundary hoardings/fences and traffic barriers	Adjustment of property boundaries (where required); relocation of services	General land clearing, tree and stump removal, topsoil stripping, loading		Formation of road alignment. Excavation of soil and rock, hammering/rock breaking, drilling, loading, haulage, compaction of fill areas, grading	Crushing and screening of building waste/rock material for re-use on site	Deliveries. Plant and equipment. Maintenance. Office areas. Storage areas.	Excavation of trenches and pits; delivery and placement of precast pipes and pits; filling and compacting		Casting; concrete pours; placement of pre-cast elements; piling (mainly bored); and demolition	Deliveries. Plant and equipment. Maintenance. Office areas.		Deliveries. Plant and equipment. Maintenance. Office areas.	Demolition of existing structures	Delivery of raw materials. Placement of surface material. Saw cutting.	Milling the asphalt to expose the underlying concrete, then laying the new asphalt	Deliveries. Plant and equipment. Maintenance. Office areas. Storage areas. Batching plant	Signposting and line marking
Air track drill[1]	129	25	124																		
Asphalt truck & sprayer	106	100	112															1	1		
Backhoe	106	50	111					1[5]													
Batching plant (Concrete)	115	100	118																		

Batching plant (Asphalt)	114	100	117																	1	
Bulldozer D9	116	100	120			1		1[6]	1												
Chainsaw 4-5hp	114	25	117			1															
Compactor	113	25	115					1										1	1		
Compressor	109	100	110				1						1	1		1				1	
Concrete pump	109	50	112									1	1								
Concrete saw[1]	122	25	122		1													1			
Concrete truck	109	50	112		1						1		1					1			
Concrete vibrator	113	100	115									1									
Crane (Fixed)	105	100	113																		
Crane (Franna 20t)	105	100	113	1	1						1		1		1						1
Crane (Mobile)	105	100	113									1									
Crushing Plant	118	100	124							1											
Daymakers	98	100	98																1		
Drill (Hydraulic)[1]	118	100	115					1							1						
Drill (Percussive)[1]	121	100	121																		
Excavator (tracked) 35t	100	100	110		1	1		1[6]	1		1	1					1				
Excavator (tracked) 35t + hydraulic hammer[1]	123	50	123					1[6]									1				
Front end loader 23t	113	100	115				1			1				1		1	1			1	
Grader	110	100	115					1[4]							1[4]			1[4]			
Light vehicles (e.g. 4WD)	103	100	108				3			3				3		3				3	
Line marking truck	108	100	108																		1
Pavement laying	110	100	114															1	1		
Pavement profiler[1]	118	100	117																1		
Piling rig - bored	108	50	112									1	1								
Piling rig - impact[1]	128	50	133																		

Pneumatic hammer	115	50	117					1[5]													
Power generator	103	100	105		1		1					1	1	1	1	1				1	
Rock crusher	115	100	118						1												
Scraper 651	110	100	116					1[4]													
Smooth drum roller	107	100	111															1	1		
Truck compressor	75	100	78								1										
Truck (Dump truck)	110	100	112		1	1		2[7]	1					1		1	1	1	1	1	
Truck (medium rigid)	108	100	110	1						1											
Truck (Road truck)	108	100	111	1			1				1										1
Truck (Vacuum truck)	109	100	111																		
Tub grinder/ mulcher 40-	116	100	118			1															
Vibratory roller[1]	114	100	113								1										
Water cart	107	100	108	1				1													
Welding equipment	105	100	110				1							1		1				1	
TOTAL NUMBER OF EQUIPMENT				5	6	5	8	10	4	6	6	7	6	8	4	8	4	8	7	9	4
TOTAL SWL				113	118	120	117	124[6]	11	120	116	124	114	117[3]	119[3]	117[3]	121	120	121	119	112
MAX SWL				113	122	120	115	123[6]	12	123	113	124	113	115	115	115	123	122	117	117	113

Note 1: A 5 dB penalty has been included to the sound power levels of equipment identified as particularly annoying to nearby residents in accordance with the ICNG (such as jackhammers, rock breakers, power saws, rock drilling, vibratory rollers, milling and profiling machines and impact piling).

Note 2: Correspond to an estimated time correction of the plant and equipment use in 15 minutes.

Note 3: Updated since EIS due to revised logarithmic addition

Note 4: Updated since EIS due to missing information

Note 5: Only during OOHW

Note 6: Only during Standard Hours of Work

Note 7: Only one (1) during OOHW

APPENDIX 4 NOISECHECK MEMO

Level 3 175 Scott Street
Newcastle NSW 2300
02 4907 4800
www.emmconsulting.com.au

Memorandum

18 February 2023

To: Erran Woodward

From: Katie Teyhan

Subject: Text describing NoiseCheck for Appendix to CNVMP

1 NoiseCheck

NoiseCheck is a state-of-the-art tool that provides an interactive platform to assist in the prediction, assessment and management of noise and vibration (including blasting) from construction projects. The following has been prepared as appropriate for use in the Appendix to the Coffs Harbour Bypass CNVMP describing how NoiseCheck works.

2 NoiseCheck - noise

NoiseCheck is a 'front-end' 3-D noise prediction platform which adopts a database of predictions that are generated using third party proprietary software (iNoise) which conforms to ISO9613 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation implemented to ISO/TR 17534-3:2015 requirements.

NoiseCheck allows you to build a complex construction scenario based on multiple activity locations. Based on the defined scenario, it displays a predicted noise level at all receivers within defined noise catchment areas. The predicted noise level at each receiver is assessed against the Roads and Maritime Service (RMS) Construction Noise and Vibration Guideline (CNVG) for a given time period and determines what level of additional noise mitigation measures that need to be applied.

The predictions consider source to receiver distance and height and the noise attenuation provided by ground and air absorption, site-specific topography, surrounding buildings and other solid objects and permanent noise barriers (where applicable). Regarding ground absorption for this project, a mix of hard and soft ground has been assumed with a ground factor of 0.5 to best represent actual conditions. Volume absorption from trees or other foliage has not been considered. The typical height of construction plant and equipment is 2m. The noise predictions at single and double storey properties apply at 1.5m and 4.5m above ground level, respectively, at 1m from the most affected facade. Predictions for apartment buildings with greater than two storeys apply at the worst affected floor and facade. Each assessment presents either the total L_{Aeq} noise level from all activities or the highest L_{Aeq} level from individual activities dependent on the nature of activities modelled.

3 NoiseCheck – vibration

NoiseCheck provides indicative predictions to assist in the risk management of impacts from vibration; building damage and disturbance to people from ground-borne noise or vibration.

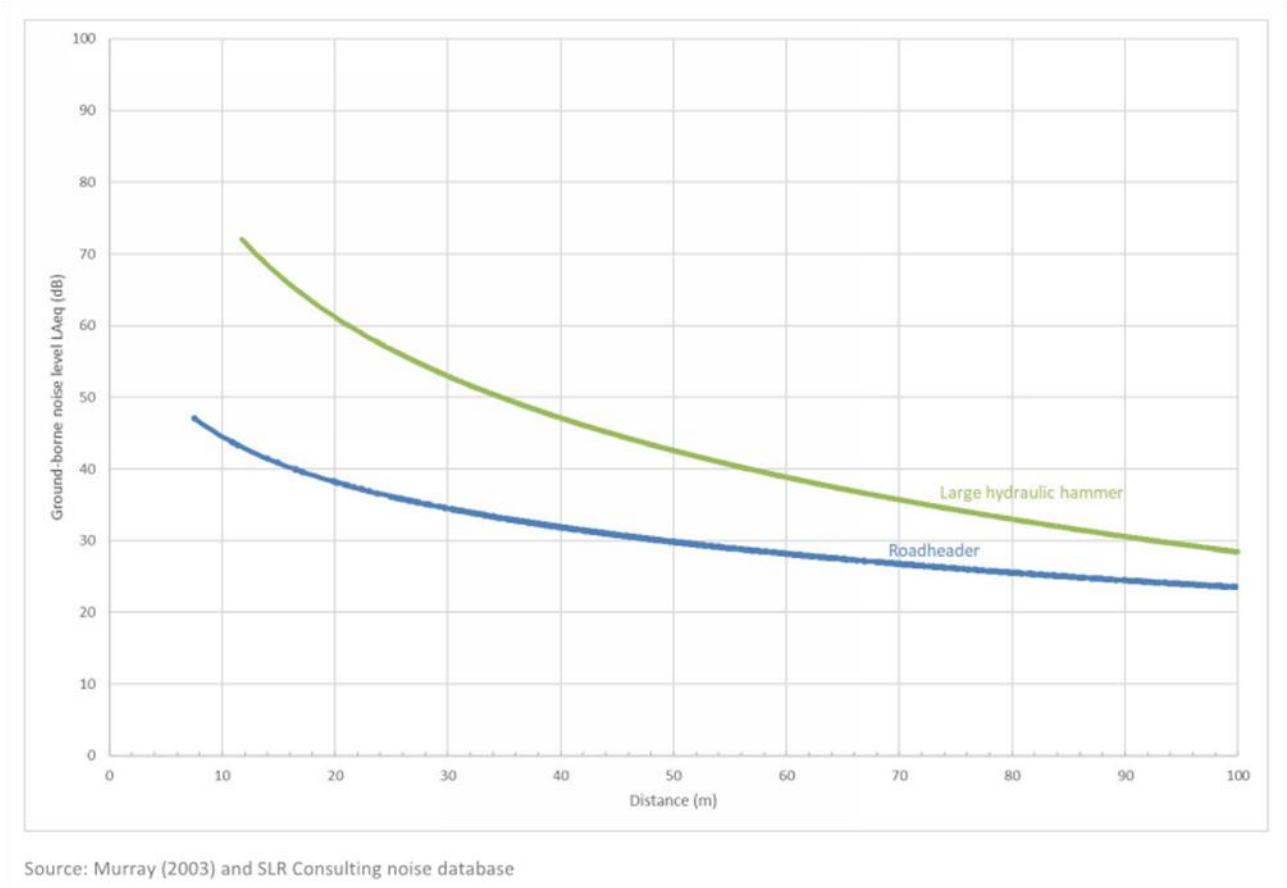
3.1 Vibration – PPV (building damage)

Vibration criteria relating to risk of cosmetic damage to buildings are typically stated as peak particle velocity (PPV). NoiseCheck indicates the risk of cosmetic damage based on typical safe-working distances from vibration-generating equipment. These are consistent with those provided in the RMS *Construction Noise and Vibration Guideline*.

3.2 Vibration – Ground-borne noise

The ground-borne noise (GBN) prediction algorithms used are based on publicly available measurement data which are used and accepted industry wide for items typically used underground; road header, rock-hammer and rock drill. The methods used to capture this measurement data has not been well documented. We have adjusted the formula to provide a conservative prediction (95th percentile). Predictions of GBN are based on the nearest distance from the equipment to the sensitive receptor.

The estimated reduction in GBN as a function of distance is shown in Figure 3.1.



Source: Murray (2003) and SLR Consulting noise database

Figure 3.1 Indicative GBN levels from tunnelling activities

Given the limited number of receptors in close proximity to the tunnels, and no receivers located directly above the tunnels, the risk of ground-borne noise impacts from the project is low.

3.3 Vibration – VDV

NoiseCheck provides predicted indicative levels of vibration dose value (VDV) from high-vibration generating sources based on the user input of estimated duration of exposure. Predictions are based on publicly available measurement data.

4 NoiseCheck – blasting

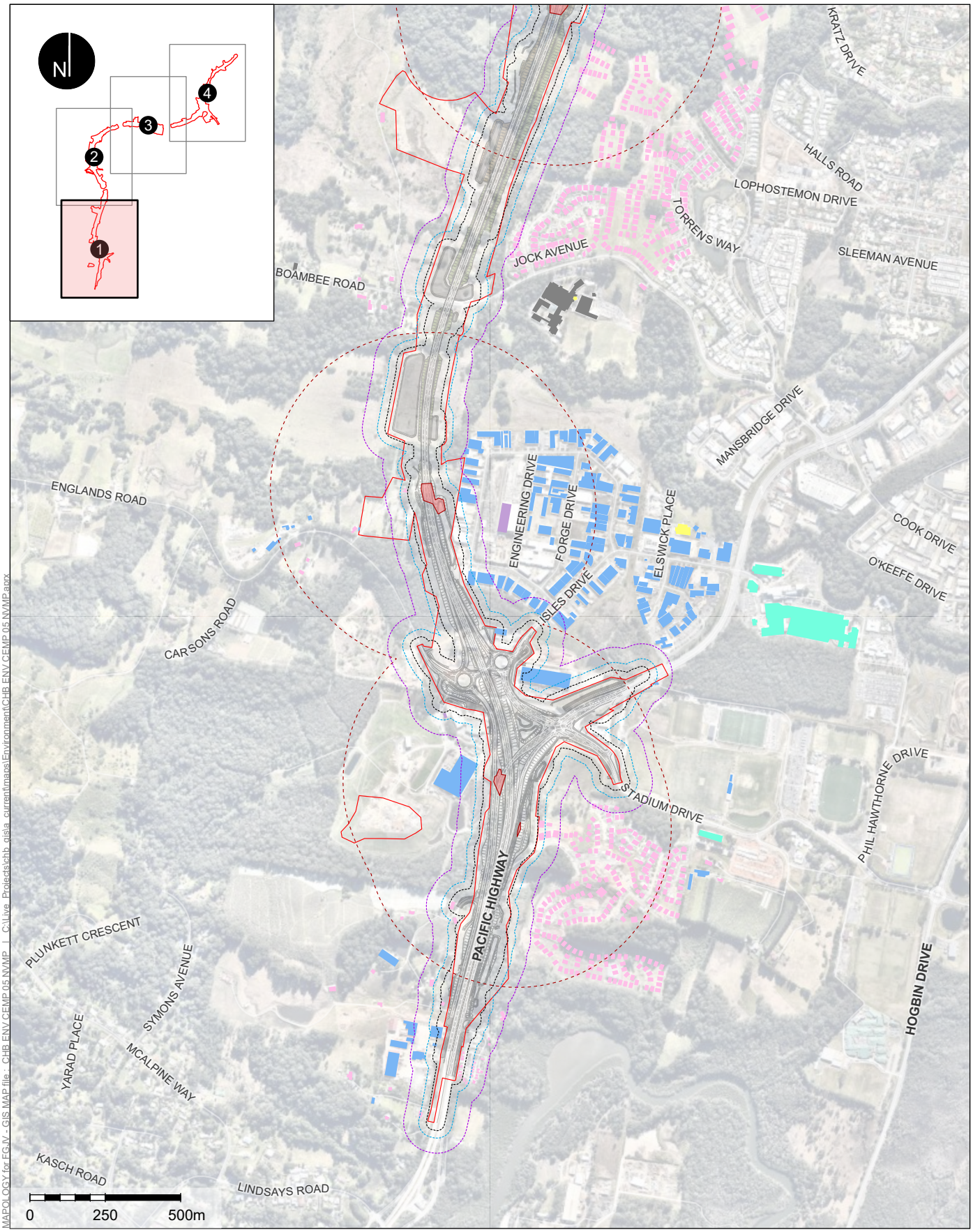
Indicative vibration levels and overpressure from blasting are predicted using the guidance given in *AS2187-2-2006: Explosives – Storage and Use Part 2: Use of Explosives* and formulae provided in *Imperial Chemical Industries (ICI) Explosives Blasting Guide* (ICI Technical Services 1995). The ICI formula has been shown to be conservative in calculating overpressure and vibration.

Blast emission predictions are compared to general guidance provided in the Australian and New Zealand Environment Council (ANZEC) guidelines *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC 1990). The criteria apply to residences only with the aim to minimise annoyance and discomfort and are generally consistent with those provided in the Project's conditions of approval.

Yours sincerely

Katie Teyhan
Associate
kteyhan@emmconsulting.com.au

APPENDIX 5 VIBRATION SAFE WORKING DISTANCES



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

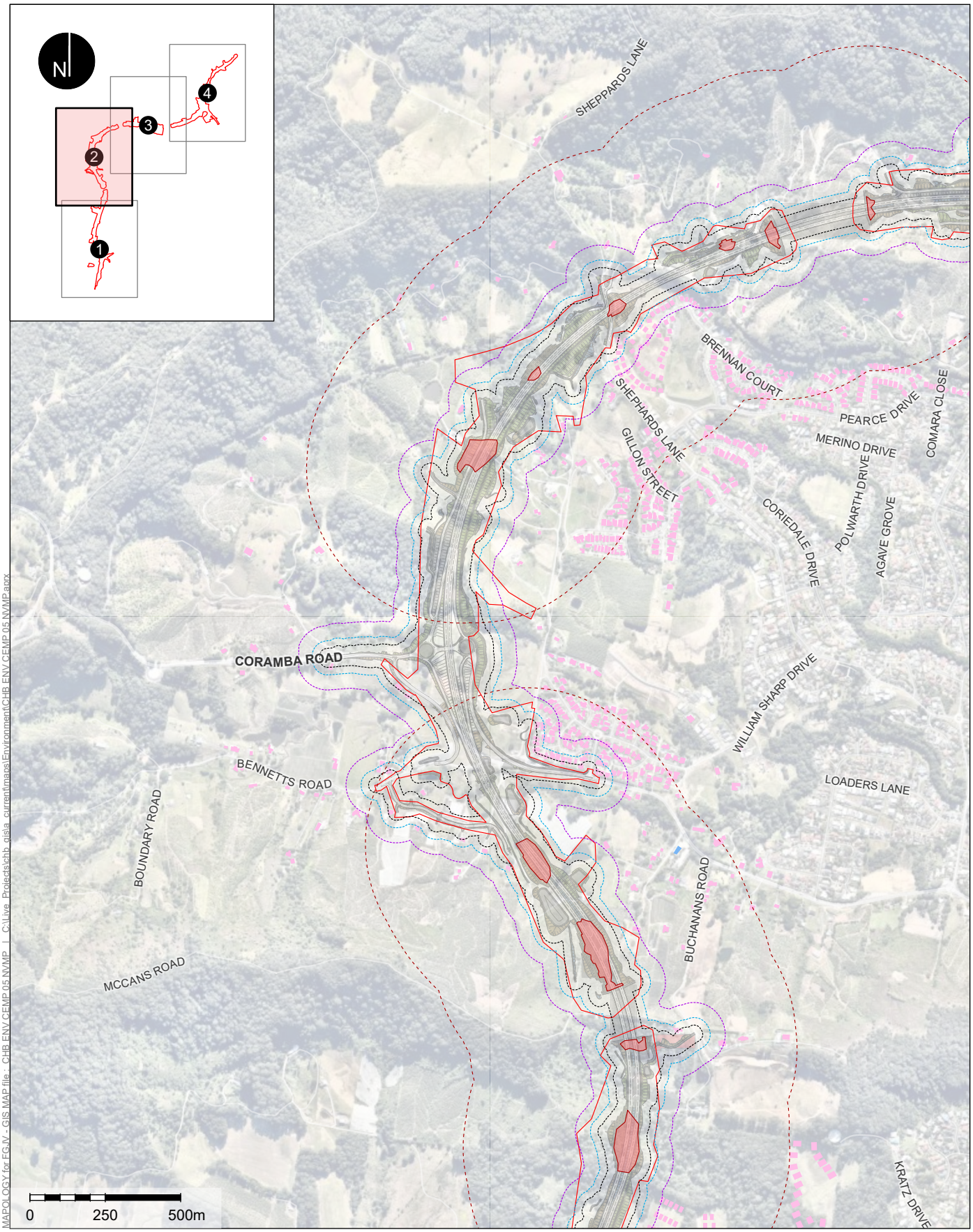
Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Safe Working Distance Contours

- 25 m
- 50 m
- 100 m
- 500 m from blasting
- Blasting locations

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School



MAPOLOGY for FGJV - GIS MAP file : .CHB ENV CEMP 05 NVMP_I_C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Safe Working Distance Contours

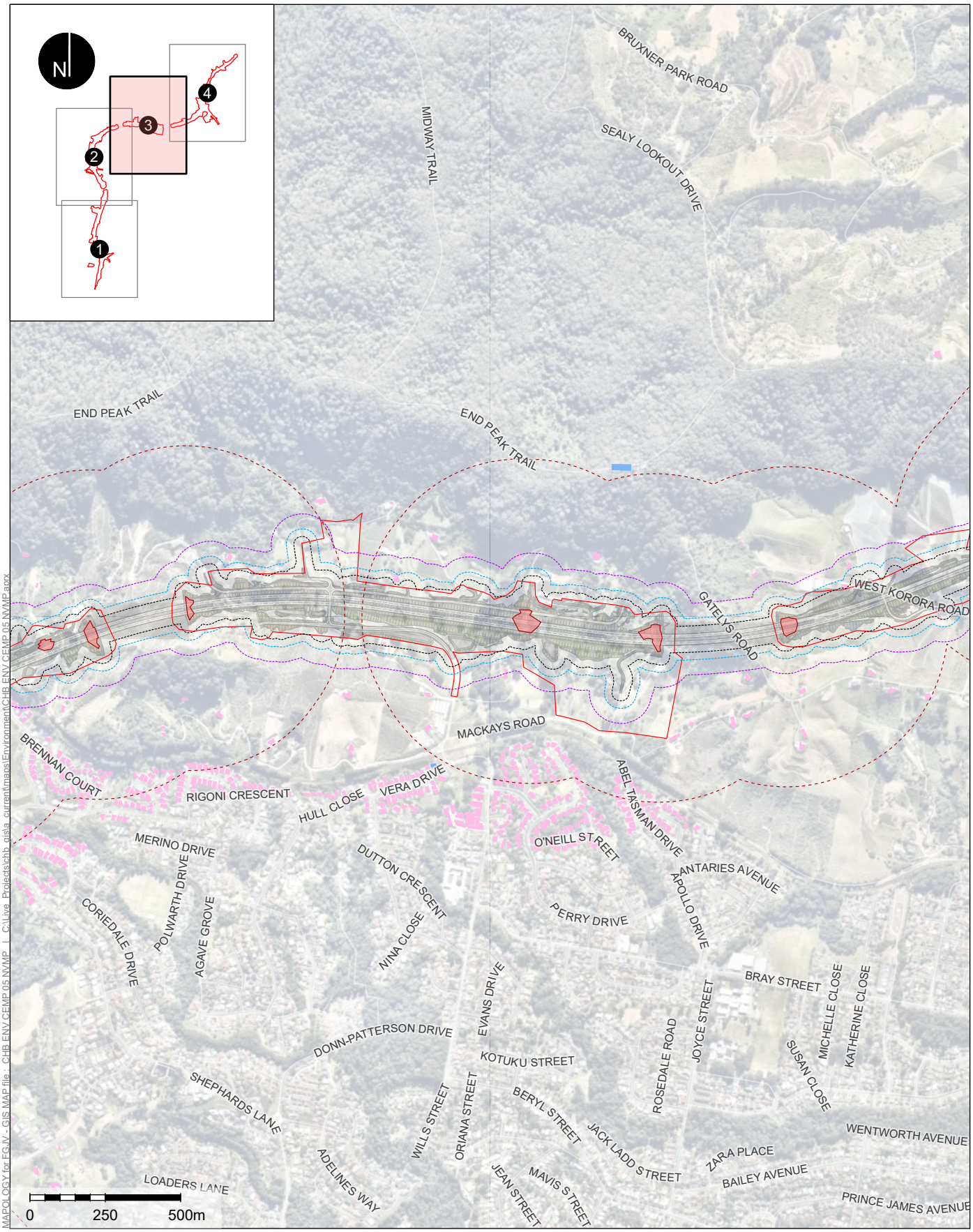
- 25 m
- 50 m
- 100 m

500 m from blasting

Blasting locations

Sensitive receiver building type

- Commercial
- Residential



MAPOLOGY for FGJV - GIS MAP file : .CHB ENV CEMP 05 NVMP_I_C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB_ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Safe Working Distance Contours

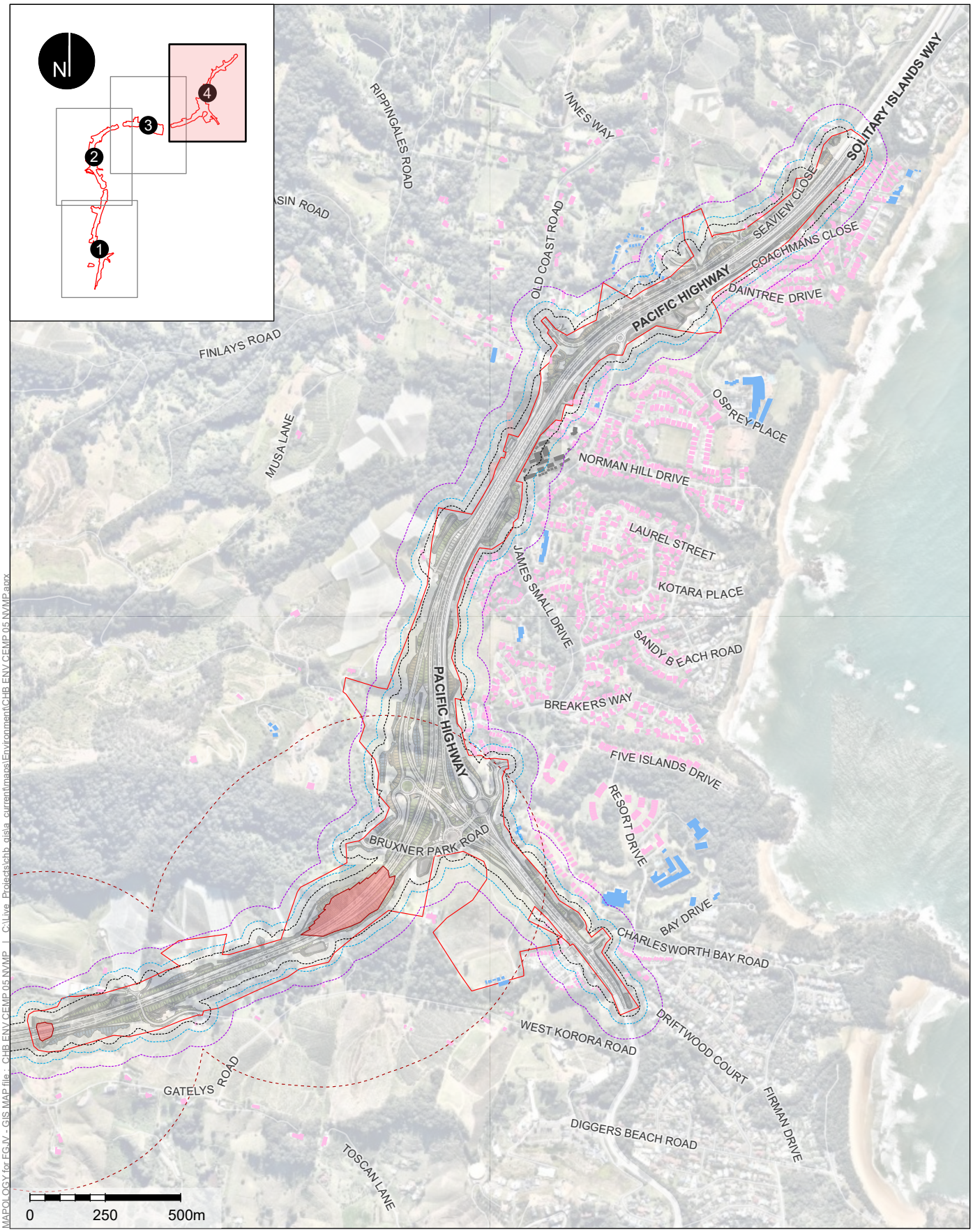
- 25 m
- 50 m
- 100 m

500 m from blasting

Blasting locations

Sensitive receiver building type

- Commercial
- Residential



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Safe Working Distance Contours

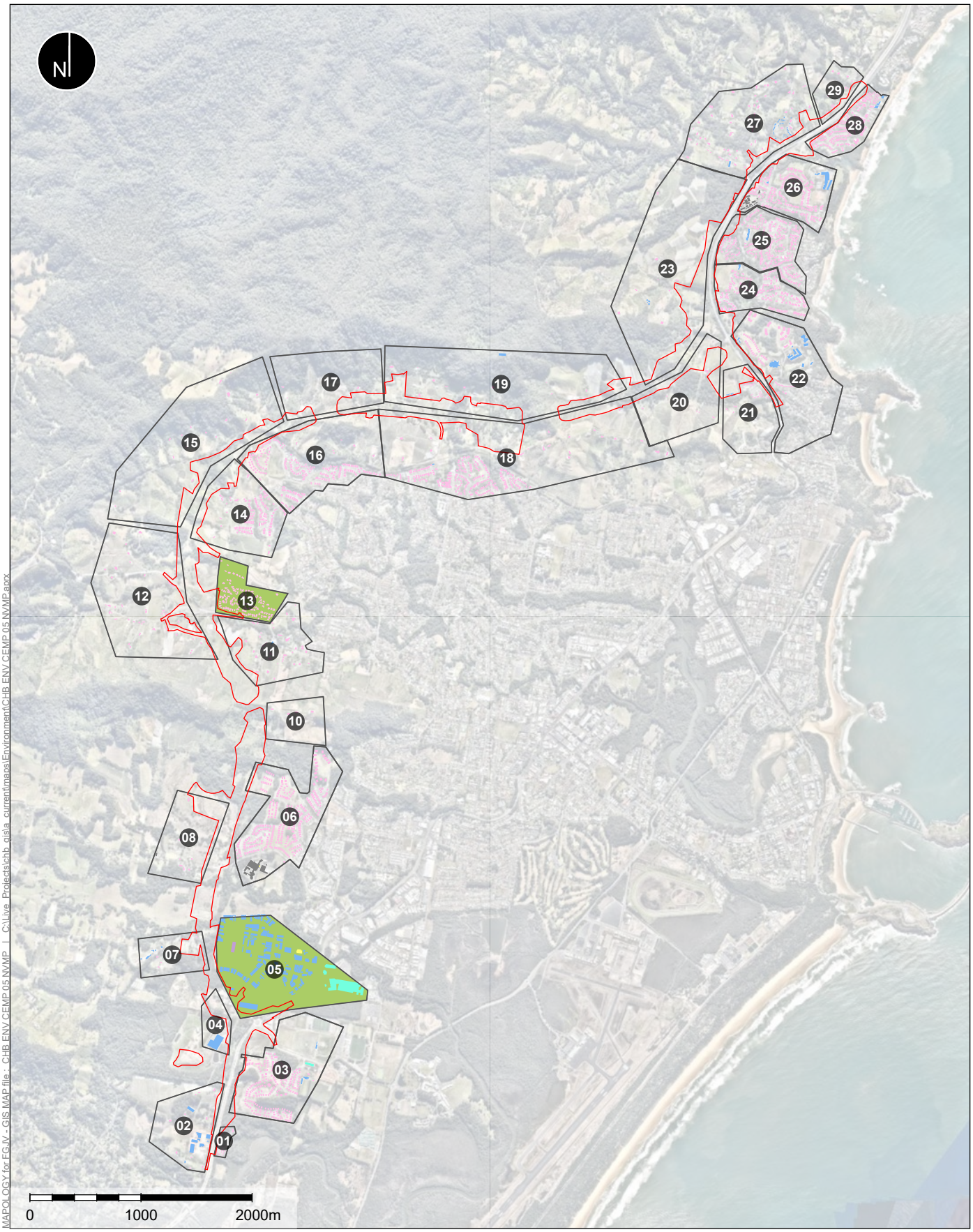
- 25 m
- 50 m
- 100 m
- 500 m from blasting
- Blasting locations

Sensitive receiver building type

- Commercial
- Residential
- School

APPENDIX 6 NOISE ASSESSMENT OUTCOMES

BULK EARTHWORKS



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

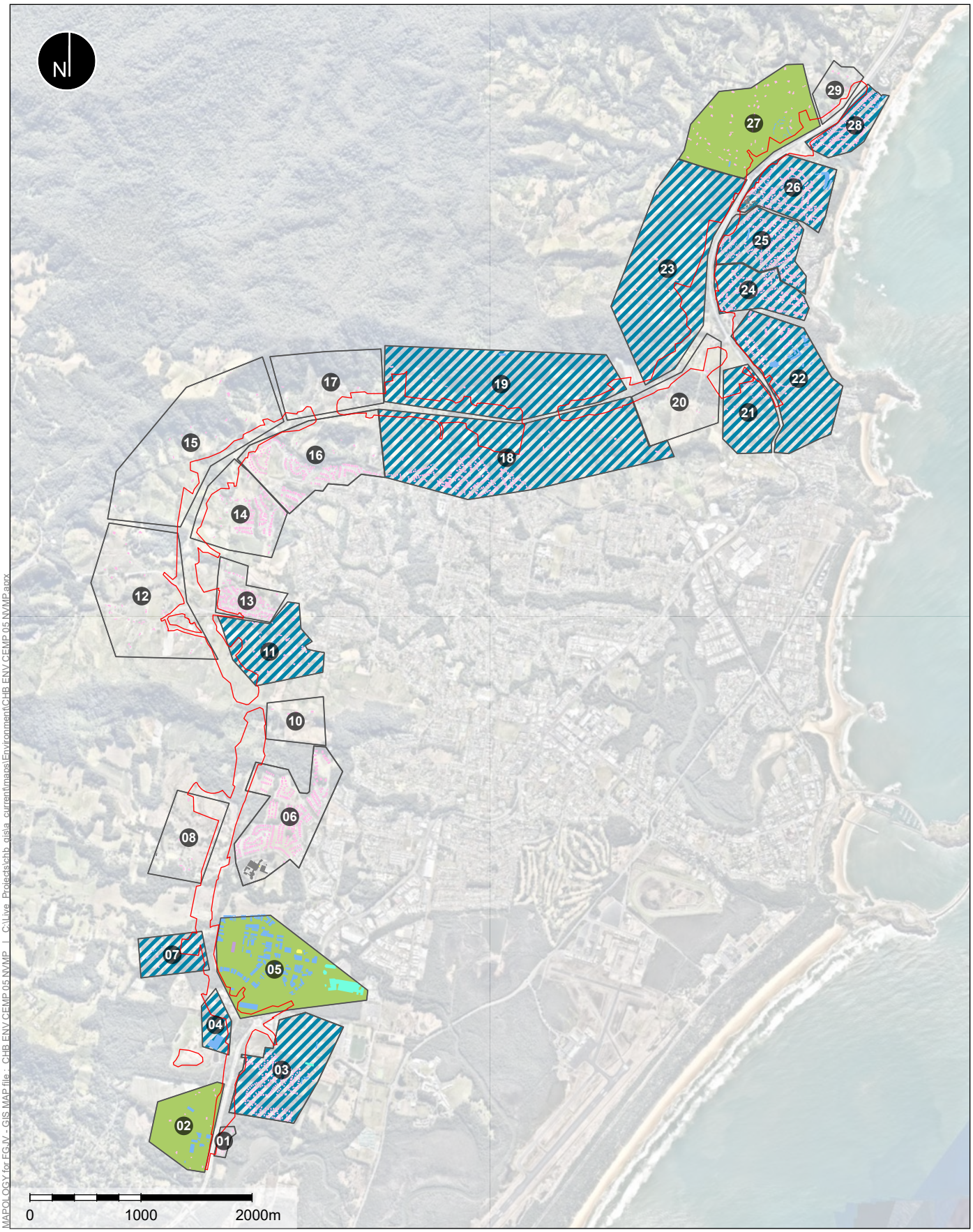
- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

Noise Catchment Area

Risk Classification

- Low
- n/a

Scenario: Bulk earthworks
Receiver Type: Child Care Facility



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

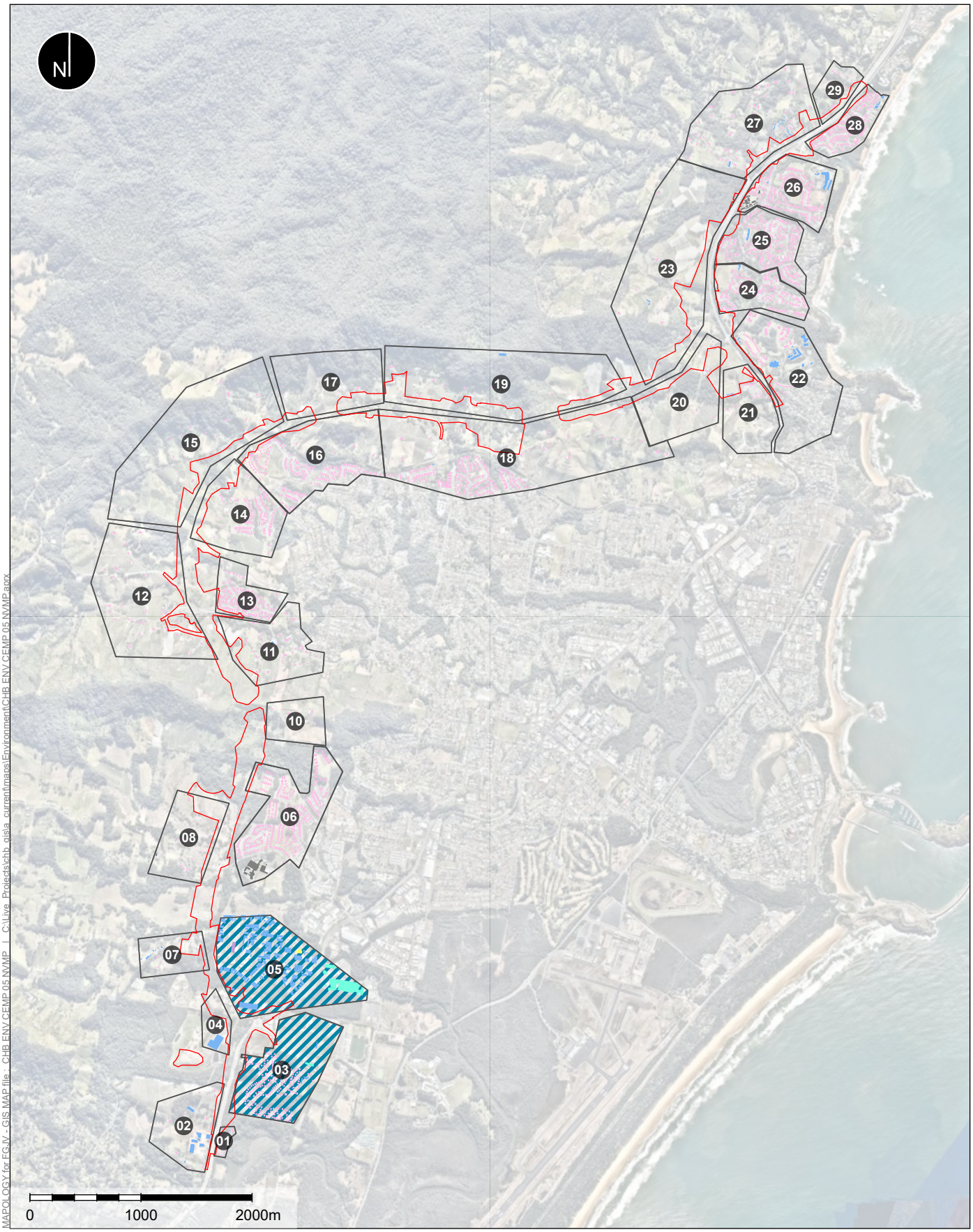
Noise Catchment Area

Risk Classification

- Low
- None
- n/a

Scenario: Bulk earthworks
Receiver Type: Commercial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

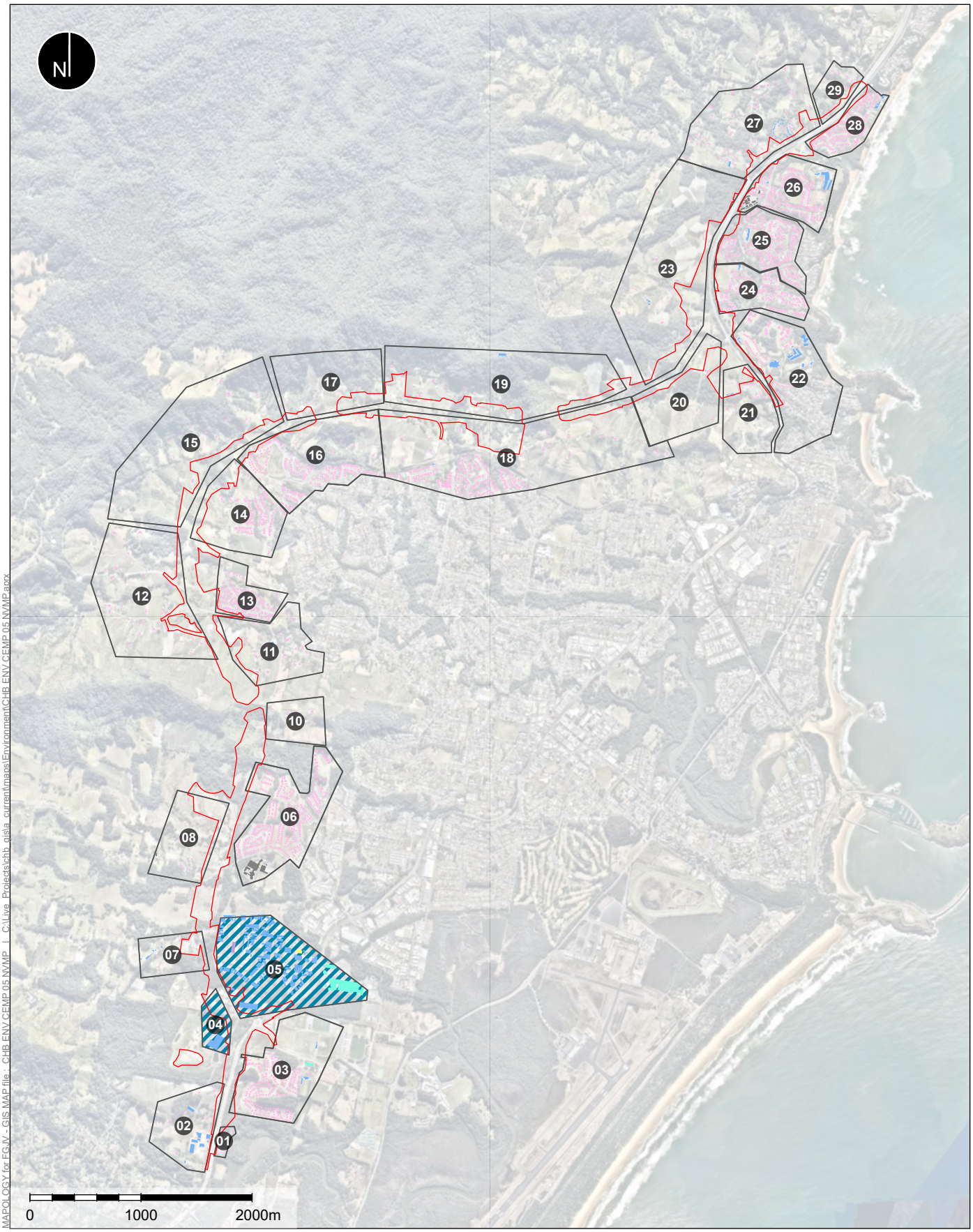
- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

Noise Catchment Area

Risk Classification

- None
- n/a

Scenario: Bulk earthworks
Receiver Type: Hospital



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

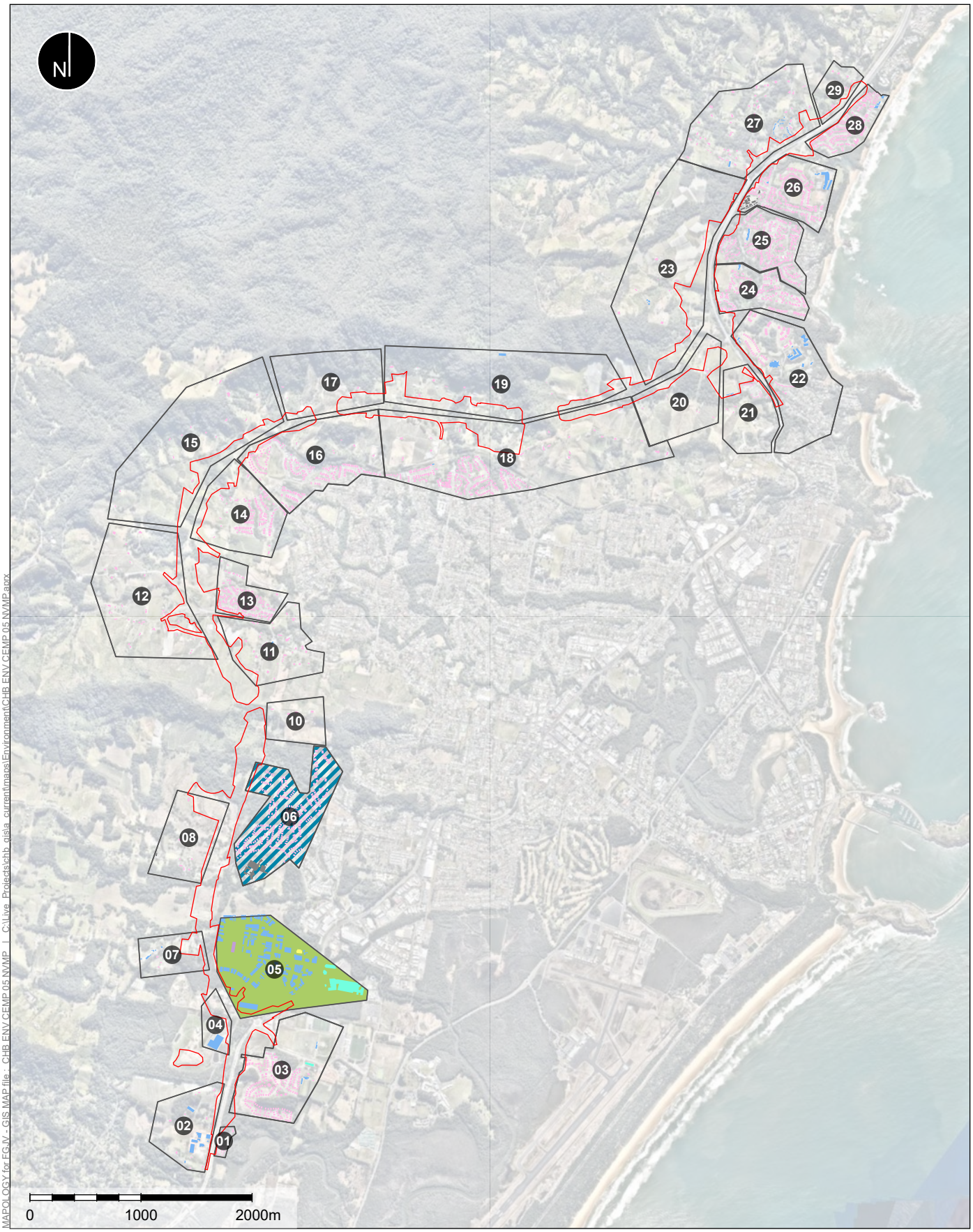
Noise Catchment Area

Risk Classification

- None
- n/a

Scenario: Bulk earthworks
Receiver Type: Industrial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

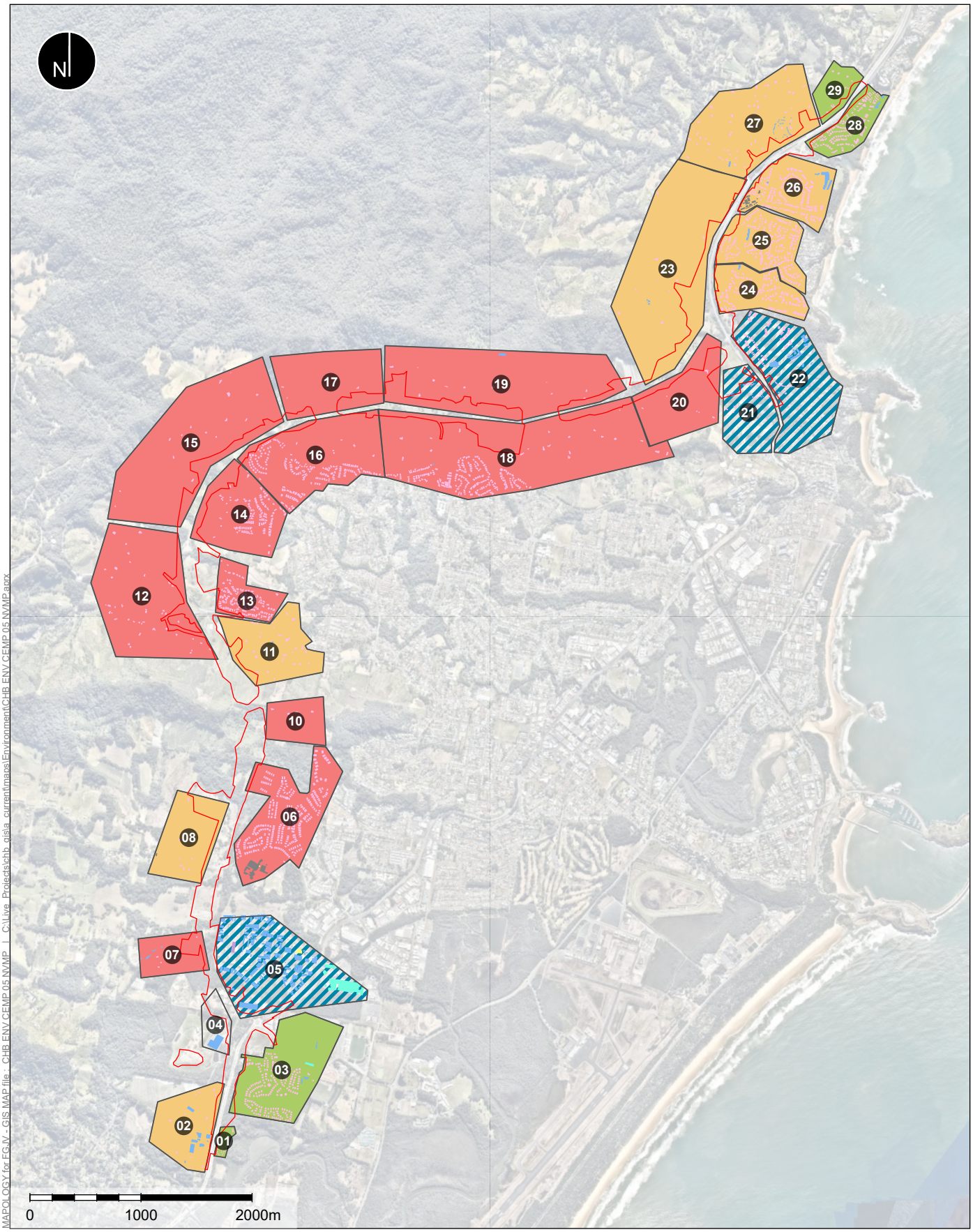
Noise Catchment Area

Risk Classification

- Low
- None
- n/a

Scenario: Bulk earthworks
Receiver Type: Place of Worship

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

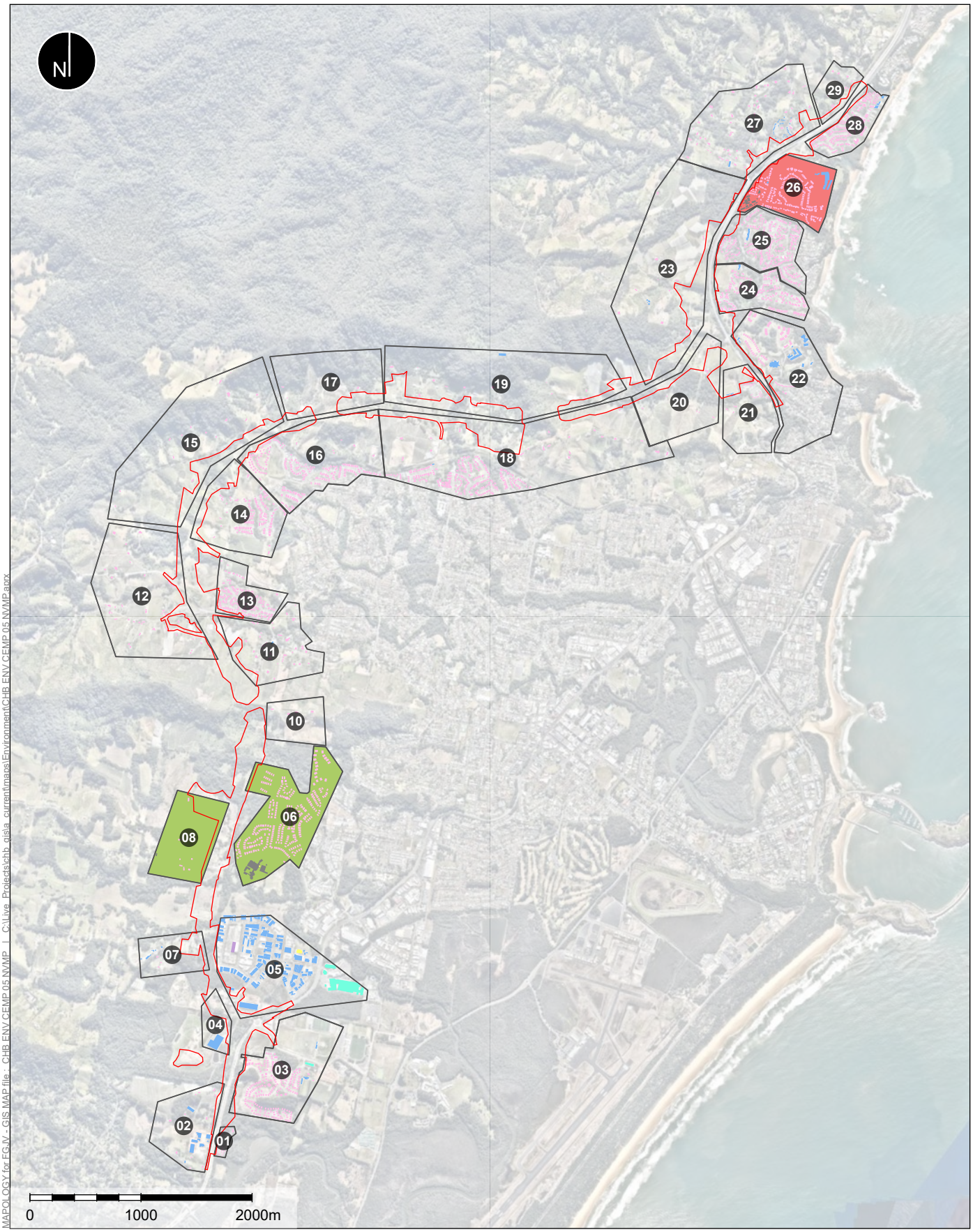
Noise Catchment Area

Risk Classification

- High
- Medium
- Low
- None
- n/a

Scenario: Bulk earthworks
Receiver Type: Residential

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

Noise Catchment Area

Risk Classification

- High
- Low
- n/a

Scenario: Bulk earthworks
Receiver Type: School

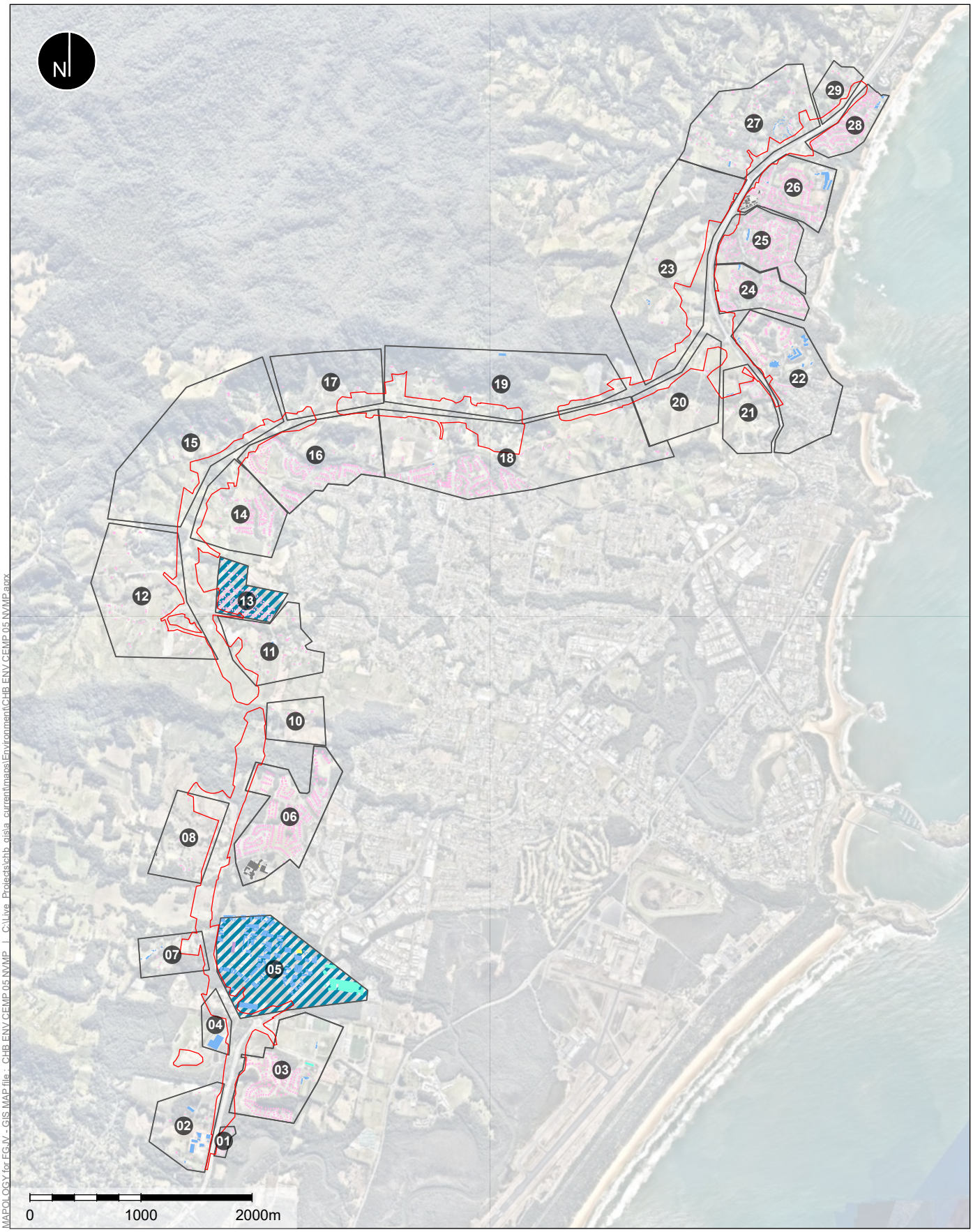
- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID5 (Bulk Earthworks)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
Residential																		
NCA01.RES	1	6	0	0	3	7	0	0	12	5	6	0	0	13	8	6	27	27
NCA02.RES	0	5	1	0	5	6	1	0	3	6	3	0	0	8	5	0	12	7
NCA03.RES	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
NCA03.RES (unbuilt)	0	38	2	0	47	56	2	0	42	82	3	0	28	113	30	0	143	40
NCA05.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA06.RES	0	17	14	9	23	19	14	9	10	37	12	12	6	41	11	13	50	20
NCA06.RES (unbuilt)	0	98	55	0	37	104	55	0	12	99	89	3	7	97	91	8	176	22
NCA07.RES	0	2	1	1	0	2	1	1	0	2	1	1	0	3	0	1	4	1
NCA08.RES	0	1	6	0	0	1	6	0	0	0	7	0	0	2	5	0	7	2
NCA09.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA10.RES	0	3	1	0	0	3	1	0	0	2	1	1	0	2	1	1	4	1
NCA11.RES	0	19	4	0	9	22	4	0	0	20	16	1	0	14	21	2	37	3
NCA12.RES	0	20	10	6	0	23	10	6	0	19	7	13	0	14	12	13	39	14
NCA13.RES	0	105	24	2	0	105	24	2	0	11	109	11	0	0	113	18	131	31
NCA14.RES	0	88	16	1	4	89	16	1	0	33	68	9	0	33	68	9	109	12
NCA15.RES	0	6	6	0	2	6	6	0	0	7	7	2	0	7	7	2	14	3
NCA16.RES	0	23	2	0	20	31	2	0	29	48	8	1	29	48	8	1	60	1
NCA16.RES (unbuilt)	0	22	24	9	3	27	24	9	0	15	34	14	0	15	34	14	63	38
NCA17.RES	0	0	3	0	0	0	3	0	0	0	1	2	0	0	1	2	3	3
NCA18.RES	0	149	12	3	28	158	12	3	10	124	73	4	12	108	91	4	183	3
NCA19.RES	0	2	7	2	0	2	7	2	0	0	5	6	0	0	5	6	11	5
NCA20.RES	0	3	5	0	0	3	5	0	0	1	5	2	0	0	5	3	8	3
NCA21.RES	0	0	0	0	0	0	0	0	0	3	0	0	2	27	4	1	34	20

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID5 (Bulk Earthworks)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA22.RES	0	0	0	0	0	0	0	0	5	0	0	0	7	14	5	0	19	7
NCA23.RES	0	0	0	0	0	0	0	0	15	15	0	0	0	0	30	0	30	30
NCA24.RES	1	4	1	1	4	4	1	1	0	5	3	2	0	4	4	2	9	4
NCA25.RES	0	26	0	0	6	27	0	0	43	25	21	0	17	64	29	4	96	27
NCA26.RES	0	17	2	0	37	21	2	0	26	75	17	0	42	83	52	8	128	44
NCA27.RES	1	19	2	0	23	23	2	0	25	49	13	0	32	105	48	7	132	53
NCA28.RES	0	1	0	0	3	2	0	0	6	11	1	0	16	34	11	0	45	12
NCA29.RES	1	4	1	0	13	11	1	0	39	31	11	1	22	79	30	2	130	99
Commercial																		
NCA02.COM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA03.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA04.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.COM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA07.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA11.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA18.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA19.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA21.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA22.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA23.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA24.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA25.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA27.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA28.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Industrial																		

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID5 (Bulk Earthworks)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA04.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Hospital																		
NCA03.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Educational																		
NCA06.SCH	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA08.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.SCH	0	6	8	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Place of worship																		
NCA05.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA06.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Child Care Facilities																		
NCA05.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA13.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A

TUNNELLING



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Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

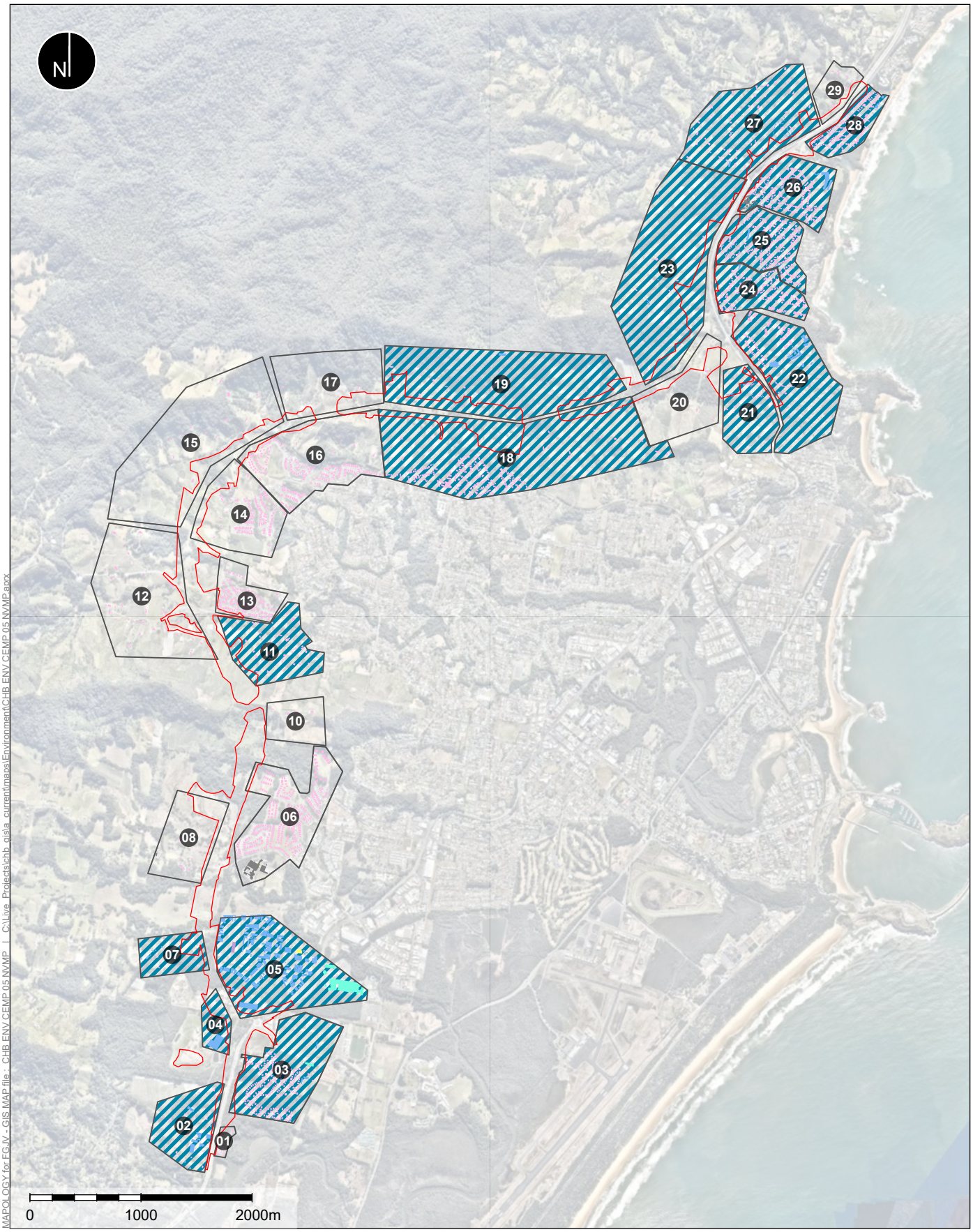
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Tunnel works
Receiver Type: Child Care Facility

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

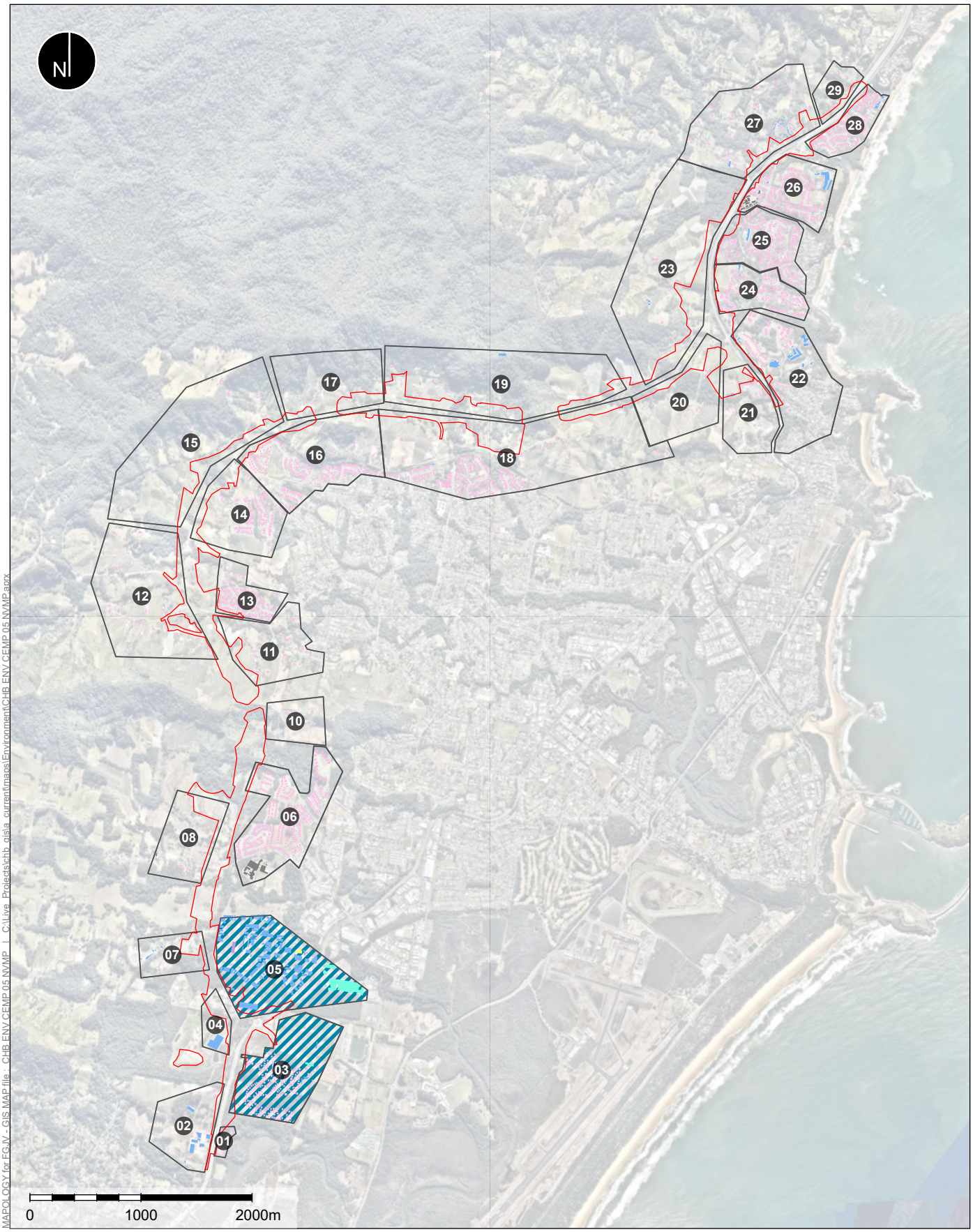
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Tunnel works
Receiver Type: Commercial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

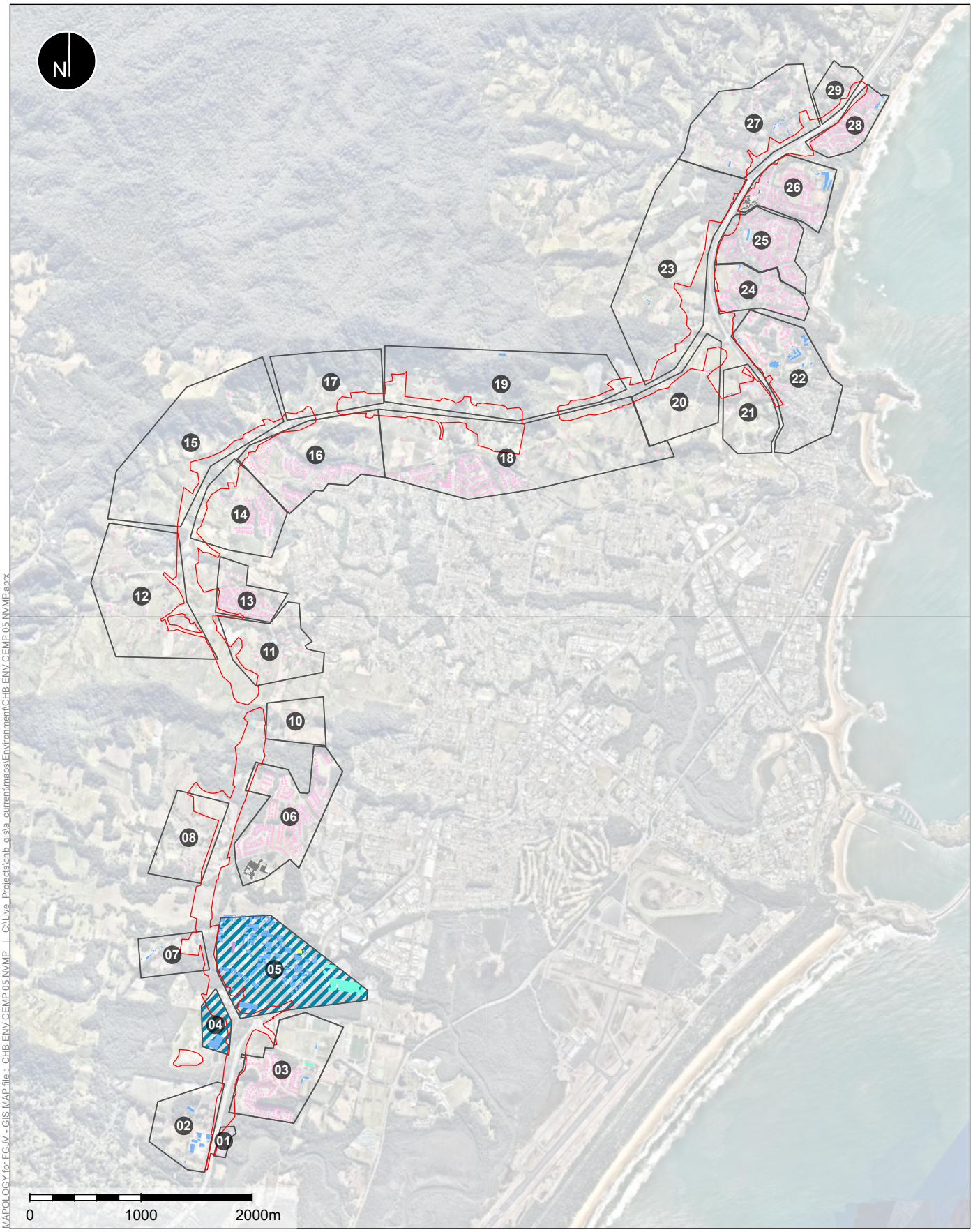
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Tunnel works
Receiver Type: Hospital

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

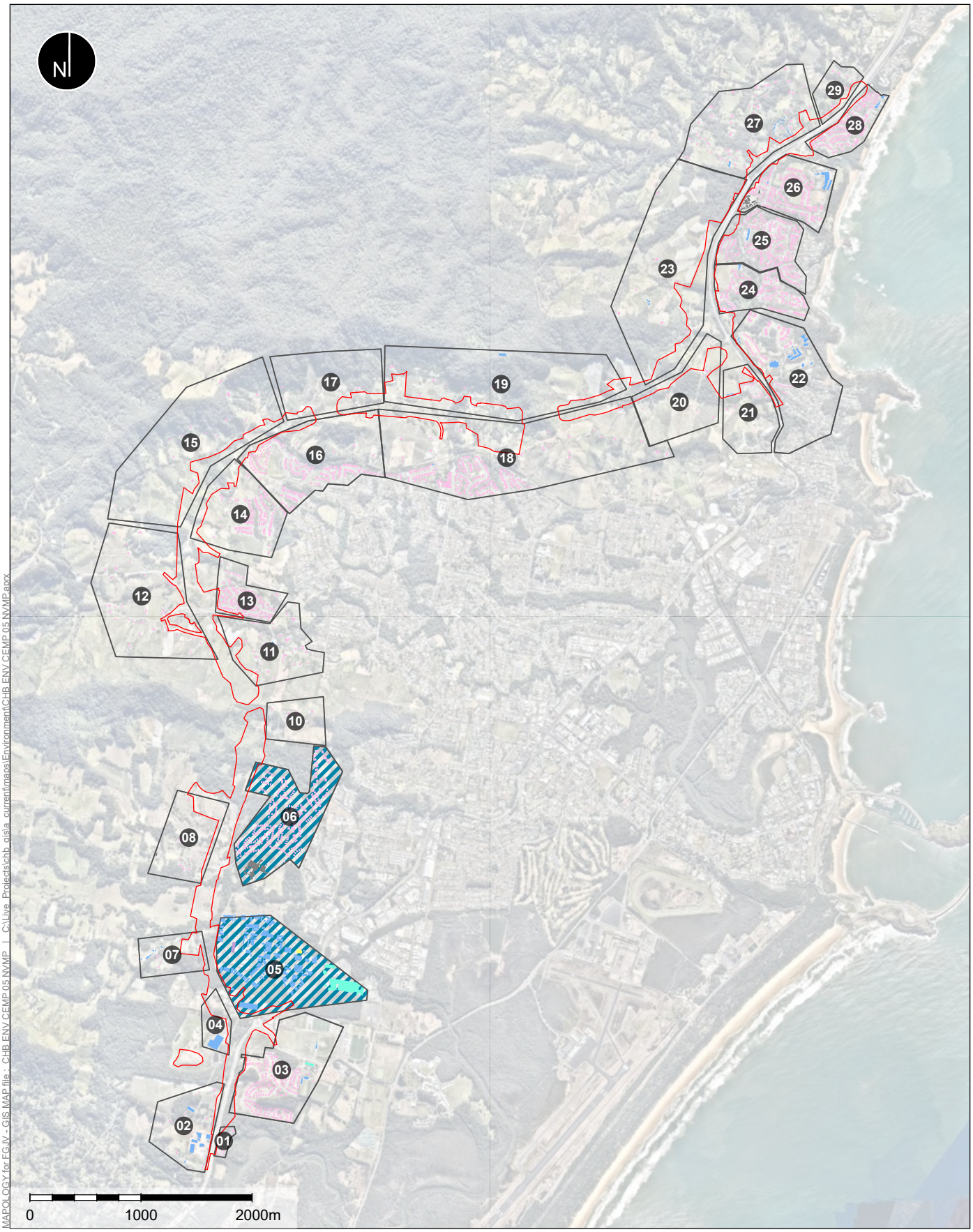
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Tunnel works
Receiver Type: Industrial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

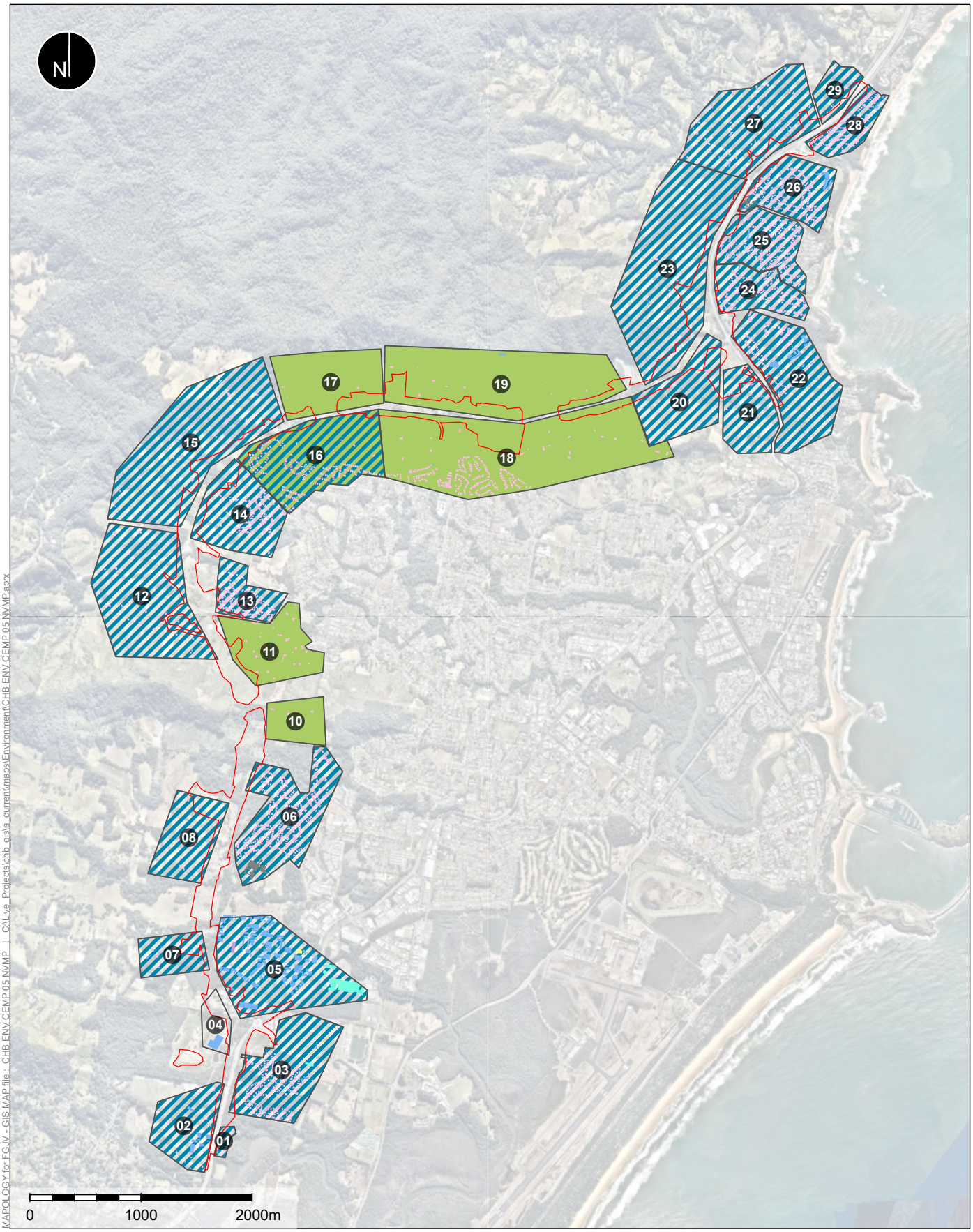
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Tunnel works
Receiver Type: Place of Worship

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

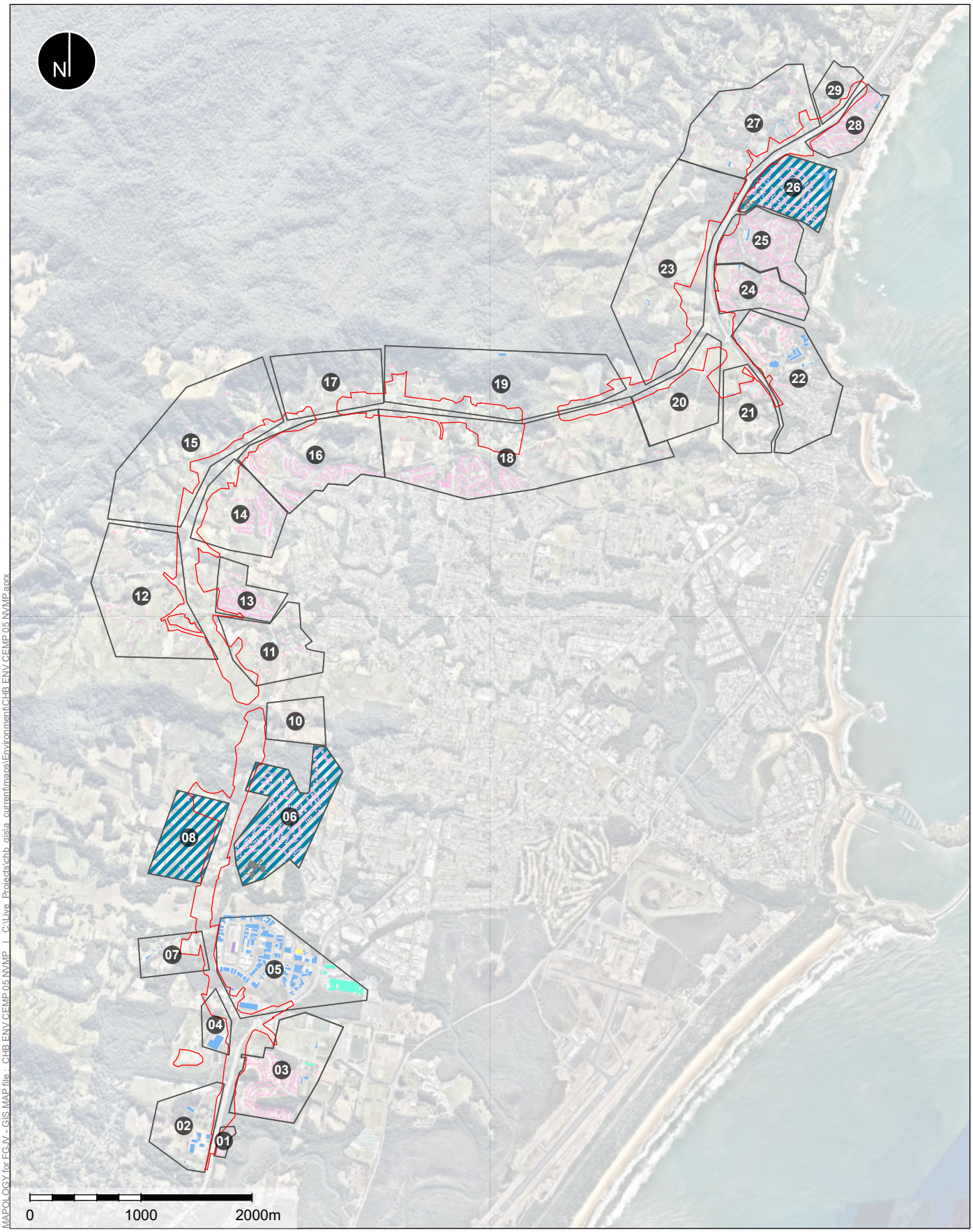
Noise Catchment Area

Standard Hours Daytime Summary

- Low
- None
- n/a

Scenario: Tunnel works
Receiver Type: Residential

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Tunnel works
Receiver Type: School

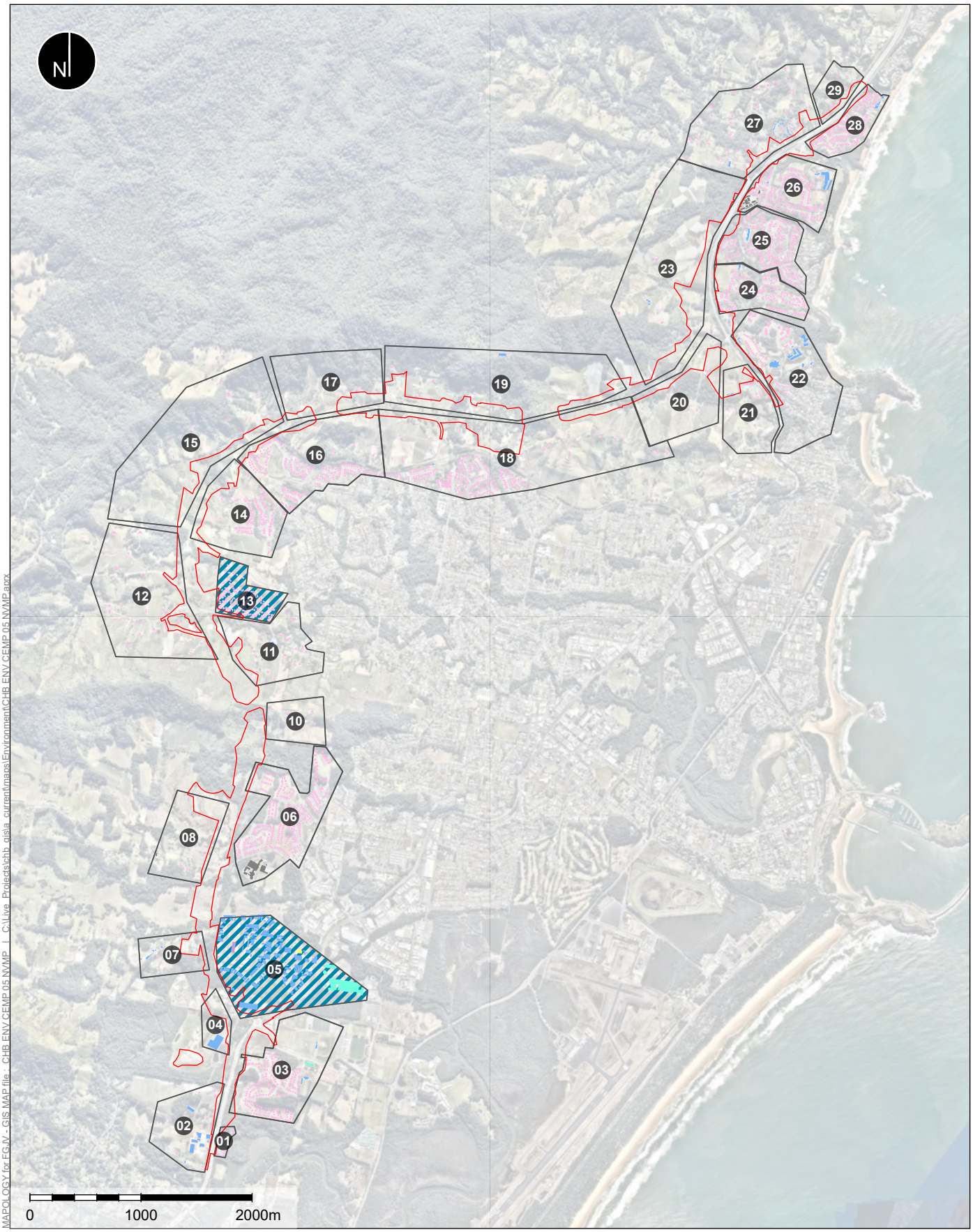
- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID12 (Tunnel works)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
Residential																		
NCA01.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA02.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA03.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NCA03.RES (unbuilt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA05.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA06.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA06.RES (unbuilt)	0	0	0	0	8	0	0	0	37	0	0	0	53	3	0	0	0	0
NCA07.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA08.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA09.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA10.RES	0	2	0	0	2	2	0	0	0	3	1	0	0	3	1	0	1	0
NCA11.RES	0	3	0	0	5	3	0	0	24	9	0	0	19	14	2	0	3	0
NCA12.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA13.RES	0	0	0	0	0	0	0	0	45	1	0	0	84	13	0	0	0	0
NCA14.RES	0	0	0	0	1	0	0	0	78	1	0	0	78	1	0	0	0	0
NCA15.RES	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0
NCA16.RES	0	9	0	0	74	9	0	0	32	83	0	0	32	83	0	0	0	0
NCA16.RES (unbuilt)	0	15	0	0	8	15	0	0	15	23	0	0	15	23	0	0	2	0
NCA17.RES	0	1	0	0	1	1	0	0	1	1	1	0	1	1	1	0	1	0
NCA18.RES	0	7	0	0	59	7	0	0	79	54	1	0	91	64	2	0	3	0
NCA19.RES	0	4	0	0	2	4	0	0	1	5	1	0	1	5	1	0	1	0
NCA20.RES	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0
NCA21.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID12 (Tunnel works)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA22.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA23.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA24.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA25.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA26.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA27.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA28.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA29.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial																		
NCA02.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA03.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA04.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA07.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA11.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA18.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA19.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA21.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA22.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA23.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA24.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA25.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA27.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA28.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Industrial																		

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID12 (Tunnel works)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA04.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Hospital																		
NCA03.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Educational																		
NCA06.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA08.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Place of worship																		
NCA05.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA06.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Child Care Facilities																		
NCA05.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA13.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A

ROAD WORKS



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

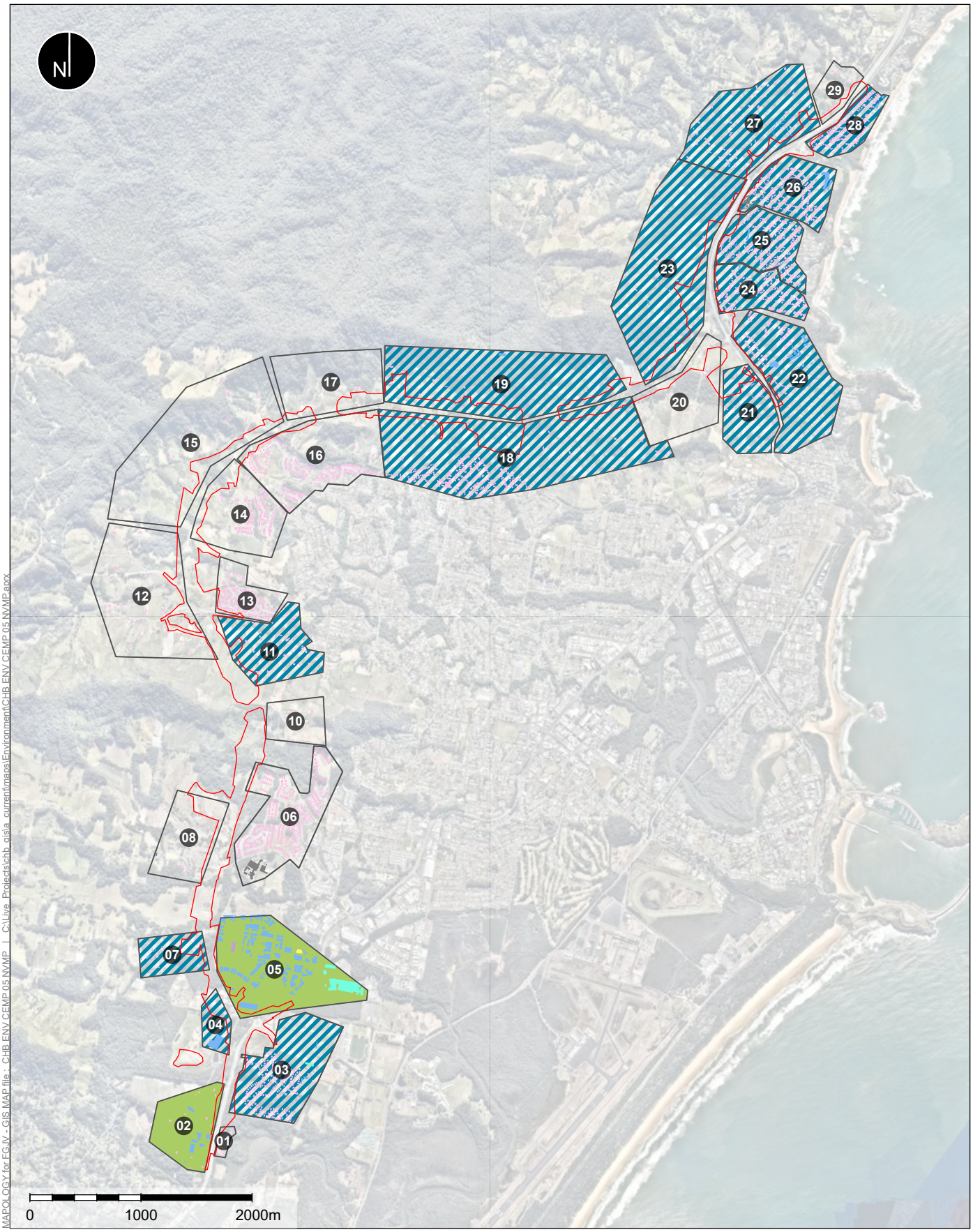
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Road works
Receiver Type: Child Care Facility

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

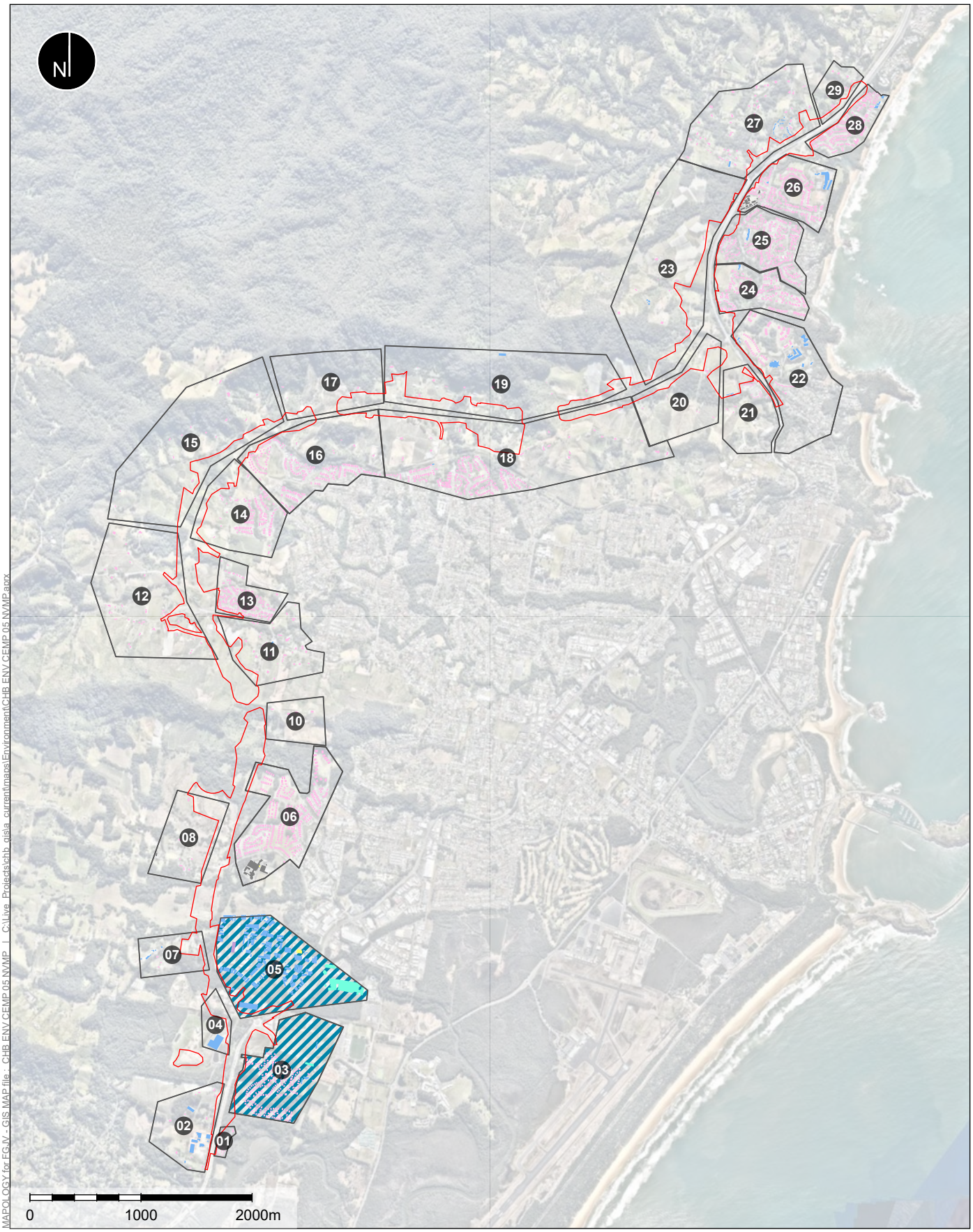
Noise Catchment Area

Standard Hours Daytime Summary

- Low
- None
- n/a

Scenario: Road works
Receiver Type: Commercial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

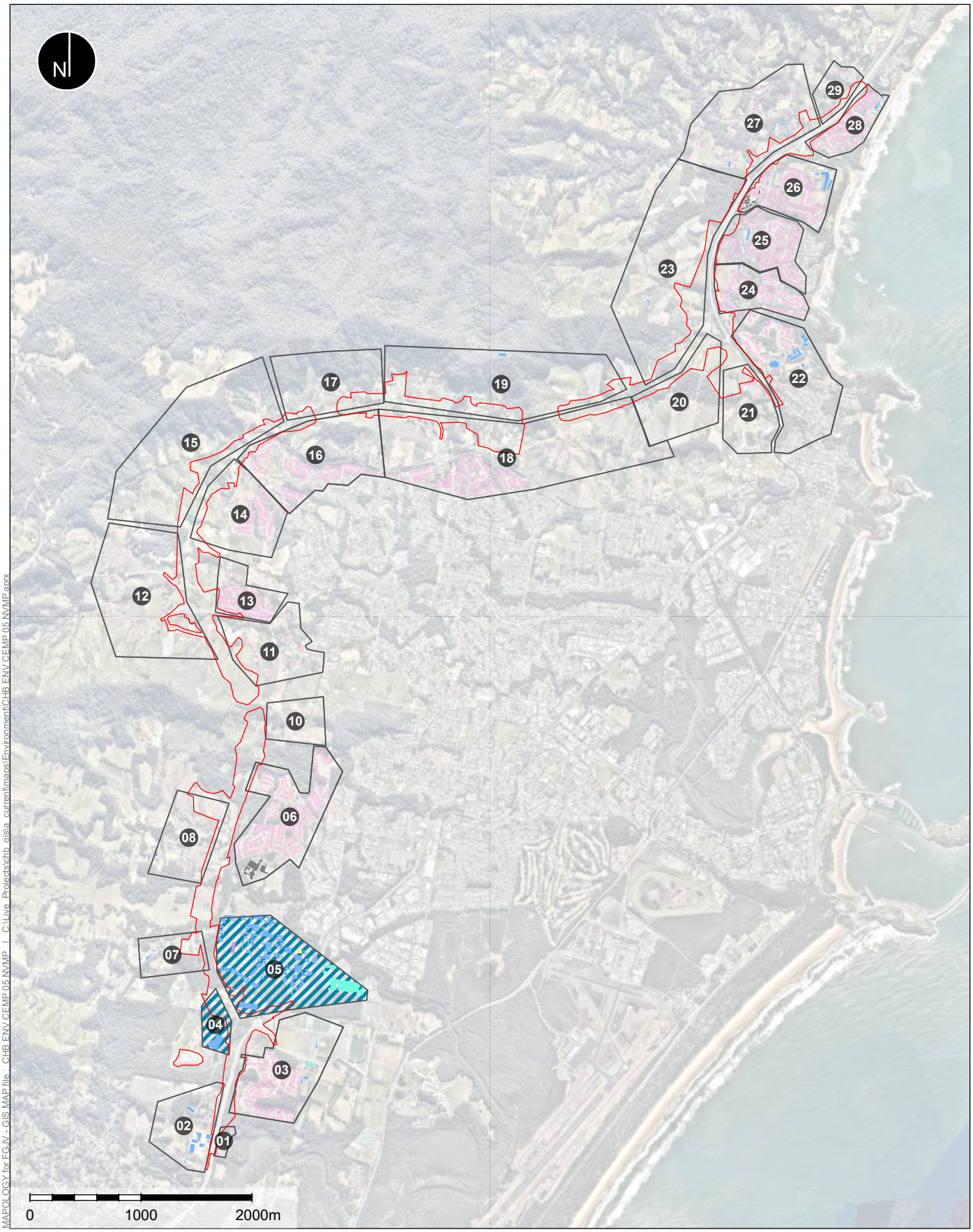
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Road works
Receiver Type: Hospital

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

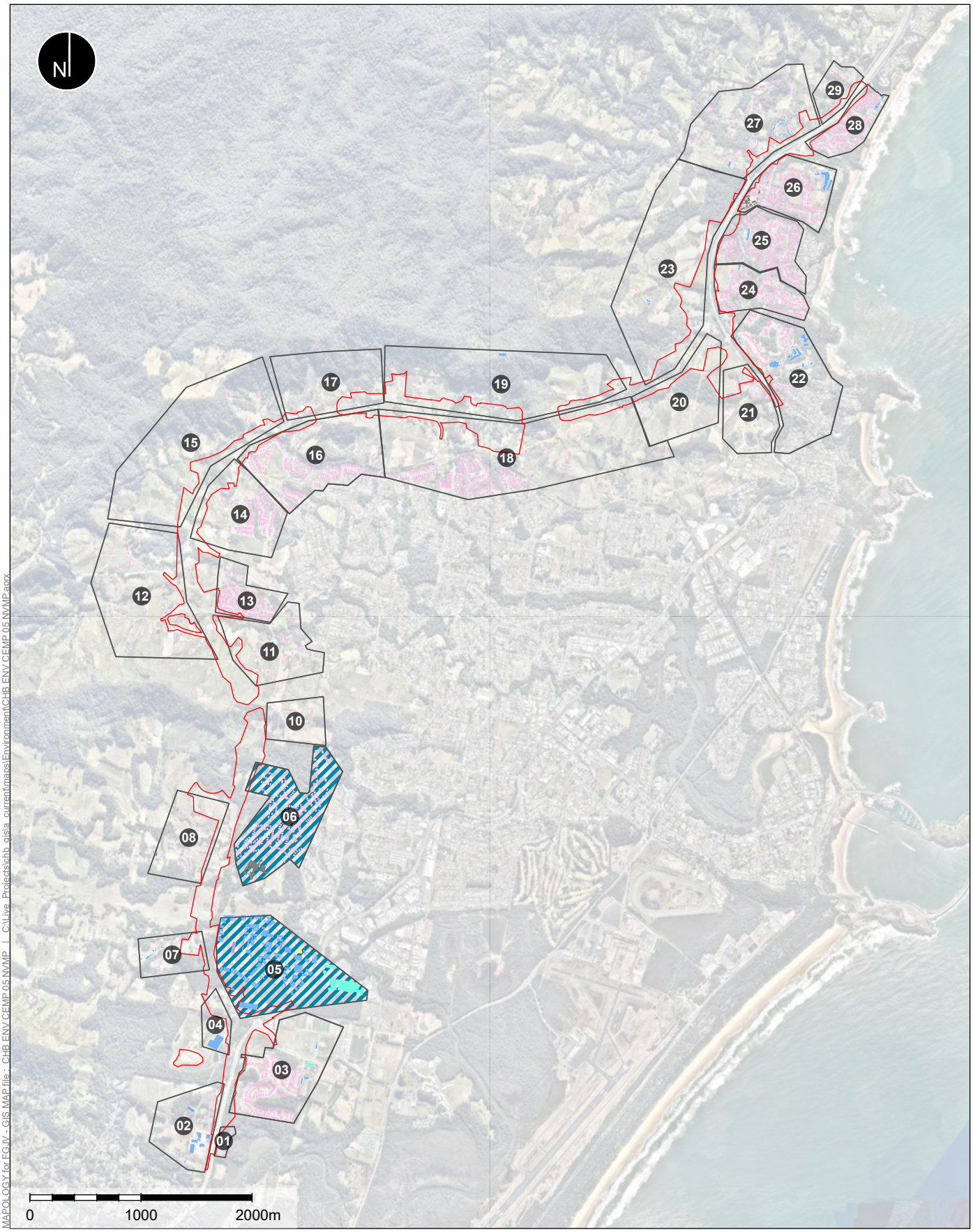
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Road works
Receiver Type: Industrial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

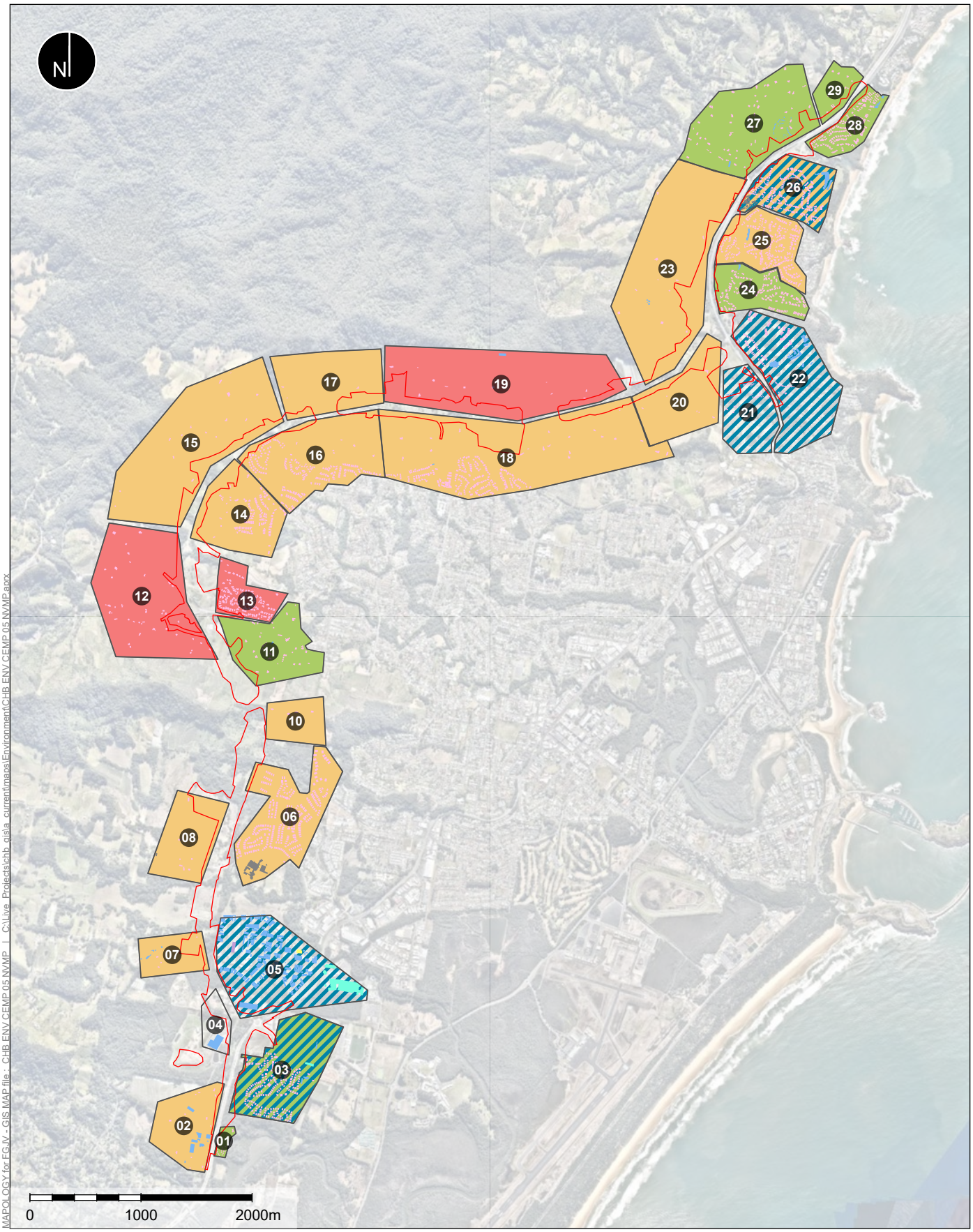
Noise Catchment Area

Standard Hours Daytime Summary

- None
- n/a

Scenario: Road works
Receiver Type: Place of Worship

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

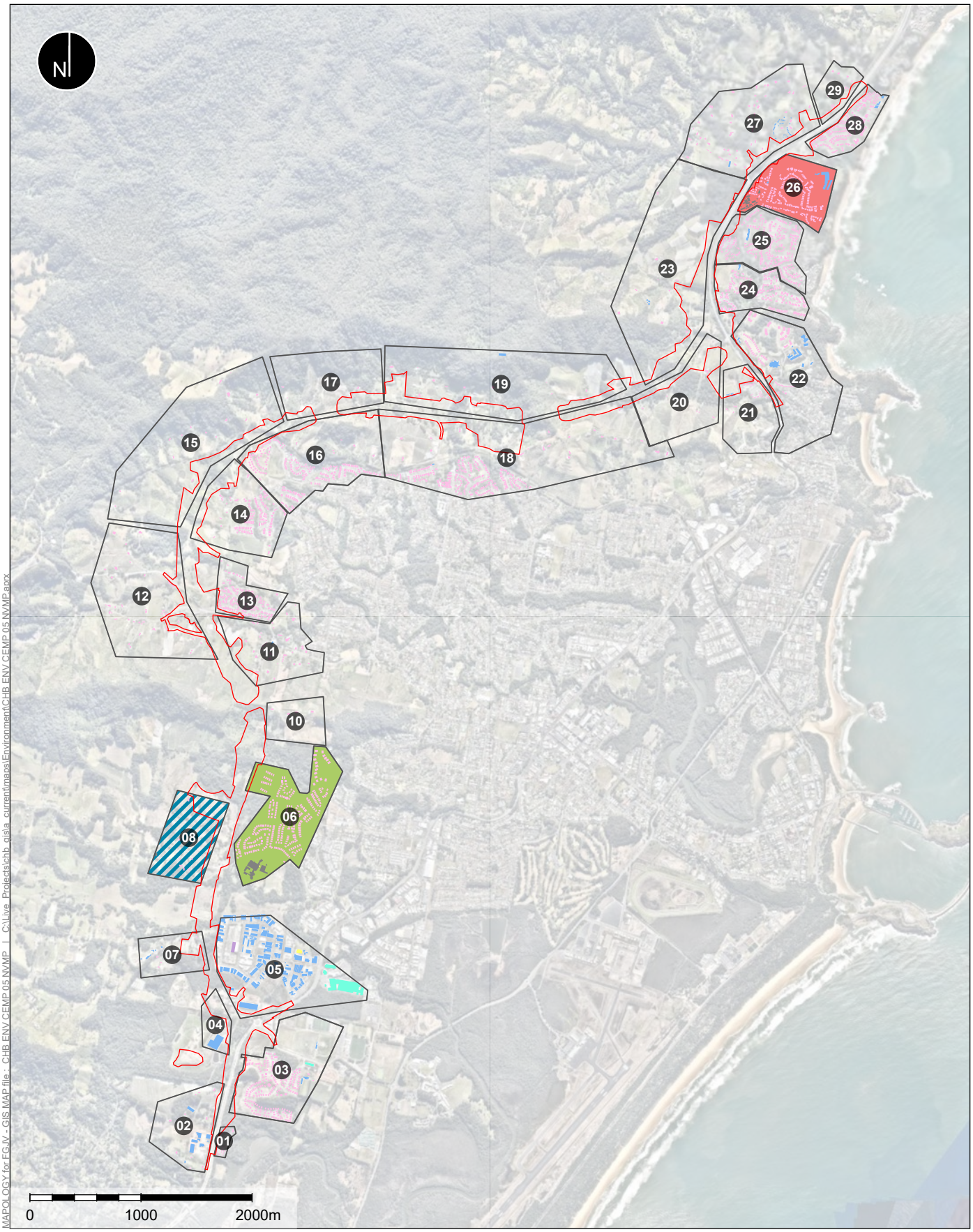
Noise Catchment Area

Standard Hours Daytime Summary

- High
- Medium
- Low
- None
- n/a

Scenario: Road works
Receiver Type: Residential

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

Noise Catchment Area

Standard Hours Daytime Summary

- High
- Low
- None
- n/a

Scenario: Road works
Receiver Type: School

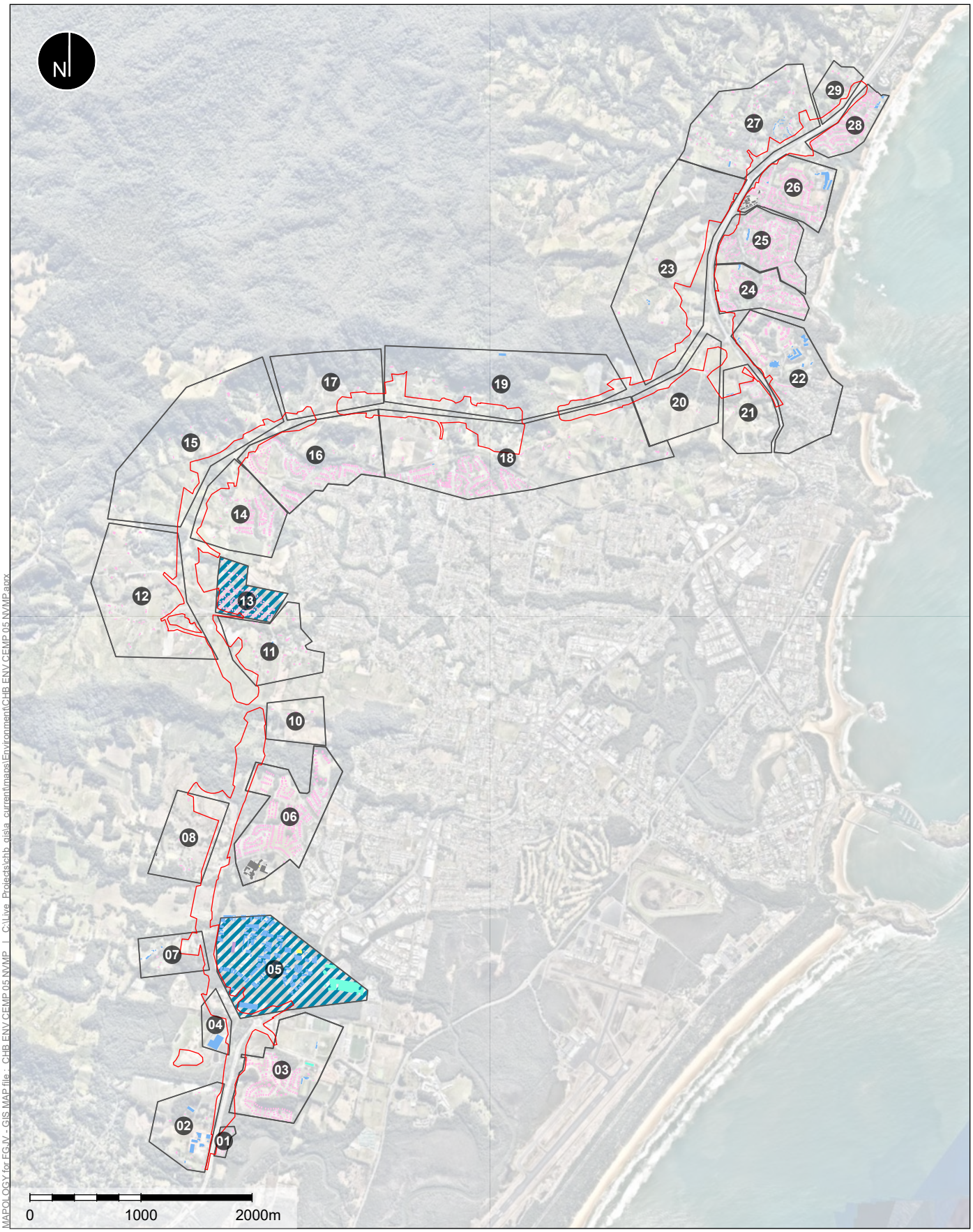
- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID14 (Road works)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
Residential																		
NCA01.RES	0	0	0	0	0	0	0	0	6	1	0	0	1	20	6	0	27	24
NCA02.RES	0	5	0	0	2	5	0	0	6	4	1	0	1	7	5	0	12	6
NCA03.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA03.RES (unbuilt)	0	9	0	0	44	13	0	0	54	26	0	0	32	105	5	0	127	17
NCA05.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA06.RES	0	17	7	0	1	17	7	0	1	8	17	0	4	5	20	0	27	15
NCA06.RES (unbuilt)	0	83	0	0	28	87	0	0	34	102	7	0	41	96	19	0	161	6
NCA07.RES	0	2	1	0	1	2	1	0	0	3	1	0	1	2	1	0	4	1
NCA08.RES	0	5	2	0	0	5	2	0	0	5	2	0	0	6	1	0	7	0
NCA09.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA10.RES	0	1	0	0	1	1	0	0	2	1	1	0	2	1	1	0	2	0
NCA11.RES	0	1	0	0	5	2	0	0	14	18	0	0	9	25	1	0	25	0
NCA12.RES	0	7	10	2	14	8	10	2	0	23	9	7	0	22	8	9	39	13
NCA13.RES	0	38	6	0	53	50	6	0	0	111	15	5	0	87	38	6	131	21
NCA14.RES	0	15	0	0	64	21	0	0	15	92	2	0	15	92	2	0	102	0
NCA15.RES	0	6	1	0	4	7	1	0	2	8	4	0	2	8	4	0	13	1
NCA16.RES	0	3	0	0	11	4	0	0	21	18	1	0	21	18	1	0	43	0
NCA16.RES (unbuilt)	0	29	11	0	6	32	11	0	8	29	26	0	8	29	26	0	63	29
NCA17.RES	0	1	2	0	0	1	2	0	0	1	2	0	0	1	2	0	3	3
NCA18.RES	0	7	3	0	48	7	3	0	99	53	4	1	74	84	5	1	130	2
NCA19.RES	0	4	7	0	0	4	7	0	0	1	8	2	0	1	8	2	11	3
NCA20.RES	0	3	2	0	1	5	2	0	0	5	3	0	0	5	3	0	8	2
NCA21.RES	0	0	0	0	0	0	0	0	1	1	0	0	21	10	2	0	34	14

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID14 (Road works)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA22.RES	0	0	0	0	0	0	0	0	0	0	0	0	6	8	0	0	11	6
NCA23.RES	0	0	0	0	0	0	0	0	10	0	0	0	0	15	15	0	30	26
NCA24.RES	0	3	2	0	2	4	2	0	2	5	3	0	0	5	5	0	9	3
NCA25.RES	0	9	0	0	13	13	0	0	23	29	6	0	26	51	26	0	71	21
NCA26.RES	0	5	1	0	21	7	1	0	42	52	6	0	43	87	26	3	120	34
NCA27.RES	0	11	1	0	12	14	1	0	24	38	5	0	61	80	32	3	123	43
NCA28.RES	0	0	0	0	2	0	0	0	4	8	0	0	31	16	5	0	35	9
NCA29.RES	0	1	0	0	4	1	0	0	15	23	1	0	41	53	20	1	127	85
Commercial																		
NCA02.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA03.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA04.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA07.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA11.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA18.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA19.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA21.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA22.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA23.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA24.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA25.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA27.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA28.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Industrial																		

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID14 (Road works)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA04.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Hospital																		
NCA03.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Educational																		
NCA06.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA08.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.SCH	0	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Place of worship																		
NCA05.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA06.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Child Care Facilities																		
NCA05.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA13.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A

ANCILLARY SITE OPERATION



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

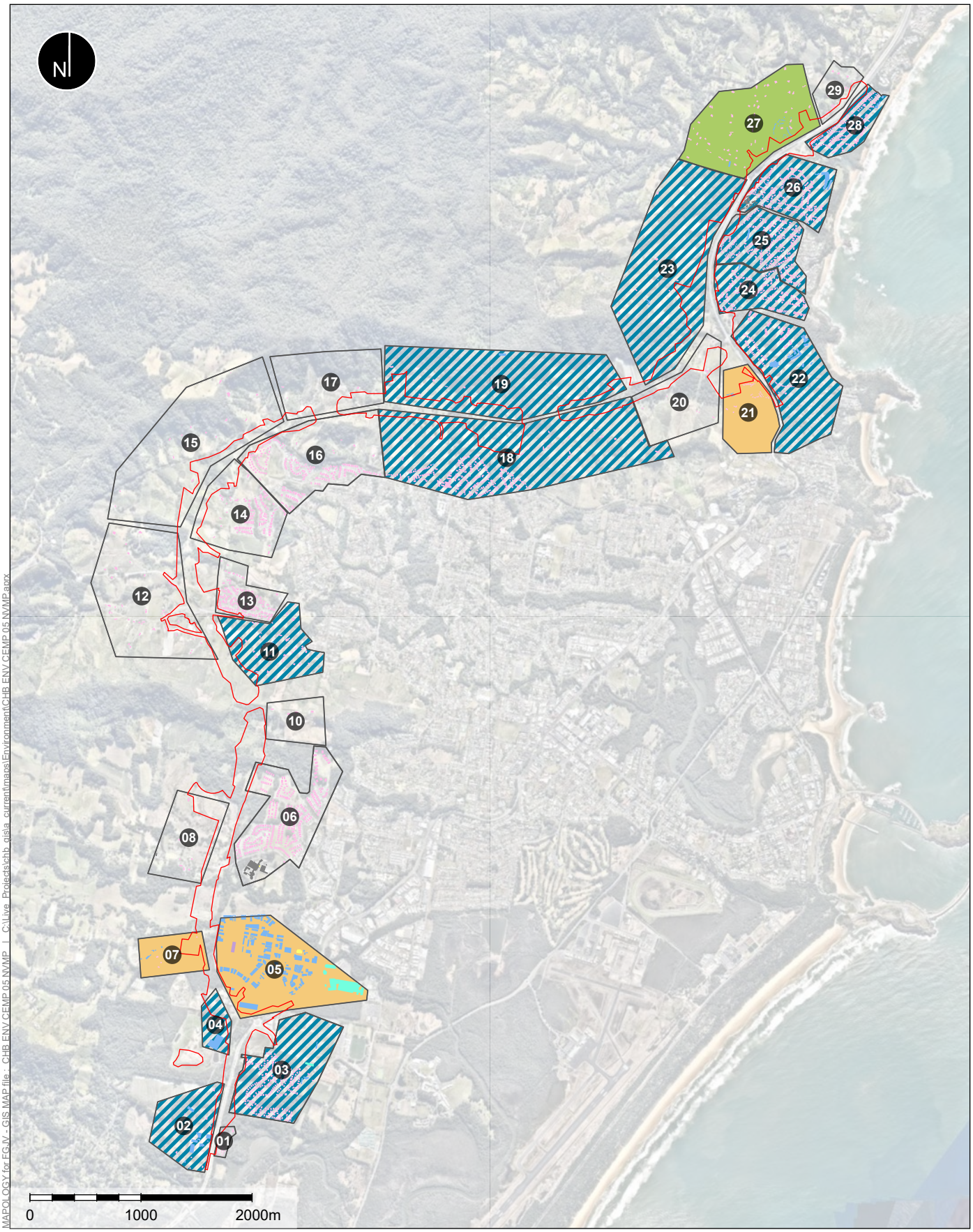
Noise Catchment Area

Risk Classification

- None
- n/a

Scenario: Ancillary sites
Receiver Type: Child Care Facility

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



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Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

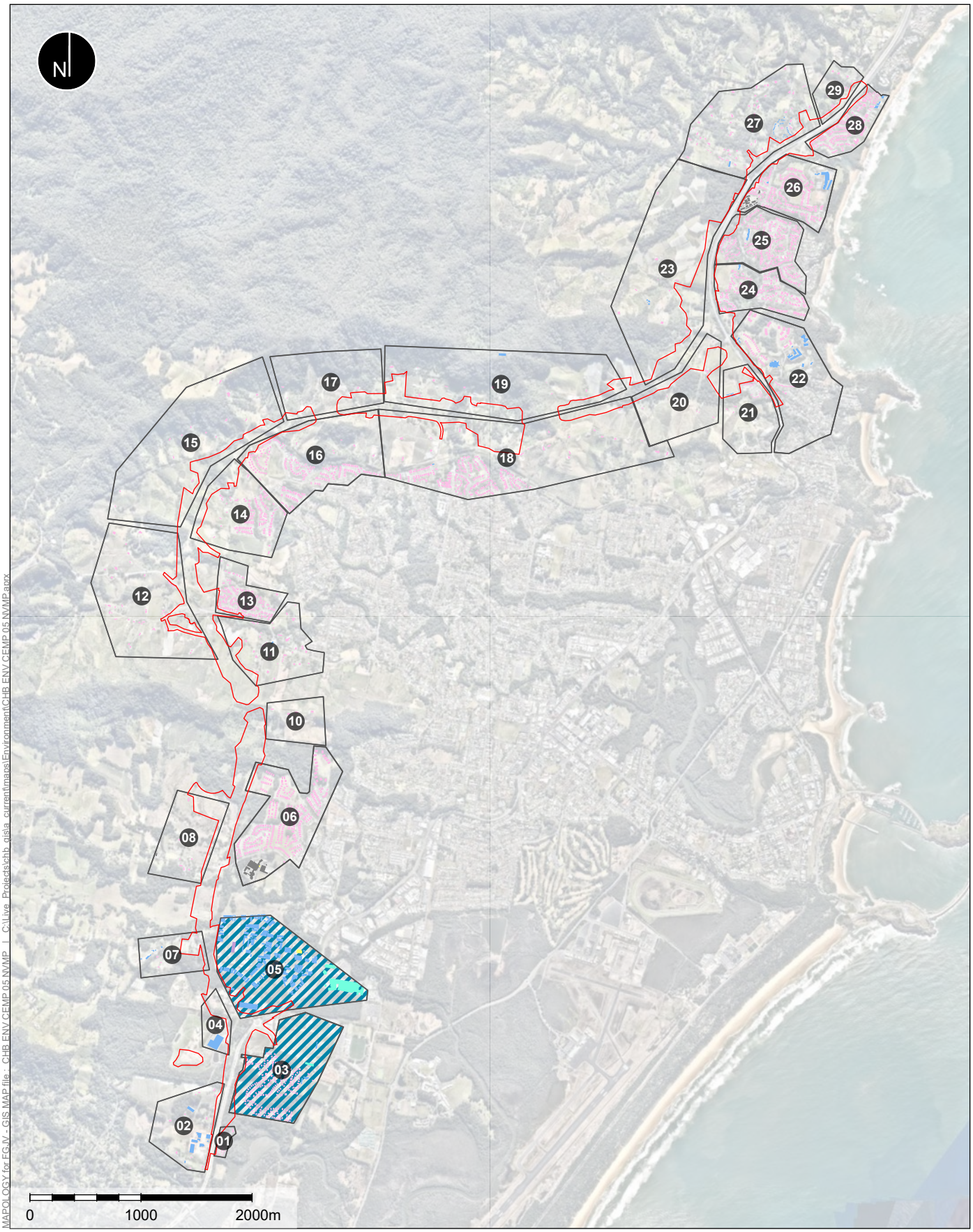
Noise Catchment Area

Risk Classification

- Medium
- Low
- None
- n/a

Scenario: Ancillary sites
Receiver Type: Commercial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

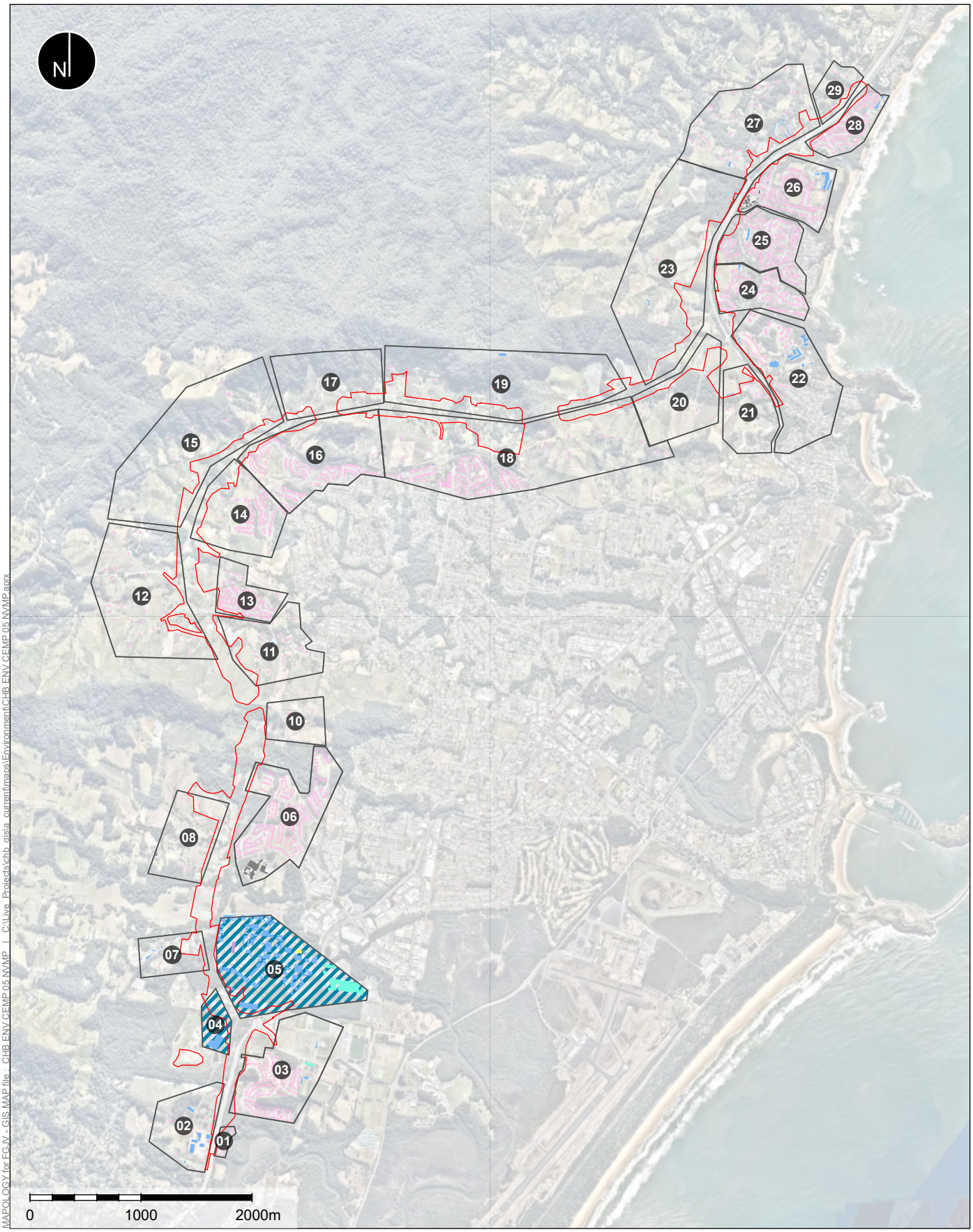
Noise Catchment Area

Risk Classification

- None
- n/a

Scenario: Ancillary sites
Receiver Type: Hospital

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

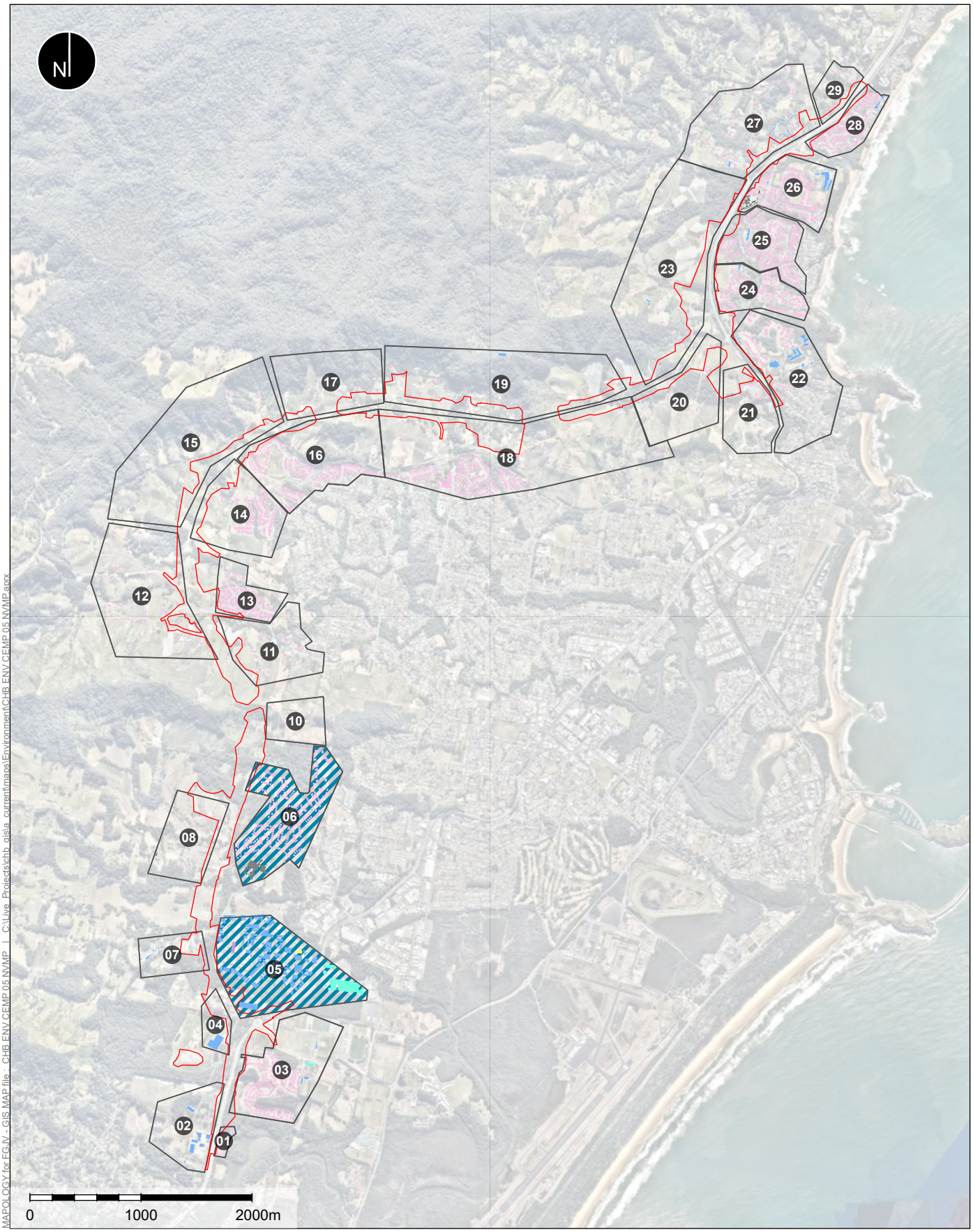
Noise Catchment Area

Risk Classification

- None
- n/a

Scenario: Ancillary sites
Receiver Type: Industrial

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

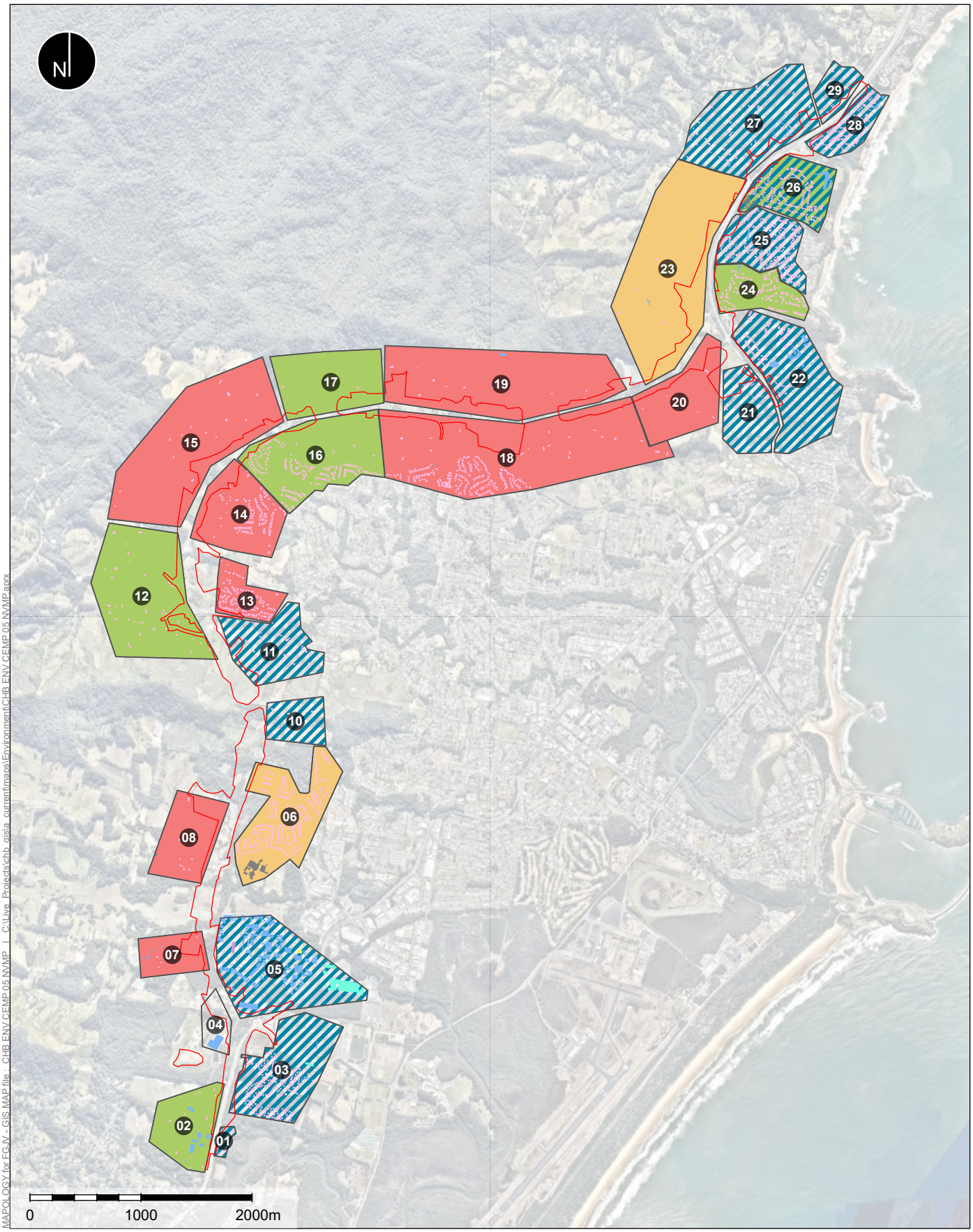
Noise Catchment Area

Risk Classification

- None
- n/a

Scenario: Ancillary sites
Receiver Type: Place of Worship

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

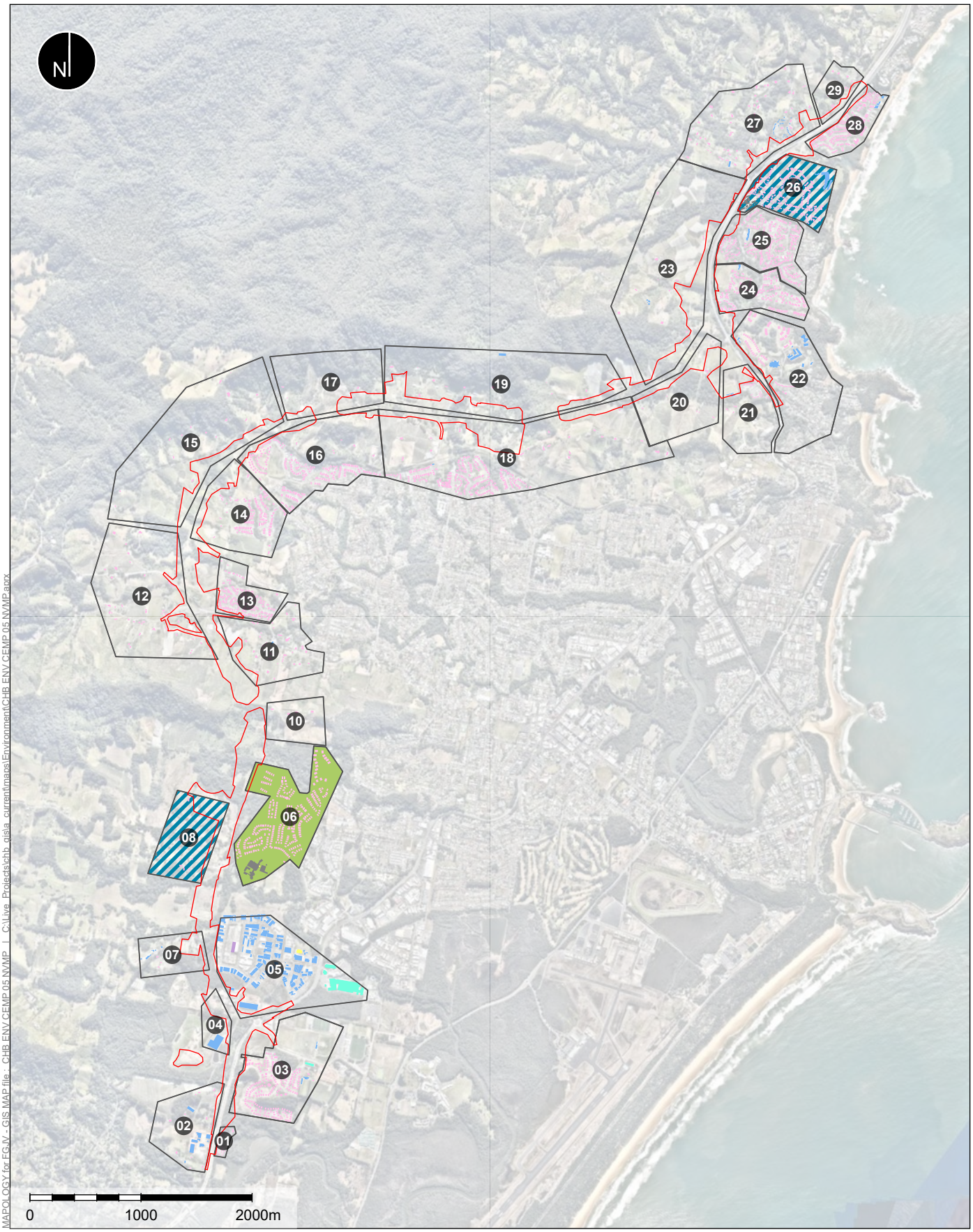
Noise Catchment Area

Risk Classification

- High
- Medium
- Low
- None
- n/a

Scenario: Ancillary sites
Receiver Type: Residential

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML



MAPOLOGY for FGJV - GIS MAP file : CHB ENV CEMP 05 NVMP | C:\Live_Projects\chb_gis\a_current\maps\Environment\CHB ENV CEMP 05 NVMP.aprx

Approved Construction Boundary – EIS (ARUP, 19/12/2019 as defined in the MCoA)

Sensitive receiver building type

- Commercial
- Hospital
- Industrial
- Place of Worship
- Residential
- School

Noise Catchment Area

Risk Classification

- Low
- None
- n/a

Scenario: Ancillary sites
Receiver Type: School

- Low = <10dB(A) exceedance of NML
- Medium = 10dB(A) to 20 dB(A) exceedance of NML
- High = >20dB(A) exceedance of NML

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID13 (Ancillary sites)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
Residential																		
NCA01.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA02.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA03.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA03.RES (unbuilt)	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0
NCA05.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA06.RES	0	19	6	0	0	19	6	0	9	14	11	0	15	12	13	0	16	0
NCA06.RES (unbuilt)	0	94	0	0	49	106	0	0	33	136	12	0	37	129	26	0	32	0
NCA07.RES	0	2	1	0	1	2	1	0	1	2	1	0	1	2	1	0	1	0
NCA08.RES	0	6	0	1	0	6	0	1	0	5	1	1	0	6	0	1	2	1
NCA09.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA10.RES	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0
NCA11.RES	0	0	0	0	0	0	0	0	19	10	0	0	9	26	0	0	0	0
NCA12.RES	0	4	0	0	16	5	0	0	6	32	1	0	3	34	2	0	8	0
NCA13.RES	0	43	14	1	24	52	14	1	20	75	27	9	7	66	45	13	79	14
NCA14.RES	0	72	12	1	8	89	12	1	0	75	34	1	0	75	34	1	37	0
NCA15.RES	0	4	5	0	1	4	5	0	0	4	7	1	0	4	7	1	8	1
NCA16.RES	0	0	0	0	11	1	0	0	49	20	0	0	49	20	0	0	0	0
NCA16.RES (unbuilt)	0	7	0	0	14	13	0	0	12	32	0	0	12	32	0	0	7	0
NCA17.RES	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0
NCA18.RES	0	54	2	0	30	62	2	0	46	64	30	0	72	64	34	1	87	2
NCA19.RES	0	4	2	0	1	6	2	0	2	6	3	0	2	6	3	0	9	0
NCA20.RES	0	2	0	1	5	2	0	1	0	6	1	1	0	6	1	1	7	1
NCA21.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID13 (Ancillary sites)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA22.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA23.RES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA24.RES	0	2	2	0	1	2	2	0	3	2	2	1	1	4	2	2	6	3
NCA25.RES	0	0	0	0	0	0	0	0	8	0	0	0	13	17	0	0	4	0
NCA26.RES	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
NCA27.RES	0	0	0	0	0	0	0	0	6	2	0	0	40	33	0	0	10	0
NCA28.RES	0	0	0	0	2	0	0	0	4	6	0	0	17	9	6	0	10	3
NCA29.RES	0	0	0	0	0	0	0	0	3	0	0	0	8	5	0	0	3	0
Commercial																		
NCA02.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA03.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA04.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.COM	0	4	0	0	1	3	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA07.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA11.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA18.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA19.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA21.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA22.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA23.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA24.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA25.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA27.COM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA28.COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Industrial																		

NCAs and receiver types	Number of receivers exceeding NMLs and sleep disturbance criteria – Construction Activity ID13 (Ancillary sites)																	
	All Hours	Standard Hours			Outside of Standard Hours												Sleep Disturbance	
		Daytime			Daytime				Evening				Night				Night	
	Highly noise affected >75dB(A)	Clearly audible <NML+10	Moderately intrusive <=NML+20	Highly intrusion >NML+20	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Noticeable <NML+5	Clearly audible <NML+15	Moderately intrusive <=NML+25	Highly intrusive >NML+25	Screening criterion RBL+15	Awakening criterion >65 dB(A)
NCA04.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.IND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Hospital																		
NCA03.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA05.HOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Educational																		
NCA06.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA08.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA26.SCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Place of worship																		
NCA05.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA06.POW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
Child Care Facilities																		
NCA05.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
NCA13.CCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A

APPENDIX 7 FGJV NOISE AND VIBRATION MONITORING PROGRAM

COFFS HARBOUR BYPASS

Noise and Vibration Monitoring Program

Revision E - Coffs Harbour Bypass

FERROVIAL GAMUDA JOINT VENTURE

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DOCUMENT DETAILS

Document Title	Noise and Vibration Monitoring Program
Project Name	Coffs Harbour Bypass
Client	Transport for New South Wales
Application No.	SSI-7666
Principal Contractor	Ferrovial Gamuda Joint Venture

DOCUMENT AUTHORISATION

	Name	Position	Signature	Date
Prepared by	Erran Woodward	FGJV Approvals Lead		
Approved by	Hari Corliss	FGJV Environment & Sustainability Manager		
Approved by	Daniel Perez	FGJV Project Director		
Approved by	Scott Lawrence	TfNSW Representative		
Endorsed by	John Hutchison	Acoustic Advisor		
Endorsed by	Duncan Thomson	Environmental Representative		

VERSION CONTROL

Revision	Date	Description	Approval
A	31/08/2022	For TfNSW and external review	
B	27/10/22	Updated to address Council, EPA, ER, AA and TfNSW comments	
C	2/12/2022	Updated following ER/AA review	
D	17/01/2023	Updated following ER/AA review	
E	16/02/2023	Updated following DPE comments	

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The document is uncontrolled when printed. One controlled hard copy of the CEMP and supporting documentation will be maintained by the Quality Manager at the project office and on the project website.

Copy No.	Issued to	Version
1		
2		
3		
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5		

GLOSSARY/ABBREVIATIONS

Abbreviation	Expanded Text
CNVMP	Construction Noise and Vibration Management Sub-Plan
CEMP	Construction Environmental Management Plan
DPE	Department of Planning and Environment
DPE, EESG	Department of Planning and Environment – Environment, Energy and Science Group
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPA	NSW Environment Protection Authority
EWMS	Environmental Work Method Statements
FGJV	Ferrovial Gamuda Joint Venture
GREP	Government Resource Efficiency Policy
MCoA	Minister's Condition of Approval
NVMP	Noise and Vibration Monitoring Program
POEO Act	Protection of the Environment Operations Act 1997
REMMs	Revised Environmental Management Measures
TfNSW	Transport for NSW

CONTENTS

TABLES

1 INTRODUCTION

1.1 CONTEXT

This Noise and Vibration Monitoring Program (NVMP) is an appendix to the Construction Noise and Vibration Management Sub Plan (CNVMP) that forms part of the Construction Environmental Management Plan (CEMP) for the Coffs Harbour Bypass (the Project).

The purpose of this Noise and Vibration Monitoring Program is to provide details on the baseline data available for Coffs Harbour, the parameters, frequency and location of monitoring required for the Project. This program will also outline the reporting requirements and any additional management and mitigation measures to be implemented on the Project. Monitoring undertaken during the construction phase of the project will verify the effectiveness of mitigation and management measures implemented to minimise potential noise and vibration impacts throughout construction of the Project.

Monitoring undertaken in accordance with this Monitoring Program will be completed throughout construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is greater.

1.2 BACKGROUND

The Coffs Harbour Bypass Environmental Impact Statement (EIS) (Chapter 9) considered the potential noise and vibration impacts during the construction of the project. The background of the Project is described in Section 1 of the CEMP.

The Project includes the construction of a 14-kilometre bypass of Coffs Harbour, including a 12-kilometre new build from south of Englands Road to Korora Hill in the north and a two-kilometre upgrade of the existing highway between Korora Hill and Sapphire. The Project would provide a four-lane divided highway that bypasses Coffs Harbour, passing through the North Boambee Valley, Roberts Hill and then traversing the foothills of the Coffs Harbour basin to the west and north to Korora Hill.

2 ENVIRONMENTAL REQUIREMENTS

Refer to the CNVMP for full list of legislation, regulation and standard mitigation measures applicable to noise and vibration monitoring. Table 2-1 details the MCoA specific to the Noise and Vibration Monitoring Program, and Table 2-2 details the REMMs applicable to this Program.

2.1 MINISTERS CONDITIONS OF APPROVAL

TABLE 2-1 MINISTERS CONDITIONS OF APPROVAL RELEVANT TO NOISE AND VIBRATION MONITORING PROGRAM

<table>
<tr><th>CoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>C13</td><td>The Construction Monitoring Programs in Table 4 must be prepared in consultation with the relevant government agencies identified for each to compare actual performance of construction of the CSSI against the performance predicted in documents listed in Condition A1 or in the CEMP.
<table>
<tr><th></th><th>Required Construction Monitoring Programs</th><th>Relevant government agencies to be consulted for each Construction Monitoring Program</th></tr>
<tr><td>(b)</td><td>Noise and vibration</td><td>EPA, Council</td></tr>
</table></td><td>Noise and Vibration Monitoring Program</td></tr>
<tr><td>C14</td><td>Each Construction Monitoring Program must provide:
(a) Details of baseline data available;</td><td>Section 3.2</td></tr>
<tr><td></td><td>(b) Details of baseline data to be obtained and when;</td><td>Section 3.2</td></tr>
<tr><td></td><td>(c) Details of all monitoring of the project to be undertaken;</td><td>Section 5, 6, 7, 8</td></tr>
<tr><td></td><td>(d) The parameters of the project to be monitored;</td><td>Section 5, 6, 7, 8</td></tr>
<tr><td></td><td>(e) The frequency of monitoring to be undertaken;</td><td>Section 5, 6, 7, 8</td></tr>
<tr><td></td><td>(f) The location of monitoring;</td><td>Section 5, 6, 7, 8</td></tr>
<tr><td></td><td>(g) The reporting of monitoring results;</td><td>Section 12</td></tr>
<tr><td></td><td>(h) Procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and</td><td>Section 10</td></tr>
<tr><td></td><td>(i) Any consultation to be undertaken in relation to the monitoring programs.</td><td>Section 2.4</td></tr>
<tr><td>C15</td><td>The Construction Monitoring Programs must be developed in consultation with relevant government agencies as identified in Condition C13 of this approval and must include 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.</td><td>Consultation records to be provided to DPE</td></tr>
<tr><td>C16</td><td>The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one month before the commencement of construction.</td><td>Document control and approvals detailed in CNVMP version control table</td></tr>
<tr><td>C17</td><td>Construction must not commence until the Planning Secretary has approved all of the required Construction Monitoring Programs, and all relevant baseline data for the specific construction activity has been collected.</td><td>Noted</td></tr>
</table>

C18	The Construction Monitoring Programs, as approved by the Planning 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 Planning Secretary, whichever is the greater.	Document control and approvals detailed in CNVMP version control table
C19	The results of the Construction Monitoring Programs must be submitted to the Planning 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 13

2.2 REVISED ENVIRONMENTAL MANAGEMENT MEASURES

TABLE 2-2 REVISED ENVIRONMENTAL MANAGEMENT MEASURES RELEVANT TO THIS NOISE AND VIBRATION MONITORING PROGRAM

Ref#	Commitment	Timing	CNVMP Reference
NV01	A Noise and Vibration Management Plan will be prepared and implemented as part of the CEMP and in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime Services 2016a) and the Interim Construction Noise Guidelines (DECC 2009b). The plan will identify: • All potential significant noise and vibration generating activities associated with the activity • Measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, respite periods, staging, placement and operation of ancillary facilities, temporary noise barriers, haul road maintenance, and controlling the location and use of vibration generating equipment • A monitoring program to assess performance against relevant noise and vibration criteria • Process for the implementation of respite periods to provide residents with respite from ongoing impact • Arrangements for consultation with affected receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Prior to and during construction	Section 4 Section 8 Section 4 Section 5 Section 8
NV04	Where vibration generating activities will be carried out within minimum working distances for cosmetic damage, vibration monitoring will be carried out. Where monitoring indicates cosmetic damage criteria are exceeded, alternative low-vibration work practices will be investigated and implemented.	During construction	Section 6

2.3 ENVIRONMENTAL PROTECTION LICENSE

An Environmental Protection License (EPL) will be sought for the Project. Upon award, this Program will be updated to reflect any license requirements or conditions applicable to noise and vibration monitoring.

2.4 CONSULTATION

In accordance with MCoA C13, this Noise and Vibration Monitoring Program has been developed in consultation with the relevant government agencies including:

- NSW EPA
- Coffs Harbour Council.

Records and evidence of consultation is included in the CNVMP.

3 EXISTING ENVIRONMENT

3.1 AMBIENT NOISE AND VIBRATION CONDITIONS

The Project is predominately located within a rural landscape surrounding Coffs Harbour. The existing Pacific Highway is the main source of sound in a sound environment that is mainly characteristic of a rural area. The ambient noise levels are influenced by road traffic during the day from the existing Pacific Highway, which has less of an influence during the evening and night-time periods. Areas of the project situated further from the existing Pacific Highway have a sound environment dominated by influences from flora and fauna, have little discernible difference between daytime and night-time ambient noise levels. The CNVMP provides additional information on the existing environment.

3.2 BASELINE MONITORING DATA

As part of the EIS, background noise monitoring was undertaken during two long-term monitoring sessions in 2016. The EIS noise monitoring data has been supplemented by more recent data collected in June and October/November 2021, as reported in *Coffs Harbour Bypass Additional Noise Monitoring Report* (Renzo Tonin & Associates, 29 July 2022). The data collected during this supplementary noise monitoring is considered representative of the current noise environment and is applicable for the purposes of the noise assessment.

The supplementary noise monitoring locations were selected as representative noise environments for each of the identified Noise Catchment Areas (NCAs) within and around the Project. Furthermore, this monitoring has determined the Rating Background Level (RBL) for each period of the day (day, evening and night) and is referenced when determining the applicable Noise Management Levels (NMLs) discussed further in Section 9.1.

No further baseline monitoring is proposed at this time.

4 NOISE AND VIBRATION GENERATING ACTIVITIES

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. Chapter 4 of the EIS and Volume 3 of the Amendment Report identified a number of construction scenarios comprising typical plant and equipment frequently used on road projects and calculated plant item sound power levels.

The broad categories of construction activity likely to interact with these receivers are identified below in Table 3.

TABLE 3 PROPOSED CONSTRUCTION ACTIVITIES

Component	Typical activity	Typical Plant & Equipment
Preconstruction and site establishment	• Property acquisition and adjustments, including property access changes • Detailed investigations and survey work including investigative drilling, contamination • Condition surveys and dilapidation assessments • General site clearance, site establishment work, fencing and signage • Establishment of temporary ancillary facilities and compound sites including the site office • Temporary traffic management arrangements including construction of minor access roads • Progressive installation of environmental controls including temporary or permanent fencing, and erosion and sediment control measures • Construction of temporary drainage controls including temporary creek crossings • Clearing and removal of vegetation (nonthreatened species) • Threatened flora translocation • Heritage area investigation and salvage • Relocation and/or protection of utilities.	• Trucks • Generators • Light vehicles • Excavators • Chainsaws • Mulchers • Water carts • Cranes • Drilling rigs
Site preparation and bulk earthworks	• Clearing and grubbing of vegetation • Mulching of vegetation for re-use in landscaping activities, where possible • Stripping topsoil and stockpiling it for reuse in landscaping • Excavation of cuttings, including processing, stockpiling or haulage of material, and • stabilisation of batters • Drilling of blast holes • Establishment of crushing plant • Crushing and screening excavated material • Hauling materials from excavated cuttings, borrow sites and external sources to fill embankment locations • Construction of fill embankments and earth mounds, including foundation drainage • Benching and stabilising cut and fill batter slopes	• Trucks • Bulldozers • Excavators • Compactors • Graders • Scrapers • Loaders • Water carts • Harvesters • Vegetation mulchers • Compactors • Vibratory rollers • Rock breakers/hammers • Drilling and blasting
Drainage and structures	• Construction of drainage, including kerb and gutter (where required) • Installation of cross-drainage, including culverts and inlet and outlet work, such as • channel diversions and scour protection • Installation of longitudinal and vertical drainage in cuttings and embankments • Construction of diversion and catch drains along the formation and sedimentation control • basins or swales (where required) • Construction of subsurface drainage • Construction of any retaining walls • Installation of fauna connectivity structures	• Concrete pumps • Piling rigs • Concrete trucks • Cranes • Excavators • Trucks • Cherry pickers • Welding equipment

	• Establishment of portal sites in preparation for tunnel excavation, including provision of • temporary tunnel services • Excavation of tunnel portals • Excavation of mined tunnels using drilling and blasting equipment for hard rock • Excavation of cross passages • Finishing works in tunnel and provision of permanent tunnel services • Test tunnel plant and equipment	• Drilling and blasting equipment for hard rock • Trucks • Tunnelling equipment • Excavators • Bulldozers • Graders • Paving machines • Light vehicles • Small cranes • Elevated working platform • Generators
Demolition	• Demolition of bridges (Luke Bowen footbridge and northbound carriageway bridge over Pine Brush Creek) • Demolition of buildings (properties and sheds).	• Trucks • Bulldozers • Excavators • Light vehicles • Concrete saws • Jack hammers
Road work and road surfacing	• Construction of temporary local traffic management • diversions • Construction of base and select layers of materials • Paving works • Construction of road surface drainage, including kerb and gutter (where required) • Construction of concrete barriers, wire rope fencing and guardrails • Installation of traffic lights, road markings, signposting, roadside furniture and lighting • Progressive landscaping and tree planting.	• Graders • Backhoes • Trucks • Water carts • Vibratory compactors • Bitumen sprayers • Rollers • Concrete trucks • Concrete pumps • Concrete saws • Compressors • Bitumen sprayers • Milling machines • Paving machines • Asphalt trucks • Curing machines. • Generators
Finishing work	• Remove temporary work • Restoration and landscaping of temporary sites • General site clean-up • Restoration of topsoil and revegetation of batters • Removal of temporary environmental controls • Site clean-up and demobilisation, including restoration of ancillary sites and construction access roads (where required).	• Trucks • Generators • Light vehicles • Cranes.
Ancillary Facilities (operation of ancillary facilities)	• Office accommodation • Staff amenities • Light vehicle parking • A plant and equipment maintenance workshop • Material and chemical storage. • Crib sheds and minimal office accommodation • Concrete and asphalt batching plants • Equipment storage • Material storage • Materials processing such as crushing and screening, mulching of vegetation and Acid Sulfate Soil treatment	• Trucks • Generators • Light vehicles • Lighting towers

The potential for noise and vibration impacts on sensitive receivers or structures will depend on a number of factors. Typically, these might include:

- The type of equipment in use
- The number of equipment simultaneously in use
- Ground conditions
- Topography and other physical barriers

- Proximity to sensitive receivers
- The condition of sensitive receivers
- Hours/duration of construction works
- Proximity of heavy traffic areas such as the highway.
- Relevant aspects and the potential for related impacts have been considered in a risk assessment
- as part of the EIS.

Noise and vibration impact attributable to the project are anticipated. Refer to the CNVMP for an assessment of the likely noise and vibration impacts associated with the construction of the Project (refer to Section 7).

5 AIRBORNE NOISE MONITORING

5.1 FREQUENCY AND LOCATION OF AIRBORNE NOISE MONITORING

The frequency and location of airborne monitoring would be dependent on the purpose of monitoring and is likely to change for each event, as described further below.

Where possible, monitoring will be undertaken at the most affected noise sensitive receiver's location in proximity to the construction activities. Noise monitoring locations will consider factors including:

- The location of previous monitoring sites
- The proximity of the receiver to a Project worksite
- Availability of power and security
- The sensitivity of the receiver to noise
- Background noise levels
- The expected duration of the impact.

Some locations may be the boundary of construction sites while others may be within the property of sensitive receivers, where access is granted.

In accordance with the ICNG the duration and amount of noise monitoring will depend on the scale of the construction activities and extent of expected noise impacts. Noise monitoring will cover a representative period of the construction activity.

5.2 ATTENDED AIRBORNE NOISE MONITORING

Construction Noise Monitoring

Noise monitoring for the Project will be undertaken to quantify the airborne or ground borne noise levels associated with construction activities as follows:

- at the commencement of works in new locations, such as a new NCA not previously affected (as identified in the Noise Assessment Maps included in the CNVMP),
- At the commencement of each new construction activity which has been assessed in the CNVMP, to confirm assessment accuracy.
- where changes in construction activities occurs which may cause significant increase in noise impacts,
- to spot check (confirm) plant and equipment Sounds Power Levels (SWL) (minimum of around once per quarter)
- in the event of a noise complaint
- as identified as a requirement in a construction noise and vibration impact assessment
- for noise assessment validation, especially in the case of Out of Hours Works where monitoring is determined to be required.

Attended noise monitoring will be conducted by using a handheld Type 1 or Type 2 sound level meter (SLM) that is within calibration, in accordance with the relevant industry guidelines and standards.

A field calibration will be conducted prior to and after all measurements to ensure the SLM is in good working order. If the noise level recorded during the post-measurement check differs by more than 1.0 decibel from the noise level recorded during the pre-measurement check, all measurements made in the intervening period must be disregarded.

Measurements will be completed usually over a 15-minute time period, with the sound level meter mounted to a tripod, where possible, at 1.2 - 1.5 m above the ground and with a windscreen fitted.

During monitoring, records of all significant noise events will be taken, along with meteorological and environmental conditions. Other details that will be recorded during the monitoring session include the time of the measurement, the plant and equipment being used at the time of the monitoring, and a map should be developed of the monitoring location and the applicable work fronts and dominant noise sources.

The relevant measurement parameters should be recorded at the end of each monitoring session, such as LAeq, LAmin, LAmax, LA1, LA10 and LA90. All noise samples shall be recorded as A-weighted levels, using the “fast” time response of the sound level meter.

Plant and Equipment Spot Checks

For spot checks of noise intensive plant and equipment, duration of monitoring will depend on the source of noise being monitored. Sources of continuous noise (such as generators), measurements will be monitored over one-to-two-minute intervals. For dynamic plant, such as front-end loaders, spot checks will capture a representative activity, such as one truck-and-dog load cycle.

Monitoring will be undertaken in line with applicable standards including:

- AS2012–1990 Acoustics – Measurement of Airborne Noise Emitted by Earthmoving Machinery and Agricultural Tractors – Stationary Test Condition Part 1: Determination of Compliance with Limits for Exterior Noise
- International Standard ISO 3740:2019 Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards

5.3 UNATTENDED AIRBORNE NOISE MONITORING

Unattended noise monitoring may be used to provide real-time monitoring throughout construction works or may be used in place of attended noise monitoring, where it is deemed appropriate.

When unattended noise monitoring is completed, monitoring results will be compared against a log of activities recorded during the monitoring period. This can be used to determine whether project activities are influencing noise levels at the monitoring location.

During unattended monitoring, noise loggers will record audio (triggered by noisy events) to allow for the identification of construction noise contribution and the presence of any extraneous noise, if privacy concerns can be overcome.

Unattended monitoring may be used for two separate purposes as outlined below.

Compliance based unattended monitoring

Where the Project uses unattended monitoring to assess compliance of construction activities, a Class 1 or Class 2 instrument will be used, and calibrations will be maintained in accordance with the manufacturers guidelines.

Construction management unattended monitoring

The Project may use unattended monitoring to evaluate the source of construction noise (i.e. time/direction) to assist in investigation of complaints, to establishment long term trends in construction noise and to monitor site activities in general. In these circumstances, monitoring equipment may include devices that are not Class 1 or Class 2 instruments, for example Site Hive Hexanodes. Where this kind of unattended monitoring is utilised, the instruments would be calibrated in accordance with the manufacturers specifications.

5.4 GENERAL AIRBORNE NOISE MONITORING REQUIREMENTS

Where possible, the monitoring location should not be within 3m of any reflective structure or wall. Where it is not possible to measure more than 3m from any reflective structure or wall, a reduction of up to 2.5 dB will be applied to the measured noise level ($L_{Aeq(15\ minutes)}$) to account for the likely increase in noise associated with reflective surfaces.

Monitoring should not be complete during time when wind speeds exceed 5 m/s at the microphone or during any rain events.

For each monitoring event, the following information will be recorded:

- Date and time of measurements,
- Name of person undertaking the measurements,
- Type and model number of instruments
- Sample times, measurement time intervals and time of day
- Map of area showing measurement location, source location and sensitive receivers
- Measurement location details and number of measurements at each location
- Construction activities being undertaken during the monitoring session
- List of the plant and equipment operating during the monitoring session.

Where the monitored level is higher than the NML or predictions, the reasons for non-compliance should be stated, and strategies for minimising noise identified and stated, and the appropriate actions to implement the strategies.

Where high background noise levels obscure construction noise contribution during attended noise measurements, operators will either:

- Measure closer to the source and calculate back to the required position
- Measure with the source noise off and then on (where possible) and calculate the difference
- Use the ‘pause and back-erase feature on the sound level meter to try to exclude as much of the extraneous noise as possible.

6 GROUND-BORNE NOISE MONITORING

6.1 FREQUENCY AND LOCATION OF GROUND-BORNE NOISE MONITORING

The need for ground-borne noise (GBN) monitoring would be determined by noise modelling predictions included in the CNVMP for the Tunnelling activity, and would be undertaken where prediction indicate an exceedance of NML criteria. Additionally, the offer of monitoring may form part of the response to complaints.

Where monitoring is not triggered by complaint, monitoring would be completed at representative receivers where tunnelling is predicted to exceed the NML and where access is granted. Frequency of GBN monitoring would be dependent on access to affected residences; however, in this way, regular verification of predicted GBN can be completed.

Most GBN monitoring will be unattended since monitoring is usually completed within a private residence and typically at night. In these cases, noise loggers may be left in place over night and picked up at a mutually agreed time with the resident.

Attended monitoring of ground-borne construction noise levels may be undertaken, where appropriate, in response to noise-related complaint (determined on a case-by-case basis), where access for unattended monitoring is not granted and the resident would prefer to be present.

6.2 GROUND BORNE NOISE MONITORING METHODOLOGY

Monitoring will be undertaken in the most affected habitable room of the residence or other sensitive building and will be conducted in conjunction with vibration measurements whenever practicable.

Ground-borne noise monitoring will be recorded over 15-minute sample intervals, where every 15 minutes the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in the memory for later retrieval include the following A-weighted noise levels: LA90, LAeq, LA1 and LA (max).

Measurements taken inside buildings should be at least one metre from walls or other reflective surface, and about 1.5 metres from windows, where such instrument siting is possible.

The room selected for noise monitoring should be well shielded from airborne noise intrusions, such as road traffic noise to allow the ground-borne noise to dominate over non-construction generated airborne noise.

There may be instances where the resident does not allow access to monitor in the most suitable habitable room. In these instances, effort will be made to monitor at the next most suitable available room or location, noting this in the monitoring form.

Noise loggers will record audio to allow for identification of the construction noise contribution and the presence of any extraneous noise provided privacy concerns can be overcome. Where the resident or receiver will not allow the noise logger to record audio, attended noise monitoring will be offered where appropriate.

Measurements will be carried out by an appropriately trained and competent person in the measurement and assessment of construction noise and vibration.

7 OUT OF HOURS WORK NOISE MONITORING

Where out-of-hours works (OOHW) are undertaken, noise monitoring including a visual inspection of the activities may be undertaken as identified by the OOHW Permit, including to:

1. Ensure noise mitigation measures specified in the approved application are appropriately implemented
2. Verify assumptions and model outcomes of the OOHW works (i.e. predicted noise levels)
3. Any necessary additional measures are identified and implemented where reasonable and feasible.

Where OOHW monitoring is required, this will be conducted as soon as practicable (e.g. preferably first night) during the approved works and would generally involve attended monitoring.

Personnel carrying out monitoring will consider the actual versus proposed equipment in use and confirm proposed physical mitigation measures (such as noise shielding and enclosures) are being implemented in accordance with the OOHW Permit.

Monitoring results will be compared with predicted levels to establish the accuracy of predicted noise and inform future predictions. Where the need for additional controls is identified, these will be implemented as soon as possible as actions undertaken in response to monitoring results.

8 VIBRATION MONITORING

8.1 FREQUENCY AND LOCATION OF VIBRATION MONITORING

Where possible, monitoring will be undertaken at the most affected vibration sensitive receiver's location in proximity to the construction activities. Vibration monitoring locations will consider factors including:

- The location of previous monitoring sites
- The proximity of the receiver to a Project worksite and consideration of safe working distances
- Availability of power and security
- The sensitivity of the receiver to vibration
- The expected duration of the impact.

Some locations may be the boundary of construction sites while others may be within the property of sensitive receivers, where access is granted.

8.2 ATTENDED VIBRATION MONITORING

Attended vibration monitoring is to be undertaken as follows:

- At the commencement of high vibration emitting plant machinery operation that:
  - Is operating within safe working distances
  - Modelling indicates exceedance
  - Screening criteria is likely to be exceeded at buildings, structures, utilities and the like.
- At the commencement of vibration generating activities that have the potential to impact on heritage items to confirm/identify the minimum working distances to prevent cosmetic damage as per CoA E44
- Where appropriate in response to a vibration related complaint(s) (determined on a case-by- case basis)

Vibration monitoring will be undertaken in accordance with the relevant vibration measurement requirements in the reference standards and documents in Section 1.4. Monitoring results will be assessed against relevant standards as follows:

- Where human comfort is a concern, Tables 2.2 and 2.4 of the EPA's Assessing Vibration – a technical guideline
- Where property damage is a concern, British Standard 7385-2:1993
- For heritage structures BS7385-2:1993 does not provide numerical vibration levels to prevent structural damage, refer to criteria and safe working distances for property damage.

Vibration monitoring shall be undertaken in accordance with the vibration measurement requirements stipulated in the reference standards and documents listed above, including the following aspects of mounting the device.

- Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest, closest to the vibrating plant
- The surface should be solid and rigid to best represent the vibration entering the structure of the building under investigation
- The vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces
- The vibration sensor or transducer shall be directly mounted to the vibrating surface using either bees wax or a magnetic mounting plate onto a steel washer, plate or bracket which shall be either fastened or glued to the surface of interest
- Where a suitable mounting surface is unavailable, then a metal stake of at least 300mm in length shall be driven into solid ground adjacent to the building of interest and the vibration sensor or transducer shall be mounted on that.

For each monitoring event, the following information shall be recorded:

- Date and time of measurements
- Name of person undertaking the measurements
- Type and model number of instruments

- Sample times, measurement time intervals and time of day
- Map of area showing measurement location, source location and sensitive receivers
- Measurement location details and number of measurements at each location
- Operation and load conditions of the plant under investigation.

Monitoring will be undertaken using tri-axial geophones or accelerometers, which measure vibration as velocity and/or acceleration in three axes.

8.3 UNATTENDED VIBRATION MONITORING

Where monitoring is planned to extend over a longer period than practicable for attended monitoring, such as when works will remain within the safe minimum working distance to prevent cosmetic damage, the monitoring instrumentation will be fitted with the ability to warn plant operators via flashing light, SMS, or email that vibration is approaching levels and where there is potential for cosmetic damage to buildings and structures.

Where unattended vibration monitors are left in place on a private property, they will be picked up at a mutually agreed time with the resident.

Vibration data will be processed statistically and stored in memory. The metric determined for recorded would be appropriate to enable comparison to relevant vibration criteria.

All short term attended vibration monitoring will be recorded over a representative sampling interval where the worst-case vibration levels can be captured. Where unattended vibration monitoring is proposed, monitoring will be undertaken continuously whilst the vibrating plant is operational to capture the worst-case vibration levels within the pre-determined 'minimum working distance' from the potentially affected building.

Ideally, vibration would be measured directly on a structure. Where access is not available, vibration will, at times, be monitored in proximity to the equipment and measured levels extrapolated to the nearest structure based on the following equation for geometric damping (conservatively ignoring material damping).

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

Where:

PPV – Peak Particle Velocity at the source (PPV1) and Receiver (PPV2)

R – distance from source of reference level (R1) and distance from source of receiver (R2)

n – ground factor assumed as 1 for body waves

For human comfort, intermittent vibration is assessed using the vibration dose concept which relates to vibration magnitude and exposure time. Acceptable values for intermittent vibration, in terms of vibration dose values (VDV), require the measurement of the overall weighted Root Mean Square (RMS) acceleration levels over the frequency range 1 Hz to 80 Hz. To calculate VDV the following formula is used:

$$VDV = \left[\int_0^T a^4(t)dt\right]^{0.25}$$

Where:

VDV - vibration dose value in $m/s^{1.75}$

a (t) - the frequency-weighted rms of acceleration in m/s^2

T - the total period of the day (in seconds) during which vibration may occur.

9 NOISE AND VIBRATION CRITERIA

9.1 NOISE MANAGEMENT LEVELS

Noise management levels (NMLs) are provided in the CNVMP and have been determined through background monitoring providing RBLs for each NCA.

The ICNG approach for determining the construction NMLs for residential receivers based on the measured Rating Background Level (RBL) has been used to develop project NMLs for standard construction hours and periods outside of standard hours. The ICNG establishes “Noise affected” and a “Highly noise affected” construction NMLs to determine the noise management requirements necessary to minimise the construction noise impacts upon noise sensitive residential receivers. Measured noise data obtained at the logger location most representative of each noise catchment area has been used to derive appropriate construction NML’s for the project as part of the EIS.

For the assessment of noise disturbance that could potentially cause awakening reaction during out of hours work, the ICNG recommends that where construction works are planned to extend over more than two consecutive nights, maximum noise levels should be considered.

As per the ICNG, further guidance is taken from the *Environmental Criteria for Road Traffic Noise* (EPA 2011), which describes sleep disturbance assessment with a screening level of LAmax ≤ LA90(15min) + 15 dB(A).

Where there are noise events found to exceed the initial screening level, further analysis is made to identify:

- The likely number of events that might occur during the night assessment period, and
- Whether events exceed an 'awakening reaction' level of LAmax 55 dB(A) (internal), which equates to NML of 65 dB(A) (assuming open windows).

Table 4 below summarises the calculated NML’s and sleep disturbance criteria for working periods at each Noise Catchment Area across the project alignment. Refer to Appendix A of the CNVMP for the mapped location of the Noise Catchment Areas.

TABLE 4 NMLS FOR THE PROJECT NOISE CATCHMENT AREAS

Location	Logger ID	RBL, dB(A) (Refer to Section 2.2) 1			Construction NMLs, $dBL_{Aeq\ 15minute}$					Sleep Disturbance dBL_{Amax}	
					Standard Hours		Outside Standard Hours				
					Highly Noise Affected	Noise affected (RBL + 10dB)	Noise affected (RBL + 5dB)			Screening criterion RBL + 15	Max
		Daytime	Evening	Night time	Standard Hours Day[3]	Standard Hours Day[3]	OOSH Day[4]	OOSH Evening[4]	OOSH Night time [4]		
Residential											
											65
NCA 2	1	47	45	39	75	57	52	50	44	54	65
NCA 3	1	47	45	39	75	57	52	50	44	54	65
NCA 4	1	47	45	39	75	57	52	50	44	54	65
NCA 5	2	35	32	31	75	45	40	37	36	46	65
NCA 6	2	35	32	31	75	45	40	37	36	46	65
NCA 7	3	42	40	38	75	52	47	45	43	53	65
NCA 8	3	42	40	38	75	52	47	45	43	53	65
NCA 9	20	35	30	30	75	45	40	35	35	45	65
NCA 10	20	35	30	30	75	45	40	35	35	45	65
NCA 11	4	39	32	30	75	49	44	37	35	45	65
NCA 12	5	37	31	30	75	47	42	36	35	45	65
NCA 13	4	39	32	30	75	49	44	37	35	45	65
NCA 14	12	35	30	30	75	45	40	35	35	45	65
NCA 15	6	35	30	30	75	45	40	35	35	45	65

NCA 16	16	35	30	30	75	45	40	35	35	45	65
NCA 17	19	35	30	30	75	45	40	35	35	45	65
NCA 18	13-7[2]	35	31	30	75	45	40	36	35	45	65
NCA 19	19	35	30	30	75	45	40	35	35	45	65
NCA 20	13-7[2]	35	31	30	75	45	40	35	35	45	65
NCA 21	8	65	53	68	75	75	70	58	53	53	65
NCA 22	L12	42	38	36	75	52	48	43	41	51	65
NCA 23	18	43	38	34	75	53	48	43	39	49	65
NCA 24	L13	48	48	45	75	58	53	52	50	60	65
NCA 25	9	48	40	34	75	58	53	45	39	49	65
NCA 26	15	52	46	37	75	58	53	45	39	49	65
NCA 27	L15	51	51	44	75	61	56	56	49	59	65
NCA 28	10	60	50	42	75	70	65	55	47	57	65
NCA 29	L15	51	51	44	75	61	56	56	49	59	65
Commercial	-	Use Hours			-	70				-	-
Educational	-	Use Hours			-	55				-	-
Hospital	-	Use Hours			-	45				-	-
Place of worship	-	Use Hours			-	55				-	-
Childcare facilities	-	Use Hours			-	45				-	-

Note 1: The RBLs have been adjusted in accordance with the NPI definition of minimum RBLs (daytime – 35 dB(A), Evening – 30 dB(A), Night-time – 30 dB(A)) Note 2: Minimum of monitoring location 7 and 13
Note 3 - 07:00-18:00 Monday to Friday, 08:00-13:00 Saturday Note 4 - Outside Standard hours – Day 13:00-18:00 Saturday, 08:00-18:00 Sunday Note 5 -Outside Standard hours – Evening: 18:00-22:00 Monday to Sunday Note 6 - Outside Standard hours – Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays.

9.2 VIBRATION MANAGEMENT LEVELS

9.2.1 STRUCTURAL DAMAGE

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard 7385 part 2 (BS7385-2).

The British Standard BS 7385-2 sets limits for the protection against the different levels of structural damage, which are provided in Table 9-5 below.

TABLE 9-5 BS 7385-2 STRUCTURAL DAMAGE CRITERIA

Group	Type of Structure	Peak component particle velocity, mm/s[1]		
		4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50		
2	Un-reinforced or light framed structures residential or light commercial type buildings	15 to 20		50

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. The guide values in Table 5.9 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low rise buildings. Where the dynamic loading caused by continuous vibration from activities such as vibratory rolling and impact piling is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 5.9 may need to be reduced by up to 50%.

The DIN 4150 criteria for short term vibration is provided below in Table 9-6. For heritage buildings that have determined to be potentially structurally unsound, criteria associated with group 3 should be used.

TABLE 9-6 DIN 4150-3 STRUCTURAL DAMAGE CRITERIA – SHORT TERM VIBRATION

Group	Type of Structure	Vibration Velocity, mm/s			
		At foundation at frequency of			Vibration at horizontal plane of highest floor
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3		3	3 to 8	8 to 10	8

Note that short-term vibration is defined as vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance in the structure being evaluated.

Buried Services

DIN 4150-2:1999 sets out guideline values for vibration effects on buried pipework and reproduced in Table 9-7 below. Consultation should be undertaken with buried asset owners to confirm acceptable vibration limits.

TABLE 9-7 GUIDELINE VALUES FOR SHORT-TERM VIBRATION IMPACTS ON BURIED PIPEWORK

	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, prestressed concrete, metal (with oi without flange)	80
3	Masonry, plastic	50

Note: For gas and water supply pipes within 2m of buildings, the levels given in Table 25 should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

The guideline values above may be reduced by 50% without further analysis when evaluating the effects of long-term vibration on buried pipework.

9.2.2 HUMAN COMFORT

Table 9-8 reproduces the 'Preferred' and 'Maximum' values for continuous and impulsive vibration from DEC (2006) *Assessing Vibration – A Technical Guideline*, which are adopted as assessment criteria for the Project.

TABLE 9-8 PREFERRED AND MAXIMUM VIBRATION ACCELERATION LEVELS FOR HUMAN COMFORT (M/S2, 1-80HZ)

Location	Assessment period[1]	Preferred values		Maximum values	
		z axis	X and y axis	z axis	X and y axis
CONTINUOUS VIBRATION (WEIGHTED RMS ACCELERATION, M/S2, 1 80HZ)					
					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
Workshop	Day- or night	0.04	0.029	0.080	0.058
IMPULSIVE VIBRATION (WEIGHTED RMS ACCELERATION, M/S2, 1 80HZ)					
					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
Workshop	Day- or night	0.64	0.46	1.28	0.92

[1] *Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am*
[2] *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Alternative criteria are outside the scope of the policy and other guidance documents should be referred to.*

Table 9-9 provides the 'Preferred' and 'Maximum' values for intermittent vibration, which are adopted from the DEC (2006) *Assessing Vibration – A Technical Guideline* as the assessment criteria for the project. VDV is a cumulative value, which increases with measurement duration. It is assessed using the length of time of the measurement and the total time of exposure.

TABLE 9-9 ACCEPTABLE VIBRATION DOSE VALUES (VDV) FOR INTERMITTENT VIBRATION (M/S$^{1.75}$)

Location	Daytime[1]		Night time1	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
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
Workshop	0.80	1.60	0.80	1.60

[1] Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
[2] Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous of impulsive criteria for critical areas.
Source: British Standard BS6472-1992

10 MONITORING RECORDS AND ASSESSMENT

For each monitoring event, the following information shall be recorded:

- Date and time of measurements;
- Name of person undertaking the measurements;
- Type and model number of instruments;
- Sample times, measurement time intervals and time of day;
- Map of area showing measurement location, source location and sensitive receivers;
- Measurement location details and number of measurements at each location;
- Operation and load conditions of the plant under investigation;
- Measured noise parameters including LA90, LAeq, LA10, LA (max);
- Measured vibration parameters including the following criteria where applicable: mm/s (structural damage), m/s2, 1-80Hz (Human Comfort) and $m/s^{1.75}$ (VDV).
- Estimated contribution of the Project's activities vs. noise from extraneous and environmental sources (e.g. traffic, aircraft, trains, dogs barking, insects); and
- Where possible, describe the frequency of noise events noticeably above the LAeq level, i.e. transient or impulsive events at or around the LAMax value for the monitoring period, either numerically (e.g. up to 5 events in the monitoring period) or subjectively (frequent/single event).

On conclusion of each monitoring event, the monitoring results will be compared to input or output data, or relevant criteria as described in Table 10-1. The intention of all monitoring is to provide improved noise and vibration management outcomes, ensure compliance with criteria and reduce impacts to receivers.

TABLE 10-1 ACTIONS FOR MONITORING OUTCOMES

Reason for monitoring	Comparison	Outcome
To ensure accurate input into modelling or predictions		Make corrections to models as appropriate to ensure future predictions and modelling outcomes are more accurate.
To review accuracy of modelling or predictions outcomes	Compare to model outputs	Make corrections to models as appropriate to ensure future predictions and modelling outcomes are more accurate.
As identified by a construction noise and vibration impact assessment	Noise and vibration assessment outcomes	To confirm noise and vibration impacts are consistent with predictions and appropriate mitigation measures are implemented.
To confirm compliance with relevant criteria	Compare to relevant noise and vibration criteria	To identify where additional mitigation measures may be required.
In response to a complaint	Compare to relevant noise and vibration criteria, and model outcomes (such as in the case of Out of Hours Works Permits).	To identify where additional mitigation measures may be required.

Where a non-compliance with criteria is identified or results of monitoring are otherwise unsatisfactory, additional mitigation measures will be implemented as discussed below.

11 MITIGATION MEASURES

Monitored noise and vibration levels will be analysed against the noise and vibration objectives and predictions made in the relevant DNVIS or using the Project's predictive tools. Results will be utilised to confirm model predictions and confirm vibration minimum working distances (i.e. 'site law').

In the course of standard construction management, the mitigation measures as described in the CNVMP will be applied. Where monitored construction levels are found to be above noise or vibration criteria, predictions or are otherwise unsatisfactory, the following actions will be undertaken:

- Assess the noise/vibration generating sources and activities to identify a potential source of the exceedance;
- Confirm the monitored levels are not being impacted by other noise or vibration sources;
- Confirm if the exceedance is due to an uncharacteristically noisy or vibration-intensive piece of equipment;
- Confirm that the modelling reflects the actual activity being undertaken;
- Implement other feasible and reasonable measures which may include:
  - reducing plant type or size,
  - modifying time of works,
  - changing operational settings (such as turning off the vibratory function of the machine),
  - utilising alternative construction methodology
  - implementation of additional respite periods to provide residents with respite from ongoing impact
  - consultation with residents to confirm if alternative construction hours or respite periods may provide greater relief from construction impacts
  - supplementary or augmented noise and vibration controls in place during construction
  - consideration of alternative construction methodology, including reconsideration of short term programming to split up noisy activities
  - additional consultation with affected receivers, including notification and complaint handling procedures.
- Ensure that the learnings from the above are fed back into the noise modelling assessment process for fine-tuning;
- Continue work where impacts can be reduced;
- Where noise cannot be reduced for this activity, re-assess the extent of impacts based on new information (e.g. revised equipment sound power level) and implement appropriate mitigation and management measures;
- Communicate lessons learnt to relevant personnel; and
- FGJV will review the activity and where possible, modify the work or activity to prevent any recurrence. Lessons learnt will be communicated to relevant personnel in toolbox talks.

In the case of an exceedance in SWL the item of plant may require:

- Maintenance;
- A non-tonal movement alarm;
- An enclosure around items of stationary plant (e.g. pumps or generators); and
- Replacement item of plant

Where monitored construction levels are found to be below predicted noise or vibration levels, there may be an opportunity to highlight a technique or item of equipment that can be used in other situations to reduce noise impacts or amend the noise predictions for improved accuracy. In this situation:

- Assess the noise/vibration generating sources and activities to identify potentially lower noise levels than anticipated
- Confirm if the reduced level is due to equipment sound power or operating variables
- Where sound power is lower, include data in register of plant noise levels for future reference
- Where operation is less intense, or other mitigation has been applied to reduce levels, make a note in the register of plant noise levels for future reference and identification of any trends.

12 CALIBRATION, QUALITY ASSURANCE AND COMPETENCY

All monitoring will be undertaken by competent personnel, suitability trained and experienced in undertaking noise and vibration measurements. Specific targeted training will be developed by the Environmental Manager to ensure that environmental monitoring officers are appropriately trained. Refer to the CEMP for full details on environmental training.

All instruments will be calibrated in accordance with manufacturers specifications or relevant Australian Standards. Records of monitoring equipment calibration will be maintained by FGJV throughout delivery of the Project.

Attended noise monitoring would be completed using at minimum Class 2 instruments, as per Australian Standard IEC 61672.1.

Realtime, unattended construction management tools may be used to assess construction activities and the effectiveness of mitigation measures throughout the life of the project, some of these tools do not meet the technical requirements of a Class 1 or Class 2 instrumentation. In these instances, the instrumentation will be calibrated to the manufacturers specifications.

13 REPORTING

Where monitoring is conducted externally, the report would be submitted to the construction contractor Environment Manager generally within one week or at weekly intervals for continuous monitoring.

Results of noise and vibration monitoring are to be reported on a 6-monthly basis. In accordance with CoA C19, the results Monitoring Report incorporating the results of this Program will be submitted to the Planning Secretary, and relevant regulatory agencies, for information.

The 6-monthly report will include the following details:

- A summary of the monitoring undertaken (for noise monitoring: attended monitoring and compliance related unattended monitoring will be reported as described in sections 5.2 and 5.3 above)
- An assessment of monitoring results assessed against relevant criteria
- Details of any exceedance of assessment criteria
- Outcome of investigations to confirm if the exceedances were the result of construction activities
- Details of construction activities or circumstances that may have contributed to the exceedance
- Details of corrective actions implemented to prevent the recurrence of exceedances confirmed to be the result of construction activities

On receipt of the Project Environmental Protection License, document will be updated to capture any additional reporting obligations.

APPENDIX 8 OPERATIONAL NOISE MITIGATION MEASURES

Legend

- Construction footprint
- Study Area
- North Coast Railway
- Watercourse

Road Surfaces

- OGA
- DGA
- Concrete

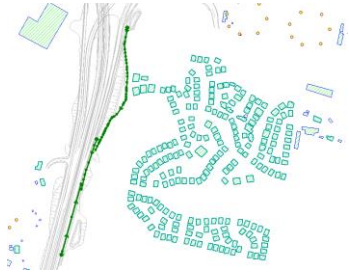
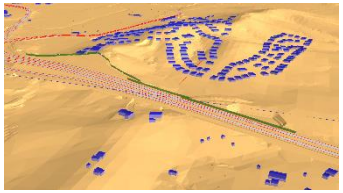
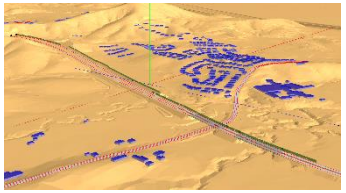
Coffs Harbour Bypass
Road Surface Types
Figure 8

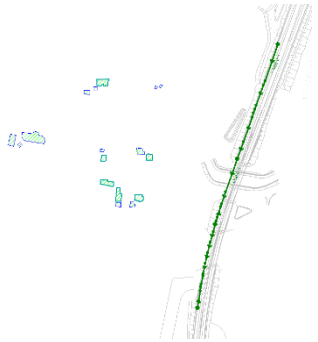
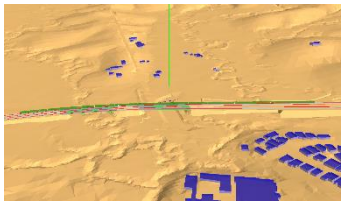
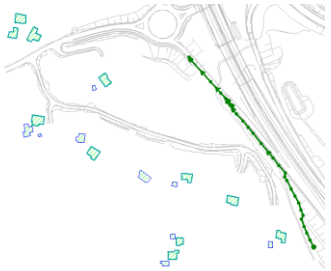
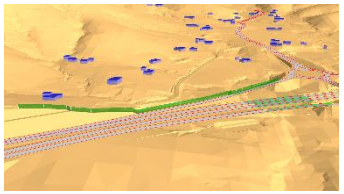
0 0.5 1 1.5 km

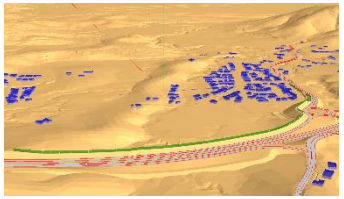
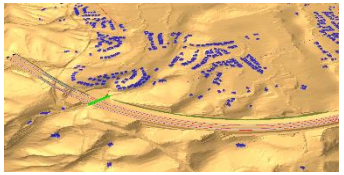
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56

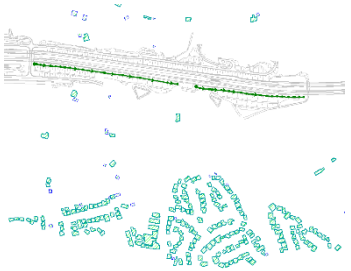
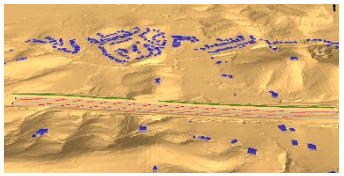
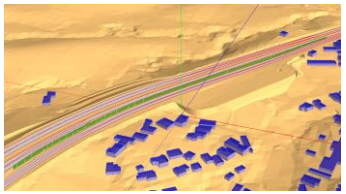
N

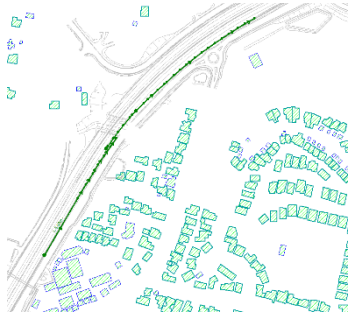
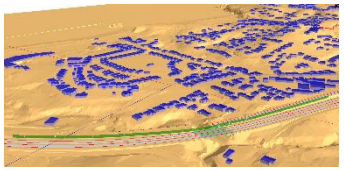
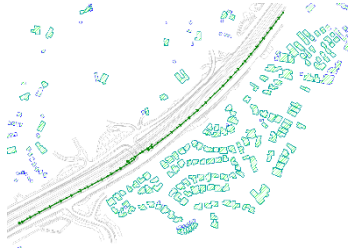
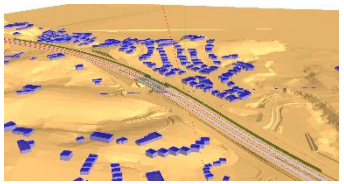
Table 36: Noise barrier summary

Barrier Name	Chainages	Barrier height (m)				Insertion loss (dB)				Recommended design height	Notes	Indicative noise barrier extent (plan view)	Indicative recommended design height barrier (axonometric view)
		Existing	Maximum	Initial design	Final design	Existing	Maximum	Initial design	Final design				
NW_NCA03_SB_01	9830 to 10530	-	8.0m	5.0m	5.0m	-	8.8	5.8	5.8	5.0m	*Final design height barrier is recommended because it provides more than 5dB insertion loss.		
NW_NCA06_SB_01	11900 to 13610	-	8.0m	6.0m	6.0m	-	11.1	9.2	9.2	5.0m	*5m barrier is recommended because final design height does not achieve more than 10dB insertion loss.		

Barrier Name	Chainages	Barrier height (m)				Insertion loss (dB)				Recommended design height	Notes	Indicative noise barrier extent (plan view)	Indicative recommended design height barrier (axonometric view)
		Existing	Maximum	Initial design	Final design	Existing	Maximum	Initial design	Final design				
NW_NCA08_NB_01	11890 to 12500	-	8.0m	0.0m	0.0m	-	4.7	0.0	0.0	0.0m	*Maximum barrier height does not provide more than 10dB insertion loss at most benefiting receiver; *Initial design height is 0m due to points weighting; *Noise barrier not recommended at this location.		
NW_NCA12_NB_01	14300 to 14680	-	8.0m	0.0m	0.0m	-	6.6	0.0	0.0	0.0m	*Maximum barrier height does not provide more than 10dB insertion loss at most benefiting receiver; *Initial design height is 0m due to points weighting; *Noise barrier not recommended at this location.		

Barrier Name	Chainages	Barrier height (m)				Insertion loss (dB)				Recommended design height	Notes	Indicative noise barrier extent (plan view)	Indicative recommended design height barrier (axonometric view)
		Existing	Maximum	Initial design	Final design	Existing	Maximum	Initial design	Final design				
NW_NCA13_SB_01	14580 to 15430	-	8.0m	4.5m	4.5m	-	11.3	7.4	7.4	4.5m	*Final design height barrier is recommended because it provides more than 5dB insertion loss.		
NW_NCA14_SB_01	15430 to 16970	-	8.0m	5.5m	6.0m	-	9.4	6.8	7.3	5.0m	*5m barrier is recommended because final design height does not achieve more than 10dB insertion loss.		

Barrier Name	Chainages	Barrier height (m)				Insertion loss (dB)				Recommended design height	Notes	Indicative noise barrier extent (plan view)	Indicative recommended design height barrier (axonometric view)
		Existing	Maximum	Initial design	Final design	Existing	Maximum	Initial design	Final design				
NW_NCA18_SB_01	17810 to 18900	-	8.0m	5.0m	5.5m	-	6.4	4.7	5.0	5.0m	*5m barrier is recommended because final design height does not achieve more than 10dB insertion loss.		
NW_NCA25_SB_01	21590 to 22150	3.0m	8.0m	5.5m	5.5m	3.5	7.4	6.1	6.1	5.0m	*5m barrier is recommended because final design height does not achieve more than 10dB insertion loss. *Supplemented height is recommended due to road widening and the additional noise reduction is greater than 2.0dBA		

Barrier Name	Chainages	Barrier height (m)				Insertion loss (dB)				Recommended design height	Notes	Indicative noise barrier extent (plan view)	Indicative recommended design height barrier (axonometric view)
		Existing	Maximum	Initial design	Final design	Existing	Maximum	Initial design	Final design				
NW_NCA26_SB_01	22150 to 22725	-	8.0m	4.5m	6.5m	-	12.2	8.2	10.7	5.0m	*Final design height barrier is recommended because it provides more than 5dB insertion loss; *Final design height is limited to 5m considering feasible and reasonable analysis (refer to NW_NCA26_SB_01 text preceding this table)		
NW_NCA28_SB_01	22725 to 23650	3.0m	8.0m	4.0m	4.5m	5.4	13.4	7.5	8.4	4.5m	*Final design height barrier is recommended because it provides more than 5dB insertion loss; *Supplemented height is recommended due to road widening.		

APPENDIX 9 OUT OF HOURS WORKS PROTOCOL

COFFS HARBOUR BYPASS

Out of Hours Protocol

Revision E - Coffs Harbour Bypass

FERROVIAL GAMUDA JOINT VENTURE

VERSION CONTROL

Revision	Date	Description	Approval
A	22/09/2022	FGJV Version for external review	
B	27/10/2022	Updated to address Council, EPA, ER, AA and TfNSW comments	
C	2/12/2022	Updated following ER/AA Review	
D	17/01/2023	Updated Following ER/AA Review	
E	16/02/2023	Updated following DPE comment	

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 PURPOSE

This Out of Hours Works Protocol (OOHW Protocol, or the Protocol) has been prepared in accordance with the Minister's Condition of Approval (MCoA) E40 for the Coffs Harbour Bypass (CHB) project (the Project) for works to be undertaken outside of standard construction hours that are not applicable to an Environmental Protection License (EPL) granted by the Environmental Protection Authority (EPA).

The purpose of this Protocol is to identifies the process for the consideration, management and approval of work which are outside of the standard construction hours defined in MCoA E32.

This Procedure should be implemented as described in the Project Construction Noise and Vibration Management Plan (NVMP) which in turn forms part of the Construction Environmental Management Plan (CEMP)

This OOHW protocol has been developed to:

- Provide a process to justify and assess the impact of OOHW against relevant noise and vibration criteria
- Define criteria to determine the risk of OOHW and who has the authority to approve the OOHW
- Determine the application of standard and additional noise and vibration mitigation measures based on defined criteria
- Outline community consultation and other notification requirements.

1.2 SCOPE

During construction of the Project, some work will be required to take place outside of standard working hours due to worker and community safety reasons, product quality, operational constraints imposed by utility and service providers, and traffic restrictions due to a need to maintain a sufficient level of service during high traffic demand in standard daytime working hours.

In some circumstances, where community agreement has been reached with the substantial majority of impacted receivers construction activities may be undertaken outside standard construction hours to increase productivity and de risk construction program.

Tunnelling works and tunnel fit out within an acoustic shed are permitted to be carried out 24 hours a day, seven days a week in accordance with MCoA E33 and are not subject to this protocol.

This Protocol does not apply to works managed under the Project EPL.

1.3 CONSULTATION

As required under CoA This Protocol has been prepared in consultation with the Environmental Representative (ER), Acoustic Advisor (AA) and the EPA, and will be approved by the Department of Planning and Environment (DPE) prior to the commencement of OOHW.

2 REQUIREMENTS FOR OOHW

2.1 CONDITIONS OF APPROVAL

The MCoA relevant to this Protocol are listed in Table 1. A cross reference is also included to indicate where the condition is addressed in this Protocol or other project management documents.

TABLE 1 MINISTER'S CONDITION OF APPROVAL RELEVANT TO THE OOHW PROTOCOL

CoA No.	Condition Requirements	Reference
E32		**Section 4.1**
E33		**Section 2.2**
E34		**Section 2.2, & Section 6**
E35		**Section 4 & Section 6**

E36	**Variation to Work Hours** Notwithstanding Conditions E32 and E38, work may be undertaken outside the hours specified, 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 different construction hours are permitted or required under an EPL in force in respect of the CSSI; or (d) work not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E40; or (e) construction that causes LAeq(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), or (ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the *Interim Construction Noise Guideline* (DECC, 2009) at other sensitive land uses, or (f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of *Assessing Vibration: a technical guideline (*DEC 2006), or (g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of *Assessing Vibration: a technical guideline* (DEC,2006); or (h) negotiated agreements with directly affected residents and sensitive land uses. ***Note**: Section 5.24(1)(e) of the EP&A Act requires that an EPL be substantially consistent with this approval.*	**Section 4, Section 5 & Section 6**
E37	On becoming aware of the need for emergency work in accordance with Condition E36(b), the Proponent must notify the AA, the ER, the Planning Secretary and the EPA of the reasons for such work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those work.	**Section 7**
E38	Except as permitted by an EPL, highly noise intensive work that result in an exceedance of the applicable NML at the same receiver must only be undertaken: (a) between the hours of 8:00am to 6:00pm Monday to Friday; (b) between the hours of 8:00am to 1:00pm Saturday; and (c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour. For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.	**Section 5**

	In order to undertake work outside hours specified in Condition E32, the Proponent must identify appropriate respite periods for the out-of-hours work in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with: (a) a schedule of likely out-of-hours work for a period of (c) the noise characteristics and likely noise levels of (d) likely mitigation and management measures to be and the scheduling of the likely out-of-hour work must be This condition does not apply where works are no more than 5	
E40	**Out-of-Hours Work Protocol – Work not subject to an EPL** An Out-of-Hours Work Protocol must be prepared to identify a work which are outside the hours defined in Conditions E32, and that are not subject to an EPL. The Protocol must be approved The Protocol must be prepared in consultation with the ER, AA (a) identification of low and high-risk activities and an approval process that considers the risk of activities, (i) the ER and AA review all proposed out-of-hours (ii) low risk activities can be approved by the ER in (iii) high risk activities that are approved by the (b) a process for the consideration of out-of-hours work (c) a process for selecting and implementing mitigation E39. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive (d) procedures to facilitate the coordination of out-of-hours work including those approved by an EPL or undertaken by a third party, to ensure appropriate (e) notification arrangements for affected receivers and the EPA for all approved out-of-hours works and This condition does not apply if the requirements of Condition	**Section 5**

E41	**Noise and Vibration Mitigation** Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria: (a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009); (b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure); (c) Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives"; (d) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and (e) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage); and Any work identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan. *Note: The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level (NML).*	**Section 5**
E42	Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded: (a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and (b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A). The mitigation measures must be outlined in the Noise and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol, required by Condition E40.	**Section 6**

2.2 REVISED ENVIRONMENTAL MANAGEMENT MEASURES

Relevant Revised Environmental management Measures (REMMs) derived from Chapter 6 of the CHB Submissions Report are listed Table 2 below. This includes reference to required outcomes, the timing of when the commitment applies, relevant documents or sections of the environmental assessment influencing the outcome and implementation.

TABLE 2: REVISED ENVIRONMENTAL MANAGEMENT MEASURES RELEVANT TO OOHW

Ref #	Commitment	Timing

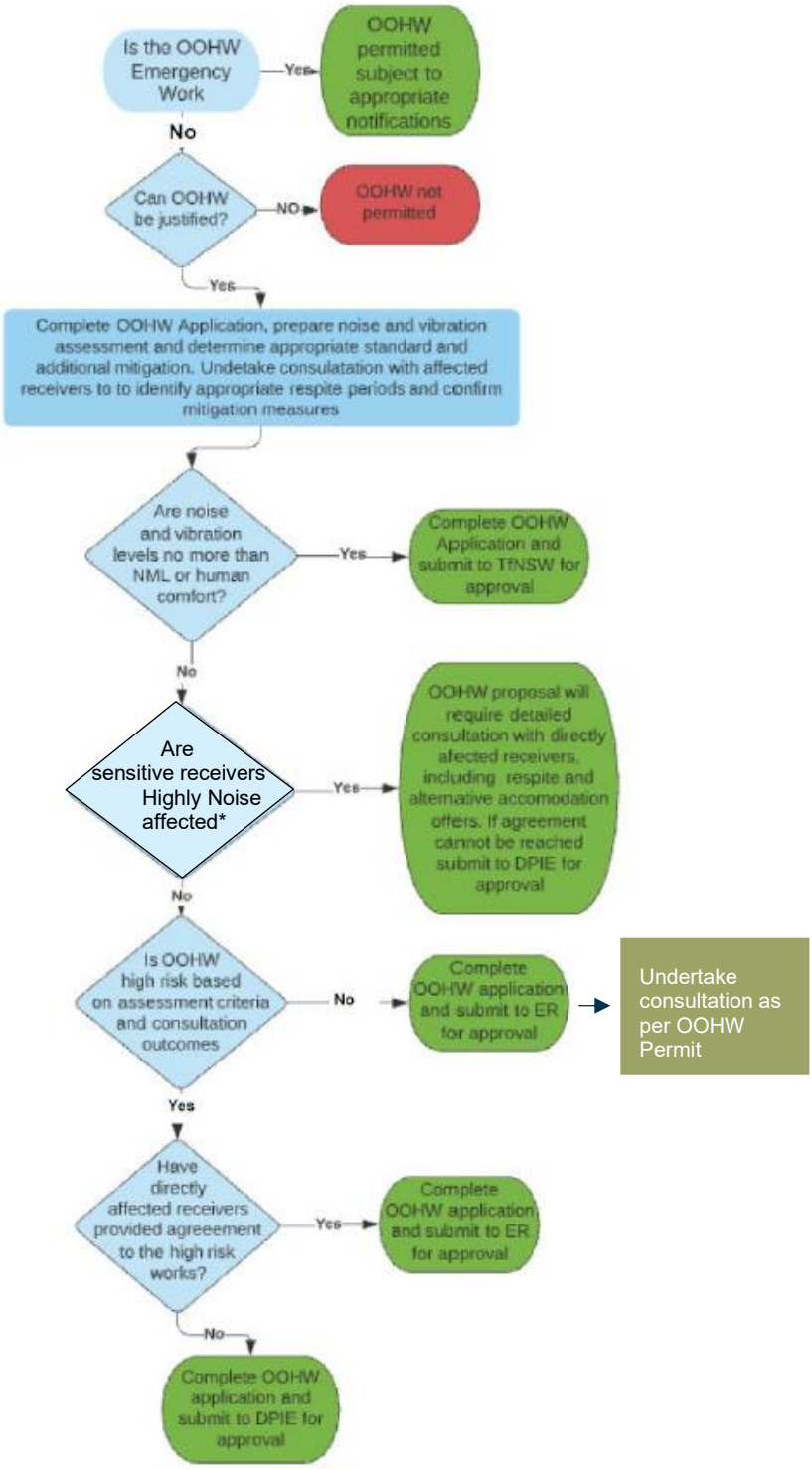
NV06	An Out of Hours Work Procedure will be included as part of the Noise and Vibration Management Plan to manage any variations to the standard construction hours. The procedure will follow the approach in Construction Noise and Vibration Guideline (Roads and Maritime Services 2016a) and the Interim Construction Noise Guideline (DECC 2009b). The procedure will include, but not be limited to: • Scheduling of noise intensive or high noise impact work to evening periods where feasible • Use of alternative plant and equipment and/or construction techniques to minimise noise • Notification and consultation requirements including preparation of a six-month 'look ahead' program for likely out of hours work • Use of temporary noise barriers • Acoustic sheds will be included around tunnel portals to shield noise from within the tunnel during evening and night periods • Respite periods • Representative noise monitoring • Offers of reasonable and temporary alternative accommodation or an act of good will • Use of negotiated agreements.	During Construction

3 OVERVIEW OF THE OOHW POCESS

To undertake OOHW, the project team will be required to undertake an evaluation of the works and noise and/or vibration impacts, answer a series of questions and document these in an OOHW Permit for approval by the delegate. Note that the AA and ER are to review all completed applications.

**(>75DB(A))*

Figure 1 illustrates the step-by-step process for assessing and approving proposed OOHW.



(>75DB(A))

FIGURE 1 OVERVIEW OF PROCESS FOR OOHW

4 OOHW JUSTIFICATION

4.1 STANDARD CONSTRUCTION HOURS

Delivery of the Project may require some work to be carried out outside of approved standard construction hours. Standard construction hours defined by CoA E32 and not requiring OOHW assessment are:

- 7:00 am to 6:00 pm Mondays to Fridays, inclusive
- 8:00am to 1:00pm Saturdays
- At no time on Sundays or public holidays

All activities carried during standard hours are assessed and managed in accordance with the Construction Noise and Vibration Management Plan. OOHW assessment and approval is required for all construction activities outside of these times within the periods specified below:

OOHW Period 1:

Monday–Friday: 6 pm – 10 pm

Saturday: 7 am - 8 am & 1 pm – 10 pm

Sunday and Public Holidays: 8 am – 6 pm

OOHW Period 2:

Monday– Friday: 10 pm – 7 am

Saturday: 10 pm - 8 am

Sunday and Public Holidays: 6 pm – 7 am

Sections 4.3 and 4.4 provide further information on what constitutes emergency or other work and justified OOHW that can take place with approval.

4.2 VARIATION TO STANDARD CONSTRUCTION WORK HOURS

Condition E36 states that notwithstanding Conditions E32 and E38, work may be undertaken outside the hours specified, 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 different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
d) work not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E40; or
e) construction that causes $LA_{eq(15\ minute)}$ 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), or
   ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, or
f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or

g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006); or
h) negotiated agreements with directly affected residents and sensitive land uses.

4.3 EMERGENCY WORKS AND POLICE ESCORTED DELIVERIES

CoA E36 allows for a variation to standard work hours for OOHW that can be carried out without further approval in the following circumstances:

(a) for the delivery of materials where required by the NSW Police Force or other authority for safety reasons
(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.

As required by CoA E37, on becoming aware of the need for emergency work in accordance with CoA E36 (b) above, the Environmental Manager (or delegate) will notify the project ER, AA, the Planning Secretary and the EPA of the reasons for such work. Additional notification to all noise and/or vibration affected sensitive receivers should be provided where reasonable and feasible of the likely impact and duration of those works.

4.4 OTHER OOHW REQUIRING JUSTIFICATION AND APPROVAL

Work associated with the CHB Project will be undertaken generally in accordance with the assessment and management approach outlined in the Interim Construction Noise Guideline (ICNG) and within the conditions prescribed by the CoA. The ICNG recommends standard construction hours and requires that OOHW has a strong justification. Where it is considered possible (safe, reasonable and not prevented by a road occupancy licence) for work to be undertaken during standard hours, OOHW proposals will not be considered justified and will not be considered further. These works would be undertaken during standard working hours.

In general, OOHW undertaken on public infrastructure projects, such as road construction necessary to sustain the operational integrity of roads, are considered justified in the ICNG.

In relation to the CHB Project this OOHW protocol considers valid reasons for work to be undertaken out of hours to include, but not be limited to:

- Ensuring the safety of the public and CHB Project personnel;
- Minimising disruption to the existing road network and the network level of service;
- Following directions by Traffic Management Centre and/or relevant roads authority;
- Minimising disruption to road users / pedestrians;
- Minimising disruptions to essential services and utilities for surrounding businesses and adjoining residential receivers;
- Work that shortens the length of the project where supported by the affected community; and
- Technical and/or engineering justification that requires the work to be undertaken to completion e.g. deck pours, concrete curing requirements, etc.

5 OOHW IMPACT ASSESSMENT AND APPROVAL

5.1 ASSESSMENT CRITERIA

5.1.1 NOISE AND VIBRATION ASSESSMENT CRITERIA

CoA E41 lists the guidelines and standards for establishing project-specific noise and vibration criteria to guide the application of mitigation measures. The guidelines and standards adopted for the CHB Project include:

a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009);
b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure);
c) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions";
d) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage); and
e) RMS Construction Noise and Vibration Guideline – Version 1, 2016.

Note: The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level (NML).

5.1.2 NOISE MANAGEMENT LEVELS

Project-specific noise management levels (NMLs) and sleep disturbance criteria have been calculated for each Noise Catchment Area (NCA) within the Project area and are provided in the NVMP. Construction NML criteria for non-residential, commercial and industrial receivers have also been defined. Mitigation measures will be applied with regard to relevant thresholds as described in Section 6.

5.1.3 VIBRATION CRITERIA

Vibration criteria has been adopted directly from the standards outlined in Section 5.1.1 as applicable to Australian conditions, the British Standard BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" forms the basis of vibration assessment criteria for the Project. German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures would be considered in assessment of vibration where a heritage listed structure is present in poor condition. An adaptive approach to mitigation will be applied to vibration from OOHW including plant selection, plant substitution and consultation with affected receivers. Vibration criteria adopted for the CHB project are provided in the NVMP.

5.2 NOISE AND VIBRATION ASSESSMENT

5.2.1 NOISE ASSESSMENT

A noise assessment to determine the noise impacts of the proposed OOHW will be undertaken for all planned OOHW using an appropriately detailed noise prediction tool. The assessment will predict the level and extent of noise impact that OOHW activities will have on potentially affected sensitive receivers based on inputs including location, and the types and number of construction machinery operating at any one time under a worst-case scenario in any of the defined CHB Project specific NCAs.

As noted in Section 5.1.2, NMLs have been established for each NCA based on the ICNG procedure.

Quantitative noise assessments conducted for all OOHW will predict the potential exceedances of the OOHW scenario against the relevant NMLs and sleep disturbance screening criteria identified for potentially affected sensitive receivers. The assessment will include, but not be limited to:

1) Details of the nature and scope of each activity, including details of times, location of works, distance to nearest receivers, duration, vehicles, plant and equipment to be used
2) Justification of the selected construction and work methods, plant and equipment compared to alternatives taking into consideration noise and vibration impacts
3) An evaluation of the worst case scenario for each affected NCA including:
    - the addresses of the most affected noise sensitive receivers
    - the background noise level for the NCA
    - NMLs for the NCA
    - the predicted LAeq (15 min) noise level, incorporating any 5 dB correction for particularly annoying activities as listed in the ICNG assessment of sleep disturbance against EIS construction noise assessment criteria (provided in the NVMP)
    - The cumulative impact of other OOHW activities approved under an EPL,CNG separate OOHW application or work undertaken by a third party occurring concurrently need so to be investigated and included in noise assessments to ensure that appropriate respite and mitigation measures are implemented for sensitive receivers.
4) The potential noise impacts for highly noise intensive works described in CoA E38 need to be considered in the assessment of OOHW proposals, highly noise intensive works are defined as the following:
    - use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work;
    - grinding metal, concrete or masonry;
    - rock drilling;
    - line drilling;
    - vibratory rolling;
    - bitumen milling or profiling;
    - jackhammering, rock hammering or rock breaking; and
    - impact piling
5) The use of equipment that generates noise impacts in the highly noise intensive works category will be undertaken in accordance with the following measures:
    - the equipment will be used before 10 pm where reasonable and feasible;
    - where the above cannot be achieved the equipment will be used before midnight where reasonable and feasible; and;
    - The project team do not propose to apply a three hour on and one hour off respite approach to ensure that the use of such equipment is completed as early in the night as possible.
6) Additional consideration is required to assess compliance of the proposed OOHW against MCoA E42, which requires that mitigation measures must be applied when the residential ground-borne noise levels listed below are exceeded: (Mitigation measures detailed in section 5.2 and 5.3 are to be implemented for the corresponding OOHW period and predicted noise level to comply with this condition, as a minimum the standard mitigation measures are to be applied.)
    a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and
    b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A).

Noise mitigation measures to be adopted based on the predicted noise levels include respite periods to minimise noise and vibration impacts on surrounding noise sensitive receivers in each locality and are detailed further in Sections 6.2 and 6.3.

5.2.2 VIBRATION ASSESSMENT

An assessment of vibration intensive activities that may impact sensitive receivers or structures will be required for out of hours vibration intensive work. The proposed out of hours work activities will be assessed for compliance with safe working distances for:

1) Cosmetic and/or structural impacts (including safe working distances), in accordance with MCoA E44, vibration testing must be conducted 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 construction methodology must be reviewed, and, if necessary, additional mitigation measures implemented.

2) Human comfort impacts due to vibration. Assessments will be undertaken in accordance with the safe working distance guide in the NVMP. The safe working distances provided in the NVMP are indicative and will vary depending on the item of plant (particularly its power rating) and local geotechnical conditions. Consideration to these factors will be undertaken during the assessment of all vibration generating OOHW.

Prior to undertaking an assessment, all other feasible and reasonable options to use less vibration intensive equipment will be investigated and exhausted.

5.3 OOHW PROPOSAL RISK CLASSIFICATION AND APPROVAL

5.3.1 PREPARATION OF OOHW APPLICATION

All planned works outside of standard construction hours can only proceed where a comprehensive OOHW application has been prepared and approved. Attachment 1 of this OOHW protocol provides the application template to capture all necessary information for this process including:

- Relevant personnel details;
- Detailed work description including location, activity, equipment required, duration etc;
- Valid justification;
- Noise and vibration assessment against CHB Project specific criteria;
- Review and endorsement of all OOHW applications by the Project AA, and concurrence on the determination of a risk category based;
- Standard and additional mitigation measures to be adopted; and
- Details of community consultation including relevant feedback and how it has been addressed, and the status of any agreements.

This information will be reviewed by the relevant approval delegate when considering whether proposed OOHW can proceed as documented, proceed on a conditional basis, or not proceed at all.

5.3.2 RISK CLASSIFICATION AND APPROVAL DELEGATION

The approval process for justified OOHW will be determined on a risk-based case-by-case basis to ensure that OOHW is approved by the appropriate delegate in accordance with MCoA E40 (a).

The approval process for OOHW application follow the simplified steps detailed below:

1) The Engineer responsible for the works will prepare and submit an application form detailing the scope, need and justification for the works to the wider project team.
2) The Environmental Team will undertake a noise and vibration assessment for the proposed activity.
3) The completed application form and supporting information is then provided to the ER and AA for review and concurrence on the risk classification and proposed reasonable and feasible mitigation and management measures.
4) Consultation with will be held with the following stakeholders, as appropriate:
    - Potentially affected sensitive receivers
    - Coffs Harbour City Council
    - NSW EPA
5) The complete endorsed and signed application form is then forwarded to the approval delegate based on the determined risk classification
6) Management and mitigation measures are to be planned for implementation and monitoring undertaken as required during the activity

The overarching OOHW approval process is also captured in the flow chart in Section 3.

Following assessment of the risk category classification of the proposed OOHW, Justified OOHW applications will be reviewed by the ER and AA to confirm assessment and risk classification, and will then be referred to the approval delegate indicated below in Table 3.

5.3.3 NML COMPLIANT WORKS

Works confirmed through noise assessment as being NML compliant and not having vibration impacts (i.e. working within safe working distance) can be approved by the Environment and Sustainability Manager. The ER and AA must be given opportunity to confirm the risk category.

5.3.4 LOW RISK OOHW ACTIVITIES

The ER has the authority to approve activities (in consultation with the AA) determined as low risk in accordance with the one of the following requirements:

1) OOHW assessed to meet the perception classification of Noticeable; OR
2) OOHW assessed to meet the perception classification of Clearly Audible and above at any one residential receiver for a maximum of:
   a. Two consecutive evenings or nights, in a calendar week
   b. Three evenings or nights in a calendar week
   c. A maximum of 10 evenings or nights in a calendar month.

   The effect of the above facilitates two nights in a row and at least one period off before the third period that week; OR
3) Where negotiated agreements with directly affected residents and sensitive land uses have agreed to the OOHW and mitigation measures proposed.

5.3.5 HIGH RISK OOHW ACTIVITIES

OOHW are considered high risk when the duration limitations outlined above cannot be achieved. In this instance, the OOHW assessment and application for high risk OOHW activities will be issued to the Planning Secretary for review and approval as described in Table 3.

TABLE 3: OOHW APPROVAL DELEGATION

Approval Delegate	OOHW Risk Category
Environment and Sustainability Manager (following confirmation of risk category by ER and AA)	Justified OOHW where it is demonstrated that noise is not predicted to exceed the NML at the nearest worst effected receiver
CHB Project ER (in consultation with the AA)	Justified OOHW where it is demonstrated the OOHW is low risk
Planning Secretary	Justified OOHW where it is demonstrated the OOHW is high risk

5.3.6 KEY OOHW APPLICATION SUBMISSION TIMEFRAMES

In order to obtain approval for justified OOHW, a number of submissions might be required. Table 4 identifies the number of days in advance of the OOHW an application is required, and who the submission must be made to, based on the assessed risk category. Note that community and affected resident notification and consultation will be completed prior to the OOHW application submission in accordance with the CCS.

TABLE 4: OOHW SUBMISSION TIMEFRAME

OOHW risk category	Submission to	Days prior to OOHW
Equal to or less than NML	Environment and Sustainability Manager (following confirmation of risk category by ER and AA)	7
Low risk	Environment Manager (in consultation with the AA)	14

	ER (in consultation with the AA)	14
High risk	Environment and Sustainability Manager (in consultation with the AA).	14
	Planning Secretary	28

6 APPLICATION OF MITIGATION MEASURES

6.1 STANDARD MITIGATION MEASURES

Reasonable and feasible standard mitigation measures will be implemented for all OOHW where there is predicted to be impacts on sensitive receivers. These measures include, but are not limited to:

- Modifying behavioural practices on site
- Equipment selection / maintaining and monitoring plant
- Use and siting of plant and hoardings
- Switching off plant and machinery when not in use
- Site inductions
- Use of non-tonal reversing alarms
- Stakeholder notification
- Planning noisier work to be carried out earlier in the period

Section 8.1 of the CNVMP outlines all mitigation measures to manage the impacts on sensitive receivers.

6.2 ADDITIONAL MITIGATION MEASURES

The CNVG approach for the application of additional mitigation measures to minimise impacts of OOHW is provided in the NVMP.

A definition of the standard and additional mitigation measures referred to in section 5.1 and section 5.2 is provided in Attachment 2.

6.3 MITIGATION MEASURES FOR OTHER SENSITIVE RECEIVERS

Noise generating work in the vicinity of sensitive receivers (including community, religious, educational institutions and noise and vibration-sensitive businesses and medical facilities) resulting in noise levels above the NMLs at critical working areas (such as operating theatres and precision laboratories) will not be timetabled within sensitive periods, unless other reasonable arrangements with the affected receivers are made at no cost to the affected receivers.

7 OOHW CONSULTATION AND NOTIFICATION

7.1 PROJECT STAKEHOLDER NOTIFICATION

In accordance with CoA E40(e), The EPA and Planning Secretary are to be notified of all approved OOHW, including low impact works approved by the ER, approved application forms are to be issued to EPA and the Planning Secretary by appropriate means (Via DPE Submissions Portal and nominated EPA Representative email) and detailed in the monthly AA Project Reports.

7.2 EMERGENCY WORK NOTIFICATION

On becoming aware of the need for emergency work in accordance with CoA E36 (a) or (b), the Environmental Manager (or delegate) will notify the project ER, AA and the EPA of the reasons for such work. The Project will implement best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those works.

7.3 COMMUNITY CONSULTATION

Prior to carrying out any OOHW, consultation will be held with the following stakeholders, as appropriate:

- Potentially affected sensitive receivers
- Coffs Harbour City Council (as applicable).

As required by the Community Communication Strategy (CCS) and CoA E39, consultation with the community at each location affected by OOHW will occur on a regular basis. The consultation will include, but not be limited to:

- Providing a schedule of likely OOHW for a period of no less than three months in advance;
- Explaining potential work, location and duration;
- Explaining reasons for the work to be done OOH
- Providing proposed respite periods
- Discussing noise characteristics and likely noise and vibration levels
- Discussing likely mitigation and management measures to be implemented

The outcomes of the community consultation, the identified respite periods and the scheduling of likely OOHW will be included in the assessment and mitigation measures as part of the OOHW application and provided to the ER, AA, EPA, Council and the Planning Secretary in a manner agreed with each agency.

7.4 COMMUNITY AGREEMENTS

Where noise or vibration modelling for proposed OOHW shows that high risk factors and/or screening criteria is predicted to be exceeded, and the work would otherwise be subject to approval by the Planning Secretary, the Project may enter into individual voluntary agreements with potentially affected sensitive receivers. The ER, in consultation with the AA, may then consider and approve the OOHW application as a low-risk activity.

Community agreements must include all relevant information required for community consultation (refer Section 7.3), and also:

- Advise of the level and extent of the potential impact of the proposed OOHW;
- Identify any unique measures or requirements agreed to by both parties (e.g. regular advice on the status of the OOHW by text message);
- Document the period in which the agreement remains in effect; and
- Provide a mechanism to review and/or revise the agreement where circumstances might have changed.

In these situations, the ER (in consultation with the AA) can only consider an application for OOHW to be categorised as a low risk activity if agreement with directly affected residents and land uses has been reached.

For clarity, all directly affected resident and land uses would be predicted to experience noise impacts in the “clearly audible”, “moderately intrusive” and “highly intrusive” range as defined in the CNVG, Table C-1 (refer Section 6.2).

In circumstances where a sensitive receiver has no objections to the OOHW but has indicated they do not wish to sign a written agreement; the ER can consider a communication record (or file note) of the verbal agreement. The record must include the date, time and place of the conversation and those in attendance. It must also include any special circumstances under which the receiver has advised that they are in agreement with the OOHW. The record must be signed by the CHB Project representative in attendance and an electronic copy retained. Details of identified receiver properties that have been deemed vacant or unoccupied are to be included in the consultation records.

All agreements would be recorded in accordance with the processes outlined in the CHB Project CCS and captured in the Consultation Manager database. Any agreements made for the purposes of undertaking OOHW that might otherwise be categorised as a high-risk activity would be made available to the ER and/or Planning Secretary on request.

7.5 COMMUNITY NOTIFICATION

Community notifications will be used as a mitigation measure for receivers of potential noise and vibration impacts from OOHW.

Where OOHW have been scheduled, the Community Liaison Representative will notify the potentially affected noise sensitive receivers of upcoming OOHW.

Specific notifications of OOHW events will be issued to potentially affected sensitive receivers at least five days, and not more than 14 working days, prior to the OOHW commencing.

OOHW notifications will be prepared generally in accordance with the CNVG. The notifications will:

- Be undertaken by letterbox drop, email or text message;
- Clearly outline the reason that the work is required to be undertaken outside standard construction hours specified;
- 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, type of work, scope and days and dates and hours of the proposed works, including contingency for wet weather, cancellation of works and unforeseen delays;
- Detail the expected noise impact of the works on potentially affected noise sensitive receivers;
- Detail mitigation and management measures and proposed respite periods;
- Clearly state how complaints may be made and additional information obtained; and
- Include the number of the 24-hour telephone complaints line and the CHB Project website address.

In accordance with CoA E39, the Community Liaison Representative will notify the landowners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage prior to OOHW that generate vibration commencing near those properties. If the potential exceedance is to occur more than once, or extend over a period of 24 hours, landowners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the landowner and occupier.

8 COMPLIANCE MANAGEMENT

This document forms part of the Project Environment Management System (EMS) and is an Appendix to the CHMP.

Compliance with all relevant laws and approvals will be monitored throughout construction through the auditing program, monitoring and inspections. Refer to CEMP Section 8.5.3 for compliance tracking.

8.1 MONITORING OF OOHW

The Environmental Site Representative will ensure the following OOHW noise and vibration monitoring is undertaken:

- Attended noise monitoring at representative sensitive receivers in the first instance of an activity that has been assessed to be clearly audible or worse (as defined in the CVNG, 20 to 30 dB(A) above RBL);
- Attended vibration monitoring at representative sensitive receivers in the first instance of work where vibration generating plant are within safe working distances for cosmetic damage;
- Additional noise and vibration monitoring and review if complaints about the activity are received;
- Attended noise or vibration monitoring at appropriate representative stages of OOHW that has been determined by the ER to be low risk to verify predictions; and
- Where required by the Additional Mitigation Measures.

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

8.2 COMPLAINTS MANAGEMENT

Complaints received as a result of the OOHW will be managed in accordance with the Project Complaints Management System (CMS). On receipt of any complaints, an investigation will be undertaken and where feasible and reasonable, changes to the works implemented to address the issue of concern. Where relevant to the detail of the complaint, monitoring will be undertaken to confirm compliance with the noise levels identified in CoA E36 and predicted vibration levels.

8.3 EXCEEDANCES / NON-CONFORMANCES

Where monitoring identifies any exceedances of the levels predicted in the OOHW assessment, a review of OOHW activities will be carried out to determine whether noise or vibration levels can be further reduced via additional feasible and reasonable measures, this is to be undertaken in accordance with the requirements of the CNVMP.

8.4 TRAINING

Training on this Protocol will be managed as described in the CNVMP.

8.5 REPORTING AND RECORD KEEPING

Reporting of incidents or non-compliances will be undertaken as described in the CEMP.

Accurate records of all OOHW applications and noise and vibration monitoring undertaken during OOHW will be maintained for the duration of the works.

8.6 REVIEW AND IMPROVEMENT

Continuous improvement of this Protocol 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.

This process detailed in Section 9 of the CEMP and applies to this Procedure.

This Procedure will be maintained and updated as required following the review processes described in Sections 1.4 and 9 of the CEMP.

APPENDIX A OOHW APPLICATION FORM

CHB Project OOHW application form

Out of hours work approval request form			
No:	**Notification date:**	**Approval date:**	**Project:**
A. Contact details	**Name**	**Mobile number**	**Email**
FGJV Environmental Site Representative			
FGVJ Project Manager			
B. Details of work: Include a map showing location of work extent and nearest sensitive receivers			
Location / chainages:			
NCA/s:			
Description of works – also include a brief description of the sequence of activities:			
Machinery/ plant to be used			
Traffic control measures required:			
Lighting required:			
Proposed dates:			
Proposed times:			
Justification - why does work need to occur outside of standard construction hours? (attach support information as required)			
Select OOHW Category as defined by MCoA E36	Select ☐ ☐	(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 different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
	☐	(d) work not subject to an EPL that are approved under an **Out-of-Hours Work Protocol** as required by **Condition E40**; or
	☐ ☐	(e) construction that causes $L_{Aeq(5\ minute)}$ 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), or (ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the *Interim Construction Noise Guideline* (DECC, 2009) at other sensitive land uses, or
	☐	(f) continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of *Assessing Vibration: a technical guideline* (DEC, 2006), or
	☐	(g) intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of *Assessing Vibration: a technical guideline* (DEC, 2006); or
	☐	(h) negotiated agreements with directly affected residents and sensitive land uses.
C. Risk assessment		
NML (refer Table 3-2 of OOHW protocol)		
Is the work highly noise intensive? (refer to definition in Project Approval)	*If yes, the work cannot proceed out of hours unless permitted by an EPL*	

Out of hours work approval request form			
Risk factor category (refer section 4.3 of OOHW protocol):	*Other*	*Low*	*High*
	Comments:		
D. Details of noise or vibration assessment completed:			
Comments:			
E. Proposed mitigation measures, including respite			
Comments:			
F. Community consultation			
Outline consultation undertaken for the proposed OOHW:			
Has respite periods for OOHW been identified with the affected community on a monthly basis and a three-month schedule of likely OOHW provided (refer CoA E39)?			
Has the outcome of community consultation, the identified respite periods and scheduling of likely OOHW been provided to the ER, AA and Planning Secretary as required?			
G. Respite framework			
Outline any previous respite within the last month and the status of community agreements (where relevant)?			
Have cumulative impacts from OOHW permitted by an EPL or third party works been considered during the development of appropriate respite?			
H. Details of non-residential sensitive receivers (if any) and corresponding NMLs			
Comments:			

Out of hours work approval request form			
I. Are there any properties at risk of exceeding the screening criteria (CNVG minimum distances for vibration intensive plant) safe working distance for plant) for cosmetic damage?			
Comments:			
I. Review / Approval / Endorsement			
Project Community Liaison Representative	Community notified		Date:
	Additional consultation requirements:		
	Have the works been reviewed and endorsed?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Project Environmental Manager	Agreed mitigation measures:		
	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Project Acoustic Advisor	Agreed mitigation measures:		
	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Project Manager	Have the works been reviewed and endorsed?		Yes / No
	Have the works been approved where neither low nor high risk (predicted to be <NML and below cosmetic damage vibration screening criteria)?		Yes / No
	Name:	Signature:	Date:
	Comments:		

ER approval (low risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		
Planning Secretary approval (high risk activities)	Are the works approved?		Yes / No
	Name:	Signature:	Date:
	Comments:		

APPENDIX B MITIGATION MEASURE DEFINITIONS

Standard notification for OOHW

Standard notifications of OOHW will be issued to potentially affected sensitive receivers at least five days and not more than 14 working days, prior to the OOHW commencing. The notification will include:

- Potential work, location and duration
- Proposed respite periods
- Noise characteristics and likely noise and vibration levels
- Likely mitigation and management measures
- The name and contact telephone number of the Community Liaison Representative's representative to enable potentially affected sensitive receivers to lodge any concerns about extended working hours.

OOHW notifications will be prepared in accordance with the CNVG (Roads and Maritime, 2016)

Additional Mitigation Measures – (Where construction noise and vibration levels are still predicted to exceed the noise or vibration objectives after the application of the standard mitigation measures)

Specific notifications

Specific notifications will be provided in the form of letterbox drops (or equivalent) to identified stakeholders no later than five days ahead of OOHW that are predicted likely to exceed the noise objectives. The specific notification provides additional information when relevant and is informative to more highly affected receivers than what is covered by a standard notification.

Phone calls

Phone calls to potentially affected sensitive receivers detailing relevant information will be made within five working days and no less than 48 hours prior to the proposed OOHW. Phone calls provide potentially affected sensitive receivers with personalised contact and tailored advice, with the opportunity to provide comments on the proposed OOHW and specific needs. The responses of sensitive receivers will be addressed to ensure an optimum outcome is achieved regarding mitigation of OOHW impacts. Where the resident cannot be telephoned then an alternative form of engagement will be used.

Individual briefings

Where required, individual briefings will be used to inform affected sensitive receivers about the impacts of OOHW and mitigation measures that will be implemented. Where required, the Community Liaison Representative will visit potentially affected sensitive receivers at least 48 hours ahead of the proposed OOHW. Individual briefings provide potentially affected sensitive receivers with personalised contact and tailored advice. Contact with sensitive receivers will be documented and concerns addressed where feasible and reasonable.

Where there are many sensitive receivers predicted to be above the NML and it is not practical to discuss the proposed OOHW with every resident, or the resident cannot be met with individually, then an alternative form of engagement will be used.

Respite Offers

Respite Offers will be considered where noise and/or vibration levels are predicted to be moderately or highly intrusive, or exceed maximum vibration levels, respectively, at affected sensitive receivers to provide residents with respite from an ongoing impact. As suggested in the CNVG (Roads and Maritime, 2016), work will be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite will be flexible to accommodate the usage of and amenity at nearby receivers. The purpose is to provide residents with respite from an ongoing impact. This measure will be evaluated on an event-by-event basis, and may not be applicable to all OOHW events.

Respite Periods

Transport for NSW will identify appropriate respite periods for the OOHW in consultation with the community at each affected location. Scheduled respite periods determined in consultation with potentially affected sensitive receivers will be implemented to mitigate the impacts of ongoing periods of noise criteria exceedances at nearby receivers. Where reasonable and feasible, proposed OOHW will be coordinated to avoid the same sensitive receiver being affected over consecutive nights and OOHW will be staggered in order to maximise the respite period between OOHW. Modifications to the scheduled construction activities

to accommodate respite periods where necessary. Respite periods will be flexible and determined on a case-by-case basis, taking into account predicted maximum exceedance levels, duration and timing of exceedances, surrounding land uses and community feedback. Indicative respite periods for OOHW, to be discussed during consultation are summarised below.

OOHW Period 1 Monday–Friday: 6 pm – 10 pm Saturday: 7 am - 8 am & 5 pm – 10 pm Sunday and Public Hol: 8 am – 6 pm	• Construction noise will be limited to no more than three consecutive evenings per week except where there is a Duration Respite.
OOHW Period 2 Monday– Friday 10 pm – 7 am Saturday: 10 pm - 8 am Sunday and Public Hol. 6 pm – 7 am	• Night time construction noise 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 / particularly annoying activities 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 activities. 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 construction can be completed more quickly.

The Community Liaison Representative will engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite. Consultation will be undertaken in accordance with the CHB CCS.

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 are likely to experience highly intrusive noise levels. Aspects for consideration include whether the highly intrusive activities occur throughout the night or before midnight.

Verification

Verification should include measurement of the background noise level and construction noise (and vibration where considered a risk factor). Monitoring would be undertake in accordance with Section 7.1 of this protocol and applying the methodology documented in the Transport for NSW CNVG.

APPENDIX 10 TUNNELLING GROUNDBORNE NOISE ASSESSMENT PROTOCOL

NCAs and receiver types	Number of receivers exceeding ground borne noise criteria – Construction Activity ID12 (Tunnel works)	
	Day	Night
Residential		
NCA01.RES	0	0
NCA02.RES	0	0
NCA03.RES	0	0
NCA03.RES (unbuilt)	0	0
NCA05.RES	0	0
NCA06.RES	0	0
NCA06.RES (unbuilt)	0	0
NCA07.RES	0	0
NCA08.RES	0	0
NCA09.RES	0	0
NCA10.RES	0	0
NCA11.RES	0	0
NCA12.RES	0	0
NCA13.RES	0	0
NCA14.RES	0	0
NCA15.RES	0	0
NCA16.RES	0	0
NCA16.RES (unbuilt)	0	0
NCA17.RES	0	0
NCA18.RES	0	0
NCA19.RES	0	0
NCA20.RES	0	0
NCA21.RES	0	0
NCA22.RES	0	0
NCA23.RES	0	0
NCA24.RES	0	0
NCA25.RES	0	0
NCA26.RES	0	0
NCA27.RES	0	0
NCA28.RES	0	0
NCA29.RES	0	0
Commercial		
NCA02.COM	0	0

NCAs and receiver types	Number of receivers exceeding ground borne noise criteria – Construction Activity ID12 (Tunnel works)	
	Day	Night
NCA03.COM	0	0
NCA04.COM	0	0
NCA05.COM	0	0
NCA07.COM	0	0
NCA11.COM	0	0
NCA18.COM	0	0
NCA19.COM	0	0
NCA21.COM	0	0
NCA22.COM	0	0
NCA23.COM	0	0
NCA24.COM	0	0
NCA25.COM	0	0
NCA26.COM	0	0
NCA27.COM	0	0
NCA28.COM	0	0
Industrial		
NCA04.IND	0	0
NCA05.IND	0	0
Hospital		
NCA03.HOS	0	0
NCA05.HOS	0	0
Educational		
NCA06.SCH	0	0
NCA08.SCH	0	0
NCA26.SCH	0	0
Place of worship		
NCA05.POW	0	0
NCA06.POW	0	0
Child Care Facilities		
NCA05.CCF	0	0
NCA13.CCF	0	0