Pacific Highway / Italia Road Intersection

Construction Noise and Vibration Impact Assessment

Boral Resources (NSW) Pty Ltd

02 August 2024

→ **The Power of Commitment**

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Abbreviations and glossary

Abbreviation	Meaning
Ambient Noise Level	The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' ($L_{Aeq, T}$).
Background Noise Level	The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90% of the measurement period 'T' ($L_{A90,T}$). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often seven days).
CNML	Construction Noise Management Level.
CNVMP	Construction Noise and Vibration Management Plan.
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
DECC	Department of Environment and Climate Change (NSW Government), later known as the Department of Environment Climate Change and Water, and now known as the Department of Planning and Environment (DPE).
GHD	GHD Pty Ltd.
ICNG	Interim Construction Noise Guideline.
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Aeq\ (15\ hr)}$	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
$L_{Aeq\ (9\ hr)}$	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
$L_{A1(period)}$	The sound pressure level that is exceeded for 1% of the measurement period.
$L_{A10(period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
Noise Sensitive Receptor	Noise sensitive land use that may be impacts by noise from the development.
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
Sound Pressure Level (SPL or L_p)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_P = 10 \log_{10} (P_a/P_o)^2$ dB (or $20 \log_{10} (P_a/ P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is 20 µPa (20×10^{-6} Pa) for airborne sound. SPL varies with distance from a noise source.
Sound Power Level, L_W	The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.

1. Introduction

1.1 Overview

Boral Resources (NSW) Pty Ltd (Boral) is acting on behalf of Eagleton Rock Syndicate (ERS) and Australian Resource Development Group Pty Limited (ARDG) (collectively referred to as the 'quarry operators') in submitting a development application (DA) to Port Stephens Council (Council), pursuant to Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), for proposed upgrades to the Italia Road and Pacific Highway intersection (the proposed development).

The proposed development involves safety upgrades to the Italia Road and Pacific Highway intersection, including:

– Construction of a dedicated left-turn northbound acceleration lane from Italia Road onto the Pacific Highway.
– Widening of the existing bridge over the Balickera Canal (to accommodate the northbound acceleration lane).
– Lengthening of the northbound deceleration lane into Italia Road.

All works are proposed to be undertaken within the existing road reserve.

1.2 Project description

Transport for NSW (TfNSW) has identified the need for safety upgrades to the intersection to meet the future predicted traffic growth of the area. The need to bring forward the safety upgrades to the Italia Road / Pacific Highway intersection is in direct response to the vehicle movements predicted to be generated by the State significant development (SSD) applications submitted by all three quarry operators. Consequently, the quarry operators have been working closely with TfNSW since 2020 to prepare a design for the intersection upgrades.

In-principle, support was provided by TfNSW for a concept design in June 2022 on the basis that the quarry operators agreed to jointly fund all costs associated with the approval and construction of the required upgrades. A commercial agreement between the quarry operators is in place and (subject to approvals) construction of the intersection is expected to be finalised and operational within the last quarter of 2025.

The concept design has now been further developed to meet the requirements of TfNSW, Council and Hunter Water Corporation (HWC) and this refined design forms the basis of the DA.

– An updated concept road design
– Bridge and culvert extension concept designs
– Flood impact assessment
– Geotechnical desktop assessment
– Construction noise and vibration impact assessment
– Phase 1 preliminary contamination assessment
– Traffic impact assessment
– A road safety audit
– A detailed cost report

The existing concept design includes northbound widening of the Pacific Highway to facilitate deceleration and acceleration lanes connecting with new turn lanes into and out of Italia Road. Road widening associated with the deceleration lane is in the order of 250 m in length, while the widening associated with the acceleration lane is in the order of 650 m in length. The northbound acceleration lane will also require widening of the bridge over the Balickera Canal.

1.3 Purpose of this report

This report assesses the noise and vibration impacts of the proposed intersection upgrade and excludes any quarrying activities.

This construction noise and vibration assessment has been prepared on behalf of Boral. The purpose of the construction noise assessment is to evaluate the potential noise and vibration impacts associated with the proposed development. It will form part of the environmental planning process.

The scope of work undertaken by GHD for this assessment is summarised below:

– Initial review of project information including, design plans and proximity of identified sensitive receivers.
– Establish the Construction Noise Management Levels (CNML), based on the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009), for the construction works associated with the proposed development.
– Establish construction vibration criteria based on relevant regulations, guidelines, policies.
– Based on the anticipated construction equipment associated with the proposed development, calculate the buffer distances required from the works to comply with the established CNMLs and relevant construction vibration criteria.
– Where receivers are expected to be within the buffer distances and exceedance of the established project criteria are expected, in-principle advice was provided on possible noise and vibration attenuation measures to mitigate construction impacts from the site.

1.4 Scope and limitations

This report has been prepared by GHD for Boral Resources (NSW) Pty Ltd and may only be used and relied on by Boral Resources (NSW) Pty Ltd for the purpose agreed between GHD and Boral Resources (NSW) Pty Ltd as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Boral Resources (NSW) Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Boral Resources (NSW) Pty Ltd and others who provided information to GHD such as noise observation data (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD has relied on this data and does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.5 Assumptions

GHD has undertaken this assessment based on the following assumptions:

– The noise monitoring data provided by Boral was conducted as per relevant standards and policies.
– The environment has not changed significantly since the noise monitoring.
– The construction works will not generate a significant increase in road traffic to what is existing on the road network.
– The construction works will operate during standard day time construction hours.

2. Project description

Currently, the Italia Road / Pacific Highway intersection is a seagull type intersection, with short right turn and left turn deceleration lanes. The intersection features a long acceleration lane for southbound vehicles turning right onto the Pacific Highway, which forms a third lane on the Highway until it merges approximately 1.2 km downstream of the intersection. This allows right turning vehicles to enter Pacific Highway giving way to traffic in the northbound direction and vehicles turning into Italia Road heading southbound only.

The proposed development involves safety upgrades to the intersection of Italia Road and Pacific Highway, including the following:

– Construction of a dedicated left-turn northbound acceleration lane from Italia Road onto the Pacific Highway, which will replace the current left-turn give-way movement with a safer downstream merge movement.
– Widening of the existing bridge over the Balickera Canal (to accommodate the northbound acceleration lane).
– Lengthening of the northbound deceleration lane into Italia Road.

All works are proposed to be undertaken within the existing road reserve.

The construction works is expected to be conducted during the standard day period, however some bridgeworks may be conducted during the night time period to minimise impact to traffic flow (*refer to Section 4.1.1 for time period definition*).

3. Existing environment

3.1 Project locality

Boral's Seaham Quarry is located on the southern side of Italia Road in Balickera, to the east of the township of Seaham and to the north of Newcastle. The Seaham Quarry is a primary source of hard rock for aggregate products used in the Hunter and Port Stephens regions of NSW.

The proposed development site (the Site) is located at the intersection of Italia Road and Pacific Highway and is the main access route for Boral's Seaham Quarry. The intersection of is located approximately 10 km north of Raymond Terrace, 25 km north of Newcastle and is in the Port Stephens local government area. Figure 3.1 shows the proposed development site and the immediate surrounding area.

Legend

- Site boundary
- Waterways
- Roads
- Proposed design
- Cadastre
- Nearest identified receivers
- Noise monitoring location (Umwelt 2022)

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Project locality, sensitive receivers and noise monitoring location

Project No. **12599191**
Revision No. **0**
Date **17/04/2023**

FIGURE 3.1

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Print date: 22 Jun 2023 - 14:48

Data source: World Hillshade: Esri, CGIAR
World Topographic Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS
Metromap Tile Service: . Created by: tthompson2

3.2 Sensitive receivers

The proposed development site is located east of the Seaham township and has sensitive receivers in the vicinity, which may be impacted by noise from the construction of the proposed development. Surrounding sensitive receivers have been identified via aerial imagery and are categorised as:

– Residential
– Active recreational
– Industrial

The nearest surrounding receivers and their type are listed in Table 3.1 and shown in Figure 3.1.

Table 3.1 Sensitive receivers

Receiver ID	Address	Receiver type	Approx. distance and direction from works
R01	16 Italia Road, Balickera	Residential	90 m North
R02	3848 Pacific Highway, Ferodale	Residential	75 m South
R03	3878 Pacific Highway, Ferodale	Residential	250 m North-East
R04	3880 Pacific Highway, Ferodale	Industrial	360 m North-East
R05	7 Barleigh Ranch Way, Eagleton	Active recreational	730 m South-West
R06	53 Italia Road, Balickera	Active recreational	520 m North-West

3.3 Noise levels

Existing noise levels of the area are based on noise monitoring conducted in the area in 2022 by Umwelt as part of another study. This base data is relied upon for this assessment.

It is assumed that the noise environment has not changed significantly since the noise monitoring.

Table 3.2 Unattended noise monitoring results

Location	L_{A90} RBL noise levels dB(A)			L_{Aeq} ambient noise levels dB(A)		
	Day	Evening	Night	Day	Evening	Night
Reserve off Italia Road (near Pacific Highway)	50	49	39	57	58	56
Note: Day time: 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays. Evening: 6:00 pm to 10:00 pm. Night time: remaining period (NSW *Noise Policy for Industry* (NPI), 2017).						

4. Regulatory requirements

4.1 Construction noise

4.1.1 General

Construction noise criteria were developed in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) for each noise catchment area. Standard hours defined in the guideline are:

– 7:00 am to 6:00 pm Monday to Friday
– 8:00 am to 1:00 pm on Saturday
– No work on Sundays or public holidays

It is anticipated that construction activities will take place during standard construction hours.

The ICNG acknowledges that the following activities can be justified to be conducted outside the recommended construction hours:

– The delivery of oversized plant or structure.
– Emergency work.
– Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours.
– Works which maintain noise levels at receivers below the night time noise affected construction noise management levels.

For recommended standard hours, the following terms are used in relation to establishment of construction noise criteria:

– The 'noise affected level' represents the point above which there may be some community reaction to noise. For standard construction hours this level is established with reference to the measured rating background level (RBL) (described in Table 4.1) plus 10 dB(A). Outside standard construction hours this level is the RBL plus 5 dB(A).
– The 'highly noise affected level' represents the point above-which there may be strong community reaction to noise. This level is set at $L_{Aeq(15min)}$ 75 dB(A).

The construction noise management levels (CNMLs) that apply to sensitive receivers within each noise catchment area during construction of the proposed development are presented in Table 4.1.

Table 4.1 ICNG CNMLs at identified receivers, dB(A)

Receiver type	ICNG Construction Noise Management Level $L_{Aeq(15min)}$ dB(A)	
	Highly affected noise level	During standard construction hours[1]
Residential	75 dB(A)	47 dB(A)
Active recreational	-	65 dB(A) (when in use)
Industrial		75 dB(A) (when in use)

[1]Standard construction hours (day) is defined as 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm on Saturdays.

[2]Outside standard construction hours (day) is defined as 7:00 am to 8:00 am and 1:00 pm to 6:00 pm on Saturdays, 8:00 am to 6:00 pm Sundays and public holidays.

[3] Outside standard construction hours (night) is defined as 6:00 pm to 7:00 am Monday to Friday and 6:00 pm to 8:00 am on Saturdays, Sundays and public holidays.

4.1.2 Construction vibration criteria

Human comfort

Vibration criteria for human comfort have been established with consideration to the *Assessing Vibration: A Technical Guideline* (AVTG) (February 2006) for guidance on human exposure to vibration.

The AVTG separates sources of vibration into continuous, impulsive and intermittent and explains that each category should be assessed differently. Vibration from construction work, passing heavy vehicles, and piling is provided as an example of an intermittent source of vibration which is to be assessed using the vibration dose value (VDV) method.

While the AVTG recommends that for intermittent vibration VDV is used as the primary indicator for human comfort, the British Standard BS 5228-2:2009 *Code of practice for noise and vibration on construction and open sites – Part 2: Vibration* guidance can be used as an additional indicator of perceptibility. BS 5228-2 recommends the guidance values presented in Table 4.2. These values are often more suitable for construction works as available information for construction activities and equipment is typically in the form of a peak particle velocity value rather than a dose value.

Table 4.2 Guidance on effects of vibration levels

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30 mm/s	Vibration might be just perceptible in residential environments.
1.00 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Cosmetic damage

Vibration criteria for cosmetic damage have been established with consideration to:

– British Standard BS 7385:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground Borne Vibration for guidance on cosmetic damage to residential buildings*.

– German Standard DIN 4150-3: 2016 *Vibrations in buildings – Part 3: Effects on structures for guidance on cosmetic damage to heritage buildings*.

Table 4.3 Transient vibration guide for cosmetic damage (BS 7385:1993)

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

Table 4.4 Guideline values for short term vibration on structures (DIN 4150-3)

Type of structure	Guideline values for velocity, (mm/s)		
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example heritage listed buildings)	3	3 to 8	8 to 10

No vibration sensitive buildings (i.e. heritage buildings) were identified in the sensitive receiver areas and is not discussed further in this report.

Vibration damage to utilities

The British Standard BS 5228-2:2009 Code of Practice for noise and vibration control on construction and open sites and the German Standard 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures which provide information on the vulnerability of ground-related services and structures to vibration. Table 4.5 and Table 4.6 present the vibration guideline values in the British Standard and German Standard (DIN), respectively.

For the purpose of this assessment, the British Standard criteria (the more conservative criteria) has been adopted for damage to underground services. Applicable criteria can be summarised as 30 mm/s for intermittent or transient vibrations (excavators and grader) and 15 mm/s for continuous vibrations (compactors and rollers).

Table 4.5 Vibration guide values for underground services - British Standard

Type of Utility	Maximum PPV (mm/s)	
	Intermittent or transient vibrations	Continuous vibrations
Underground services	30	15

Table 4.6 Guideline values for vibration on buried pipework - DIN

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

Note that in general, compliance with the guideline values for structural damage would result in compliance with the guideline values for buried pipework.

5. Impact assessment

5.1 Construction noise assessment

Due to the inherent nature of construction and proximity of sensitive receivers to the proposed development site, it is expected that noise from certain activities associated with the construction works will impact the receivers. Noise from construction works should be minimised where possible.

Table 5.1 shows a list of anticipated construction activities, their equipment and associated sound power levels (SWL). The equipment's SWLs were selected with reference to AS2436, BS5228, RMS's Construction Noise and Vibration Guidelines, manufacturer's technical specification datasheets and GHD's internal database.

To provide an understanding of potential noise impacts, Table 5.2 lists the distances required to comply with the established construction noise management levels. These distances represent a conservative scenario where all equipment of an activity is operating simultaneously for the assessment period.

Table 5.1 Indicative construction activities and equipment

Scenario ID	Activity	Equipment	Qty	Operational time	Sound Power Level (dB(A))	Equivalent Sound Power Level (dB(A))
S1	Planning, mobilisation and preparation	Light vehicle	2	100%	103	110
		Delivery truck	1	100%	106	
		Hand tools	1	100%	101	
S2	Tree clearing	Chainsaw	2	100%	114	121
		Delivery Truck	2	100%	108	
		Excavator	2	100%	107	
		Mulcher	1	100%	116	
S3	Excavation/Earthworks	Dump trucks	2	100%	108	120
		Tracked excavator	1	100%	107	
		Jackhammer	1	100%	112	
		Generator	1	100%	88	
		Hydraulic hammer	1	100%	117	
		Water cart	1	100%	109	
		Concrete/Asphalt Saw	1	100%	112	
		Dozer	1	100%	109	
S4	Filling, compacting and resurfacing	Dump truck	2	100%	108	118
		Vibratory roller	1	100%	103	
		Tracked excavator	1	100%	107	
		Grader	1	100%	115	
		Concrete truck	1	100%	104	
		Compactor	1	100%	106	
		Delivery Truck	1	100%	108*	

Scenario ID	Activity	Equipment	Qty	Operational time	Sound Power Level (dB(A))	Equivalent Sound Power Level (dB(A))
S5	Bridgeworks	Franna crane 20t	1	100%	98	118
		Piling rig - bored	1	100%	112	
		Power generator	1	100%	100.1*	
		Concrete pump	1	100%	102*	
		Concrete truck	1	100%	109*	
		Compressor	1	100%	109*	
		Pneumatic hammer	1	100%	115*	
		Welding equipment	1	100%	105*	
S6	Asphalting	Tracked excavator	1	100%	107	117
		Drum roller	1	100%	108	
		Dump truck	2	100%	108	
		Asphalt truck	1	100%	105	
		Bitumen sprayer	1	100%	103	
		Front end loader	1	100%	114	
S7	Guardrail and signage installation	Delivery Truck	1	100%	108	116
		Post Hammer/Driver	1	100%	115	
		Hand tools	1	100%	98	
S8	Site clean-up, stabilisation and restoration	Light vehicle	2	100%	103	111
		Delivery truck	1	100%	108	
		Hand tools	1	100%	105	
S9	Compound	Light vehicle	5	100%	103	112
		Delivery truck	1	100%	108	

Based on the distances shown in Table 5.2 and the distance of the site to the nearby sensitive receivers, the noise impacts from the construction activities are identified as follows:

– Planning, mobilisation and preparation will:
  - Comply with the Construction Noise Management Level (CNML) for all identified receivers
– Tree clearing:
  - Exceed the CNML at R01 and R02
  - Comply with the CNML for all other identified receivers
– Excavation:
  - Exceed the CNML at R01 and R02
  - Comply with the CNML for all other identified receivers
– Filling, compacting and resurfacing:
  - Exceed the CNML at R02
  - Comply with the CNML for all other identified receivers

– Bridgeworks:
  - Comply with the CNML for all identified receivers
  - Exceed the night time CNML at R01 and R02
  - Comply with the night time CNML for all other receivers
– Asphalting:
  - Exceed the CNML at R02
  - Comply with the CNML for all other identified receivers
– Guardrail and signage installation:
  - Comply with the CNML for all identified receivers
– Site clean-up, stabilisation and restoration:
  - Comply with the CNML for all identified receivers
– Compound:
  - Comply with the CNML for all identified receivers for day and night periods

The CNML represents the point above which there may be some community reaction to noise. Highly affected level (residential receivers only) represents the point above which there may by strong community reaction to noise.

Section 6 outlines general mitigation measures, which are recommended to reduce the noise impact. The mitigation measures in Section 6.2 should be applied where reasonable and feasible. Community engagement and consultation should be carried out with the surrounding area to minimise community reaction to noise.

5.2 Construction road noise

It is not expected that the construction will significantly increase the number of vehicles on the surrounding road network and would represent a negligible perceived increase to the existing road traffic noise. For reference, a doubling of existing traffic would result in an increase of 3 dB to the existing road traffic noise.

Table 5.2 Construction noise impact buffer distances for sensitive receivers.

ID	Activities	Equivalent SWL (dB(A))	Noise impact buffer distances (m)		
			Residential Receivers		Other sensitive land uses
			Construction Noise Management Level (60 dB(A))	Highly Affected Level (75 dB(A))	Active Recreation Areas (65 dB(A))
S1	Planning, mobilisation and preparation	110	42	11	28
S2	Tree clearing	121	105	30	69
S3	Excavation/Earthworks	120	105	30	69
S4	Filling, compacting and resurfacing	118	81	24	54
S5	Bridgeworks	118	88 416 (Night time)	26	59
S6	Asphalting	117	81	24	54
S7	Guardrail and signage installation	116	69	20	46
S8	Site clean-up, stabilisation and restoration	111	50	14	33
S9	Compound	113	54 224 (Night time)	15	36

5.3 Construction vibration assessment

Construction activities would result in a short-term increase in localised vibration levels, as energy from equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on a range of factors including the method of energy transfer, the vibration frequency and type and the characteristics of the ground and surrounding topography. Due to complicated ground conditions and other variables associated with construction vibration, an exact vibration assessment result is generally not expected from available prediction methods.

For reference, Table 5.3 provides indicative safe working buffer distances to comply with human comfort, cosmetic damage for standard dwellings and underground utilities. Note that construction will require plant and equipment not listed in the table, but the below are some of the typical equipment that generate the most vibration.

Table 5.3 Vibration safe working distances

Equipment	Safe working buffer distances (m)		
	Human Comfort (1 mm/s)	Residential Building Cosmetic Damage (5 mm/s)	General Underground Utilities (15 mm/s)
15t Tandem Roller (CB15) [1]	55	20	10
10t Tandem Roller (CB10) [1]	45	15	10
7t Tandem Roller (CB7) [1]	35	15	5
10t Single Roller (CS10GC) [1]	85	30	15
Orteco Piledriver (HD1000) [2]	3	1	<1
Jackhammer (45 J) [2]	1	<1	<1
Hydraulic hammer (2 kJ) [2]	4	1	<1
Hydraulic hammer (3 kJ) [2]	5	2	<1
Hydraulic hammer (4 kJ) [2]	5	2	<1
Hydraulic hammer (6 kJ) [2]	6	2	<1
Hydraulic hammer (7.5 kJ) [2]	7	2	1
Hydraulic hammer (10.2 kJ) [2]	7	2	1
Concrete saw [3]	6	2	1
Dozer [3]	35	9	3
Excavator [3]	18	5	2
Asphalt Paver [3]	10	3	1

[1] Vibration levels are based on steady-state vibratory compaction formula from BS5228-2:2009.

[2] Vibration levels are based on percussive piling formula from BS5228-2:2009.

[3] Vibration levels are based on the application of the typical vibration attenuation formula against general sample data.

The most vibration intensive equipment associated with the construction works are anticipated to be vibratory roller and hydraulic hammer.

The activities are not expected to exceed the residential building vibration criteria at the nearest receivers, but have the potential to exceed the human comfort vibration criteria at R02, if a 10T Single Roller is used.

These safe working distances are indicative only and may vary depending on the specific equipment used, nearby receiver dwelling type and the ground conditions. The construction contractor should verify the proximity of sensitive receivers, buildings and underground utilities from vibration intensive works prior to commencing. If operation of any of the above equipment are within the safe working distances, it is recommended that the vibration mitigation measures covered in Section 6.2 be implemented.

6. Noise mitigation measures

6.1 In-principle noise control methods

The measures provided below are best practice and should be implemented to minimise potential noise and vibration impacts where reasonable and feasible.

In principle, there are three approaches to controlling noise and vibration:

– Control at the source
– Control on the source-to-receiver pathway
– Control at the receiver

6.1.1 Control at the source

Control at the source is considered to be the most cost-effective in the reduction of noise and vibration levels and as such should be given highest priority when considering mitigation options. The solutions available include:

– Substitution of equipment:
  - Substitution involves where reasonably practicable the use of less noisy. Equipment should be selected to meet the needs of the project or process it is required for and not be excess.
– Modification of existing equipment:
  - Modification of equipment involves the addition of acoustic treatments to parts of the machinery. These include but are not limited to improved mufflers, stiffening of panels and surface coating of resonance dampening material. These options would often require discussion with the supplier and manufacturer of the equipment.
– Use and siting of equipment:
  - Plant should always be used in accordance with the manufacturer's instructions. Where possible the location of equipment should be away from noise sensitive areas. This includes taking into consideration the emission direction of equipment and directing this away from noise sensitive receivers. Plant used intermittently should be shut down during the intervening periods or throttled down to a minimum.
– Regular and effective maintenance:
  - Maintenance should be carried out to ensure equipment is running at optimal conditions.

6.1.2 Control along the path

There are two ways of mitigating noise along the transmission path:

– Increasing the distance between the source and receiver.
– Where distance is limited, screening of noise may be considered. In some circumstances it may also be possible to enclose the equipment during the operation.

Table 6.1 provides typical noise attenuation provided by noise control methods.

Table 6.1 Typical attenuations for source to receiver noise control methods

Control by	Nominal noise reduction possible, in total A-weighted sound pressure level LpA dB
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum of 15
Enclosure	Normally 15 to 25, maximum of 50

6.1.3 Control of noise at the receiver

Reasonable and feasible mitigation measures at the receivers for this project are limited to effective community consultation at this stage of the design. It is envisioned that design focused mitigation measures (i.e. Control at the source) will help the construction of the proposed development achieve compliance at all receivers during standard construction hours.

In the event that there are exceedances at sensitive receivers after all reasonable and feasible mitigation measures are implemented at the site, noise treatments at the receiver property may need to be considered.

6.2 Construction mitigation and management measures

The noise and vibration mitigation measures detailed in Section Table 6.2 are recommended where reasonable and feasible to reduce the impact on the surrounding receivers and sensitive land uses during construction.

Table 6.2 Mitigation measures for construction noise and vibration

Action required	Details
General controls	
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction should include: – All relevant project specific and standard noise and vibration mitigation measures – Relevant licence and approval conditions – Permissible hours of work – Location of nearest sensitive receivers – Construction employee parking areas – Designated loading/unloading areas and procedures – Site opening/closing times (including deliveries) – Environmental incident procedures
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Implement community consultation measures	Contact will be established with the local residents and the construction program and progress communicated on a regular basis, particularly when noisy or vibration-generating activities are planned. Affected receivers will be notified of the intended work, its duration and times of occurrence. This may include a local community update letters for specific construction activities and a Project info line.
Implement complaints management measures	Complaints will be managed in accordance with the procedure outlined below. Signage at each site will clearly and visibly provide a contact number and name to receive complaints and enquiries about construction. Potential complaints specific to these works could include: – Vibration impacts from works that significantly affect structures or dwellings. – A cluster of noise and/or vibration complaints. In this instance the response would be to: – Verbally respond to complainant. – Provide a written response within seven calendar days if the complaint cannot be resolved verbally. – Log the complaint, and any actions taken with regards to the complaint within a complaints register. – Undertake monitoring at the complainant's residence(s). – Investigate the nature and reasons of the impact. – Investigate and implement further mitigation measures to minimise the impact.

Action required	Details
Compliance vibration measurements	Vibration monitoring will be undertaken where construction equipment operate within the safe working distances, outlined in Table 5.3, of a building or when a complaint is received. Vibration monitoring should be conducted during these activities at the most susceptible buildings close to the construction sites. Where exceedances of the relevant vibration criteria outlined in Section 4.1.2 are recorded, the situation should be reviewed in order to identify the measures that can be taken to minimise the impacts to sensitive equipment and prevent structural damage. The review may result in a requirement to modify work practices or use alternative, low-vibration methods and equipment. Any vibration measurement will be undertaken by a qualified professional and with consideration to the ICNG guidelines.
Source controls	
Construction hours and scheduling	Comply with the recommended standard construction hours outlined in Section 4.1.1, unless out of hours work has been approved. No truck movements before 7.00 am or after 6.00 pm. For any work that would take place outside of normal construction hours: – Undertake an assessment of the potential noise and vibration impacts associated with the proposed activities and outline specific mitigation measures. – Residents potentially affected by such activities will be notified at least five days before hand. – Minimise consecutive night activities in the same locality and provide periods of quiet if activities occur for extended periods during the night. – Conduct activities in a manner that eliminates or minimises the need for audible warning alarms.
Construction respite period	High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. Examples of these activities include pneumatic or hydraulic hammering, concrete/asphalt sawing and vibratory rollers near sensitive receivers. High noise refers to construction noise impacts which exceed the highly affected noise management level of 75 dB(A) $L_{Aeq(15\text{-}min)}$ during standard construction hours.
Equipment selection	Use quieter and less vibration emitting construction methods where reasonable and feasible. Use tandem vibratory rollers instead of single drum rollers – 10T single drum roller are anticipated to exceed the human comfort level at R02.
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading unloading areas to minimise reversing movements within the site.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur during standard construction hours. Contractors are to avoid dropping materials from height where practicable, during loading and unloading. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Path controls	
Use of safe working/buffer distances	The safe working/buffer distances outlined in Table 5.2 and Table 5.3 will be observed when reasonable and feasible to minimise adverse vibration impacts.

7. Conclusions

GHD Pty Ltd was engaged by Boral Resources (NSW) Pty Ltd (Boral) to develop a design for the intersection upgrade of the intersection at Pacific Highway and Italia Road, Balickera (the proposed development). The purpose of the construction noise and vibration assessment is to evaluate the potential noise and vibration impacts associated with the construction of the proposed development.

This noise and vibration assessment has led to the following conclusions, which are subject to the limitations and assumptions outlined in Section 1.4 and 1.5:

– For construction activities associated with the proposed development:
  - Based on indicative construction equipment and distances involved between the construction areas and the nearest sensitive receivers:
    – Noise impacts are expected at R01 and R02 during different construction activities of the proposed development.
    – Vibration levels generated are not expected to have any impacts on nearby buildings in terms of cosmetic damage.
    – Vibration levels generated can potentially have human comfort impacts at a single receiver (R02), if a 10T single drum roller is used.
  - It is recommended, where reasonable and feasible, that the mitigation measures outlined in Section 6.2 be used to minimise noise impacts due to construction activities.
  - It is recommended that a construction noise management plan is developed for the works. The plan will cover more detailed construction activities, their impacts and the mitigation measures to be implemented.

Appendix A

Noise buffer zones

Legend

- Waterways
- Roads
- Cadastre
- Construction activity area
- Nearest identified receivers

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Planning, mobilisation and preparation

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12599191\GIS\Maps\Deliverables\12599191_NVIA_0.aprx
Print date: 22 Jun 2023 - 14:47

Data source: World Hillshade: Esri, CGIAR
World Topographic Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS
Metromap Tile Service: . Created by: tthompson2

Legend

- Waterways
- Roads
- Suburbs
- Cadastre
- Construction activity area
- Nearest identified receivers

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Tree clearing

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.2

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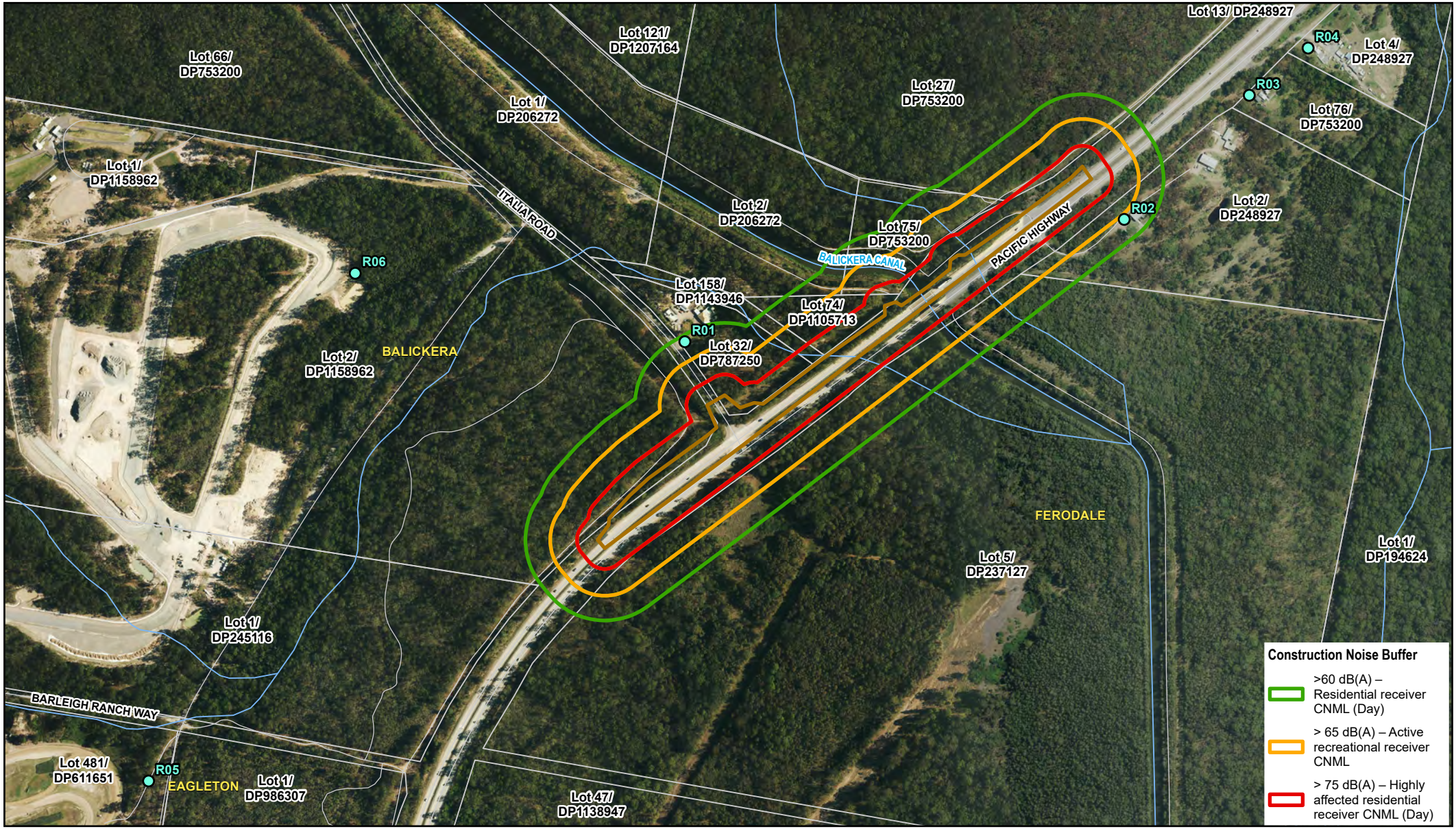
Metromap Tile Service: . Created by: tthompson2



Legend

- Waterways
- Roads
- Cadastre
- Construction activity area
- Nearest identified receivers

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Excavation/Earthworks

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.3

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World Topographic Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS
Metromap Tile Service: . Created by: tthompson2

Legend

- Waterways
- Roads
- Cadastre
- Nearest identified receivers
- Construction activity area

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Filling, compacting and resurfacing

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.4

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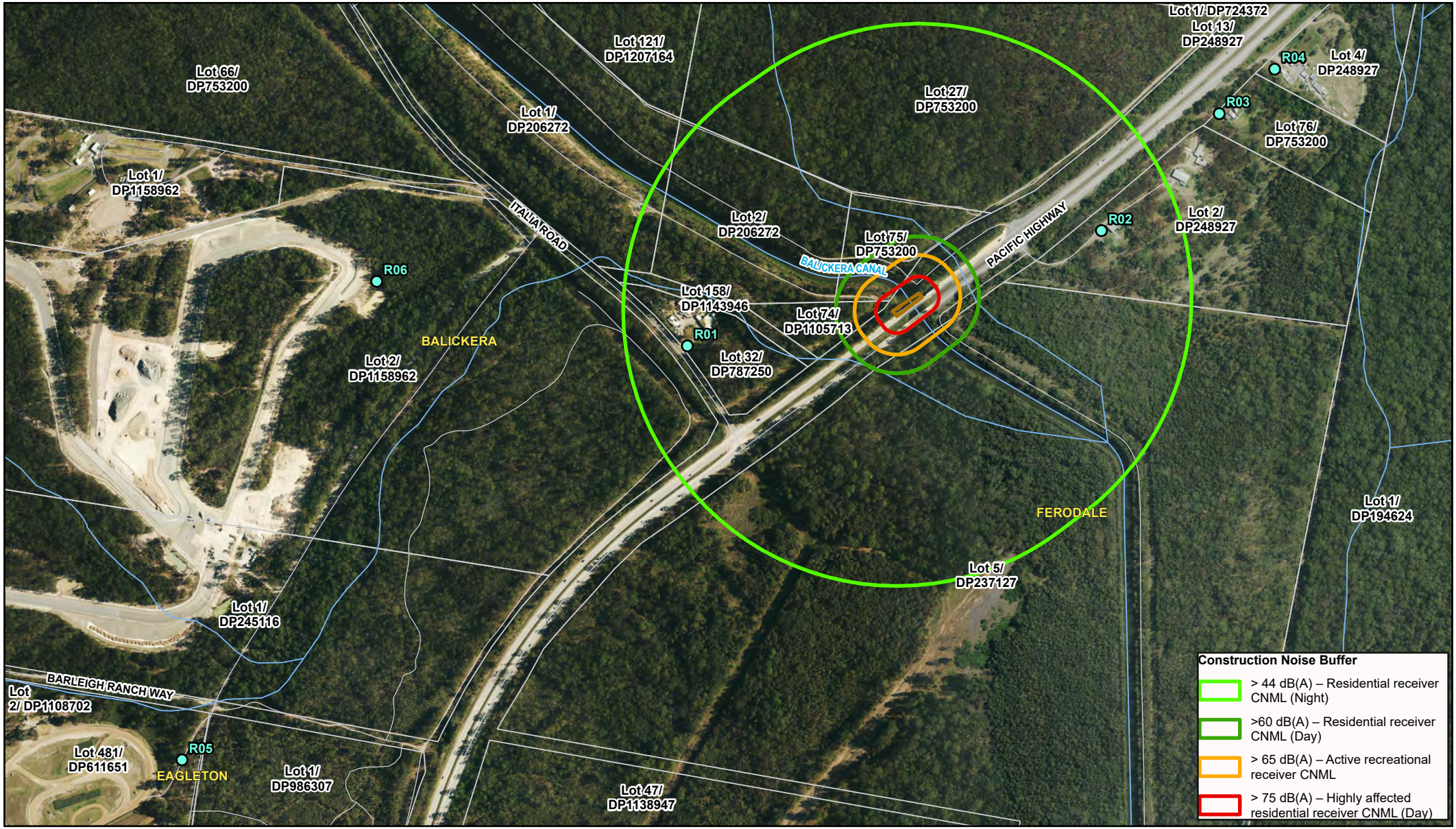
Metromap Tile Service: . Created by: tthompson2



Legend

- Waterways
- Roads
- Cadastre
- Nearest identified receivers
- Construction activity area

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Bridgeworks

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.5

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World Topographic Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS
Metromap Tile Service: . Created by: tthompson2

Legend

- Waterways
- Roads
- Suburbs
- Cadastre
- Construction activity area
- Nearest identified receivers

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Asphalting

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.6

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World Topographic Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS
Metromap Tile Service: . Created by: tthompson2

Legend

- Guardrail
- Waterways
- Roads
- Suburbs
- Cadastre
- Construction activity area
- Nearest identified receivers

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Guardrail and signage installation

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.7

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World Topographic Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS
Metromap Tile Service: . Created by: tthompson2

Legend

- Waterways
- Roads
- Suburbs
- Cadastre
- Construction activity area
- Nearest identified receivers

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Site clean-up, stabilisation and restoration

Project No. **12599191**
Revision No. **0**
Date **15/05/2023**

FIGURE A.8

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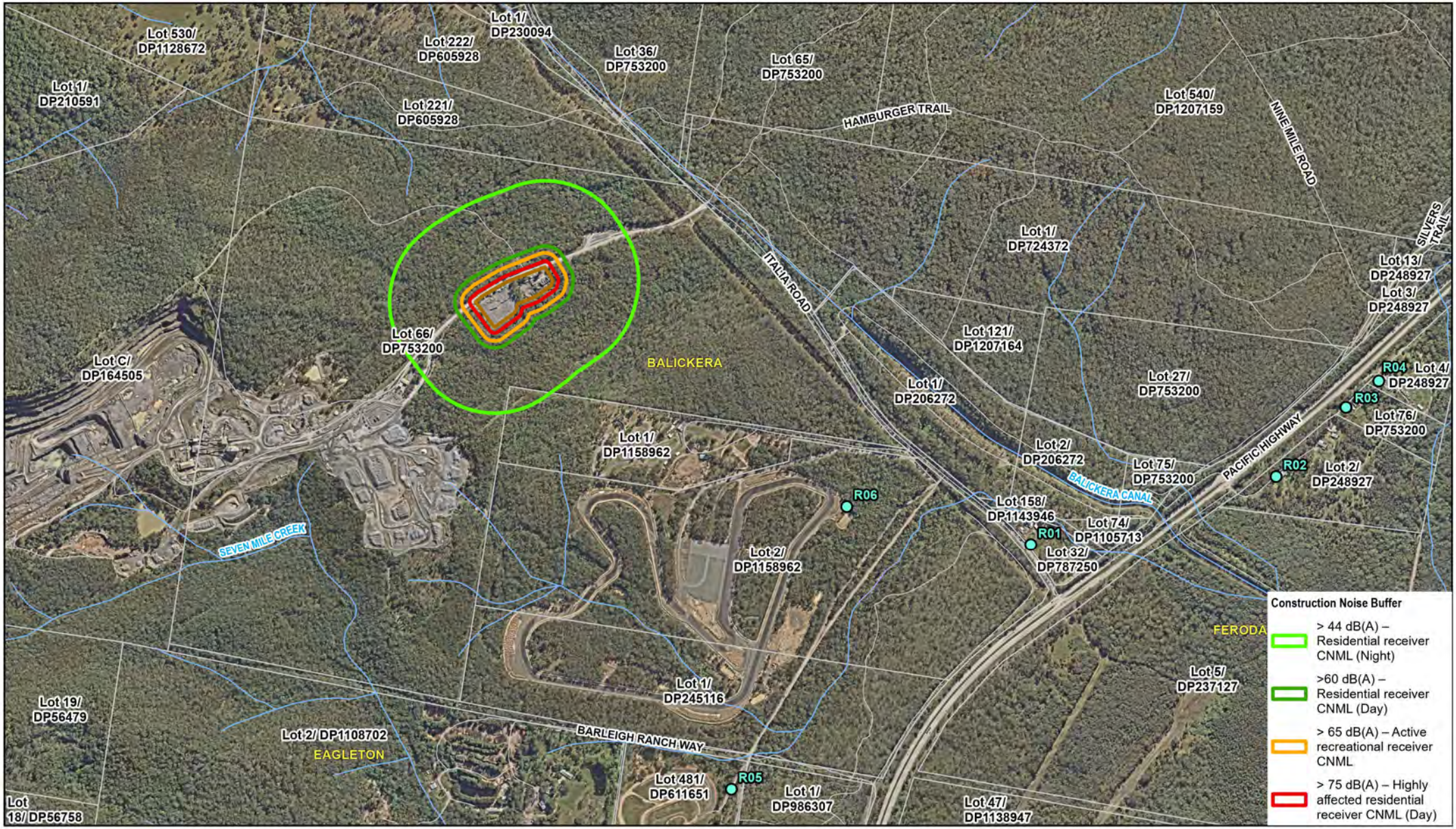

Legend

- Waterways
- Roads
- Suburbs
- Cadastre
- Nearest identified receivers
- Construction activity area

Paper Size ISO A4

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Boral Resources (NSW) Pty Ltd
Boral Quarry Seaham -
Italia Road Intersection
Construction Noise and Vibration Impact Assessment

Compounds

Project No. **12599191**
Revision No. **0**
Date **02/08/2024**

FIGURE A.9

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Data source: World Hillshade: Esri, CGIAR
World Topographic Map: Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
Nearmap WMS Server: . Created by: ehaverkamp

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The Power of Commitment