Bentley Quarry

Environmental Impact Statement

R & S Contracting

11 November 2021

→ **The Power of Commitment**

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Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	C Harris	B Luffman		S Lawer		29/10/2021
S4	1	B Luffman	S Lawer		S Lawer		11/11/2021

Submission of Environmental Impact Statement

Prepared under the Environmental Planning and Assessment Act 1979, Section 78A		
Environmental Assessment prepared by	Name:	Ben Luffman
	Qualifications:	B.App.Sc. (Hons), Grad. Dip Urban and Regional Planning
	Address:	GHD Pty Ltd 230 Harbour Drive, Coffs Harbour, New South Wales 2450, Australia
	In respect of:	Bentley Quarry
Development Application	Applicant name:	R & S Contracting
	Applicant address:	1465 Bentley Road Bentley NSW 2480
	Land to be developed:	1465 Bentley Road Bentley NSW 2480
	Lot no, DP/MPS, vol/fol etc:	Lot 2 DP 1196757
Environmental Impact Statement	An Environmental Impact Statement is attached.	
Certificate	I certify that I have prepared the contents of this Environmental Impact Statement and to the best of my knowledge: – It is in accordance with the requirements of Part 4; – It contains all available information that is relevant to the Environmental Impact Statement; and – That the information contained in the Environmental Impact Statement is neither false nor misleading	
	Signature	
	Name	Ben Luffman
	Date	11 November 2021

Executive summary

R & S Contracting Pty Ltd proposes to construct and operate a hard rock quarry (Bentley Quarry) to extract up to 300,000 tonnes per annum and 2,000 tonnes per day over 30 years, with a total disturbance area of approximately 6.5 hectares (the project). Bentley Quarry will predominantly supply materials for use as fill and for road construction and maintenance.

Site overview

The site is approximately 214 ha in area and sits on undulating pasture land. The site is approximately 14 kilometres west of Lismore.

The northern portion of the site has been cleared due to historical agricultural land uses, with scattered paddock trees remaining. Native vegetation exists on the higher slopes in the southern portion of the site.

The site is zoned RU1 Primary Production under *Richmond Valley Local Environmental Plan 2012*, as is the surrounding area.

The surrounding area is sparsely populated. The closest residence lies 650 m north of the site; however, it is currently not occupied. The closest occupied dwelling is located 1.25 km east of the Project site.

Overview of the Project

The project generally involves:

– Progressive installation of environmental controls including erosion and sediment control measures, establish revegetation area and install nest boxes
– Delineation of the site and stockpiling areas
– Construction of fencing
– Construction of a site office, weighbridge and car parking area
– Crush and screen material at the site to use to construct the access road and intersection
– Construction of an access road and intersection with Bentley Road, including installation of signage
– Importation of clean soil for landscape mounds to the east and west of the quarry
– Vegetation clearance, soil stripping and stockpiling for use in landscape mounds
– Expanded quarry operations, including blasting, crushing, screening, precoating and importing materials for blending
– Close and rehabilitate the quarry

Statutory legislation

This Environmental Impact Statement has been prepared in accordance with the provisions of the *Environmental Planning and Assessment Act 1979* and addresses the Department of Planning, Industry & Environment's Secretary's Environmental Assessment Requirements (no 1589) issued for the project on 20 July 2021.

The project is classified as designated development as defined in Schedule 3 of the Environmental Planning and Assessment Regulation 2000, as it is an extractive industry with an intended capacity of more than 30,000 cubic metres of material per year and disturbing a total surface area of more than 2 hectares of land.

The project is also integrated development, in accordance with Section 4.46 of the EP&A Act, as an Environmental Protection Licence under the *Protection of the Environment Operations Act 1997* and an approval under Section 138 of the *Roads Act 1993* will be required.

The project is also regional development as defined in Schedule 7 of *State Environmental Planning Policy (State and Regional Development) 2011* as it involves an extractive industry that is designated development. The Northern Regional Planning Panel will therefore be the consent authority for the project unless the Minister orders otherwise.

Consultation

Consultation with a range of government agencies and community stakeholders was undertaken for the EIS, to both inform the stakeholders of the project and to allow any issues of concern to be raised at an early stage of the planning process and incorporated into the EIS.

Concerns raised by the local community included water, dust, noise and traffic related impacts as well as the concerns regarding the quarry limiting the subdivision potential and value of neighbouring properties and undermining Bentley Road. These concerns have been addressed throughout the EIS.

Land resources

The disturbance area is in the northern section of the property, which has an elevation of 63 m Australian Height Datum (AHD). The property slopes up towards a ridge in the southern portion of the site with an elevation of 256 m AHD. The ridge is the highest point in the area, with the surrounding plains having an elevation between 60 and 200 m AHD. The soils are generally not suitable for intensive agriculture.

The project would change the topography of the site but due to previous quarrying activities and the relatively small area (the extraction area is only a little over 1% of the property) this is not considered to result in a significant impact on available land resources in the local area.

The project will have minimal impact on adjacent existing agricultural activities, with the project expected to coexist with the surrounding agricultural land uses in the locality.

Water resources

No watercourses or dams are located on the site, however there is an ephemeral drainage line to the west where a dam has been constructed. This flows north into Back Creek. Back Creek is located approximately 883 m to the north of the quarry, travelling in an east-west direction. Another watercourse is located approximately 872 m to the west of the quarry, travelling in a north-south direction and connecting to Back Creek.

A groundwater monitoring bore was installed at the site as part of geotechnical investigations undertaken by GHD in 2021. The screened interval is 23 to 27.5 m below ground level (bgl). Depth to groundwater was 11.9p m bgl (54.1 m AHD), which represents the level of the water table.

Groundwater interception is expected during Stages 3 and 4 of the Project with the lowering of the quarry floor to RL49m.

The average total water deficit for dust suppression demands is approximately 1 ML/year. External water sources such as water trucks or nearby farm dams may be used to cover for the total water deficit.

Noise and vibration

Existing noise levels in the area surrounding the site are low and typical of a rural environment.

The noise assessment prepared for the project indicates that noise levels generated from worst case quarry operations for Stage 1 of the project are predicted to exceed criteria at sensitive receivers R1 and R2 by 2.3 and 2.6 dB respectively. These exceedances are considered low risk as R1 is the quarry owner and R2 is the abandoned homestead which is uninhabited. Additionally, the NPI considers an exceedance of 2 dB to be negligible and does not warrant receiver-based treatments or controls.

The predicted growth in quarry traffic along local roads due to peak production operations was investigated using the United States EPA's Intermittent Traffic Noise guidelines. This model indicated road noise along the local roads would comply with the Road Noise Policy (RNP) criteria at all assessed sensitive receivers.

The assessment indicates blasting would be restricted by the air blast overpressure rather than the ground vibration levels.

Air quality

The annual average wind speed is moderate at 2.8 m/s and predominantly from the northwest, south and southeast sectors. There is limited information available on the air quality of the area, therefore, a default rural background daily average has been adopted.

An Air Quality Impact Assessment, prepared for the project, has determined that dust and particulate matter would be the primary emission to air from the quarry with potential for off-site impact. The assessment of dust impacts on surrounding residential receptors showed that no incremental impacts are predicted for TSP, PM_{10} or $PM_{2.5}$.

Biodiversity

The project site has previously been cleared for cattle grazing and is dominated by exotic grasses and other weeds. Based on field assessments, no threatened flora species were detected within the proposed disturbance area.

BioNet search results identified records of 11 threatened fauna species listed under the BC Act within the search area. Three threatened fauna species were confirmed at the site during the field assessments.

Based on the desktop analysis and habitat present, species assessed as having a moderate or higher likelihood of occurrence within the study area were further considered. Tests of significance were completed for the species recorded or assessed has having a moderate or higher likelihood of occurrence within the study area, which found that the project is unlikely to result in a significant impact to the species within the locality.

A Koala Habitat Assessment was undertaken under the *Environment Protection and Biodiversity Conservation Act 1999*, which found that the vegetation in the proposed disturbance area is not likely to constitute habitat critical to the survival of the species.

Traffic and transport

The Project site is located on Bentley Road, a 2-way, line marked, sealed road with a speed limit of 100 km/h in the vicinity of the site. Bentley Road intersects with Summerland Way 20 km to the north-west of the site, which connects to the towns of Kyogle and Casino.

The traffic generated by the project is expected to have minimal impact on the mid-block capacity, safety and traffic on the local network. However, turn treatments at the access road are required. The right turn from Bentley Road to the site access road requires a channelised right-turn (CHR(S)), and for the left turn, an auxiliary left-turn (short lane) (AUL(S)) is required.

The proposed access routes to and from the site are considered suitable to accommodate the specified type of haulage vehicles.

Heritage

A site investigation and search of the available databases did not reveal any location of heritage significance within the site.

Aboriginal community consultation was undertaken via the Casino Bolangle Local Aboriginal Land Council (LALC). The LALC conducted a heritage survey of the proposed disturbance area, which did not uncover any Aboriginal objects. The LALC has recommended mitigation measures to protect Aboriginal objects.

Visual amenity

The disturbance area is visible from Bentley Road. Earth berms will be constructed to screen the disturbance area from view of Bentley Road and surrounds.

Waste management

The Project has the potential to generate waste from quarry activities and general site use but the types of waste generated are not expected to be in significant quantities.

All waste would be managed in accordance with the waste hierarchy where emphasis is placed upon reducing, re-using and recycling prior to disposal.

Hazards and risks

There are limited hazards and risks associated with the project and they have been addressed in other sections of this EIS.

Socio-economic

The project is not located within proximity to incompatible land uses, such as residential development.

During operation it is likely that there would be a maximum of 5 workers or plant operators on the site at any one time. These employment opportunities will be made available to the labour pool of the Richmond Valley LGA.

The project will supply material for construction of both public and private roads, thereby facilitating development of the Richmond Valley LGA.

Conclusion

This EIS has been prepared in accordance with the provisions of the EP&A Act and addresses the SEARs.

The project justification is robust because the project responds to a recognised need for resources and provides several economic benefits. The EIS has demonstrated that the project site is suitable for the proposed use, the project is in the public interest and that it is consistent with the objects of the EP&A Act and the principles of Ecologically Sustainable Development.

The EIS has documented the potential environmental impacts of the project, considering both negative and positive impacts, and recommended management and mitigation measures to protect the environment, where required. Based on this, the environmental and community impacts are minimal, and the project benefits outweigh the negatives. Accordingly it is considered the project should be approved in accordance with this EIS and associated development plans.

Note

This EIS is subject to, and must be read in conjunction with, the limitations set out in section 1.7 and the assumptions and qualifications contained throughout the EIS.

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1. Introduction

1.1 Project overview

R & S Contracting Pty Ltd (R & S Contracting) proposes to construct and operate a hard rock quarry (Bentley Quarry) to extract up to 300,000 tonnes per annum (tpa) and 2,000 tonnes per day (tpd) over 30 years, with a total disturbance area of approximately 6.5 hectares (the project). Bentley Quarry will predominantly supply materials for use as fill and for road construction and maintenance.

The property is owned by SL McKenzie & RG McKenzie and is approximately 214 hectares in size, located approximately 14 kilometres west of Lismore (refer Figure 1.1). A quarry has operated at the site intermittently since the 1970's. Recently the quarry has operated according to existing use rights which allowed an extraction rate of 3,000 m^3 and an extraction area of approximately 1 hectare.

The project would fulfil demand for aggregate products for the construction of roads within the region.

GHD Pty Ltd (GHD) has been engaged by R & S Contracting to prepare an Environmental Impact Statement (EIS) to support a development application for the project under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

This EIS has been prepared in accordance with the provisions of the EP&A Act and addresses the Department of Planning, Industry & Environment's (DPIE) Secretary's Environmental Assessment Requirements (SEARs) (no 1589) issued for the project on 20 July 2021 (provided in Appendix A).

1.2 Project location

The property is Lot 2 DP 1196757, 1465 Bentley Road, Bentley which is in the Richmond Valley Local Government Area (LGA) in the Northern Rivers region of NSW (refer Figure 1.1).

An existing quarry is located at the northern end of the property, near Bentley Road.

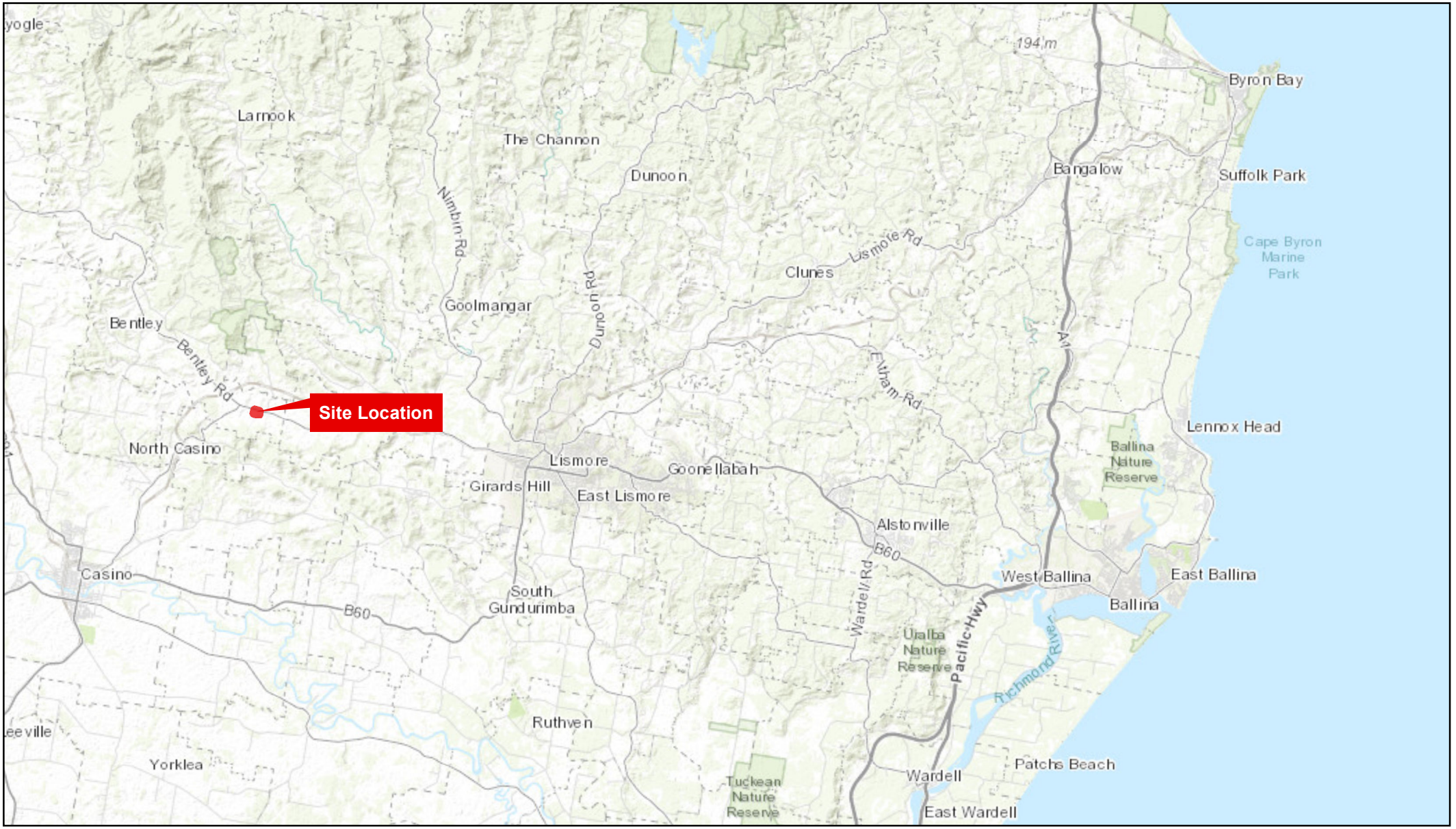
The project site would be in the same location as the existing quarry. The project site covers an area of 6.5 hectares, which would be the disturbance area. The disturbance area includes an extraction area of 3.65 hectares (refer Figure 1.2).

1.3 Project overview

The project generally involves the establishment of a hard rock quarry and ancillary facilities on the site. The project will include:

- Progressive installation of environmental controls including erosion and sediment control measures, establish revegetation area and install nest boxes
- Delineation of the site and stockpiling areas
- Construction of fencing
- Construction of a site office, weighbridge and car parking area
- Crush and screen material at the site to use to construct the access road and intersection
- Construction of an access road and intersection with Bentley Road, including installation of signage
- Importation of clean soil for landscape mounds to the east and west of the quarry
- Vegetation clearance, soil stripping and stockpiling for use in landscape mounds
- Expanded quarry operations, including blasting, crushing, screening, precoating and importing materials for blending
- Close and rehabilitate the quarry

Plans of the project are provided in Appendix B.



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0 1.5 3 4.5 6

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Bentley Quarry

Site Location

Project No. **12547851**
Revision No. **-**
Date **14/04/2021**

FIGURE 1-1

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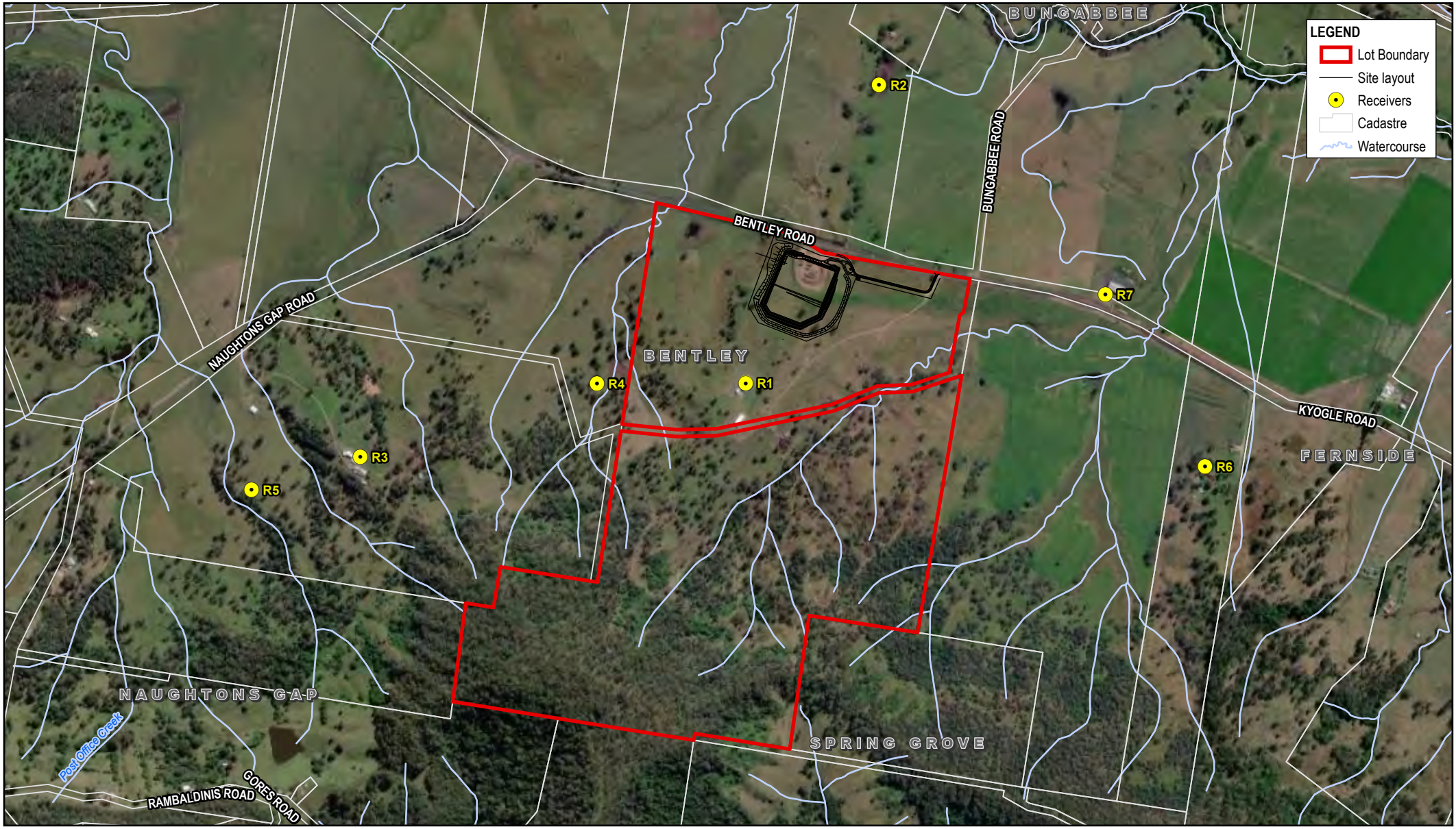

Paper Size ISO A4

120 240 360 480

Metres

Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56

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GHD

R&S Contracting Pty Ltd
Bentley Quarry
Environmental Impact Statement

Project No. **12547851**
Revision No. **A**
Date **27/10/2021**

Site Overview

Figure 1-2

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Data source: LPI: DCDB/DTDB, 2017. World Imagery: Maxar.
Created by: tmorton

1.4 Proponent details

The proponent details are provided below.

Information	Details
Name	R & S Contracting Pty Ltd
Postal address	1465 Bentley Road, Bentley
ABN	26 601 969 288
Nominated contact	Ben Luffman
Contact details	A: 230 Harbour Drive, COFFS HARBOUR NSW 2450 E: ben.luffman@ghd.com P:02 6650 5613
Site owner	SL McKenzie & RG McKenzie

1.5 Purpose and structure of this report

GHD has been engaged by R & S Contracting to prepare an EIS to support a development application for the project under Part 4 of the EP&A Act. It has been prepared in accordance with the requirements of Section 4.15 of the EP&A Act and the SEARs. The EIS provides:

– Details on the project, including need and alternatives considered
– An assessment of the potential key environmental impacts of the project as identified by the SEARs
– R & S Contracting's commitments in terms of measures to minimise and manage potential environmental impacts

The EIS is structured as follows:

– Section 1 – Introduction
– Section 2 – Description of the site and surrounds
– Section 3 – Description of the project
– Section 4 – Consideration of the legislative and policy requirements relating to the project and the site
– Section 5 – Overview of the consultation completed to date and ongoing consultation to be completed for the project
– Section 6 – Identification and prioritisation of key issues and risks assessment
– Section 7 – Assessment of the issues potentially impacted by the project
– Section 8 – Justification for the project and how it addresses the objects of the EP&A Act and the principles of ecologically sustainable development
– Section 9 – Conclusion
– Section 10 – References for the report
– Section 11 – Terms and acronyms used in this report
– Appendices – Relevant additional information and specialist reports

1.6 Definitions

For the purpose of this EIS, the following definitions apply:

– The 'project' is the construction and operation of Bentley Quarry to which the development application relates, as described in Section 3.
– The 'property' refers to the Lot and DP relevant to the project and is the development application area within which all activities for the project are proposed (Lot 2 DP 1196757).
– The 'project site' is the area that would be directly impacted by the project.
– The 'locality' encompasses the area immediately surrounding the project site, being the suburb of Bentley.

1.7 Scope and limitations

This report: has been prepared by GHD for R & S Contracting and may only be used and relied on by R & S Contracting for the purpose agreed between GHD and R & S Contracting as set out in section 1.5 of this report.

GHD otherwise disclaims responsibility to any person other than R & S Contracting 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.

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

GHD has prepared this report on the basis of information provided by R & S Contracting and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD 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.

2. The site

2.1 Site overview

The property is approximately 214 hectares in area and sits on undulating pasture land to the west of Lismore (refer Figure 1.1).

The northern portion of the property has been cleared due to historical agricultural land uses, with scattered paddock trees remaining. Native vegetation exists on the higher slopes in the southern portion of the site, which rise to a ridgeline.

The project site is zoned RU1 Primary Production under *Richmond Valley Local Environmental Plan* (LEP) *2012*, as is the surrounding area.

The surrounding area is sparsely populated. The closest residence lies 650 m north of the site, however, it is currently not occupied. The closest occupied dwelling is located 1.25 km east of the project site.

Figure 2.1 Existing quarry looking north-west

2.2 Site history

The property predominantly consists of cleared land that is currently being used as pasture. The southern section of the site is covered in native vegetation.

The property includes a house and agricultural shed and is occupied by the owners of the site.

The site has been used for extraction for many years, with obvious signs of benching from past operations. A small quarry has been operating at the project site intermittently since the 1970's and more frequently recently. The recent operations have been limited an extraction rate of 3,000 m^3 (estimated to be 6,000 tonnes based on a conversion of 2 tonnes per m^3) and a disturbance footprint of approximately 1 hectare. Blasting and crushing is not currently undertaken at the site. Due to increasing demand, it is proposed to increase the extraction rate and include blasting and crushing.

2.3 Existing environment

2.3.1 Regional context

The site is located in the Richmond Valley LGA in the Northern Rivers area of NSW, approximately 14 km west of Lismore. The LGA covers an area of approximately 3,051 km^2 and has a population of approximately 23,000 people.

The town of Casino is the largest and administrative centre of the Richmond Valley LGA. The area is home to agricultural industries and food manufacturing including beef production, dairy products, sugar processing, grain, fruits, vegetables, tea tree, timber and the fishing industry. In addition to manufacturing, the climate, coast and hinterland attract strong tourism interest all year round.

2.3.2 Topography and catchments

The northern edge of the site, where the existing quarry is located, has an elevation of 63 m Australian Height Datum (AHD). The site slopes up towards the south to a ridge with an elevation of 256 m AHD. The ridge is the highest point in the area, with the surrounding plains having an elevation between 60 and 200 m AHD.

The existing quarry is approximately 5 m below the natural ground surface.

No watercourses are located on the site, however there is an ephemeral drainage line to the west where a dam has been constructed. This flows north into Back Creek. Back Creek is located approximately 883 m to the north of the existing quarry, travelling in an east-west direction. Another watercourse is located approximately 872 m to the west of the quarry, travelling in a north-south direction and connecting to Back Creek.

2.3.3 Geology and soils

Reference to eSpade indicates the quarry site is located within the McKee (9450mc) soil landscape which comprises low undulating hills and rises with relief of 30 m to 50 m and slopes of up to 10% (~5°) related to tertiary basalts. The landscape is typically extensively cleared and comprises grassland with sporadic stands of mature trees. Soils are generally shallow, high plasticity and highly reactive.

The quarry and associated access comprise the Disturbed soil landscape (9450xx).

Reference to Tweed Heads 1:250,000 geological mapsheet indicates the site is underlain by residual soil and weathered basalt rock of the Tertiary aged Lismore Basalt (Lamington Volcanics) (refer Figure 2.3). No significant geological structures (faults / folding) were evident from the available geological information.

The Minview website indicates that groundwater bores installed in sandstone, located 1.4 km southwest and 1.2 km east of the site encountered ground water at a depth of 7.3 m and 5.4 m below ground surface level respectively. No elevation data was available for the bores.

Based on historical google imagery, the current extents of the quarry, including the northern quarry face, were developed in late 2020 or early 2021. The crest of the northern quarry face is offset by <10 m from the crest of the Bentley Road cut.

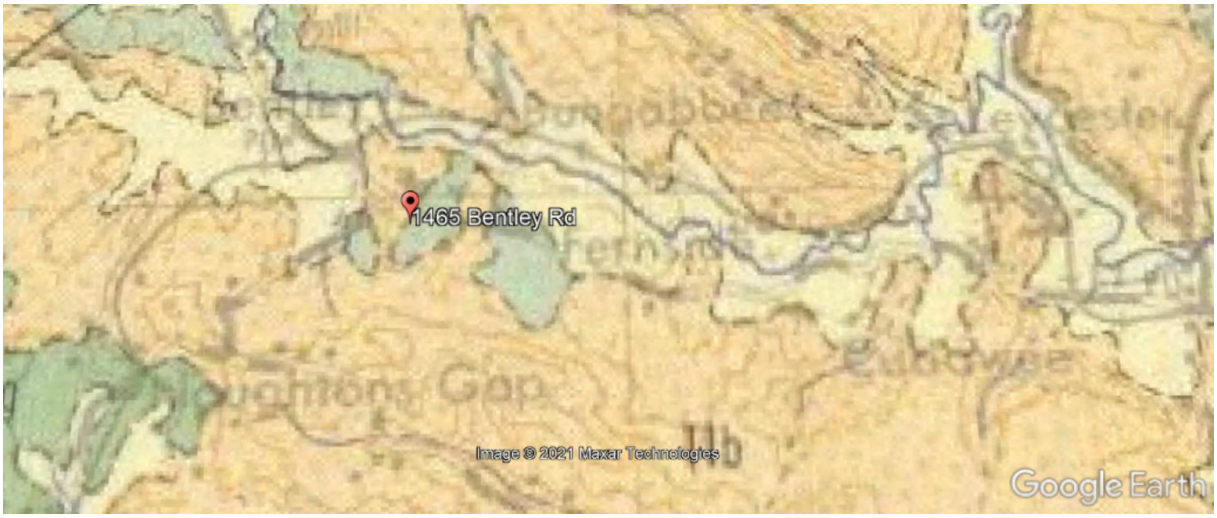


Figure 2.2 Excerpt of Tweed Heads 1:250,000 scale mapsheet (GSNSW, 1963)

The rockmass for the full depth of the quarry may be divided into two separate sections as shown in Table 2.1 (depths are in metres below existing natural ground surface level).

Table 2.1 Summary of rockmass

Depth (m) [1]		Rockmass conditions
From	To	
0	11 / 17	Variably (highly) weathered very low to low strength, highly jointed basalt
11 / 17	30	Slightly weathered / fresh, high to extremely high strength, medium to widely spaced joints

A Petrographic Inspection Report was prepared by Groundwork Plus for the existing quarry. The resource is 90% basalt and 10% clay. The report stated that the resource is predicted to be suitable as fine aggregate in concrete, asphalt and unbound pavement materials. A copy of the report is provided in Appendix C.

2.3.4 Climate

The Lismore area has a warm and temperate climate. The closest Bureau of Meteorology (BoM) weather station is located approximately 14 km west of the project site at Lismore Airport (station IDN60801).

The average annual rainfall in the region is between 1,000-1,500 mm (BoM, 2021) and average annual evaporation is between 1,400-1,600 mm (BoM, 2021).

2.3.5 Surrounding land uses

Land uses surrounding the project site are predominantly associated with agricultural activity.

The southern portion of the property is vegetated, with a small portion of land identified as containing Biodiversity Values on the NSW Biodiversity Values Map and Threshold Tool (refer Figure 2.4).

A sensitive receptor is defined as a location where people are likely to work or reside. This may include dwellings, schools, hospitals, offices or public recreational areas. Nearby sensitive receptors in the vicinity of the project site include only rural dwellings:

– A dwelling is located approximately 360 m south of the proposed quarry, which is owned and occupied by the applicant (R1).
– The closest dwelling (R2) that is not associated with the proposal is located 650 m north of the proposed quarry. Disputed Plains Homestead has been vacant since the 1990's (NSW State Heritage Inventory, N.D.).
– The closest occupied dwelling (R6) that is not associated with the proposal is located 1.25 km east of the proposed quarry (refer Figure 1.2).

– A proposed subdivision to the east has nominated a dwelling site 600 m from the proposed quarry (R4).
– A commercial farm shed (R7) is located 750 m east of the proposed quarry.
– The nearby rail way is proposed to be converted into a ‘rail trail’ which is 1.25km to the north.
– A proposed subdivision to the east has nominated a dwelling (R5) site 1.5km from the proposed quarry.
– A B&B (R8) operates 1.65km east of the proposed quarry.

The locations of the above are shown on Figure 1.2.

Figure 2.3 Existing quarry looking north-west

Source: GHD

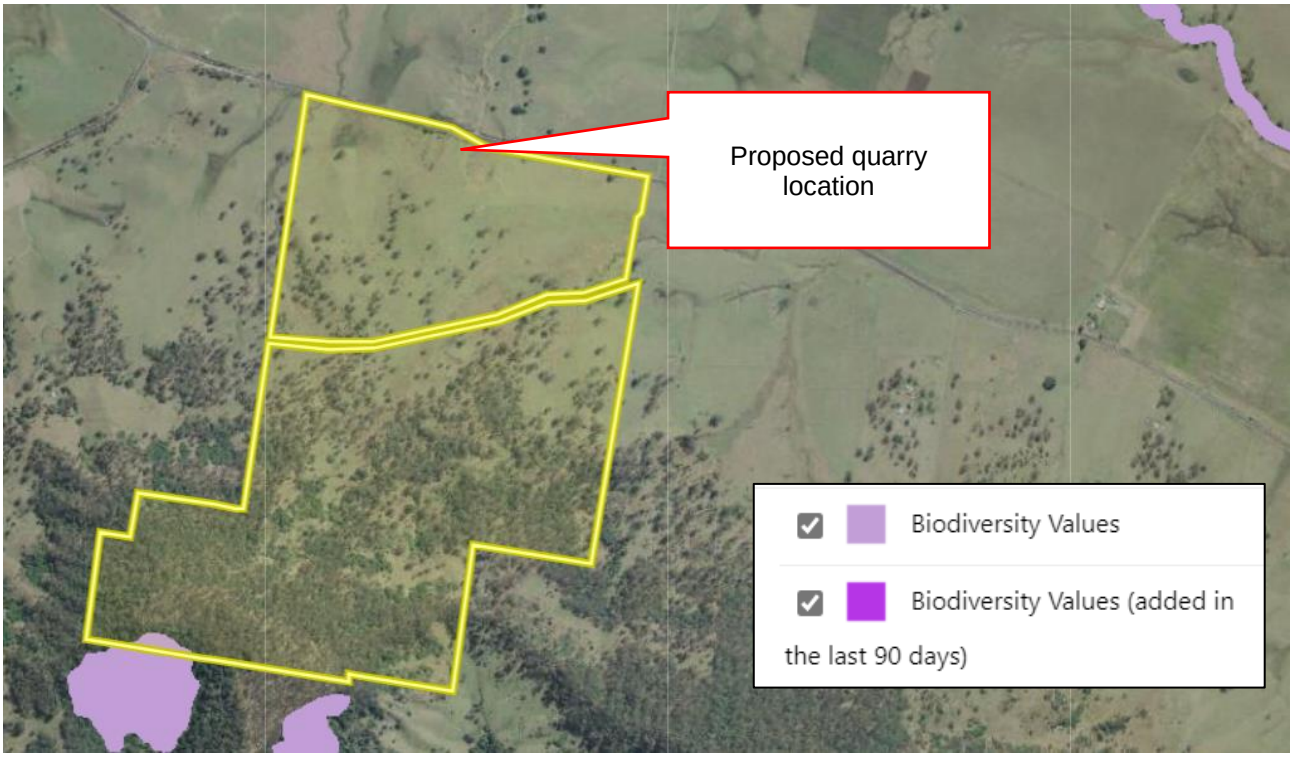


Figure 2.4 Biodiversity values to the south of the Project Site

Source: NSW Biodiversity Values Map and Threshold Tool

3. Description of the Project

3.1 Overview

The project involves a hard rock quarry with an annual extraction rate of 300,000 tpa and a maximum daily extraction rate of 2,000 tpd. The total disturbance area is approximately 6.5 hectares which includes an extraction area of approximately 3.65 hectares. The primary purpose of the project is to supply materials for use as fill and for road construction and maintenance. Plans of the project are provided in Appendix B.

Project activities would generally include:

– Initial and progressive installation of environmental controls including erosion and sediment control measures, establish revegetation area and install nest boxes
– Delineation of the site and stockpiling areas
– Construction of fencing
– Crush and screen material at the site to use to construct the access road and intersection
– Construction of an access road and intersection with Bentley Road, including installation of signage
– Construction of a site office, weighbridge and car parking area
– Importation of clean soil for landscape mounds to the east and west of the quarry
– Vegetation clearance, soil stripping and stockpiling
– Expanded quarry operations, including blasting, crushing, screening, precoating and importing materials for blending
– Close and rehabilitate the quarry

3.2 Resources and demand

A Petrographic Inspection Report was prepared by Groundwork Plus for the existing quarry. The resource is 90% basalt and 10% clay. The report stated that the resource is predicted to be suitable as fine aggregate in concrete, asphalt and unbound pavement materials. A copy of the report is provided in Appendix C.

The project would fulfil a demand for aggregate products for use as general fill and for the construction and maintenance of roads in the region. Currently the quarry extracts up to 6,000 tonnes per annum but local Councils and other clients have indicated they would source more material if available. Following floods, one local Council has indicated they can require up to 150,000 tonnes to repair damage to roads.

It is expected the demand for material will be on average 100,000 tonnes per annum but the proposed extraction rate of 300,000 tonnes per annum is to allow flexibility so material can be supplied during periods of high demand e.g. floods, large construction projects in the local area, etc.

3.3 Site establishment

The site establishment phase of the quarry would be relatively short (i.e. about 2 months). The main activity would be the construction of the access road and the intersection with Bentley Road. Other activities would be:

– Initial and progressive installation of environmental controls including erosion and sediment control measures, establish revegetation area and install nest boxes
– Delineation of the site and stockpiling areas
– Construction of fencing
– Crush and screen material at the site to use to construct the access road and intersection
– Construction of an access road and intersection with Bentley Road, including installation of signage
– Construction of a site office, weighbridge and car parking area
– Importation of clean soil for landscape mounds to the east and west of the quarry

– Vegetation clearance, soil stripping and stockpiling
– Installation of nest boxes at a ratio of two nest boxes to one hollow bearing tree removed. Nest boxes would be designed for microbat use and positioned in mature trees within a designated area to the south west of the quarry

It is also proposed to crush and screen existing extracted material during this phase to facilitate the construction of the access road and intersection. It is not proposed to expand the existing quarry, blast, transport or sell any material from the site during the construction works.

A dozer, excavator and haul trucks are the main items of equipment likely to be required during construction. Other equipment may include:

– Roller
– Grader
– Water cart
– Compactor
– Crusher
– Screen
– Light vehicles
– Hand tools

3.4 Operation

3.4.1 Staging

The quarry operations would be carried out in four stages and in response to demand. To minimise the initial impact of the proposed quarry, Stage 1 would encompass the existing footprint of the quarry and expand it at a depth of RL63 m until the northern half of the proposed quarry is exhausted. Stage 2 would continue at RL63 m to the southern extent of the proposed quarry. Stage 3 will involve lowering the northern half of the proposed quarry to its final depth of RL49 m. This will involve constructing a drainage pipe through the western wall of the quarry to the discharge location. Stage 4 would be the final stage which would continue at a depth of RL49 m to the southern extent of the proposed quarry. A summary of the stages is outlined in Table 3.1 and the general layout and benching diagrams are provided in Appendix B.

The main activities during operation of the quarry are described below.

Table 3.1 Quarry stages

Stages	Volume (m^3)	Volume (tonnes*)
1	107,000	214,000
2	148,000	296,000
3	188,000	376,000
4	190,000	380,000
Total	**633,000**	**1,266,000**

* based on a density of 2 tonnes per m^3

Topsoil stripping would occur in stages prior to excavation. Generally areas would be stripped immediately prior to quarrying. Overburden would either be stockpiled for future rehabilitation works or placed in final location as voids are created.

3.4.2 Extraction rate

The project would extract up to 300,000 tonnes of material per annum. The actual extraction rate would be dictated by demand requirements; however extraction would not exceed 300,000 tonnes in any twelve-month period. The total available resource is estimated to be 1,266,000 tonnes.

The maximum extraction rate of 300,000 tonnes per annum has been nominated to allow sufficient capacity to service demand during peak periods. It is expected that the average extraction rate would be 100,000 tonnes per annum.

The maximum daily extraction and haul rate would be about 2,000 tonnes but this extraction rate would be a rare occurrence.

The volume of material extracted from the quarry would be recorded using a loader with scales until the quarry was selling 100,000 tonnes of material per annum. At this stage a weighbridge is proposed to be installed. When a weighbridge is installed, it is proposed to provide it as a public weighbridge for private vehicles to use.

3.4.3 Quarry activities

The main activities during operation of the quarry would include the following:

– Drilling and blasting
– Crushing and screening
– Blending
– Stockpiling

The main activities during operation of the quarry are described below.

3.4.3.1 Drilling and blasting

Overlying weathered material would be removed using bulldozers and excavators. Underlying fresh rock would require blasting.

Blasting would be strictly controlled and conducted by a suitably qualified blasting contractor who would bring explosives onto site as required and fill a series of holes that would be pre-drilled by a separate drilling contractor.

Bulk emulsion explosives such as Ammonium Nitrate Fuel Oil (ANFO) would be used. Following blasting, all blasting equipment and any unused explosives would be removed from site. No explosives would be stored on site. It is anticipated that blasting would be undertaken in 20-30,000 tonne shots with up to one blast per month during peak periods but normally three to four blasts per year.

3.4.3.2 Crushing and screening

Contractors would crush and screen the extracted material using mobile plant positioned close to the extraction area. An excavator would feed the excavated rock into a mobile primary crusher. The primary crusher would then pass the crushed material to a secondary or tertiary mobile crusher for further crushing, at which point the material would be passed through a screening plant to sort the crushed aggregate into different grades depending on market demand. The screening plant would discharge the crushed and screened aggregate into a stockpile area using a radial stacking conveyor.

3.4.3.3 Blending

Some of the extracted material would be blended with imported waste concrete and possibly clay and sand, depending on the specifications the ultimate client requires.

3.4.3.4 Stockpiling

Material would be stockpiled in designated areas within the pit. Material would be stored in various grades for sale or distribution.

Some imported materials may be stockpiled to the east of the extraction area, as shown on the plans in Appendix B.

3.4.4 Pre-coat operation

At times, pre-coated materials may be required to be provided. To satisfy this demand, a mobile pre-coat plant would periodically be used. This is a fully self contained plant that would precoat the aggregates, which would be stockpiled within the quarry until sold.

3.4.5 Imported material

Materials would be imported to site for constructing landscape mounds, rehabilitation and blending with aggregate material. The site would not be open to the public or trucks not directly contracted by Bentley Quarry. This will ensure all materials imported to site would be from a known source and of a known quality. Typical materials to be imported to site and the approximate quantities are provided in Table 3.2. The quantities are approximate and will vary depending on supply and demand.

The volume of imported material would be included as part of the proposed maximum 300,000 tonnes extraction rate, not additional.

No other types of waste will be accepted at the facility.

Table 3.2 Imported materials and approximate volume

Material	Classification	Approximate volume (t/year)	Use
Concrete waste	General solid waste (non-putrescible)	50,000	Crushed and blended with materials from the quarry
ENM	Excavated natural material exemption 2014		Used to construct bunds and rehabilitation works
VENM	General solid waste (non-putrescible)		Used to blend with materials from the quarry and construct bunds and rehabilitation works

Although all materials will be from a known source, Bentley Quarry will implement a material acceptance process in accordance with the *Standards for managing construction waste in NSW* (EPA, 2019) and *Draft Protocol For Managing Asbestos During Resource Recovery Of Construction And Demolition Waste* (EPA, 2014). A summary of the proposed material acceptance process includes:

– Bentley Quarry will have written agreements with all waste generators, transporters and customers that clearly state that the facility only accepts concrete, ENM and VENM and does not accept asbestos.
– Trucks will enter via the single entrance/exit off the access road.
– All vehicles will be weighed on the weighbridge (once installed) upon entry and exit with a docket provided to the driver.
– Prior to unloading, the truck covers will be removed and the loads visually inspected by the Quarry Manager or trained delegate and checked for compliance with site acceptance criteria. The minimum training for those conducting the inspections will be an asbestos awareness course.
– Where non-conforming material including asbestos containing material is sighted or suspected, the entire load will be rejected and details of the load entered into the Rejected Load Register. If the load contains suspected asbestos containing material, it will be immediately wetted down.
– Details of the imported material will be documented including:
    - Date and time.
    - The name of the trained inspector.

- Registration details of the waste delivery vehicle and name and address of the waste generator and transporter.
- The source of the material and name of the waste producer.
- Waste description, mass and physical nature.
- Where the load was inspected.
- Documentation accompanying the material including VENM certificates, waste classification reports, resource recovery exemptions or contaminant testing.
- Whether asbestos containing material was observed.

– If the feed materials passes the visual inspection, the driver will be directed to the specific concrete pad area for unloading.
– The Quarry Manager or trained delegate will inspect the unloaded material (for a second time) for compliance with site acceptance criteria. To facilitate the inspection, the tipped waste would be spread by an excavator to approximately 100 mm thick, so any non-conforming materials would be visible.
– Where non-conforming material including asbestos is sighted or suspected, the entire waste load will be rejected and details of the load entered into the Rejected Load Register. If asbestos containing material is sighted, the load will be wetted down prior to further handling.
– Trucks will be directed to the exit. For trucks registered at the site, weighing on exit is not required as the tare weights will have been recorded. New trucks will be required to reweigh on exit.

The Rejected Load Register will be based on the examples provided in the *Draft Protocol For Managing Asbestos During Resource Recovery Of Construction And Demolition Waste* (EPA, 2014) and will include:

– Type and amount of waste
– Full name (and, if relevant, Australian Company Number) of the generator of the waste
– Full name (and, if relevant, Australian Company Number) of the transporter of the waste
– Registration of the waste delivery vehicle
– Address of the source of the waste and transporter
– Time and date that the load was rejected

The Rejected Load Register will be maintained on site for a minimum of four years and be available for inspection by the NSW Environment Protection Authority (EPA) at any time.

3.4.6 Processing

– Materials will be stored on site in separate stockpiles of ENM, VENM and concrete.
– When sufficient quantities of soil, aggregate or concrete materials have been obtained, the materials will be crushed, screened and/or blended (if required, as described in Section 3.4).
– Material would be tracked throughout the importing, processing and stockpiling on a stockpile register.

3.4.7 Project life and working hours

As the demand for product from the site will vary, it is not possible to put firm durations on each stage of activity. However, the quarry is expected to commence operation in early 2022 and be in operation for 10-30 years.

Operations would generally be limited to the following times:

– Monday to Friday: 7:00 am to 6:00 pm
– Saturday: 7:00 am to 2:00 pm
– No work on Sundays or Public Holidays

Staff may arrive and leave site before and after these times to ‘start-up’ and ‘shut-down’ the quarry but excavation, crushing or loading would not occur outside the times specified above. Blasting would only occur on weekdays between the hours of 10:00 am and 3:00 pm.

3.4.8 Workforce

The operational workforce for the Project will vary depending on the needs for specific activities (contracted crushing and screening, haulage, etc.), however it is anticipated to be up to a maximum of 5 staff at any time.

3.4.9 Operational plant and equipment

Equipment at the quarry would depend on levels of activity which would vary from time to time. A description of the plant and equipment to be used is provided in Table 3.3. The frequency of use is relevant to the periods when the quarry is operating. As an example, following a blast, the crusher will be operating 100% of the time but once the material is crushed, the crusher would not be operating until the next blast.

Table 3.3 Proposed quarry plant and equipment

Type	Approximate Number	Typical Frequency of use during operation	Description
Dozer	1	25%	Clearing and grubbing of vegetation and stripping of topsoil Construction of bunding Rehabilitation
Excavators	2	100%	Excavating material and stockpiling Clearing and grubbing of vegetation and stripping of topsoil
Jaw, cone and impact crusher	1	70%	Crushing rock and waste concrete
Screen	1	70%	Aggregate/gravel production and overburden screening Mixing imported waste concrete with aggregate
Front-end Loader	1	100%	Loading material onto the haul trucks and stockpiling material within the pit floor
Grader	1	25%	Road and bund construction and maintenance
Haul Trucks	Up to 70/day	100%	Delivery of materials to customers, carting unsuitable materials to rehabilitation areas, importing soil and importing waste concrete
Pre-coat plant	1	20%	Used to produce pre-coated aggregates as required
Water Cart	1	40%	To water haul roads and stockpiles
Water Pump	2	40%	To dewater excavation/basin and to fill watercart from standpipe To water stockpiles and put moisture in products
Hand tools	5	5%	General activities maintaining plant
Light vehicles	Up to 5	20%	Transporting staff to, from and around site

3.5 Access and traffic

The source, destination and route of light and heavy vehicles accessing the quarry is difficult to predict, however it is assumed they would travel via various routes to projects and customers around the area via Bentley Road. R & S Contracting has indicated that approximately 60% of operational traffic will travel to and from the site via Bentley Road east of the site, approximately 30% will travel to and from the site via Naughtons Gap Road, and 10% will travel to and from the site via Bentley Road west of the site. It is assumed that these indicative proportions are representative of vehicle movements during both site establishment and operational phases.

As part of the project the intersection of the site access road and Bentley Road would be upgraded to cater for the increased activity. The intersection is proposed to be upgraded with a Channelised Right-Turn (CHR(S)) and Auxiliary Left-Turn (short lane) (AUL(S)) treatment. Diagrams of these turning lanes can be found in the Traffic Impact Assessment in Appendix K.

The site access road would also be sealed to provide a stable surface for traffic and minimise dirt being tracked onto Bentley Road.

3.5.1 Site establishment traffic generation

During the site establishment phase the traffic generated would consist of heavy vehicle movements, mostly relating to the construction of the Bentley Road intersection and access road. The number of heavy vehicle movements would be minimised by using material from the quarry, where possible.

A few light vehicles would also access the site daily during the site establishment phase.

3.5.2 Operational traffic generation

Workforce traffic

During operation it is likely that there would be a maximum of 5 workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 10 vehicle trips per day (vtpd). It is assumed the majority of the workforce would arrive between 6:30 am and 7:30 am and depart generally between 3:00 pm and 6:30 pm.

Heavy vehicle traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At maximum daily production (i.e. 2,000 tonnes), the quarry is expected to generate about 70 truck and dog loads or 140 truck movements per day. The truck movements would start at 7:00 am and continue evenly throughout the day until 6pm, making about 7 truck loads or 14 movements per hour.

This rate of maximum truck movement is expected to be infrequent and for short durations. The average number of truck movements is expected to be a lot less and there would be times when no trucks would access the site.

The total truck movements, includes any movements associated with importing materials or trucks using the weighbridge but not hauling materials to or from the quarry.

3.6 Site facilities

3.6.1 Site drainage

The clean water management system consists perimeter screening bunds located on the western, eastern and southern areas of the Project that are designed to divert clean water runoff generated within the undisturbed areas upslope of the site.

The dirty water management system consists of a sump and sediment basin. Surface and groundwater flows from within the quarry pit would drain to the sump and sediment basin. The basin would naturally overflow to the west, via an open channel for Stages 1 and 2 and via pipe during Stages 3 and 4. The estimated dirty water catchment is 4.06 ha.

All sediment and erosion controls would be designed and implemented in accordance with the *NSW Soils and Construction – Managing Urban Stormwater Volume 1* ‘the Blue Book (Landcom, 2004).

3.6.2 Dust suppression

During dry conditions, exposed areas would be sprayed with water from a water cart to suppress dust. Water will be sourced from the sediment basin. A water balance model has been developed to determine water availability for the quarry. The model found that the average total water deficit for dust suppression demands was only 1 ML/year. To address this a larger basin than is required for sediment control is proposed. Also, the maximum harvestable rights for the property is 24.6 ML, so this could also be used to satisfy the calculated water deficit. Further discussion is provided in Section 7.2.

3.6.3 Site office

An office and carpark would be constructed adjacent to the access road. The site office would consist of a demountable building. Conceptual plans of the demountable building are provided in Appendix B.

3.6.4 Weighbridge

Once the operation is processing 100,000m^3 tonnes per annum, it is proposed to install a weighbridge. The weighbridge would be located adjacent to the site office. The details of the weighbridge will be confirmed prior to installation but indicative plans are provided in Appendix B. It is proposed to provide the weighbridge for ongoing processing and auditing purposes.

3.6.5 Fuel storage

Mobile plant refuelling would take place on site from a self-bunded portable fuel truck with a capacity of up to 10,000 litres. No fuel would be stored on site.

All scheduled plant and equipment maintenance would take place off site.

3.6.6 Lighting

Quarrying would be limited to daylight hours only, avoiding the need for lighting infrastructure and services.

3.6.7 Utilities

No new utilities are required for the operation of the project initially. Drinking water and toilet facilities will be provided by those in the existing shed, which was approved as part of Development Application No. DA2017/0139 on 10 October 2017.

Water for dust suppression and vehicle washing would be obtained from the sediment basin or imported to the site on an as needed basis.

Power is not required to operate the quarry initially. If operations warrant the installation of a weighbridge in the future, power will be extended within the site to the location of the weighbridge.

3.6.8 Waste management

Small amounts of domestic refuse would be generated on site and be removed for recycling or disposal at a suitably licensed facility. The extraction of rock material is not expected to generate any other waste material, as all extracted material would be either sold as a product or retained for reuse during rehabilitation.

3.6.9 Signage

A business sign approximately 1.2 m by 1.2 m would be installed at the entrance to the quarry on Bentley Road, as shown on the plans in Appendix B.

3.7 Decommissioning and rehabilitation

It is unknown if the quarry would be fully exhausted as proposed at this stage, so the final landform is also unknown. It is expected that if the quarry progresses below a depth of RL63 m, the pit will fill with water over time. It is therefore proposed that five years prior to the closure of the quarry, a detailed rehabilitation plan be prepared in consultation with Council and other relevant regulatory agencies.

The objectives of the plan would be:

– To establish a stable, safe final landform that maximises the potential land use
– To minimise any environmental or social impact of the site

To achieve the above, it is anticipated the rehabilitation would involve:

– Removal of all structures, equipment and other materials from the works area
– Earthworks and landscaping to shape the land so it is stable
– Ripping benches and the floor (if not submerged) to a depth of 250 mm
– Spread at least 100 mm of topsoil across the floor (if not submerged) and benches
– Revegetate the floor (if not submerged) with native and introduced pasture species to match existing conditions and revegetate the benches with a mix of native trees and shrubs
– Monitoring and maintenance as required until the vegetation is established
– Erosion and sedimentation control would remain in place until the site is appropriately reinstated and revegetated

A concept rehabilitation plan is provided in Appendix B.

To ensure the rehabilitation is completed, R & S Contracting will establish a ‘rehabilitation account’ where $0.05 per tonne of material sold will be deposited which is to be used for the costs relevant to rehabilitation.

3.8 Capital investment

The majority of plant required for the operation would be provided by contractors, so the capital investment would be limited to the site establishment, site office, intersection, weighbridge and site access road. This is expected to cost less than $988,582.10, as detailed in the quotes in Appendix D.

3.9 Alternatives to the project

Alternatives to the project are summarised below.

3.9.1 Extraction from alternative resource

Extracting another resource (quarry) may have similar or greater impacts than the current project. Another quarry location may require extensive clearing, create water quality, noise or dust issues on adjoining sensitive receivers. The site is relatively clear of vegetation and is located in a relatively sparsely populated area, adjacent to a busy road, which reduces the potential disturbance to sensitive receivers.

3.9.2 Do nothing

The “do nothing” option would likely mean the operation would continue based on the existing use rights or cease. This may reduce the impacts at the site due to the lower volume extracted but would also have the following consequences:

– Aggregate for general fill and road construction may have to be quarried from further away, increasing costs and potential greenhouse gas emissions.
– The high-quality resources, identified at the site, would not be utilised to the extent proposed.
– The direct economic benefits in the form of capital investment, plus expenditure associated with quarry operations and labour, providing an ongoing contribution to the local economy, will not be realised.

– The site would continue to be quarried but would not have the conditions and controls (e.g. management plans, upgraded access, rehabilitation) likely to be imposed if the proposal is approved.
– There may be pressure to establish new quarries that contain less suitable resources with greater environmental consequences or uncertainties.

3.10 Justification for the project

The project is justified because:

– The disturbance area is clear of significant vegetation and is in a sparsely populated area which reduces the potential disturbance to sensitive receivers.
– The development of the project would provide a source of aggregate to be used as general fill and for the construction and maintenance of roads in the region. This would reduce the costs associated with importing aggregate from other quarries that are located further away.
– Extractive industries may be carried out with consent on any land for which agriculture or industry is permitted with or without consent. As the site is zoned RU1 Primary Production pursuant to Richmond Valley LEP 2012, development for the purpose of extractive industries is permissible with development consent within the RU1 zone.
– The project would provide direct economic benefits in the form of capital investment, plus expenditure associated with quarry operations and labour, providing an ongoing contribution to the local economy.

4. Statutory legislation and strategic context

4.1 NSW Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the statutory basis for planning and environmental assessment in NSW. All development is assessed in accordance with the provisions of the EP&A Act and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). The EP&A Act institutes a system for environmental planning and assessment, including approvals and environmental impact assessment for proposed developments. The EP&A Act contains several relevant parts that impose requirements for planning approval.

All relevant statutory planning instruments, developed in accordance with the EP&A Act, have been examined in relation to the Project.

4.1.1 Designated development

Clause 4.10 of the EP&A Act specifies 'designated development' as development declared in Schedule 3 of the EP&A Regulation or other environmental planning instrument. The project is classified as 'designated development' because it falls within the specified category of 'extractive industries' under Clause 19, Schedule 3 which states:

1. *Extractive industries (being industries that obtain extractive materials by methods including excavating, dredging, tunnelling or quarrying or that store, stockpile or process extractive materials by methods including washing, crushing, sawing or separating):*
    a. *that obtain or process for sale, or reuse, more than 30,000 cubic metres of extractive material per year, or*
    b. *that disturb or will disturb a total surface area of more than 2 hectares of land by:*
        i. *clearing or excavating, or*
        ii. *constructing dams, ponds, drains, roads or conveyors, or*
        iii. *storing or depositing overburden, extractive material or tailings, or*

Comment: The project is an extractive industry that will extract and process hard rock quarry product, extracting up to 300,000 tpa and with a disturbance area of approximately 6.5 hectares, therefore it is designated development.

Schedule 3 Clause 32 waste management facilities or works may also apply to the project but is excepted by virtue of Clause 37A ancillary development because it is ancillary to other development being the extractive industry and is not proposed to be carried out independently of the extractive industry.

As the project is considered designated development, Section 4.12(8) of the EP&A Act requires the preparation of an EIS to accompany the development application lodged with Council.

4.1.2 Integrated development

Integrated development is development (not being State significant development or complying development) that, in order for it to be carried out, requires a licence or approval listed in Section 4.46 of the EP&A Act.

Comment: The Project is integrated development as it requires the following approvals from the EPA and from Transport for NSW:

– An Environment Protection Licence (EPL) from the NSW Environment Protection Authority (EPA) under Section 53 of the *Protection of the Environment Operations Act 1997* (POEO Act)
– A Section 138 permit from Transport for NSW under Section 138 of the *Roads Act 1993*.

Further details on these approvals are provided in Section 4.4.

4.1.3 Matters for consideration

Part 4 of the EP&A Act applies to the assessment of development that requires consent. The matters to be considered when determining a development application are outlined in Section 4.15 of the EP&A Act and include:

a. the provisions of:

i. any environmental planning instrument, and

ii. any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and

iii. any development control plan, and

iv. any planning agreement that has been entered into under Section 93F, or any draft planning agreement that a developer has offered to enter into under Section 93F, and

v. the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and

vi. any coastal zone management plan (within the meaning of the Coastal Protection Act 1979),

that apply to the land to which the development application relates,

Comment: The relevant EPIs and DCP applicable to the project are addressed in the following section. There are no proposed instruments that pertain to the project or the site. No planning agreements pertain or are proposed to the project or the site. The requirements of the regulations are addressed in the following section. No coastal zone management plan is applicable to the site.

b. the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

Comment: Impacts of the project are discussed in Section 6.

c. the suitability of the site for the development,

Comment: The site is considered suitable for the project due to its zoning as RU1 (Primary Production) under Richmond Valley LEP 2012. Further discussion around the project's suitability is provided in Section 8.3.

d. any submissions made in accordance with this Act or the regulations,

Comment: Comments made about the project during consultation to date have been considered during the preparation of the EIS. This is discussed further in Section 5. Once exhibited, further submissions will be received and considered by the consent authority. The proponent will review public submissions made during the exhibition period and prepare a response to those submissions, as required.

e. the public interest.

Comment: The project is considered to be in the public interest through direct means such as employment and wages, and indirectly via spending on goods and services in the region.

The project would provide access to hard rock quarry material and provide a long-term supply of construction materials into the local and regional market. This project would fulfil demand for high quality aggregate products in the region.

Bentley Quarry has actively engaged with stakeholders, including the local community, to seek to understand the key concerns and issues associated with the project and to help Bentley Quarry to effectively manage these issues through appropriate location and design. This is discussed further in Section 5.

4.2 Environmental planning instruments

Environmental planning instruments (EPIs) are made under Part 3 of the EP&A Act. The relevant EPIs are discussed in the following sections.

4.2.1 State Environmental Planning Policy (State and Regional Development) 2011

A regional development needs to be notified and assessed by a Council and then determined by the relevant Planning Panel. Regional development is defined in Schedule 7 of the *State Environmental Planning Policy (State and Regional Development) 2001* as follows*:*

> *7 Particular designated development*
>
> *Development for the purposes of—*
>
> *(a) extractive industries, which meet the requirements for designated development under clause 19 of Schedule 3 to the Environmental Planning and Assessment Regulation 2000, or*
>
> *(b) marinas or other related land and water shoreline facilities, which meet the requirements for designated development under clause 23 of Schedule 3 to the Environmental Planning and Assessment Regulation 2000, or*
>
> *(c) waste management facilities or works, which meet the requirements for designated development under clause 32 of Schedule 3 to the Environmental Planning and Assessment Regulation 2000.*

Comment: The project is classified as 'regional development' because it falls within the specified category of Schedule 7 and the Northern Regional Planning Panel (Northern RPP) would be the determining authority for the project.

4.2.2 State Environmental Planning Policy (Mining Petroleum and Extractive Industries) 2007

The aims of *State Environmental Planning Policy (Mining Petroleum and Extractive Industries) 2007* (MPEI SEPP) recognise the importance to New South Wales of mining, petroleum production and extractive industries, and are:

> *(a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State,*
>
> *(b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and*
>
> *(c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.*

Comment: Under the MPEI SEPP, extractive industries may be carried out with consent on any land for which agriculture or industry is permitted with or without consent. The Project site is zoned RU1 Primary Production pursuant to Richmond Valley LEP 2012. Development for the purpose of extractive industries is permissible with development consent within the RU1 zone.

Part 2 of the MPEI SEPP lists development permissible with consent:

> ***(4) Co-location of industry*** *If extractive industry is being carried out with development consent on any land, development for any of the following purposes may also be carried out with development consent on that land—*
>
> *(a) the processing of extractive material,*
>
> *(b) the processing of construction and demolition waste or of other material that is to be used as a substitute for extractive material,*
>
> *(c) facilities for the processing or transport of extractive material,*
>
> *(d) concrete works that produce only pre-mixed concrete or bitumen pre-mix or hot-mix.*

Comment: Imported soil and concrete and pre-coat operations would be ancillary to the quarry operations and permitted as co-location of industry.

Part 3 of the MPEI SEPP establishes specific requirements for the assessment of development permissible under the SEPP. These include (in this case with respect to an extractive industry):

– *Consideration of the compatibility of the proposal with the existing uses and approved uses of land in the vicinity, potential impacts on preferred land uses in the vicinity, a comparison of the public benefits of these land uses with the proposal, and measures to avoid or minimize incompatibility.*
– *Consideration of conditions to be imposed on consents to ensure extractive industries are carried out in an environmentally responsible manner in respect of water resources, biodiversity and greenhouse gas emissions.*
– *Resource recovery aspects of the proposed extractive industry.*
– *The transport impacts of the proposal, including impacts and management of truck movements on public roads, taking into account advice from the Roads and Maritime.*
– *The need for conditions concerning rehabilitation*

Comment: This EIS has been prepared to support a DA and includes an assessment of all matters for consideration prescribed under MPEI SEPP.

4.2.3 State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)

State Environmental Planning Policy No. 33 (Hazardous and Offensive Development) (SEPP 33) presents a systematic approach to planning and assessing proposals for potentially hazardous and offensive development or industry.

SEPP 33 applies to any proposal which falls under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'. If not controlled appropriately some activities within these industries may create an offsite risk or offence to people, property or the environment, thereby making them potentially hazardous or potentially offensive.

Clause 3 of the *Hazardous and Offensive Development SEPP* defines a 'Potentially Hazardous Industry' as:

"a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

(a) to human health, life or property, or

(b) to the biophysical environment, and includes a hazardous industry and a hazardous storage establishment.

Clause 3 of the SEPP defines a Potentially Offensive Industry as:

***potentially offensive industry** means a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*

Comment: The very nature of extractive industries suggests the potential for such uses to be hazardous or offensive to the local environment if not appropriately managed.

However, all appropriate site management controls and environmental impact mitigation measures would be implemented and monitored during the site's operations.

Additionally, given the location of the site, its separation from neighbours, and the intended management, mitigation and monitoring measures proposed to be implemented, no such detrimental impacts are anticipated to occur. In summary, if all mitigation measures provided in this EIS are implemented:

– There would be limited potential for polluting discharge from the site which would pose a significant risk to human health, life or property.
– There would be limited potential for polluting discharge from the site which would pose a significant risk to the biophysical environment.

4.2.4 State Environmental Planning Policy (Koala Habitat Protection) 2020 & 2021

State Environmental Planning Policy (Koala Habitat Protection) 2021 (Koala SEPP) commenced 17 March 2021. This Policy aims to encourage the conservation and management of areas of natural vegetation that provides habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline.

The Koala SEPP 2021 reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 LGAs in NSW. At this stage:

– In nine of these LGAs – Metropolitan Sydney (Blue Mountains, Campbell Town, Hawkesbury, Ku- ring-gai, Liverpool, Northern Beaches, Hornsby, Wollondilly) and the Central Coast LGA – Koala SEPP 2021 applies to all zones.
– In all other identified LGAs, Koala SEPP 2021 does not apply to land zoned RU1 Primary Production, RU2 Rural Landscape or RU3.

The site is located in Richmond Valley LGA and the land zoning is RU1 – Primary Production, as a result, Koala SEPP 2020 applies to the site. This is an interim measure while new land management and private native forestry codes are developed. Based on the above, the following assessment has been completed.

Circular B35 (Department of Urban Affairs and Planning, 1995) underpins SEPP 44 and sets out the framework for Koala SEPP assessments over several steps. GeoLink (2021) assessed the project against these steps below.

Is the Land 'potential Koala habitat'?

The Koala SEPP 2020 defines potential Koala habitat as "areas of native vegetation where Schedule 2 trees constitute at least 15% of the total number of trees in the upper or lower strata of the tree component". With regard to potential and core Koala habitat assessment, Section 1.5 of Circular B35 states that:

> *"In relation to affected DAs it is the intention of the policy that investigations for 'potential' and 'core' koala habitats be limited to those areas which it is proposed to disturb habitat."*

This Koala SEPP 2020 assessment pertains to the impact area on site and associated adjacent vegetation within the study area, hence allowing for disturbance during site establishment and operation of the project. Within the study area, one Schedule 2 tree species occurs – *Eucalyptus tereticornis* (Forest Red Gum). These trees occur in the project area in isolation and constitute at least 15% of the total number of trees in the upper or lower strata of the tree component across the study area. On this basis, potential Koala habitat does occur within the project site.

Is the Land 'core Koala habitat'?

In regard to the definition of 'core Koala habitat', SEPP 2020 defines potential Koala habitat as *"an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population".*

Despite targeted surveys, including SAT surveys, nocturnal surveys and direct observations, no Koalas were identified within the impact area. Although Koalas may occur within the locality and there is possibility that individuals may intermittently occur within the project area in order to move and access greater quality habitat in the locality, it is unlikely that the project area is 'core habitat' for Koalas. Due to the project area's highly disturbed nature, lack of high-density Koala feed trees and its isolated and fragmented position in the landscape from higher quality habitats, makes it unlikely to provide habitat that is reliant on a local residential Koala population with breeding females.

Furthermore, as addressed under the Koala EPBC Habitat Assessment in the Biodiversity Assessment Report (refer Appendix J), it is unlikely that the impact area contains 'critical Koala habitat' which would be important to the recovery objectives for the species within the locality. On this basis, the project does not contain 'core Koala habitat' and in accordance with Circular B35, the Policy requires no further consideration.

4.2.5 State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No. 55 - Remediation of Land (SEPP 55) provides a state-wide planning approach to the remediation of contaminated land and states that all remediation work must be carried out in accordance with:

– The contaminated land planning guidelines
– Any guidelines in force under the Contaminated Land Management Act 1997
– In the case of remediation work defined as category 1 remediation work under SEPP 55, a plan of remediation approved by the consent authority and prepared in accordance with the contaminated land planning guidelines

Clause 7(1) of the SEPP states that 'a consent authority must not consent to the carrying out of any development on land unless:

a. it has considered whether the land is contaminated
b. if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out
c. if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.'

Comment: The NSW Environment Protection Authority's record of notified and contaminated sites was searched on 21 October 2021. The property is not listed in the register. The site has not been identified as being contaminated and it is therefore considered that the site is suitable for the proposed quarry, in respect to contamination.

4.2.6 State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

The proposal includes the installation of a sign at the intersection of the site access road and Bentley Road, which would be approximately 1.2 metres by 1.2 metres. State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 (Codes SEPP) contains exemptions for signage, which ae detailed in Section 2.83 of Division 2, Part 2 of the SEPP. Section 2.83 states:

> ***2.83 General requirements***
>
> *(1) To be exempt development under this code, development specified in this Division must—*

(a) have the consent in writing of the owner of the land on which the sign is to be located and, if the sign or part of the sign projects over adjoining land, the consent of the owner of the adjoining land, and

(b) be approved under section 138 of the Roads Act 1993, if the sign or part of the sign projects over a public road, including a footway, and

(c) not be carried out on or in relation to a building being used as restricted premises, and

(d) not cover any mechanical ventilation inlets or outlets located on any building on which it is carried out, and

(e) not obstruct or interfere with any traffic sign, and

(f) not result in more than 3 business identification signs being constructed or installed in relation to a building if the building houses only one commercial tenant, and

(g) not result in more than 6 business identification signs being constructed or installed in relation to any building, and

(h) not result in more than one business identification sign being constructed or installed in relation to a home business, home industry or home occupation in a residential zone, and

(i) not be under or attached to an awning, unless the awning complies with the requirements set out in BP1.1 and BP1.2 of Volume 1 of the Building Code of Australia.

(2) This clause does not affect any other requirement of this Policy in relation to exempt development.

Note—

The Summary Offences Act 1988 regulates or prohibits certain business signs.

Comment: The proposed signage would comply with the provisions of Section 2.83 of the Codes SEPP and would be classified as exempt development.

4.2.7 Richmond Valley Local Environmental Plan 2012

The Project is wholly located within the Richmond Valley LGA. The Richmond Valley LEP 2012 is the principal planning instrument within the LGA.

The project is located on land within zone RU1 Primary Production. The objectives of zone RU1 Primary Production are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To ensure that development does not unreasonably increase the demand for public services or public facilities.*

No other provisions of the LEP apply to the Project or Project site.

Comment: Under the provisions of zone RU1 Primary Production, development for the purpose of extractive industries is permissible with development consent. The project is defined as an extractive industry and is therefore permissible on the site with development consent.

4.2.8 Richmond Valley Development Control Plan 2021

The Richmond Valley Development Control Plan 2021 (RDCP 2021) contains detailed guidelines and planning controls applying to all development within the LGA. Two chapters are relevant to the Project:

- Part I Chapter 7 – Noise Impact Assessment
- Part I Chapter 11 – Land Use Conflict Risk Assessment – LUCRA

Chapter 7 - Noise Impact Assessment

Chapter 7 requires that a High Degree Noise Impact Assessment (NIA) be prepared for quarries which involve blasting and/or crushing.

Comment: As the project involves blasting and/or crushing, a NIA has been produced for the Project and is attached in Appendix H.

Chapter 11 - LUCRA

Chapter 11 requires that a Land Use Conflict Risk Assessment (LUCRA) be prepared for development applications that are within a certain buffer distance to a conflicting land use. The minimum buffer distances required are taken from *Living and Working in Rural Areas – A handbook for managing land use conflict NSW North Coast*. The handbook contains recommended minimum buffers for extractive industries, which are detailed in Table 4.1.

Table 4.1 Recommended buffer distances for mining, petroleum, production & extractive industries

	Metres	
Residential areas & Urban development	500	1000*
Rural dwellings	500	1000*
Education facilities & pre-schools	500	1000*
Rural tourist accommodation	500	1000*
Watercourses & wetlands	SSD+	
Bores & wells	SSD	
Potable water supply/catchment	SSD	
Property boundary	SSD	
Roads	SSD	

*Recommended min. for operations involving blasting

+SSD = Site specific determination (no standard buffer distance applies)

Comment: In relation to the recommended buffer distances:

– The Project would be within 1000 m of a rural dwelling. The heritage listed Disputed Plains Homestead is 650 m north of the existing quarry on the site. The homestead has been vacant since the 1990's. The homestead is severely dilapidated and is currently used to store hay.
– There is also a subdivision proposed to the south west that has a proposed dwelling location which would be less than 1000 m from the site.
– The Project would be adjacent to the northern property boundary and Bentley Road. The handbook does not contain a recommended buffer distance to property boundaries or roads, it is subject to a site-specific determination.

As the Project would be within 1000 m of a rural dwelling and adjacent to a road, a LUCRA is required. A LUCRA is provided in Appendix E.

4.3 Regional strategic context

4.3.1 North Coast Regional Plan 2036

The *North Coast Regional Plan 2036* is a 20-year blueprint for the future of the North Coast. Direction 13 of the plan is relevant to the Project:

> ***Direction 13: Sustainably manage natural resources***
>
> *Actions:*
>
> - *13.1 Enable the development of the region's natural, mineral and forestry resources by directing to suitable locations land uses such as residential development that are sensitive to impacts from noise, dust and light interference.*
> - *13.2 Plan for the ongoing productive use of lands with regionally significant construction material resources in locations with established infrastructure and resource accessibility.*

The development of the Project does not conflict with any of the directions or actions of the plan.

4.3.2 Northern Rivers Farmland Protection Project (2005)

The Northern Rivers Farmland Protection Project (2005) highlights state and regionally significant agricultural land in the Northern Rivers. The site is identified as regionally significant farmland.

While mapped as regionally significant, the project would impact a relatively small area (i.e. a little over 1% of the lot) and due to the topography and previous use as a quarry, it's agricultural use is limited to cattle grazing. As explained in Section 7, the project is not expected to impact on any adjacent properties or limit their agricultural viability.

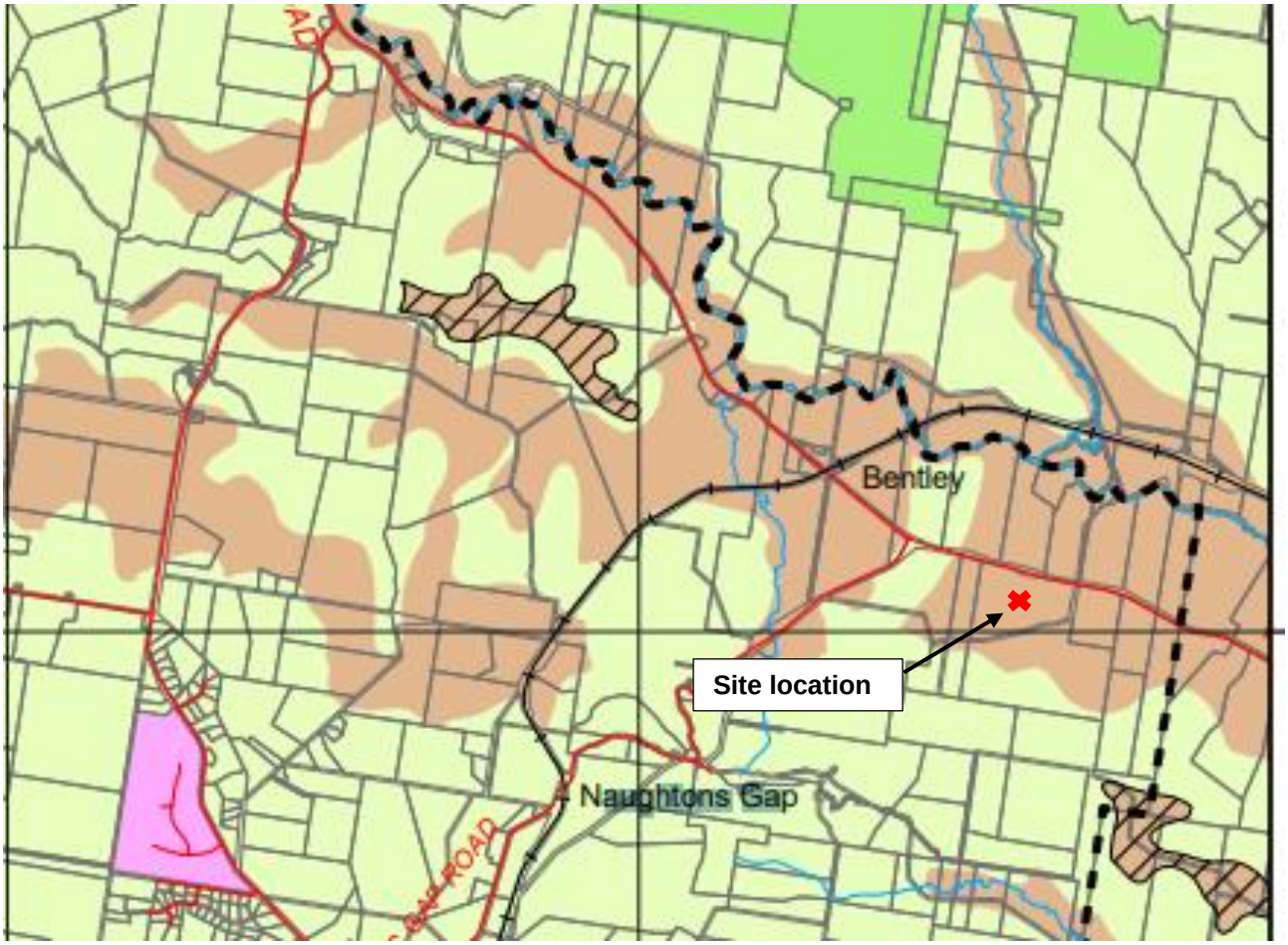


Figure 4.1 Regionally significant farmland to the east of the Project site

Source: Northern Rivers Farmland Protection Project (2005)

4.4 Other State legislation

Table 4.2 discusses the application of other NSW legislation to the project.

Table 4.2 Summary of other State legislation

Legislation	Key requirements	Comment
Heritage Act 1977	The Heritage Act 1977 (Heritage Act) is administered by the NSW Heritage Council and aims to ensure that the heritage of NSW is adequately identified and conserved. An approval under section 60 of the Heritage Act is required for impacts to State Heritage Register listed heritage items. An excavation permit under section 140 of the Heritage Act is required for impacts to archaeological relics.	The property does not contain any heritage items listed in the NSW State Heritage Inventory or Schedule 5 of the Richmond Valley LEP 2012. The heritage listed Disputed Plains Homestead is 650 m north of the project. The homestead has been vacant since the 1990's. The homestead is severely dilapidated and is currently used to store hay. The project is not expected to impact on the homestead.

Legislation	Key requirements	Comment
Protection of the Environment Operations Act 1997	The POEO Act establishes a licensing regime for pollution generating activities in NSW. Under Sections 47 and 48, an EPL is required for scheduled development work and scheduled activities respectively.	The project would extract more than 30,000 tonnes of extractive material per year and therefore meets the definition of a scheduled activity under Clause 19 of Schedule 1 of the POEO Act. Although ancillary, the Project also meets the POEO Act Schedule 1 definition of Clause 16 -crushing, grinding or separating and Clause 41 waste processing (non-thermal). An EPL is therefore required from the EPA.
National Parks and Wildlife Act 1974 (NPW Act)	The NPW Act is administered by the Department of Planning, Industry and Environment (DPIE) and aims to prevent the unnecessary or unwarranted destruction of Aboriginal relics and the active protection and conservation of Aboriginal relics of high cultural significance. The Act also provides for the protection of native flora and fauna.	A search of the Aboriginal Heritage Information Management System was conducted on 29 March 2021 for the site with a 50 m buffer, which found no Aboriginal heritage items. A site inspection by Casino Bolangle Local Aboriginal Land Council did not locate any visual evidence of aboriginal objects or occupation sites. A copy of the report is provided in Appendix L.
Biodiversity Conservation Act 2016 (BC Act)	Projects assessed under Part 4 of the *EP&A Act* are required to address the requirements of the *BC Act* which includes provisions for offsetting once certain thresholds for vegetation clearing are met.	The project requires clearing of 0.23 ha of native vegetation. A Biodiversity Assessment Report was prepared for the project which addresses the relevant requirements of the BC Act (refer Appendix J).
Roads Act 1993	The *Roads Act 1993* determines the rights of the public and adjacent land owners to use public roads, and establishes procedures for the opening and closing of public roads. Under the Act applications are required to be made for the closure of roads and for works in road reserves.	The project involves the upgrading of the intersection with Bentley Road and therefore requires a Section 138 permit from Transport for NSW.
Water Management Act 2000 (WM Act)	This Act regulates the taking, interception, storage and use of surface water and groundwater within areas subject to water sharing plans. The Project is within the *Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources 2010*. As such, surface water within the catchment is managed under the WM Act.	The project is covered by the: – For surface water: Coraki Non Tidal Management Zone within Coraki Area Water Source under the Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources (2010). – For groundwater: North Coast Volcanics groundwater sources under the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources (2016). The maximum harvestable right dam capacity for the site is 14.805 ML (Megalitres). The Water Resources Assessment for the Project found that no approvals are required under the WM Act (refer Appendix G).
Rural Fires Act 1997	Development on land that has been dedicated as bushfire prone must meet specific requirements under the *Rural Fires Act 1997* (Rural Fires Act) and the EP&A Act. The EP&A Act establishes a system for requiring bushfire protection measures on bushfire prone land at the DA stage.	The site is not mapped as bushfire prone land.

4.5 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas.

The EPBC Act is administered by the Department of the Environment and Energy (DotEE) and provides protection for listed Matters of National Environmental Significance (MNES). There are currently nine MNES:

– World heritage properties
– National heritage properties
– Wetlands of international importance
– Listed threatened species and ecological communities
– Listed migratory species
– Protection of the environmental from nuclear actions
– Commonwealth marine areas
– The Great Barrier Reef Marine Park
– Water resources

Comment: A Biodiversity Assessment was prepared for the project and is attached in Appendix J. The Biodiversity Assessment included an assessment under the EPBC Act, which found that the project's impacts are not likely to have a significant impact on any threatened biodiversity listed under the EPBC Act. Accordingly, an EPBC Act Referral is not considered a requirement for the project.

4.6 Summary of approvals required

According to Richmond Valley LEP 2012, the project is permissible with consent. The project is also classified as designated development as defined in Schedule 3 of the EP&A Regulation, as it is an extractive industry with an intended capacity of more than 30,000 cubic metres of material per year and disturbing a total surface area of more than 2 hectares of land. The project therefore requires the preparation of an EIS to accompany the development application lodged with Council.

The project is also integrated development, in accordance with Section 4.46 of the EP&A Act, and requires:

– An EPL under the POEO Act
– A Section 138 approval under the *Roads Act 1993*

The project is also regional development according to Schedule 7 of the *State Environmental Planning Policy (State and Regional Development) 200,* as it involves an extractive industry that is designated development. In accordance with Clause 4.5(b) of the EP&A Act, the Northern RPP will therefore be the consent authority for the project unless the Minister orders otherwise.

5. Community and other stakeholder engagement

5.1 Introduction

A consultation strategy was formulated as a part of the EIS process to assist in the identification of key stakeholders and issues for consideration. Consultation with a range of government agencies and community stakeholders was incorporated into the strategy to both inform the stakeholders of the Project and to allow any issues of concern to be raised at an early stage of the planning process and incorporated into the EIS.

This chapter provides a description of the government and community consultation activities undertaken and outlines the key issues identified and where they are addressed in this document.

5.2 Consultation with government agencies

Issues identified in the SEARs and references to where these issues are considered in the EIS are outlined in Table 5.1.

Table 5.1 SEARs and response

SEARs key issues	Where addressed in the EIS
In particular, the EIS must include:	
an executive summary;	Executive summary
a comprehensive description of the development, including:	
a detailed site description and history of any previous quarrying on the site, including a current survey plan;	Section 2 and plans in Appendix B
identification of the resource, including the amount, type and composition;	Section 1.1 and Appendix C
the layout of the proposed works and components (including any existing infrastructure that would be used for the development);	Section 3 and Appendix B
an assessment of the potential impacts of the development, as well as any cumulative impacts, including the measures that would be used to minimise, manage or offset these impacts;	Section 7
a detailed rehabilitation plan for the site;	Section 3.7
any likely interactions between the development and any existing/approved developments and land uses in the area, paying particular attention to potential land use conflicts with nearby residential development;	Section 2.3.5
a list of any other approvals that must be obtained before the development may commence;	Section 4.6
the permissibility of the development, including identification of the land use zoning of the site;	Section 4.2.7
identification of sensitive receivers likely to be affected by the development using clear maps/plans, including key landform areas, such as conservation areas and waterways;	Section 2.3.5 and Figure 1.2
a conclusion justifying why the development should be approved, taking into consideration: – alternatives; – the suitability of the site; – the biophysical, economic and social impacts of the project, having regard to the principles of ecologically sustainable development; and – whether the project is consistent with the objects of the Environmental Planning and Assessment Act 1979; and	Sections 3.9, 3.10 and 9
a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	Included prior to the Executive Summary

SEARs key issues	Where addressed in the EIS
Consultation In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers and any surrounding landowners that may be impacted by the development. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	Section 5
The EIS must assess the potential impacts of the proposal at all stages of the development, including the establishment, operation and decommissioning of the development. The EIS must address the following specific issues:	
Noise – including a quantitative assessment of potential: – construction and operational noise and off-site transport noise impacts of the development in accordance with the *Interim Construction Noise Guideline, NSW Noise Policy for Industry and NSW Road Noise Policy* respectively; – reasonable and feasible mitigation measures to minimise noise emissions; and monitoring and management measures;	Section 7.3, Appendix H
Blasting & Vibration – – proposed hours, frequency, methods and impacts; and – an assessment of the likely blasting and vibration impacts of the development, having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features;	Section 7.3, Appendix H
Air – including an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage;	Section 7.4, Appendix I
Water – including: – a detailed site water balance and an assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; – identification of any licensing requirements or other approvals required under the *Water Management Act 2000*; – demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) – a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo; – an assessment of activities that could cause erosion or sedimentation issues, and the proposed measures to prevent or control these impacts; – an assessment of any likely flooding impacts of the development; – an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; and – a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts;	Sections 7.2 and Appendix G
Biodiversity – including: – accurate predictions of any vegetation clearing on site; – a detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems undertaken in accordance with Sections 7.2 and 7.7 of the Biodiversity Conservation Act 2016; and – a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant.	Section 7.5, Appendix J

SEARs key issues	Where addressed in the EIS
Heritage – including: – An assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and – identification of Historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1;	Section 7.7
Traffic &Transport – including: – accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products; – an assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads; – a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development; – evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and – a description of access roads (specifically in relation to nearby Crown roads and fire trails;	Section 7.6, Appendix K
Land Resources– including an assessment of: – potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate); – potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms (such as overburden dumps, bunds etc); and – the compatibility of the development with other land uses in the vicinity of the development, in accordance with the requirements of Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;	Section 7.1, Appendix C
Waste – including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams;	Section 7.9
Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks and the transport, storage, handling and use of any hazardous or dangerous goods;	Section 7.10
Visual – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, including with respect to any new landforms;	Section 7.8
Social & Economic – an assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project; and	Section 7.11
Rehabilitation – including: – a detailed description of the proposed rehabilitation measures that would be undertaken throughout the development and during quarry closure; – a detailed rehabilitation strategy, including justification for the proposed final landform and consideration of the objectives of any relevant strategic land use plans or policies; and – the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy, recognising that a rehabilitation bond will likely be required as a condition of any future development consent.	Section 3.7
Environmental Planning instruments The EIS must take into account all relevant State Government environmental planning instruments, guidelines, policies, and plans. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies and plans that may be relevant to the environmental assessment of this development.	Section 4

SEARs key issues	Where addressed in the EIS
During the preparation of the EIS you must also consult the Department's EIS Guideline – Extractive Industries Quarries. This guideline is available at http://www.planning.nsw.gov.au/~/media/Files/DPE/Guidelines/extractive-industries- quarries-eis-guideline-1996-10.ashx.	Noted.
In addition, the EIS must assess the development against the *Richmond Valley Local Environmental Plan 2012* and any relevant development control plans/strategies.	Section 4.2.7

5.3 Community consultation

The location of the quarry is relatively isolated, so large scale community consultation was considered unnecessary. GHD contacted the Beyond Bentley group and all neighbouring residents. A meeting was held on 18 March 2021 with the Beyond Bentley group at the start of the EIS process to gain feedback form the community regarding the project. Some neighbours did not object to the project, while others expressed strong opposition. Issues raised and how they were considered is provided in Table 5.2. Minutes of the meeting are provided in Appendix F.

An attempt at further consultation was made prior to the EIS being lodged but due to COVID restrictions face-to-face consultation was not possible. An online meeting was advertised but only one person registered and another indicated there would be many in the community who are unlikely to attend or would not be familiar with online meetings. It was therefore decided to lodge the EIS and undertake further community consultation during the exhibition period when COVID restrictions have hopefully eased.

Table 5.2 Initial issues raised by the community – 18 March 2021

Issue	Response
The existing use rights and the current operation is invalid and is not being complied with	While it is acknowledged the validity of the existing use rights is related, the current project is a separate matter. The current proposal partially addresses the concern about the validity of the existing use rights because a DA will be lodged, and the community will be able to make submissions. And, if approved, compliance may be improved because NSW Environment Protection Authority (EPA) would be the regulator. To prevent the current operations influencing the assessments for the proposed quarry (e.g. noise), the current operations ceased operating when required (e.g. during background noise monitoring).
The proposal is not consistent with the holistic agricultural approach being adopted by neighbouring farms	As explained in Section 4.3.2 and Section 7 the project would impact a relatively small area and would not be expected to impact the agricultural pursuits of neighbouring farms.
The proposal will limit the subdivision potential and value of neighbouring properties	Most properties surrounding the site are 40 hectares or less, so there is limited opportunity for subdivision due to a minimum lot size of 40 hectares in the area. One property to the west currently has a DA lodged for a three lot subdivision and the proposed dwelling sites have been considered in the relevant impact assessments in Section 7, which show minimal impact.
Noise impacts	The noise assessment indicates the noise levels are less than the relevant criteria at all sensitive receivers. Refer to Section 7.3.
Traffic impacts	The traffic impact assessment indicates the road is capable of accommodating the extra traffic movements but Bentley Road will need to be upgraded at the access point. Refer to Section 7.6
Dust impacts	The air assessment indicates the dust levels are less than the relevant criteria at all sensitive receivers. Refer to Section 7.4.
Water impacts	The water resources assessment indicates water quality can be managed, water demand can be satisfied and groundwater impacts are acceptable, Refer to Section 7.2.
Undermine the stability of Bentley Road	The design of the quarry has been based on a geotechnical assessment, which is in Appendix A. This means there is unlikely to be an impact on the road reserve and even less likely to be stability issues with Bentley Road.

5.3.1 Further community consultation

Further community consultation will occur during the EIS assessment process and during operations, if approved.

5.4 Aboriginal consultation

Aboriginal community consultation was undertaken via the Casino Bolangle Local Aboriginal Land Council (LALC). The LALC conducted a heritage survey of the proposed disturbance area, which did not uncover any Aboriginal objects. The LALC has recommended mitigation measures to protect Aboriginal objects, refer to Section 7.7.

5.5 Richmond Valley Council

At the pre-DA meeting held on 18 March 2021 and 28 October 2021, Council gave the advice detailed in Table 5.3.

Table 5.3 Council pre-DA advice

Council advice	GHD response
TfNSW referral required.	Noted.
Visual impact analysis should be considered, and that vegetation screening along Bentley Road should be considered to assist in reducing the visual amenity impacts of the quarry.	A visual impact analysis is provided in Section 7.8
Due to the location of the quarry in relation to Kyogle and Lismore Councils, it is likely a referral to these neighbouring councils will be issued seeking their input into the proposal.	Noted.
EPA referral required as the proposal involves a scheduled activity.	Noted.
Noise, blasting and dust impacts will require detailed reports to be submitted with the application.	A Noise Impact Assessment is attached in Appendix Hand an Air Quality Impact Assessment is attached in Appendix I.
Any clearing of vegetation will require assessment under the Biodiversity Conservation Act.	A Biodiversity Assessment Report is attached in Appendix J.
The site is mapped as regionally significant farmland therefore this will need to be considered in the EIS. Department of Primary Industries (DPI) Agriculture may be consulted.	Refer to Section 4.3.2.
Any onsite facilities including but not limited to weighbridge, amenities, office, truck shake downs, crushing plant, fuel facilities, onsite waste management to be detailed in the application.	Details of facilities are provided in Section 3.6 and plans are provided in Appendix B.
Depending upon any dewatering requirements, a referral to Water NSW may be required.	Noted. Refer to Section 7.2.
An intersection upgrade may be required; however a full traffic assessment will need to be undertaken and a referral will be made to TfNSW. If an upgrade is required a S138 permit will need to be sought along with an occupancy licence from TfNSW.	A Traffic Impact Assessment is attached in Appendix K.
Heavy haulage contributions are likely to be imposed by Council as the site is a located off a regional road maintained by Council.	Noted.

6. Risk assessment

6.1 Overview

This chapter provides the results of the identification and prioritisation of issues. The analysis was undertaken in the form of a preliminary, desktop level risk assessment, to broadly assess the potential environmental risks that may arise as a result of the project. The preliminary environmental risk assessment identifies and ranks potential environmental risks with the aim of identifying potential impacts for detailed assessment.

The outcome of the assessment was used to inform the scope of further work and investigations. Proposed mitigation measures are provided in Section 7.

6.2 Risk assessment method

6.2.1 Impacts, risks and risk analysis

The project is likely to result in some impacts to the surrounding environment. An impact can be considered as any change to the environment either wholly or partially resulting from activities associated with the project. Impacts may either be beneficial to the environment and the community, or may give rise to changes that are considered less desirable.

The events or activities that are likely to lead to impacts that do not provide a benefit will require some level of monitoring, mitigation and/or land management. The extent of management or monitoring required will depend on the level of risk that may be associated with the impact.

Risk is generally measured as the result of a combined consideration of:

– How likely it is that an impact would occur ('likelihood')
– What would be the outcomes if it did occur ('consequence')

The environmental risk assessment was undertaken with general consideration of *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines* (Australian Standards, 2009). This involves:

– Evaluating likelihood of occurrence
– Evaluating consequence
– Assigning a risk rating

6.2.2 Evaluating likelihood

The likelihood of an impact occurring can be described in terms of probability. Overlaying this is the need to recognise the uncertainty that may be associated with the potential impacts, particularly during the initial risk assessment process. Where there is scientific uncertainty, a cautious approach would identify a higher level of risk.

Each identifiable impact can be assigned a likelihood between remote and almost certain. In simplifying the possible impacts for the purpose of a risk assessment an element of subjectivity is introduced. The purpose of the risk assessment is not necessarily to agree on the probability of any particular impact, but to facilitate an understanding of the relative probability of different impacts.

To undertake the risk analysis for this project, potential risks were given a ranking between one and three with regard to the likelihood of it occurring (assuming that the project is designed and implemented with standard environmental controls) in accordance with the following definitions:

– 1 Lower: unlikely to occur
– 2 Medium: potential to occur
– 3 Higher: likely to occur

6.2.3 Evaluating consequence

Assessing the consequences of a potential risk requires a degree of subjective assessment, as the likely consequences of an impact may consist of several elements. To undertake the risk analysis for the project, potential risks were given a number between one and three with regard to the perceived consequence if left unmanaged, in accordance with the following definitions:

– 1 Lower: potential for insignificant to minor environmental change; localised implications; imperceptible or short term cumulative impacts; offsets readily available.
– 2 Medium: potential for moderate adverse environmental change; regional implications; modest or medium term cumulative impacts; offsets available.
– 3 Higher: potential for adverse environmental change; inter-regional implications; serious or long term cumulative impacts; offsets not readily available.

6.2.4 Risk rating

Based on the assessment of likelihood and consequence a foreseeable impact/risk can be assigned a risk rating. This enables higher rating risks to be identified early in the process for the purpose of focusing the environmental assessment process. The matrix shown in Table 6.1 was used to prioritise potential Project environmental risks as either category A, B or C.

Table 6.1 Impact priority matrix

	Consequence		
Likelihood	3 Higher	2 Medium	1 Lower
3 Higher	*Category A*	*Category A*	*Category B*
2 Medium	*Category A*	*Category B*	*Category C*
1 Lower	*Category B*	*Category C*	*Category C*

Category A issues were considered the highest priority and were the main focus of the environmental impact assessment.

In general, the following was applied when scoping requirements for the environmental impact assessment:

– Category A issues – require detailed specialist investigations and field work, and were the highest priority to enable identification of appropriate management and mitigation options
– Category B issues – desirable to undertake further investigations as part of the environmental assessment to address some uncertainties
– Category C issues – may not require detailed specialist investigations, particularly where identifiable management/mitigation guidelines exist, only broad or desktop investigations were undertaken

6.3 Assessment results

The preliminary risk assessment for the project involved:

– Identifying potential environmental issues (listed below)
– Identifying potential key risks (or impacts) associated with each of these potential issues
– Evaluating the likelihood of occurrence and consequence in accordance with the definitions provided in Section 6.2
– Assigning a risk ranking/priority using Table 6.1
– Deciding on a response – it was decided that a specialist study will be undertaken for any overall issues which included a risk ranking of category A or B
– The potential environmental issues associated with the project were considered to include (in no particular order):
    - Land resources

- Water resources
- Noise and vibration
- Air quality and greenhouse gas emissions
- Biodiversity
- Traffic
- Heritage
- Visual amenity
- Waste management
- Hazards and risk
- Socio-economic

Table 6.2 provides the results of the preliminary environmental risk assessment for the project. It includes:

– A summary of the potential issues and potential key risks (columns 1 and 2)
– Likelihood of occurrence and consequence (columns 3 and 4)
– The risk ranking/prioritisation categories that were assigned (column 5)
– A comment regarding the findings of the assessment (column 6)

Table 6.2 Results of risk assessment and prioritisation of environmental issues

Issue	Potential key risks	Likelihood	Consequence	Priority category	Comment/response
Land resources	Erosion during construction and operation. Modification to the landform and impact on adjacent land uses	Higher	Medium	A	The extraction will alter the topography but the impacts are to be minimised via the proposed rehabilitation and controls recommended in Section 7.1.3. The project also has the potential to impact neighbouring properties and land uses during the operation. This has been addressed in Section 7. The SEARs have identified land resources and water resources as key issues requiring assessment. Potential land resource and water resource impacts are considered in Sections 7.1 and 7.2 respectively.
Water	Erosion and sediment and surface water quality impacts during construction. Erosion and sediment and/or surface water quality impacts, potential groundwater infiltration to pits, or impacts to groundwater dependent ecosystems (GDEs) during operation.	Higher Medium	Medium Medium	A B	The project has medium potential for erosion and sedimentation during construction and operation. However, appropriate erosion and sediment management controls are proposed to manage surface water run-off. Flooding events may occur as a result of extreme or extended rainfall events. However, given the local climate and the locality of the project site with little risk of flooding, these types of events are unlikely to impact on the project. The project may have potential to alter groundwater levels and possibly affect the water quality which may have potential to affect groundwater dependent ecosystems. The SEARs have identified soil and water resources as key issues requiring assessment. Potential soil and water resource impacts are considered in Section 7.2.

Issue	Potential key risks	Likelihood	Consequence	Priority category	Comment/response
Noise and vibration	Noise emissions from site activities during construction affecting sensitive receptors. Noise emissions and vibration from quarry operations exceeding noise and blasting limits and affecting sensitive receptors.	Medium Medium	Low Medium	C B	The project has potential to have noise impacts during the construction of the intersection of Bentley Road and the access road, with other site establishment activities with potential to have noise impacts being: – Construction of fencing – Vegetation clearance, soil stripping and stockpiling – Construction of temporary drainage controls. However, site establishment activities will be short-term, and given the proximity of the site to sensitive receivers, the impacts are not expected to be significant. There will be impacts in relation to quarrying activities during operation (blasting, material handling, crushing, screening, material handling and vehicle movements), noise and vibration from truck movements, and noise, vibration and air over-pressure from blasting. Hence there is potential for noise and vibration (during operation and site establishment). The SEARs have also identified this as a key issue requiring assessment. Potential noise and vibration impacts are considered in Section 7.3.
Air quality and greenhouse gas emissions	Dust emissions from construction activities and operations causing nuisance to sensitive receptors. Greenhouse gas emissions from operation of machinery during construction and operation.	Medium Higher	Medium Lower	B B	Some dust emissions will be generated during site establishment and operation in relation to land disturbance (areas stripped of soils, stockpiles, unsealed roads) and quarrying activities (blasting, material handling, crushing, screening, material handling and vehicle movements). The project will also result in emissions from vehicles accessing the site during site establishment and operation, particularly trucks exporting products. The SEARs identified air as a key issue requiring assessment. Potential air quality impacts including both dust and greenhouse gas emissions are considered in Section 7.4.
Biodiversity	Effects on threatened or vulnerable species through removal of vegetation and destruction of habitat	Medium	Medium	B	The project will result in the clearing of approximately 0.23 ha of native vegetation. This loss of vegetation may impact on species, populations and ecological communities listed under the EPBC Act and/or BC Act. The SEARs have identified this as a key issue requiring assessment. This issue has been considered in Section 7.5.

Issue	Potential key risks	Likelihood	Consequence	Priority category	Comment/response
Traffic and access	Increase in traffic during construction and operation affecting the operation of the Gwydir Highway and local roads.	Higher	Medium	A	Construction of the project will generate additional traffic in the local area, including both light and heavy vehicle movements. Construction of the intersection with Bentley Road will result in short-term traffic impacts. Heavy vehicle movements will also be requiring during operation of the project in relation to the transport of quarry materials and may represent new potential traffic hazards. The SEARs have also identified this as a key issue requiring assessment. Potential traffic impacts are considered in Section 7.6.
Heritage	Encounter and disturbed items of Aboriginal cultural and historic heritage during construction and operation.	Lower	Lower	C	No heritage sites have previously been identified to occur within or near the project site, and it is not anticipated that the Project will disturb any sites of heritage significance. Disputed Plains Homestead is a local heritage item located to the north of the site at 1480 Bentley Road. The homestead is located 650 m north of the Project site. It is in extremely poor condition, has been vacant since the 1990's and has been used to store hay (NSW State Heritage Inventory, N.D.) It is not expected that the project would impact on this heritage item. The SEARs have identified this as a key issue requiring assessment. This issue has been considered in Section 7.7.
Visual amenity	Visibility of the project reducing the amenity of nearby sensitive receivers.	Medium	Lower	C	The project will disturb an area of approximately 6.5 hectares and create a 30-metre excavation which would change the topography of the site. The project would also create stockpiles, access roads and temporary and permanent structures. Screening bunds are proposed to hide the quarry from view of Bentley Road. The SEARs have identified this as a key issue requiring assessment. Potential visual impacts are considered in Section 7.8.

Issue	Potential key risks	Likelihood	Consequence	Priority category	Comment/response
Waste management	Production and inappropriate disposal of waste generated from the project.	Lower	Lower	C	The project will generate a number of waste types, with potential for on-site and off-site impacts including: – Contamination of land – Pollution of waterways – Air pollution – Overuse of scarce resources – Human and animal health impacts. The SEARs have identified this as a key issue requiring assessment. Waste management is considered in Section 7.9.
Hazards and risks	Dangerous or hazardous materials or scenarios causing harm to the environment or people.	Lower	Lower	C	Potential hazard scenarios associated with the operation of the project may include: – Occupational health and safety associated with drilling, blasting and rock extraction handling – Fly-rock risks associated with blasting – Fire and pollution risk from storage and handling of fuels – Road traffic risks associated with truck movements – Risk of bushfires and floods – Controls and procedures will be implemented to ensure hazards and risks are managed on site. The SEARs have also identified this as a key issue requiring assessment. Potential hazards and risks are considered in Section 7.10.
Socio-economic	Amenity impacts during construction and operation.	Lower	Lower	C	There is potential for some amenity impacts during construction of the project. These are addressed in various specialist studies and chapters of the EIS. The project includes design features and mitigation measures to reduce the potential for amenity impacts. Once operational, the project is likely to result in positive impacts for the community, including increased employment (and sustaining several existing jobs associated with the existing quarry operation). The project will also provide a facility where local residents and businesses have continued access to new aggregate products. The SEARs have also identified this as a key issue requiring assessment. Potential socio-economic impacts are considered in Section 7.11.

7. Impact assessment

7.1 Land resources

This section provides a description of the landform, geology, soils and land use of the project site.

7.1.1 Existing environment

The existing site has been impacted by previous quarry operations, altering both the topography and lithology of the land.

Landform

The existing site has been impacted by previous quarry operations dating back to the early 1970's, altering both the topography and lithology of the land. Based on historical google imagery, the current extents of the quarry, including the northern quarry face, were developed in late 2020 or early 2021. The crest of the northern quarry face is offset by <10 m from the crest of the Bentley Road cut.

The disturbance area is in the northern section of the property, which has an elevation of 63 m AHD. The property slopes up towards a ridge in the southern portion of the site with an elevation of 256 m AHD. The ridge is the highest point in the area, with the surrounding plains having an elevation between 60 and 200 m AHD.

No watercourses or dams are located on the quarry site, however there is an ephemeral drainage line to the west where a dam has been constructed. This flows north into Back Creek. Back Creek is located approximately 883 m to the north of the quarry, travelling in an east-west direction. Another watercourse is located approximately 872 m to the west of the quarry, travelling in a north-south direction and connecting to Back Creek.

Geology and soils

Reference to eSpade indicates the quarry site is located within the McKee (9450mc) soil landscape which comprises low undulating hills and rises with relief of 30 m to 50 m and slopes of up to 10% (~5°) related to tertiary basalts. The landscape is typically extensively cleared and comprises grassland with sporadic stands of mature trees. Soils are generally shallow, high plasticity and highly reactive.

The quarry and associated access comprise the Disturbed soil landscape (9450xx).

Reference to Tweed Heads 1:250,000 geological mapsheet indicates the site is underlain by residual soil and weathered basalt rock of the Tertiary aged Lismore Basalt (Lamington Volcanics). No significant geological structures (faults / folding) were evident from the available geological information.

A Petrographic Inspection Report was prepared by Groundwork Plus for the existing quarry. It reported that the resource is 90% basalt and 10% clay. The report stated that the resource is predicted to be suitable as fine aggregate in concrete, asphalt and unbound pavement materials. A copy of the report is provided in Appendix A.

Land and soil capability

Land and soil capability (LSC) is the ability of the land to sustain a range of land uses and land management practices in the long term without degradation of soil, land, air and water resources (OEH, 2012). In particular, the LSC assessment scheme is designed to provide regional scale information about land and soil capability as applied to broad scale, dry-land agricultural uses.

The LSC classes identify limitations on the type and intensity of use as a result of the severity of constraints related to the physical attributes of the soil and the extent to which intensive management is required to prevent on and off site degradation under varying land uses. The LSC assessment scheme requires that each tract of similar land is assessed for each of the hazards and ranked from 1 to 8 where Class 1 represents the least hazard and Class 8 the highest hazard. From this, the overall LSC Class is determined by the ranking of the most limiting hazard.

It is important to note that the classification does not necessarily reflect existing land uses; rather, it indicates the potential of the land for different agricultural purposes, while maintaining the quality of natural assets.

The proposed disturbance area is classified as Disturbed Terrain (in the location of the existing quarry) and LSC Class 3. Class 3 land is defined as:

> *High capability land (moderate limitations): Land has moderate limitations and is capable of sustaining high impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.*

Land use

The property is zoned RU1 Primary Production under *Richmond Valley Local Environmental Plan* (LEP) *2012*, as is the surrounding area.

The northern portion of the property has been cleared due to historical agricultural land uses, with scattered paddock trees remaining. Native vegetation exists on the higher slopes in the southern portion of the site, which rise to a ridgeline.

The site and surrounding land is used for agriculture.

Contamination

The NSW Environment Protection Authority's record of notified and contaminated sites was searched on 21 October 2021. The property is not listed in the register.

7.1.2 Impact assessment

Landform

The project would change the topography of the site by creating an excavation 3.65 ha in area and a maximum of 30 m deep. The project would have a total disturbance area of approximately 6.5 hectares.

Geology and soils

Soil would be removed and stockpiled for use in the rehabilitation of the project site. Erosion of the soil would also be a potential impact of the project, if appropriate erosion and sediment controls are not undertaken. The removal of this material would expose the remaining rock to weathering and ultimately inundation with water; however, this is expected to only impact the surface of the rock.

Due to the extraction area being close to and extending below the level of Bentley Road, a geotechnical assessment was undertaken to determine if there were any stability issues to be considered in the design of the quarry. A copy of the Geotechnical Assessment of Bentley Road Frontage is attached in Appendix A. This indicated that the current northern cut batter comprises a highly fractured, highly weathered rockmass that is currently subject to spauling and shallow wedge / planar failure due to steeply (>70°) dipping joint sets. It is expected that the highly weathered rockmass conditions may extend to a depth of 11 m to 17 m. Between 11 m to 17 m below ground surface the rockmass conditions improve, comprising slightly weathered fresh, high to very high strength basalt with medium or greater defect spacing.

it is recommended a 15 m setback between the quarry crest and road reserve boundary is adopted. This will allow for a 2 m high bund (5 m wide base) to be placed adjacent to the road reserve boundary and offset 10 m from the quarry crest (refer to Figure 7.1).

It is recommended that the quarry should be excavated to allow for final batter slope of 54° in the variably (highly) weathered rockmass, and include a 3 m wide bench where batter slopes exceed a height of 7 m. In slightly weathered or better rockmass conditions it is recommended that batter slopes are developed to a maximum inter-bench angle of 65° (i.e. two vertical faces with a minimum bench width of 3 m).

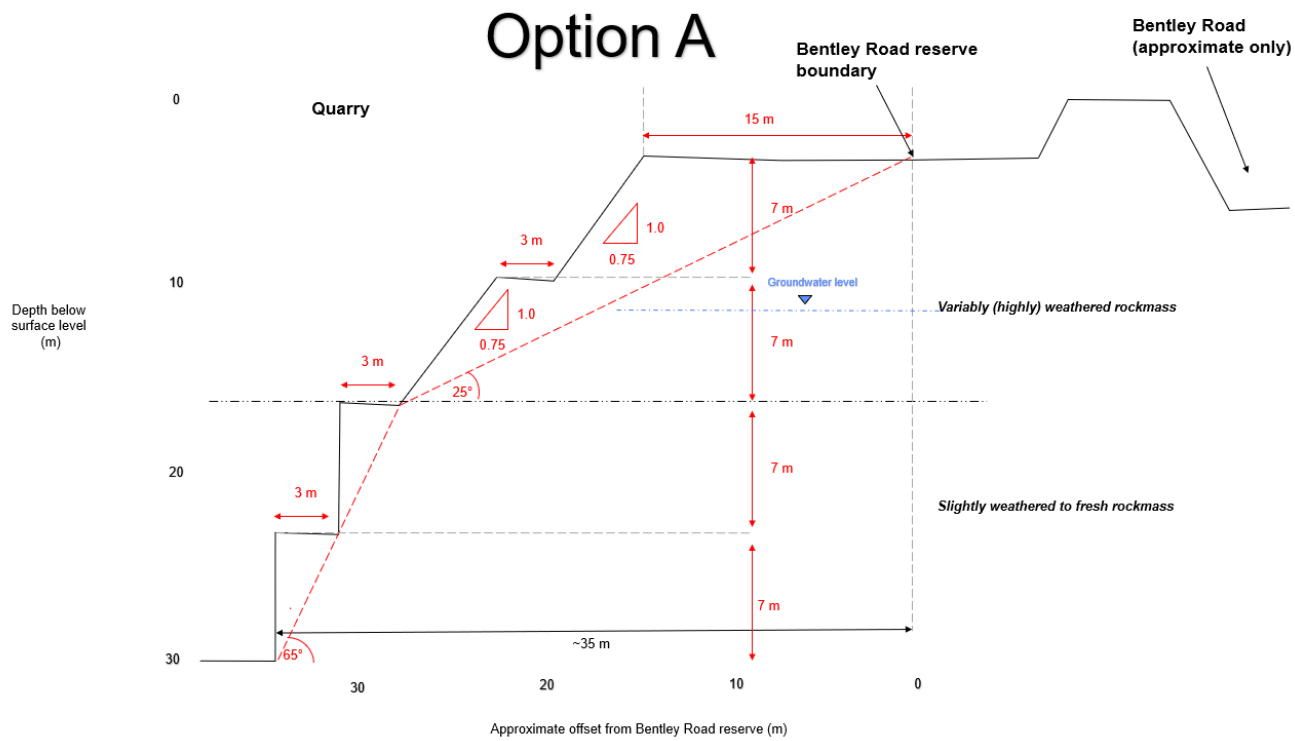


Figure 7.1 Long term batter slope geometry

Land and soil capability

While the proposed disturbance area is mapped as LSC Class 3 land and Disturbed Terrain with moderate limitations that is suitable for cropping, part of the site has been historically used for quarrying and is now exposed weathered basalt. This and the topography of the disturbance area mean it is not suitable for these more intensive agricultural pursuits, which is why it has only been used for grazing. Following rehabilitation, it is only the relatively small area (approximately 2.65 hectares i.e., 3.65 hectares minus the 1 hectare currently not suitable for grazing due to past quarrying activities) of the extraction area that would no longer be suitable for grazing. The lot is 214 hectares, so the reduction of useable land equates to a little over 1% and this is not considered to impact the agricultural viability of the property.

Land use

Extractive industries are permissible with consent for the zone, so the project is consistent with intended land use of the area. As explained above, the project would only impact a little more than 1% of the property, so is not expected to impact the ability to use the project site for agricultural activities in the future. Due to the topography and past land use, the project site was primarily suited to grazing, not any form of intensive agriculture such as cropping.

The project will have minimal impact on adjacent existing agricultural activities, with the project expected to coexist with the surrounding agricultural land uses in the locality. The impacts of the project on the surrounding properties are addressed throughout the relevant sections of this EIS and the LUCRA assessment in Appendix E.

Contamination

Potential sources of contamination during construction and operation of the quarry include:

– Spillage of fuels, oils and chemicals
– Inappropriate disposal of wastes
– Degraded potentially hazardous materials in soils
– Residual fuels, oils or chemicals in soils

The proposed disturbance area consists predominantly of cleared land which has been subject to past disturbance through agricultural activities. It is considered that there is low potential for any contaminated material to be present in the soil. If any contamination is present in the soil it is likely to be in small isolated areas. Management measures outlined below would minimise the potential for harm if any area of contamination was identified during site establishment or operation.

7.1.3 Mitigation measures

- Where topsoil is to be disturbed, R & S Contracting will implement the following procedures:
  - To minimise disturbance, topsoil will be stripped prior to quarrying in stages and stockpiled separately for later reuse in rehabilitation activities.
  - Where topsoil stockpiles are expected to remain in place for longer than three (3) months they will be re-grassed with local native seed to inhibit erosion, dust and siltation.
  - Where possible, freshly stripped topsoil will continue to be placed directly onto rehabilitated areas to reduce the potential for loss of soil structure and make best use of soil seed stores.
- Erosion and sediment controls will be implemented in accordance with Managing Urban Stormwater Soils and Construction – Volume 2e Mines and quarries (Landcom, 2004).
- Extraction of the resource would be undertaken in stages to minimise the area of disturbance at any one time.
- If obvious signs of contamination such as discoloured soils or odorous soils are encountered during construction, work will stop in the vicinity of the area and, if considered safe to do so, samples will be collected for analysis.
- Fuels, lubricants and chemicals will be stored and, where practicable, used within containment/hardstand areas designed to prevent the escape of spilt substances to the surrounding environment.
- The amount of hazardous material stored and used on site will be kept to the minimum practicable.
- Personnel will be trained in spill containment and response procedures.
- Appropriate spill response material will be kept on site.
- Appropriate maintenance schedules for plant and equipment will be followed to detect and repair leaks.
- Spills will be reported and managed in accordance with legislative and licensing requirements.
- The disturbance area would be rehabilitated once quarrying is complete to maximise the potential use of the site.
- Design and develop the quarry as illustrated in Figure 7.1 with a 15 m setback between the quarry crest and road reserve boundary. Allow for final batter slope of 54° in the variably (highly) weathered rockmass, and include a 3 m wide bench where batter slopes exceed a height of 7 m. In slightly weathered or better rockmass conditions it is recommended that batter slopes are developed to a maximum inter-bench angle of 65° (i.e. two vertical faces with a minimum bench width of 3 m).
- As benches progress a geological assessment will be undertaken to review the rock mass integrity, jointing and weathering to check that adverse conditions do not affect the stability of the slopes. As a minimum a geological review should be undertaken with the excavation of each bench.
- Routine review of pit wall stability and maintenance conditions should be undertaken monthly.
- The Quarry Manager should document a walkover around the crest of the slope adjacent to Bentley Road reserve searching for signs of slope movement and poor surface water control. Any surface water control issues should be remediated immediately. Where tension cracks, hummocky or broken ground or ground movements are noted or suspected specialist geological review should be sought immediately.
- The design of the pit walls must include the provision for drainage of surface water away from the walls around the crest of the slopes.

7.2 Water resources

A Water Resources Assessment was prepared for the project and is attached in Appendix G. It assessed the impacts from the construction and operation of the project on the water environment, and where required, identified feasible and reasonable management measures.

7.2.1 Existing environment

Surface water

No watercourses or dams are located within the disturbance area, however there is an ephemeral drainage line to the west where a dam has been constructed. This flows north into Back Creek. Back Creek is located approximately 883 m to the north of the quarry, travelling in an east-west direction. Another watercourse is located approximately 872 m to the west of the quarry, travelling in a north-south direction and also connecting to Back Creek.

The NSW ePlanning Spatial Viewer map shows a wetland on the property, to the east of the project site.

Surface water at the site currently drains into the quarry pit and overflows to the north into the Bentley Road table drain before flowing west and into the ephemeral drainage line mentioned above.

Groundwater

Groundwater has not been intercepted by the existing quarry.

A groundwater monitoring bore was installed at the project site as part of geotechnical investigations undertaken by GHD in 2021. The screened interval is 23 to 27.5 m below ground level (mbgl). Depth to groundwater was 11.9 m bgl (54.1 m AHD), which represents the level of the water table.

7.2.2 Impact assessment

Surface water

As part of the project, the proposed water management system at Bentley Quarry will essentially include the following:

– Perimeter screening bunds to divert upslope catchment runoff around Bentley Quarry
– Sump and sediment basins to collect catchment runoff from the disturbed area of the quarry

The proposed surface water management system is expected to mitigate potential surface water impacts. The residual potential impacts of the project to surface water are considered low.

The project has the potential to impact on flow regimes in watercourses due to changes to surface water runoff and baseflow contributions. The project will change the catchments of Oakey Creek and two unnamed tributaries of Back Creek. The project is expected to reduce catchments of Oakey Creek by less than 3% of its existing catchment and unnamed creek 1 and 2 by less than 1% of its respective existing catchments. This reflects the relatively small disturbance areas of the project.

There is no expected significant change to the extent of flooding and the stability of downstream water courses, due to changes to catchment area as a result of the project.

A site water balance model was developed to quantify the potential impacts under a range of rainfall conditions. The model found that the average total water deficit for dust suppression demands is approximately 1 ML/year. External water sources such as water trucks or nearby farm dams may be used to cover for the total water deficit.

Groundwater

Groundwater interception is expected during Stages 3 and 4 of the project with the lowering of the quarry floor to RL49m. Preliminary groundwater inflow and drawdown estimates were undertaken, and these were assessed in accordance with the NSW Aquifer Interference Policy Level 1 minimal impact consideration. Due to the minimal groundwater inflow and drawdown predicted, it is not expected that the project will impact other groundwater users, GDEs or groundwater quality. As such, the groundwater impacts from the project are expected to meet the Level 1 minimal impact considerations and are therefore considered to be acceptable.

7.2.3 Mitigation measures

Surface water

– Implement all sediment and erosion controls in accordance with the NSW Soils and Construction – Managing Urban Stormwater Volume 1 'the Blue Book' (Landcom, 2004) and Volume 2E 'Mines and Quarries' (DECC 2008).
– The development of a discharge permit is recommended to manage the process and record discharges required during operation.
– Discharge water quality monitoring is to be undertaken prior to any controlled release of water from sediment basins. All water quality monitoring is to be undertaken in accordance with the Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA 2004).
– In the absence of adequate reference site monitoring data, a list of the DGVs recommended by ANZECC (2000) to assess water quality is presented in Table 7.1.
– Where monitoring indicates a water quality exceedance in discharges off site, an investigation will be undertaken and a notification to the EPA shall be undertaken as soon as practicable.
– Following construction, the operational treatment devices that have been sized during the design process will seek to meet the above guideline values, the defined water quality objectives and load-based design criteria. These criteria would apply to all surface areas where runoff has been concentrated into defined outlet points of the drainage system.

Table 7.1 Default guideline values for assessment of water quality

Parameter	Units	Guideline value	Comments (reference within ANZECC)
Electrical conductivity (EC)	µS/cm	300	NSW lowland river (Table 8.2.8)
pH	pH units	6.5-9.0	NSW lowland river (Table 8.2.9)
Total suspended solids (TSS)	Mg/L	50	NSW lowland river (Table 8.2.12)
Turbidity	NTU	50	NSW lowland river (Table 8.2.11)

Groundwater

– Groundwater inflows into the quarry pit should be metered (if possible), although the minimal flows are expected to evaporate from the pit walls before reaching the in-pit sump.
– Groundwater monitoring (levels and quality) should be undertaken at the existing monitoring bore (BH01) to confirm the groundwater drawdown predictions. Monitoring should be undertaken on a quarterly basis before and during quarrying operations. Samples should be analysed for pH, EC, major ions (sodium, potassium, calcium, magnesium, chloride, sulfate and alkalinity) and dissolved metals.

Licensing

– The Environment Protection Licence for the site should include a licensed discharge point from the outlet of the sediment control dam.

7.3 Noise and vibration

A Noise and Vibration Impact Assessment was prepared for the Project and is attached in Appendix H.

7.3.1 Existing environment

Existing noise levels in the area surrounding the site are typical of a rural environment.

Between 3 and 18 August 2021 noise monitoring was undertaken at the site using 3 noise loggers. Quarry activities ceased during the logging period to obtain a true background noise level without quarry activity. The noise loggers recorded the Measured Rating Background Level (RBL) levels at (or in representative locations for) sensitive receivers R1, R2 and R3 which are shown in Figure 1.2. The results at all locations are shown in Table 7.2. The results were all minimum assessable background levels as per the NSW EPA Noise Policy for Industry (NPI).

Table 7.2 Summary of rating background noise levels, dBA

Logger ID	Rating background level 90th percentile $L_{A90(15min)}$		
	Day[1,2]	Evening[1,2]	Night[1,2]
L1	31 (35)	19 (30)	18 (30)
L2	30 (35)	23 (30)	20 (30)
L3	28 (35)	19 (30)	12 (30)

Note:

2. Daytime 7:00 am to 6:00 pm; Evening 6:00 pm to 10:00 pm; Night-time 10:00 pm to 7:00 am
   Sundays and Public Holidays, Daytime 8:00 am to 6:00 pm; Evening 6:00 pm to 10:00 pm; Night-time 10:00 pm to 8:00 am.
3. In accordance with the NPI, minimum RBLs apply. The daytime RBLs will increase to 35 dBA and evening and night-time RBLs will increase to 30 dBA.

7.3.2 Impact assessment

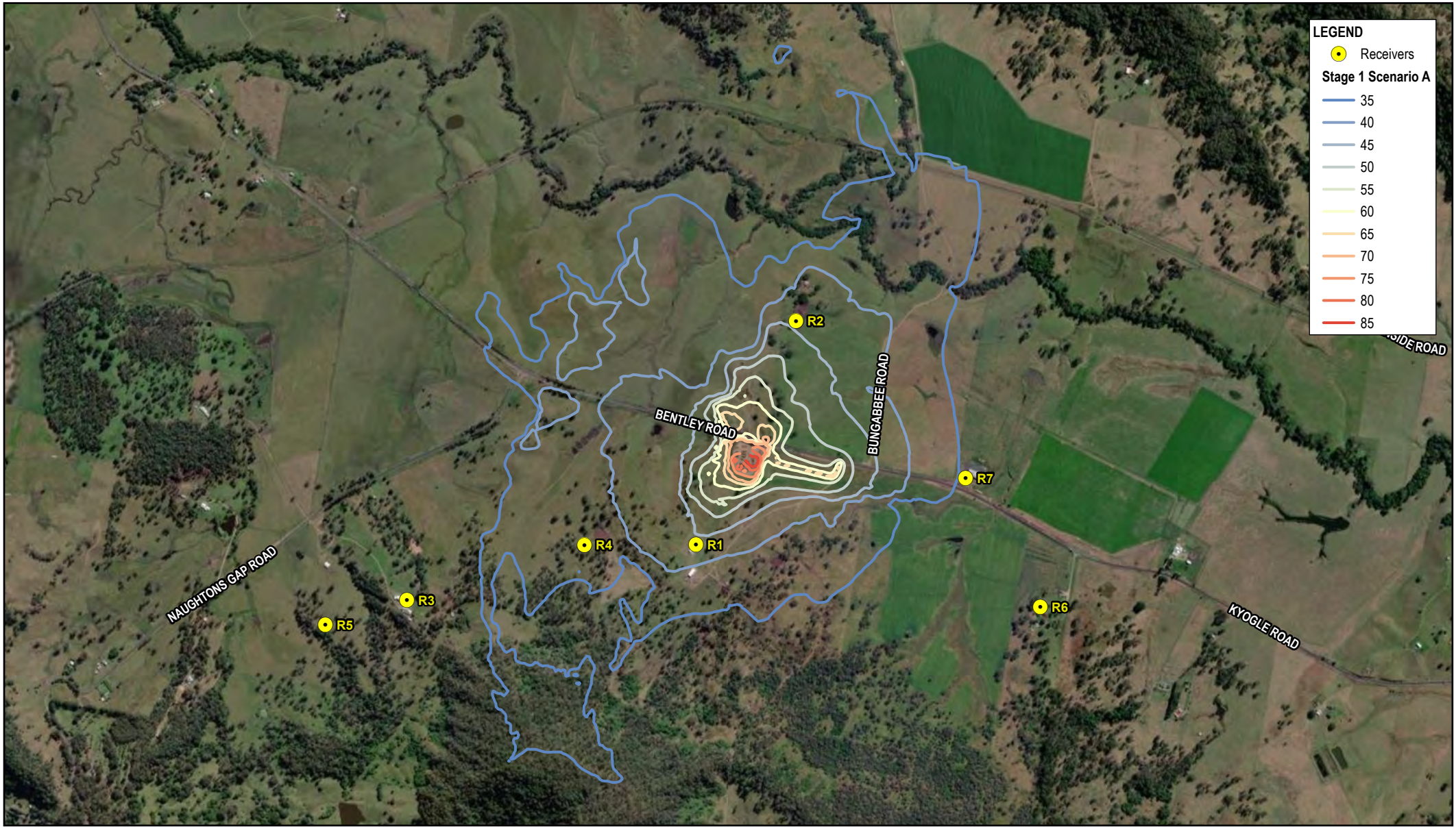
An operational noise impact assessment was undertaken for the project, which involved modelling of operational noise levels. The predicted noise levels for daytime site operations are shown in Table 7.3.

Model results indicate that noise levels generated from worst case quarry operations for Stage 1 of the project are predicted to exceed criteria at sensitive receivers R1 and R2 by 2.3 and 2.6 dB respectively. These exceedances are considered low risk as R1 is the quarry owner and R2 is the abandoned homestead which is uninhabited. Additionally, the NPI considers an exceedance of 2 dB to be negligible and does not warrant receiver-based treatments or controls.

Model results indicate that noise levels generated from worst case quarry operations for Stage 2 are predicted to exceed criteria at R1 and R2 by 0.6 and 0.4 dB respectively. These exceedances are considered marginal and also low risk based on the ownership as discussed above.

Noise levels are predicted to comply with the NPI daytime noise criteria at all other residential and non-residential receptors.

The predicted growth in quarry traffic along local roads due to peak production operations was investigated using the United States EPA's Intermittent Traffic Noise guidelines. This model indicated road noise along the local roads would comply with the NSW Road Noise Policy criteria at all assessed sensitive receivers.



Paper Size ISO A4

0 160 320 480 640

Metres

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

N

GHD

R&S Contracting Pty Ltd
Bentley Quarry
Noise Impact Assessment

Predicted operational noise levels Stage 1 Scenario A

Project No. **12547851**
Revision No. **0**
Date **29/10/2021**

Figure 7-2

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Data source: LPI: DTDB, 2017. World Imagery: Maxar.
Created by: tmorton

Table 7.3 Predicted operational noise levels

Sensitive receptor	Noise criterion L_{Aeq} dBA Daytime	Predicted noise level L_{Aeq} dBA	
		Stage 1	Stage 2
		Scenario A	Scenario A
R1	40	42.3	40.6
R2	40	42.6	40.4
R3	40	29.7	26.9
R4	40	37.0	33.7
R5	40	22.9	21.4
R6	40	26.7	26.5
R7	65	34.4	34.4

Blasting

It is noted that the current proposed blasting location is in a rural environment, with the nearest sensitive receptor approximately 360 m away (R1).

The predicted results shown in Figure 7.3 and Figure 7.4 indicate that blasting would be restricted by the air blast overpressure rather than the ground vibration levels.

Human comfort

Based on the calculated results, a maximum instantaneous charge of no more than 1.5 kg can be used in order to remain within the recommended 115 dB(L) criteria at the nearest identified sensitive receptor (R1).

If the closest occupied dwelling not associated with the quarry were used (R6 approximately 1.2 km away), a maximum instantaneous charge of no more than 50 kg can be used in order to remain with the recommended 115 dB(L) criteria.

Based on the calculated results, a maximum charge mass of no more than 145 kg can be used in order to remain within the recommended 5 mm/s PPV human comfort criteria at all sensitive receptors.

Structural damage

Since the human comfort criteria is the limiting criteria in terms of ground vibration, a residential building damage assessment will not be done.

Bentley Road is approximately 60 m from the current stage 1 starting point. If blasting is required during stage 1, although damage is not likely, it is recommended not to exceed the 15 mm/s maximum PPV building damage criteria at the road, which equates to approximately 70 kg MIC. When blasting in close proximity to the road (within 500 m) it is recommended to temporarily close Bentley Road to traffic while blasting is occurring.

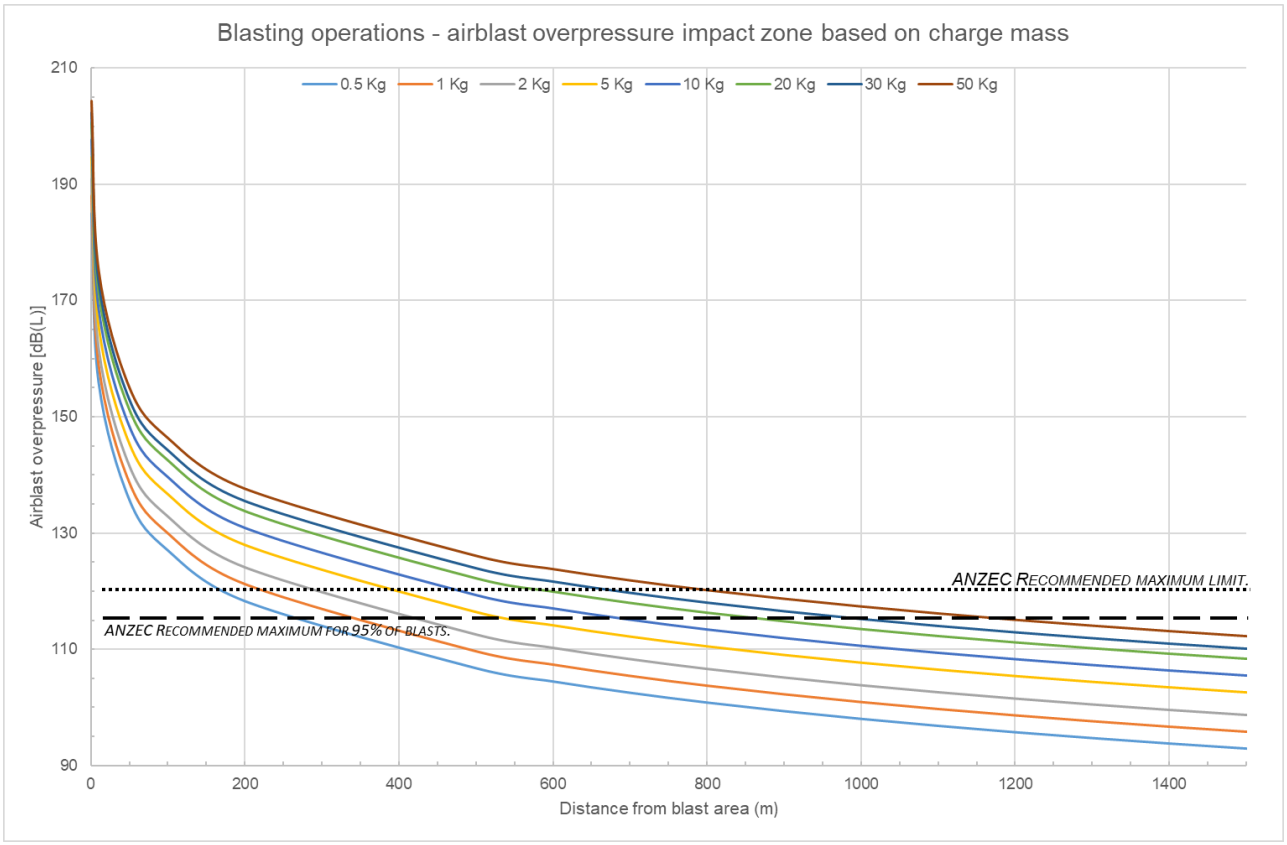


Figure 7.3 ***Airblast overpressure impact zone based on charge mass***

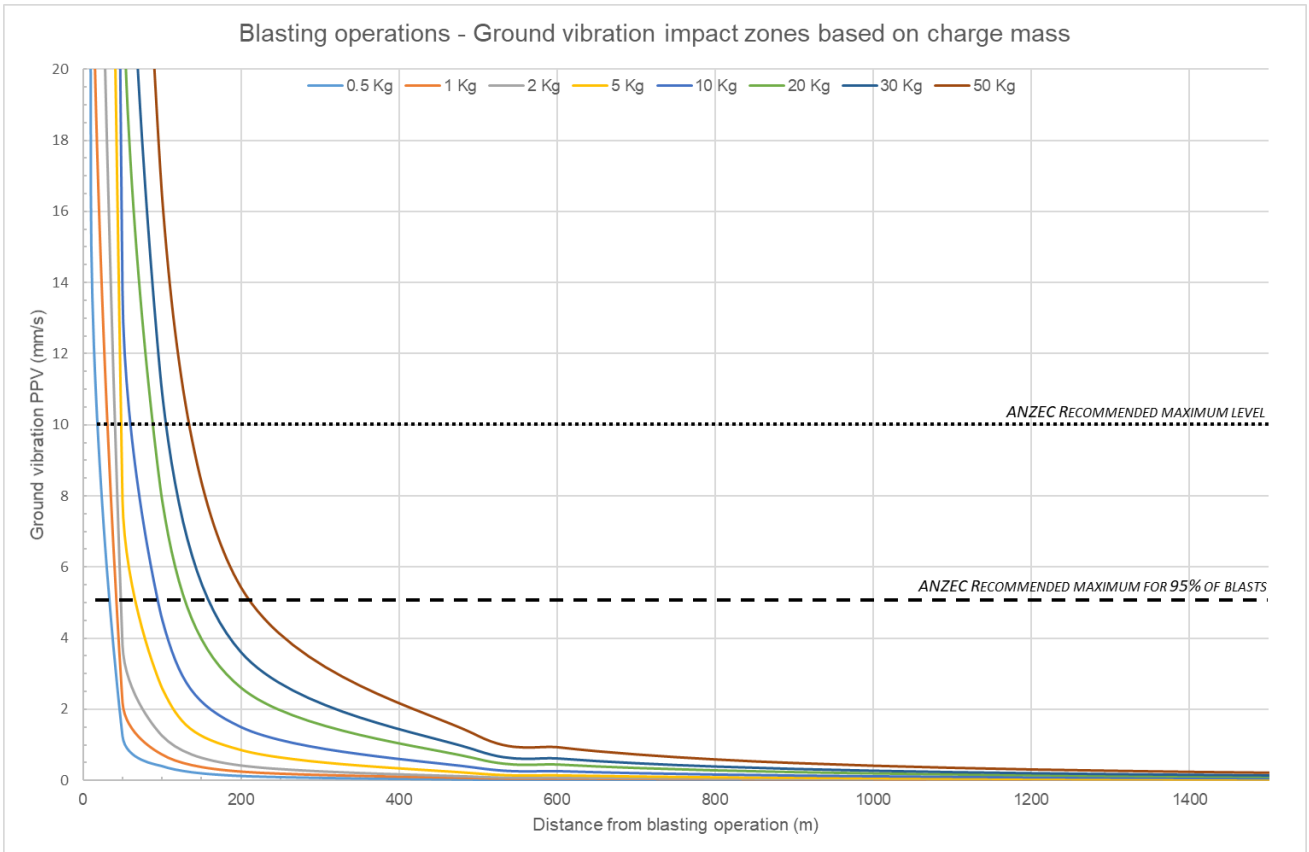


Figure 7.4 ***Ground vibration impact zone based on charge mass***

7.3.3 Mitigation measures

– All site workers would be sensitised to the potential for noise impacts on local residents and encouraged to take practical and reasonable measures to minimise the impact during the course of their activities. This would include:
  - Where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods.
  - Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours.
  - Avoid dropping materials from height and avoid metal to metal contact on material.
  - All engine covers would be kept closed while equipment is operating.
– The quarry manager would erect a sign at the entrance of the quarry with a phone number and permanent site contact so that noise complaints can be received and addressed in a timely manner.

Additional mitigation options that should be considered if required for noise control are:

– Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise. Bentley Quarry has already incorporated a screening bund around the west, southern and eastern sides of the proposed quarry pit to improve visual amenity and reduce noise impacts.
– Ensuring all equipment is not operating simultaneously, i.e. using only two pieces of crushing plant simultaneously instead of three would lower the predicted noise impacts at the closest receptors by up to 2 dB.
– Keeping equipment well maintained.
– Restricting truck speed on the site to reduce noise from the transport operation.
– Employing “quiet” practices when operating equipment (e.g. positioning and unloading of trucks in appropriate areas).
– Running staff-education programmes on the effects of noise and the use of quiet work practices.
– Using a non-acoustic warning method to warn if a vehicle is reversing or if this method does not prove satisfactory for safety reasons, adjusting the reversing alarm volume on heavy equipment to make them “smarter”, by limiting acoustic range to immediate danger area.
– Using pieces of equipment with efficient muffler design.
– Using vehicles with quieter engines.
– Active noise control.

Compliance noise monitoring program:

– To validate the predicted noise levels in this report, noise monitoring should be undertaken within three months of commencement of Stage 1 operation at a minimum of three representative locations during the day period. Truck passby monitoring should also be undertaken to ensure road traffic noise levels associated with Bentley Quarry are within the identified RNP road noise criteria.
– Should the results of monitoring identify exceedances of the predicted noise levels, additional reasonable and feasible mitigation measures would be implemented in consultation with the client and affected property owners.
– All acoustic instrumentation shall meet the requirements of AS IEC 61672 2004 *Electroacoustics - Sound Level Meters* (Parts 1, 2 & 3) and carry current National Association of Testing Authorities (NATA) and manufacturer calibration certificates. Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dB(A).

A noise compliance assessment report shall be prepared, including all details of the noise monitoring. As a minimum, the compliance noise report should include the following items:

– Scope of work.
– Details of instrumentation and methodology.

– Noise criteria.
– Details of monitoring locations.
– Time, date, duration of measurements.
– Meteorological conditions during monitoring.
– A description of the quarry operations during monitoring.
– L_{Amax}, L_{A1}, L_{A10}, L_{A90}, L_{Aeq} levels over the measurement period, including noise levels (SPL) of events attributed to Interchange operations as well as other noise sources.
– High level assessment of noise environment including dominant noise sources. Noise contribution from quarry operations should be estimated.
– Statement of compliance/non-compliance.
– Recommendations for additional mitigation measures if required.

Blasting

– All residential receptors within 1 km of Bentley Quarry will be notified 2 days prior to any blasting being undertaken at the site.
– A maximum instantaneous charge of no more than 1.5 kg can be used in order to remain within the recommended 115 dB(L) criteria at the nearest identified sensitive receptor (R1).
– A maximum instantaneous charge of no more than 50 kg can be used in order to remain within the recommended 115 dB(L) criteria at the nearest identified sensitive receptor not associated with the Quarry (R6).
– Based on the calculated results, a maximum charge mass of no more than 145 kg can be used in order to remain within the recommended 5 mm/s PPV human comfort criteria at all sensitive receptors.
– If blasting during stage 1 operations, it is recommended not to exceed the 15 mm/s maximum PPV building damage criteria at Bentley Road, which equates to approximately 70 kg MIC. When blasting in close proximity to the road (within 500 m) it is recommended to temporarily close Bentley Road to traffic while blasting is occurring.
– Initial blast monitoring should be conducted where one or more sensitive sites may be exposed to airblast and or ground vibration (i.e. R1 and R6) to ensure that the blasting program is able to comply with the prescribed criteria. This will enable changes to be made to the blasting methods if it is found that the levels do not comply with the criteria. This monitoring should be done over enough blasts to show consistent results, usually a minimum of five. These tests should be done at the most affected sensitive sites in two or more directions. The closest residential sensitive receptors to Bentley Quarry are R1 and R6.
– Regular ongoing monitoring should be continued at the closest sensitive receptors to confirm overpressure and ground vibration targets are met. This should be outlined in an appropriate Blast Management Plan. Where the initial monitoring shows that vibration targets are easily met at the closest receptors, ongoing monitoring may not be required, however any changes to blasting methods or MIC amounts would warrant a restart of the monitoring program.

7.4 Air quality

An Air Quality Impact Assessment was prepared for the project and is attached in Appendix I.

7.4.1 Existing environment

The NSW DPIE operates ambient air quality monitoring stations in selected areas around NSW.

There is no regular ambient air quality monitoring data available for the project site location or its immediate surrounds. The nearest AQMS station to the site with sufficient data is the Armidale station, approximately 230 km southwest of the site. Due to the large separation distance the particulate levels monitored at this station cannot be determined to be entirely representative of the project site.

A review of the environment and industry surrounding the project site has been undertaken to develop an understanding of the potential ambient dust levels. The area is a rural farming area with little industrial activity. It is anticipated that the ambient dust levels in the area are moderate to low.

The average PM_{10} concentration in rural areas across the state (2010-2019) was 18 µg/m^3, as reported in the *NSW Annual Compliance Report 2019* (DPIE, 2019).

7.4.2 Impact assessment

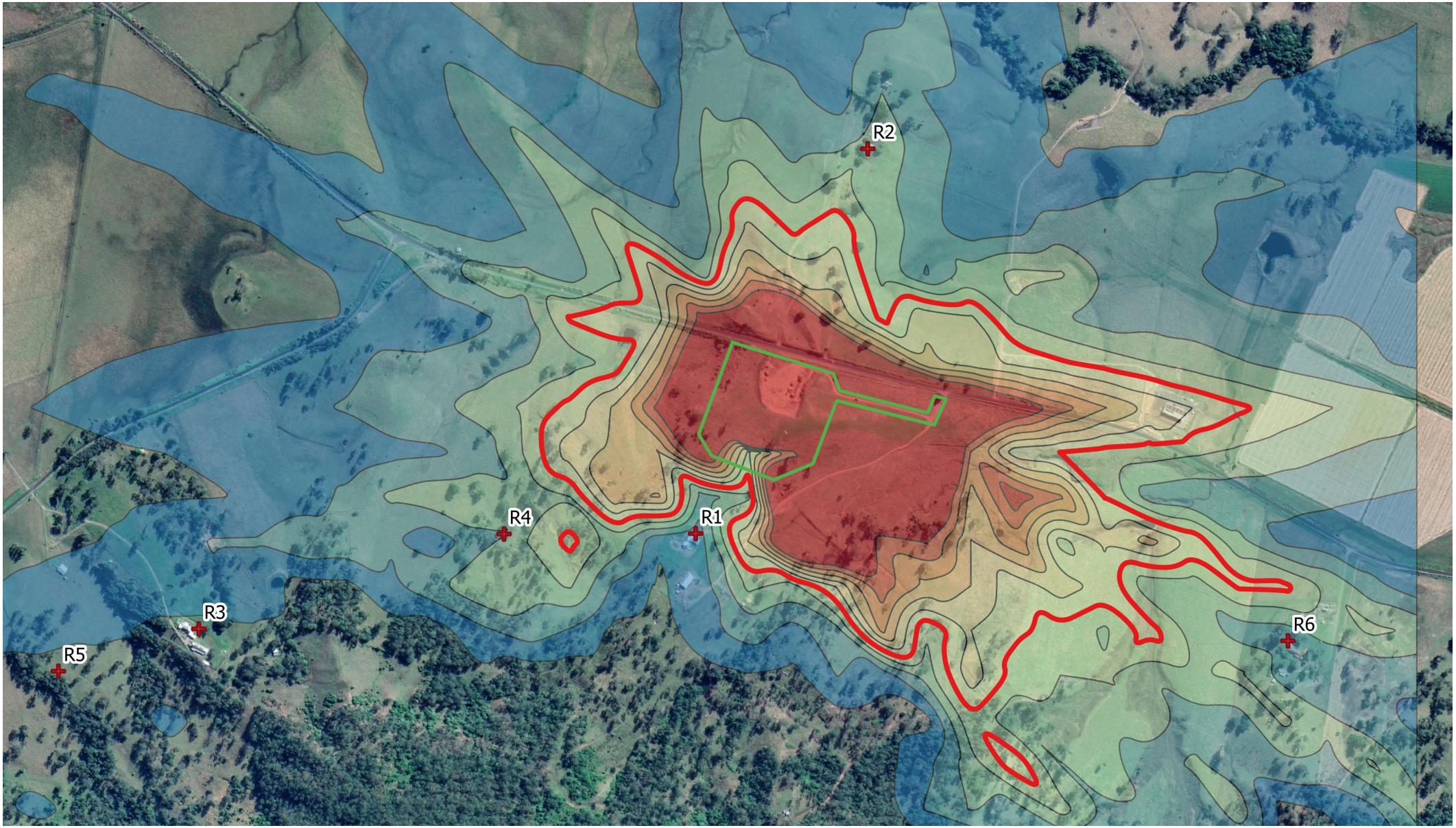
Dust and particulate matter would be the primary emissions to air expected during operation of the Project. The processes that may generate significant amounts of particulate matter (dust) are:

– Stripping of topsoil
– Extraction by excavation
– Screening and crushing of material
– Loading of materials to trucks
– Internal haulage routes
– Wind erosion of topsoil and product stockpiles

Other air emissions such as combustion products (e.g. vehicle exhaust) would also be present within the quarry, however due to the small number of vehicles, the potential for impact from these emissions is negligible.

The predicted particulate (TSP, PM_{10} and $PM_{2.5}$) impacts were assessed at six nearby sensitive receptors during the operation of the quarry. The predicted concentrations were assessed against the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2016) (refer Table 7.4).

The assessment found that the project would not exceed the assessment criteria. The worst-case impact is at R02, where the maximum incremental 24-hour PM_{10} concentration is approximately 76% of the criteria.



Legend

- Bentley Quarry
- Sensitive receptors

24 hour criteria level - 50 µg/m3

PM10 concentration (µg/m3)

10		30	70
20		40	80
		50	90
		60	>100

Paper Size ISO A4

0 200 400 m

N

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

GHD

R & S Contracting Pty Ltd
Bentley Quarry
Air Quality Impact Assessment

PM10 maximum 24 hour incremental concentration

Project No. **12547851**
Revision No. **-**
Date. **20/10/2021**

FIGURE 7.5

Document Path: \\ghdnet\ghd\AU\Coffs Harbour\Projects\22\12547851\Tech\Air Quality\04_modelling\Bentley.qgz
Print Date: 20/10/2021

Data Source:Google Earth Imagery 2021.
Created By: rbrowell

Table 7.4 Predicted incremental particulate concentrations

Receptor	Annual average (µg/m^3)			Maximum 24 – hour (µg/m^3)	
	TSP	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Assessment criteria	**90**	**25**	**8**	**50**	**25**
R01	0.73	0.45	0.11	16	4.0
R02	0.68	0.36	0.091	38	9.5
R03	0.09	0.054	0.013	5.8	1.5
R04	0.43	0.25	0.061	29	7.4
R05	0.072	0.039	0.0094	5.7	1.4
R06	1.1	0.59	0.15	24	6.1

Greenhouse gas

The greenhouse gas (GHG) assessment estimated the emissions associated with construction activities and quarry operation (including downstream emissions) based on previous similar projects.

The following scopes of emissions were considered:

– Scope 1: Emissions from direct energy use.
– Scope 2: Indirect energy use from imports and exports of electricity, heat or steam.
– Scope 3: Limited to emissions associated with Scope 1 and 2 emissions and downstream emissions from the transportation of material from the quarry.

The greenhouse gas estimate considered emissions from the major emission sources during construction and operation activities as follows:

– Construction emission sources:
  - Fuel consumption during construction activities
  - Vegetation removal
– Operation emission sources:
  - Fuel consumption during operation of the plant
  - Transport of product 50 km off site

The greenhouse gas emissions are estimated to be approximately 26,700 t CO_2-e over a 20 year life (approximately 1,335 t CO_2-e per annum on average). Emissions associated with the transportation of material from the facility were estimated to be about 66% of emission for the project. The next greatest source of emissions at 32% was fuel consumption during operations.

The likely emissions are minor compared with Australia's and NSW total GHG emissions. To March 2021 Australia's greenhouse gas emissions were estimated as 494 Mt CO_2-e and in 2019 New South Wales' greenhouse gas emissions were 141 Mt CO_2-e. The emissions from the project per annum would be approximately 0.0005% of New South Wales' total greenhouse gas emissions and 0.0002% of Australia's total GHG emissions. Emissions during peak operation could be as high as double the average annual emissions. These high emissions would still be minor compared with total emissions for NSW and Australia.

7.4.3 Mitigation measures

The following control measures must be implemented:

– Water sprays of crushing and screening activities.
– Level 2 watering (> 2 litres/m_2/h) present across all access roads.
– Visual dust monitoring will be performed on a routine basis, and all staff will be trained to look out for visible dust leaving the worksite in the direction of sensitive receptors. If the works are creating visible dust plumes that are leaving the site boundary, the works will be modified or stopped until the dust hazard is reduced to an acceptable level.

– Ambient dust levels should be considered and care taken on days when high ambient dust levels are high, such as days when bushfires or hazard reduction burns are nearby. Production, especially high dust generating activities, should be actively minimised on these days to avoid cumulative dust impacts.
– Dust suppression will be undertaken as required, using level 2 watering (> 2 L/m^2/h) via water sprays and water carts:
    - Unpaved work areas subject to traffic or wind.
    - Topsoil and aggregate stockpiles.
    - During the loading and unloading of dust generating materials.
– Maintain an orderly and clean work site.
– If complaints are received relating to dust, works will be reviewed to identify opportunities to reduce potential impacts from dust.
– Should complaints persist a dust monitoring system will be implemented to determine dust levels at receptors.

7.5 Biodiversity

7.5.1 Existing environment

A Biodiversity Assessment was prepared for the project and is attached in Appendix J.

The Project site has previously been cleared for cattle grazing and is dominated by exotic grasses and other weeds. The assessment recorded 8.87 ha of exotic vegetation and 0.25 ha of native vegetation, which is shown in Figure 7.6.

Based on field assessments, no threatened flora species were detected within the project site.

BioNet search results identified records of 11 threatened fauna species listed under the BC Act within the search area. Three threatened fauna species were confirmed at the site during the field assessments:

– Little Bent-winged Bat
– Large Bent-winged Bat
– Yellow-bellied Sheathtail-bat

Based on the desktop analysis and habitat present, species assessed as having a moderate or higher likelihood of occurrence within the study area were further considered. These species are listed in Figure 7.6.

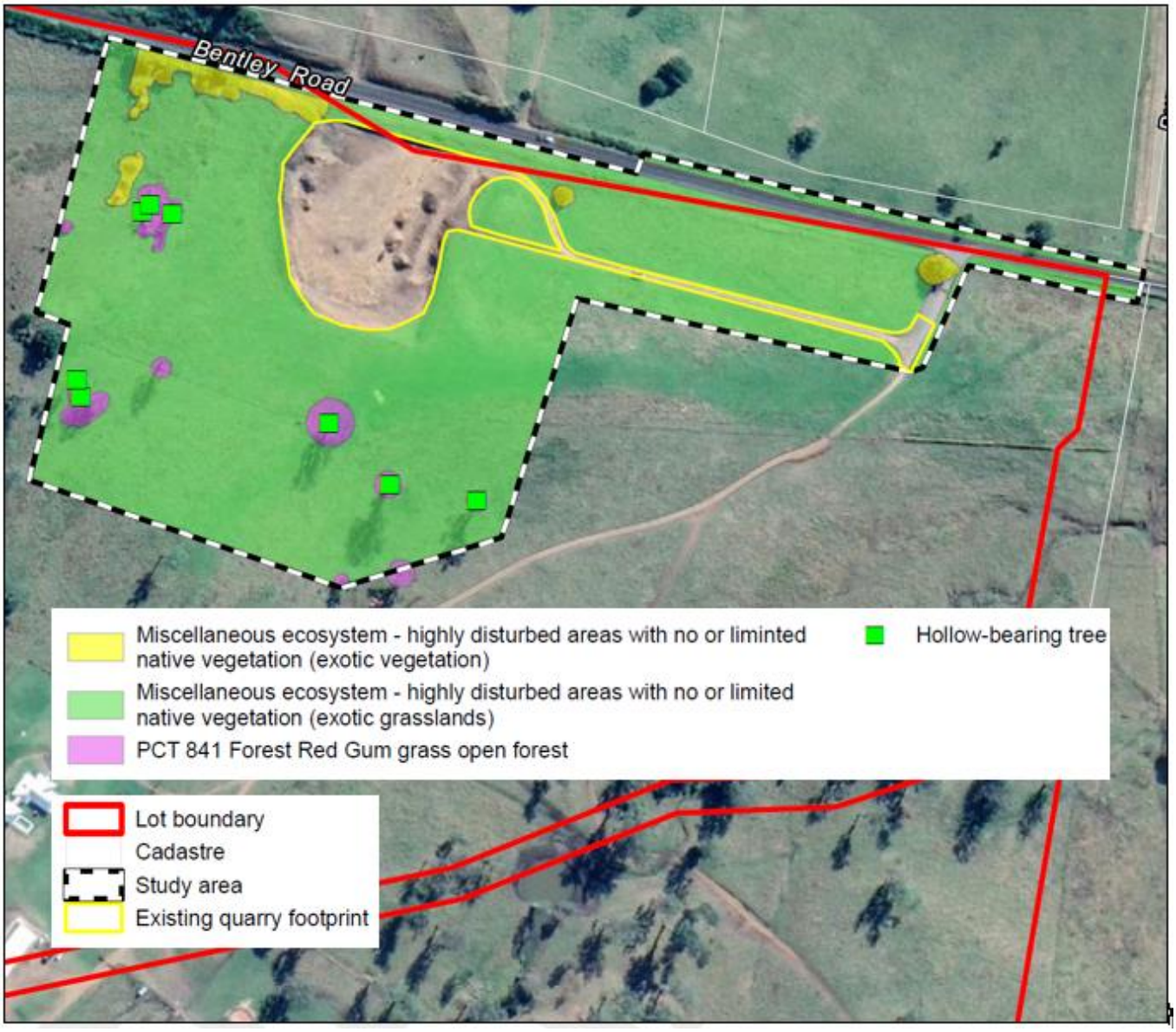


Figure 7.6 Vegetation types at the Project site

Table 7.5 Threatened fauna listed under BC Act recorded or with moderate - higher likelihood of occurrence in study area

Scientific Name	Common Name	BC Act[1]	Likelihood of occurrence
Blossom nomads			
Glossopsitta pusilla	Little Lorikeet	V	Moderate - potential foraging habitatin the form of blossom eucalypts.
Pteropus poliocephalus	Grey-headed Flying-fox	V	Moderate - potential foraging habitatin the form of blossom eucalypts.
Arboreal mammals			
Phascolarctos cinereus	Koala	V	Moderate – marginal habitat presentin form of small stands of native Corymbia and Forest Red Gum species in study area. BioNet records within close proximity to study area.
Microbats			
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	Moderate - Potential foraging habitatpresent in patches of native vegetation stands with canopy cover
Scoteanax rueppellii	Greater Broad-nosedBat	V	

Scientific Name	Common Name	BC Act[1]	Likelihood of occurrence
Saccolaimus flaviventris	Yellow-belliedSheathtail-bat	V	Recorded – Anabat detector
Miniopterus australis	Little Bent-winged Bat	V	
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	

7.5.2 Impact assessment

Based on the results of the Biodiversity Assessment, biodiversity impacts of the project are relatively low, particularly with the low impacts on native vegetation. However the potential biodiversity impacts are as follows:

– Removal of native vegetation
– Loss of hollow-bearing trees
– Potential for injury or mortality of fauna during clearing works
– Weed dispersal

Removal of vegetation

The construction of the project will require the removal of approximately 0.23 ha of native vegetation in the form of *PCT 841: Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion*. Approximately 5.72 ha of highly disturbed areas with no or limited native vegetation would also be impacted.

Removal of hollow-bearing trees

The project is likely to include the loss of 8 hollow-bearing trees and has the potential to affect native animals such as:

– Hollow-nesting and canopy-nesting birds
– Hollow-dependent bats
– Arboreal mammals and reptiles

Injury and mortality

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur. The extent of this impact would be proportionate to the extent of vegetation that is cleared. Less mobile species (e.g. ground dwelling reptiles and frogs), or those that are nocturnal and nest or roost in trees during the day (e.g. arboreal mammals and microchiropteran bat species), may find it difficult to rapidly move away from the clearing when disturbed.

Owing to the proposed vegetation to be removed being predominately disturbed habitat, the utilisation by fauna species is considered to be low. Therefore, vehicle strike during and after construction works is not likely to be significant.

Noise and vibration impacts

The project would generate noise during both the site establishment and operational phases. These impacts have been assessed as part of Noise and Vibration Impact Assessment (GHD, 2021) for the project, summarised in Section 7.3.

As previously indicated, model results indicate that noise levels generated from worst case quarry operations for Stage 1 are predicted to exceed criteria at R1 and R2 by 2.3 and 2.6 dB respectively, whilst model results indicate that noise levels generated from worst case quarry operations for Stage 2 are predicted to exceed criteria at R1 and R2 by 0.6 and 0.4 dB respectively. Given these relatively minor exceedances affect sensitive receptors within only 360 and 660 m of the quarry respectively, any potential noise impacts on fauna or associated habitat as a result of the operation of the quarry are expected to be negligible, particularly as the quarry would not operate at night.

No impacts are expected at Muckleewee Mountain Nature Reserve which is over 2.5 km from the quarry.

Weed dispersal

The project has the potential to further disperse weeds into nearby areas of native vegetation and adjacent properties. The greatest potential for weed dispersal and establishment associated with the project would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery where these are utilised within or adjacent to retained vegetation. The clearing of native vegetation for the project, including earthworks would increase the potential for weed invasion into adjacent patches of native vegetation. Management measures would be required to minimise the risk of introduction and spread of weeds. With appropriate weed management, the overall impact of weed invasion within surrounding areas is likely to decrease in the medium to long term.

Threatened species

Tests of significance were completed for the threatened species considered likely to occur, which found that the project is unlikely to result in a significant impact to these species within the locality.

A Koala Habitat Assessment was undertaken under the *Environment Protection and Biodiversity Conservation Act 1999*, which found that the vegetation in the proposed disturbance area is not likely to constitute habitat critical to the survival of the species.

7.5.3 Mitigation measures

Vegetation and habitat loss

- Mark the limits of clearing and install temporary fencing around the construction footprint area prior to construction activities commencing to avoid unnecessary vegetation and habitat removal/disturbance.
- Prior to clearing commencing a suitably qualified ecologist is to undertake a pre-clearing survey to ensure no fauna are present within clearing area.
- Implement clearing protocols, including:
  - Marking trees to be removed and preparing an inventory of trees and hollows to be removed.
  - Checking hollow-bearing trees for the presence of bird nests and arboreal mammals, such as possum and bats, prior to felling.
  - Animals found to be occupying trees should be safely removed before the clearing of trees if possible and relocated into nearby woodlands.
- A Vegetation Management Plan (VMP) will be prepared and will incorporate the following:
  - Protocols and implementation scheduled of weed control and management in accordance with the Biosecurity Act 2015 surrounding the project site.
  - Compensatory / offset planting of native trees species which will include:
    - A ratio of 5:1 native tree planted (a total of 50) for the removal of 10 mature Eucalyptus spp and Corymbia spp trees impacted.
- Compensatory/offset trees will be planted within a designated area within the project site (refer to Figure 7.7 below) and be a combination of Eucalyptus tereticornis, Eucalyptus siderophloia and Corymbia intermedia.
- Replacement of hollow-bearing trees with microbat nest boxes, with a removal ratio 2 (nest boxes):1 (hollow-bearing tree removed). Nest boxes are to be designed for microbat use and positioned in mature trees within a designated area within the project site (refer to Figure 7.7).

Erosion and sedimentation

- Best practice erosion and sediment controls should be implemented in accordance with Volume 2D of Managing Urban Stormwater: soils and construction (Department of Environment and Climate Change 2008). Design temporary scour protection and energy dissipation measures to protect receiving environments from erosion.

Weeds

- Measures must be implemented during construction to ensure the potential for the introduction of weed propagules to the site is minimised

– Priority weeds within the study area would be managed in accordance with the Biosecurity Act 2015

Rehabilitation and landscaping

– Landscaping and screen bunding should aim to utilise endemic native species (where possible).

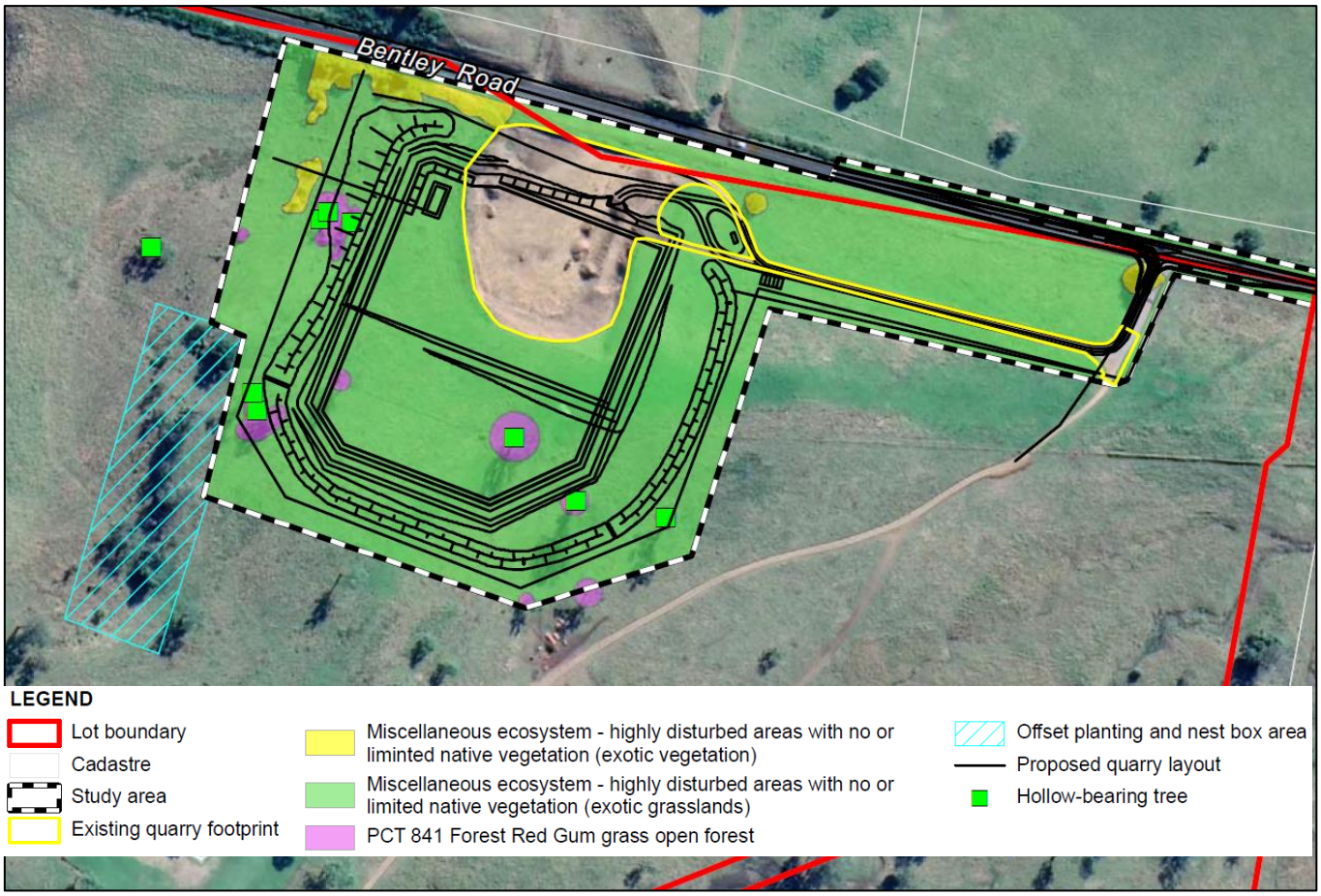


Figure 7.7 Offset planting and nest box area

7.6 Traffic and transport

A Traffic Impact Assessment (TIA) was prepared for the project and is attached in Appendix K.

7.6.1 Existing environment

Access to the site is via Bentley Road. Bentley Road is a regional arterial road managed by Richmond Valley Council and connects Summerland Way in the north-west to Kyogle Road in the south-east. Bentley Road forms part of the east-west route between Lismore and Kyogle. It is a two-way two-lane sealed line marked road with a posted speed limit of 100 km/h in the vicinity of the site. No parking, kerb and guttering, active transport infrastructure or street lighting is provided on Bentley Road in the vicinity of the site. Bentley Road is approximately 6.3 metres wide near the Project site.

This site access road is unsealed and its intersection with Bentley Road permits all movements however it does not have any turn treatments (such as a basic left-turn (BAL) or a basic right-turn (BAR) treatment).

7.6.2 Impact assessment

Construction

During the site establishment phase the traffic generated would primarily consist of heavy vehicle movements, mostly relating to the construction of the intersection of Bentley Road and the site access road. A few light vehicles would also access the site daily during the construction works. The traffic generated during construction is anticipated to be less than that generated during operation of the quarry.

The safety of the local network during the site establishment phase is not expected to be negatively affected, provided that the works are carried out with appropriate and compliant temporary traffic management. Site establishment works are expected to have some negative impact on travel times on Bentley Road due to reduced speed zones, however construction would be carried out over a brief period and therefore the effect on local traffic is not expected to be significant.

Operation

During operation of the Bentley Quarry, it is assumed there would be a maximum of five workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 10 vehicle trips per day.

Truck and dog trailer combinations have a capacity of about 32 tonnes. At maximum daily production (i.e. 2,000 tonnes), the quarry is expected to generate about 70 truck and dog loads or 140 truck movements per day.

The peak traffic volumes on Bentley Road during the operation phase are expected to be a maximum of 693 vehicles per hour (occurring during the PM peak in 2032), which is well within the typical capacity for a two-lane two-way rural road or highway. Similarly, the peak traffic volumes on Naughtons Gap Road during the operation phase are expected to be a maximum of 307 vehicles per hour (occurring during the AM peak in 2032), which is also well within the typical capacity. The operation of Bentley Quarry is expected to have no noticeable impact on Bungabbee Road. Therefore, the proposed operations of the quarry are expected to have minimal impact on the mid-block capacity of the local network during the operation phase.

The increase in traffic on the local network during the operation phase is approximately 3% and is considered relatively low and within the typical hourly capacity of such roads, therefore the impact on local traffic is expected to be minimal. However, the expected the traffic volumes warrant turn treatments for the right turn from Bentley Road to the site access road as a channelised right-turn (CHR(S)), and for the left turn as an auxiliary left-turn (short lane) (AUL(S)).

7.6.3 Mitigation measures

– In constructing the intersection and any upgrade to the existing site access road it is recommended that the alignment of the site access road be such that an Approach Sight Distance (ASD) of 69 metres on approach to Bentley Road is achieved.
– Construction of turn treatments for the right turn from Bentley Road to the site access road as a channelised right-turn (CHR(S)), and for the left turn as an auxiliary left-turn (short lane) (AUL(S)).
– To assist with maintenance of the local roads, R & S Contracting pay contributions in line with the *Richmond Valley Council Section 94 Heavy Haulage Contributions Plan* 2013 and the *Richmond Valley Council Section 94A Contributions Plan.*

7.7 Heritage

7.7.1 Existing environment

Non-Aboriginal heritage

The NSW State Heritage Inventory and Schedule 5 of the Richmond Valley LEP 2012 were searched for heritage items. No heritage items were identified at the property.

Disputed Plains Homestead is a local heritage item located to the north of the site at 1480 Bentley Road. The homestead is located 650 m north of the existing quarry. It is in extremely poor condition, has been vacant since the 1990's and has been used to store hay (NSW State Heritage Inventory, N.D.)

Aboriginal heritage

A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted on 29 March 2021 for the site with a 50 m buffer, which found no recorded Aboriginal heritage items. A copy of the AHIMS search result is attached in Appendix L. Part of the site has been quarried in the past, making it unlikely that any items of Aboriginal heritage significance remain.

The Casino Bolangle Local Aboriginal Land Council (LALC) conducted a Cultural Heritage Assessment of the proposed project area on 19 October 2021. The survey did not uncover any Aboriginal objects due to the long grass. The LALC has recommended mitigation measures, which are detailed below. The Cultural Heritage Assessment is attached in Appendix L.

7.7.2 Impact assessment

No impacts are expected on the Disputed Plains Homestead or Aboriginal heritage items.

7.7.3 Mitigation measures

– Casino Bolangle LALC Aboriginal Heritage Officers must be present during the initial stages of the Project when the grass and topsoil to a depth of 5–10 cm is removed.
– In the event that an unexpected aboriginal object is exposed during the removal of the top soil a proposed stop work procedure (SWP) is to occur.
    - *Stop work* – Immediately, upon becoming aware of a potential cultural heritage object.
    - *Contact* – the Bolangle LALC and site officer (if they are not already on site).
    - *Notify* – the Casino Bolangle LALC & aboriginal site officer present and advise OEH as soon as possible. If bones or potential human remains are discovered. Police must be notified immediately. Police must provide written notification to proceed. If human remains are identified as Aboriginal, OEH will provide written notification of required actions.
    - *Assess* - A cultural heritage professional in conjunction with OEH and the Casino Bolangle site officer should assess the significance of the resource and recommend a course of action e.g. Protect and avoid; or Investigate, in accordance with the Code of Practice for Archaeological Investigation; or Develop, management strategies to inform an AHIP to regulate the unavoidable harm to Aboriginal objects.
    - *Action* – Identification of a previously unrecorded cultural heritage object will require registration as an Aboriginal site on the OEH AHIMS database. Registration is required as soon as practicable.
    - *Apply* – To OEH for an AHIP if necessary.
    - *Recommence* – Only when OEH has approved a course of action and/or provided conditions of approval for an AHIP.

7.8 Visual amenity

A visual impact assessment investigates the potential visual impacts of the proposed quarry on the surrounding environment. This assessment reviews the existing visual character of the site and its surrounds and the expected impacts of the quarry on the existing visual character of the surrounds, nearby existing residences and publicly accessible locations. More specifically, the visual assessment considers the following:

– Existing views to the project site from Bentley Road
– The visual character of the surrounding landscape
– The sensitivity of the landscape to alteration by the project
– The visual character and extent of the project
– Viewer sensitivity to alteration of the environment by the project
– Future views to the site after construction of earth berms

7.8.1 Existing environment

The existing visual environment is of a rural nature. The existing quarry is visible from Bentley Road as shown in the figures below. The location of nearby sensitive receivers is shown in Figure 1.2. The nearest resident with a view of the project site is 1.25 km to the east. The project site is visible from several other resident to the east and north east but they are further away. A farm shed 800 m to the east also has a view of the site.

Due to topography and vegetation the site is not visible from any other neighbouring residents.

The existing quarry is visible on the eastern approach and from the western approach on Bentley Road. Existing views of the quarry from Bentley Road are shown in Figure 7.8, Figure 7.11, Figure 7.14 and Figure 7.17. The quarry is not visible from Bentley Road directly to the north, due to the road passing through a cutting.

7.8.2 Impact assessment

Computer-generated images of the final landform of the Project are shown in Figure 7.8 to Figure 7.19. The final landform would incorporate earth berms on the western, southern and eastern sides. These are are shown in the concept plan in Appendix A. Images are provided for early in the establishment of the quarry when the landscape mounds are only covered in grass and then later when vegetation is established.

The project would have a total disturbance area of approximately 6.5 hectares and create a 30-metre excavation which would change the topography of the project site. The proposed earth berms would be visible from Bentley Road on the eastern and western approaches as shown in the images below. The office, weighbridge and staff car park would be visible from Bentley Road.

The quarry area would not be visible from Bentley Road as it would be hidden by earth berms. These berms would be planted with native species to improve the visual amenity of the Project site.

As a result of these measures, the overall visial impact of the project is considered low.

Figure 7.8 Existing view from Bentley Road, east of the project site, at a distance

Figure 7.9 Proposed final landform with grass on landscape bunds, view from Bentley Road, east of the project site, at a distance

Figure 7.10 Proposed final landform with established vegetation on landscape bunds, view from Bentley Road, east of the project site, at a distance

Figure 7.11 Existing view from Bentley Road, east of the project site, closer to the site

Figure 7.12 Proposed final landform with grass on landscape bunds, view from Bentley Road, east of the project site, closer to the site

Figure 7.13 Proposed final landform with established vegetation, view from Bentley Road, east of the project site, closer to the site

Figure 7.14 Existing view from Bentley Road, west of the project site, at a distance

Figure 7.15 Proposed landform with grass on landscape bunds , view from Bentley Road, west of the project site, at a distance

Figure 7.16 Proposed final landform with established vegetation on landscape bunds, view from Bentley Road, west of the project site, at a distance

Figure 7.17 Existing view from Bentley Road, west of the project site, closer to the site

Figure 7.18 Proposed final landform with grass on landscape bunds, view from Bentley Road, west of the project site, closer to the site

Figure 7.19 Proposed final landform with established vegetation on landscape bunds, view from Bentley Road, west of the project site, closer to the site

7.8.3 Mitigation measures

Whilst the visual impact from the project is low, the following mitigation measures are proposed to minimise future visual impacts:

- Maintenance of existing vegetation outside the extraction limit boundary for visual screening.
- Maintain the site in a clean and tidy condition at all times.
- Ensure that areas of disturbance are kept to the minimum practicable at any one point in time.
- Progressively revegetate all areas where quarrying is completed.
- Where possible, stockpiles, plant and equipment should be located in positions which are screened from views into the site.

7.9 Waste management

The project has the potential to generate waste from quarry activities and general site use.

This section describes the type and classification of waste that would be generated at the site. The potential impacts of the project regarding waste generation during the establishment, operation and decommissioning of the quarry is also assessed.

A description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/ or monitor the potential impacts associated with the waste generated, as a result of the project, are provided.

7.9.1 Existing environment

A small quarry has been operating at the project site. This is expected to generate very little, if any, waste.

7.9.2 Impact assessment

Imported material

Materials would be imported to site for constructing landscape mounds, rehabilitation and blending with aggregate material. These materials would be concrete waste, Excavated Natural Material and Virgin Excavated Natural Material. A total volume of up to 50,000 tonnes would be imported to the site each year.

A waste acceptance procedure has been developed to reduce the risk of negative impacts from importing material. This is detailed in Section 3.4.5. The procedure is designed to ensure that imported materials are managed appropriately.

Quarrying

Quarrying involves the stripping and emplacement of topsoil and overburden, extraction, screening and stockpiling of raw materials and product loading and distribution. The types of waste generated by the project are not expected to be generated in significant quantities.

The operation of the project would generate the following waste types:

– Excavated material (topsoil and overburden not suitable for sale)
– Green waste
– Liquid waste
– Contaminated soil
– Wastewater from amenities and office
– Domestic waste (e.g. office paper and general rubbish)

The classification and description of each of the general waste types to be potentially generated by the project is summarised in Table 7.6.

Table 7.6 Potential wastes description

Waste type	Waste classification	Detail
Excavated material	General Solid Waste (non-putrescible)	Excavated material waste is likely to consist of rock, gravel and silt. The volume of waste excavated material would be small as excess excavated material would generally be utilised on-site as backfill or for rehabilitation and other site works.
Green Waste	General Solid Waste (non-putrescible)	The disturbance area would be limited to approximately 6.5 hectares. All cleared vegetation would be mulched and stockpiled on site for revegetation works.
Liquid waste	Liquid Waste	A limited amount of liquid waste is expected to be generated by the project. The waste is expected to consist of oil, paint, lubricants, glue etc. Liquid wastes would be stored and disposed of appropriately.
Contaminated Soil	To be determined	Any spills of chemicals or fuel could result in contaminated soil that would require disposal in an appropriately licenced landfill or trade waste facility.
Wastewater	Liquid Waste	Wastewater may be generated because of dewatering of pits and sediment ponds. Management of this wastewater is outlined in Section 7.2.
Biological waste (Sewage)	Liquid Waste and General Solid Waste (putrescible)	The site would use the wastewater system at the existing shed.
Domestic waste	General Solid Waste (non-putrescible and putrescible)	The limited general waste generated on-site would be collected and disposed of appropriately (in Council bins and/or landfills). Waste would consist of everyday items such as paper, aluminium cans, plastics, packaging, and other material generated by onsite staff.

Potential impacts from the production and inappropriate disposal of waste generated from the project include:

– Contamination of land
– Pollution of waterways
– Air pollution
– Overuse of scarce resources
– Human and animal health impacts

7.9.3 Mitigation measures

Waste management

– All waste would be managed in accordance with the requirements of the *Waste Avoidance and Resource Recovery Act 2001*, the POEO Act, and the *Waste Classification Guidelines* (NSW EPA, 2014) and the principles of the waste management hierarchy.
– All waste generated by the project would be managed by way of Council collection services or via appropriately licensed waste contractors. No on-site disposal of waste would occur.
– The project would reduce, reuse and recycle its wastes. In order to minimise the generation of waste and maximise re-use of waste products, where practicable, the mitigation measures summarised in Table 7.7 would be undertaken for the project.

Table 7.7 Proposed waste management measures

Waste Type	Waste Management Hierarchy		
	Avoid	Reuse/ Recycle/Recover	Dispose
Excavated material	Avoid excess excavation	Use excess material on site as fill and/or in rehabilitation works.	Excess excavated material to be classified and disposed in accordance with the *Waste Classification Guidelines*.
Green waste	Minimise clearing	Mulch cleared vegetation and use on site.	Excess material to be classified and disposed in accordance with the *Waste Classification Guidelines*.
Contaminated soil	Proper storage of all chemicals and fuels (e.g. bunded areas with 110% capacity). Refuel plant and machinery offsite, where possible or using appropriate equipment	Utilise bioremediation for large quantities of fuel-impacted soil. Tracking during transportation would be carried out where required.	Disposed in accordance with the *Waste Classification Guidelines*.
Liquid waste	Materials to be sourced and ordered in appropriate quantities	Reuse excess material on-site wherever possible (e.g. store and reuse lubricants).	Excess material to be classified and disposed in accordance with the *Waste Classification Guidelines*.
Wastewater	Divert clean water from the site	Waste water to be used on-site (e.g. for dust suppression/ plant watering etc.).	Discharge wastewater, in accordance with EPL requirements.
Biological (sewage) waste	Minimise use of site facilities e.g. toilets	Consider using composting toilet.	Sewage waste to be disposed via a suitable treatment system.
Domestic waste	Materials to be sourced and ordered in appropriate quantities	Reuse excess material on-site wherever possible. All recyclables to be collected and recycled accordingly.	Excess material to be classified and disposed in accordance with the *Waste Classification Guidelines*.

7.10 Hazards and risks

As indicated by Table 6.2 there are limited hazards and risks associated with the project and most have been addressed in other sections of this EIS, as follows:

– Blasting - refer to Section 7.3
– Traffic - refer to Section 7.6

The project site is not mapped as bushfire prone or flood prone on ePlanning Spatial Viewer.

7.10.1 Impact assessment

Impacts relating to blasting and traffic are addressed in Sections 7.3 and 7.6.

7.10.2 Mitigation measures

Mitigation measures relating to blasting and traffic are addressed in Sections 7.3 and 7.6. No further mitigation measures are proposed.

7.11 Socio-economic

The following section describes the social and economic impacts of the project. The potential social and economic impacts requiring assessment are as follows:

– Alteration of social activities or employment due to employment generation and capital expenditure
– Perceived or real impacts on local amenity of neighbouring properties
– Reduction in property values due to the presence of the quarrying operation
– Implications of the increased workforce on the need for services and infrastructure
– Actual or perceived reduction in quality of life

7.11.1 Existing environment

The property is located on Bentley Road, Bentley and has a site area of approximately 214 hectares. The site is occupied by the current owners. A small quarry has been operating at the site intermittently since the 1970s.

The surrounding area is sparsely populated, with the closest occupied residence lying approximately 1.25 kilometres east of the property. Land uses surrounding the property are associated with agricultural enterprises.

The existing quarry currently employs two full-time employees. Haulage of material also provides employment for truck drivers. Minor additional off-site employment is also generated, through maintenance and support services for equipment and machinery.

The project site is strategically placed to provide a supply of aggregate material for use as fill and for road construction and maintenance for the local area.

7.11.2 Impact assessment

Socio-economic impacts were identified based on the impact assessments completed for this EIS and the stakeholder consultation conducted for the Project.

The assessment considered both positive and negative impacts.

Social

The noise and vibration, air quality, traffic and visual amenity impacts on the surrounding community would be minimal as shown in Sections 7.3, 7.4, 7.6 and 7.8 of this EIS.

The project site is a significant distance from major residential and retail areas, with the township of Lismore located approximately 14 kilometres to the east. The nearest existing occupied residential receiver is approximately 1.25 kilometres from the proposed quarry. The location of the quarry is not located within close proximity to incompatible land uses, such as residential development.

Any impacts on amenity, quality of life and property prices will be dependent upon the influence of noise, vibration, dust, and traffic generated by the project, or impacts on views or water quality. The project has considered the potential for impacts against each of these issues (Sections 7.2, 7.3, 7.4, 7.6 and 7.8) and concluded that it is unlikely to have a significant impact on adjoining and surrounding sensitive receptors. As such there is not expected to be any reduction in the amenity, quality of life nor property prices as a result of the project.

In regards to development potential, due to the zoning and minimum lot size restrictions, all properties with 1 km of the site are not able to be subdivided further (except the property to the west which already has lodged a subdivision and the applicants property). If in future a more sensitive land use is proposed on a neighbouring property e.g. eco-tourist facility, it is considered the quarry will not prevent this from occurring. As demonstrated in Sections 7.2, 7.3 and 7.4, the impacts are largely contained on the same property as the quarry. Where impacts in excess of the relevant criteria extend onto adjacent properties, the properties still have ample room to establish a development outside the extent of the impact. It should also be noted, the impacts have been predicted based on worst case scenarios, which are unlikely to occur and if they do it would only be for short durations.

The project will provide a valuable resource to meet the existing demand for aggregate for use as fill and for road construction and maintenance.

Economic

The site establishment and operation of the project will require a workforce of approximately five full-time equivalent (FTE) personnel. These employment opportunities will be made available to the labour pool of Richmond LGA.

Construction and operation of the project will generate the need for goods and services thereby creating opportunities for business development in the Casino and Lismore region. Employees working at the quarry would have a positive economic impact through spending their weekly earnings in the region. Expenditure by workers from their wages would largely occur in the town where they reside and in nearby towns.

The expenditure on materials by the quarry during both the construction and operations phases is spread more widely than expenditure by employees. This is to be expected with materials and equipment being sourced from outside of Lismore and the surrounding area, and outside of NSW.

Access to the aggregate resource is critical to the continued sustained growth of the Richmond Valley and surrounding LGAs. Additionally, the operation of the project would support the local economy through local expenditure on maintenance of equipment and supply of services.

State Governments can expect economic benefits from the quarry, including revenue from taxes and payments for service from statutory bodies.

A potential negative impact which may be perceived by some adjoining landowners is the degradation of the road from truck movements and creation of potholes. It is anticipated that this impact would be minimal as the operation would pay heavy haulage contributions imposed by Council as the site is a located off a regional road maintained by Council.

7.11.3 Mitigation measures

The following mitigation measures are proposed:

– As part of the construction contractor's terms of engagement, R & S Contracting will encourage local recruitment and procurement to maximise local employment and business opportunities.
– Ongoing stakeholder consultation through the construction and operation of the project.

7.12 Cumulative impacts

This chapter describes the cumulative impacts likely to arise from the combination of the construction and operation of the project with other projects and activities planned in the area.

The cumulative impact assessment considers those impacts which may result from several activities interacting and impacting the same receivers. Cumulative impacts are considered at both the local and regional level where these impacts could potentially be significant.

The assessment involved:

– Identifying proposed or approved developments of a significant scale to include in the assessment from the following sources:
  - Major Projects register maintained by DPIE
  - Richmond Valley DA Tracker
– Assessing whether these developments will impact the same study area and sensitive receptors as the project through a review of publicly available documents and aerial photographs.

The DPIE Major Projects register shows no current projects in the area. The Richmond Valley Council DA Tracker shows that no projects of concern have been approved or are seeking approval.

No impacts are expected and no mitigation measures are proposed.

8. Project justification

8.1 There is a justified need for the Project

The project site is strategically placed to provide a supply of aggregate material for use as fill and for road construction and maintenance. Currently the quarry extracts up to 6,000 tonnes per annum but local Councils and other clients have indicated they would source more material if available. Following floods, one local Council has indicated they can require up to 150,000 tonnes to repair damage to roads.

8.2 The Project will provide significant benefits

Overall, the project will:

– Provide access to a total of up to approximately 1.266 million tonnes of aggregate materials.
– Provide for the employment of up to five quarry personnel, with additional support of employment in relation to road transport drivers; resulting in positive flow on economic effects to the local and regional economy.
– Assist in meeting the demand for aggregate for fill, construction of roads and maintenance of roads in the region.
– Contribute to the State and Commonwealth government finances through payment of various taxes.
– Have minimal significant environmental impacts.

8.3 Suitability of the site

The Project site is suitable for the project for the following reasons:

– Extractive industries are permissible with consent in the RU1 zoning of the site.
– The project is located within a generally rural environment approximately 14 kilometres west of Lismore. The primary land use in the vicinity of the project site is agriculture.
– The project is positioned away from major population centres and incompatible land uses. The project site is a significant distance from any dwellings.
– The ridgeline, undulating terrain and remnant vegetation surrounding the project site provides topographical shielding for the project from rural-residential properties. The nearest occupied sensitive receiver is approximately 1.25 kilometres east of the existing quarry.
– The project is located on land which has been heavily modified historically by land clearing activities and disturbances associated with agricultural activities.
– The project is in the Richmond LGA and can supply aggregate to this region, which assists in reducing supply costs, greenhouse gas emissions and other environmental impacts per tonne kilometre of product transported.

8.4 Public interest

The project is in the public interest as it will:

– Provide a high-quality supply of construction materials into the region to meet an identified need for these materials.
– Provide for the employment of up to five quarry personnel, with additional support of employment in relation to road transport drivers; resulting in positive flow on economic effects to the local and regional economy.
– Provide direct economic benefits in the form of an initial $988,582.10 in capital investment value (CIV), plus expenditure associated with quarry operations and labour, royalties on the resource, wages and income providing an ongoing contribution to the local economy.

The environmental and social impacts of the project have been minimised through refining the project design in consideration of environmental constraints and stakeholder input, and implementation of appropriate control measures as part of an iterative project design process. With the proposed measures to avoid, minimise and/or manage impacts associated with the project, it is anticipated the project can proceed without significantly impacting the environment or local community.

The Project is therefore in the public and community's interest.

8.5 Consistency with the objects of the EP&A Act

Table 8.1 identifies the objects of the EP&A Act and their relevance to the project.

Table 8.1 Objects of the EP&A Act

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The project responds to an identified need for quarry products in the short, medium and long term within the region. The project design has been refined in consideration of environmental constraints and stakeholder input, and appropriate control measures are proposed to avoid, minimise and/or manage project impacts.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	The project site is highly modified from clearing activities associated with historical land uses including logging, cattle grazing and quarrying. The Project is considered to constitute the orderly economic use and development of the land.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	The project will not impact on communication or utility services.
5(a)(iv) To encourage the provision of land for public purposes.	Not relevant to the project.
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	Not relevant to the project.
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The project has been sited and designed to minimise the impacts on the environment. Potential impacts have been identified within the EIS and mitigation and management measures have been proposed to encourage the protection of the environment.
5(a)(vii) To encourage ecologically sustainable development.	Ecologically sustainable development (ESD) is considered in Section 8.2.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the project.
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	Not relevant to the project.
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	Consultation with the community and relevant government agencies was undertaken during the development of the project. Details of this consultation can be found in Section 6. Consultation will be ongoing during the construction and operation of the Project.

8.6 Consistency with the principles of ecologically sustainable development

The principles of ESD are defined under the EP&A Regulation (Schedule 2) as:

> *(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options,*
>
> *(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*
>
> *(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*
>
> *(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:*
>
> *(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
>
> *(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

These principles are addressed in turn, as they apply to the Project, in the following sections.

The precautionary principle

This principle states, 'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.

Evaluation and assessment of alternative options has aimed to reduce the risk of serious and irreversible impacts on the environment. Stakeholder consultation considered issues raised by stakeholders and a range of specialist studies were undertaken for key issues to provide accurate and impartial information to assist in the development process.

A range of environmental studies have been undertaken as part of development of the project and the environmental assessment process, to ensure that the potential impacts are understood. The assessment of the potential impacts of the project is consistent with the precautionary principle. It is considered that the assessments that have been undertaken are consistent with accepted scientific and assessment methodologies and have taken into account relevant statutory and agency requirements.

The project has evolved to avoid impacts where possible and to reflect the findings of the studies undertaken.

A number of safeguards have been proposed to minimise potential impacts. These safeguards will be implemented during construction and operation of the project. No safeguards have been postponed as a result of lack of scientific certainty.

A EMP will be prepared before construction starts. This requirement will ensure the project achieves a high-level of environmental performance. No management measures or mechanisms will be postponed as a result of a lack of information.

Intergenerational equity

This principle states, 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhance for the benefit of future generations'.

The project will not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations.

The key objective of the project is to maximise the effective use of existing resources and meet the needs of the community for extractive resources, whilst minimising environmental and social impacts. As part of quarrying operations to recover a substantial, hard rock resource, a comprehensive rehabilitation strategy will be developed for the project site which will assist in returning the site to a rehabilitated state for future agricultural use.

As detailed in Section 7, the project can be undertaken without having a significant adverse impact on the local environment or community. The environmental management measures detailed in Section 7 have been developed to minimise the impact of the project on the environment and community to the greatest extent reasonably possible.

In addition, the project will improve local employment potential and contribute to economic growth in the local area.

The management of environmental issues, as outlined in this EIS, will maintain the health, diversity and productivity of the environment for future generations.

Conservation of biological diversity and ecological integrity

This principle states the 'diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival'.

All environmental components, ecosystems and habitat values potentially affected by the project are described in this EIS. Potential impacts are also outlined (refer to Section 7.5) and measures to ameliorate adverse impacts are outlined in Section 7. Consequently, the biodiversity assessment completed for the project (refer to Section 7.5 and Appendix J) concluded that the project can be undertaken in a manner that will not have a significant impact on biodiversity of the surrounding area. Furthermore with landscaping and rehabilitation management measures will assist in improving biodiversity at the site in the long term.

Improved valuation, pricing and incentive mechanisms

This principle requires 'costs to the environment to be factored into the economic costs of a project'.

The EIS has examined the environmental consequences of the project and identified management measures to manage the potential for adverse impacts. The requirement to implement these management measures will result in an economic cost to R & S Contracting. The implementation of management measures will increase both the capital cost and operating costs of the project. This signifies that environmental resources have been given appropriate valuation.

The quarry design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the project is being developed with an environmental objective in mind.

8.7 Environmental considerations

Environmental investigations were undertaken during the preparation of the EIS to assess the potential impacts. These included assessments of:

– Land resources
– Water resources (surface water and groundwater)
– Noise and vibration
– Air quality and greenhouse gas emissions
– Biodiversity
– Traffic and access
– Heritage (Aboriginal and non-Aboriginal)

– Visual amenity
– Waste management
– Hazards and risks
– Socio-economic

The EIS has documented the potential impacts of the project, considering both potential positive and negative impacts, and identifies mitigation and management measures to protect the environment where required, as outlined in Section 7.

The Project also incorporates measures and design features to ensure that impacts are managed and mitigated as far as practicable.

With the implementation of the identified mitigation measures, the project is not expected to have a significant negative environmental impact.

8.8 Consequences of not proceeding

The consequences of not proceeding are as follows:

– An identified need to provide a high-quality supply of construction materials in the region will not be met.
– Direct economic benefits in the form of $988,582.10 CIV, plus expenditure associated with quarry operations and labour, providing an ongoing contribution to the local economy will not be realised.
– The Project site would remain undeveloped and its ongoing use would likely be in the form of agricultural grazing, which would not provide the economic benefits afforded by the Project.

8.9 Summary

The Project is considered to be justified as:

– It responds to a recognised need in the Richmond and surrounding LGAs for aggregate materials in the short, medium and long term.
– It will provide a number of social and economic benefits.
– Is in the public interest and the site is suitable for the Project.
– Is consistent with the objects of the EP&A Act and the principles of ESD.
– It will not have any significant negative environmental impact as long as the identified mitigation measures are implemented.
– The consequences of not proceeding are considered to be unacceptable.

9. Conclusion

The project involves the construction and operation of Bentley Quarry, 14 kilometres west of Lismore. Bentley Quarry will supply materials for use as fill and for road construction and maintenance. The project would extract up to 300,000 tpa over 30 years with a total disturbance area of approximately 6.5 hectares.

The project is classified as designated development under the EP&A Regulation. This EIS has been prepared in accordance with the provisions of the EP&A Act and addresses the SEARs.

As summarised in Section 8, the project justification is robust because it responds to a recognised need for resources and provides a number of economic benefits. The EIS has demonstrated that the site is suitable for the proposed quarry, that the project is in the public interest and that it is consistent with the objects of the EP&A Act and the principles of ESD.

The EIS has documented the potential environmental impacts of the project, considering both negative and positive impacts, and recommended management and mitigation measures to protect the environment, where required. Based on this, the environmental and community impacts are considered to be minimal and the project benefits outweigh the negatives.

Accordingly it is considered the project should be approved in accordance with this EIS and associated development plans.

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11. Terms and acronyms used in this report

Term	Definition
°C	Degrees Celsius
AHD	Australian height datum
ANFO	Ammonium Nitrate Fuel Oil
AHIMS	Aboriginal Heritage Information Management System
AQIA	Air Quality Impact Assessment
BC Act	NSW *Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
CIV	Capital investment value
DCP	Development control plan
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry & Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW *Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental planning instrument
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
FTE	Full-time equivalent
GDE	Groundwater dependent ecosystem
GHD	GHD Pty Ltd
Heritage Act	NSW *Heritage Act 1977*
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LSC	Land and soil capability
LUCRA	Land Use Conflict Risk Assessment
ML	Megalitre
MNES	Matters of National Environmental Significance
NIA	Noise Impact Assessment
NPW Act	NSW *National Parks and Wildlife Act 1974*
NSW	New South Wales
NPI	NSW EPA Noise Policy for Industry
POEO Act	NSW *Protection of the Environmental Operations Act 1997*
R & S Contracting	R & S Contracting Pty Ltd

Term	Definition
RBL	Rating background level
RNP	*Road Noise Policy*
Roads Act	NSW *Roads Act 1993*
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEPP 33	*State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)*
The project	The construction and operation of Bentley Quarry
tpa	tonnes per annum
tpd	tonnes per day
VMP	Vegetation Management Plan
WM Act	NSW *Water Management Act 2000*

Appendix A

Secretary's Environmental Assessment Requirements No. 1589

Planning and Assessments
Energy and Resource Assessments
Contact: Joel Herbert
Phone: (02) 8289 6614
Email: Joel.Herbert@planning.nsw.gov.au

Ben Luffman
Technical Director - Environment
GHD Consulting

Via email: Ben.luffman@ghd.com

20/07/2021

Dear Mr Luffman,

Planning Secretary's Environmental Assessment Requirements
Bentley Quarry (EAR 1589)

I refer to your request for the Planning Secretary's Environmental Assessment Requirements (SEARs) for the above development, which is designated local development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Please find attached a copy of the SEARs for the Environmental Impact Statement (EIS) for the development. These requirements have been prepared in consultation with relevant government agencies based on the information your company has provided to date. The agencies' comments are attached for your information (see Attachment 2). You must have regard to these comments in the preparation of the EIS.

In your request for SEARs, you have also indicated that the proposal is classified as integrated development under section 4.46 of the EP&A Act. You are encouraged to consult with the relevant agencies with respect to licence/approval requirements. If further integrated approvals are required, you must undertake your own consultation with the relevant public authorities and address their requirements in the EIS.

The Department wishes to emphasise the importance of effective and genuine community consultation during the preparation of the EIS. This process should provide the community with a clear understanding of the proposal and its potential impacts and include active engagement with the community regarding key issues of concern. The development application (DA) for the proposed development must be accompanied by clear evidence of the consent to the lodgement of the DA of all owners of land directly subject to the DA.

Please contact the consent authority at least two weeks before you propose to submit your DA. This will enable the consent authority to:

- confirm the applicable fees; and
- determine the number of copies (hard-copy and digital) of the EIS that will be required for reviewing purposes.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This approval would be in addition to any approvals required under NSW legislation and it is your responsibility to contact the Commonwealth Department of the Environment to determine if an approval under the EPBC Act is required (http://www.environment.gov.au or 6274 111).

You should contact the Mine Safety branch of the NSW Resources Regulator in regard to this and other matters relating to compliance with the *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*

If you have any enquiries about these requirements, please contact Joel Herbert on the details listed above.

Yours sincerely

Matthew Sprott
Director
Resource Assessments
as delegate for the Planning Secretary

Planning Secretary's Environmental Assessment Requirements

Section 4.12(8) of the *Environmental Planning and Assessment Act 1979* and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*

Designated Development

EAR Number	EAR 1589
Proposal	Expansion of the existing quarry to extract hard rock at a maximum rate of 300,000 tonnes per annum for up to 30 years from a total resource of 2.5 million tonnes.
Location	1465 Bentley Road, Bentley, NSW 2480 (Lot 2 DP 1196757)
Applicant	Bentley Quarry Pty Ltd
Date of Issue	20/07/2021
Date of Expiry	20/07/2023
General Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* In particular, the EIS must include: • an executive summary; • a comprehensive description of the development, including: - a detailed site description and history of any previous quarrying on the site, including a current survey plan; - identification of the resource, including the amount, type, composition; - the layout of the proposed works and components (including any existing infrastructure that would be used for the development); - an assessment of the potential impacts of the development, as well as any cumulative impacts, including the measures that would be used to minimise, manage or offset these impacts; - a detailed rehabilitation plan for the site; - any likely interactions between the development and any existing/approved developments and land uses in the area, paying particular attention to potential land use conflicts with nearby residential development; - a list of any other approvals that must be obtained before the development may commence; - the permissibility of the development, including identification of the land use zoning of the site; - identification of sensitive receivers likely to be affected by the development using clear maps/plans, including key landform areas, such as conservation areas and waterways; • a conclusion justifying why the development should be approved, taking into consideration: – alternatives; – the suitability of the site; – the biophysical, economic and social impacts of the project, having regard to the principles of ecologically sustainable development; and – whether the project is consistent with the objects of the Environmental Planning and Assessment Act 1979; and • a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.
Consultation	In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers and any surrounding landowners that may be impacted by the development. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.
Key Issues	The EIS must assess the potential impacts of the proposal at all stages of the development, including the establishment, operation and decommissioning of the development. The EIS must address the following specific issues: • **Noise** – including a quantitative assessment of potential:

	- construction and operational noise and off-site transport noise impacts of the development in accordance with the *Interim Construction Noise Guideline, NSW Noise Policy for Industry and NSW Road Noise Policy* respectively; - reasonable and feasible mitigation measures to minimise noise emissions; and - monitoring and management measures; • **Blasting & Vibration** – - proposed hours, frequency, methods and impacts; and - an assessment of the likely blasting and vibration impacts of the development, having regard to the relevant ANZEC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features; • **Air** – including an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage; • **Water** – including: - a detailed site water balance and an assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; - identification of any licensing requirements or other approvals required under the *Water Act 1912* and/or *Water Management Act 2000*; - demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) - a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo; - an assessment of activities that could cause erosion or sedimentation issues, and the proposed measures to prevent or control these impacts; - an assessment of any likely flooding impacts of the development; - an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; and - a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts; • **Biodiversity** – including: - accurate predictions of any vegetation clearing on site; - a detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems undertaken in accordance with Sections 7.2 and 7.7 of the *Biodiversity Conservation Act 2016*; and - a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant. • **Heritage** – including: - an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and - identification of Historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1; • **Traffic & Transport** – including: - accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products; - an assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads; - a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development; - evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and - a description of access roads, specifically in relation to nearby Crown roads and fire trails; • **Land Resources**– including an assessment of: - potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate);

	- potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms (such as overburden dumps, bunds etc); and - the compatibility of the development with other land uses in the vicinity of the development, in accordance with the requirements of Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*; • **Waste** – including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams; • **Hazards** – including an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks and the transport, storage, handling and use of any hazardous or dangerous goods; • **Visual** – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, including with respect to any new landforms; • **Social & Economic** – an assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project; and • **Rehabilitation** – including: - a detailed description of the proposed rehabilitation measures that would be undertaken throughout the development and during quarry closure; - a detailed rehabilitation strategy, including justification for the proposed final landform and consideration of the objectives of any relevant strategic land use plans or policies; and - the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy, recognising that a rehabilitation bond will likely be required as a condition of any future development consent.
Environmental Planning Instruments	The EIS must take into account all relevant State Government environmental planning instruments, guidelines, policies, and plans. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies and plans that may be relevant to the environmental assessment of this development. During the preparation of the EIS you must also consult the Department's EIS Guideline – Extractive Industries – Quarries. This guideline is available at http://www.planning.nsw.gov.au/~/media/Files/DPE/Guidelines/extractive-industries-quarries-eis-guideline-1996-10.ashx. In addition, the EIS must assess the development against the *Richmond Valley Local Environmental Plan 2012* and any relevant development control plans/strategies.

ATTACHMENT 1

The following guidelines may assist in the preparation of the Environmental Impact Statement. This list is not exhaustive and not all of these guidelines may be relevant to your proposal.

Many of these documents can be found on the following websites:
http://www.planning.nsw.gov.au
http://www.bookshop.nsw.gov.au
http://www.publications.gov.au

Environmental Planning Instruments, Policies, Guidelines & Plans

Environmental Planning Instruments - General	
	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
	State Environmental Planning Policy (State and Regional Development) 2011
	State Environmental Planning Policy (Infrastructure) 2007
	Richmond Valley Local Environmental Plan 2012
Risk Assessment	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
Land	
	State Environmental Planning Policy No. 55 – Remediation of Land
	Agricultural Land Classification (DPI)
	Rural Land Capability Mapping (OEH)
	Soil and Landscape Issues in Environmental Impact Assessment (NOW)
	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
	Guidelines for Consultants Reporting on Contaminated Sites (EPA)
	Agricultural Issues for Extractive Industry Development (DPI)
Water	
Groundwater	NSW Aquifer Interference Policy 2012 (NOW)
	NSW State Groundwater Policy Framework Document (NOW)
	NSW State Groundwater Quality Protection Policy (NOW)
	NSW State Groundwater Quantity Management Policy (NOW)
	Australian Groundwater Modelling Guidelines 2012 (Commonwealth)
	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	Guidelines for the Assessment & Management of Groundwater Contamination (EPA)
Surface Water	NSW State Rivers and Estuary Policy (NOW)
	NSW Government Water Quality and River Flow Objectives (EPA)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (EPA)
	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA)
	Managing Urban Stormwater: Soils & Construction (Landcom) and associated Volume 2E: Mines and Quarries (DECC)
	Managing Urban Stormwater: Treatment Techniques (EPA)
	Managing Urban Stormwater: Source Control (EPA)
	Technical Guidelines: Bunding & Spill Management (EPA)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	NSW Guidelines for Controlled Activities (NOW)
Flooding	Floodplain Development Manual (OEH)
	Floodplain Risk Management Guideline (OEH)
Biodiversity	
	Biodiversity Assessment Method (OEH 2017)

	Guidance and Criteria to assist a decision maker to determine a serious and irreversible impact (OEH 2017)
	Ancillary rules: Biodiversity conservation actions
	Ancillary rules: Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying variation rules
	NSW Guide to Surveying Threatened Plants (OEH 2016)
	Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECC 2009)
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC 2004)
	Threatened Species Assessment Guideline – The Assessment of Significance (DECC 2007)
	OEH principles for the use of biodiversity offsets in NSW
	NSW State Groundwater Dependent Ecosystem Policy (NOW)
Heritage	
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
	Guide to investigation, assessing and reporting on Aboriginal cultural heritage in NSW (OEH) 2011
	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)
	Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (OEH)
	Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (OEH)
	NSW Heritage Manual (OEH)
	Statements of Heritage Impact (OEH)
Noise	
	NSW Noise Policy for Industry (EPA)
	Interim Construction Noise Guideline (EPA)
	NSW Road Noise Policy (EPA)
Air	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA)
	Assessment and Management of Odour from Stationary Sources in NSW (DEC)
	National Greenhouse Accounts Factors (Commonwealth)
Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RMS) & relevant Austroads Standards
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Hazardous and Offensive Development Application Guidelines – Applying SEPP 33
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
	Planning for Bushfire Protection 2019 (RFS)
Resource	
	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves 2012 (JORC)
Waste	
	Waste Classification Guidelines (EPA)
	Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes 1999 (EPA)
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Strategic Framework for Mine Closure (ANZMEC-MCA)

ATTACHMENT 2

AGENCIES' CORRESPONDENCE

Heritage NSW

Our ref: HMS ID 160

Joel Herbert
Planner
Department of Planning Industry & Environment
GPO BOX 404
PARRAMATTA NSW 2124

By email: Joel.Herbert@planning.nsw.gov.au

Dear Mr Herbert

Request for Environmental Assessment Requirements (EARs) for Bentley Quarry Extension (EAR ID no. 1589)

Thank you for your referral dated 21 June 2021 inviting EARs input from the Heritage Council of NSW on the above Designated Development proposal.

The subject site is not listed on the State Heritage Register (SHR), nor is it in the immediate vicinity of any SHR items. Further, the site does not contain any known historical archaeological relics. Therefore, no heritage comments are required. The Department does not need to refer subsequent stages of this proposal to the Heritage Council of NSW.

As the site is in the vicinity of a local heritage item, advice should be sought from the relevant local council.

If you have any questions regarding the above advice, please contact Gary Hinder, A/Senior Customer Strategies Officer, at Gary.Hinder@environment.nsw.gov.au or on 9873 8547.

Yours sincerely

Anna London
A/Senior Team Leader Customer Strategies
Heritage NSW
Department of Premier and Cabinet
As Delegate of the Heritage Council of NSW
29 June 2021

Council's Reference:
ECM Property No. 165345
Reference:
Scoping Report Bentley Quarry - Response RVC

Telephone Enquiries to:
Pooja Chugh

5 July 2021

Resource Assessments
Department of Planning, Industry and Environment
Locked Bag 5022
PARRAMATTA NSW 2124

Response regarding Bentley Quarry Scoping Report

Richmond Valley Council welcomes the opportunity to provide comments concerning the Bentley Quarry Scoping Report and Request for the Planning Secretary's Requirements for the preparation of an Environmental Impact Assessment.

The Bentley Quarry currently operates at No. 1465 Bentley Road, Bentley pursuant to the *existing use rights* provisions. The current operational footprint is approximately 1 hectare. The proposal is for the expansion of the hard rock quarry, with an annual maximum extraction rate of 300,000 tonnes per annum and a maximum daily extraction rate of 2,000 tonnes per day. The total area of disturbance is proposed to be 5 hectares with a pit of approximate 3.4 hectares. In addition, a maximum of 50,000 tonnes per annum of soil, topsoil and waste concrete is proposed to be imported to the site to be used for constructing landscape mounds, rehabilitation and blending with aggregate material.

The proposed development is classified as '*designated development'* as it falls within the specified category of *'extractive industries'* under Schedule 3 of the *Environmental Planning and Assessment Regulation (EP&A Reg)*. The proposal is '*integrated development*' as it requires approval from the Environment Protection Authority (EPA) and from Transport for NSW (TfNSW).

Council has reviewed the Scoping Report prepared by GHD and notes the following:

1. Site Details

The subject quarry at No. 1465 Bentley Road, Bentley comprises three (3) existing allotments. The Scoping Report notes that the site is Lot 2 DP 1196757. However, Lot 1 DP 1173124 and Lot 1 DP 1196757 that also form

part the proposal site, have been omitted. The Environmental Impact Statement (EIS) to be prepared for the Development Application should include all lots that are part of the subject site.

2. Capital Investment Value (CIV)

The Scoping Report notes that the CIV of the proposal is expected to cost less than $500,000. Council considers that the cost of construction of the site office and weighbridge, upgrade of the intersection including site access road will be significantly greater than the estimated CIV. In this regard, an itemised quotation from a suitably qualified person or a Quantity Surveyor's Report should be submitted with the Development Application.

3. Neighbouring Councils

The subject quarry site is in proximity to neighbouring Kyogle and Lismore Councils. Furthermore, the ongoing operation of the quarry will have potential impacts on the road network and residents of these Councils. It is therefore recommended that the EIS is forwarded to both Councils for comments.

4. Additional Matters

The following matters are to be considered in the Development Application and the EIS:

- A Construction Management Plan (CMP) detailing how the site will be managed in respect to access, traffic, storage of material, sediment erosion and run-offs and the like during the construction phase of the development should be submitted.

- Architectural Drawings that include a full site plan, identify part of the site that the subject proposal relates to, details of the earth work, location of storage areas, site amenities, parking and the like should be submitted for assessment.

- The proposed operation process should be detailed in a plan form. For e.g., the plan should show the area of drilling and blasting, crushing and screening, blending and stockpiling.

- The Preliminary Concept Layout Plan included in the Scoping Report indicates a landscaped visual screen along the western part of the site. In absence of details such as its height and type of vegetation, it is unclear if this will be sufficient. Furthermore, landscape screening may be required along the front/ northern and eastern side.

- The EIS should clarify the total quantity of waste products generated on site including the waste concrete imported to blend with aggregate material. Further details should be provided in respect to the resource recovery aspects of the proposed *extractive industry.*

- The details provided in respect to rehabilitation under dot point 3.11.2 of the Scoping Report are noted. In this respect, a rehabilitation plan should be provided which includes earthworks, landscaping, and revegetation details.

4. Infrastructure Comments

Council's Engineering Section notes the following matters:

- A full traffic impact assessment will be submitted for assessment. As the proposal includes upgrade of the intersection, a S138 approval and Occupancy Licence would be required from TfNSW.

- The proposal is likely to incur Heavy Haulage contributions as the site is a located off a regional road which is maintained by Council.

5. Environmental Health Considerations

The following environmental health related matters, as noted in the pre-lodgement meeting of 18 March 2021, are to be considered:

- All parameters including, but not limited to, dust, vibration and noise must be addressed. Increase in blast size or frequency has potential to affect the current parameters of existing Environmental Protection License (EPL).

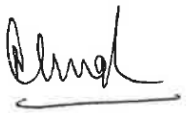
- Council would not support the use of porta loos on site for staff amenities. A minimum 3000 litre wastewater tank and trench would need to be installed for both toilet facilities and kitchenette wastewater.

- An OSMS (s68) application is required to be submitted with a wastewater consultant's report for the installation of the onsite sewage management system.

- Any fuel storage areas would require bunding and access to a spill kit.

Please note that assessment of the Development Application and EIS may raise additional issues. If you have any enquiries regarding this matter, please do not hesitate to contact Pooja Chugh on (02) 6660 0303 or by email at pooja.chught@richmondvalley.nsw.gov.au.

Yours sincerely



Pooja Chugh
Development Assessment Planner

Richmond Valley Council

Joel Herbert

From: Lands Ministerials Mailbox
Sent: Tuesday, 6 July 2021 1:51 PM
To: Joel Herbert
Subject: Re: Request for Requirements - EARs 1589 - Bentley Quarry Extension

Hi Joel

Crown Lands has no comments for the proposal as no Crown land, roads or waterways are currently affected by the proposal.

If the Crown public road which adjoins the western boundary to the site, which is not currently within the footprint of the development area and is not proposed to be used for access at this time, is required for access purposes at a later time, the proponent will need to contact Crown Lands, using my details below, to start the road transfer process, as it will need to be transferred to Council in that circumstance.

Thank you
Kirstyn

Kirstyn Goulding
Lands Stakeholder Relations

Team telephone numbers: Rebecca Johnson, Principal Project Officer, 4920 5040; Kirstyn Goulding, Administration Officer - Customer Liaison, 4920 5058; Kim Fitzpatrick, Senior Project Officer, 4920 5015, Deb Alterator, Project Support Officer 4920 5172

Crown Lands | Department of Planning, Industry and Environment
E lands.ministerials@dpie.nsw.gov.au
Level 4, 6 Stewart Avenue, Newcastle West NSW 2302
www.dpie.nsw.gov.au

Our Vision: Together, we create thriving environments, communities and economies.

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: Joel Herbert <Joel.Herbert@planning.nsw.gov.au>
Sent: Monday, 21 June 2021 2:50 PM
To: OLG - Richmond Valley Council <council@richmondvalley.nsw.gov.au>; DPI Landuse Enquiries Mailbox <landuse.enquiries@dpie.nsw.gov.au>; DPI Landuse Ag Mailbox <landuse.ag@dpi.nsw.gov.au>; DPI AHP Central Mailbox <ahp.central@dpi.nsw.gov.au>; development.northern@rms.nsw.gov.au <development.northern@rms.nsw.gov.au>; records@rfs.nsw.gov.au <records@rfs.nsw.gov.au>; Planning Matters Mailbox <planning.matters@environment.nsw.gov.au>; INFOEnvironment <info@environment.nsw.gov.au>; EPA Planning Matters Mailbox <planning.matters@epa.nsw.gov.au>; DRG RO Assessment Coordination Mailbox <assessment.coordination@planning.nsw.gov.au>; lands.ministerials@industry.nsw.gov.au <lands.ministerials@industry.nsw.gov.au>; OEH HD Heritage Mailbox

<HERITAGEMailbox@environment.nsw.gov.au>; Environmental Assessments <environmental.assessments@waternsw.com.au>; RRD EO Executive Director Resources Regulator Mailbox <ED.ResourcesRegulator@planning.nsw.gov.au>
Subject: Request for Requirements - EARs 1589 - Bentley Quarry Extension

Good afternoon,

Proposal – Bentley Quarry Extension
EAR ID No. 1589

GHD on behalf of Bentley Quarry Pty Ltd (the Applicant) has requested the requirements of the Secretary of the Department of Planning and Environment for the preparation of an Environmental Impact Statement (EIS) for the above local designated development located in the Richmond Valley local government area.

The proposal seeks to extract hard rock at a rate of 300,000 tonnes per annum from a total resource of approximately 2.5 million tonnes for up to 30 years.

I have attached a copy of the Applicant's request for your reference.

Under Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*, the Secretary is requesting your requirements for the EIS. It would be greatly appreciated if we could receive your advice by **Tuesday 6 July 2021.** Please direct ALL responses to myself on the email address provided below.

Kind regards,

Joel Herbert
Environmental Assessment Officer - Resource Assessments
Energy, Industry and Compliance
4 Parramatta Square, 12 Darcy Street Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124

T 02 8289 6614 | E Joel.Herbert@planning.nsw.gov.au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Department of Primary Industries

OUT21/8325

Joel Herbert
Environmental Assessment Officer - Resource Assessments
Energy, Industry and Compliance
Locked Bag 5022
Parramatta NSW 2124
Joel.herbert@planning.nsw.gov.au

Dear Joel

Environmental Assessment Requirements – EARs 1589 - Bentley Quarry Extension

Thank you for your correspondence requesting Environmental Assessment Requirements (EARs) for the above proposal.

The NSW Department of Primary Industries (NSW DPI) Agriculture is committed to the protection and growth of agricultural industries, and the land and resources upon which these industries depend. Important issues for extractive industries are the potential impact on limited agricultural resources and the ability to rehabilitate the land to enable continued agricultural investment.

NSW DPI Agriculture provides EARs (Attachment 1) and a range of publications to assist consent authorities, proponents and the community in addressing the recommended EARs (Attachment 2).

Should you require clarification on any of the information contained in this response, please contact Selina Stillman, Agricultural Land Use Planning Officer, on 0412424397 or by email at landuse.ag@dpi.nsw.gov.au

Yours sincerely

Lilian Parker

Lilian Parker
Agricultural Land Use Planning Officer
Esigned 22-6-2021

Attachment 1: Environmental Assessment Requirements

Issue	Environmental Assessment Requirements for the Environmental Impact Statement
Site Suitability	• Include a Land Use Conflict Risk Assessment (LUCRA) to identify potential land use conflict with sensitive receptors including surrounding agricultural land uses. The LUCRA is to address separation distances and management practices to minimise odour, dust and noise impacts on sensitive receptors including surrounding agricultural land uses. A LUCRA is described in the DPI Land Use Conflict Risk Assessment Guide. • Include a map, to scale, showing the above operational and infrastructure details including separation distances from sensitive receptors including surrounding agricultural land uses.
Consideration of impacts on agricultural resources and land	**Characteristics of Agricultural Land** • Describe the soil, slope, land capability, agricultural productivity, land characteristics and the history of agricultural land uses on the proposed development site. • Describe the current and historical agricultural land uses on surrounding land in the locality including the land capability and agricultural productivity of the surrounding land. **Impacts on Agricultural Land, Resources and Land Uses** • Detail the potential impacts from the proposed extractive industry on agricultural land and agricultural land uses on the site and in the locality. • Consider possible cumulative impacts on surrounding agricultural enterprises and landholders. **Measures to Mitigate Impacts on Agricultural Land** • Demonstrate that all significant impacts on current and potential agricultural developments and resources can be reasonably avoided or adequately mitigated. • Detail the expected life span of the proposed development.
Suitable and secure water supply	• Detail the estimated water demand and water availability and the source of water and any sanitisation methods proposed. • Outline any impacts to water use for agriculture and measures to mitigate against these impacts.
Biosecurity	• Include a biosecurity (pests, weeds and disease) risk assessment outlining the likely plant, animal and community risks. The relevant weed or pest animals for a region are addressed in the regional plans or strategies issued by NSW Local Lands Services. • Include details of how the proposal will deal with identified biosecurity risks as well as contingency plans for any failures. Include monitoring and mitigation measures for weed and pest management.
Traffic movements	• Detail the volume and route of traffic movements for the proposed development and how potential impacts on surrounding agricultural land uses are proposed to be mitigated (eg noise, dust, volume of traffic). This should include consideration of Travelling Stock Reserves (TSR) and the movement of livestock or farm vehicles along / across the affected roads.

Land stewardship	• Describe the final proposed land use and land form. • Detail the proposed rehabilitation and decommissioning/closure measures to achieve this land use including the expected timeline for the rehabilitation program. • Outline the monitoring and mitigation measures to be adopted for rehabilitation remedial actions.
Community Consultation	• Consult with the owners / managers of affected and adjoining agricultural operations in a timely and appropriate manner about: the proposal, the likely impacts and suitable mitigation measures or compensation.
Emergency Management	• The proposal is to detail contingency plans to enable the operation to deal with emergency situations. The proposal is to detail Emergency Management procedures and responsibilities for responding to bushfire threats, extreme climatic conditions, and animal disease outbreaks.

Attachment 2: Guidelines for assessment

Title	Location
Land Use Conflict Risk Assessment Guide	https://www.dpi.nsw.gov.au/agriculture/lup/development-assessment2/lucra
Agricultural Issues for Extractive Industry Development	https://www.dpi.nsw.gov.au/agriculture/lup/development-assessment2/extractive-industries

Joel Herbert

From: Annette Comerford
Sent: Thursday, 24 June 2021 2:30 PM
To: Joel Herbert
Cc: Jonathan Yantsch
Subject: RE: Request for Requirements - EARs 1589 - Bentley Quarry Extension

Hi Joel,

These works are not considered key fish habitat in line with DPI Fisheries *Policy and guidelines for fish habitat conservation and management (Update 2013)* and therefore do not trigger any of the provisions under the *Fisheries Management Act, 1994*. As such, DPI Fisheries has no comment in relation to these proposed works.

Regards,

Annette Comerford | Fisheries Manager - Coastal Systems (North Coast)
Aboriginal Fishing and Marine and Coastal Environments
NSW Department of Primary Industries | Fisheries
1243 Bruxner Hwy | Wollongbar | Bundjalung Nation | NSW 2477
T: 02 6626 1395 | M: 0418 211 843 | E: annette.comerford@dpi.nsw.gov.au

PERMIT APPLICATION FORMS & FISH HABITAT POLICIES:
www.dpi.nsw.gov.au/fishing/habitat/protecting-habitats/toolkit
Submit permit applications via email to ahp.central@dpi.nsw.gov.au
NB: From date of receipt of application, please allow:
- 21 days for s199 Consultations
- 28 days for Permits, Consultations and Land Owner's Consent responses
- 40 days for Integrated Development Applications

KNOWN & EXPECTED DISTRIBUTION OF THREATENED FISH SPECIES:
www.dpi.nsw.gov.au/fishing/threatened-species/threatened-species-distributions-in-nsw

DPI Fisheries acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work.

From: Joel Herbert <Joel.Herbert@planning.nsw.gov.au>
Sent: Monday, 21 June 2021 2:50 PM
To: OLG - Richmond Valley Council <council@richmondvalley.nsw.gov.au>; DPI Landuse Enquiries Mailbox <landuse.enquiries@dpie.nsw.gov.au>; DPI Landuse Ag Mailbox <landuse.ag@dpi.nsw.gov.au>; DPI AHP Central Mailbox <ahp.central@dpi.nsw.gov.au>; development.northern@rms.nsw.gov.au; records@rfs.nsw.gov.au; Planning Matters Mailbox <planning.matters@environment.nsw.gov.au>; INFOEnvironment <info@environment.nsw.gov.au>; EPA Planning Matters Mailbox <planning.matters@epa.nsw.gov.au>; DRG RO

Assessment Coordination Mailbox <assessment.coordination@planning.nsw.gov.au>; lands.ministerials@industry.nsw.gov.au; OEH HD Heritage Mailbox <HERITAGEMailbox@environment.nsw.gov.au>; Environmental Assessments <environmental.assessments@waternsw.com.au>; RRD EO Executive Director Resources Regulator Mailbox <ED.ResourcesRegulator@planning.nsw.gov.au>
Subject: Request for Requirements - EARs 1589 - Bentley Quarry Extension

Good afternoon,

Proposal – Bentley Quarry Extension
EAR ID No. 1589

GHD on behalf of Bentley Quarry Pty Ltd (the Applicant) has requested the requirements of the Secretary of the Department of Planning and Environment for the preparation of an Environmental Impact Statement (EIS) for the above local designated development located in the Richmond Valley local government area.

The proposal seeks to extract hard rock at a rate of 300,000 tonnes per annum from a total resource of approximately 2.5 million tonnes for up to 30 years.

I have attached a copy of the Applicant's request for your reference.

Under Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*, the Secretary is requesting your requirements for the EIS. It would be greatly appreciated if we could receive your advice by **Tuesday 6 July 2021.** Please direct ALL responses to myself on the email address provided below.

Kind regards,

Joel Herbert
Environmental Assessment Officer - Resource Assessments
Energy, Industry and Compliance
4 Parramatta Square, 12 Darcy Street Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124

T 02 8289 6614 | E Joel.Herbert@planning.nsw.gov.au

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12 Darcy Street
Parramatta
NSW 2124

Attention: Joel Herbert

Notice Number	1610003
File Number	DOC21/510902
Date	02-Jul-2021

RE: Bentley Quarry Extension - EAR ID No. 1589

I refer to your request for the Environment Protection Authority's (EPA) requirements for the environmental assessment (EA) in regard to the above proposal received by EPA on 21 June 2021.

The EPA has considered the details of the proposal as provided by DPIE and has identified the information it requires to issue its general terms of approval in Attachment A. In summary, the EPA's key information requirements for the proposal include an adequate assessment of:

1. Air Quality;
2. Noise and vibration impacts, including potential noise impacts from truck movements along Bentley Road;
3. Soil and water management;
4. Waste management

In carrying out the assessment, the proponent should refer to the relevant guidelines as listed in Attachment B and any relevant industry codes of practice and best practice management guidelines.

Please note that this response does not cover biodiversity or Aboriginal cultural heritage issues, which are the responsibility of the Department of Planning, Industry and Environments' (DPIE) Environment, Energy and Science (EES) Group.

The Proponent should be made aware that any commitments made in the EA may be formalised as approval conditions and may also be placed as formal licence conditions.

The Proponent should be made aware that, consistent with provisions under Part 9.4 of the *Protection of the Environment Operations Act 1997* ("the Act") the EPA may require the provision of a financial assurance and/or assurances. The amount and form of the assurance(s) would be determined by the EPA and required as a condition of an Environment Protection Licence ("EPL").

In addition, as a requirement of an EPL, the EPA will require the Proponent to prepare, test and implement a Pollution Incident Response Management Plan and/or Plans in accordance with Section 153A of the Act.

Yours sincerely

.....

Bryce Gorham

Unit Head, Regulatory Operations

Environment Protection Authority

(by Delegation)

ATTACHMENT A: EIS REQUIREMENTS FOR

Bentley Quarry Extension - EAR ID No. 1589

How to use these requirements

The EPA requirements have been structured in accordance with the DIPNR EIS Guidelines, as follows. It is suggested that the EIS follow the same structure:

A. Executive summary

B. The proposal

C. The location

D. Identification and prioritisation of issues

E. The environmental issues

F. List of approvals and licences

G. Compilation of mitigation measures

H. Justification for the proposal

A Executive summary

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

B The proposal

1. Objectives of the proposal

- The objectives of the proposal should be clearly stated and refer to:
  a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced
  b) a life cycle approach to the production, use or disposal of products
  c) the anticipated level of performance in meeting required environmental standards and cleaner production principles
  d) the staging and timing of the proposal and any plans for future expansion
  e) the proposal's relationship to any other industry or facility.

2. Description of the proposal

General

- Outline the production process including:
  a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc)
  b) any life-cycle strategies for the products.
- Outline cleaner production actions, including:
  a) measures to minimise waste (typically through addressing source reduction)
  b) proposals for use or recycling of by-products
  c) proposed disposal methods for solid and liquid waste
  d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points
  e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.
  f) soil contamination treatment and prevention systems.
- Outline construction works including:
  a) actions to address any existing soil contamination

b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site)

c) construction timetable and staging; hours of construction; proposed construction methods

d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.

- Include a site diagram showing the site layout and location of environmental controls.

Air

- Identify all sources or potential sources of air emissions from the development.
  Note: emissions can be classed as either:
  - *point (e.g. emissions from stack or vent) or*
  - *fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).*
- Provide details of the project that are essential for predicting and assessing air impacts including:

  a) the quantities and physio-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored

  b) an outline of procedures for handling, transport, production and storage

  c) the management of solid, liquid and gaseous waste streams with potential to generate emissions to air.

Noise and vibration

- Identify all noise sources or potential sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.
- Specify the times of operation for all phases of the development and for all noise producing activities.
- For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.

Water

- Provide details of the project that are essential for predicting and assessing impacts to waters including:

  a) the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on http://www.environment.nsw.gov.au/ieo/index.htm, using technical criteria derived from *the Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC 2000)

b) the management of discharges with potential for water impacts

c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.

- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts e.g. effluent ponds) and showing potential areas of modification of contours, drainage etc.
- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Waste and chemicals

Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the EPA's *Waste Classification Guidelines 2014 (as amended from time to time)*

- Provide details of liquid waste and non-liquid waste management at the facility, including:
  a) the transportation, assessment and handling of waste arriving at or generated at the site
  b) any stockpiling of wastes or recovered materials at the site
  c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site
  d) the method for disposing of all wastes or recovered materials at the facility
  e) the emissions arising from the handling, storage, processing and reprocessing of waste at the facility
  f) the proposed controls for managing the environmental impacts of these activities.
- Provide details of spoil disposal with particular attention to:
  a) the quantity of spoil material likely to be generated
  b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil
  c) the need to maximise reuse of spoil material in the construction industry
  d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material
  e) designation of transportation routes for transport of spoil.
- Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.
- Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.

- Reference should be made to the guidelines: EPA's *Waste Classification Guidelines 2014 (as amended from time to time)*

ESD

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:

an assessment of a range of options available for use of the resource, including the benefits of each option to future generations

proper valuation and pricing of environmental resources

f) identification of who will bear the environmental costs of the proposal.

3. Rehabilitation

- Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses).

4. Consideration of alternatives and justification for the proposal

- Consider the environmental consequences of adopting alternatives, including alternative:
  a) sites and site layouts
  b) access modes and routes
  c) materials handling and production processes
  d) waste and water management
  e) impact mitigation measures
  f) energy sources
- Selection of the preferred option should be justified in terms of:
  a) ability to satisfy the objectives of the proposal
  b) relative environmental and other costs of each alternative
  c) acceptability of environmental impacts and contribution to identified environmental objectives
  d) acceptability of any environmental risks or uncertainties
  e) reliability of proposed environmental impact mitigation measures
  f) efficient use (including maximising re-use) of land, raw materials, energy and other resources.

C The location

1. General

- Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:
  a) meteorological data (e.g. rainfall, temperature and evaporation, wind speed and direction)
  b) topography (landform element, slope type, gradient and length)
  c) surrounding land uses (potential synergies and conflicts)
  d) geomorphology (rates of landform change and current erosion and deposition processes)
  e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils)
  f) ecological information (water system habitat, vegetation, fauna)
  g) availability of services and the accessibility of the site for passenger and freight transport.

2. Air

- Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
- Describe surrounding buildings that may effect plume dispersion.
- Provide and analyse site representative data on following meteorological parameters:
  a) temperature and humidity
  b) rainfall, evaporation and cloud cover
  c) wind speed and direction
  d) atmospheric stability class

3. Noise and vibration

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4. Water

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website:

http://www.environment.nsw.gov.au/ieo/index.htm should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.

5. Soil Contamination Issues

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred.

D Identification and prioritisation of issues / scoping of impact assessment

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
  a) relevant NSW government guidelines
  b) industry guidelines
  c) EISs for similar projects
  d) relevant research and reference material
  e) relevant preliminary studies or reports for the proposal
  f) consultation with stakeholders.
- Provide a summary of the outcomes of the process including:
  a) all issues identified including local, regional and global impacts (e.g. increased/ decreased greenhouse emissions)
  b) key issues which will require a full analysis (including comprehensive baseline assessment)
  c) issues not needing full analysis though they may be addressed in the mitigation strategy
  d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

E The environmental issues

1. General

- The potential impacts identified in the scoping study need to be assessed to determine their significance, particularly in terms of achieving environmental outcomes, and minimising environmental pollution.
- Identify gaps in information and data relevant to significant impacts of the proposal and any actions proposed to fill those information gaps so as to enable development of appropriate management and mitigation measures. This is in accordance with ESD requirements.

Note: The level of detail should match the level of importance of the issue in decision making which is dependent on the environmental risk.

Describe baseline conditions

- Provide a description of existing environmental conditions for any potential impacts.

Assess impacts

- For any potential impacts relevant for the assessment of the proposal provide a detailed analysis of the impacts of the proposal on the environment including the cumulative impact of the proposal on the receiving environment especially where there are sensitive receivers.
- Describe the methodology used and assumptions made in undertaking this analysis (including any modelling or monitoring undertaken) and indicate the level of confidence in the predicted outcomes and the resilience of the environment to cope with the predicted impacts.
- The analysis should also make linkages between different areas of assessment where necessary to enable a full assessment of environmental impacts e.g. assessment of impacts on air quality will often need to draw on the analysis of traffic, health, social, soil and/or ecological systems impacts; etc.
- The assessment needs to consider impacts at all phases of the project cycle including: exploration (if relevant or significant), construction, routine operation, start-up operations, upset operations and decommissioning if relevant.
- The level of assessment should be commensurate with the risk to the environment.

Describe management and mitigation measures

- Describe any mitigation measures and management options proposed to prevent, control, abate or mitigate identified environmental impacts associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.
- Proponents are expected to implement a 'reasonable level of performance' to minimise environmental impacts. The proponent must indicate how the proposal meets reasonable levels of performance. For example, reference technology based criteria if available, or identify good practice for this type of activity or development. A 'reasonable level of performance' involves adopting and implementing technology and

management practices to achieve certain pollutant emissions levels in economically viable operations. Technology-based criteria evolve gradually over time as technologies and practices change.

- Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.
- Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include:

  a) operational procedures to manage environmental impacts

  b) monitoring procedures

  c) training programs

  d) community consultation

  e) complaint mechanisms including site contacts

  f) strategies to use monitoring information to improve performance

  g) strategies to achieve acceptable environmental impacts and to respond in event of exceedences.

1. Air

Describe baseline conditions

- Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.

Assess impacts

- Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.
- Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.
- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.
- For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.

  Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates.

- Reference should be made to:

1. *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2016)*;*

2. *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC, 2007)*;*

Describe management and mitigation measures

- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

2. Noise and vibration

Describe baseline conditions

- Determine the existing background (LA90) and ambient (LAeq) noise levels, as relevant, in accordance with the *NSW Noise Policy for Industry*.
- Determine the existing road traffic noise levels in accordance with the *NSW Road Noise Policy*, where road traffic noise impacts may occur.
- The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:
  a) details of equipment used for the measurements
  b) a brief description of where the equipment was positioned
  c) a statement justifying the choice of monitoring site(s), including the procedure used to choose the site(s), having regards to Fact Sheets A and B of the *NSW Noise Policy for Industry.*
  d) details of the exact location of the monitoring site and a description of land uses in surrounding areas
  e) a description of the dominant and background noise sources at the site
  f) day, evening and night assessment background levels for each day of the monitoring period
  g) the final Rating Background Level (RBL) value
  h) graphs of the measured noise levels for each day should be provided
  i) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring.

Assess impacts

- Determine the project noise trigger levels for the site. For each identified potentially affected receiver, this should include:
  a) determination of the project intrusive noise level for each identified potentially affected receiver
  b) selection and justification of the appropriate amenity category for each identified potentially affected receiver
  c) determination of the project amenity noise level for each receiver
  d) determination of the appropriate maximum noise level event assessment (sleep disturbance) trigger level.

- Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Determine expected noise level and noise character likely to be generated from noise sources during:
  a) site establishment
  b) construction
  c) operational phases
  d) transport including traffic noise generated by the proposal
  e) other services.

  Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).
- Determine the noise levels likely to be received at the reasonably most affected location(s) (these may vary for different activities at each phase of the development).
- The noise impact assessment report should include:
  a) a plan showing the assumed location of each noise source for each prediction scenario
  b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site
  c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc
  d) methods used to predict noise impacts including identification of any noise models used.
  e) the weather conditions considered for the noise predictions
  f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario
  g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived
  h) an assessment of the need to include modification factors as detailed in Fact Sheet C of the *NSW Noise Policy for Industry*.
- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional feasible and reasonable mitigation measures.
- The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.
  a) Where relevant noise/vibration levels cannot be met after application of all feasible and reasonable mitigation measures the residual level of noise impact needs to be quantified
- For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.
- Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:

a) bench height, burden spacing, spacing burden ratio

b) blast hole diameter, inclination and spacing

c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

Describe management and mitigation measures

- Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.
- For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:
  a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage
  b) control of traffic (eg: limiting times of access or speed limitations)
  c) resurfacing of the road using a quiet surface
  d) use of (additional) noise barriers or bunds
  e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern
  f) more stringent limits for noise emission from vehicles (i.e. using specially designed ‘quite’ trucks and/or trucks to use air bag suspension
  g) driver education
  h) appropriate truck routes
  i) limit usage of exhaust brakes
  j) use of premium muffles on trucks
  k) reducing speed limits for trucks
  l) ongoing community liaison and monitoring of complaints
  m) phasing in the increased road use.

1. Water

Describe baseline conditions

- Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

  Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004) *or be approved and analyses undertaken by accredited laboratories).*

- Provide site drainage details and surface runoff yield.
- State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: http://www.environment.nsw.gov.au/ieo/index.htm. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal. NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.
- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html) (Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines). NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.
- State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries or the NSW Salinity Strategy (DLWC, 2000) (http://www.environment.nsw.gov.au/salinity/government/nswstrategy.htm).
- Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.
- Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:

  a) lake or estuary flushing characteristics

  b) specific human uses (e.g. exact location of drinking water offtake)

  c) sensitive ecosystems or species conservation values

d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc

e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment

f) historic river flow data where available for the catchment.

Assess impacts

- No proposal should breach clause 120 of the *Protection of the Environment Operations Act* 1997 (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).
- Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.
- Include a rationale, along with relevant calculations, supporting the prediction of the discharges.
- Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).
- Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).
- Identify any potential impacts on quality or quantity of groundwater describing their source.
- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.
- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.
- Containment of spills and leaks shall be in accordance with EPA's guidelines section 'Bunding and Spill Management' at http://www.epa.nsw.gov.au/mao/bundingspill.htm and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.
- The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:

  a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and

  b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.

- Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment.

Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

- Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.
- Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.
- Reference should be made to:

a. *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004),

b. *Guidelines for Fresh and Marine Water Quality* ANZECC 2000),

c. *Environmental Guidelines: Use of effluent by Irrigation* (DEC, 2004)>.

Describe management and mitigation measures

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.
- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.
- Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.
- Outline pollution control measures relating to storage of materials, possibility of accidental spills (e.g. preparation of contingency plans), appropriate disposal methods, and generation of leachate.
- Describe hydrological impact mitigation measures including:
  a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition)
  b) minimising runoff
  c) minimising reductions or modifications to flow regimes
  d) avoiding modifications to groundwater.
- Describe groundwater impact mitigation measures including:
  a) site selection
  b) retention of native vegetation and revegetation
  c) artificial recharge
  d) providing surface storages with impervious linings
  e) monitoring program.
- Describe geomorphological impact mitigation measures including:

a) site selection
b) erosion and sediment controls
c) minimising instream works
d) treating existing accelerated erosion and deposition
e) monitoring program.

- Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC 2004).

5. Soils and contamination

Describe baseline conditions

- Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.

Assess impacts

- Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of:
  a) disturbing any existing contaminated soil
  b) contamination of soil by operation of the activity
  c) subsidence or instability
  d) soil erosion
  e) disturbing acid sulfate or potential acid sulfate soils.
- Reference should be made to:

a. *Contaminated Sites – Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011)*;*

b. Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015).

Describe management and mitigation measures

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
  a) erosion and sediment control measures
  b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
  c) proposals for the management of these soils – see *Acid Sulfate Soil Manual* (Acid Sulfate Soil Advisory Committee 1998) and *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soil Advisory Committee 1998).

6. Waste and chemicals

Describe baseline conditions

- Describe any existing waste or chemicals operations related to the proposal.

Assess impacts

- Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.
- Reference should be made to: the EPA's *Waste Classification Guidelines 2014 (as in force from time to time)*

Describe management and mitigation measures

- Outline measures to minimise the consumption of natural resources.
- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

7. Cumulative impacts

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.
- Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.
- Identify infrastructure requirements flowing from the proposal (e.g. water and sewerage services, transport infrastructure upgrades).
- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (e.g. travel demand management strategies).

F. List of approvals and licences

- Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).

G. Compilation of mitigation measures

- Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under EPA licences or approvals (e.g. outline of an environmental management plan).
- The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.

H. Justification for the Proposal

- Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.

ATTACHMENT B: GUIDANCE MATERIAL

Title	Web address
Relevant Legislation	
Contaminated Land Management Act 1997	http://www.legislation.nsw.gov.au/#/view/act/1997/140
Environmentally Hazardous Chemicals Act 1985	http://www.legislation.nsw.gov.au/#/view/act/1985/14
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/#/view/act/1979/203
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/#/view/act/1997/156
Water Management Act 2000	http://www.legislation.nsw.gov.au/#/view/act/2000/92
Licensing	
Guide to Licensing	www.epa.nsw.gov.au/licensing/licenceguide.htm
Air Issues	
Air Quality	
Approved methods for modelling and assessment of air pollutants in NSW (2016)	http://www.epa.nsw.gov.au/air/appmethods.htm
POEO (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/#/view/regulation/2010/428
Noise and Vibration	
NSW Noise Policy for Industry	http://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-(2017)
Interim Construction Noise Guideline (DECC, 2009)	http://www.epa.nsw.gov.au/noise/constructnoise.htm
Assessing Vibration: a technical guideline (DEC, 2006)	http://www.epa.nsw.gov.au/noise/vibrationguide.htm
NSW Road Noise Policy (DECCW, 2011)	http://www.epa.nsw.gov.au/your-environment/noise/transport-noise
NSW Rail Infrastructure Noise Guideline (EPA, 2013)	http://www.epa.nsw.gov.au/your-environment/noise/transport-noise
Human Health Risk Assessment	

Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards (enHealth, 2012)	http://www.eh.org.au/documents/item/916
Waste, Chemicals and Hazardous Materials and Radiation	
Waste	
Environmental Guidelines: Solid Waste Landfills (EPA, 2016)	http://www.epa.nsw.gov.au/waste/landfill-sites.htm
Draft Environmental Guidelines - Industrial Waste Landfilling (April 1998)	http://www.epa.nsw.gov.au/resources/waste/envguidlns/industrialfill.pdf
EPA's Waste Classification Guidelines 2014	http://www.epa.nsw.gov.au/wasteregulation/classify-guidelines.htm
Resource recovery orders and exemptions	http://www.epa.nsw.gov.au/wasteregulation/orders-exemptions.htm
European Unions Waste Incineration Directive 2000	http://ec.europa.eu/environment/archives/air/stationary/wid/legislation.htm
EPA's Energy from Waste Policy Statement	http://www.epa.nsw.gov.au/wastestrategy/energy-from-waste.htm
NSW Waste Avoidance and Resource Recovery Strategy 2014-2021	http://www.epa.nsw.gov.au/wastestrategy/warr.htm
Chemicals subject to Chemical Control Orders	
Chemical Control Orders (regulated through the EHC Act)	http://www.epa.nsw.gov.au/pesticides/CCOs.htm
National Protocol - Approval/Licensing of Trials of Technologies for the Treatment/Disposal of Schedule X Wastes - July 1994	Available in libraries
National Protocol for Approval/Licensing of Commercial Scale Facilities for the Treatment/Disposal of Schedule X Wastes - July 1994	Available in libraries
Water and Soils	
Acid sulphate soils	
Coastal acid sulfate soils guidance material	http://www.environment.nsw.gov.au/acidsulfatesoil/ and http://www.epa.nsw.gov.au/mao/acidsulfatesoils.htm
Acid Sulfate Soils Planning Maps	http://www.environment.nsw.gov.au/acidsulfatesoil/riskmaps.htm
Contaminated Sites Assessment and Remediation	
Managing land contamination: Planning Guidelines – SEPP 55 Remediation of Land	http://www.epa.nsw.gov.au/clm/planning.htm

Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000)	http://www.epa.nsw.gov.au/resources/clm/20110650consultantsglines.pdf
Guidelines for the NSW Site Auditor Scheme - 2nd edition (DEC, 2006)	http://www.epa.nsw.gov.au/resources/clm/auditorglines06121.pdf
Sampling Design Guidelines (EPA, 1995)	http://www.epa.nsw.gov.au/resources/clm/95059sampgdlne.pdf
National Environment Protection (Assessment of Site Contamination) Measure 1999 (or update)	http://www.scew.gov.au/nepms/assessment-site-contamination
Soils – general	
Managing land and soil	http://www.environment.nsw.gov.au/soils/landandsoil.htm
Managing urban stormwater for the protection of soils	http://www.environment.nsw.gov.au/stormwater/publications.htm
Landslide risk management guidelines	http://australiangeomechanics.org/admin/wp-content/uploads/2010/11/LRM2000-Concepts.pdf
Site Investigations for Urban Salinity (DLWC, 2002)	http://www.environment.nsw.gov.au/resources/salinity/booklet3siteinvestigationsforurbansalinity.pdf
Local Government Salinity Initiative Booklets	http://www.environment.nsw.gov.au/salinity/solutions/urban.htm
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html
Applying Goals for Ambient Water Quality Guidance for Operations Officers - Mixing Zones	Contact the EPA on 131555
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

DOC21/516434
MAAG0011360

Joel Herbert
Environmental Assessment Officer
Resource Assessment

Via: Email: Joel.Herbert@planning.nsw.gov.au

Dear Mr Herbert

Re. Bentley Quarry Request for EARs

I refer to your request of 21 June 2021 for advice regarding Bentley Quarry's request for EARs. The Resources Regulator has reviewed the request.

Assessment
Based on review of the application and scoping report the Resources Regulator advises that the operation does not propose to extract a scheduled mineral (ie. primarily basalt for aggregate production) under the *Mining Act 1992* and the operation's rehabilitation is therefore not regulated by the Resources Regulator.

Whilst the activity is not regulated by the Resources Regulator under the Mining Act the mine operator is reminded of their obligations under the *Work Health and Safety Act 2011* and *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated regulations.

Regulatory requirements if approved
The Resources Regulator may undertake assessments of the mine operators' proposed mining activities under the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and Regulation as well as other WHS regulatory obligations.

Background
The Mining Act Inspectorate within the Resources Regulator undertake risk-based compliance and enforcement activities in relation to obligations under the *Mining Act 1992*. This includes undertaking assessment and compliance activities in relation to mine rehabilitation activities and determination of security deposits.

The Mine Safety Inspectorate within the Resources Regulator is responsible for ensuring the mine operators' compliance with the Work Health and Safety (WHS) legislation, in particular the effective management of risks associated with the principal hazards as specified in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*.

Contact
Should you require any further information or clarification, please contact the Office of the Executive Director (ED.ResourcesRegulator@planning.nsw.gov.au)

Yours sincerely,

Garvin Burns
Executive Director
Resources Regulator

5 July 2021

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Level 3
49 Victoria Street, Grafton
www.waternsw.com.au
ABN 21 147 934 787

Contact: Melissa Hundy
Phone: 0447 202 523
Email : Melissa.hundy@waternsw.com.au
Our ref: D2021/70776
Your ref: EARs 1589

Joel Herbert
Environmental Assessment Officer
Resource Assessments
Department of Planning, Industry and Environment
Locked Bag 5022
Parramatta NSW 2124
Via email: joel.herbert@planning.nsw.gov.au

25th June 2021

Dear Joel,

Re: EARs ID No.1589 – Bentley Quarry Extension

WaterNSW has reviewed the supporting documentation accompanying your email dated 21st June 2021, a request for Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an EIS for the above designated development. WaterNSW appreciates the opportunity and provides the following comments, and further detail in **Attachment A**.

WaterNSW administers the Water Management Act 2000 through the granting and administration of Water Access Licences (WALs) and Water Supply Work Approvals for surface water and groundwater resources.

Water NSW recommends that as a minimum the EIS address the identification, assessment and management of potential impacts on surface water and groundwater resources arising from the proposed development. This will need to include adequate assessment of any water quality impacts.

It is recommended that the EIS be required to include:

Access to surface and groundwater resources

- Annual volumes of surface water and groundwater proposed to be taken by the activity (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.
- Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project).
- Assessment of the impact and approvals (Works and Use Approvals under the WMA 2000) required for the taking or storage of water.
- The identification of an adequate and secure water supply for the life of the project. Confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased.
- A detailed and consolidated site water balance.

Impact on surface and groundwater resources

- Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.
- Full technical details and data of all surface and groundwater modelling.
- Proposed surface and groundwater monitoring activities and methodologies.
- Proposed management and disposal of produced or incidental water.

Flooding

WaterNSW is responsible for the management and licensing of flood work approvals.

If the proposal is for an earthwork, embankment or levee, wherever situated or proposed to be constructed that is reasonably likely to affect the flow of water to or from a river or lake then the assessment is required to address potential impacts detailed in attachment A.

Impact on waterfront land and water resource dependents

- Clear identification of "waterfront land" (as defined in the WMA 2000) and an assessment of impacts of works and activities on waterfront land. (Works on waterfront land may be subject to Controlled Activity Approval (CAA) under the *Water Management Act 2000.)*
- Details of the final landform of the site, including final void management (where relevant) and rehabilitation measures.
- Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts.
- Consideration of relevant policies and guidelines.
- A statement of where each element of the SEARs is addressed in the EIS (i.e. in the form of a table).

Note:

WaterNSW will require an assessment of the flooding impacts and mitigation measures. The assessment will need to demonstrate that the principles of the Water Management Act have been meet.

Please direct any questions or correspondence to **Melissa Hundy at melissa.hundy@waternsw.com.au**.

Yours sincerely

Melissa Hundy
Water Regulation Officer, Assessments and Approvals
Customer and Community
WaterNSW

ATTACHMENT A

WaterNSW General Assessment Requirements

The following detailed assessment requirements are provided to assist in adequately addressing the assessment requirements for this proposal.

Key Relevant Legislative Instruments

This section provides a basic summary to aid proponents in the development of an Environmental Impact Statement (EIS), and should not be considered a complete list or comprehensive summary of relevant legislative instruments that may apply to the regulation of water resources for a project.

The EIS should take into account the objects and principles of the *Water Management Act 2000* (WMA 2000), applicants must ensure the EIS demonstrates (where relevant) how their proposal will minimise or mitigate impacts on the following matters:

- water sources, floodplains and dependent ecosystems (including groundwater dependent ecosystems and wetlands, swamps, bogs, depressions and perennial streams) which should be protected and restored where possible;
- habitats, animals and plants that benefit from water;
- water quality including sediment and dissolved oxygen, its beneficial use classification and impacts;
- groundwater pollution, contamination and disposal, including short and long term protection measures;
- acidity, waterlogging, or salinity (including dryland salinity where relevant),
- cumulative impacts associated with other approvals, and impacts on existing groundwater users;
- geographical and other features of indigenous, major cultural, heritage or spiritual significance (natural or built);
- soil erosion and compaction (impact of final land form on groundwater regime),
- vegetation clearing (include dimensions of area and details of native species to be cleared);
- contamination of soils, sediment control, contamination of water and other relevant sites;
- geomorphic instability – including inducing landslip or subsidence; and
- Impacts on other users.

Water Management Act 2000 (WMA 2000)
Key points:

- Volumetric licensing in areas covered by water sharing plans
- Works within 40m of waterfront land
- SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*.
- No exemptions for volumetric licensing apply as a result of the *EP&A Act*.
- Basic landholder rights, including harvestable rights dams
- Aquifer interference activity approval and flood management work approval provisions have not yet commenced and are regulated by the *Water Act 1912*
- Maximum penalties of $2.2 million plus $264,000 for each day an offence continues apply under the *WMA 2000*

The EIS should also consider associated regulations and instruments, as applicable.

Water Management (General) Regulation 2011
Key points:

- Provides various exemptions for volumetric licensing and activity approvals
- Provides further detail on requirements for dealings and applications.

Water Sharing Plans – these are considered regulations under the *WMA 2000*

Access Licence Dealing Principles Order 2004

Harvestable Rights Orders

Water Sharing Plans

It is important that the proponent understands and describes the ground and surface water sharing plans, water sources, and management zones that apply to the project. Multiple water sharing plans may apply and these must all be described.

The EIS is required to:

- Demonstrate how the proposal is consistent with the relevant rules of the Water Sharing Plan including rules for access licences, distance restrictions for water supply works and rules for the management of local impacts in respect of surface water and groundwater sources, ecosystem protection (including groundwater dependent ecosystems), water quality and surface-groundwater connectivity.
- Provide a description of any site water use (amount of water to be taken from each water source) and management including all sediment dams, clear water diversion structures with detail on the location, design specifications and storage capacities for all the existing and proposed water management structures.
- Provide an analysis of the proposed water supply arrangements against the rules for access licences and other applicable requirements of any relevant WSP, including:
    - Sufficient market depth to acquire the necessary entitlements for each water source.
    - Ability to carry out a “dealing” to transfer the water to relevant location under the rules of the WSP.
    - Daily and long-term access rules.
    - Account management and carryover provisions.
- Provide a detailed and consolidated site water balance.
- Further detail on licensing requirements is provided below.

Relevant Policies and Guidelines

The EIS should take into account the following policies (as applicable):

- NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012)
- NSW Aquifer Interference Policy (NOW, 2012)
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012)
- Australian Groundwater Modelling Guidelines (NWC, 2012)
- NSW State Rivers and Estuary Policy (1993)
- NSW Wetlands Policy (2010)
- NSW State Groundwater Policy Framework Document (1997)
- NSW State Groundwater Quality Protection Policy (1998)
- NSW State Groundwater Dependent Ecosystems Policy (2002)
- NSW Water Extraction Monitoring Policy (2007)

Licensing Considerations

The EIS is required to provide:

- Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).
- Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.
- Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc.).
- Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc).
- Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing.
- Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages
- Details on the location, purpose, size and capacity of any new proposed dams/storages.
- Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.

Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered.

The Harvestable Right gives landholders the right to capture and use for any purpose 10 % of the average annual runoff from their property. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.

For more information on Harvestable Right dams, including a calculator, visit:
https://www.waternsw.com.au/customer-service/water-licensing/blr/harvestable-rights-dams

Dam Safety

Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.

See www.damsafety.nsw.gov.au for further information.

Surface Water Assessment

The predictive assessment of the impact of the proposed project on surface water sources should include the following:

- Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project.

- Identification of all surface water sources as described by the relevant water sharing plan.
- Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users.
- Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources.
- Assessment of predicted impacts on the following:
    - flow of surface water, sediment movement, channel stability, and hydraulic regime,
    - water quality,
    - flood regime,
    - dependent ecosystems,
    - existing surface water users, and
    - planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.

Flooding

If the proposal is for an earthwork, embankment or levee, wherever situated or proposed to be constructed that is reasonably likely to affect the flow of water to or from a river or lake then the assessment is required to address potential impacts detailed below;

- the contents of any relevant floodplain management plan or any other relevant Government policy,
- the need to maintain the natural flood regimes in wetlands and related ecosystems and the preservation of any habitat, animals (including fish) or plants that benefit from periodic flooding,
- the effect or likely effect on water flows in downstream river sections,
- any geographical features, or other matters, of Aboriginal interest that may be affected by a controlled work,
- the effect or likely effect of a controlled work on the passage, flow and distribution of any flood waters,
- the effect or likely effect of a controlled work on existing dominant flood ways or exits from flood ways, rates of flow, flood water levels and the duration of inundation,
  the protection of the environment

Groundwater Assessment

To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources including:

- Works likely to intercept, connect with or infiltrate the groundwater sources.
- Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Bore construction information is to be supplied to WaterNSW by submitting a “Form A” template. WaterNSW will supply “GW” registration numbers (and licence/approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.

- A description of the water table and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).
- Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.
- The predicted impacts of any final landform on the groundwater regime.
- The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.
- An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.
- An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).
- Measures proposed to protect groundwater quality, both in the short and long term.
- Measures for preventing groundwater pollution so that remediation is not required.
- Protective measures for any groundwater dependent ecosystems (GDEs).
- Proposed methods of the disposal of waste water and approval from the relevant authority.
- The results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Groundwater Dependent Ecosystems

The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:

- Identify any potential impacts on GDEs as a result of the proposal including:
    - the effect of the proposal on the recharge to groundwater systems;
    - the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and
    - the effect on the function of GDEs (habitat, groundwater levels, connectivity).
- Provide safeguard measures for any GDEs.

Watercourses, Wetlands and Riparian Land

The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal, including:

- Scaled plans showing the location of:
  - wetlands/swamps, watercourses and top of bank;
  - riparian corridor widths to be established along the creeks;
  - existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  - the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas; and
  - proposed location of any asset protection zones.
- Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken.
- A detailed description of all potential impacts on the watercourses/riparian land.
- A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands.
- A description of the design features and measures to be incorporated to mitigate potential impacts.
- Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.
- Works on waterfront land may be subject to Controlled Activity Approval (CAA) under the *Water Management Act 2000.* Further information can be obtained from: https://www.industry.nsw.gov.au/water/licensing-trade/approvals/controlled-activities

Drill Pad, Well and Access Road Construction

- Any construction activity within 40m of a watercourse, should be designed by a suitably qualified person, consistent with the NSW *Guidelines for Controlled Activities on Waterfront Land* (July 2012).
- Construction of all wells must be undertaken in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (3rd edition 2012) by a driller holding a bore drillers' licence valid in New South Wales.
- The length of time that a core hole is maintained as an open hole should be minimised.

Landform rehabilitation (including final void management)

Where significant modification to landform is proposed, the EIS must include:

- Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems;
- A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape;
- Outline of proposed construction and restoration of topography and surface drainage features if affected by the project;

- Detailed modelling of potential groundwater volume, flow and quality impacts of the presence of an inundated final void (where relevant) on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent;
- An outline of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation; and
- The measures that would be established for the long-term protection of local and regional aquifer systems and for the ongoing management of the site following the cessation of the project.

Consultation and general enquiries
General licensing enquiries can be made to Advisory Services:
customer.helpdesk@waternsw.com.au or 1300 662 077.

End Attachment A

6 July 2021

File No: NTH21/00146/01
Your Ref: SEAR 1589

The Director
Department of Planning, Industry and Environment
Locked Bag 5022
PARAMATTA NSW 2124

Attention: Joel Herbert

Dear Sir,

RE: Secretary's Environmental Assessment Requirements for Bentley Quarry Extension Lot 2 DP1196757, 1465 Bentley Road, Bentley – SEAR 1589

I refer to your email dated 21 June 2021 requesting input from Transport for NSW to the Secretary's Environmental Assessment Requirements (SEARs) for the abovementioned development proposal.

Roles and Responsibilities

Our key interests are the safety and efficiency of the transport network, the needs of our customers and the integration of land use and transport in accordance with Future Transport Strategy 2056.

Bentley Road is a classified (Regional) Road (MR 544), being part of the road connecting Lismore to the Summerland Way. Richmond Valley Council is the Roads Authority for all public roads (other than freeways or Crown roads) in the local government area pursuant to Section 7 of the *Roads Act 1993* and can exercise roads authority functions for classified roads in accordance with the Roads Act.

In accordance with Clause 101 of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) the Consent Authority is to have consideration for the safety, efficiency and ongoing operation of the classified road as the development has frontage to a classified road.

Council is responsible for setting standards, determining priorities and carrying out works on Local and Regional roads. However, TfNSW concurrence is required prior to Council's approval of works on classified (Regional) roads under Section 138 of the *Roads Act 1993.*

In accordance with Clause 16 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*, TfNSW is given the opportunity to review and provide comment on the subject development application.

It is emphasised that the following comments are based on the information provided to TfNSW at this time, they are not to be interpreted as binding upon TfNSW and further comment will be provided following formal review of a development application referred by the appropriate Consent Authority.

Transport for NSW Response

It is understood that the proposal is for the construction and operation of a 300,000 tonnes per annum hard rock quarry at 1465 Bentley Road, Bentley which is located some 14 kms west of Lismore. The Scoping Report prepared by GHD and dated April 2021 notes that Bentley Road intersects with the Summerland Way 20km to the north-west of the site.

TfNSW requests that a Traffic Impact Assessment (TIA) be prepared by suitably qualified person/s in accordance with the *Austroads Guide to Traffic Management Part 12*, the complementary TfNSW Supplement and *RTA Guide to Traffic Generating Developments*. The TIA should include, but not necessarily be limited to, an assessment of the considerations outlined in **Attachment A**. The traffic information and proposed intersection drawings included in the Scoping Report are acknowledged.

TfNSW highlights that in determining the application under the *Environmental Planning and Assessment Act 1979*, it is the Consent Authority's responsibility to consider the environmental impacts of any roadworks which are ancillary to the development. This includes any works which form part of the proposal and/or any works which are deemed necessary to include as requirements in the conditions of project approval.

If you have any further enquiries regarding the above comments please do not hesitate to contact Cheryl Sisson, Development Services Case Officer or the undersigned on (02) 6640 1362 or via email at: development.northern@transport.nsw.gov.au

Yours faithfully,

for Matt Adams
Team Leader, Development Services
Community and Place | Region North
Regional & Outer Metropolitan
Transport for NSW

Enc. ATTACHMENT A - Requested TIA consideration for SEAR

ATTACHMENT A - Traffic Impact Assessment – Requested considerations for SEAR

For context, this attachment must be read with TfNSW letter of 6 July 2021, Ref: NTH21/00146/01.

A Traffic Impact Assessment (TIA) to be prepared by suitably qualified person/s in accordance with the *Austroads Guide to Traffic Management Part 12*, the complementary TfNSW Supplement and *RTA Guide to Traffic Generating Developments*.

The TIA is to identify the impacts of the development and the proposed on-site and off-site measures proposed to mitigate the impacts of the development on any road or rail related infrastructure. The TIA must explain and justify all inputs informing the proposed mitigation measures and TIA conclusions.

The TIA should be tailored to the scope of the proposed development and include, but not necessarily be limited to, consideration of the following;

- A map of the surrounding road network identifying all public roads proposed to obtain access from the development site to the classified (State) road.
- The total impact of existing and proposed development on the road network with consideration for a 10 year horizon. This should include;
  - Identify Annual Average Daily Traffic (AADT) volumes with percentage heavy vehicles along the transport route/s and diagrammatically demonstrate AM and PM peak hour movements at key intersections.
  - Background traffic data from published sources and/or recent survey data. The source of data and any assumptions are to be clearly explained and justified, including the growth rate applied to the future horizon. Due to the impact of COVID-19 on travel patterns, traffic counts undertaken at this time may not be representative of normal volumes. Alternative approaches to understanding the impact of COVID-19 on traffic patterns should be discussed with TfNSW.
  - The volume and distribution of existing and proposed trips to be generated by the construction, operation and/or decommission phases of the development. This should identify the maximum daily and hourly demands generated by the development, particularly where they coincide with the network peak hour.
  - The type and frequency of design vehicles accessing the development site.
- Details of the road geometry and alignment along the identified transport route/s, including existing formations, crossings, intersection treatments and any identified hazards. This should include;
  - Available sight distances at the site access and nearby intersections, identifying any constraints to achieving the required sight distance for the posted speed limit.
  - An assessment of turn treatment warrants in accordance with the *Austroads Guide to Traffic Management Part 6* and *Austroads Guide to Road Design Part 4A* for intersections along the identified transport route/s, identifying the existence of the minimum basic turn treatments and addressing the need for any warranted higher order treatments.

  - Swept path analysis demonstrating the largest design vehicle entering and leaving the development, and moving in each direction through intersections along the proposed transport route/s.

- Where relevant, capacity analysis using SIDRA or other relevant application, to identify an acceptable Level of Service (LOS) at intersections with the classified (State) road/s, and where relevant, analysis of any other intersections along the proposed transport route/s.
- A review of crash data along the identified transport route/s for the most recent 5 year reporting period and an assessment of road safety along the proposed transport route/s considering the safe systems principles adopted under *Future Transport 2056*.
- Site plan demonstrating site access, internal manoeuvring, servicing and parking areas consistent with the relevant parts of *AS2890* and Council requirements.
- Strategic (2D) design drawings of all proposed road works and the site access demonstrating scope, estimated cost and constructability of works required to mitigate the impacts of the development on road safety, traffic efficiency and the integrity of transport infrastructure. Works must be appropriately designed for the existing posted speed limit.
- Details of measures to address impacts on public transport services and active transport modes, such as, public and school bus services, walking and cycling.
- Details of measures to ameliorate the impacts of road traffic noise, dust, and/or glare generated along the proposed transport route/s.
- Details of any Traffic Management Plan (TMP) proposed to address the construction, operation and decommission phases of the proposed development. The TMP may include temporary measures such a Traffic Guidance Scheme (TGS) prepared and implemented by suitably qualified persons in accordance with the current *Traffic Control at Work Sites Manual*. It is recommended that any TMP adopt a Driver Code of Conduct, including but not necessarily limited to, the following;
  - A map of the primary transport route/s highlighting critical locations.
  - An induction process for vehicle operators and regular toolbox meetings.
  - Procedures for travel through residential areas, school zones and/or bus route/s.
  - A complaint resolution and disciplinary procedure.
  - Community consultation measures proposed for peak periods.
  - Work, health and safety requirements under the *Work Health and Safety Regulation 2017*.

Where road safety concerns are identified at a specific location along the proposed haulage routes, TfNSW suggests that the TIA be supported by a targeted Road Safety Audit undertaken by suitably qualified persons in accordance with the Austroads Guidelines.

Any roadwork on classified (State/Regional) road/s is to be designed and constructed in accordance with the current *Austroads Guidelines, Australian Standards* and *TfNSW Supplements*.

DOC21/516434
MAAG0011360

Joel Herbert
Environmental Assessment Officer
Resource Assessment

Via: Email: Joel.Herbert@planning.nsw.gov.au

Dear Mr Herbert

Re. Bentley Quarry Request for EARs

I refer to your request of 21 June 2021 for advice regarding Bentley Quarry's request for EARs. The Resources Regulator has reviewed the request.

Assessment
Based on review of the application and scoping report the Resources Regulator advises that the operation does not propose to extract a scheduled mineral (ie. primarily basalt for aggregate production) under the *Mining Act 1992* and the operation's rehabilitation is therefore not regulated by the Resources Regulator.

Whilst the activity is not regulated by the Resources Regulator under the Mining Act the mine operator is reminded of their obligations under the *Work Health and Safety Act 2011* and *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated regulations.

Regulatory requirements if approved
The Resources Regulator may undertake assessments of the mine operators' proposed mining activities under the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and Regulation as well as other WHS regulatory obligations.

Background
The Mining Act Inspectorate within the Resources Regulator undertake risk-based compliance and enforcement activities in relation to obligations under the *Mining Act 1992*. This includes undertaking assessment and compliance activities in relation to mine rehabilitation activities and determination of security deposits.

The Mine Safety Inspectorate within the Resources Regulator is responsible for ensuring the mine operators' compliance with the Work Health and Safety (WHS) legislation, in particular the effective management of risks associated with the principal hazards as specified in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*.

Contact
Should you require any further information or clarification, please contact the Office of the Executive Director (ED.ResourcesRegulator@planning.nsw.gov.au)

Yours sincerely,

Garvin Burns
Executive Director
Resources Regulator

5 July 2021

Our Ref: DOC21/509122
Your Ref: SEAR ID 1589

Department of Planning Industry and Environment
Mineral and Quarry Assessments
Locked Bag 5022
Paramatta NSW 2124

Attention: Attention: Mr Joel Herbert

Dear Mr Sprott

Re: Request for Biodiversity and Conservation Division's Environmental Impact Statement Environmental Assessment Requirements – Bentley Quarry Extension SEAR ID 1589

Thank you for your e-mail dated 21 June 2021 bout the Bentley Quarry Extension SEAR ID 1589 seeking Environmental Assessment Requirements (EARs) from the Biodiversity and Conservation Division (BCD) of the Biodiversity, Conservation and Science Directorate in the Environment, Energy and Science Group of the Department of Planning, Industry and Environment. I appreciate the opportunity to provide input.

The BCD was formerly part of the Office of Environment and Heritage, but now forms part of a Group that has responsibilities relating to biodiversity (including threatened species and ecological communities, or their habitats), National Parks and Wildlife Service (NPWS) estate, climate change, sustainability, flooding, coastal and estuary matters.

On 1 July 2020 Aboriginal cultural heritage (ACH) functions were transferred from the BCD to Heritage NSW in the Department of Premier and Cabinet. For ACH advice, please contact Heritage NSW at heritagemailbox@environment.nsw.gov.au.

We note that the project will be assessed in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Environmental Impact Statement (EIS) EARs provided by the BCD are limited to biodiversity, NPWS estate, flooding and stormwater.

The proponent should ensure that the EIS will be sufficiently comprehensive to enable unambiguous assessment of all direct and indirect impacts of the proposed development.

In particular, the BCD notes the proximity of the proposed quarry to the Muckleewee Mountain Nature Reserve (approximately 2,500m), and the potential for noise impacts on fauna within the reserve resulting from blasting and drilling activities associated with quarry operations. The EIS should document consultation with the NPWS and the development of protocols to ensure that no harm occurs to fauna within the reserve from noise impacts associated with rock harvesting activities. We consider that this information is necessary for a comprehensive EIS for the proposed development.

The full list of our requirements that may need to be addressed in the EIS is provided in **Attachment 1**. In preparing the EIS, the proponent should refer to the relevant guidance material listed in **Attachment 2.**

If you have any further questions about this advice, please do not hesitate to contact Mr Paul Houlder, Project Officer Data Support, at paul.houlder@environment.nsw.gov.au or on 6670 8679

Yours sincerely

23 June 2021

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Biodiversity and Conservation

Enclosures:
Attachment 1 - BCD Recommended EARs – EIS – Bentley Quarry Extension SEAR ID 1589
Attachment 2 - EIS Guidance Material

Attachment 1

Biodiversity and Conservation Division's Recommended Secretary's Environmental Assessment Requirements (SEARs) for Preparation of an Environmental Impact Statement

for the

Bentley Quarry Extension

SEAR ID 1589

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TABLE OF CONTENTS

A. The Proposed Development

The Environmental Impact Statement (EIS) should fully and clearly describe the proposed development, including any environmental impact mitigation measures, and identify all the processes and activities intended for the site during the life of the proposed development.

The description of the proposed development in the EIS should, where relevant, include:

1. the location of the proposal and details of the surrounding environment;
2. appropriate land use zoning;
3. the size and type of the proposal and its operation;
4. the proposed layout of the site;
5. the staging and timing of the proposal;
6. the proposal's relationship to any other proposal.
7. all equipment proposed for use at the site;
8. chemicals, including fuel, used on the site and proposed methods for the transportation, storage, use and emergency management;
9. waste generation, storage and disposal;
10. the anticipated environment impacts of the proposal, both direct and indirect,
11. a plan showing the distribution of any threatened flora or fauna species and the vegetation communities on or adjacent to the subject site, and the extent of vegetation proposed to be cleared; and
12. ownership details of any residence and/or land likely to be affected by the proposal;
13. maps/diagrams showing the location of residences and properties likely to be affected and other industrial developments, conservation areas, wetlands, etc. in the locality that may be affected by the proposal;
14. methods to mitigate any expected environmental impacts of the proposal; and
15. the anticipated level of performance in meeting required environmental standards.

B. Environmental Impacts of the Proposed Development

Impacts related to the following environmental issues should be assessed, quantified and reported on:

- Aboriginal cultural heritage
- Biodiversity
- NPWS Estate (land reserved or acquired under the *National Parks and Wildlife Act 1974*)
- Acid Sulfate Soils
- Flooding, Stormwater and Coastal Erosion
- Cumulative Impacts

The EIS should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at **Attachment 2**.

C. Biodiversity

1. The EIS must assess the impacts of the proposed development on biodiversity values to determine if the proposed development is "likely to significantly affect threatened species" for the purposes of Section 7.2 of the *Biodiversity Conservation Act 2016* (BC Act) as follows:

   A. The EIS must demonstrate whether the proposed development is to be carried out in a declared area of outstanding biodiversity value.

   B. If the proposed development is not carried out in a declared area of outstanding biodiversity value, then the EIS must demonstrate and document whether the proposed development exceeds the biodiversity offset scheme threshold, as set out in section 7.4 of the BC Act and clause 7.1 of the *Biodiversity Conservation Regulation 2017* (BC Regulation), by determining whether the proposed development involves:

      I. The clearing of native vegetation of an area declared by clause 7.23 of the BC Regulation as exceeding the threshold, or

      II. The clearing of native vegetation, or other action prescribed by clause 6.1 of the BC Regulation, on land included on the Biodiversity Values Map published under clause 7.3 of the BC Regulation.

   C. If the biodiversity offset scheme threshold is not exceeded, then the EIS must document *the test for determining whether proposed development is likely to significantly affect threatened species or ecological communities* as outlined in Section 7.3 of the BC Act, by preparing an ecological assessment that should include:

      I. A field survey of the site conducted and documented in accordance with relevant guidelines, including:

         a. *Field survey methods for environmental consultants and surveyors when assessing proposed developments or other activities on sites containing threatened species* https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/field-survey-method-guidelines.pdf

         b. *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECC, 2009) http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf

         c. *NSW Guide to Surveying Threatened Plants* (OEH 2016) https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/guide-surveying-threatened-plants-160129.pdf

         d. *"Species credit' threatened bats and their habitats https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf*

e. *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004), https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/draft-threatened-biodiversity-survey-guide.pdf

If a proposed field survey methodology is likely to vary significantly from the methods in the guidelines above, then the proponent should discuss the proposed methodology with the Biodiversity and Conservation Division prior to undertaking surveys for the EIS, to determine whether the Biodiversity and Conservation Division considers the proposed methodology appropriate.

The results of recent (less than five years old) field surveys may be used. However, the results of previous field surveys should not be used if they have:

- been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or

- utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species,

unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the field surveys.

If the results of previous field surveys are used, then field surveys for any additional threatened entities listed under the BC Act since the previous field surveys took place, must be undertaken and documented.

The list of potential threatened species, populations, ecological communities, or their habitats for the site should be determined in accordance with:

- the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004), and
- the Department's Threatened Species website http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species ,and
- the *Bionet Atlas of NSW* http://www.environment.nsw.gov.au/wildlifeatlas/about.htm , and
- the Vegetation Information System (BioNet Vegetation Classification) http://www.environment.nsw.gov.au/research/Visclassification.htm , and
- other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (http://www.ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.

II. The following information as a minimum:

a. A description, spatial data files, and geo-referenced mapping of the study area, (overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone), showing all field survey locations, vegetation communities classified in accordance with the BioNet Vegetation Classification (http://www.environment.nsw.gov.au/research/Visclassification.htm), key

habitat features and reported locations of threatened species and ecological communities present in the subject site and study area.

b. A description of survey methodologies used, including timing, location and weather conditions.

c. Details, including qualifications and experience, of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIS.

d. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.

e. A description of the likely impacts of the proposed development on biodiversity values, including direct and indirect impacts and construction and operation impacts, with impacts quantified, wherever possible, such as the amount of each vegetation community or species habitat to be cleared or impacted, and/or the degree of fragmentation of a habitat connectivity.

f. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposed development to avoid or minimise biodiversity impacts, including details about alternative options considered and how long-term management arrangements will be guaranteed.

g. A description of the residual impacts of the proposed development.

III. The '*test for determining whether proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats'* as outlined in Section 7.3 of the BC Act undertaken in accordance with the gazetted *Threatened Species Test of Significance Guidelines* (OEH 2018) available at: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/threatened-species-test-significance-guidelines-170634.pdf

2. If the EIS determines under 1 above that the proposed development is likely to significantly affect threatened species, then in accordance with Section 7.7 of the BC Act the EIS must be accompanied by a Biodiversity Development Assessment Report prepared in accordance with Part 6, Division 3 of the BC Act.

3. If the EIS determines under 1 above that the proposed development is unlikely to significantly affect threatened species, then the proposed development should:

   a. be designed to avoid and minimise impacts on biodiversity values to the fullest extent possible, and

   b. include a biodiversity offset package to offset remaining direct and indirect impacts on biodiversity values, prepared in accordance with the Department's 13 offsetting principles available at http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm:

Note:

For the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999,* the EIS should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

D. NPWS Estate

The EIS should address the following with respect to land reserved under the *National Parks and Wildlife Act 1974*.

1. Where appropriate, likely impacts (both direct and indirect) of the proposed development on any adjoining and/or nearby NPWS estate reserved under the National Parks and Wildlife Act 1974 should be considered, with reference to the *Developments adjacent to National Parks and Wildlife Service lands Guidelines for consent and planning authorities (DPIE 2020)* available at:

   https://www.environment.nsw.gov.au/research-and-publications/publications-search/developments-adjacent-to-national-parks-and-wildlife-service-lands

Note: Proposed development which may impact marine protected areas should be referred to the Regions, Industry, Agriculture and Resources Group in the Department of Planning, Industry and Environment to determine the assessment and approval requirements.

E. Flooding and Stormwater

The EIS should include an assessment of the following referring to the relevant guidelines in Attachment 2:

1. Whether the proposed development is consistent with any floodplain risk management plans.

2. Whether the proposed development is compatible with the flood hazard of the land.

3. Whether the proposed development will significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties.

4. Whether the proposed development will significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

5. Whether the proposed development incorporates appropriate measures to manage risk to life from flood.

6. Whether the proposed development is likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

7. The implications of flooding over the full range of potential flooding, including the probable maximum flood, should be considered as set out in the NSW Government Floodplain Development Manual. This should include the provision of:

    a. Full details of the flood assessment and modelling undertaken in determining any design flood levels (if applicable), including the 1 in 100 year flood levels.

    b. A sensitivity assessment of the potential impacts of an increase in rainfall intensity and runoff (10%, 20% and 30%) and sea level rise on the flood behaviour for the 1 in 100 year design flood if applicable.

8. All site drainage, stormwater quality devices and erosion / sedimentation control measures should be identified and the onsite treatment of stormwater and effluent runoff and predicted stormwater discharge quality from the proposed development should be detailed.

F. Cumulative Impacts

The EIS should include an assessment of the following:

1. The cumulative impacts, including both construction and operational impacts, from all clearing activities and operations, associated edge effects and other indirect impacts on cultural heritage, biodiversity and NPWS Estate in accordance with the *Environmental Planning and Assessment Act 1979*.

2. The cumulative impacts, including both construction and operational impacts, of the proponent's existing proposals and other proposals and associated infrastructure (such as access tracks etc.) as well as the cumulative impact of the proposed development in the context of other proposals located in the vicinity.

Attachment 2 – EIS Guidance Material

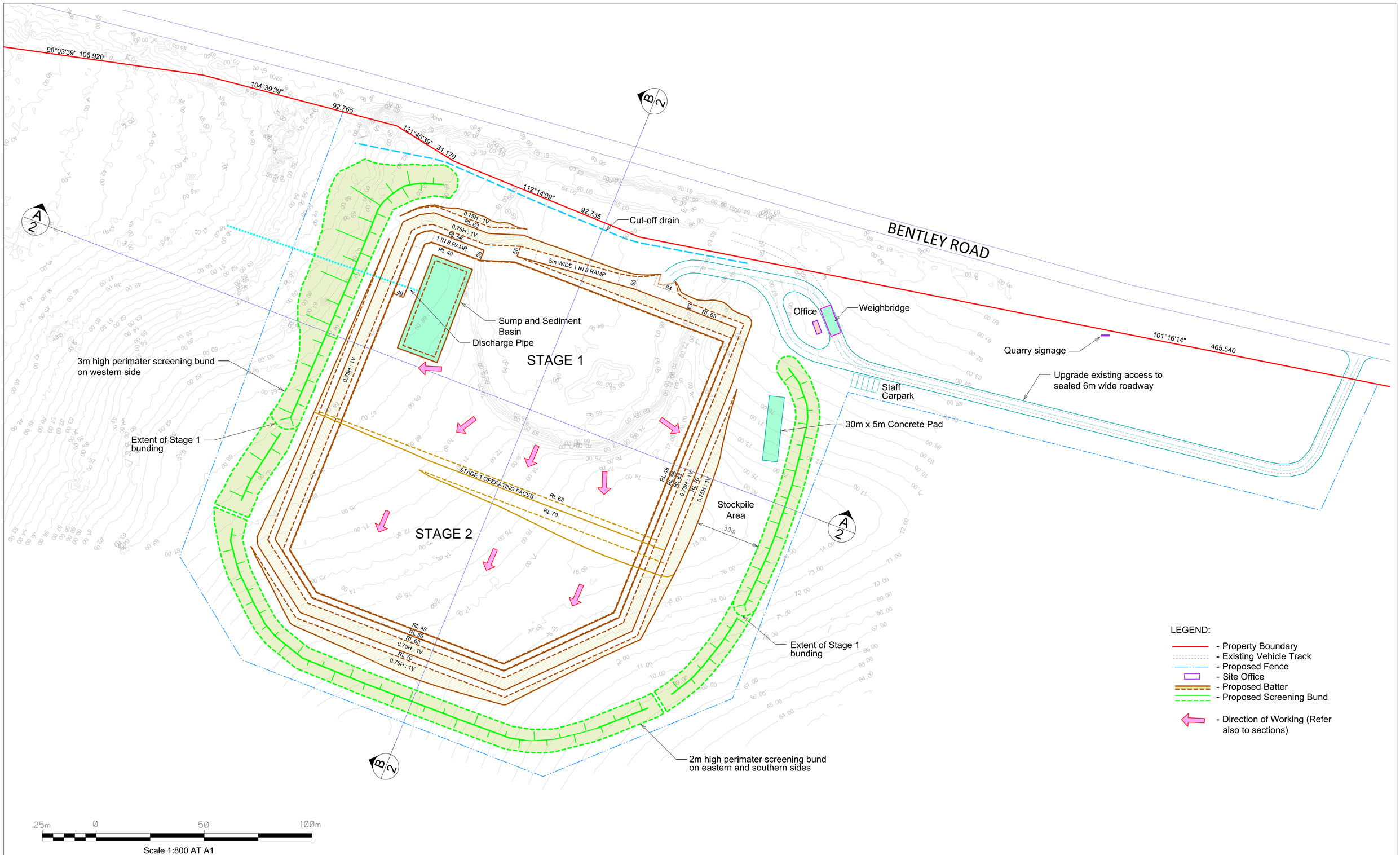
Title	Web address
Relevant Legislation	
Biodiversity Conservation *Act 2016*	https://www.legislation.nsw.gov.au/#/view/act/2016/63/full
Coastal Management Act 2016	https://www.legislation.nsw.gov.au/#/view/act/2016/20/full
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
Marine Parks Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Wilderness Act 1987	http://www.legislation.nsw.gov.au/viewtop/inforce/act+196+1987+FIRST+0+N
Biodiversity	
Biodiversity Assessment Method (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf
Biodiversity Development Assessment Report	https://www.legislation.nsw.gov.au/#/view/act/2016/63/part6/div3/sec6.12
Guidance and Criteria to assist a decision maker to determine a serious and irreversible impact (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/guidance-decision-makers-determine-serious-irreversible-impact-170204.pdf
Accreditation Scheme for Application of the Biodiversity Assessment Method Order 2017	https://www.legislation.nsw.gov.au/regulations/2017-471.pdf

Title	Web address
Biodiversity conservation actions	www.environment.nsw.gov.au/resources/bcact/ancillary-rules-biodiversity-actions-170496.pdf
Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying the variation rules	www.environment.nsw.gov.au/resources/bcact/ancillary-rules-reasonable-steps-170498.pdf
Threatened Species Website	www.environment.nsw.gov.au/threatenedspecies/
NSW BioNet (Atlas of NSW Wildlife)	www.bionet.nsw.gov.au/
NSW guide to surveying threatened plants (OEH 2016)	www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf
Threatened species survey and assessment guideline information	www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm
BioNet Vegetation Classification - NSW Plant Community Type (PCT) database	www.environment.nsw.gov.au/research/Vegetationinformationsystem.htm
Data Portal (access to online spatial data)	http://data.environment.nsw.gov.au/
Fisheries NSW policies and guidelines	http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation
List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
Revocation, recategorisation and road adjustment policy (OEH, 2012)	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Developments adjacent to National Parks and Wildlife Service lands Guidelines for consent and planning authorities (DPIE 2020)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Development-guidelines/developments-adjacent-npws-lands-200362.pdf
Flooding and Water	
Flooding	
Floodplain development manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
NSW Climate Impact Profile	http://climatechange.environment.nsw.gov.au/
Climate Change Impacts and Risk Management	Climate Change Impacts and Risk Management: A Guide for Business and Government, AGIC Guidelines for Climate Change Adaptation
Water	

Title	Web address
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	www.environment.gov.au/water/publications/quality/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Appendix B

Project plans



Rev	Description	Checked	Approved	Date
Author	S. Verhellen	Drafting Check		
Designer		Design Check		

N

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Project No.

Client **R & S CONTRACTING Pty Ltd**

Project **BENTLEY QUARRY**

Drawing Title **PROPOSED QUARRY PLAN**

Size **A1**

Status

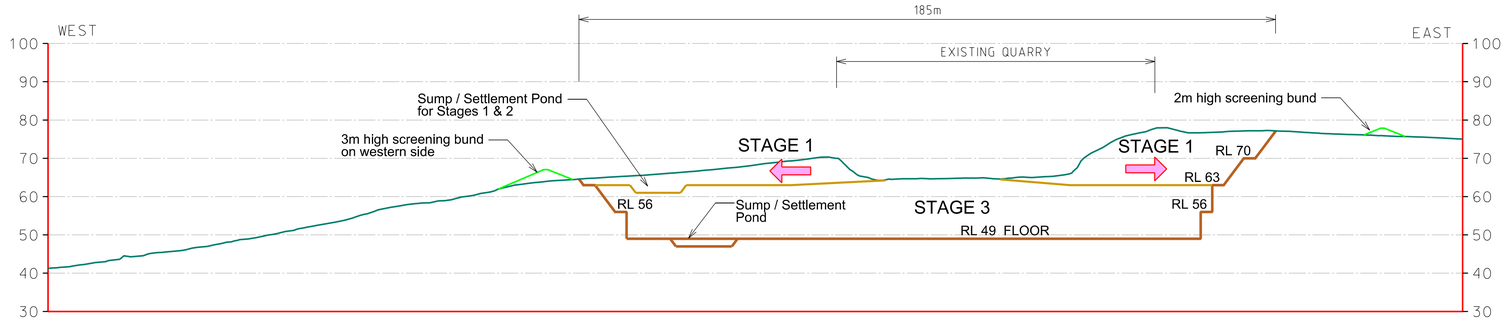
Status Code

Drawing No. **22-12547851-001**

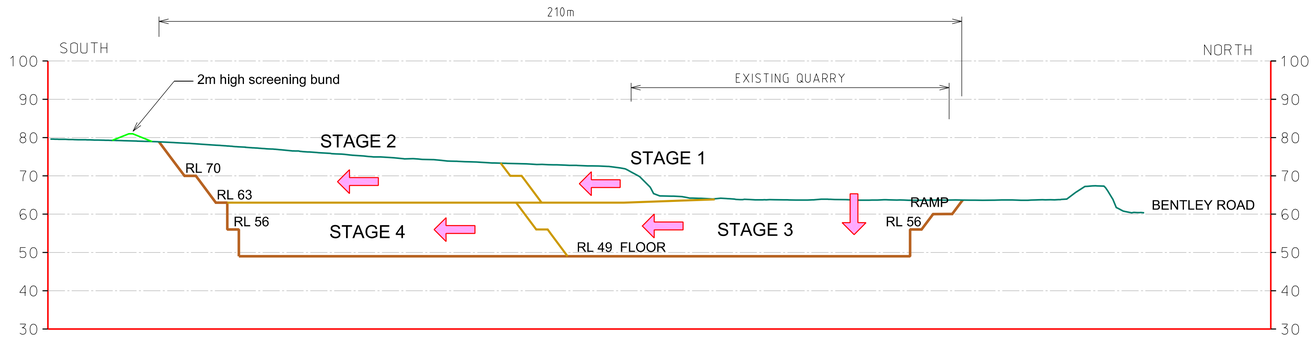
Rev

Plot Date: - Plotted by: - File Name: C:\loy\Minedata\Stefan\V\GHD A1 Landscape Sheet.dgn

22-12547851-001_Bentley_Quarry.dgn 29/10/2021 3:30:41 PM



SECTION A - A



SECTION B - B

25m 0 50 100m

Scale 1:800 AT A1

Rev	Description	Checked	Approved	Date
Author	S. Verhellen	Drafting Check		
Designer		Design Check		

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Project No.

Client **R & S CONTRACTING Pty Ltd**

Project **BENTLEY QUARRY**

Drawing Title **PROPOSED QUARRY SECTIONS**

Size **A1**

Status

Status Code

Drawing No. **22-12547851-002**

Rev

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22-12547851-001_Bentley_Quarry.dgn 29/10/2021 3:31:25 PM

Develop outwards from existing faces to final pit batter at RL 63 and RL 70 levels then excavate to depth in Northern/Western area to allow

98°03'39" 106.920
104°39'39"
92.765
121°40'39"
31.170
112°14'09"
92.735
BENTLEY ROAD
101°16'14"
465.540

Create overflow weir at RL 62

Redirect cut-off drain into pit

Remove or seal discharge pipe

Remove buildings,infrastructure and roads. Rip disturbed areas to 300mm depth, topsoil and grass.

Remove bunding. Topsoil and grass disturbed areas.

Remove fencing

A

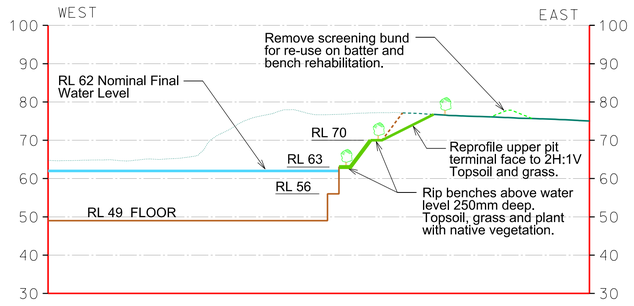
A

Rehabilitate stockpile area. Rip to 300mm depth, topsoil and grass

RL 63
2H : 1V
RL 63
RL 63
0.75H : 1V
RL 70
2H : 1V
RL 63
0.75H : 1V
RL 70
2H : 1V

Remove fencing

Remove bunding. Topsoil and grass disturbed areas.



TYPICAL TERMINAL FACE REHABILITATION

SECTION A - A

25m 0 50 100m

Scale 1:800 AT A1

Rev	Description	Checked	Approved	Date
Author	S. Verhellen	Drafting Check		
Designer		Design Check		

N

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Project No.

Client **R & S CONTRACTING Pty Ltd**

Project **BENTLEY QUARRY**

Drawing Title **PROPOSED QUARRY CONCEPT REHABILITATION PLAN**

Size **A1**

Status

Status Code

Drawing No. **22-12547851-004**

Rev

Plot Date: -

Plotted by: -

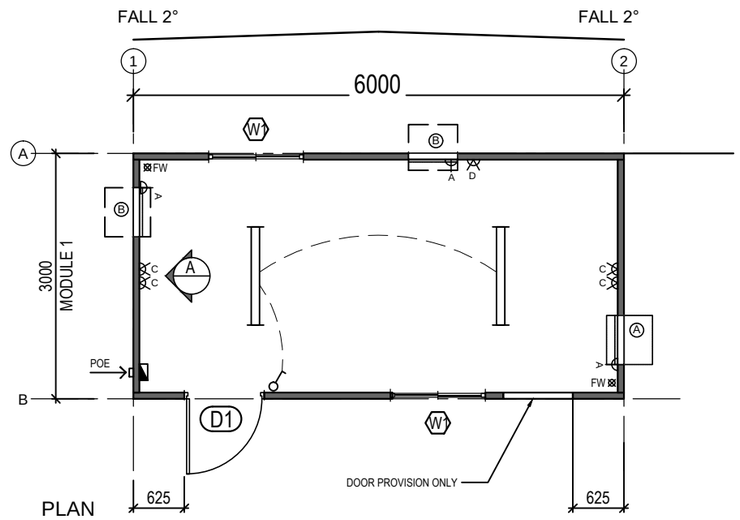
File Name: C:\oy\Minedata\Stefan\V\GHD A1 Landscape Sheet.dgn

DESIGN SPECIFICATION

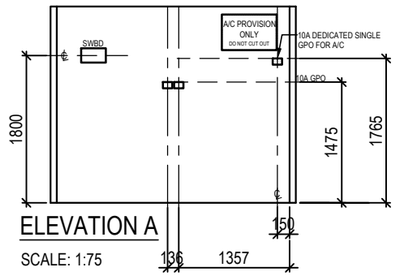
BASEFRAME / REFER BASEFRAME LAYOUTS FOR DETAILS	
BEARER	150 x 75mm PFC, TOES OUT
OUTRIGGER/SPREADER	100 x 50mm PFC
BRACING ANGLE	50 x 50 x 5mm EQUAL ANGLE
END MEMBER	100 x 50mm PFC
LIFTING MECHANISMS	EXTENDABLE OUTRIGGERS
TOW LUG	8mm PLATE / Ø30mm HOLE
STEELWORK TREATMENT	FINISHED WITH ANTI CORROSIVE BLACK ENAMEL / TOW LUGS = CLARKE GREEN / LIFTING POINTS = SAFETY YELLOW
FLOOR FRAME / REFER BASEFRAME LAYOUTS FOR DETAILS	
JOISTS	C10015 @ 480 CENTRES
CAPPER	C10415
END JOIST	100 x 100 x 4mm SHS
FLOORING	
FLOOR SHEET	17mm TONGUE AND GROOVE PLYWOOD F11
FLOOR COVERING	2.0mm VINYL - (SEALED) ARMSTRONG ARMATRANS NEUTRAL GREY
SKIRTING	PVC D MOULD - GREY
COMPLEXING	-
WATERPROOFING	-
OTHER	DRY FLOOR WASTES WITH PLUGS
WALLS	
INTERNAL HEIGHT	2400mm
INTERNAL LINING	4mm POLYPLY PRE-FINISHED EMBOSSED PLYWOOD - GREY
INTERNAL TRIM	PVC D MOULD - GREY (GREY WAFER HD SCREWS)
WALL INSULATION	R1.8 (75mm)
EXTERNAL CLADDING	COLORBOND PANELRIB, LAID HORIZONTALLY - SURFMIST
EXTERNAL CORNER	HD 40x40x2.5mm D'GAL ANGLE, SILICONE SEAL WALL TO FLOOR
WALL FRAMES	
FRAMING	75 x 41 x 0.75mm G550 STEEL STUDS
STUD SPACING	400mm CTS (WIND REGION N3)
STRAP BRACING	WALLS TO FLOOR & WALLS TO CEILING STRAP BRACED EVERY 1200mm WITH 125 x 30 x 1.2mm BUILDERS STRAP - 8/18x20mm SCREWS x 4
ROOF / CEILING	
CEILING TYPE	FLAT
CEILING LINING	4mm PRE-FINISHED PLYWOOD - MIRAGE PEARL
CEILING INSULATION	R1.8 (75MM)
ROOF PITCH	2° CENTRE PITCH
ROOF CLADDING	TRIMDECK 0.42 BMT - ZINCALUME
ROOF INSULATION	-
UNDER BARGE FLASHING	ZINC
BARGE	WOODLAND GREY
GUTTER	NIL
DOWNPIPE	NIL
STEPDOWN FLASHING	30 x 60 STEP DOWNS - WOODLAND GREY
ROOF / CEILING FRAMES	
FRAMING	75 x 41 x 0.75mm G550 STEEL STUDS
STUD SPACING	400mm CTS (WIND REGION N3)
ELECTRICS	
SPECIFICATION	TO AS3000, 3001, 3012
S/W BOARD	P.O.E. LOCATED BEHIND SWITCHBOARD, POLY PLASTIC INTERNALLY MOUNTED SWITCHBOARD, 1800mm AFFL(TO CTR)

ITEMS & EQUIPMENT SCHEDULE

TAG	QTY	DESCRIPTION
A	1	FRAME FOR A/C CUT OUT - 435h x 670w FRAME OPENING & FIT A/C
		SUPPLIED BY COATES HIRE
B	2	FRAMEOUT FOR A/C, DO NOT CUT
NOTES:		COATES SIGNS - 1 / PER BUILDING @ TOP RIGHT CORNERS
		COATES ASSET TAGS - FIT BESIDE ENTRY DOOR @ LOCK
		ALLOW NOGS IN CEILINGS AND EXTERNAL WALL FOR FUTURE PARTITIONS

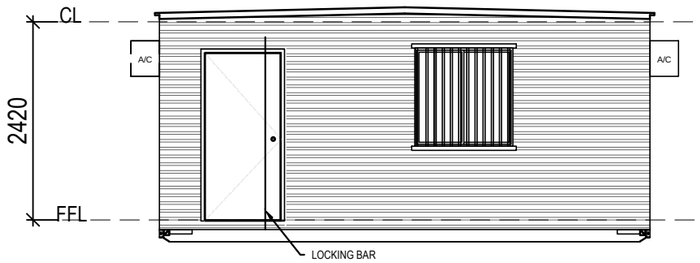


PLAN

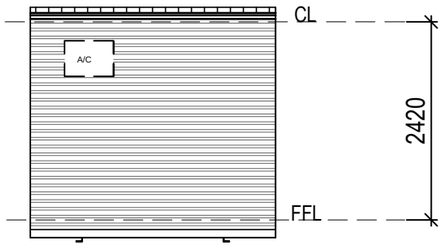


ELEVATION A

SCALE: 1:75



TYPICAL FRONT ELEVATION



TYPICAL END ELEVATION

GENERAL ARRANGEMENT

SCALE: 1:75

DOOR SCHEDULE

TAG	SIZE	QTY	LOCATION	COLOUR	FURNITURE	LOCKING	KEYING	ARCHITRAVE	GLASS	CLOSER	STOP	NOTES: "DO NOT" REBATE BOTTOM OF DOORS FOR DOOR SWING TO MISS VERANDAH DECKING
D1	2040 x 920mm	1	EXTERNAL	SURFMIST	KNOB	PASSAGE SET	-	PVC	-	NIL	YES	CABIN HOOK REBATED EDGE; SECURITY - ZINC PLATED PIVOT LOCKING BAR - BOTTOM OF BAR TO BE 5mmABOVE DOOR THRESHOLD

WINDOW SCHEDULE

TAG	SIZE H x W	QTY	LOCATION	HEIGHT	OPENING	COLOUR	KEYING	ARCHITRAVE	GLASS	BLINDS	NOTES
W1	1200 x 1180mm	2	EXTERNAL	900 AFFL	1210 x 1190mm CUT-OUT	WHITE	-	PVC	CLEAR	NIL	TAPE & SILICON SEAL TOP SIDES. GAL. SEC. BARS BOLT FIX w/NYLOC NUTS @ 4 CORNERS

ELECTRICAL LEGEND

ITEM	DESCRIPTION	HEIGHT	QTY
EDB	ELECTRICAL DISTRIBUTION BOARD	-	1
POE	ELECTRICAL SUPPLY POINT OF ENTRY	1800 AFFL	1
	2xSL 9732/40cw LED LIGHTS - SURFACE MOUNT	C/MNTD	2
	SINGLE LIGHT SWITCH	1300 AFFL	1
A	SINGLE GPO - 10 AMP DOUBLE POLE	1765 AFFL	3
B	SINGLE GPO - 10 AMP DOUBLE POLE	1765 AFFL	-
C	DOUBLE GPO - 10 AMP DOUBLE POLE	1475 AFFL	4
D	DOUBLE GPO - 10 AMP DOUBLE POLE	375 AFFL	1

coateshire

THIS SPECIFICATION TO BE COMPLIANT IN CONJUNCTION WITH THE COATES HIRE PURCHASE SPECIFICATIONS (PLANT) PART 2 - EQUIPMENT TYPE AND PART 3 - COMMON REQUIREMENTS WITH MBS MARK UPS DATED 21.06.17

FOR CONSTRUCTION

MBS modular building systems

132 WARREN RD, SMITHFIELD NSW 2164
TEL: 1800 217 131 D: (02) 8718 2500
FAX: (02) 8718 2599

PROJECT / TYPE :

SIGNATURE:

NAME: .....

DATE: .....

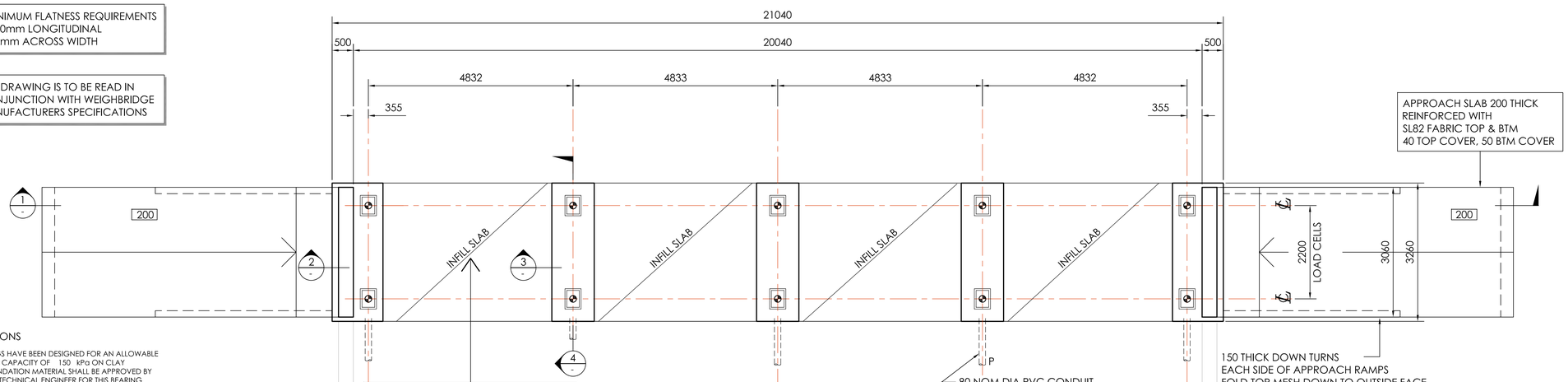
PROJECT: COATES HIRE COMMONWEALTH GAMES 6.0 x 3.0m SHELL

DATE : 15.01.2018	TITLE : PLAN- GENERAL ARRANGEMENT		
DRAWN BY : TW			
CHECKED BY : DT	DRAWING NUMBER : MS-200108-101	BUILDING NUMBER : #0000	
SCALE : SHOWN	QUOTATION NUMBER : 200108	REV : [1]	

ISSUE	AMENDMENT	BY	DATE
1	FOR CONSTRUCTION	TW	15.01.2018

MINIMUM FLATNESS REQUIREMENTS
+-10mm LONGITUDINAL
+-5mm ACROSS WIDTH

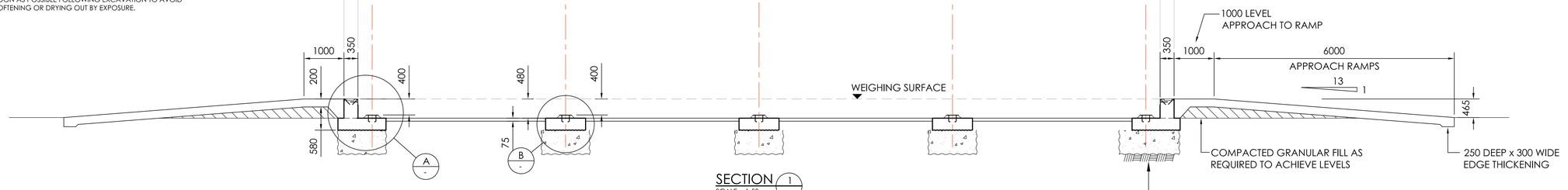
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH WEIGHBRIDGE MANUFACTURERS SPECIFICATIONS



SPB PITLESS MOUNTED WEIGHBRIDGE DIMENSIONAL LAYOUT PLAN

SCALE 1:50

CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADMIXTURE	F'c (MPa)
FOOTINGS	80	20	GP	NIL	25
INFILL SLAB	80	20	GP	NIL	25



SECTION 1 - SCALE = 1:50

FOOTINGS ARE DESIGNED TO BE FOUNDED ON CONSISTENT STRATA MIN. SBV 150kPa.
THIS MUST BE CONFIRMED ON SITE PRIOR TO CONSTRUCTING FOOTINGS.
INSTALL MASS CONCRETE BLINDING UNDER FOOTINGS TO DEPTH AS REQUIRED.

FOUNDATIONS

F1 FOOTINGS HAVE BEEN DESIGNED FOR AN ALLOWABLE BEARING CAPACITY OF 150 kPa ON CLAY
THE FOUNDATION MATERIAL SHALL BE APPROVED BY THE GEOTECHNICAL ENGINEER FOR THIS BEARING CAPACITY BEFORE PLACING MEMBRANE, REINFORCEMENT OR CONCRETE.

F2 FOOTINGS SHALL BE LOCATED CENTRALLY UNDER WALL AND COLUMNS UNLESS NOTED OTHERWISE.

F3 DO NOT EXCEED A RISE OF: 1 IN A RUN OF: 1
FOR THE LINE OF SLOPE BETWEEN ADJACENT FOOTINGS OR EXCAVATIONS.

F4 DO NOT BACKFILL RETAINING WALLS (OTHER THAN CANTILEVER WALLS) UNTIL FLOOR CONSTRUCTION AT TOP AND BOTTOM IS COMPLETED. ENSURE FREE DRAINING BACKFILL AND DRAINAGE IS IN PLACE.

F5 FOOTINGS TO BE CONSTRUCTED AND BACKFILLED AS SOON AS POSSIBLE FOLLOWING EXCAVATION TO AVOID SOFTENING OR DRYING OUT BY EXPOSURE.

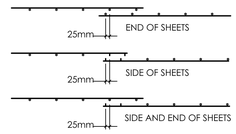
REINFORCEMENT

R1 ALL REINFORCEMENT BARS ARE TO BE D500N U.N.O.

R2 ALL REINFORCEMENT WELDED MESHES TO BE GRADE 500L U.N.O.

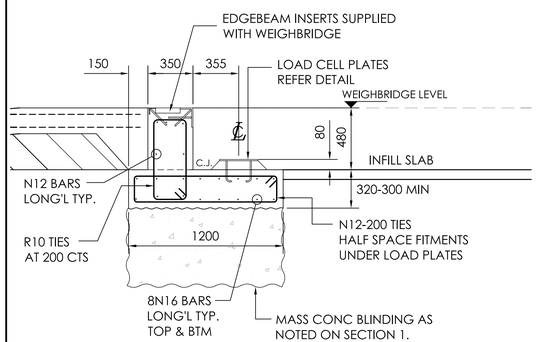
R3 WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED UNLESS SHOWN ON THE STRUCTURAL DRAWINGS OR APPROVED BY THE ENGINEER.

MINIMUM MESH LAPS

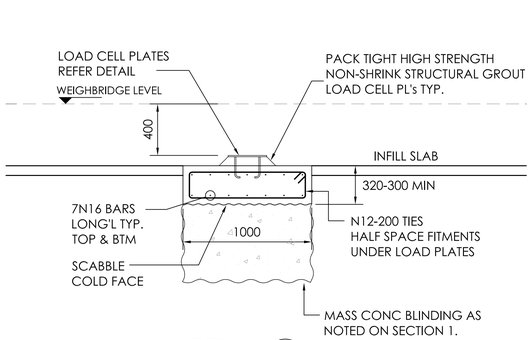


CONCRETE CONCRETE COVER

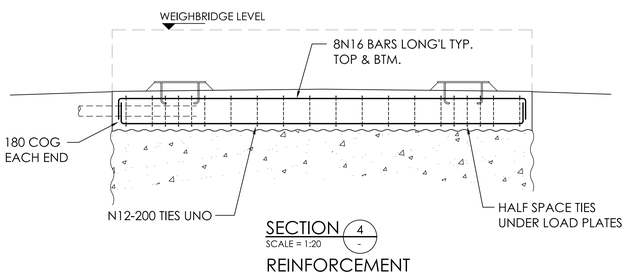
REINFORCEMENT TO HAVE THE FOLLOWING CLEAR CONCRETE COVER:
CAST AGAINST MEMBRANE = 30mm
CAST AGAINST UNPROTECTED GROUND = 50mm
INTERNAL SURFACES = 20mm
EXTERNAL SURFACES = 40mm



DETAIL A - SCALE = 1:20



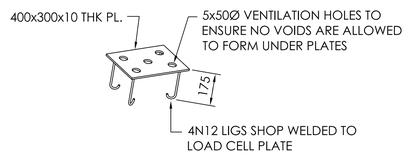
DETAIL B - SCALE = 1:20



SECTION 4 - SCALE = 1:20

REINFORCEMENT

DENOTES LOAD CELL LOCATIONS.
DESIGN POINT LOAD 16,000kg
REFER TO LOAD CELL ANCHOR PLATE DETAILS



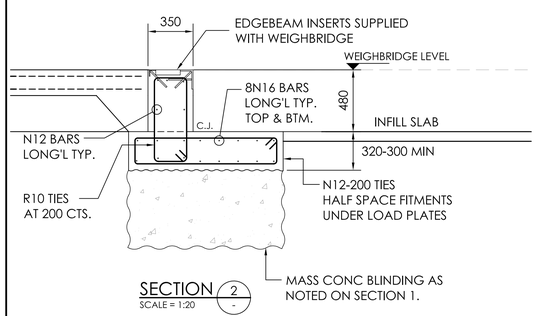
NOTE: IT IS EXTREMELY IMPORTANT TO AVOID ANY AIR POCKETS BEING FORMED UNDER THE PLATES.
USE OF HIGH STRENGTH NON-SHRINK GROUT AS REQUIRED.

LOAD CELL ANCHOR PLATE DETAILS

NTS

LOAD CELL PLATES
(ARE NOT INCLUDED IN SUPPLY)

POINT 'P'.
PROVIDE EARTH PLATE (PILE SHOE) CONNECTION AT POSITION P VIA COPPER 95 SQmm CROSS SECTION CABLE IN ORDER TO ACHIEVE AN OVERALL RESISTANCE AS NEAR AS POSSIBLE TO 1 Ω (ohm)
CONNECT EARTH OF MAIN EQUIPMENT TO EARTH PLATE AT POINT 'P' PIT WITH COPPER CABLE WITH CROSS SECTION OF 6 SQmm



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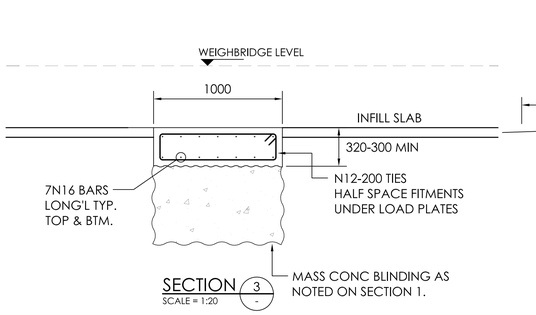

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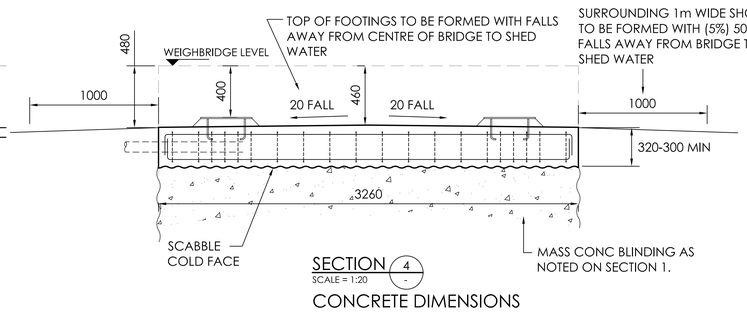

SECTION 4 - SCALE = 1:20

CONCRETE DIMENSIONS

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT B1 SHEET

500mm 0 1 2 3 4 5m
SCALE 1:50 AT B1 SHEET

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION	03.11.17	2
ISSUED FOR CONSTRUCTION	03.11.17	1
ISSUED FOR CONSTRUCTION	02.11.17	0

STATUS: FOR CONSTRUCTION

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SYDNEY | ADELAIDE | BAROSSA | DARWIN | MUDGEE

CLIENT
NATIONAL WEIGHING & INSTRUMENTS
UNIT 1, 88 MAGOWAR ROAD
GIRRAWEEN NSW
PH: (02) 8868 2222

PROJECT
SPB PITLESS MOUNTED WEIGHBRIDGE

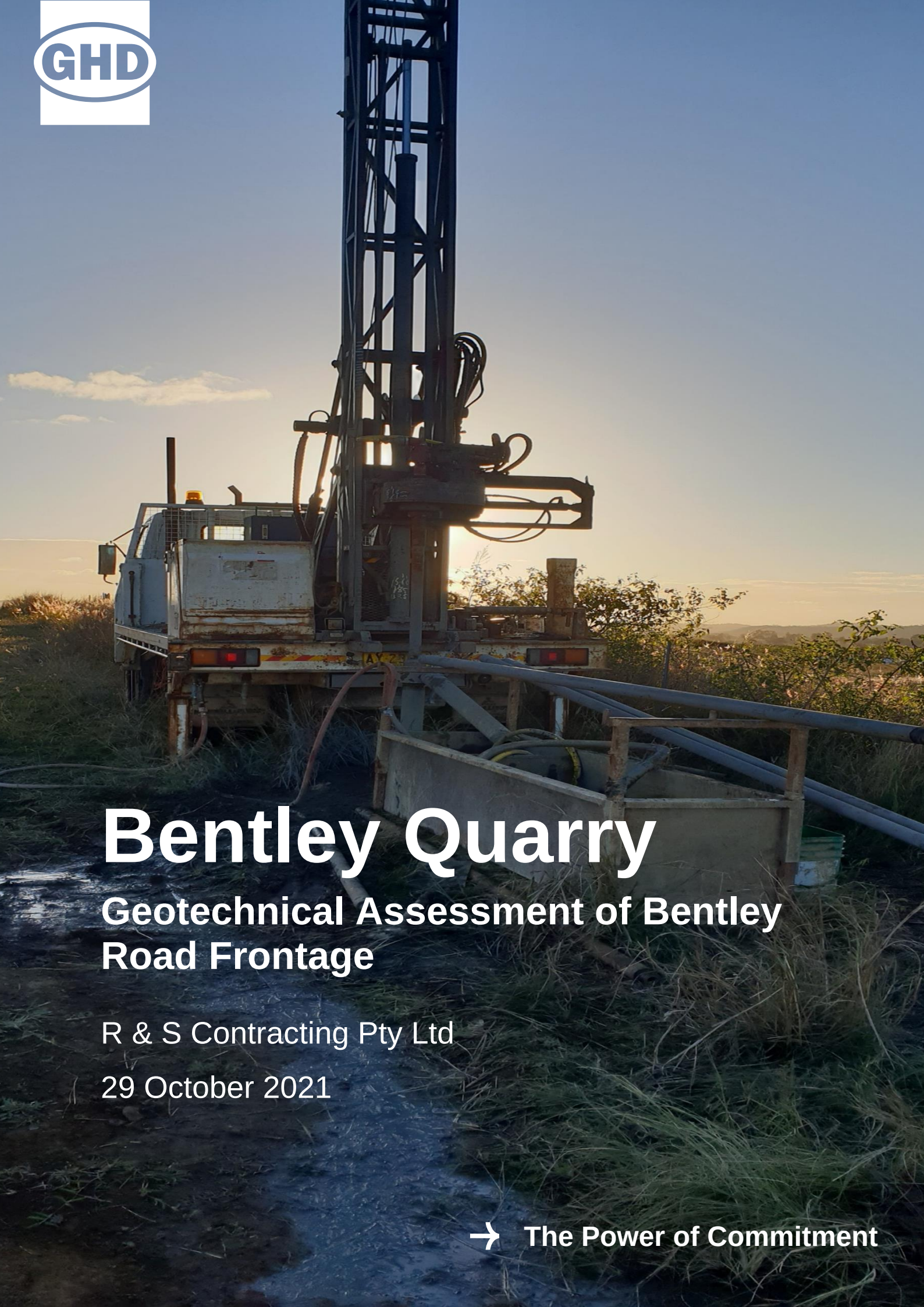
DESIGNED	DRAWN	DATE	SIZE	CAD REF
JK	FN	02.11.17	B1	TX-10281.00-S54

DRAWING TITLE
20m PITLESS MOUNTED WEIGHBRIDGE STRUCTURAL DETAILS

DRAWING No: TX10281.00 - S54
ISSUE: 2

Appendix C

Geotechnical information



Bentley Quarry

Geotechnical Assessment of Bentley Road Frontage

R & S Contracting Pty Ltd

29 October 2021

The Power of Commitment

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Printed date	29/10/2021 2:02:00 PM
Last saved date	29 October 2021
File name	https://projectsportal.ghd.com/sites/pp01_04/bentleyquarry/ProjectDocs/12547851_Bentley Quarry Frontage Geotechnical Assessment.docx
Author	James Petersen
Project manager	Ben Luffman
Client name	R & S Contracting Pty Ltd
Project name	Bentley Quarry Expansion
Document title	Bentley Quarry | Geotechnical Assessment of Bentley Road Frontage
Revision version	Rev 0
Project number	12547851

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	J Petersen	T Nicholson		S Lawer		29/10/21

Contents

Table index

Figure index

Appendices

1. Introduction

GHD was engaged by R & S Contracting Pty Ltd to undertake a geotechnical assessment of the proposed northern pit wall of Bentley Quarry. The assessment is required to determine the potential impact on Bentley Road and to provide advice and recommendations with regard to suitable long term batter slopes and set back distances between the road and quarry.

This report presents the results of the assessment.

1.1 Purpose

This report has been prepared to provide R & S Contracting Pty Ltd an assessment of the stability of the northern wall of the Bentley Quarry to allow preliminary planning of the possible bench arrangement for the proposed expansion of the quarry.

The report includes recommendations on risk management tasks that should be understood and followed prior to excavating the slope.

1.2 Limitations

This report has been prepared by GHD for R & S Contracting Pty Ltd and may only be used and relied on by R & S Contracting Pty Ltd for the purpose agreed between GHD and R & S Contracting Pty Ltd as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than R & S Contracting 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.

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

GHD has prepared this report on the basis of information provided by R & S Contracting Pty Ltd and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD 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.

2. Scope of work

The scope of the assessment comprised geotechnical assessment of the stability of the proposed northern pit wall by way of:

– A review of publicly available geological and soil maps.
– Drilling two (2) boreholes at the proposed pit margin to a depth of around 30 m below the existing ground surface level, to determine the subsurface conditions.
– Preparation of a report, that:
    - Summarises factual information from the investigation, such as boreholes logs, point load index test results and core photographs.
    - Provides a summary of the geological conditions encountered.
    - Provides an assessment of the stability of the proposed pit with specific reference to the Bentley Road reserve and pavement.
    - Provides advice on the long term batter slopes and maintenance to manage pit wall stability.

3. Methodology

3.1 Desktop study

A review of publicly available online aerial imagery, geology and soil maps was undertaken to provide an understanding of the subsurface conditions. The following sources were reviewed:

– Online State Government of NSW published soil landscape and geological information including:
  - eSPADE, Government of NSW, Environment and Heritage
  - MinView, seamless geology
– Current and old google earth images

3.2 Underground service locating

A 'Dial-Before-You-Dig' (DBYD) buried services enquiry was performed prior to the fieldwork. The obtained DBYD and utility plans were reviewed in relation to proposed test locations. Based on the available information the borehole locations were considered not to impact underground utilities near the site. Hence, electromagnetic field scanning was not required to clear proposed test locations.

3.3 HSE documentation

A project specific Health, Safety and Environment (HSE) Plan, including a Job Safety and Environment Analysis (JSEA) and a reviewed subcontractor Safe Work Method Statement (SWMS), was prepared and approved prior to conducting the fieldwork. All project site staff were inducted into the JSEA prior to commencing fieldwork by the GHD supervisor, who also conducted daily pre-work safety assessments.

3.4 Fieldwork

Subsurface investigations comprising the drilling of two (2) boreholes was undertaken between 12 July and 16 July 2021. The locations of the boreholes are shown on Figure A1 in Appendix A.

The boreholes were drilled using auger drilling techniques in soils and NMLC diamond coring techniques in rock with a truck mounted drilling rig supplied and operated by MRD Drilling Pty Ltd.

A groundwater piezometer was installed in borehole BH01 to a depth of 27.5 m to allow the measuring and sampling of ground water in future, if required.

The fieldwork was supervised by a scientist from GHD who was responsible for positioning the boreholes, logging the encountered strata, collecting representative soil samples, boxing and photographing recovered core. The logging was carried out in general accordance with Australian Standard, AS1726-2017.

Upon completion of the fieldwork, point load index (PLI) testing was undertaken in a storage area off site. The core was kept at natural moisture content until PLI testing was completed.

4. Results of the investigation

4.1 Desktop study

Reference to eSpade indicates the quarry site is located within the McKee (9450mc) soil landscape which comprises low undulating hills and rises with relief of 30 m to 50 m and slopes of up to 10% (~5°) related to tertiary basalts. The landscape is typically extensively cleared and comprises grassland with sporadic stands of mature trees. Soils are generally shallow, high plasticity and highly reactive.

The quarry and associated access comprise the Disturbed soil landscape (9450xx).

Reference to Tweed Heads 1:250,000 geological mapsheet indicates the site is underlain by residual soil and weathered basalt rock of the Tertiary aged Lismore Basalt (Lamington Volcanics). No significant geological structures (faults / folding) were evident from the available geological information.

The Minview website indicates that groundwater bores installed in sandstone, located 1.4 km southwest and 1.2 km east of the site encountered ground water at a depth of 7.3 m and 5.4 m below ground surface level respectively. No elevation data was available for the bores.

Based on historical google imagery, the current extents of the quarry, including the northern quarry face, were developed in late 2020 or early 2021. The crest of the northern quarry face is offset by <10 m from the crest of the Bentley Road cut.

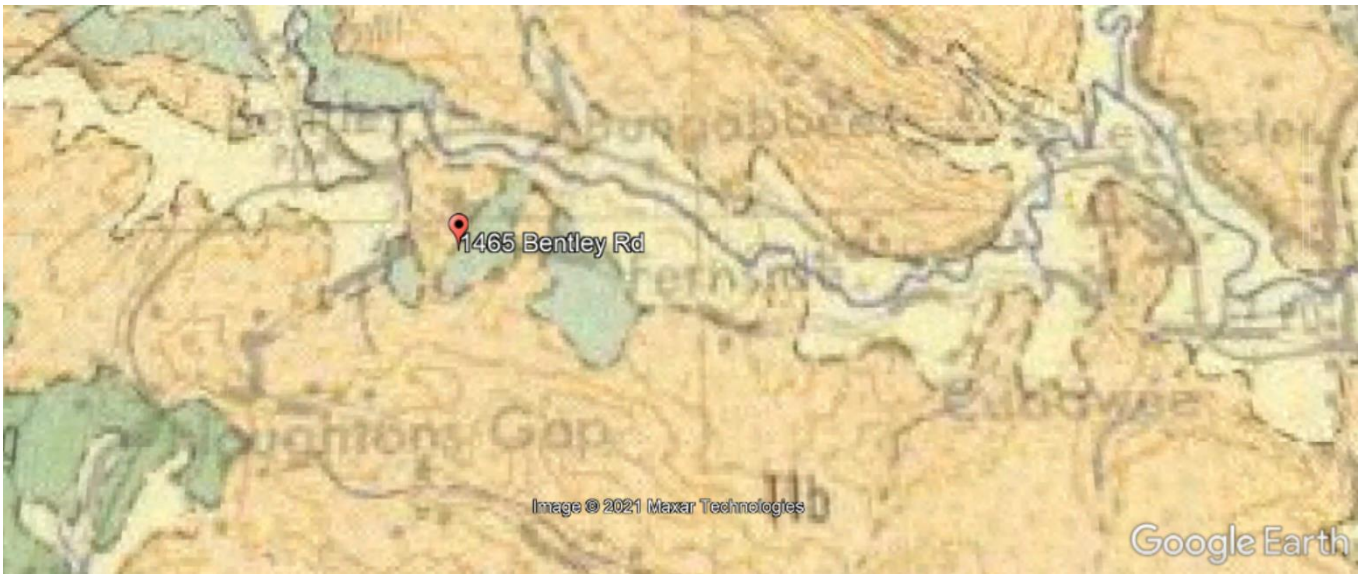


Figure 4.1 Excerpt of Tweed Heads 1:250,000 scale mapsheet (GSNSW, 1963)

4.2 Site location and surface conditions

The site is located at 1465 Bentley Road, Bentley, approximately 15 km west of Lismore.

The land surrounding the site is undulating and rises to a ridgeline to the south.

Access to the site is via Bentley Road. The site consists of cleared land, except for isolated native trees located in adjacent fields, and is currently being used as a quarry and cattle grazing. The existing quarry has a disturbance area of approximately 1 ha and comprises a single ~6 m high cut batter (refer to Figure 4.2).

A dwelling is located approximately 360 m to the south of the quarry.

Cattle grazing is the main use surrounding the site, with some cropping and plantation forestry beyond this use.

Adjacent to the site, Bentley Road comprises a single lane, bidirectional road within a cutting. It is understood that the road is >50 years old (refer to Figure 4.3).

Figure 4.2 Existing quarry looking north-west

Figure 4.3 Photograph of cutting on Bentley Road adjacent to the quarry site

4.3 Subsurface conditions

4.3.1 Exposures

Quarry and road cutting exposures show a strongly jointed, highly weathered basalt rockmass. Major joint sets observed in cuttings comprise:

– J1 – sub-vertical, northwest to north-northwest striking, generally rough, undulating joint set spaced up to 0.5 m and relatively persistent (extends the full height of the exposure)
– J2 – sub-vertical, northeast to north northeast striking, rough, undulating joint set spaced up to 0.5 m and relatively persistent (extends the full height of the exposure)
– J3 – Sub-vertical, east-northeast striking, undulating, rough joint set, unknown spacing and potentially less persistence than joint sets J1 and J2.

Remaining joints appear to be formed from weathering of the rockmass, which was notably spheroidal in some areas.

Both the quarry and the road batters have been cut steeply (between 70° and vertical). An apron of sand and gravel sized fragments has accumulated at the base of the batters, presumably from material that has been released from the face. On the quarry side of the cut, the apron of material has formed over the past 8 to 12 months. Photographs of typical quarry face conditions are shown in Figure 4.4.

Figure 4.4 Photographs showing rockmass conditions exposed in northern quarry face

4.3.2 Boreholes

Reference to the engineering logs in Appendix C should be made for a detailed description of the subsurface conditions encountered. Test procedures, classification methods and descriptive terms are discussed in the Standard Sheets in Appendix B.

The investigation comprised drilling of two boreholes between the quarry and Bentley Road. The locations of the boreholes are shown on Figure A1 in Appendix A.

The subsurface conditions in the boreholes may be summarised as:

– 0.1 m to 0.15 m thick layer of clay topsoil.
– Residual, low to high plasticity CLAY to a depth of between 0.2 m and 0.45 m.
– Extremely weathered, very low to low strength, fine grained, dark brown BASALT to a depth of between 2.56 m to 2.7 m.
– Variably weathered (ranging from extremely weathered to fresh) fine grained BASALT of variable strength (generally low to very high strength), extremely close (<20 mm) to closely (60 mm to 600 mm) spaced joints to depths of 7.2 m (BH01) and 13 m (BH02).
– Slightly and fresh, high to extremely high strength, fine grained BASALT to 30 m and 30.4 m.

The profile includes sections of sandstone that occur as fresh, low and medium strength lenses from 13.7 m to 15.8 m in borehole BH01 and, highly weathered, low strength from 7.08 m to 8.04 m in borehole BH02. Borehole BH01 also includes fresh very low to low-medium strength metasandstone lenses that occur from 16.8 m to 17.35 m and 29.26 m to 29.79 m. It is noted that borehole BH01 also included significant sections of core loss from 14.42 m to 16.80 m.

5. Expected rockmass conditions and recommendations

5.1 Rockmass conditions and potential modes of failure

Subsurface conditions encountered in borehole BH01 and BH02 and the exposed cuts within the quarry and on Bentley Road indicate the rockmass includes significant sections of highly weathered, very low and low strength, extremely close to closely jointed basalt, with some notably weak zones (clay seams / core loss) to a depth of between 11 m (encountered in borehole BH02) and 17 m (encountered in BH01), over high to extremely high, slightly weathered to fresh, medium to widely jointed basalt to a depth of >30 m.

Existing cuts are very steep, between 70° and vertical, and have presumably been relatively stable for the life of the road (>50 years) and quarry (~1 year) excavations. In this time material, predominantly comprising sand and gravel sized fragments of rock, has fallen from the batters and accumulated at the base.

Based on the results of the investigation, the rockmass for the full depth of the quarry may be divided into two separate sections of rockmass (depths are in metres below existing natural ground surface level). Table 5.1 summarises the rockmass properties and potential failure modes that may impact on the stability of the northern batter of the proposed quarry.

Table 5.1 Summary of rockmass and potential failure modes

Depth (m) [1]		Rockmass conditions	Potential failure modes and stability notes
From	To		
0	11 / 17	Variably (highly) weathered very low to low strength, highly jointed basalt	**Progressive** disintegration of rockmass Shallow **wedge** and **planar** failure Stability will be dependant on final cut batter slope angle, good cut practice and surface water management
11 / 17	30	Slightly weathered / fresh, high to extremely high strength, medium to widely spaced joints	**Toppling** – caused by bench scale **Wedge** – steep defect sets (J1, J2) dipping out of the slope intersecting releasing rock from slope, relatively shallow (~0.5 m) bench scale failure, managed during operation and likely to be retained bench **Planar** – caused by steep defect set (J3) dipping out of the slope, bench scale failure, managed during operation and likely to be retained bench

Given the potential 30 m final overall wall height, high intact rock strength and relatively wide defect spacing (and hence lower likelihood of interconnecting defects) stresses in the slope are not considered to be sufficient to cause failure through the rockmass. Hence, full quarry wall scale rockmass failure is not considered to be a likely form of slope failure that may affect the quarry. Wall scale failure would rely on a significant geological structure (shear, fault or similar) to form a continuous plane or planes of weakness for failure to initiate.

Smaller scale, bench sized failures however could occur if the cut slopes are too high or too steep. Potential wedge and toppling and planar failures could occur within individual benches, if the cut geometry is too aggressive.

5.2 Recommended setback and slope geometry

In general, observations indicate that the current northern cut batter comprises a highly fractured, highly weathered rockmass that is currently subject to spauling and shallow wedge / planar failure due to steeply (>70°) dipping joint sets. Based on the subsurface information in boreholes BH1 and BH2, it is expected that the highly weathered rockmass conditions may extend to a depth of 11 m to 17 m.

Between 11 m to 17 m below ground surface the rockmass conditions improve, comprising slightly weathered fresh, high to very high strength basalt with medium or greater defect spacing. Failure modes are expected to be limited to shallow wedge and potentially shallow planar failures that would be expected to be managed during excavation with mechanical batter scaling.

Due to the location of Bentley Road, the objective of the northern quarry wall design would be to provide batter slopes that will remain stable and not be prone to erosion for well in excess of 100 years (i.e. for the life of the road or any development beyond the road reserve boundary). Therefore, the basis for the batter design would be to allow sufficient setback from the road reserve to allow for the construction of a safety bund (preventing access to the quarry crest) and an exclusion zone to allow for potential further weathering and instability.

Guideline for the provision of exclusion zones for abandoned open pits are provided by the Western Australian and Victorian State Governments. Of the two, the guide provided by the WA Department of Industry and Resources (WA DoIR, formerly the Department of Mines and Petroleum) is the most prescriptive. Based on tension crack measurements around open pits, the maximum area of potentially unstable rock mass was developed:

– 25° for rock masses up to moderately weathered
– 45° for unweathered rock (including slightly weathered materials)

Based on the performance of the existing road cutting it is considered that the WA DoIR guide is a pragmatic approach to use in this case.

Based on a 17 m highly weathered rockmass depth (equivalent to a depth of approximately 14 m from existing quarry floor), it is recommended a 15 m setback between the quarry crest and road reserve boundary is adopted. This will allow for a 2 m high bund (5 m wide base) to be placed adjacent to the road reserve boundary and offset 10 m from the quarry crest (refer to Option A in Figure A2 in Appendix A).

It is recommended that the quarry should be excavated to allow for final batter slope of 54° in the variably (highly) weathered rockmass, and include a 3 m wide bench where batter slopes exceed a height of 7 m. In slightly weathered or better rockmass conditions, it is recommended that batter slopes are developed to a maximum inter-bench angle of 65° (i.e. two vertical faces with a minimum bench width of 3 m).

If a reduced setback distance (say 10 m) from the road reserve boundary is preferred, more geotechnical information would be required to confirm assumed failure modes. This additional information, such as defect alignment / spacing / persistence, rockmass variability, presence or absence of faults and / or other major structures, may be gathered by mapping the quarry face once exposed.

Option B (refer to Figure A3 in Appendix A), shows a potential quarry profile with a 10 m minimum setback from the road reserve (representing greater confidence in data) and highly weathered rockmass to only 11 m deep (approximately 7 m below the existing quarry floor). Development of Option B is subject to confirmation of actual rockmass conditions by geotechnical mapping at a quarry wall / batter scale as the quarry is progressed.

We note that proceeding to Option B on the initial excavation would not be recommended. Given the proximity of the property boundary and Bentley Road, excavation to Option A prior to considering pushing back the quarry faces to meet Option B geometry is more prudent. This would allow clear understanding of the rock mass and properties of the materials along the quarry boundary prior to committing to a steeper slope. If the quarry were developed initially to the geometry of Option B there would be an elevated risk that mechanical support could be required if the conditions were found to be poor. Such support could entail extensive rock bolting and soil nailing and would be very costly.

5.3 Geological review and drainage design and maintenance

The recommendations in this report are pursuant to the implementation of good drainage design and the requirement for periodic review of geological conditions and maintenance of drainage systems. The following sections delineate the minimum standards expected to be required to achieve the recommendations in this report.

5.3.1 Specialist Geological Review

We recommend that as benches progress geological review is undertaken to review the rock mass integrity, jointing and weathering to check that adverse conditions do not affect the stability of the slopes. It is possible that conditions could vary from that expected in this report and as a consequence batter slope design may need to be altered as quarrying progresses.

As a minimum a geological review should be undertaken with the excavation of each bench.

5.3.2 Routine review

Routine review of pit wall stability and maintenance conditions should be undertaken monthly.

The Quarry Manager should document a walkover around the crest of the slope adjacent to Bentley Road reserve searching for signs of slope movement and poor surface water control. Any surface water control issues should be remediated immediately. Where tension cracks, hummocky or broken ground or ground movements are noted or suspected specialist geological review should be sought immediately.

5.3.3 Drainage design and maintenance

The design of the pit walls must include the provision for drainage of surface water away from the walls around the crest of the slopes. This can be achieved by:

1. Installation of a drainage bund around the crest of the quarry to stop all run on water flowing into the quarry.
2. Sloping of benches back into the hillside and then draining the benches to a common point where water can be transferred down the slope over competent rock mass, typically at a location where two pit walls meet or at the location of the entry and exit ramp.
3. Maintenance of the drainage system shall be undertaken on a routine basis. It is recommended that monthly inspection of the drainage measures be recorded and that all breaches and dilapidation of the drainage measures be repaired immediately as they are noted.

Good maintenance of the pit walls will improve the stability of the slopes (compared to un-maintained slopes) and will reduce the rate of rockfalls into the working quarry.

6. Conclusions

– Existing onsite cuttings in highly weathered / highly fractured rockmass are relatively stable at near vertical batter slopes.
– The development of the quarry wall will need to consider long-term slope stability and include suitable setback distance from the road reserve boundary to allow for construction of a safety bund and exclusion zone to the final quarry crest.
– Subsurface conditions are variable to a depth of at least 17 m below the ground surface level.
– Two potential final quarry profiles have been provided:
    - Option A is based on highly weathered rockmass conditions to a depth of 17 m and a minimum setback from the road reserve of 15 m.
    - Option B, may potentially be adopted once enough of the quarry wall has been excavated and exposed and additional mapping is undertaken at a wall / batter scale by an experienced engineering geologist to confirm wall conditions are consistent with the Option B profile.

It is recommended that Option A profile is adopted until engineering geological mapping of the northern wall can be undertaken and wall conditions confirmed.

Appendices

Appendix A

Figures

GHD

R & S Contracting Pty Ltd
Bentley Quarry
Geotechnical Assessment of Bentley Road Frontage

Borehole Location Plan

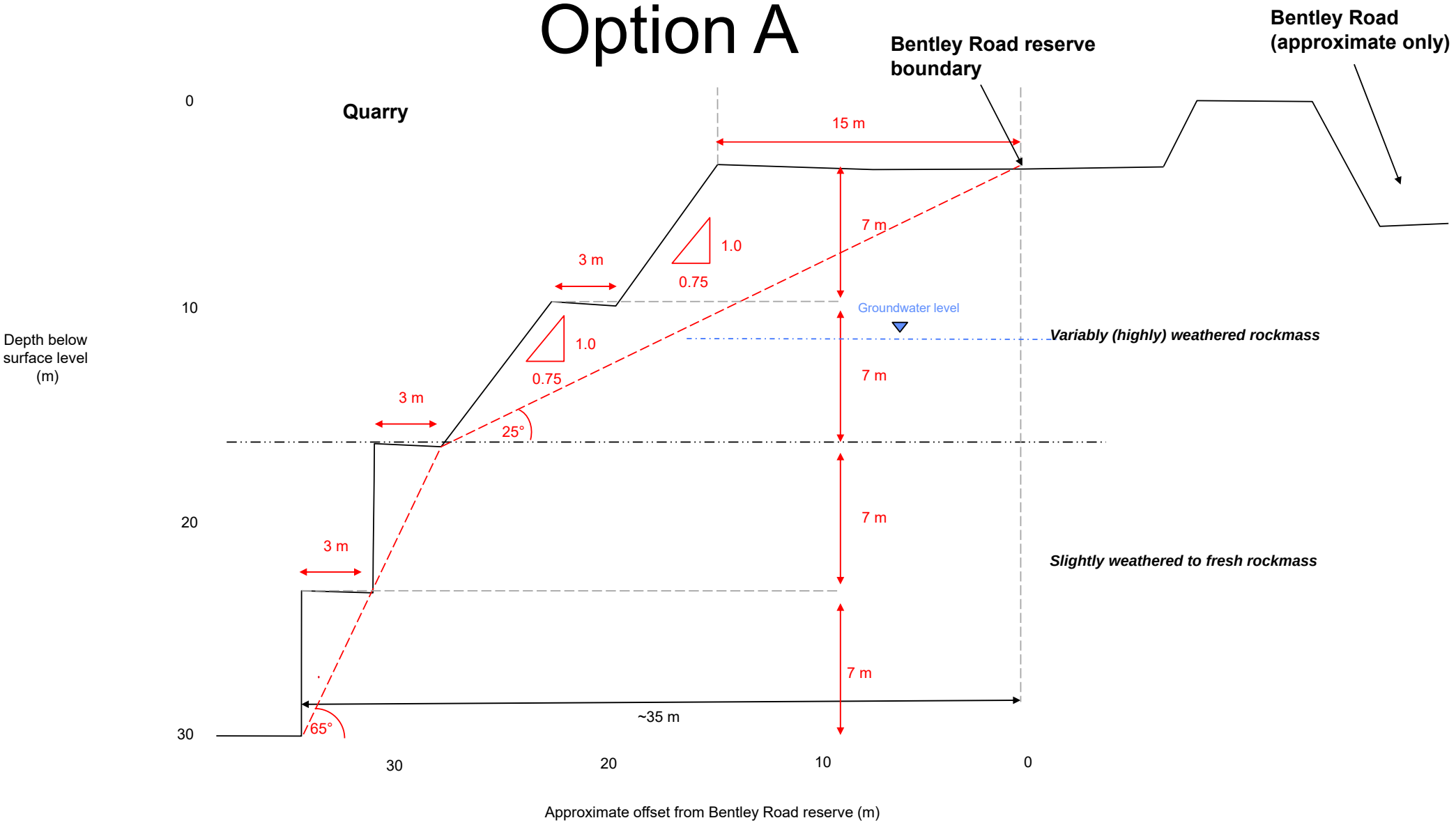
scale | NA date | August 2021

job no | 12545019
file ref | Figures.ppt

Figure A1

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 T 61 2 49 79 9999 F 61 2 49 79 9988 Web www.ghd.com.au

Option A



R & S Contracting Pty Ltd
Bentley Quarry
Geotechnical Assessment of Bentley Road Frontage

Sketch of longterm batter slope geometry

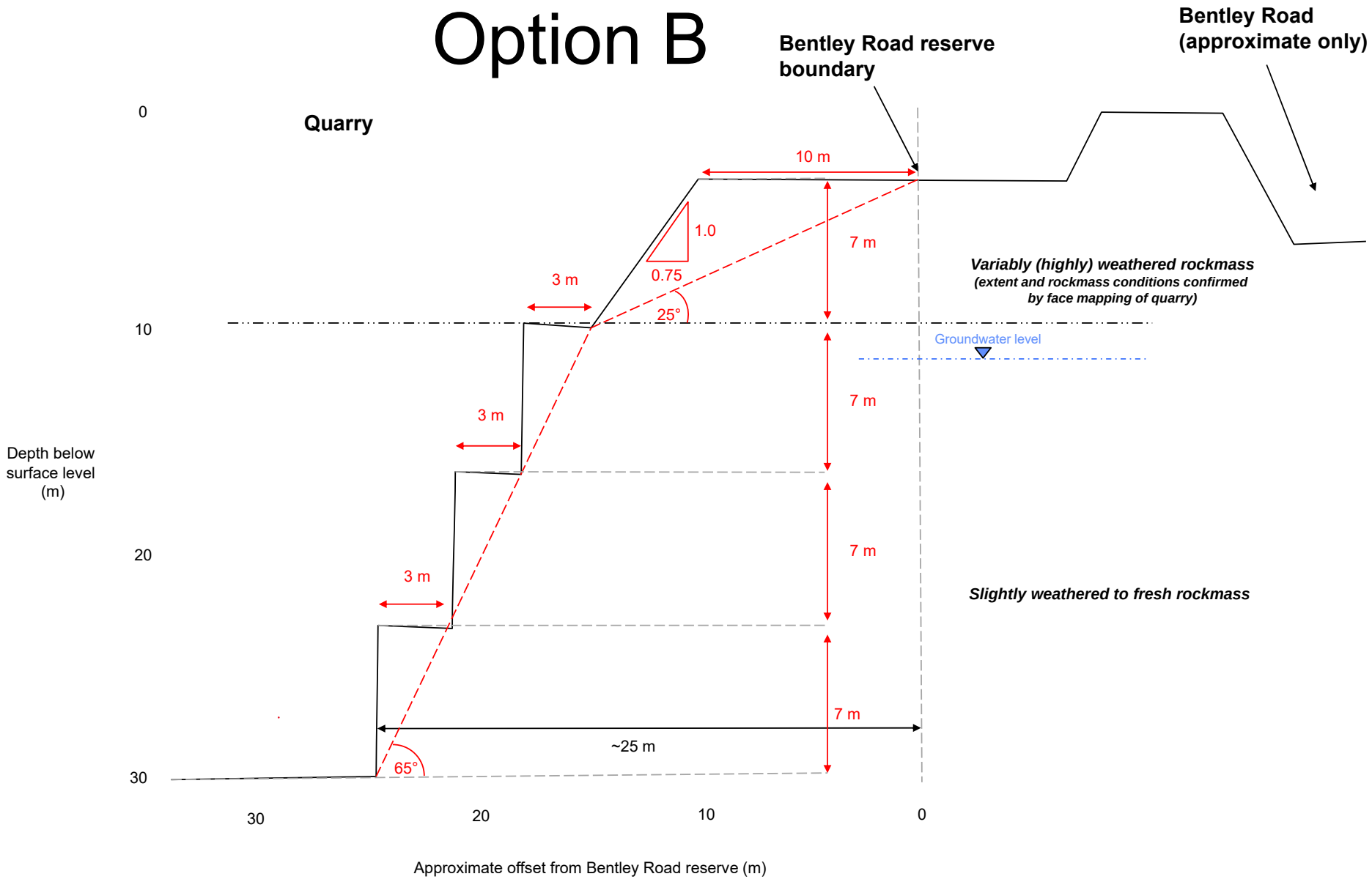
scale | As Shown | date | August 2021

job no | 12545019
file ref | Figures.ppt

Figure A2

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 T 61 2 49 79 9999 F 61 2 49 79 9988 Web www.ghd.com.au

Option B



R & S Contracting Pty Ltd
Bentley Quarry
Geotechnical Assessment of Bentley Road Frontage

Sketch of alternate long term batter slope geometry

scale | As Shown date | August 2021

job no | 12545019
file ref | Figures.ppt

Figure A3

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Appendix B

Standard sheets

GENERAL NOTES

GHD
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The report contains the results of a geotechnical investigation or study conducted for a specific purpose and client. The results may not be used or relied on by other parties, or used for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the report are excluded unless they are expressly stated to apply in the report.

TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information. Moreover, the location of test holes should be considered approximate, unless noted otherwise (refer report). Reference should also be made to the relevant standard sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

GROUNDWATER

Unless otherwise indicated, the water depths presented on the test hole logs are the depths of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater depth may differ from this recorded depth depending on material permeabilities (i.e. depending on response time of the measuring instrument). Further, variations of this depth could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities such as a change is ground surface level. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate surveys, instrumentation techniques and monitoring programmes.

INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data, often with only approximate locations (e.g. GPS). Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

CHANGE IN CONDITIONS

Local variations or anomalies in ground conditions do occur in the natural environment, particularly between discrete test hole locations or available observation sites. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural processes.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to GHD for appropriate assessment and comment.

GEOTECHNICAL VERIFICATION

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system and/or to conduct monitoring as a result of this natural variability. Allowance for verification by appropriate geotechnical personnel must be recognised and programmed for construction.

FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate. The estimate is influenced, and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

REPRODUCTION OF REPORTS

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions must include at least all of the relevant test hole and test data, together with the appropriate Standard Description sheets and remarks made in the written report of a factual or descriptive nature.

Ref: DS5.5.1 Issue 0 Date: 05/10/2018

SOIL DESCRIPTION AND CLASSIFICATION

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Soil is described in general accordance with Australian Standard AS 1726-2017 (Geotechnical Site Investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines soil as particulate materials that occur in the ground and can be disaggregated or remoulded by hand in air or water without prior soaking. Classification of the soil is undertaken following description.

SOIL DESCRIPTION

The soil description includes a) Composition, b) Condition, c) Structure, d) Origin and e) Additional observations. 'FILL', 'TOPSOIL' or a 'MIXTURE OF SOIL AND COBBLES / BOULDERS' (with dominant fraction first) is denoted at the start of a soil description where applicable.

a) Soil Composition (soil name, colour, plasticity or particle characteristics, secondary and then minor components)

Soil Name: A soil is termed a *coarse grained soil* where the dry mass of sand and gravel particles exceeds 65% of the total. Soils with more than 35% fines (silt or clay particles) are termed *fine grained soils*. The soil name is made up of the primary soil component (in BLOCK letters), prefixed by applicable secondary component qualifiers. Minor components are applied as a qualifiers to the soil name (using the words 'with' or 'trace').

Particles are differentiated on the basis of size. 'Boulders' and 'cobbles' are outside the soil particle range, though their presence (and proportions) is noted. While individual particles may be designated as silt or clay based on grain size, fine grained soils are characterised as silt or clay based on tactile behaviour or Atterberg Limits, and not the relative composition of silt or clay sized particles.

Colour: The prominent colour is noted, followed by (spotted, mottled, streaked etc.) then secondary colours as applicable. Roughly equally proportioned colours are prefixed by (spotted, mottled, streaked etc.). Colour is described in its moist condition, though both wet and dry colours may also be provided if appropriate.

Plasticity: Fine grained soils are designated within standard ranges of plasticity based on tactile assessment or laboratory assessment of the Liquid Limit.

Particle Characteristics: The particle shape, particle distribution and particle size range within a coarse grained soil is described using standard terms. Particle composition may be described using rock or mineral names, with specific terms for carbonate soils.

Secondary and Minor Components: The primary soil is described and modified by secondary and minor components, with assessed ranges as tabulated.

Carbonate Soils: Carbonate content can be assessed by use of dilute '10%' HCl solution. Resulting clear sustained effervescence is interpreted as a *Carbonate soil* (approximately >50% carbonate), while weak or sporadic effervescence indicates *Calcareous soil* (< 50% carbonate). No effervescence is interpreted as a non-calcareous soil.

Organic and Peat Soils: Where identified, organic content is noted. *Organic soil* (2% to 25% organic matter) is usually identified by colour (usually dark grey/black) and odour (i.e. 'mouldy' or hydrogen sulphide odour). *Peat* (>25% organic matter) is identified by a spongy feel and fibrous texture. Peat soils' decomposition may be described as '*fibrous*' (little / no decomposition), '*pseudo-fibrous*' (moderate decomposition) or '*amorphous*' (full decomposition).

Fraction	Components		Particle Size (mm)
Oversize	BOULDERS		> 200
	COBBLES		63 - 200
Coarse grained soil particles	GRAVEL	Coarse	19 - 63
		Medium	6.7 -19
		Fine	2.36 - 6.7
	SAND	Coarse	0.6 - 2.36
		Medium	0.21 - 0.6
		Fine	0.075 - 0.21
Fine grained soil particles	SILT		0.002 - 0.075
	CLAY		< 0.002

Plasticity Terms (Fine Grained Soils)		Laboratory Liquid Limit Range
Silt	**Clay**	
N/A	N/A	(Non Plastic)
Low Plasticity	*Low Plasticity*	≤ 35%
	Medium Plasticity	> 35% and ≤ 50%
High Plasticity	*High Plasticity*	> 50%

Particle Distribution Terms (Coarse Grained Soils)	
Well graded	good representation of all particle sizes
Poorly graded	one or more intermediate sizes poorly represented
Gap graded	one or more intermediate sizes absent
Uniform	essentially of one size

Particle Shape Terms (Coarse Grained Soils)		
Rounded	*Sub-angular*	*Flaky or Platy*
Sub-rounded	*Angular*	*Elongated*

Secondary and Minor Components for Coarse Grained Soils			
Fines (%)	**Modifier** (as applicable)	**Accessory coarse (%)**	**Modifier** (as applicable)
≤ 5	*'trace silt / clay'*	≤ 15	*'trace sand / gravel'*
> 5, ≤ 12	*'with clay / silt'*	> 15, ≤ 30	*'with sand / gravel'*
> 12	*prefix 'silty / clayey'*	> 30	*prefix 'gravelly / sandy'*

Secondary and Minor Components for Fine Grained Soils	
% Coarse	**Modifier** (as applicable)
≤ 15	add *"trace sand / gravel"*
> 15, ≤ 30	add *"with sand / gravel"*
> 30	prefix soil *"sandy / gravelly"*

Ref: DS6.5.1.1 Rev 0 Date: 2/03/2018

SOIL DESCRIPTION AND CLASSIFICATION

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b) Soil Condition (moisture, relative density or consistency)

Moisture: Fine grained soils are described relative to plastic or liquid limits, while coarse grained soils are assessed based on appearance and feel. The observation of seepage or free water is noted on the test hole logs.

Moisture - Coarse Grained Soils

Term		Tactile Properties
Dry	*('D')*	Non-cohesive, free running
Moist	*('M')*	Feels cool, darkened colour, tends to stick together
Wet	*('W')*	Feels cool, darkened colour, tends to stick together, free water forms when handling

Moisture - Fine Grained Soils

Term		Tactile Properties
Moist, dry of plastic limit	*('w < PL')*	Hard and friable or powdery
Moist, near plastic limit	*('w ≈ PL')*	Can be moulded
Moist, wet of plastic limit	*('w > PL')*	Weakened, free water forms on hands with handling
Wet, near liquid limit	*('w ≈ LL')*	Highly weakened, tends to flow when tapped
Wet, wet of liquid limit	*('w > LL')*	Liquid consistency, soil flows

Relative Density (Non Cohesive Soils): The Density Index is inherently difficult to assess by visual or tactile means, and is normally assessed by penetration testing (e.g. SPT, DCP, PSP or CPT) with published correlations. Assessment may be affected by moisture and *in situ* stress conditions. Density Index assessment may be refined by combination of *in situ* density testing and laboratory reference maximum and minimum density ranges.

Consistency (Cohesive Soils): May be assessed by direct measurement (shear vane, CPT etc.), or approximate tactile correlations. Cohesive soils include fine grained soils, and coarse grained soils with sufficient fine grained components to induce cohesive behaviour. A 'design shear strength' must consider the mode of testing, the *in situ* moisture content and potential for variations of moisture which may affect the shear strength.

Relative Density (Non-Cohesive Soils)

Term and (Symbol)		Density Index (%)
Very Loose	*(VL)*	≤ 15
Loose	*(L)*	> 15 and ≤ 35
Medium Dense	*(MD)*	> 35 and ≤ 65
Dense	*(D)*	> 65 and ≤ 85
Very Dense	*(VD)*	> 85

Consistency assessment can be influenced by moisture variation.

Consistency (Cohesive Soils)

Term and (Symbol)		Tactile Properties	Undrained Shear Strength
Very Soft	*(VS)*	Extrudes between fingers when squeezed	< 12 kPa
Soft	*(S)*	Can be moulded by light finger pressure	12 - 25 kPa
Firm	*(F)*	Can be moulded by strong finger pressure	25 - 50 kPa
Stiff	*(St)*	Cannot be moulded by fingers	50 - 100 kPa
Very Stiff	*(VSt)*	Can be indented by thumb nail	100 - 200 kPa
Hard	*(H)*	Can be indented with difficulty by thumb nail	> 200 kPa
Friable	*(Fr)*	Easily crumbled or broken into small pieces by hand	-

c) Structure (zoning, defects, cementing)

Zoning: The *in situ* zoning is described using the terms below. *'Intermixed'* may be used for an irregular arrangement.

'layer' (a continuous zone across the exposed sample)

'lens' (a discontinuous layer with lenticular shape)

'pocket' (an irregular inclusion of different material).

'interbedded' or *"interlaminated"* (alternating soil types)

Defects: Described using terms below, with dimension orientation and spacing described where practical.

'parting' (an open or closed surface or crack sub parallel to layering with little / no tensile strength - open or closed)

'fissure' (as per a parting, though not parallel or sub parallel to layering – may include desiccation cracks)

'sheared seam' (zone of sub parallel near planar closely spaced intersecting smooth or slickensided fissures dividing the mass into lenticular or wedge shaped blocks)

'sheared surface' (a near planar, curved or undulating smooth, polished or slickensided surface, indicative of displacement)

'softened zone' (in clayey soils, usually adjacent to a defect with associated higher moisture content)

'tube' (tubular cavity, singly or one of a large number, often formed from root holes, animal burrows or tunnel erosion)

'tube cast' (an infilled tube – infill may vary from uncemented through to cemented or have rock properties)

'infilled seam' (sheet like soil body cutting through the soil mass, formed by infilling of open defects)

Cementation: Soils may be cemented by various substances (e.g. iron oxides and hydroxides, silica, calcium carbonate, gypsum), and the cementing agent shall be identified if practical. Cemented soils are described as:

'weakly cemented'	easily disaggregated by hand in air or water
'moderately cemented'	effort required to disaggregate the soil by hand in air or water

Materials extending beyond '*moderately cemented*' are encompassed within the rock strength range. Where consistent cementation throughout a soil mass is identified as a duricrust, it is described in accordance with duricrust rock descriptors. Where alternate descriptors of cementation development are applied for consistency with regional practices or geology, or client requirements, these are outlined separately.

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Rock is described in general accordance with Australian Standard AS 1726-2017 (Geotechnical site investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines rock as any aggregate of minerals and/or organic materials that cannot be disaggregated by hand in air or water without prior soaking. The rock description and classification distinguishes between rock material, defects, structure and rock mass.

ROCK DESCRIPTION AND CLASSIFICATION

a) Description of rock material (rock name, grain size and type, colour, texture and fabric, inclusions or minor components, moisture content and durability)

Rock Name: Simple rock names are used to provide a reasonable engineering description rather than a precise geological classification. The rock name is chosen on the basis of origin, with common types summarised below. Additional, non-exhaustive, terminology is included in AS 1726. Rock names not described within AS 1726 may be adopted, with geological characteristics typically noted within accompanying text.

<table>
<tr><th rowspan="2">Grain Size (mm)</th><th colspan="4">Sedimentary</th><th colspan="2">Metamorphic</th><th colspan="3">Igneous</th></tr>
<tr><th colspan="2">Clastic or Detrital</th><th colspan="2">Carbonate</th><th rowspan="2">Pyroclastic</th><th rowspan="2">Foliated</th><th rowspan="2">Non-Foliated</th><th rowspan="2">Felsic</th><th rowspan="2">↔</th><th rowspan="2">Mafic</th></tr>
<tr><th colspan="2"></th><th>Low Porosity</th><th>Porous</th></tr>
<tr><td>>2.0</td><td colspan="2">CONGLOMERATE
(rounded grains in a finer matrix)

BRECCIA
(angular or irregular fragments in a finer matrix)</td><td rowspan="4">LIMESTONE
(Predominantly $CaCO_3$)

or

DOLOMITE
(Predominantly $CaMgCO_3$)</td><td>CALCIRUDITE</td><td>AGGLOMERATE
(rounded grains in a finer matrix)

VOLCANIC BRECCIA
(angular fragments in a finer matrix)</td><td>GNEISS</td><td>MARBLE
(carbonate)

QUARTZITE</td><td>GRANITE</td><td>DIORITE</td><td>GABBRO</td></tr>
<tr><td>2.0-0.06</td><td colspan="2">SANDSTONE</td><td>CALCARENITE</td><td>TUFF</td><td>SCHIST</td><td rowspan="3">SERPENTINITE

HORNFELS</td><td>MICRO-GRANITE</td><td>MICRO-DIORITE</td><td>DOLERITE</td></tr>
<tr><td>0.06-0.002</td><td rowspan="2">MUDSTONE
(silt and clay)</td><td>SILTSTONE
(mostly silt)</td><td>CALCISILTITE</td><td rowspan="2">Fine grained TUFF</td><td rowspan="2">PHYLLITE or SLATE</td><td rowspan="2">RHYOLITE</td><td rowspan="2">ANDESITE</td><td rowspan="2">BASALT</td></tr>
<tr><td><0.002</td><td>CLAYSTONE
(mostly clay)</td><td>CALCILUTITE</td></tr>
</table>

Reproduced with modification from Tables 15, 16 and 17, Clause 6.2.3.1, AS 1726-2017, Geotechnical site investigations.

Grain size: For rocks with predominantly sand sized grains the dominant or average grain size is described as follows:

Rock type	Coarse grained	Medium grained	Fine grained
Sedimentary rocks	Mainly 0.6 mm to 2 mm	Mainly 0.2 mm to 0.6 mm	Mainly 0.06 mm (just visible) to 0.2 mm
Igneous and metamorphic rocks	Mainly >2 mm	Mainly 0.06 mm to 2 mm	Mainly <0.6 mm (just visible)

Colour assists in rock identification and interpolation. Rock colour is generally described in a *"moist"* condition, using simple terms (e.g. grey, brown, etc.) and modified as necessary by *"pale"*, *"dark"*, or *"mottled"*. Borderline colours may be described as a combination of these colours (e.g. red-brown).

Texture refers to the arrangement of, or the relationship between, the component grains or crystals (e.g. porphyritic, crystalline or amorphous).

Fabric refers to visible grain arrangement along a preferential orientation or a layering. Fabric may be noted as *"indistinct"* (little effect on strength) or *"distinct"* (rock breaks more easily parallel to the fabric). Common terms include *"massive"* or *"flow banding"* (igneous), *"foliation"* or *"cleavage"* (metamorphic). Sedimentary layering is described as *"bedding"* or (where thickness < 20 mm) *"lamination"*. The typical orientation, spacing or thickness of these structural features can be described directly in millimetres and metres. Further quantification of bedding thickness applied by GHD is as follows:

Bedding Term	Thickness
Very thickly bedded	>2 m
Thickly bedded	0.6 to 2 m
Medium bedded	0.2 to 0.6 m
Thinly bedded	60 to 200 mm
Very thinly bedded	20 to 60 mm
Laminated	6 to 20 mm
Thinly laminated	<6 mm

Features, Inclusions and Minor Components are typically only described when those features could influence the engineering behaviour of the rock. Described features may include: gas bubbles in igneous rocks; veins of quartz, calcite or other minerals; pyrite crystals and nodules or bands of ironstone or carbonate; cross bedding in sandstone; clast or matrix support in conglomerates and breccia.

Moisture content may be described by the feel and appearance of the rock, as follows: *"dry"* (looks and feels dry), *"moist"* (feels cool, darkened in colour, but no water is visible on the surface), or *"wet"* (feels cool, darkened in colour, water film or droplets visible on the surface). The moisture content of rock cored with water may not represent in situ conditions.

Durability of rock samples is noted where there is an observed tendency of samples to crack, breakdown in water or otherwise deteriorate with exposure.

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b) Classification of the rock material condition (strength, weathering and/or alteration)

Estimated Strength refers to the rock material and not the rock mass. The strength is defined in terms of uniaxial compressive strength (UCS), though is typically estimated by either tactile assessment or Point Load Strength Index ($Is_{(50)}$) (measured perpendicular to planar anisotropy). A correlation between $Is_{(50)}$ and UCS is adopted for classification, though is not intended for design purposes without appropriate supporting assessment. A field guide follows:

Term and (Symbol)		UCS (MPa)	$Is_{(50)}$ (MPa)	Field Guide
Very Low	*(VL)*	0.6 – 2	0.03 - 0.1	Material crumbles under firm blows with sharp end of geological pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm thick can be broken by finger pressure.
Low	*(L)*	2 - 6	0.1 - 0.3	Easily scored with knife; indentations 1 to 3 mm show in the specimen with firm blows of a geological pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	*(M)*	6 - 20	0.3 - 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	*(H)*	20 - 60	1 - 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a geological pick with a single firm blow; rock rings under hammer.
Very High	*(VH)*	60 - 200	3 -10	Hand specimen breaks with geological pick after more than one blow; rock rings under hammer.
Extremely High	*(EH)*	>200	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Based on Table 19, Clause 6.2.4.1, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Material with strength less than *"very low"* is described using soil characteristics, with the presence of an original rock texture or fabric noted if relevant.

Weathering and Alteration: The process of weathering involves physical and chemical changes to the rock resulting from exposure near the earth's surface. A subjective scale for weathering is applied as follows:

Weathering Term and (Symbol)		Description
Residual Soil	*(RS)*	Material has weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered	*(XW)*	Material has weathered to such an extent that it has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	*(HW)*	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered	*(MW)*	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered	*(SW)*	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	*(Fr)*	Rock shows no sign of decomposition of individual minerals or colour changes.

Modified based on Table 20, Clause 6.2.4.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Where physical and chemical changes to the rock are caused by hot gases or liquids at depth, the process is called alteration. Unlike weathering, the distribution of altered material may occur at any depth and show no relationship to topography. Where alteration minerals are identified the terms *"extremely altered" (XA)*, *"highly altered" (HA)*, *"moderately altered" (MA)* and *"slightly altered" (SA)* can be used to describe the physical and chemical changes described above.

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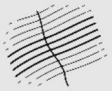
c) Description of defects (defect type, orientation, roughness and shape, coatings and composition of seams, spacing, length, openness and thickness, block shape)

Defects often control the overall engineering behaviour of a rock mass. AS 1726 defines a defect as “a discontinuity, fracture, break or void in the material or materials across which there is little or no tensile strength”. Describing the type, character and distribution of natural defects is an essential part of the description of many rock masses.

Commonly described characteristics of defects within a rock mass include type, orientation, roughness and shape, coatings and composition of seams, aperture, persistence, spacing and block shape.

The degree of detail required for defect descriptions depends on project requirements. All defects judged of engineering significance for the site and project are described individually. Where appropriate, generalised descriptions for less significant, or multiple similar, defects can be provided for delineated parts of rock core or exposures. A general description of delineated defect sets is provided when sufficient orientation data is available.

Defect Type is described using the terms summarised below. On core logs, only natural defects across which the core is discontinuous are described (i.e. inferred artificial fractures such as drill breaks are excluded). Incipient defects are described using the relevant texture or fabric terms. Healed defects (those that have been re-cemented by minerals such as chlorite or calcite) are described using the prefix “healed” (e.g. healed joint).

Type and (Symbol)		Description	Diagram
Parting	(Pt)	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed.	
Joint	(Jt)	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or subparallel to layering or to planar anisotropy in the rock material. May be open or closed.	
Sheared Surface	(SS)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.	
Sheared Zone	(SZ)	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
Sheared Seam	(SSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
Crushed Seam	(CSm)	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.	
Infilled Seam	(ISm)	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.	
Extremely Weathered Seam	(WSm)	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.	

Modified based on Table 22, Clause 6.2.5.2, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Defect Orientation is recorded as the “dip” (maximum angle of the mean plane, measured from horizontal) and the “dip direction” (azimuth of the dip, measured clockwise from true north). Dip and dip direction is expressed in degrees, with two-digit and three-digit numbers respectively, separated by a slash (e.g. 45/090). For vertical boreholes, the defect dip is measured as the acute angle from horizontal. Rock core extracted from vertical boreholes is generally not oriented, so the dip direction cannot be directly measured. For non-oriented inclined boreholes, a defect “alpha” (α) angle is measured as the acute angle from the core axis. For vertical and non-oriented inclined boreholes, the dip direction can sometimes be estimated from the relationship of the defect to a well-defined site structure such as fabric. For oriented inclined boreholes, the measurement of the defect orientation is carried out and recorded in a form suited to the particular device being used and later processed to report true dip and dip direction.

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Roughness and Shape of the defect surface combine to have significant influence on shear strength. Standard descriptions and abbreviations include:

Roughness and (Symbol)		Description
Very Rough	(VR)	Many large surface irregularities (amplitude generally more than 1 mm). Feels like, or coarser than very coarse sand paper.
Rough	(Rf)	Many small surface irregularities (amplitude generally less than 1 mm). Feels like fine to coarse sand paper.
Smooth	(So)	Smooth to touch. Few or no surface irregularities.
Polished	(Pol)	Shiny smooth surface.
Slickensided	(Slk)	Grooved or striated surface, usually polished.

Shape and (Symbol)		Description
Planar	(Pln	The defect does not vary in orientation.
Curved	(Cu)	The defect has a gradual change in orientation.
Undulating	(Un)	The defect has a wavy surface.
Stepped	(St)	The defect has one or more well defined steps.
Irregular	(Ir)	The defect has many sharp changes of orientation.

Although the surface roughness of defects can be described at small (10-100 mm) scales of observation, the overall shape of the defect surface can usually be observed only at medium (0.1-1 m) and large (>1 m) scale.

Where it is necessary to assess the shear strength of a defect, observations are generally made at multiple scales. Surface roughness may also be characterised by using the joint roughness coefficient (JRC) profiles established by Barton and Choubey (1977). Where large-scale observations are possible, further measurement of defect "waviness" (angle of the asperities relative to the overall dip angle of the plane) is made.

Coatings and Composition of Seams: Many defects have surface coatings, which can affect their shear strength. Standard descriptions include:

Coating and (Symbol)		Description
Clean	(Cn)	No visible coating.
Stained	(Sn)	No visible coating but surfaces are discoloured.
Veneer	(Ve)	A visible coating of soil or mineral substance, but too thin to be measured may be patchy.
Coating	(Co)	A visible coating up to 1 mm thick. Soil material greater than 1 mm thick is described using defect terms (e.g. infilled seam). Rock material greater than 1 mm thick is described as a vein (Vn).

Common Minerals and (Symbol)	
Clay	(CLAY)
Calcite	(Ca)
Carbonaceous	(X)
Chlorite	(Kt)
Iron Oxide	(Fe)
Micaceous	(Mi)
Manganese	(Mn)
Pyrite	(Py)
Quartz	(Qz)

The composition of seams are described using soil description terms as given on the SOIL DESCRIPTION AND CLASSIFICATION Standard Sheet. Where possible the mineralogy of coatings is identified. Common mineral coatings include:

Aperture: Defects across which there is little or no tensile strength can be either *"open"* (*Op*) or *"closed"* (*Cl*). For rock core, the width of the "open" defect is measured whilst still in the core barrel splits. The descriptor *"tight"* (*Ti*) can only apply to healed or incipient defects (i.e. veins, foliation, etc.).

Persistence and Spacing of defects is described directly in millimetres and metres. If the measurement of defect persistence is limited by the extent of the exposure, the end conditions are noted (i.e. 0, 1 or 2 defect ends observed). The spacing between defects of similar orientation (i.e. within a specific defect set) is recorded when possible.

The frequency of defects within rock core can be measured as either: the spacing between successive defects; or the "Fracture Index", which is the number of defects per metre of core.

Spacing Term	Thickness
Very wide	>2 m
Wide	0.6 to 2 m
Medium	0.2 to 0.6 m
Closely	60 to 200 mm
Very closely	20 to 60 mm
Extremely closely	6 to 20 mm

Block Shape: Where it is considered significant, block shape can be described using the subjective terms as follows:

Block Shape	Description
Polyhedral	Irregular discontinuities without arrangement into distinct sets, and of small persistence.
Tabular	One dominant set of parallel discontinuities, for example bedding planes, with other non-continuous joints; thickness of blocks much less than length or width.
Prismatic	Two dominant sets of discontinuities, approximately orthogonal and parallel, with a third irregular set; thickness of blocks much less than length or width.
Equidimensional	Three dominant sets of discontinuities, approximately orthogonal, with occasional irregular joints, giving equidimensional blocks.
Rhomboidal	Three (or more) dominant, mutually oblique, sets of joints giving oblique-shaped, equidimensional blocks.
Columnar	Several, usually more than three sets of continuous, parallel joints usually crossed by irregular joints; lengths much greater than other dimensions.

Modified based on Table 23, Clause 6.2.5.7, AS 1726-2017, Geotechnical site investigations. Refer to source document for further detail.

Ref: DS6.5.2.1 Issue 2.0 Date: 01/08/2019

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d) Interpreted stratigraphic unit

Stratigraphic units may be interpreted and reported, in accordance with The Australian Stratigraphic Units Database (ASUD). The terms *"possibly"* or *"probably"* indicate increased uncertainty in this interpretation.

e) Geological structure

After describing the rock material and defects, an interpretation of the nature and configuration of rock mass defects may be presented in logs, charts, 2D sections and 3D models (e.g. dipping strata, folds, unconformities, weathering profiles, defect sets, geological faults, etc.).

PARAMETERS RELATED TO CORE DRILLING

Drill Depth and Core Loss: Drilling intervals are shown on GHD Core Log Sheets by depth increments and horizontal marker lines.

"Core loss", or its inverse "total core recovery" (TCR), is measured as a percentage of the core run. If the location of the core loss is known, or strongly suspected, it is shown in a region of the column bounded by dashed horizontal lines. If unknown, core loss is assigned to the bottom of a core run.

Rock Quality Designation (RQD), described by Deere et al. (1989), may be recorded on GHD Core Log Sheets.

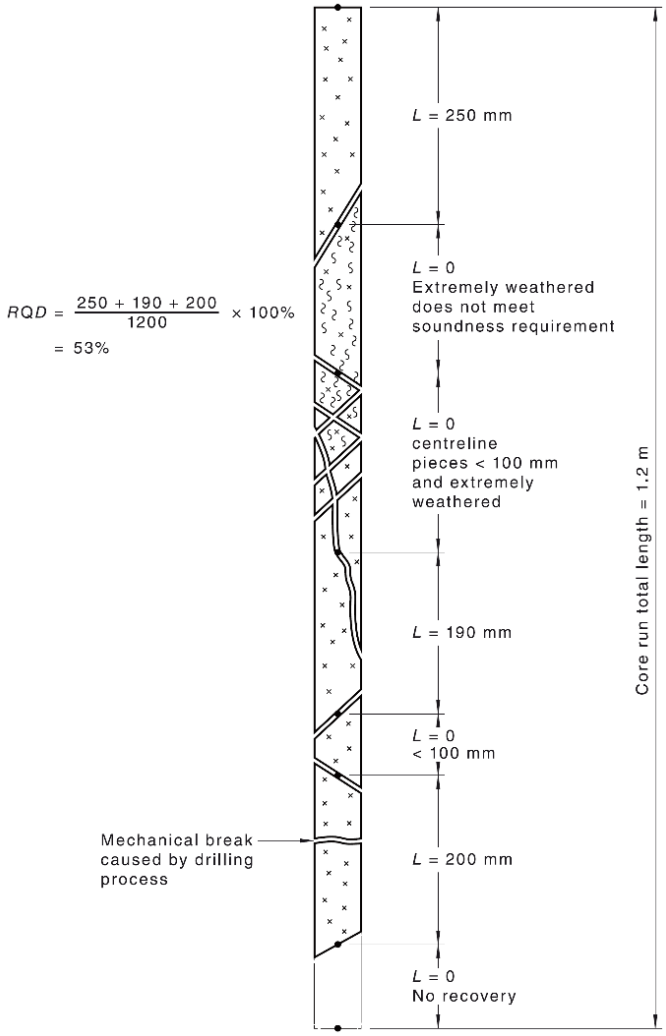
For certain projects, such as tunnelling or underground mining investigations, rock mass ratings or classifications can be required as part of the design process. The RQD forms a component of these rock mass ratings and provides a quantitative estimate of rock mass quality from rock core logs.

The rock core must be "N" sized (nominally 50 mm) or greater for derivation of RQD. The RQD is expressed as a percentage of intact rock core (excluding residual soil and extremely weathered rock) greater than 100 mm in length over the total selected core length.

Deere et al. (1989) recommends measuring lengths of core along the centreline, as shown right.

RQD is expressed as:

$$RQD = \frac{\sum Length\ of\ sound\ core\ pieces > 100\ mm\ in\ length}{Length\ of\ core\ run}\ x\ 100\%$$



RQD measurement procedure
(reproduced from Figure 13, Clause 6.2.9.4, AS 1726-2017, Geotechnical site investigations)

ROCK MASS CLASSIFICATION

Rock mass classification schemes may be used to represent the engineering characteristics of a rock mass. A large variety of classification schemes have been developed by various authors, ranging from simple to complex. All of the schemes are limited in their application and many rock mass classification systems assume that the rock mass is isotropic, which is rarely the case.

References

STANDARDS AUSTRALIA (2017). AS 1726-2017. GEOTECHNICAL SITE INVESTIGATIONS.
BARTON, N. AND CHOUBEY, V. (1977). THE SHEAR STRENGTH OF ROCK JOINTS IN THEORY AND PRACTICE. ROCK MECHANICS 10, 1-54. SPRINGER.
DEERE, D.U. AND DEERE, D.W. (1989). ROCK QUALITY DESIGNATION (RQD) AFTER TWENTY YEARS. CONTRACT REPORT GL-89-1. ARMY CORPS OF ENGINEERS. WASHINGTON DC, 1989.

SOIL DESCRIPTION AND CLASSIFICATION

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d) Origin

An interpretation is provided based on observations of landform, geology and fabric, and may further include assignment of a stratigraphic unit. The use of terms 'possibly' or 'probably' indicates a higher degree of uncertainty regarding the assessed origin or stratigraphic unit. Typical origin descriptors include:

Residual	Formed directly from in situ weathering with no visible structure or fabric of the parent soil or rock.
Extremely weathered	Formed directly from in situ weathering, with remnant and/or fabric from the parent rock.
Alluvial	Deposited by streams and rivers (may be applied more generically as transported by water).
Estuarine	Deposited in coastal estuaries, including sediments from inflowing rivers, streams, and tidal currents.
Marine	Deposited in a marine environment.
Lacustrine	Deposited in freshwater lakes.
Aeolian	Transported by wind.
Colluvial and Slopewash	Soil and rock debris transported down slopes by gravity (with or without assistance of water). Colluvium is typically applied to thicker / localised deposits, and slopewash for thinner / widespread deposits.
TOPSOIL	Surficial soil, typically with high levels of organic material. Topsoils buried by other transported soils are termed *'remnant topsoil'*. Tree roots within otherwise unaltered soil does not characterise topsoil.
FILL	Any material which has been placed by anthropogenic processes (i.e. human activity).

e) Additional Observations

Additional observations may be included to supplement the soil description. Additional observations may consist of notations relating to soil characteristics (odour, contamination, colour changes with time), inferred geology (with delineation of soil horizons or geological time scale) or notes on sampling and testing application (including the reliability, recovery, representativeness, or condition of samples or test conditions and limitations). If the material is assessed to be not representative, terms such as 'poor recovery', 'non-intact', 'recovered as' or 'probably' are applied.

SOIL CLASSIFICATION

Classification allocates the material within distinct soil groups assigned a two character Group Symbol:

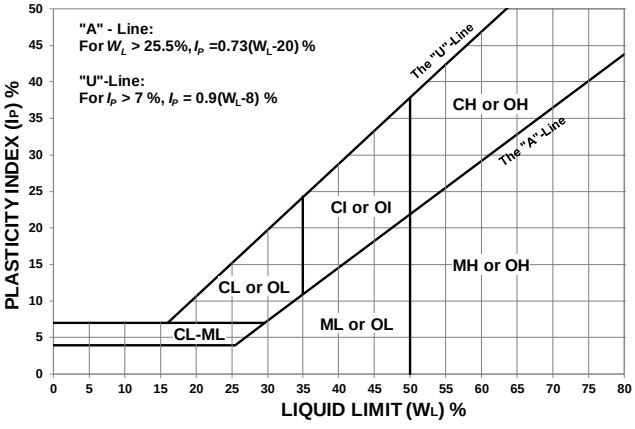
Coarse Grained Soils (sand and gravel: more than 65% of soil coarser than 0.075 mm)		
Major Division	**Group Symbol**	**Soil Group**
GRAVEL (more than half of the coarse fraction is > 2.36 mm)	GW	GRAVEL, well graded
	GP	GRAVEL, poorly graded
	GM	Silty GRAVEL
	GC	Clayey GRAVEL
SAND (more than half of the coarse fraction is < 2.36 mm)	SW	SAND, well graded
	SP	SAND, poorly graded
	SM	Silty SAND
	SC	Clayey SAND

Fine Grained Soils (silt and clay: more than 35% of soil finer than 0.075 mm)		
Major division	**Group Symbol**	**Soil Group**
SILT and CLAY (low to medium plasticity)	ML	SILT, low plasticity
	CL	CLAY, low plasticity
	CI	CLAY, medium plasticity
	OL	Organic SILT
SILT and CLAY (high plasticity)	MH	SILT, high plasticity
	CH	CLAY, high plasticity
	OH	Organic CLAY / SILT
Highly Organic	Pt	PEAT

Coarse grained soils with fines contents between 5% and 12% are provided a dual classification comprising the two group symbols separated by a dash, e.g. for a poorly graded gravel with between 5% and 12% silt fines (poorly graded 'GRAVEL with silt'), the classification is GP-GM.

For the purpose of classification, *poorly graded, uniform,* or *gap graded* soils are all designated as poorly graded. Soils that are dominated by boulders or cobbles are described separately and are not classified.

Classification is routinely undertaken based on tactile assessment with the soil description. Refinement of soil classification may be applied using laboratory assessment, including particle size distribution and Atterberg Limits. Atterberg Limits testing is applied to the sample portion finer than 0.425 mm. Fine grained soil components are assessed on the basis of regions defined within the Modified Casagrande Chart.



Appendix C

Engineering logs

BOREHOLE LOG SHEET WITH STANDPIPE PIEZOMETER

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH01

SHEET 1 OF 7

Position : Refer to test location plan MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears	**Date:** 09/08/2021

DRILLING					MATERIAL								PIEZOMETER
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	Description	Moisture Condition	Consistency / Density Index	Comments/ Observations	PIEZOMETER Log	Components
0	TC-bit auger	HW casing	Nil	SPT 25 for 150mm N=ref	0.10			[TOPSOIL]: CLAY: high plasticity, dark brown, trace sand.	M	F			1m stickup
					0.20		CL		M	F			Concrete
								CLAY: low plasticity, dark brown, with fine to medium, angular gravel, trace sand (residual).	M	St			
								BASALT: fine grained, dark brown, highly jointed, iron stained, extremely weathered. 0.5m, highly to moderately weathered.		VSt			Bentonite
1													
2				SPT 25 for 60mm N=ref	2.56			Start of coring at 2.56 metres. For cored interval, see Core Log Sheet.					Sand Backfill
3													
4													
5													

Note: * indicates signatures on original issue of log or last revision of log

See standard sheets for details of abbreviations & basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No. 12547851

CORE LOG SHEET WITH STANDPIPE PIEZOMETER

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH01

SHEET 2 OF 7

Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears		**Date Logged :** 12/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING						MATERIAL				NATURAL FRACTURES				
Progress														
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral Soil 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.	PIEZOMETER Log	COMPONENTS
1														
2						2.56		Start of coring at 2.56 metres. For Non Cored interval, see Borehole Log Sheet.						
3	NMLC coring	(5% LOSS)	3.00	(20)		2.65		CORE LOSS: 90mm						
								BASALT: fine grained, grey-brown, highly fractured/jointed, iron stained joints.				2.56-4.5m, recovered as highly jointed/fractured rock, randomly orientated, iron stained, some healed joints		
												3.14-3.63m, healed joints		
			3.70	(0)					HW			3.64m, Jt, 20°, Pln, Fe Sn 3.67m, Jt, 10°, Pln, Fe Sn 3.7m, DL 3.76m, Jt, 15°, Pln, Fe Sn 3.8m, Jt, 75°, Pln, Fe Sn 3.82m, CSm, 5°, Fe/CLAY, 5mm 3.96m, HB 4.0m, HB 4.05m, Jt, 15°, Rf, Pln, Fe Sn 4.08m, Jt, 15°, Rf, Pln, Fe Sn 4.11m, CSm, Fe/CLAY 4.15m, HB 4.19m, Jt, 35°, Rf, Pln, Fe Sn		Sand Backfill
4			4.50	(0)				4.5m, less joints/fractures.	MW			4.33m, Jt, 40°, Rf, Pln, Fe Sn 4.34m, Jt, 15°, Rf, Pln, Fe Sn 4.37m, Jt, 35°, Rf, Pln, Fe Sn 4.48m, Jt, 25°, Rf, Pln, Fe Sn 4.5m, DL 4.7m, HB 4.76m, HB		
5				(0)								4.92m, Jt, 15°, Rf, Pln, Fe Sn		

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Job No. 12547851

CORE LOG SHEET WITH STANDPIPE PIEZOMETER

Client : R&S Contracting Pty Ltd				**HOLE No. BH01**	
Project : Bentley Quarry Geotechnical Assessment					**SHEET 3 OF 7**
Location : Bentley, NSW					
Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears		**Date Logged :** 12/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (●- Axial O- Diametral)	Spacing (mm)	Visual	Additional Data	PIEZOMETER Log	COMPONENTS
								ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)		Soil, 0.03, VL, 0.1, L, 0.3, M, 1, H, 3, VH, 10, EH	20, 40, 100, 300, 1000		(joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.		
6	NMLC coring	(5% LOSS)	5.20	(0)		5.20		BASALT: as previous.	MW			5.0m, HB 5.14-5.2m, recovered as rock fragments 5.15m, Jt, 30°, Rf, Pln, Fe Sn		
						5.45		CLAY: high plasticity, grey, very stiff, w~PL.							
			6.30					BASALT: fine grained, grey-brown, vesicular (~10%), healed iron joints, 5-10° orientation.				5.74m, CSm, 5°, Fe/CLAY, 25mm 5.91m, CSm, 5°, Fe/CLAY, 15mm 6.14m, CLAY filled seam, 5° 6.19m, Jt, 5°, Pln, Fe Sn 6.21m, Jt, 5°, Pln, Fe Sn 6.3m, Jt, 5°, Rf, Pln, Fe Sn 6.34m, HB 6.38m, DL 6.4m, HB 6.45m, Jt, 5°, Rf, Pln, Fe Sn 6.48m, CSm, 5°, CLAY/rock fragments 6.56m, DB 6.65m, DB 6.69m, Jt, 5°, Rf, Pln, Fe Sn		Sand Backfill
7								7.2m, grey, vesicular (up to 30%), with calcite infill.				7.12m, Jt, 30°, Rf, Pln, Fe Sn 7.25m, Jt, 5°, Rf, Pln, Fe Sn 7.45m, Jt, 10°, Rf, Pln, Fe Sn 7.48m, Jt, 15°, Rf, Pln, Fe Sn 7.62m, Jt, 5°, Rf, Pln, Fe Sn 7.75m, DB		50mm PVC casing
8				(0)					SW			8.1m, Jt, 25°, Rf, Ir, Fe Sn 8.23m, DB 8.41m, Jt, 20°, Rf, Ir, Fe Sn 8.75m, DB		
9			9.25					9.0m, grey to dark grey.	Fr			9.0m, DB 9.18m, Jt, 60°, Rf, Pln, calcsilicate 9.25m, DL 9.77m, Jt, 30°, Pln, Ve		
10															

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CORE LOG SHEET WITH STANDPIPE PIEZOMETER

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH01

SHEET 4 OF 7

Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears		**Date Logged :** 12/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (●- Axial O- Diametral: Soil, 0.03, VL, 0.1, L, 0.3, M, 1, H, 3, VH, 10, EH)	Spacing (mm): 20, 40, 100, 300, 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.	PIEZOMETER Log	COMPONENTS
11	NMLC coring	(5% LOSS)	12.25	(0)				BASALT: as previous.	Fr				10.0m, HB 10.14m, Jt, 35°, Un, Ve, possible DB 10.28m, DB 10.59m, DB 10.85m, DB 10.89m, Jt, 60°, Un, Ve, possible DB 11.0m, HB 11.11m, DB 11.21m, DB 11.55m, DB		
12													11.89m, Jt, 35°, So, Un, Ve 11.95m, DB 12.0m, HB 12.23m, DB 12.55m, Db		Sand Backfill
13			13.70	(0)		13.70		SANDSTONE: fine grained, black, bedding indistinct. 13.9m, becoming grey.					12.97m, DB 13.0m, HB 13.03m, HB 13.34m, vuggy zone 13.45m, Jt, 50°, Rf, Ve 13.7m, DL 13.75m, 200mm thick zone of contact alteration		
14			14.42	(0)		14.42		CORE LOSS: 880mm.							
15				(123)											

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Job No. 12547851

CORE LOG SHEET WITH STANDPIPE PIEZOMETER

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH01

SHEET 5 OF 7

Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears		**Date Logged :** 12/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING						MATERIAL				NATURAL FRACTURES				
Progress														
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral Soil 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.	PIEZOMETER Log	COMPONENTS
			15.30			15.30		CORE LOSS: as previous.						
						15.30		SANDSTONE: fine grained, grey, bedding indistinct.	Fr					
				(68)		15.78		CORE LOSS: 1020mm.						
			16.80			16.80		METASANDSTONE?: microcrystalline. blue green (probable chilled margin).						
	NMLC coring	(5% LOSS)		(0)		17.35		BASALT: dark grey.					17.39m, Jt, 45°, Rf, Pln, Mn 17.46m, Jt, 60°, Rf, Un, Mn 17.63m, VN, 15mm 17.76m, VN, 7mm 17.85m, HB 17.89m, DB 18.0m, HB		Sand Backfill
			18.02					18.33m, 40mm thick band, dark grey.	Fr					
				(0)				19.2m, vesicular basalt, dark grey.					19.08m, DB 19.17m, DB 19.23m, DB 19.55m, DB 19.67m, DB 19.79m, DB		
								19.95m, becoming grey-red.						

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CORE LOG SHEET WITH STANDPIPE PIEZOMETER

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH01

SHEET 6 OF 7

Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears		**Date Logged :** 12/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (●- Axial O- Diametral)	Spacing (mm)	Visual	Additional Data	PIEZOMETER Log	COMPONENTS
21	NMLC coring	(5% LOSS)	20.62	(0)				BASALT: as previous.	SW				20.0m, HB 20.13m, DB 20.16m, DB 20.17m, DB 20.39m, DB 20.42m, DB 20.56m, DB 20.62m, DL 20.71m, DB 20.82m, DB 21.0m, HB 21.12m, DB 21.35m, DB 21.6m, DB 21.8m, DB 21.94m, DB		
22			22.55					22.55m, vuggy zone.					22.0m, DB 22.22m, DB		Sand Backfill
23				(0)				23.0m, non-vesicular.	Fr				23.0m, DB 23.58m, DB		4.5m slotted screen
24													23.93m, Jt. 10°, Rf, Pln, Mu Ve 24.0m, HB 24.02m, HB 24.05m, HB 24.34m, DB 24.71m, DB		
25															

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CORE LOG SHEET WITH STANDPIPE PIEZOMETER

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH01

SHEET 7 OF 7

Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 12/7/2021	**Date Completed :** 14/7/2021	**Logged by :** L. Spears		**Date Logged :** 12/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (●- Axial O- Diametral)	Spacing (mm)	Visual	Additional Data	PIEZOMETER Log	COMPONENTS
								ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)		Soil 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 40 100 300 1000		(joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.		
26	NMLC coring	(5% LOSS)	25.15	(0)				BASALT: as previous.					25.0m, HB 25.14-25.2m, recovered as rock fragments 25.55m, DB 25.74m, DB 26.0m, HB 26.19m, HB		4.5m slotted screen
27			27.15						Fr				27.0m, HB 27.15m, DL 27.19m, DB 27.2m, DB 27.32m, DB 27.58m, DB 27.75m, DB		Base of piezo @ 27.5m
28				(0)									28.0m, HB 28.55m, DB 28.63m, DB		Sand Backfill
29								28.91m, metasandstone 29.0m, metasandstone					28.8-28.84m, recovered as rock fragments 28.91-29.0m, recovered as rock fragments 29.0m, HB 29.09m, DB 29.16m, DB		Bottom of sump
						29.26		METASANDSTONE: microcystaline, blue-green					29.26-24.5m, recovered as rock fragments		
			29.50			29.50		CORE LOSS: 200mm.							
				(40)		29.70 29.79		METASANDSTONE: as above					29.7-29.79m, recovered as rock fragments		
30			30.00			30.00		BASALT: with banded metasandstone. Well installed on completion End of Borehole at 30.00 metres.	Fr						

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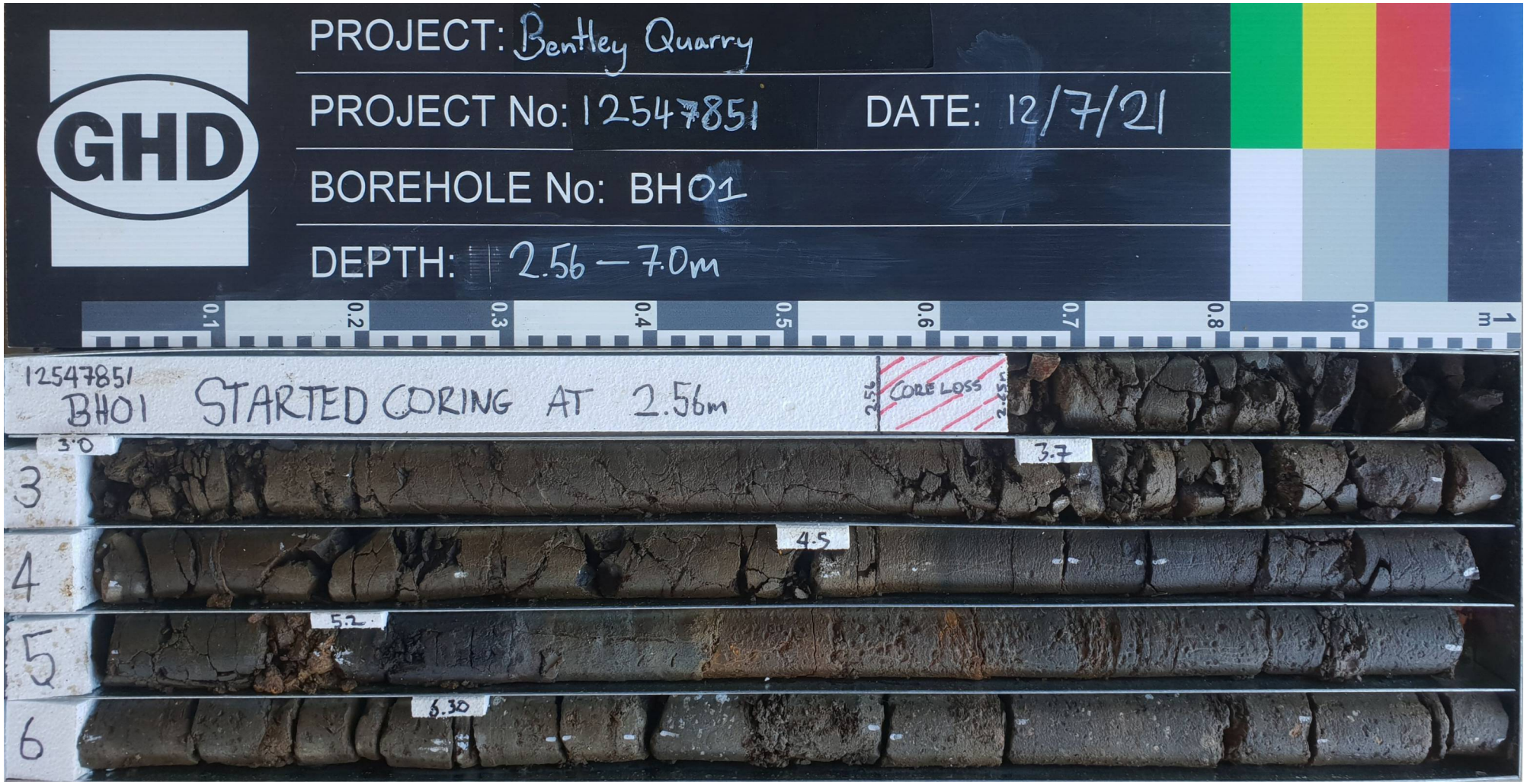
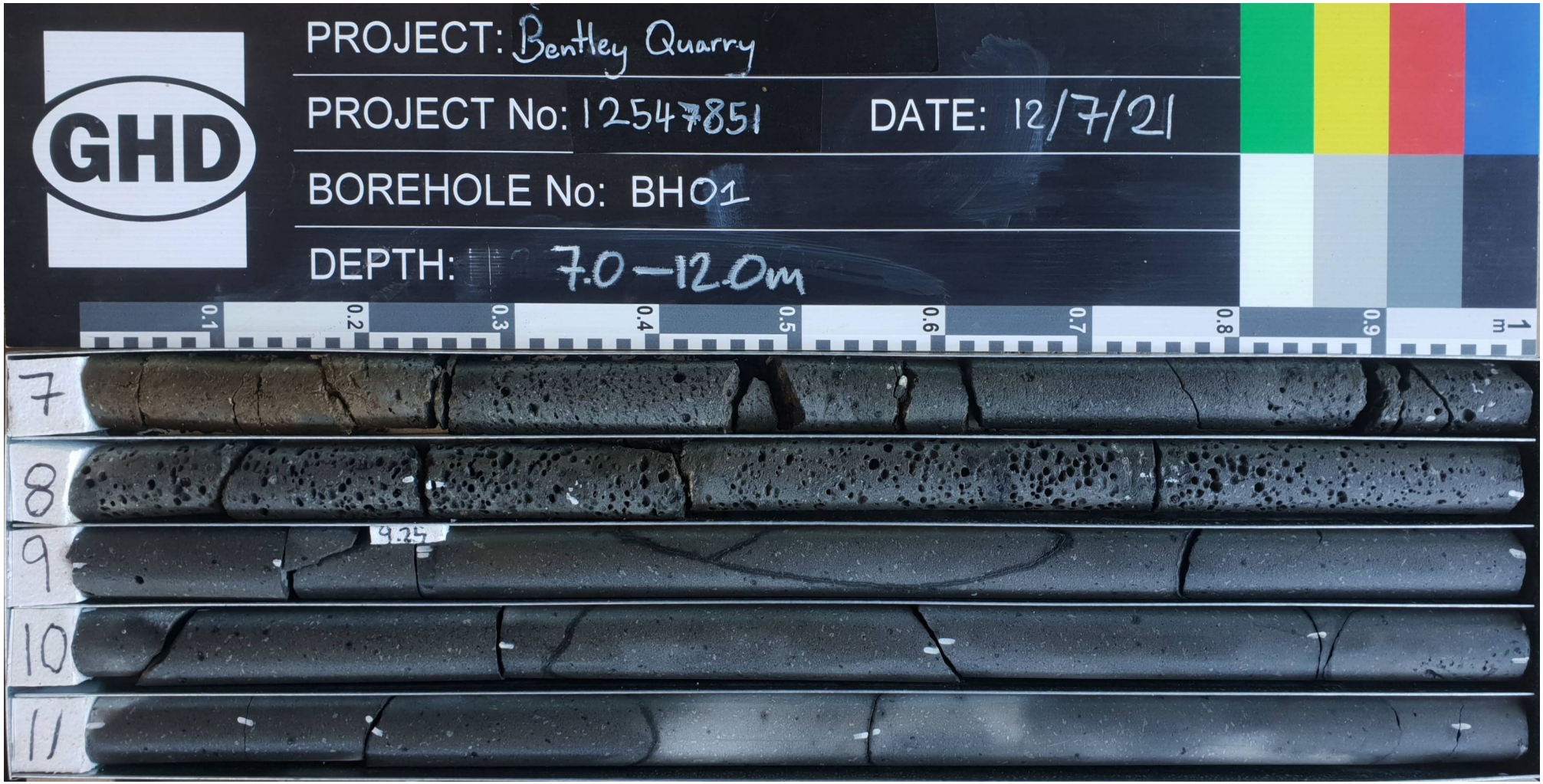


PointID : BH01 Depth Range: 2.56 - 7.00 m

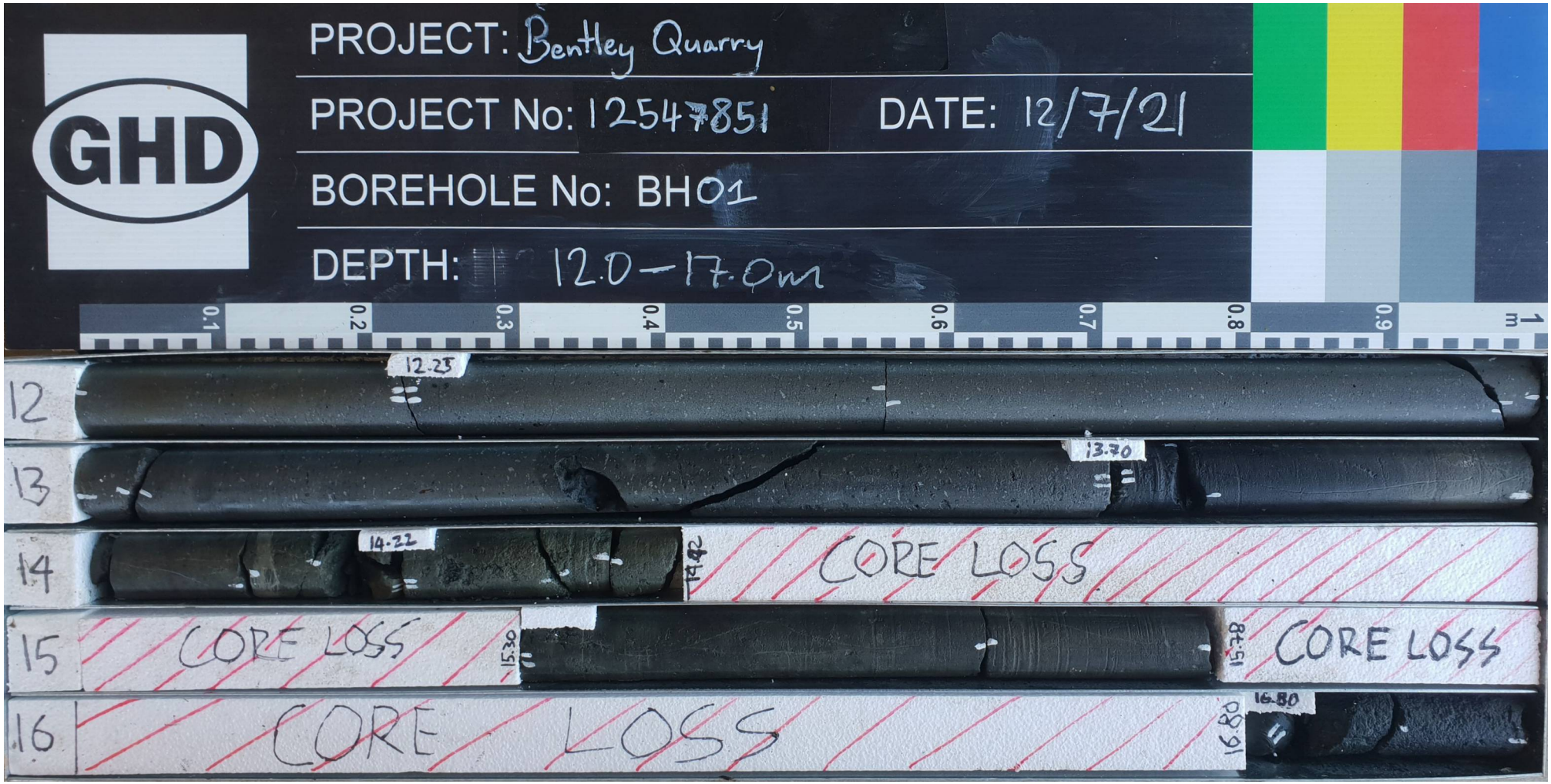
R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH01 1/6



PointID : BH01 Depth Range: 7.00 - 12.00 m

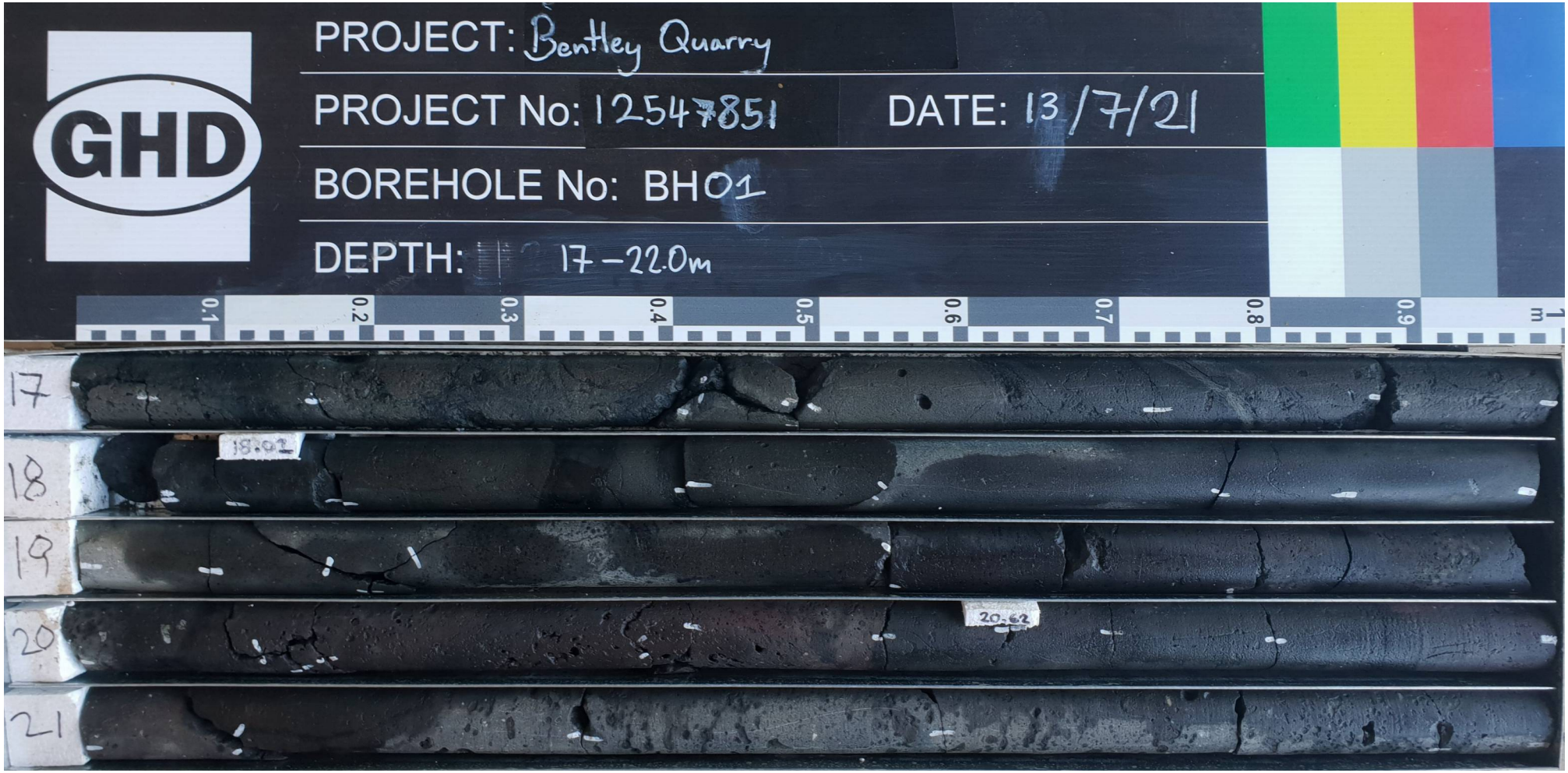
GHD	R&S Contracting Pty Ltd Bentley Quarry Geotechnical Assessment Bentley NSW Core Photographs	DRAWN: H Warr	DATE: 11/08/2021
		CHECKED: J Petersen	DATE: 11/08/2021
		SCALE: Not To Scale	A4
		PROJECT No: 12547851	FIGURE No: BH01 2/6



PointID : BH01 Depth Range: 12.00 - 17.00 m

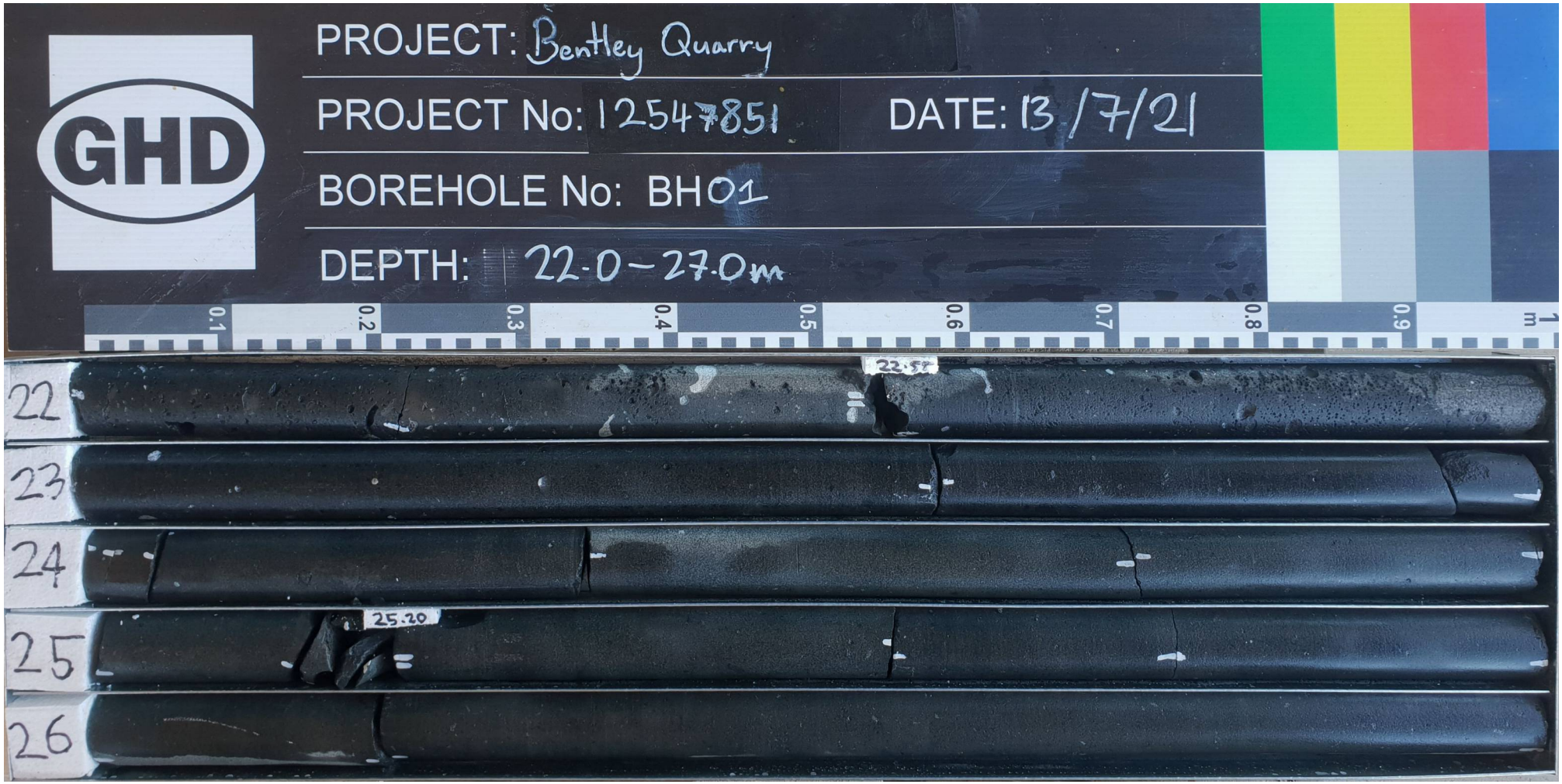
R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH01 3/6



PointID : BH01 Depth Range: 17.00 - 22.00 m

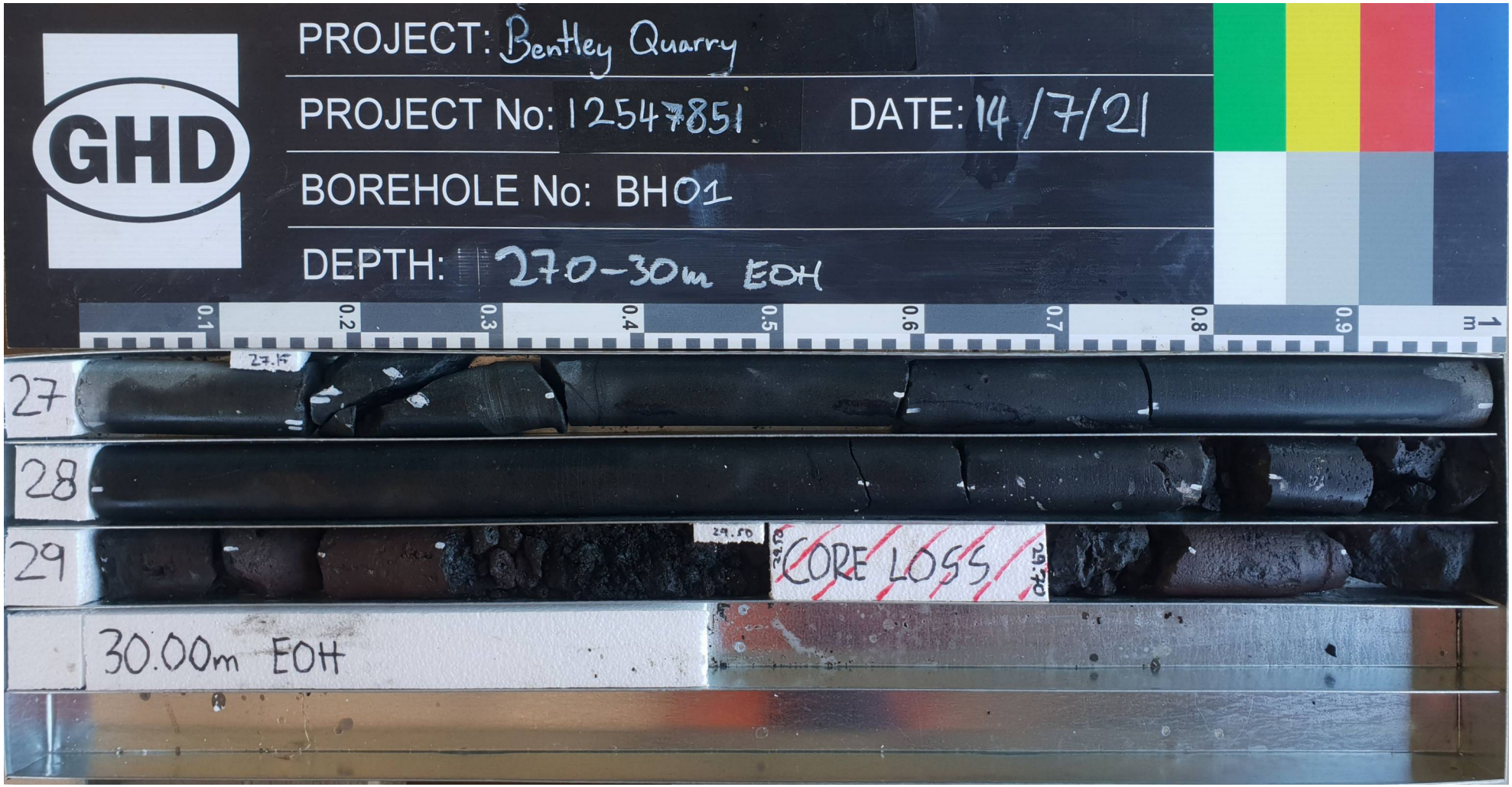
GHD	R&S Contracting Pty Ltd Bentley Quarry Geotechnical Assessment Bentley NSW Core Photographs	DRAWN: H Warr	DATE: 11/08/2021
		CHECKED: J Petersen	DATE: 11/08/2021
		SCALE: Not To Scale	A4
		PROJECT No: 12547851	FIGURE No: BH01 4/6



PointID : BH01 Depth Range: 22.00 - 27.00 m

R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH01 5/6



PointID : BH01 Depth Range: 27.00 - 30.00 m

R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH01 6/6

BOREHOLE LOG SHEET

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

SHEET 1 OF 8

Position : Refer to test location plan	MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°		**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel		**Checked :** JP
Date Started : 14/7/2021		**Date Completed :** 16/7/2021	**Logged by :** L. Spears		**Date:** 09/08/2021

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
0	TC-bit auger	HWT casing	Nil		0.15			[TOPSOIL]: CLAY: high plasticity, black, trace fine grained sand, rootlets.	M	St	
							CI-CH	CLAY: medium to high plasticity, dark brown, trace fine to medium gravel, irregular (residual).	M	VSt	
					0.45		CL-CI	Gravelly CLAY: low to medium plasticity, brown, fine to medium, angular to sub-angular basalt gravel, trace fine grained sand (extremely weathered).	M	H	
1				SPT 25 for 150mm N=ref							
2				SPT 25 for 90mm N=ref	2.70			Start of coring at 2.7 metres. For cored interval, see Core Log Sheet.			
3											
4											
5											

Note: * indicates signatures on original issue of log or last revision of log

See standard sheets for details of abbreviations & basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No. 12547851

CORE LOG SHEET

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

SHEET 2 OF 8

Position : Refer to test location plan MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond	**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears	**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (●-Axial ○-Diametral: Soil, 0.03, VL, 0.1, L, 0.3, M, 1, H, 3, VH, 10, EH)	Spacing (mm): 20, 40, 100, 300, 1000	Visual	Additional Data
1													
2								Start of coring at 2.7 metres. For Non Cored interval, see Borehole Log Sheet.					
						2.70		BASALT: fine grained, grey, trace clasts of plagioclase feldspar and chlorite, iron stained joints, some healed.					
3	HWT casing	(5% LOSS)	3.00	(0)									2.74-3.0m, recovered as rock fragments 2.75m, Jt, 45°, Rf, Un, Fe Sn 2.77m, Jt, 10°, Rf, Ir, Fe Sn 2.8m, Jt, 5°, Rf, Ir, Fe Sn 2.87m, Jt, 65°, Rf, Un, Fe Sn
			3.40	(0)									3.06m, Jt, 10°, Rf, Pln, Fe Sn 3.09m, Jt, 6°, Rf, Pln, Fe Sn 3.21m, Jt, 5°, Rf, Pln, Fe Sn 3.32m, CSm, 60°, Fe Sn, 5mm 3.38m, Jt, 50°, Rf, Pln, Fe Sn 3.4m, DL 3.45-3.55m, recovered as rock fragments 3.54m, Jt, 70-85°, Rf, Un, Fe Sn 3.61m, Jt, 10°, Rf, Pln, Fe Sn 3.63m, Jt, 10°, Rf, Pln, Fe Sn 3.74-3.85m, recovered as rock fragments
4			3.80	(0)					SW				3.86m, Jt, 35°, Rf, Ir, Fe Sn 3.92m, Jt, 70°, Rf, Un, Fe Sn 4.0m, Jt, 30°, Rf, Pln, Fe Sn 4.11m, Jt, 70°, Rf, Pln, Fe Sn 4.16m, Jt, 20°, Rf, Pln, Fe Sn 4.18m, Jt, 85°, Rf, Pln, Fe Sn 4.21m, Jt, 60°, Rf, Ir, Fe Sn 4.23m, Jt, 60°, Rf, Ir, Fe Sn 4.29m, Jt, 5°, Rf, Ir, Fe Sn 4.3m, Jt, 70-90°, Rf, Ir, Fe Sn 4.39m, Jt, 65°, Rf, Ir, Fe Sn 4.43m, Jt, 70°, Rf, Ir, Fe Sn 4.53m, Jt, 20°, Rf, Ir, Fe Sn
			4.35	(0)									4.75m, Jt, 70°, Rf, Ir, Fe Sn 4.82m, Jt, Rf 4.85m, DL 4.88m, Jt, Rf
			4.50	(0)									
5			4.85										

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GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

Position : Refer to test location plan MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond	**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears	**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress

SCALE (m) | Drilling & Casing | Water | Drill Depth (m) | (Core Loss / Run %) | Samples / RQD (%) | Depth metres | Graphic Log

Description
ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)

Weathering | **Estimated Strength $Is_{(50)}$ MPa** (●- Axial, ○- Diametral) Soil, VL, L, M, H, VH, EH (0.03, 0.1, 0.3, 1, 3, 10)

Spacing (mm) 20, 40, 100, 300, 1000

Visual

Additional Data
(joints, partings, seams, zones and veins)
Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.

Depth	Description	Weathering
5.63	BASALT: as previous.	SW
7.08	SANDSTONE: fine grained, brown.	HW
8.04	CLAY: high plasticity, cream, w~PL	XW
8.34	BASALT: dark brown-grey, vesicular, with clay infill.	HW
8.75		

Drilling & Casing: HWT casing; NMLC coring (5% LOSS)

(Core Loss / Run %): (0) (0) (0) (0) (0)

Additional Data:
5.0m, HB
5.09m, Jt, 15°, Rf, Ir, Fe Sn
5.15m, Jt, 15°, Rf, Ir, Fe Sn
5.19m, Jt, 15°, Rf, Ir, Fe Sn
5.25m, Jt, 20°, Rf, Ir, Fe Sn
5.28m, Jt, 85°, Rf, Un, Fe Sn
5.31m, Jt, 65°, Rf, Ir, Fe Sn
5.35m, Jt, 10°, Rf, Ir, Fe Sn
5.55m, Jt, 65°, Rf, Ir, Fe Sn
5.63m, Jt, 30°, Rf, Ir, Fe Sn
5.85m, Jt, 37°, Rf, Ir, Fe Sn
5.91m, Jt, 25°, Rf, Ir, Fe Sn
5.94m, Jt, 50°, Rf, Pln, Fe Sn
6.0m, HB
6.05m, Jt, 35°, Rf, Pln, Fe Sn
6.09m, Jt, 30°, Rf, Pln, Fe Sn
6.13m, Jt, 70°, Rf, Ir, Fe Sn
6.16m, Jt, 10°, Rf, Un, Fe Sn
6.23m, Jt, 40°, Rf, Pln, Fe Sn
6.3m, Jt, 35°, Rf, Pln, Fe Sn
6.53m, Jt, 10°, Rf, Ir, Fe Sn
6.73m, DB
6.85m, DB
6.92m, DB
7.08m, HB
8.04m, DB
8.11m, DB
8.16m, DB
8.21m, DB
8.34m, Jt, 70°, Rf, Pln, Fe Sn
8.6m, DB
8.72m, DB
8.75m, DL
8.89m, DB
8.91m, DB
8.98m, HB
9.0m, HB
9.05m, HB
9.2m, DB
9.21m, DB
9.33m, DB
9.58m, CSm, 5°, rock fragments, infill
9.66m, HB
9.73m, DB
9.86m, Jt, 5°, Rf, Un, Fe Sn
9.91m, Jt, 20°, Rf, Un, Fe Sn

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Job No. 12547851

CORE LOG SHEET

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

SHEET 4 OF 8

Position : Refer to test location plan	MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond	**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears	**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m) | Drilling & Casing | Water | Drill Depth (m) | (Core Loss / Run %) | Samples / RQD (%) | Depth metres | Graphic Log

Description
ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)

Weathering | **Estimated Strength $Is_{(50)}$ MPa** (●- Axial, ○- Diametral) Soil, VL 0.03, L 0.1, M 0.3, H 1, VH 3, EH 10

Spacing (mm) 20, 40, 100, 300, 1000

Visual

Additional Data
(joints, partings, seams, zones and veins)
Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.

Drill Depth (m)	(Core Loss / Run %)	Description	Weathering	Additional Data
		BASALT: as previous.	MW	10.0m, HB 10.05m, CSm, clay/rock fragments, 30mm 10.12m, HB
10.40			Fr	10.23m, DB 10.27m, DB 10.31m, HB 10.35m, HB 10.4-10.5m, recovered as rock fragments
			MW	10.56m, HB 10.59m, HB 10.61m, DB
				10.77m, CSm, 10°, Fe Sn, rock fragments 10.8m, HB 10.84m, HB
	(0)			10.93m, Jt, 45°, Rf, Un, Fe Sn 10.96m, HB 10.98m, HB 11.0m, HB 11.0-11.09m, HB 11.09m, Jt, 35°, Rf, St, Fe Sn
			Fr	11.27m, HB 11.33m, HB
			MW	11.51m, HB 11.6m, HB
			Fr	
			MW	11.84m, HB 11.88m, HB
12.05				12.0m, HB 12.08m, HB
				12.19m, DL 12.26m, HB
			SW	12.36m, HB 12.43m, HB 12.52m, HB
	(0)			12.6m, HB
			MW	12.73m, Jt, 40°, Rf, Pln, Fe Sn 12.74m, DB 12.79m, Jt, 10°, Rf, Pln, Fe Sn 12.8m, Jt, 10°, Rf, Pln, Fe Sn 12.83m, DB 12.95m, DB 12.97m, DB 13.0m, HB 13.03m, Jt, 5°, Rf, Pln, Fe Sn 13.08m, Jt, 65°, Rf, Ir, Fe Sn 13.12m, DL
13.12				13.29m, DB
			HW	13.4m, DB 13.45m, DB 13.51m, CSm, 30°, Ir, Fe, rock fragments
				13.61m, CSm, 10°, clay infill
				13.71m, CSm, 10°, Fe Sn, CLAY
				14.0m, HB 14.04m, HB
		14.28m, calcsilicate vein, 15mm thick.		14.28m, HB 14.32m, HB
			SW	
	(0)			14.6m, HB
				14.78m, HB 14.8m, DB

NMLC coring (5% LOSS)

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Job No. 12547851

CORE LOG SHEET

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

SHEET 5 OF 8

Position : Refer to test location plan	MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond	**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears	**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m) | Drilling & Casing | Water | Drill Depth (m) | (Core Loss / Run %) | Samples / RQD (%) | Depth metres | Graphic Log

Description
ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)

Weathering | **Estimated Strength $Is_{(50)}$ MPa** (● Axial, ○ Diametral): Soil | 0.03 VL | 0.1 L | 0.3 M | 1 H | 3 VH | 10 EH

Spacing (mm): 20 | 40 | 100 | 300 | 1000

Visual

Additional Data
(joints, partings, seams, zones and veins)
Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.

NMLC coring (5% LOSS)

BASALT: as previous.

15.4m, clacsilicate vein, 13mm thick.

15.82m, calcsilicate vein, 10mm thick.

16.07 — (0) — 16.33

16.2-16.26m, green calcsilicate vein.

SW

18.08

Fr

19.2m, dark brown-grey and dark green mottled (chlorite alteration?).

SW

(0) (0) (0)

15.0m, HB
15.04m, HB
15.13m, Jt, 45°, -, Rf, Ir, Fe Sn
15.3m, DB
15.34m, DB
15.47m, DB
15.82m, DB
15.96m, HB
15.97m, HB
16.0m, HB
16.07m, DL
16.26-16.52m, DB, recovered as rock fragments
16.91m, DB
17.0m, HB
17.06m, DB
17.11m, DB
17.21m, vuggy zone
17.26m, vuggy zone
17.35m, Jt, vuggy zone
17.51m, DB
17.73m, Jt, 50°, Ir, Ve, calcsilicate infill 17.76m, DB
17.94m, DB
17.95m, DB
18.0-18.08m, recovered as rock fragments
18.08m, DL
18.61m, DB
18.84m, DB
19.0m, HB
19.27m, DB
19.57m, DB
19.75m, DB

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GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

Position : Refer to test location plan	MGA94/ 56	**Surface RL:**	AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling		**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond		**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears		**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress

SCALE (m) | Drilling & Casing | Water | Drill Depth (m) | (Core Loss / Run %) | Samples / RQD (%) | Depth metres | Graphic Log

Description
ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)

Weathering | **Estimated Strength $Is_{(50)}$ MPa** (●- Axial, O- Diametral) Soil 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH

Spacing (mm) 20 40 100 300 1000 | Visual

Additional Data
(joints, partings, seams, zones and veins)
Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.

Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Description	Weathering	Additional Data
NMLC coring	(5% LOSS)	20.80	(0)	BASALT: as previous.	SW	20.06m, Jt, 65°, Ir, Fe Sn 20.15m, Jt, 80-90°, Ir, Fe Sn 20.2m, DB 20.25m, DB
				20.6m, grey-brown (unaltered).		20.56m, DB
						20.8m, DL
				20.91m, vuggy zone, infill with olivine.		20.92m, DB, vuggy zone 21.0-21.05m, HB
				21.15m, vuggy zone, infill with olivine.		21.15m, vuggy zone 21.23m, DB
						21.39m, DB
				21.61m, vuggy zone.		21.61m, vuggy zone
						21.91m, DB
						22.0m, HB
						22.17m, HB
						22.57m, DB
					Fr	22.73m, DB
						23.0m, HB
						23.13m, DB
						23.68m, DB
		23.87				23.87m, DL
						24.0m, HB
						24.18m, HB
						24.41m,DB
						24.75m,DB
						24.88m,DB
						24.98m, HB

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CORE LOG SHEET

Client : R&S Contracting Pty Ltd				**HOLE No. BH02**	
Project : Bentley Quarry Geotechnical Assessment					
Location : Bentley, NSW				**SHEET 7 OF 8**	
Position : Refer to test location plan MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond	**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears	**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING | **MATERIAL** | **NATURAL FRACTURES**

Progress: SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (●-Axial ○-Diametral: Soil, 0.03, VL, 0.1, L, 0.3, M, 1, H, 3, VH, 10, EH)	Spacing (mm): 20, 40, 100, 300, 1000	Visual	Additional Data
								ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)					(joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.
26	NMLC coring	(5% LOSS)		(0)		26.10		BASALT: as previous.	Fr				25.01m, HB 25.29m, DB 25.3m, DB
			26.60					BASALT: red/grey, chlorite alteration, calcsilicate veins present.	SW				26.0m, DB 26.08m, Jt, 35°, St, Mu Ve 26.2m, DB 26.39m, DB/ VN calcsilicate infill 26.51m, DB 26.6m, DL 26.66m, DB 26.72m, DB 26.79m, DB
27						27.25		BASALT: fine grained, dark grey.					27.0m, HB 27.23m, Jt, 40°, Rf, St, Mu 27.37m, HB 27.43m, DB
28				(0)					Fr				27.81m, DB 28.0m, HB 28.07m, vuggy zone 28.15m, HB 28.16m, vuggy zone 28.53m, vuggy zone
29			29.68										29.0m, HB 29.2m, HB 29.58m, DB 29.63m, DB 29.68m, DL
30													

GEO_COREHOLE_VISUAL_AS1726 2017 12547851 BENTLEY QUARRY.GPJ GHD_GEO_TEMPLATE 2.00.GDT 8/9/21

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Job No. **12547851**

CORE LOG SHEET

Client : R&S Contracting Pty Ltd
Project : Bentley Quarry Geotechnical Assessment
Location : Bentley, NSW

HOLE No. BH02

SHEET 8 OF 8

Position : Refer to test location plan	MGA94/ 56	**Surface RL:** AHD	**Angle from Horiz. :** 90°	**Processed :** SBO
Rig Type : Truck Mounted	**Mounting:** Truck	**Contractor :** MRD Drilling	**Driller :** R. Frappel	**Checked :** JP
Casing Dia. : HWT	**Barrel (m) :** 3.0	**Bit :** Diamond	**Bit Condition :** Good	**Date:** 09/08/2021
Date Started : 14/7/2021	**Date Completed :** 16/7/2021	**Logged by :** L. Spears	**Date Logged :** 14/7/2021	Note: * indicates signatures on original issue of log or last revision of log

DRILLING						MATERIAL				NATURAL FRACTURES			
Progress													
SCALE (m)	Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	Samples / RQD (%)	Depth metres	Graphic Log	Description ROCK NAME: grain size, colour, fabric and texture, inclusions or minor components, moisture, durability and [COBBLES / BOULDERS / FILL / TOPSOIL] then SOIL NAME: colour, plasticity / primary particle characteristics, secondary and minor components, zoning (origin)	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral Soil 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Spacing (mm) 20 40 100 300 1000	Visual	Additional Data (joints, partings, seams, zones and veins) Defect type: orientation, roughness and shape, composition or coating, aperture and thickness, other.
		(5% LOSS)	30.40	(0)		30.40		BASALT: as previous.	Fr				30.0m, HB 30.1m, HB
								End of Borehole at 30.40 metres. Target Depth					

See standard sheets for details of abbreviations & basis of descriptions

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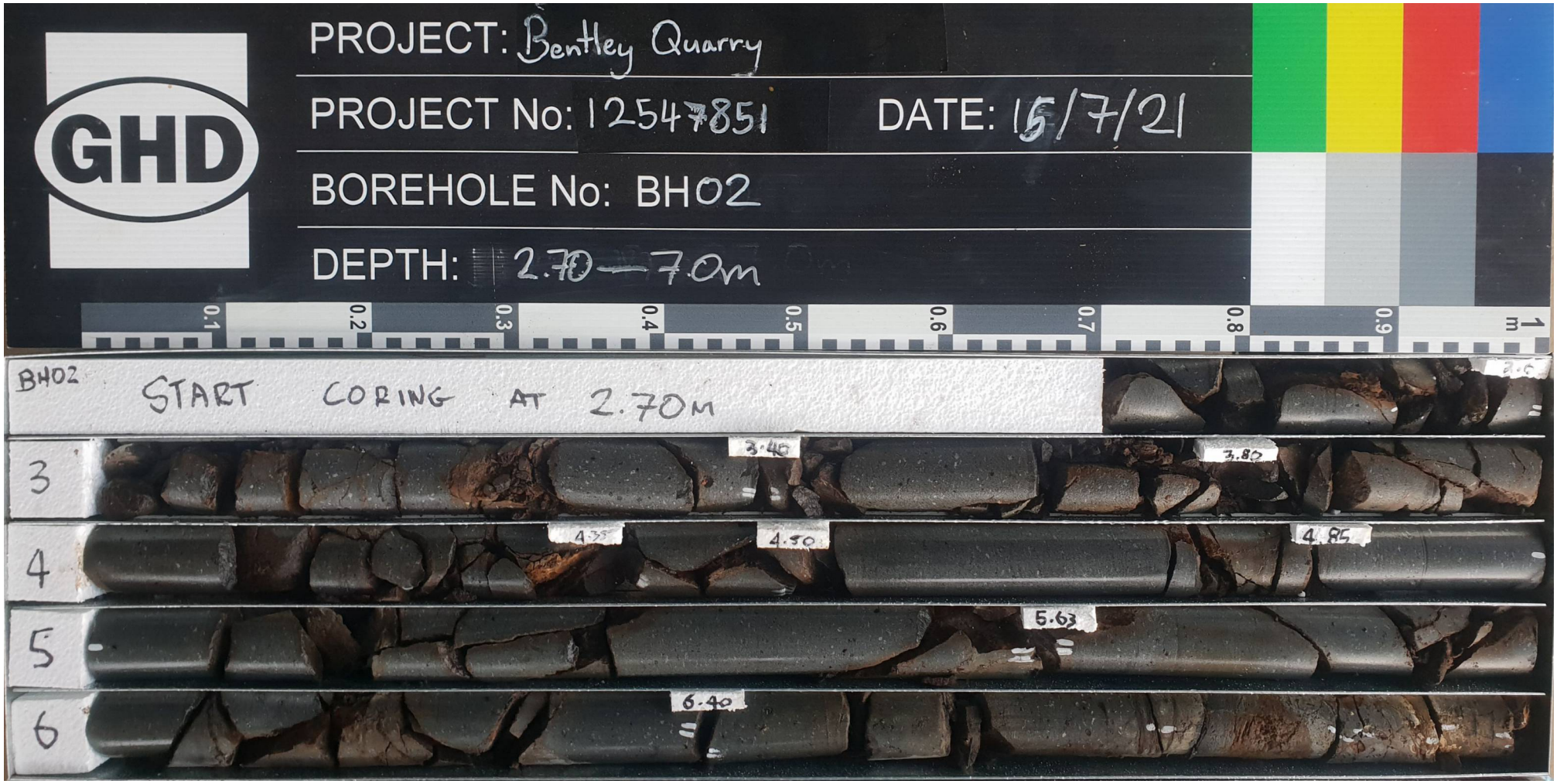
CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No. 12547851



PointID : BH02 Depth Range: 2.70 - 7.00 m

R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH02 1/6

PointID : BH02 Depth Range: 7.00 - 12.00 m

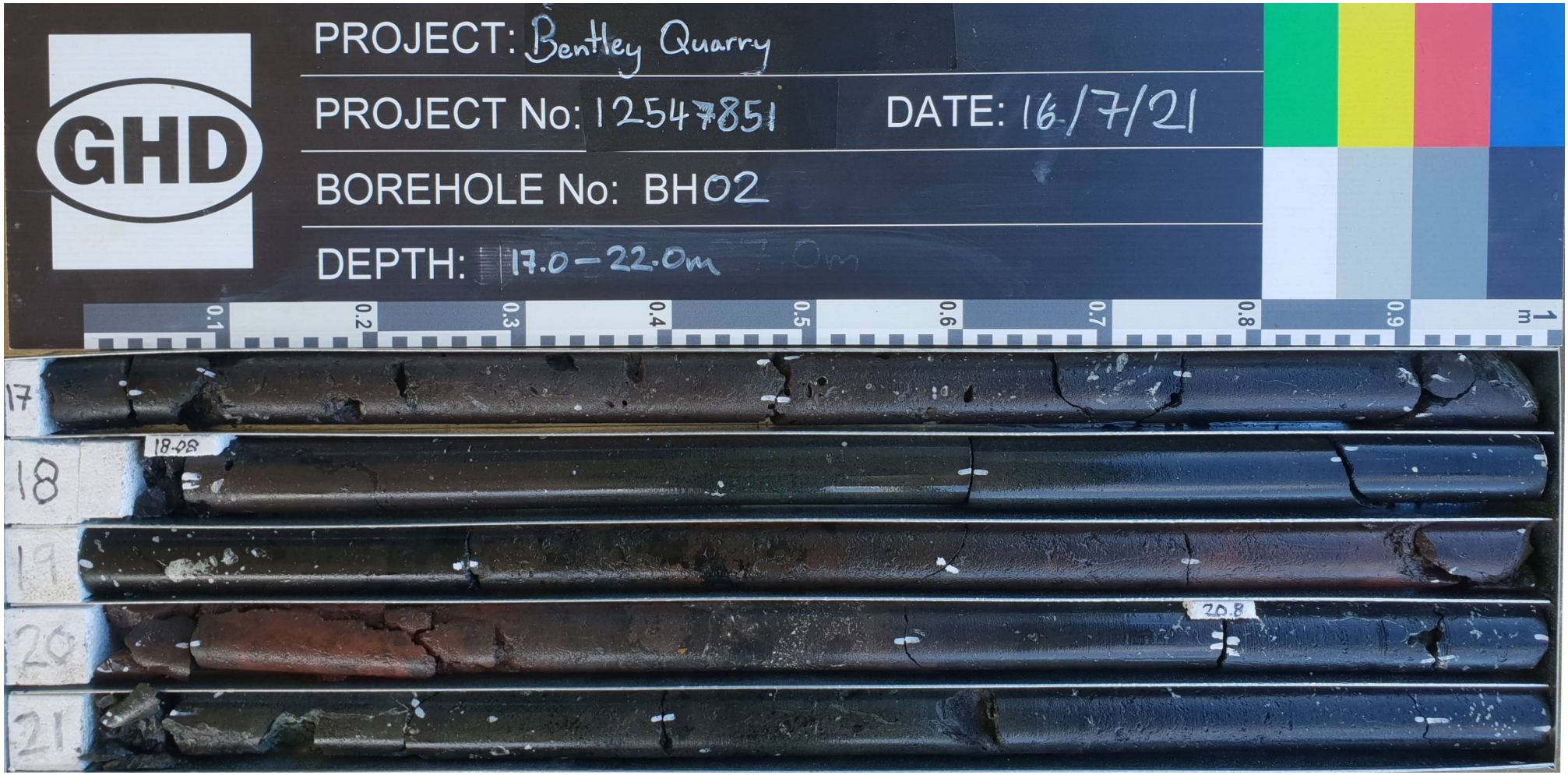
R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH02 2/6

PointID : BH02 Depth Range: 12.00 - 17.00 m

R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH02 3/6



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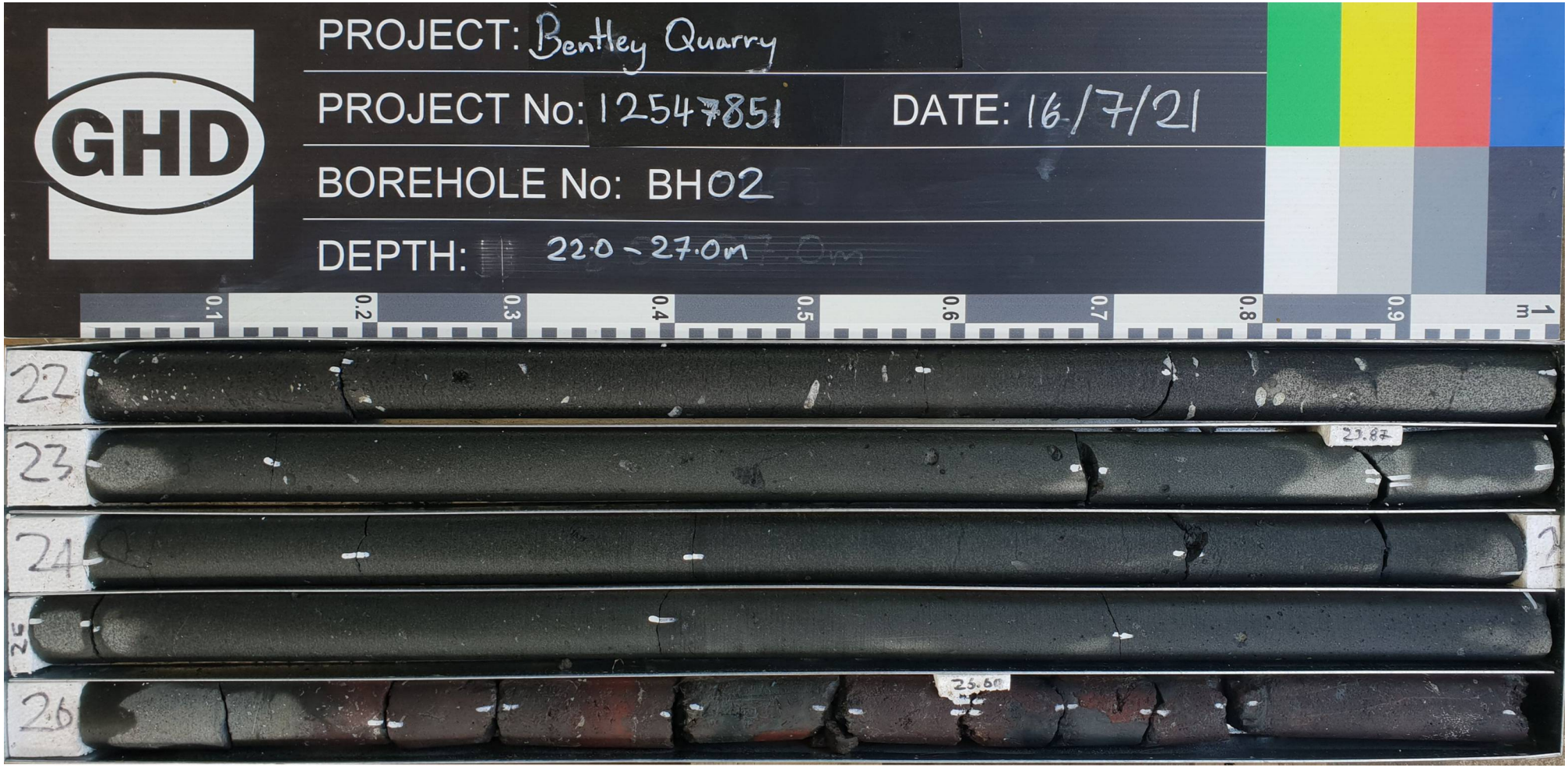
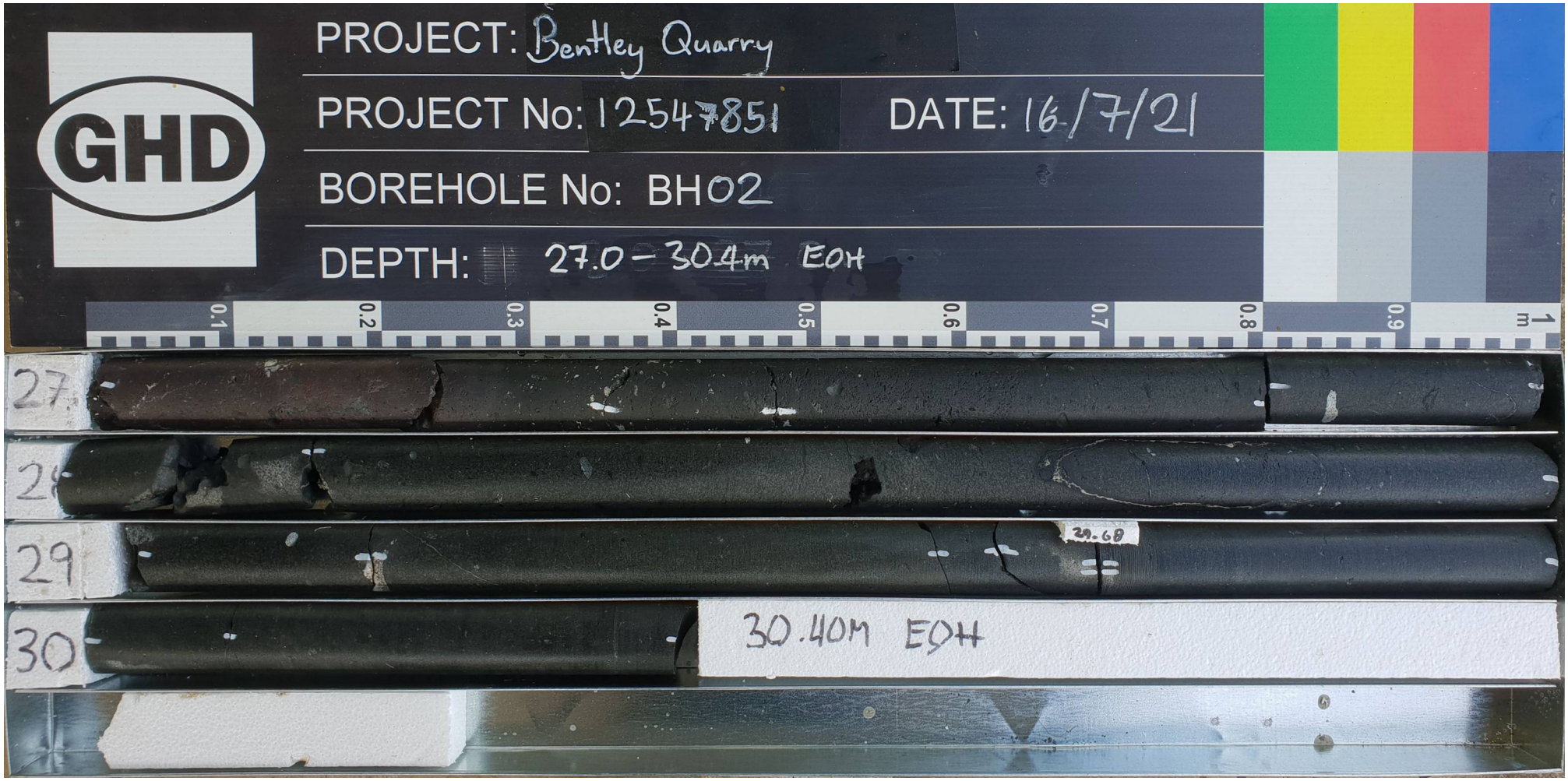
R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH02 4/6



PointID : BH02 Depth Range: 22.00 - 27.00 m

GHD	R&S Contracting Pty Ltd Bentley Quarry Geotechnical Assessment Bentley NSW Core Photographs	DRAWN: H Warr	DATE: 11/08/2021
		CHECKED: J Petersen	DATE: 11/08/2021
		SCALE: Not To Scale	A4
		PROJECT No: 12547851	FIGURE No: BH02 5/6



PointID : BH02 Depth Range: 27.00 - 30.40 m

R&S Contracting Pty Ltd
Bentley Quarry Geotechnical Assessment
Bentley NSW
Core Photographs

DRAWN	H Warr	DATE	11/08/2021
CHECKED	J Petersen	DATE	11/08/2021
SCALE	Not To Scale		A4
PROJECT No	12547851	FIGURE No	BH02 6/6

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Groundwork Plus Resources Environment Planning Laboratories
Phone: 1800 GW PLUS (1800 497 587)
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Website: groundwork.com.au
ABN 13 609 422 791

Petrographic Inspection Report

Prepared for:	Douglas Partners – Ballina
Project Number:	201967.00
Work Request:	1282
Material Source:	Bentley Quarry Middle Drill Hole East side (4-14m)
Sample Type:	Drill Chips
Lab Sample No:	BL-1282A
Date Sampled:	19/02/2021
Date of Inspection:	08/03/2021
Report Issued:	10/03/2021
Project/ File Ref.:	P2021_029_01

Author: BDeegan

Blake Deegan (BSc, MPhil)

Petrologist
Groundwork Plus

Reviewer: Rod Huntley

Rod Huntley (BSc, M.App.Sc, M.Eng)
Principal Resource Consultant
Groundwork Plus

Enquiries regarding the content of this report should be directed to Groundwork Plus 07 3871 0411*. Samples are disposed of after 3 months from the date of report. Thin sections will remain on site indefinitely. The analysis is based on a limited number of thin sections and sample provided by client, further investigation may be required. Interpretations are specific to the sample examined only.*

Executive Summary

Classification: Basalt

For Engineering Purposes AS 2758.1: Basic igneous rock

Key Material Risk: increased weak/secondary phases may be encountered throughout the deposit, lowering suitability in more demanding roles such as concrete/asphalt aggregates.

Table 1 – Summary of Sample's Compositional Characteristics

Compositional Features	%	Comments
Strong Phases	90	Principally occurring as robust primary basaltic phases, including plagioclase, clinopyroxene, volcanic glass, ilmenite/magnetite, and olivine
Weak/Secondary Phases	10	Minor smectite clay, with goethite and sericite
Clays	5	Minor shrink/swell clays as smectite
Micas	1	Minor secondary sericite
Sulphides	0	No sulphides observed
Carbonates	0	No carbonates present
Organics	0	No organic particles detected
Textural Features	**Yes/ No**	
Fracturing/Veins	Yes	Minor goethite filled fractures
Voids	No	No vesicles or other voids observed, non-porous
Free Silica	**%**	
Unstrained quartz	0	None observed
Optically strained Quartz	0	None observed
Microcrystalline Quartz	0	None observed
Volcanic Glass	0	Volcanic glass noted is ferromagnesian and regarded as non-reactive
Opaline Quartz	0	None observed
Total	**0**	

Table 2 – Risk Rating for Specific Applications and Source Rock Quality

Product Suitability	Low	Mod	High	Comments
Aggregate in Concrete	✓			Texturally isolated secondary phases unlikely to cause deleterious reactions or significantly increase water demand in concrete
Aggregate in Asphalt	✓			Suitable hardness, strength and durability provided adequate PAFV can be achieved
Roadbase	✓			Suitable pending material testing
Fill	✓			Suitable pending material testing
Expected Performance	**Low**	**Mod**	**High**	**Comments**
Hardness	✓			Hard
Strength	✓			Strong
Durability	✓			Durable
ACR in concrete	✓			Innocuous, no dolomite detected
ASR in concrete	✓			Innocuous, no free silica

Introduction

This report provides the results of a general petrographic assessment of a manufactured sand sample, which was submitted to the Groundwork Plus petrographic laboratory, and describes the method and standards used to assess the sample. The supplied sample was sampled by the client and sent to the Groundwork Plus petrographic facility. The thin section was prepared and analysed by Groundwork Plus with instructions from the client to conduct petrographic testing to ASTM C295 and recommend further testing if significant deleterious characteristics are identified pursuant to Clause 16.3 of this standard. The provided modal mineral percentages relate to the supplied sample which is understood to be representative of material on site. Assessment regarding the Alkali-Silica Reactivity (ASR) potential of the manufactured sand has been advised by SA HB 79-2015. Communication of findings are advised by AS 1726-2017 Geotechnical Site Investigations.

Methodology

The petrographic assessment of the slide is carried out using a Nikon polarising microscope equipped with a digital camera at the Groundwork Plus petrographic laboratory. Photographs of the hand specimen and thin section photomicrographs showing grain sizes and any particular aspects of the minerals are included as part of the report (**Plates 1** to **6**). Modal analysis is conducted on the sample using a MA945/10 Mechanical Point Counter on 600 points (**Table 3 – Modal Analysis of Minerals**).

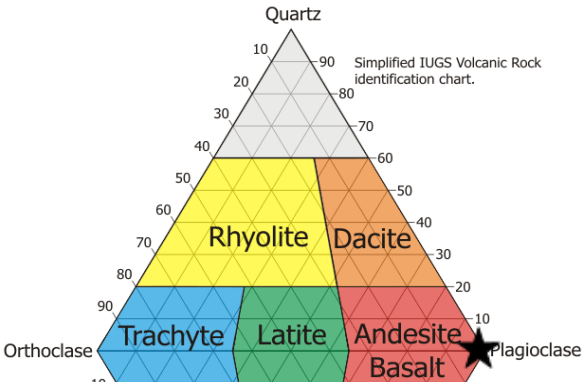
The petrology assessment is based on:

- ASTM C 295 – 2019 Standard Guide for Petrographic Examination of Aggregates for Concrete.
- AS 2758.1 – 2014 Aggregates and Rock for Engineering Purposes Part 1: Concrete Aggregates.
- AS 2758.5 – 2014 Aggregates and Rock for Engineering Purposes Part 5: Asphalt Aggregates.
- AS 1141.26 – 2019 Standard Guide for the Method for Sampling and Testing Aggregates – Secondary Minerals Content in Igneous Rocks.
- SA HB 79-2015 Alkali-Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structure in Australia - Cement and Concrete Association of Australia and Standards Australia.

Hand Specimen Description

The supplied drill chip sample was found to be derived from **Basalt**.

In hand specimen, the sample occurs as 0.5 to 5.0mm, grey-black, fine grained, volcanic rock of a basic igneous derivation. The sand is slightly weathered, robust and is composed of slightly flaky well-shaped aggregate with granular crushed faces. The fines coating the aggregate are composed principally of feldspar chips. The sand is highly magnetic, with no observable sulphides. The sand is regarded as hard and of high strength and durability.



QAPF Diagram after Streckeisen, A. L., 1978 QAPF diagram is a double triangle diagram which is used to classify igneous rocks based on mineralogical composition. The acronym, QAPF, stands for "Quartz, Alkali feldspar, Plagioclase, Feldspathoid". Black star indicates bulk mineral composition of the rock.

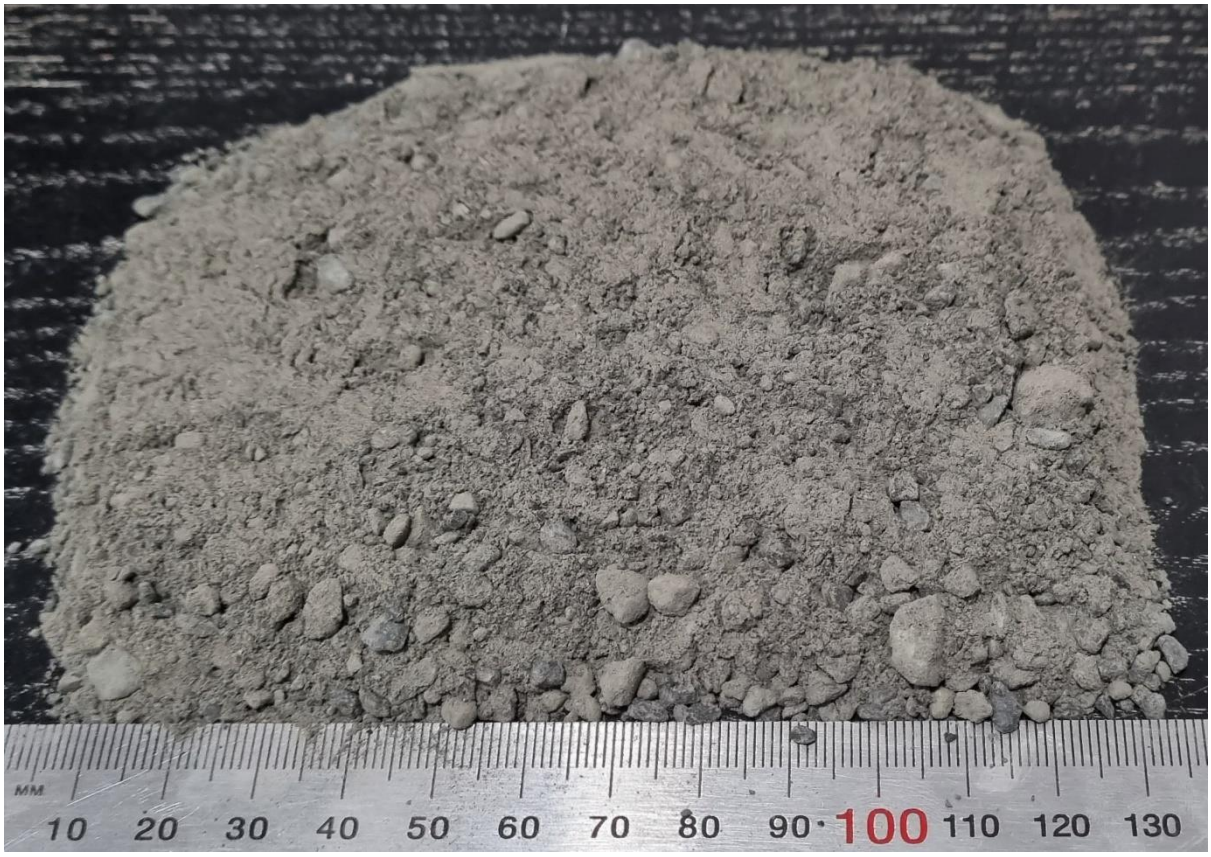


Plate 1: Photograph of the sample as provided, showing coarse sand sized fragments of basalt, accompanied by abundant dark grey fines.

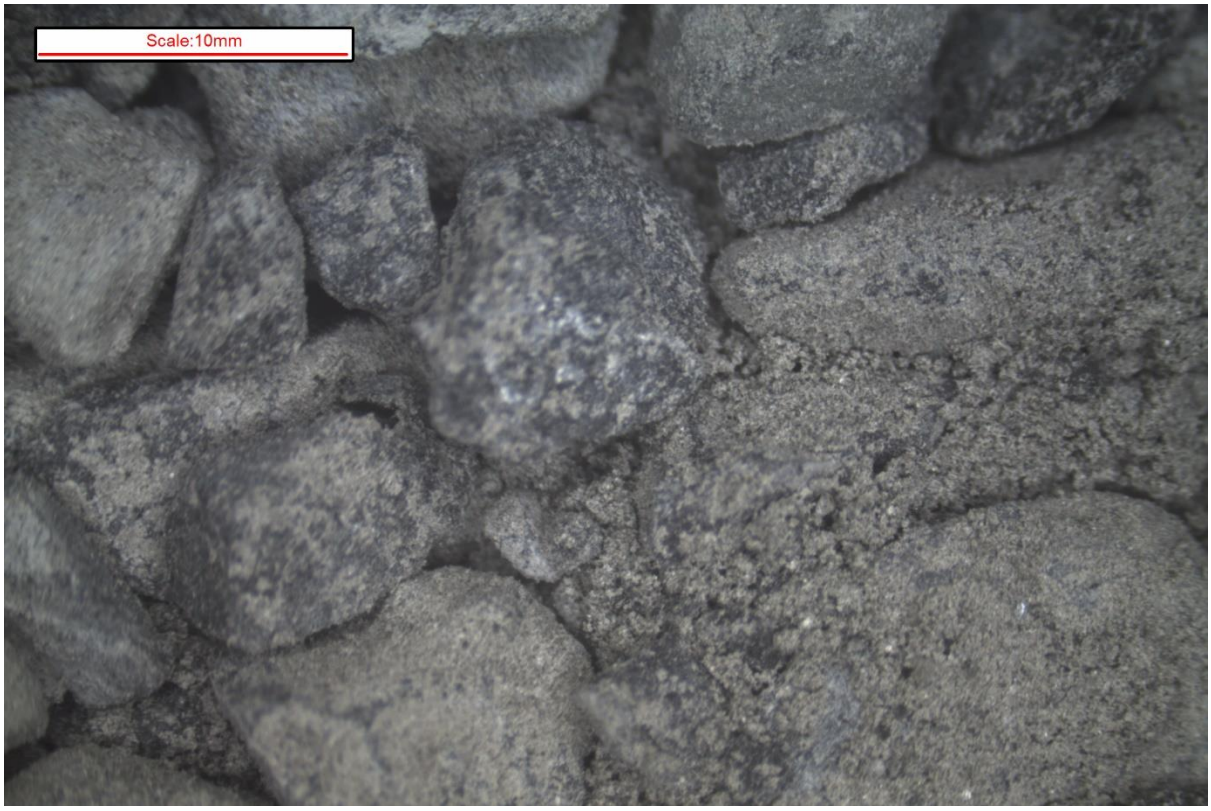


Plate 2: Photograph of the washed sample, showing the variably sized and mostly blocky nature of the manufactured sand, which are coated in light grey fines.

Thin Section Description

Petrographic analysis has identified the studied manufactured sand as being derived from an aphanitic, hypidiomorphic, hypocrystalline basalt. The sand sized fragments display characteristic basaltic mineral assembly, with abundant mildly flow aligned, plagioclase laths and tabular clinopyroxene crystals. Plagioclase also occurs as minor subhedral phenocrysts, which range in size from 0.5 – 1.5mm. Phenocrysts display characteristic polysynthetic twinning, and some phenocrysts show fractures infilled with goethite. Opaques are cubic to tabular, 0.35mm in size, and are disseminated throughout the rock as ilmenite/magnetite. The sample contains a moderate abundance of volcanic glass, which occurs as a late-stage, interstitial, dark brown ferromagnesian mesostasis. A minor proportion of the volcanic glass shows secondary alteration to smectite clay. Accessory apatite is observed as very fine, needle-like inclusions in plagioclase.

A minor textural variation is noted in the supplied drill chips, occurring as a sparsely porphyritic olivine basalt (see **plate 5**). These fragments contain sparse sub-hedral olivine phenocrysts, consolidated by a dark, microlitic groundmass composed of plagioclase, pyroxene, and opaque crystalline iron-titanium oxides. These fragments are non-porous and considered to be of equal or greater engineering potential. The sample contains a major abundance of grey fines, which are composed principally of silicate chips, including plagioclase, pyroxene, and olivine. Fines also include a moderate abundance of secondary weak material, with goethite and smectite clay.

Overall, the supplied basalt sample is principally composed of robust primary ferromagnesian phases, with subordinate weak phases not occurring as significant segregations likely to be accessed or liberated with further processing/crushing. The basalt is also free of hairline fractures and amygdules, which could facilitate weathering and secondary replacement among mafic rock types. The textural features observed in this sample have positive implications for the overall engineering strength and durability of the basalt and denote a source rock able to withstand the repeated stresses associated with road building materials. A mode based on a count of 600 widely spaced points is listed in **Table 3 - Modal Analysis of Minerals**.

Table 3 – Modal Analysis of Minerals

Primary Minerals	Mode (%)	Comments
Plagioclase	52	Mildly flow aligned pristine, variably sized laths with rare sericitisation. Also occurring as subhedral phenocrysts
Pyroxene	17	Interstitial pyroxene crystals
Volcanic glass	11	Dark brown, late-stage ferromagnesian mesostasis, with partial alteration to smectite clay
Ilmenite/Magnetite	8	Opaque tabular and cubic crystals, disseminated throughout the sample
Olivine	2	Occurring as subhedral pristine phenocrysts with mild iddingsite alteration, which has subsequently resolved to smectite/chlorite
Apatite	Trace	Very fine rods hosted by plagioclase and pyroxene crystals
Secondary Minerals		
Smectite/chlorite	5	Altering olivine phenocrysts, resolved from iddingsite alteration
Goethite	4	Ferruginous staining of the ferromagnesian groundmass
Sericite	1	Alteration product of plagioclase
Total	**100**	

Free Silica Content

After conducting a modal analysis using the MA945-10 mechanical point counter on 600 points, the supplied aggregate was found to contain **no free silica**.

According to Standards Australia HB 79-2015, the provided manufactured sand is assessed as being **innocuous in relation to ASR in concrete**.

Asbestiform Minerals

Asbestos can be defined mineralogically and by crystal habit. For the purposes of health screening asbestiform habit is relevant, which is defined as being hair-like (filiform) and flexible with a high aspect ratio. Based on the observable minerals in the thin section, the sample is considered **FREE FROM ASBESTIFORM MINERALS**.

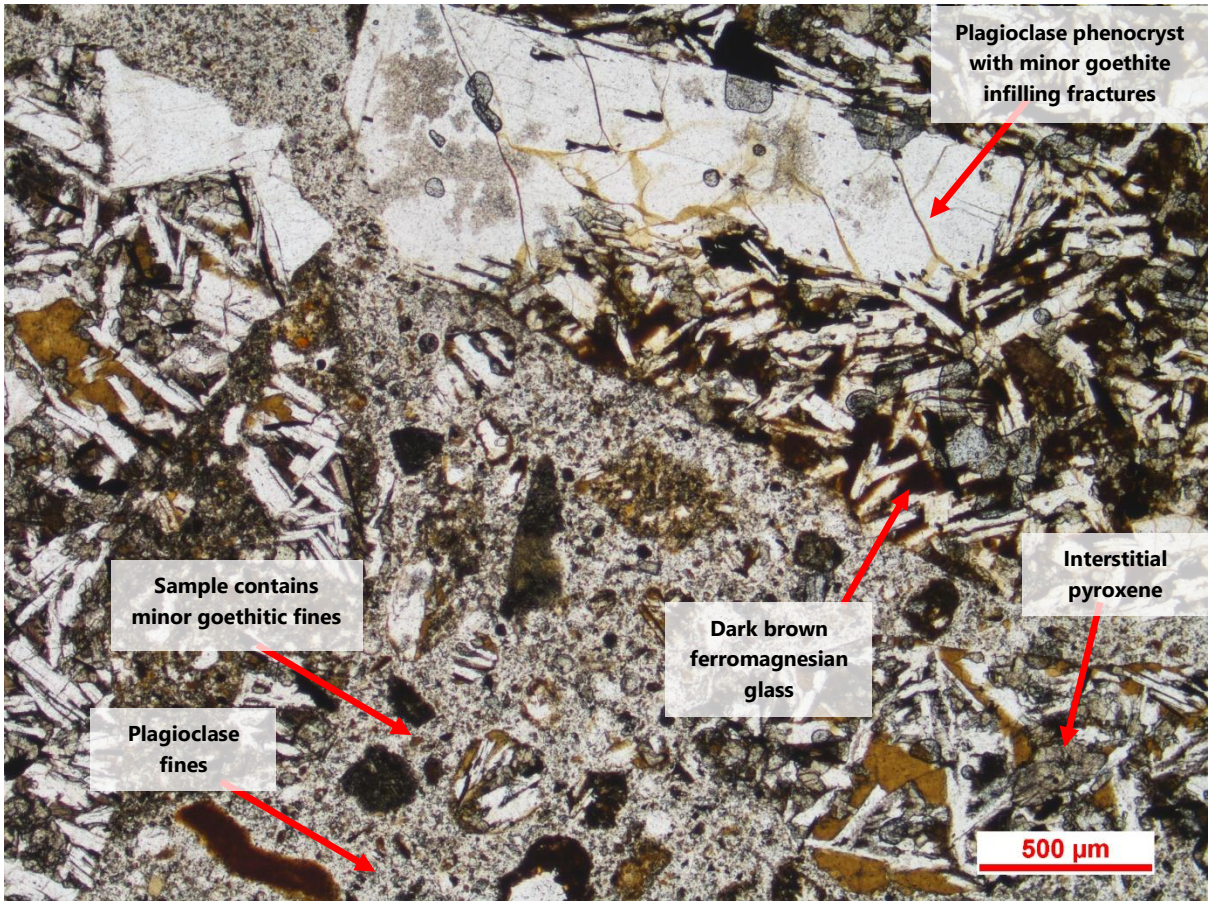


Plate 3: Microphotograph of the sample, showing basalt sand fragments with plagioclase phenocrysts and slight to moderate weathering. Image shown in plane polarised light. Scale = 500µm x 40 magnification. F.O.V. 5.2mm.

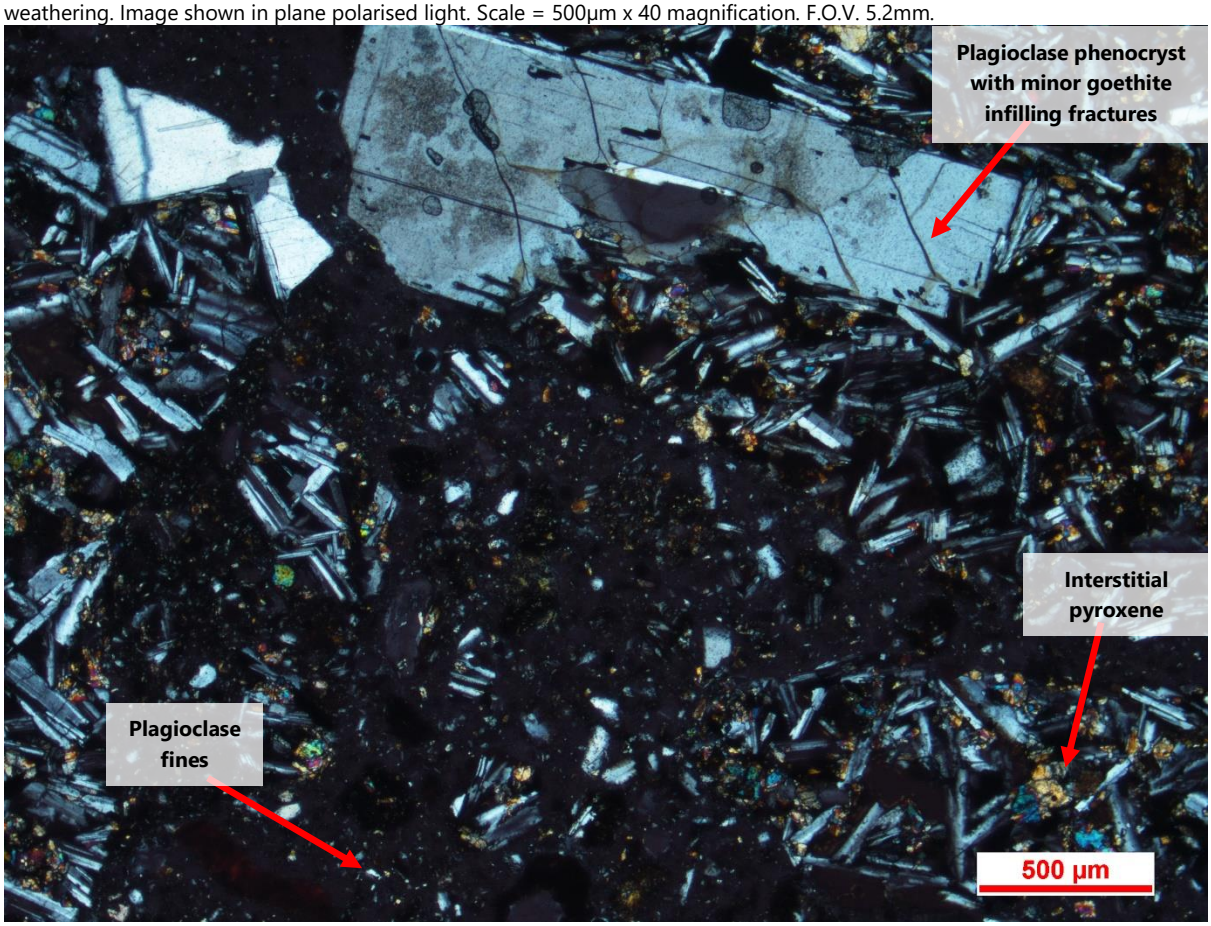


Plate 4: The same image from **Plate 3** under crossed polarised light. Scale = 500µm x 40 magnification. F.O.V. 5.2mm.

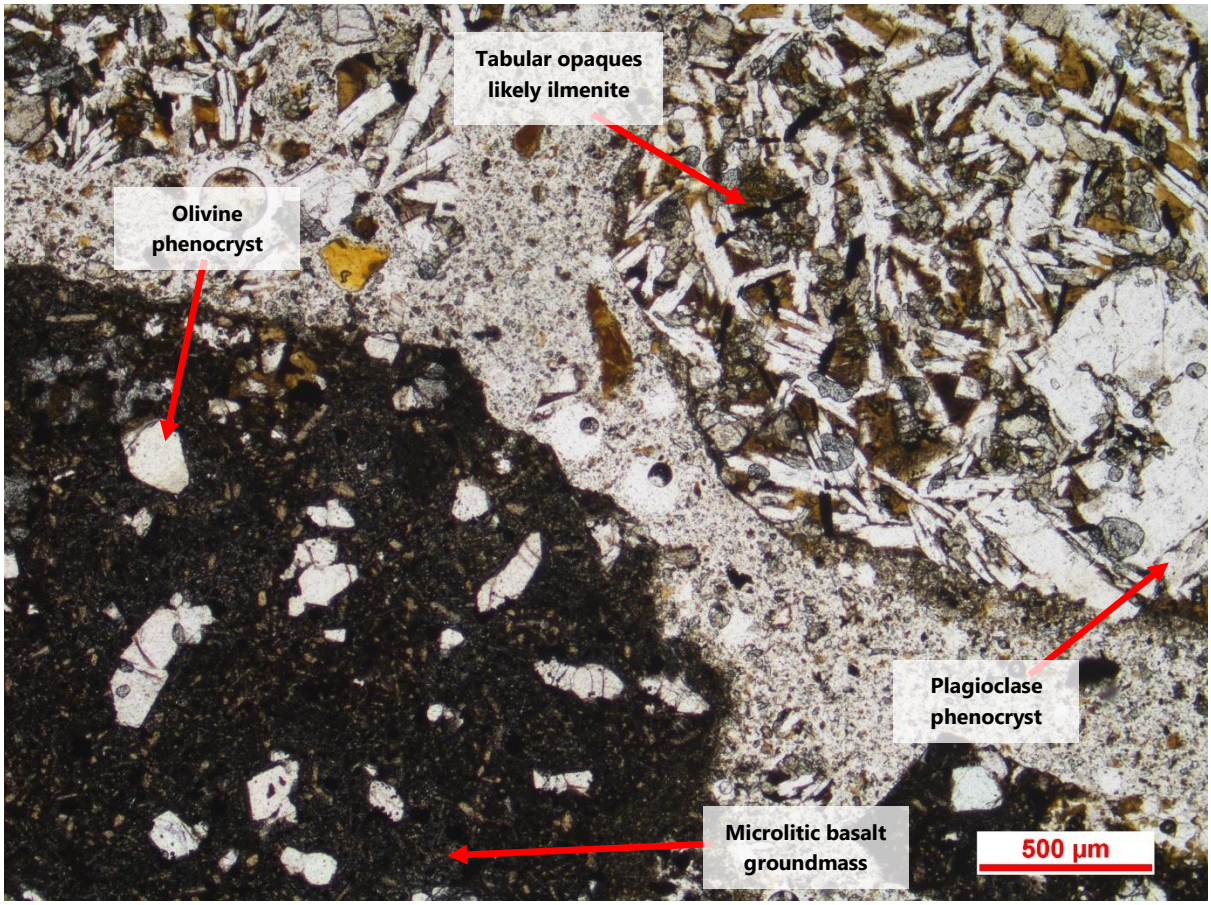


Plate 5: Microphotograph of the sample, showing a sparsely porphyritic olivine basalt textural variant, as well as disseminate tabular opaques in the coarser grained basalt. Image shown in plane polarised light. Scale = 500µm x 40 magnification.

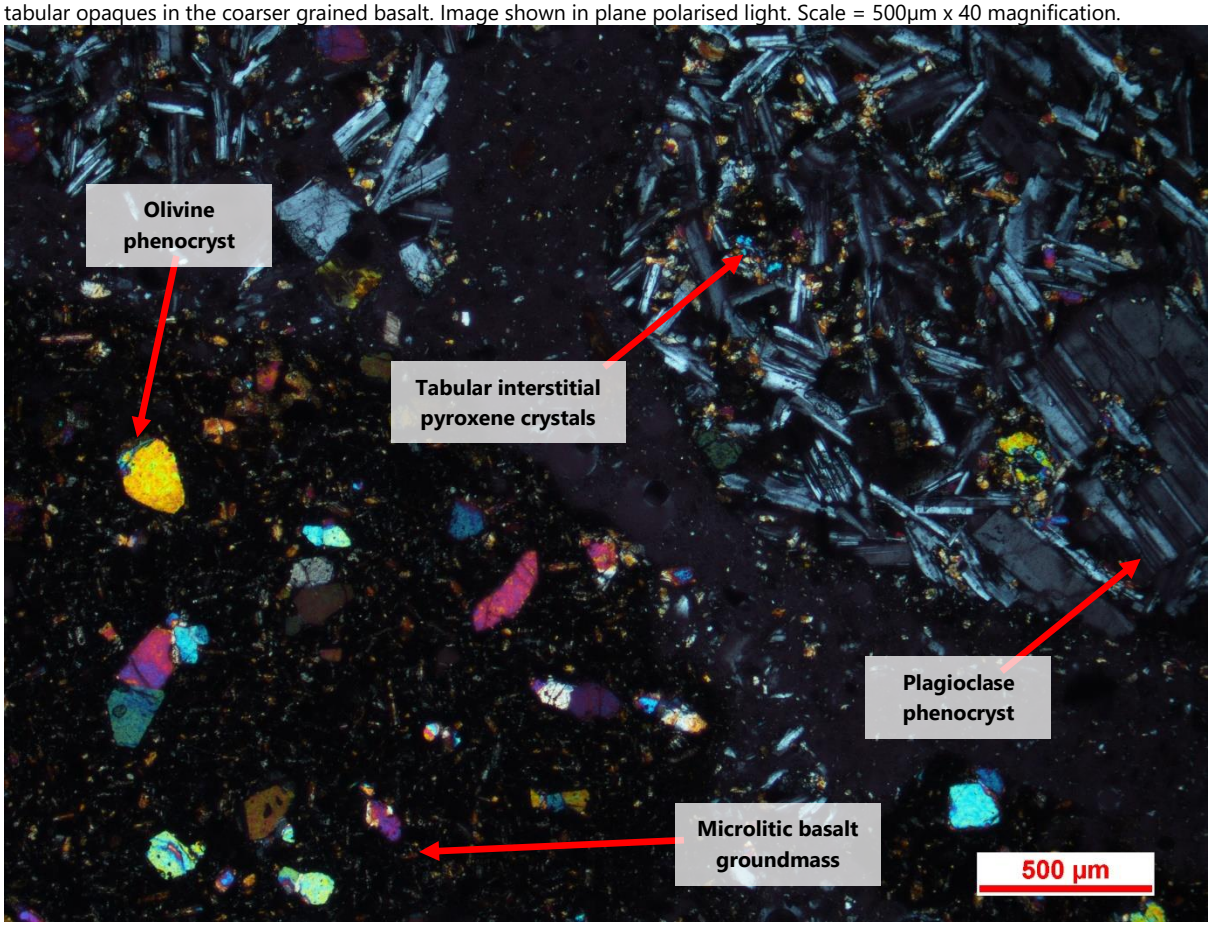


Plate 6: The same image from **Plate 5** under crossed polarised light. Scale = 500µm x 40 magnification. F.O.V. 5.2mm.

Summary

Pending relevant materials testing, the aggregate's mineral assembly, texture and weathering profile is predicted to be suitable as Fine Aggregate in Concrete, Asphalt and Unbound Pavement materials. While the bulk of the observed material displays suitability in the stated engineering roles, caution is recommended regarding the rock's potential to host increased weak secondary phases.

For engineering purposes, the rock may be summarised as:

- A manufactured sand derived from the crushing of a **Basalt**, a basic igneous rock.
- Composed principally of **robust primary silicate and opaque phases (90**%), with minor weak material as smectite/chlorite, goethite, and sericite.
- Collectively regarded as **hard**, **strong,** and **durable**. May display textural variability in the field associated with variations in volcanic stratigraphy.
- No hairline fractures or vesicles observed, regarded as non-porous.
- Containing nil free silica and considered **innocuous in relation to ASR**.

Appendix D

Capital Investment Value

QUOTE

SL McKenzie & RG McKenzie

Date
10 Nov 2021

Expiry
29 Apr 2022

Account Number

Quote Number
QU-0015

Reference
Front Entrance

ABN
26 601 969 288

Bentley Quarry
1465 Bentley Road
BENTLEY NSW 2480
AUSTRALIA

Description	Quantity	Unit Price	GST	Amount AUD
Mobilization Of Plant & Equipment to 1465 Bentley Rd Bentley	1.00	15,250.00	10%	15,250.00
Supply Plant and Equipment Grader , Excavators, Rollers, Water Truck, Tipper , for the Duration of the Bentley Road Upgrade	1.00	314,000.00	10%	314,000.00
Supply Traffic Control for Bentley Road Upgrade	1.00	66,000.00	10%	66,000.00
Supply and Deliver Gravel , Pipes and Materials for Bentley Road Upgrade	1.00	85,000.00	10%	85,000.00
Supply Hotmix and Spray Seal for Bentley Road Upgrade and Internal Access	1.00	138,000.00	10%	138,000.00
Level and Construct site for Weighbridge and Site Office Supply of all fittings	1.00	145,000.00	10%	145,000.00
Revegetation and Nest Boxes	1.00	53,254.00	10%	53,254.00
Landscaping and Landscape Mounds	1.00	42,570.00	10%	42,570.00
Fencing	1.00	24,387.00	10%	24,387.00
De Mobilization of Plant and Equipment	1.00	15,250.00	10%	15,250.00
			Subtotal	898,711.00
			Total GST 10%	89,871.10
			TOTAL AUD	**988,582.10**

Appendix E

Land Use Conflict Risk Assessment

E-1 Introduction

This Land Use Conflict Risk Assessment (LUCRA) has been prepared for the proposed Bentley Quarry at Lot 2 DP 1196757, 1465 Bentley Road, Bentley. The proposed quarry is located in a rural area with an abandoned dwelling 650 m north and a proposed subdivision with a dwelling located 600 m to the southwest. The nearest occupied dwelling is located 1.25 km to the east.

The purpose of the assessment is to address the Richmond Valley DCP 2021 which requires that a LUCRA be prepared for development applications that are within a certain buffer distance to a conflicting land use. The buffer distance for quarries that include blasting is 1000 m from rural dwellings and site specific determination for roads, property boundaries and bores (as well as other land uses).

The LUCRA has been prepared in accordance with the Land Use Conflict Risk Assessment Guide (DPI 2011) and involves four key steps:

– Describe the site and surround characteristics
– Evaluate the risk level of each activity associated with the proposal
– Identify risk reduction management strategies
– Record the LUCRA results

E-2 Background information (Step 1)

E-2-1 Site overview

The property is approximately 214 hectares in area and sits on undulating pasture land 14km to the west of Lismore (refer Figure 1.2).

The northern portion of the property has been cleared due to historical agricultural land uses, with scattered paddock trees remaining. Native vegetation exists on the higher slopes in the southern portion of the site, which rise to a ridgeline.

The project site is zoned RU1 Primary Production under *Richmond Valley Local Environmental Plan* (LEP) *2012*, as is the surrounding area.

Figure E.1 Existing quarry looking north-west

E-2-2 Site history

The property predominantly consists of cleared land that is currently being used for cattle grazing. The southern section of the site is covered in native vegetation.

The property includes a house and agricultural shed and is occupied by the owners of the site.

The site has been used for rock extraction for many years, with obvious signs of benching from past operations. A small quarry has been operating at the project site intermittently since the 1970's and more frequently of late. The recent operations have been limited to an extraction rate of 3,000 m^3 (estimated to be 6,000 tonnes based on a conversion of 2 tonnes per m^3) and a disturbance footprint of approximately 1 hectare.

E-2-3 Topography and catchments

The northern edge of the site, where the existing quarry is located, has an elevation of 63 m Australian Height Datum (AHD). The site slopes up towards the south to a ridge with an elevation of 256 m AHD. The ridge is the highest point in the area, with the surrounding plains having an elevation between 60 and 200 m AHD.

The existing quarry is approximately 5 m below the natural ground surface.

No watercourses are located on the site, however there is an ephemeral drainage line to the west where a dam has been constructed. This flows north into Back Creek. Back Creek is located approximately 883 m to the north of the existing quarry, travelling in an east-west direction. Another watercourse is located approximately 872 m to the west of the quarry, travelling in a north-south direction and connecting to Back Creek.

E-2-4 Geology and soils

Reference to eSpade indicates the quarry site is located within the McKee (9450mc) soil landscape which comprises low undulating hills and rises with relief of 30 m to 50 m and slopes of up to 10% (~5°) related to tertiary basalts. The landscape is typically extensively cleared and comprises grassland with sporadic stands of mature trees. Soils are generally shallow, high plasticity and highly reactive.

E-2-5 Groundwater

Groundwater at the site occurs within an unconfined weathered and fresh basalt aquifer which is part of the North Coast Volcanics groundwater source. According to the background document for the WSP (DPI-Water, 2016), the North Coast Volcanics is a fractured rock groundwater source with moderate bore yields in the order of 5-10 L/s where fractures occur and excellent water quality.

A search of Australian Groundwater Explorer (BOM 2019a) database identified 56 registered bores within an approximate five kilometre radius of the site. Of the registered bores, 21 were registered as stock watering and domestic supply bores, 31 were registered for water supply, while the remainder have an unknown purpose and for monitoring.

The majority of bores are shallow, having been installed to a depth of less than 25 m. There are no bores within 1 km from the site. The closest bores, GW037176 and GW038734, are registered as stock and domestic and water supply bores respectively and are located approximately 1.5 km from the site.

E-2-6 Surrounding land uses

Land uses surrounding the project site are predominantly associated with agricultural activity, predominately grazing but some cropping reportedly occurs on the lower river flats to the north east.

A sensitive receptor is defined as a location where people are likely to work or reside. This may include dwellings, schools, hospitals, offices or public recreational areas. Nearby sensitive receptors in the vicinity of the project site include:

- A dwelling is located approximately 360 m south of the proposed quarry, which is owned and occupied by the applicant (R1).
- The closest dwelling (R2) that is not associated with the proposal is located 650 m north of the proposed quarry. Disputed Plains Homestead has been vacant since the 1990's (NSW State Heritage Inventory, N.D.).
- The closest occupied dwelling (R6) that is not associated with the proposal is located 1.25 km east of the proposed quarry (refer Figure 1.2).
- A proposed subdivision to the east has nominated a dwelling site 600 m from the proposed quarry (R4).
- A commercial farm shed (R7) is located 750 m east of the proposed quarry.
- The nearby rail way is proposed to be converted into a 'rail trail' which is 1.25km to the north.
- A proposed subdivision to the east has nominated a dwelling (R5) site 1.5km from the proposed quarry.
- A B&B (R8) operates 1.65km east of the proposed quarry.

The locations of the above are shown on Figure 1.2.

E-2-7 Planning controls

According to Richmond Valley LEP 2012 the site and surrounding area are zoned RU1 Primary Production. The objectives of zone RU1 Primary Production are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To ensure that development does not unreasonably increase the demand for public services or public facilities.*

The minimum lot size for the area is 40 hectares.

The Lismore LGA boundary is 1.7km to the east but the zoning and lot size are the same.

E-2-8 Community consultation

Consultation with the community has been undertaken to understand any concerns with the proposal. In summary the relevant concerns raised, included:

– The proposal is not consistent with the holistic agricultural approach being adopted by neighbouring farms
– The proposal will limit the subdivision potential and value of neighbouring properties
– Noise impacts
– Traffic impacts
– Dust impacts
– Water impacts
– Undermine the stability of Bentley Road

E-2-9 Proposal

The project involves a hard rock quarry with an annual extraction rate of 300,000 tpa and a maximum daily extraction rate of 2,000 tpd. The total disturbance area is approximately 6.5 hectares which includes an extraction area of approximately 3.65 hectares. The primary purpose of the project is to supply materials for use as fill and for road construction and maintenance. Plans of the project are provided in Appendix B.

Project activities would generally include:

– Initial and progressive installation of environmental controls including erosion and sediment control measures
– Delineation of the site and stockpiling areas
– Construction of fencing
– Crush and screen material at the site to use to construct the access road and intersection
– Construction of an access road and intersection with Bentley Road, including installation of signage
– Construction of a site office, weighbridge and car parking area
– Importation of clean soil for landscape mounds to the east and west of the quarry
– Vegetation clearance, soil stripping and stockpiling
– Expanded quarry operations
– Close and rehabilitate the quarry

More details regarding the proposal are provided in Section 3.

E-3 Risk evaluation (Step 2)

To determine the risks associated with the proposed quarry an initial risk assessment is included in Table E.1. The risk assessment was based on the LUCRA Guide (DPI 2011) with each potential unmitigated conflict assessed according to the:

– Probability of occurrence
– Consequence of the impact

The site is predominately surrounded by agricultural land uses and rural dwellings but rural tourism has also been considered given the existing B&B (R8) and the planned rail trail. Bentley Road is also considered, while bores are considered with agriculture.

Table E.1 Initial risk evaluation

Land use	Details	Probability	Consequence	Risk Ranking
Rural dwelling	The nearest occupied dwelling is 1.25 km away but there is the potential for the abandoned dwelling 650 m to the north and the proposed dwelling site 600 m to the west to be occupied in the future. Unmitigated impacts may include: – Noise – Dust – Traffic – Vibration – Visual – Property value	B	2	21
Agriculture	Agriculture in the area is primarily grazing which is not considered as sensitive as rural dwellings but potential impacts include: – Noise – Dust – Vibration – Water – Development potential and value	B	3	17
Tourism	The existing and future tourism operations are both located over 1 km from the proposed quarry, so while sensitive land uses, the separation distance is considered to be a mitigating factor. Regardless, potential impacts include: – Noise – Dust – Traffic – Vibration	C	4	8
Bentley Road	Bentley Road is relatively close to the proposed quarry, so there are potential issues with: – Dust – Traffic – Vibration – Visual	B	3	17

Based on the LUCRA Guide (DPI 2011) a ranking of 25 is the highest magnitude of risk, considered to be a highly likely, very serious event. A rank of 10 or below is considered to be low risk. Based on this, rural dwellings, agriculture and Bentley Road require management strategies, while it is considered a conflict with tourism land uses is low risk. Nevertheless, the management strategies identified for rural dwellings and agriculture are likely to also reduce the potential impacts to tourism.

E-4 Management strategies (Step 3)

To reduce the potential risk of land use conflict identified in Step 2, a range of management strategies are outlined in Table E.2. The risk is then ranked again with consideration of the management strategies. As shown, the mitigated risk rankings are all below 10 and therefore considered acceptable and low risk of conflict.

Table E.2 Management strategies

Land use	Details	Probability	Consequence	Risk Ranking
Rural dwelling	Management strategies/mitigation for the potential impacts are outlined in: – Noise – Section 7.3.3 – Dust – Section 7.4.3 – Traffic – Section 7.6.3 – Vibration – Section 7.3.3 – Visual – Section 7.8.3 – Property value – 7.11 While there is no mitigation measures specifically for property value, it is believed the other management strategies will mitigate this impact. As shown by the relative section, the mitigation measures proposed mean the proposal achieves the relevant criteria, indicating the conflict would be minimal.	C	4	8
Agriculture	Management strategies/mitigation for the potential impacts are outlined in: – Noise – Section 7.3.3 – Dust – Section 7.4.3 – Vibration – Section 7.3.3 – Water – Section 7.2.3 – Development potential value – 7.11 As shown by the relative section, the mitigation measures proposed mean the proposal achieves the relevant criteria, indicating the conflict would be minimal. While there is no mitigation measures specifically for property value, it is believed the other management strategies will mitigate this impact. In regards to development potential, due to the zoning and minimum lot size restrictions, all properties with 1 km of the site are not able to be subdivided further (except the property to the west which already has lodged a subdivision and the applicants property). If in future a more sensitive land use is proposed on a neighbouring property e.g. eco-tourist facility, it is considered the quarry will not prevent this from occurring. As shown in the relevant section, the impacts are largely contained on the same property as the quarry. Where impacts in excess of the relevant criteria extend onto adjacent properties, the properties still have ample room to establish a development outside the extent of the impact. It should also be noted, the impacts have been predicted based on worst case scenarios, which are unlikely to occur and if they do it would only be for short durations.	D	4	5

Land use	Details	Probability	Consequence	Risk Ranking
Bentley Road	Management strategies/mitigation for the potential impacts are outlined in: – Dust – Section 7.4.3 – Traffic – Section 7.6.3 – Vibration – Section 7.3.3 – Visual – Section 7.8.3 As shown by the relative section, the mitigation measures proposed mean the proposal achieves the relevant criteria, indicating the conflict would be minimal.	D	4	5

E-5 LUCRA results (Step 4)

The LUCRA assessed potential land use conflicts of the proposed quarry with rural dwellings, agriculture, tourism and roads. The assessment identified rural dwellings, agriculture and roads to be at risk of conflict if not mitigated. Tourism was considered low risk due to the distance to the existing and proposed land uses.

Following further evaluation when mitigation measures are considered, the risk of land use conflict with rural dwellings, agriculture and Bentley Road were reduced to below 10 and therefore considered acceptable and a low risk of conflict.

Appendix F

Community consultation

Minutes

12 May 2021

Project	Bentley Quarry	From	Ben Luffman
Subject	Pre DA meeting	Tel	1800 066 243
Venue/Date/Time	John Scarrabolotti shed 18/03/2021 2pm	Job No	12547851
Copies to	John Scarrabolotti		
Attendees	Ben Luffman (GHD) Beyond Bentley Group – 15 individuals	Apologies	

Minutes	Action
Introductions. It was explained due to the time of the meeting and short notice, some people were not able to attend.	
Ben Luffman (BL) explained the purpose of the meeting was to outline the proposal and receive any feedback.	
BL outlined the current proposal is for a maximum extraction rate of 300,000 tonnes per annum over an area of about 5 hectares. This would equate to a maximum of 100 trucks per day. This is the maximum extraction rate, which would rarely, if ever, occur. BL explained this is the initial proposal and the proponent was open to modifying the proposal (within reason) i.e., reduce the extraction rate, if more acceptable to the community.	
Charlie Wilkerson (CW) (and others) questioned the legality of the existing use rights the current quarry is operating with because the quarry had not been operating continuously and the main quarry was on the property north of Bentley Road. The existing use rights process did not allow any consultation with the community. CW was also concerned the existing operation did not comply with the conditions of the existing use rights.	
BL acknowledged the concern but suggested, the existing use rights is a separate matter. The proposal partially addresses this concern because a DA will be lodged, and the community will be able to make submissions. And, if approved, compliance may be improved because NSW Environment Protection Authority (EPA) would be the regulator.	
CW provided aerial images of some of the other local quarries and expressed concern the current proposal would create a similar scar and visual impact on the area.	

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Minutes	Action
BL explained the proposed quarry would not be as large as some of those presented and there would be vegetated bunds constructed to screen the visual impact. CW disagreed and indicated the examples provided where representative of the proposal.	
The group generally made it clear they would strongly oppose the proposal and suggested they would take it to court, if necessary.	
BL asked if there were any changes to the proposal that would make it more acceptable. The group clearly indicated the only acceptable proposal, if any, was to maintain the current operation as is.	
The group explained Beyond Bentley was intending to establish the Bentley area as an example of regenerative agriculture, and a quarry would not be consistent with this vision.	
Council was also planning on developing the nearby railway line into a rail trail which would encourage tourists to the area and a quarry would detract from the experience.	
Trucks were a big concern for the group, with some examples of previous issues with trucks on Bentley Road. The concerns related to the impacts on safety, especially at the entrance to the quarry, and road damage. BL explained the proposal would be required to upgrade the intersection at the access and pay contributions to Council for the maintenance of the road.	
Some members of the group raised concerns about the impact a quarry would have on the value of their land, especially if they subdivide their properties in the future. The buffer distances required from quarries may sterilise their land for subdivision.	
Some members indicated trust in the proponent was a concern due to the existing use rights issues.	
Other issues raised by the group included: • Visual impact • Noise • Dust • Blasting	
BL explained if the proponent wished to proceed, the process involved: • Obtaining Secretaries Environmental Assessment Requirements (SEARs) • Preparing the Environmental Impact Statement (EIS), which would involve the technical assessments of all the potential impacts including dust, noise, traffic, groundwater	

Minutes	Action
• Lodging the DA (including the EIS) with Council, which would then be placed on public exhibition, so the community could make submissions for Council to consider. • The DA would then be determined by the Joint Regional Planning Panel (JRPP). During the preparation of the EIS, we would consult with the group again to provide more details of the proposal, discuss our findings and proposed mitigation of impacts.	
Close	

Ben Luffman
Senior Environmental Consultant

Appendix G

Water Resources Assessment

Bentley Quarry

Water Resources Assessment

R & S Contracting Pty Ltd

29 October 2021

→ **The Power of Commitment**

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Printed date	29/10/2021 2:45:00 PM
Last saved date	29 October 2021
File name	https://projectsportal.ghd.com/sites/pp01_04/bentleyquarry/ProjectDocs/12547851-REP-Bentley_Quarry-Water_Resources_Impact_Assessment.docx
Author	J Macatanong
Project manager	Ben Luffman
Client name	R & S Contracting Pty Ltd
Project name	Bentley Quarry Expansion
Document title	Bentley Quarry | Water Resources Assessment
Revision version	Rev0
Project number	12547851

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	J Macatanong	T Tinkler		S. Lawer		29/10/21

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1. Introduction

1.1 Project background

R & S Contracting Pty Ltd proposes to construct and operate a hard rock quarry (Bentley Quarry) to extract up to 300,000 tonnes per annum (tpa) and 2,000 tonnes per day (tpd) over 30 years, with a total disturbance area of approximately 6.5 ha (the project). Bentley Quarry will predominantly supply materials for use as fill and for road construction and maintenance.

The site is Lot 2 DP 1196757, 1465 Bentley Road, Bentley which is owned by SL McKenzie & RG McKenzie and is located approximately 14 kilometres west of Lismore as shown in Figure 1-1. Currently the quarry operates through existing use rights with an extraction rate of 3,000 m^3 and an extraction area of approximately 1 ha.

1.2 Project overview

The project would be carried out in four stages and in response to demand. To minimise the initial impact of the proposed quarry, Stage 1 would encompass the existing footprint of the quarry and expand it at RL63m until the northern half of the proposed quarry is exhausted. Stage 2 continues at RL63m to the southern extent of the proposed quarry. Stage 3 will involve lowering the northern half of the proposed quarry to its final depth of RL49m.. Stage 4 would be the final stage which would continue at RL49m to the southern extent of the proposed quarry. The general layout is provided in Figure 1-2.

1.3 Purpose of this report

The purpose of this Water Resources Assessment (WRA) report is to support the Environmental Impact Statement (EIS) for the project.

1.4 Objectives

The key objective of the WRA is to identify and determine the potential impacts of the project on the surface water and groundwater environment by addressing the relevant government agency requirements.

The scope of work for the WRA includes:

Surface Water:

– Review existing assessments and data relevant to the project.
– Review relevant statutory requirements.
– Establish the existing local and regional hydrological conditions of the project site.
– Determine the water management requirements for the project.
– Undertake an assessment of the potential impacts of the project on:
    - Water balance.
    - Surface water flow.
    - Surface water quality.
– Undertake an assessment of the cumulative impacts of the project in association with other operations in the region.
– Develop measures to avoid, minimise and mitigate potential impacts of the project and provide recommended management, monitoring and reporting requirements.

Groundwater:

– Review existing assessments and data relevant to the project.
– Review relevant statutory requirements.

- Establish the existing local and regional hydrogeological environment including the main aquifer units, groundwater levels and groundwater quality.
- Identify sensitive groundwater receptors, including Groundwater Dependent Ecosystems (GDEs) and registered groundwater bore users.
- Predict drawdown in groundwater levels, if any, as a result of the proposed development.
- Assess potential water table and groundwater quality impacts against the relevant criteria in the *NSW Aquifer Interference Policy* (2012). The criteria for Low Productive Porous and Fractured Rock Water Sources will be adopted.
- Identify avoidance and mitigation measures that should be adopted to keep impacts below the Level 1 impact criteria under the Policy.

1.5 Scope and limitations

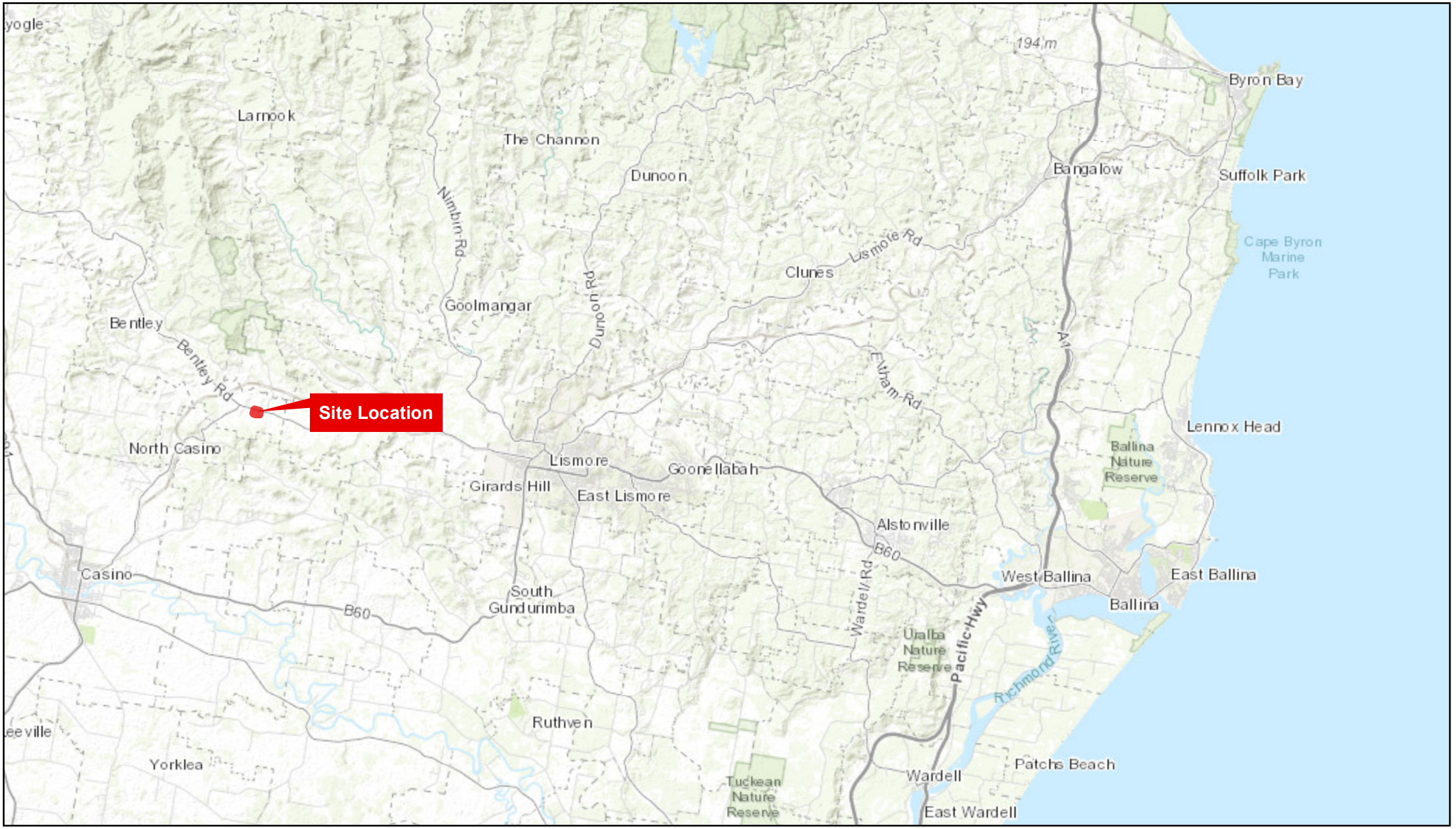
This report has been prepared by GHD for R & S Contracting Pty Ltd and may only be used and relied on by R & S Contracting Pty Ltd for the purpose agreed between GHD and R & S Contracting Pty Ltd as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than R & S Contracting 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.

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



Paper Size ISO A4

0 1.5 3 4.5 6

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Bentley Quarry

Site Location

Project No. **12547851**
Revision No. **-**
Date **14/04/2021**

FIGURE 1-1

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Print date: 20 Apr 2021 - 12:29

Paper Size ISO A4

0 20 40 60 80 100

Metres

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

N

GHD

R&S Contracting Pty Ltd
Bentley Quarry
Water Resources Assessment

Site layout

Project No. **12547851**
Revision No. **0**
Date **29 Oct 2021**

Figure 1-2

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Print date: 29 Oct 2021 - 10:30

Data source: LPI: DTDB/DCDB, 20217. LPI NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton

2. Regulatory context

2.1 Legislation

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the core legislation relating to planning and development activities in NSW and provides the statutory framework under which development proposals are assessed. The EP&A Act aims to encourage the proper management, development and conservation of resources, environmental protection and ecologically sustainable development.

The WRA has been developed to address the surface water and groundwater components of the SEARs and accompanying government agency requirements for the project, which are reproduced in Table 2-1, along with a reference to where each requirement has been addressed within this report.

Table 2-1 Secretary's Environmental Assessment requirements

Assessment requirement	Where addressed
The EIS must assess the potential impacts of the proposal at all stages of the development, including the establishment, operation and decommissioning of the development. **Water** – including:	
a detailed site water balance and an assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;	Section 5.4
- identification of any licensing requirements or other approvals required under the Water Act 1912 and/or Water Management Act 2000	Section 2
- demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)	Section 2.1.3.1
- a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo;	Section 2.1.3, 6.4
- an assessment of activities that could cause erosion or sedimentation issues, and the proposed measures to prevent or control these impacts;	Section 4.2
- an assessment of any likely flooding impacts of the development;	Section 5.3
- an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; and	Section 5
- a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts;	Section 4 and Section 6

2.1.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the Environment Protection Authority (EPA), which is an independent statutory authority and the primary environmental regulator for NSW. The objectives of the POEO Act are to protect, restore and enhance the quality of the environment, by mechanisms including programs to reduce pollution at the source and monitoring and reporting on environmental quality. The POEO Act regulates and requires licensing for environment protection, including for waste generation and disposal and for water, air, land and noise pollution.

Under the POEO Act, an Environment Protection Licence (EPL) is required for premises at which a 'scheduled activity' is conducted. Schedule 1 of the POEO Act lists activities that are scheduled activities for the purpose of the Act. Licence conditions relate to pollution prevention and monitoring and can control the air, noise, water and waste impacts of an activity.

2.1.3 Water Management Act 2000

The aim of the *Water Management Act 2000* (WM Act) is to ensure that water resources are conserved and properly managed for sustainable use benefiting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and in-stream uses as well as to provide for protection of catchment conditions.

Historically, the Water Act 1912 was the main legislation for managing water resources in NSW; however, this Act has been progressively phased out and replaced by water sharing plans (WSPs) under the WM Act. Once a WSP commenced, existing licences under the Water Act 1912 were converted to water access licences (WALs), water supply works and use approvals (controlled activity approvals) under the WM Act. All new WALs and controlled activity approvals are also issued under the WM Act.

2.1.3.1 Water sharing plans

Fresh water sources throughout NSW are managed via WSPs under the WM Act. Provisions within WSPs provide water to support the ecological processes and environmental needs of groundwater dependent ecosystems and waterways. WSPs also regulate how the water available for extraction is shared between the environment, basic landholder rights, town water supplies and commercial uses. Key rules within the WSPs specify when licence holders can access water and how water can be traded.

The project is covered by the:

– For surface water: Coraki Non Tidal Management Zone within Coraki Area Water Source under the Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources (2010).
– For groundwater: North Coast Volcanics groundwater sources under the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources (2016).

Under the WM Act, extraction of water for basic landholder rights is protected by allocating and prioritising water for basic landholder rights. There are three types of basic landholder rights in NSW under the WM Act:

– Domestic and stock rights: Landholders are entitled to take water from a river, estuary or lake which fronts their land or from an aquifer which is underlying their land for domestic consumption and stock watering, without the need for a licence. However, a water supply work approval is required to construct a dam or a groundwater bore.
– Native title rights: Anyone who holds native title with respect to water, as determined by the *Native Title Act 1993,* can take and use water for a range of purposes, including personal, domestic and non-commercial communal purposes. There are no native holder rights identified in the water sources covering the project.
– Harvestable rights: Landholders are entitled to collect a portion of runoff from their property and store it in one or more dams up to a certain capacity that are located on minor streams. This entitlement is known as a ‘harvestable right’ and is determined from the total contiguous area of land ownership. In the Eastern Division of NSW (where the project is located), landholders may capture and use up to 10 percent of the average regional runoff for their property without requiring an approval or licence under the WM Act. The maximum harvestable right is the total volume of runoff that a landholder is entitled to use without requiring a licence. If the maximum harvestable right for a landholding is exceeded, licensing for the volume of water extracted from the surface water source exceeding the harvestable right is required under the WM Act.
– Section 4.41 of the EP&A Act removes the need for a number of approvals under the WM Act when development consent has been granted for an SSD. These are a water use approval under section 89 of the Act, a water management work approval under section 90 of the Act and an activity approval (other than an aquifer interference approval) under section 91 of the Act.

There are no surface water access licences or works approvals related to the project. Surface water storages that form part of the water management system are exempt from consideration under water access licensing and harvestable rights, as they are dams solely for the capture, containment and recirculation of drainage, consistent with best management practice to prevent the contamination of a water source. A groundwater WAL is also not required for the project, as outlined further in Section 6.4.

2.2 Policies

2.2.1 NSW State Rivers and Estuary Policy

The NSW State Rivers and Estuaries Policy (NSW Water Resources Council 1993) provides objectives and principles to achieve sustainable management of rivers and estuaries in NSW to ensure resource use is consistent with the long-term biological and physical function of the natural system. The objectives of the policy are "To manage the rivers and estuaries in NSW in ways which: slow, halt or reverse the overall rate of degradation in their systems; ensure the long-term sustainability of their essential biophysical functions; and maintain the beneficial use of these resources". The policy details guiding principles for sustainable management of rivers and estuaries.

2.2.2 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) was finalised in September 2012 and clarifies the water licensing and approval requirements for aquifer interference activities in NSW, including the taking of water from an aquifer in the course of carrying out mining.

The Policy outlines the water licensing requirements under the WM Act. A water licence is required whether water is taken for consumptive use or whether it is taken incidentally by the aquifer interference activity (such as groundwater filling a void), even where that water is not being used consumptively as part of the activity's operation. Under the WM Act, a water licence gives its holder a share of the total entitlement available for extraction from the groundwater source. The WAL must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

Sufficient access licences must be held to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased. Many mining operations continue to take water from groundwater sources after operations have ceased. This take of water continues until an aquifer system reaches equilibrium and must be licensed.

Clause 37 of the *Water Management (General) Regulation 2018* exempts certain aquifer interference activities from the requirement of a works approval and a WAL, including authorised quarrying activity. Under the *Water Management (General) Regulation 2018*, up to 3 ML of water can be taken per year without a licence.

The NSW AIP requires that potential impacts on groundwater sources, including their users and GDEs, be assessed against minimal impact considerations, outlined in Table 1 of the Policy. If the predicted impacts meet the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. The adopted Level 1 minimal impact considerations for this project are discussed in Section 5.5.

2.3 Guidelines

2.3.1 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) provide guidance for assessing and managing ambient water quality in a wide range of water resource types and according to specified environmental values, such as aquatic ecosystems, primary industries, recreation and drinking water. The revised Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) were published in 2018 following scientific review of the ANZECC (2000a) guidelines. The Water Quality Management Framework (ANZG 2018) provides the key requirements for determining appropriate guideline values or performance criteria to evaluate the results of water quality monitoring programs.

The ANZG (2018) guidelines adopt a risk-based approach to assessing ambient water quality by providing the framework to tailor water quality guidelines to local environmental conditions. Guideline values provided by ANZG (2018) can be modified into regional, local or site-specific guideline values (SSGVs) by taking into account factors such as the level of modification of the ecosystem, natural variability in water quality at reference sites, and water hardness. Guideline values are applied to the receiving environment at the edge of the mixing zone and do not apply to water at the point of discharge.

2.3.2 NSW Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives (DECCW 2006) are the agreed environmental values and long-term goals for each catchment in NSW. The objectives are intended to be considered in assessing and managing the potential impacts of activities on waterways.

Water quality objectives for uncontrolled streams in the Barwon-Darling and Far Western catchment are for the protection of aquatic ecosystems; visual amenity; primary and secondary contact recreation; livestock, homestead water supply and aquatic foods (cooked. The water quality objectives are consistent with the national framework for assessing water quality provided by ANZG (2018).

The river flow objectives are to: protect pools in dry times; protect natural low flows; protect important rises in water levels; maintain wetland and floodplain inundation; mimic natural drying in temporary waterways; maintain natural flow variability; maintain natural rates of change in water levels; manage groundwater for ecosystems; minimise effects of weirs and other structures; minimise effects of dams on water quality; make water available for unforeseen events; and maintain or rehabilitate estuarine processes and habitats.

2.3.3 Using the ANZECC Guidelines and Water Quality Objectives in NSW

The document Using the ANZECC Guidelines and Water Quality Objectives in NSW (DEC 2006) provides guidance on applying the ANZECC (2000a; revised by ANZG 2018) framework for assessing water quality, including the use of water quality objectives for NSW, which is considered in the methodology for assessing water quality in Section 5.1.

2.3.4 Australian Guidelines for Water Quality Monitoring and Reporting

The Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000b) sets out a framework and guidance for the monitoring and reporting of fresh and marine surface water and groundwater. ANZECC (2000b) provides information for all aspects of a water quality monitoring program, including setting objectives, designing monitoring and sampling programs, laboratory analyses, data analysis and interpretation and reporting of results and conclusions.

The recommended water quality monitoring program, presented in Section 6.2, for the project were made in accordance with the framework presented by ANZECC (2000b).

2.3.5 Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales

The document Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (DEC 2004) lists the sampling and analysis methods to be used when sampling water quality for compliance with environmental protection legislation, a relevant licence or relevant notice. All sample collection, handling and analyses undertaken for the purpose of this SWIA is understood to have been undertaken in accordance with the requirements outlined by DEC (2004).

2.3.6 Managing Urban Stormwater: Soils and Construction

Managing Urban Stormwater: Soils and Construction – Volume 1 (the 'Blue Book'; Landcom 2004) outlines the basic principles for the design, construction and implementation of sediment and erosion control measures to improve stormwater management and mitigate the impacts of land disturbance activities on soils and receiving waters. This document relates particularly to urban development sites; however, it is relevant to the project as it provides guidance on the configuration of erosion and sedimentation controls, which may be necessary during construction and operation of the project.

Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries (DECC 2008) provides specific guidelines, principles and minimum design standards for good management practice in erosion and sediment control during the construction and operation of mines and quarries. This document relates specifically to this project as a mine site.

3. Existing environment

3.1 Climate

Climate data were obtained as SILO Patched Point Data from the Science Division of the Queensland Government's Department of Environment and Science. SILO Patched Point Data is based on historical data from a particular Bureau of Meteorology station with missing data “patched in” by interpolating with data from nearby stations.

Climate records were obtained from SILO[1] for the Bentley (station 58078), which is located approximately 2.5 km north west of the site for the period from 1 January 1889 to 1 January 2021.

The cumulative frequency of annual total rainfall and evaporation from SILO dataset between 1889 and 2021 are compared in Figure 3-1.

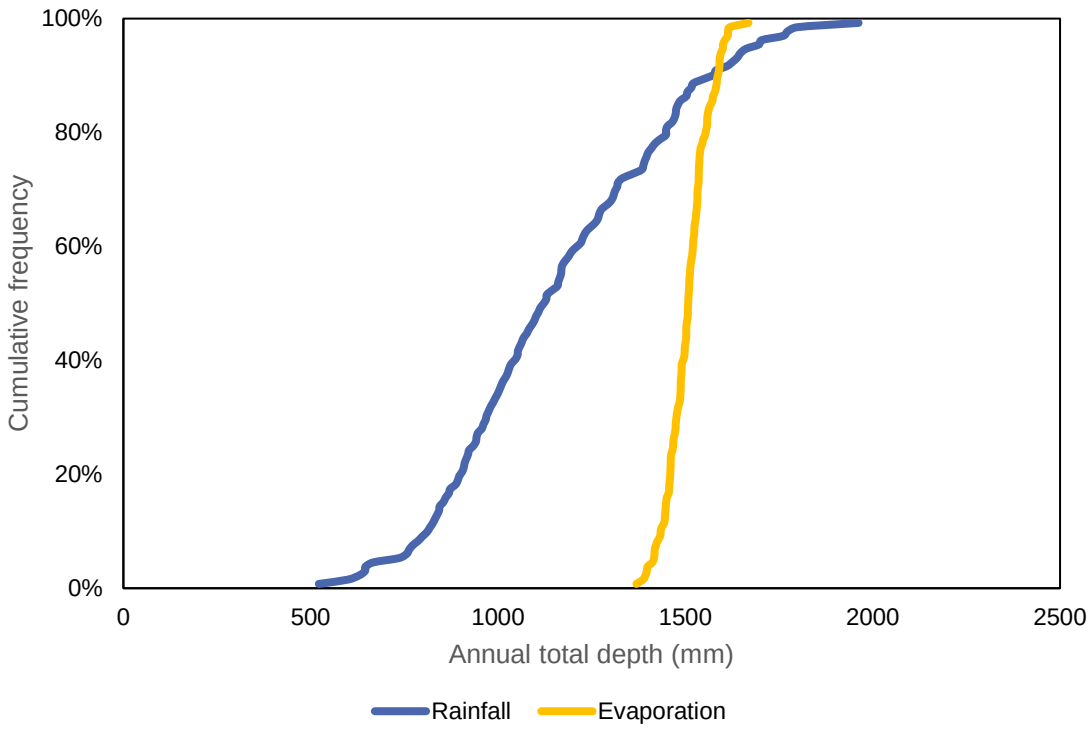


Figure 3-1 Comparison of annual rainfall depths

The statistics of annual totals of the historical rainfall record were:

- minimum 507.3 mm (1915)
- maximum of 2014.5 mm (1890)
- median of 1121.6 mm
- average of 1158.3 mm

Annual evaporation totals have an average of 1507.4 mm, corresponding to an average annual moisture deficit (the difference between rainfall and evaporation) of 349.1 mm.

A plot of average daily evaporation is compared to average daily rainfall from the historical record in Figure 3-2.

[1] SILO refers to patched point data set from the Scientific Information for Land Owners (SILO) database operated by the Queensland Department of Science, Information Technology and Innovation (DSITI). SILO patched point data is based on observed historical data from a particular Bureau of Meteorology (BOM) station with missing data ‘patched in’ by interpolating with data from nearby stations (DSITI, 2021).

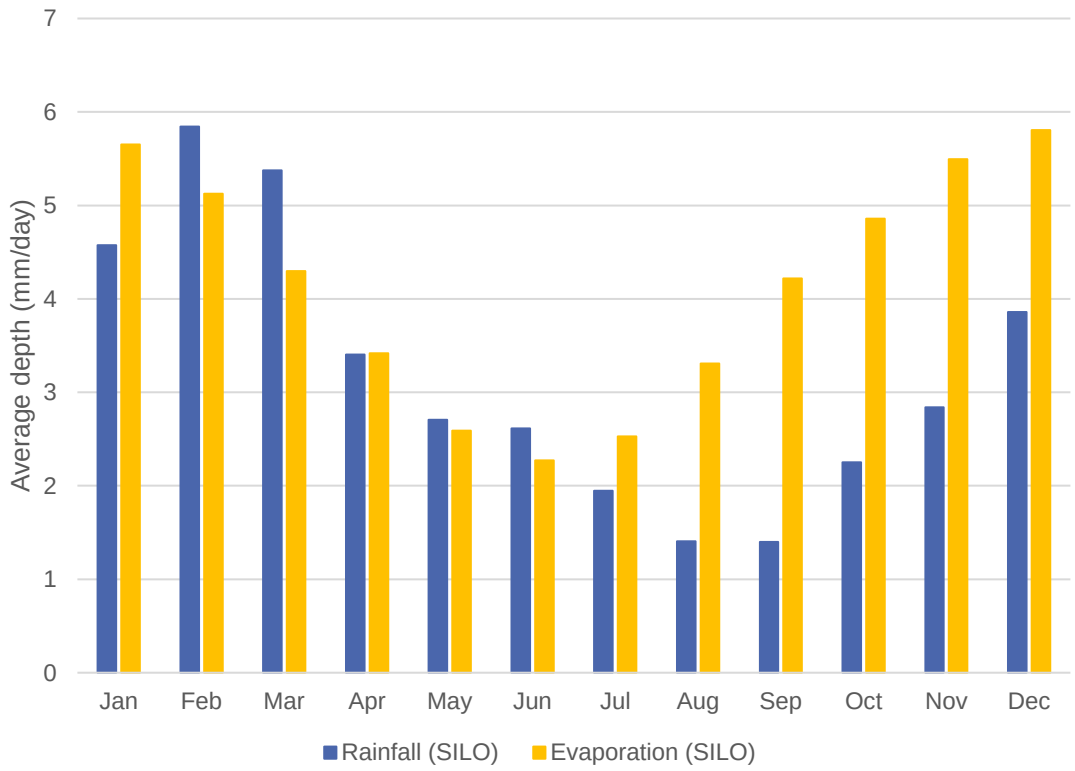


Figure 3-2 Daily evaporation and rainfall

Figure 3-2 show that evaporation and rainfall vary seasonally, both having higher records in summer compared to winter. The site has an average monthly net rainfall deficit during spring and summer seasons.

3.2 Topography and land use

The topography of the site is generally very low to low undulating hills and rises. The site sits at the top of a hill. Local relief within the area ranges from approximately 70 m AHD. The surrounding elevation of the site drops to over 40-50 m AHD.

Cattle grazing is the main use surrounding the site, with heavy vegetated area on the south and some cropping on the east. The site consists of cleared land, except for isolated native paddock trees, and is currently being used as a quarry and cattle grazing.

3.3 Geology and soils

As outlined in GHD (2021), the site is underlain by residual soil and weathered basalt rock of the Tertiary aged Lismore Basalt (Lamington Volcanics). No significant geological structures (faults / folding) were evident from the available geological information. GHD (2021) reports that at borehole BH01 weathered basalt was encountered up to a depth of 7.2 m below ground level (bgl) and then fresh fine grained basalt to depth 30 m bgl.

3.4 Hydrology and Waterways

No watercourses or dams are located on the site, however there is an ephemeral drainage line to the west where a dam has been constructed. This flows north into Back Creek. Back Creek is located approximately 883 m to the north of the quarry, travelling in an east-west direction. Another watercourse is located approximately 872 m to the west of the quarry, travelling in a north-south direction and connecting to Back Creek. A wetland is located on the adjacent property to the west. Watercourse locations are shown in Figure 3-3.

3.5 Hydrogeology and groundwater sources

Groundwater at the site occurs within an unconfined weathered and fresh basalt aquifer which is part of the North Coast Volcanics groundwater source. According to the background document for the WSP (DPI-Water, 2016), the North Coast Volcanics is a fractured rock groundwater source with moderate bore yields in the order of 5-10 L/s where fractures occur and excellent water quality.

A 50 mm groundwater monitoring bore (BH01) was installed at the site to depth 29 m bgl as part of geotechnical investigations (GHD, 2021). The screened interval is 23 to 27.5 m bgl. Depth to groundwater was 11.9 m bgl (54.1 m AHD), which represents the level of the water table. A slug test (rising head) was undertaken by removing 40 L from the bore and monitoring the rise in groundwater level. Head change was analysed using the Hvorslev equation and a hydraulic conductivity of 2 x 10^{-9} m/s was calculated for the fresh basalt.

Groundwater flow likely follows topography and therefore flows north through fractures towards Back Creek. Groundwater is recharged by rainfall (in the order of 8% rainfall based on the WSP) and likely discharges to Back Creek.

3.6 Groundwater use

A search of Australian Groundwater Explorer (BOM 2019a) database identified 56 registered bores within an approximate five kilometre radius of the site. Of the registered bores, 21 were registered as stock watering and domestic supply bores, 31 were registered for water supply, while the remainder have an unknown purpose and for monitoring.

Bore details are provided in Table 3-1. A map of bore locations is shown in Figure 3-4. The majority of bores are shallow, having been installed to a depth of less than 25 m. There are no bores within 1 km from the site. The closest bores, GW037176 and GW038734, are registered as stock and domestic and water supply bores respectively and are located approximately 1.5 km from the site.

Table 3-1 Registered bores

Bore ID	Purpose	Latitude	Longitude	Depth (m)	Lithology
GW306708	Water Supply	-28.8074	153.1004	4.5	
GW063876	Water Supply	-28.8117	153.1014	82	Clay, gravel clay, shale, sandstone, coal
GW032775	Water Supply	-28.7748	153.1805	9.4	Clay, rock
GW038815	Stock and Domestic	-28.7809	153.0916	9.1	Soil, clay, basalt
GW037570	Stock and Domestic	-28.7965	153.1813	25.9	Clay, rock, basalt, shale
GW071710	Water Supply	-28.7995	153.1794	40.5	Clay, gravel, basalt
GW031915	Water Supply	-28.7946	153.1676	61	Clay, rock, basalt, shale
GW032773	Water Supply	-28.7898	153.1041	26.2	Clay, rock, basalt, shale
GW034978	Water Supply	-28.7970	153.1591	20.7	Clay, rock, shale
GW037583	Stock and Domestic	-28.7876	153.1005	14.6	Soil, basalt, sandstone
GW033923	Stock and Domestic	-28.7929	153.0877	26.8	Clay, sandstone
GW022114	Stock and Domestic	-28.7693	153.1775	7.6	Clay

Bore ID	Purpose	Latitude	Longitude	Depth (m)	Lithology
GW038366	Stock and Domestic	-28.7809	153.1122	9.1	Basalt
GW307227	Water Supply	-28.7942	153.1100	36	Soil, clay, basalt
GW038818	Stock and Domestic	-28.7720	153.1038	4.5	Clay, basalt
GW046275	Stock and Domestic	-28.7920	153.0961	14	Clay, gravel, sandstone
GW305250	Water Supply	-28.7709	153.1030	66	Clay, hard basalt, weathered rock and ash, volcanic ash, soft clay and ash dry,
GW072800	Water Supply	-28.7995	153.1605	40	Soil, clay, basalt
GW043019	Irrigation	-28.7762	153.1302	23.6	Loam, sand, sandstone, blue metal seam
GW032774	Water Supply	-28.8315	153.1155	13.7	Clay, rock, basalt
GW046094	Water Supply	-28.7981	153.1622	4.3	Soil, clay
GW037551	Unknown	-28.8254	153.1186	6	Soil, rock
GW037585	Stock and Domestic	-28.7754	153.1041	15.2	Clay, sandstone
GW038330	Stock and Domestic	-28.7804	153.1105	13.4	Soil, clay, sandstone
GW301015	Water Supply	-28.7931	153.0958	70	Clay, sandstone
GW300966	Water Supply	-28.7834	153.1027	24	Soil, clay, shale, basalt
GW037176	Stock and Domestic	-28.7917	153.1444	25.9	Loam, clay, sandstone
GW037586	Stock and Domestic	-28.7932	153.1200	15.8	Soil, rock, sandstone
GW038816	Water Supply	-28.8012	153.0844	7.6	Clay, basalt
GW063685	Water Supply	-28.7765	153.1744	27	Clay, shale, basalt
GW038817	Stock and Domestic	-28.7590	153.1483	6	Clay, basalt
GW011588	Stock and Domestic	-28.7598	153.1502	1.2	Loam, gravel
GW302694	Water Supply	-28.8267	153.1130	0	
GW300108	Water Supply	-28.7815	153.1813	59.4	Clay, basalt, sandstone
GW038776	Stock and Domestic	-28.8165	153.1580	10.8	clay, gravel
GW038940	Irrigation	-28.7867	153.1230	30.4	loam, sand, sandstone
GW306976	Water Supply	-28.8004	153.1619	36.5	Soil, basalt
GW038491	Stock and Domestic	-28.8251	153.1105	6	Basalt
GW032450	Stock and Domestic	-28.7976	153.1647	18	Clay, sandstone, shale

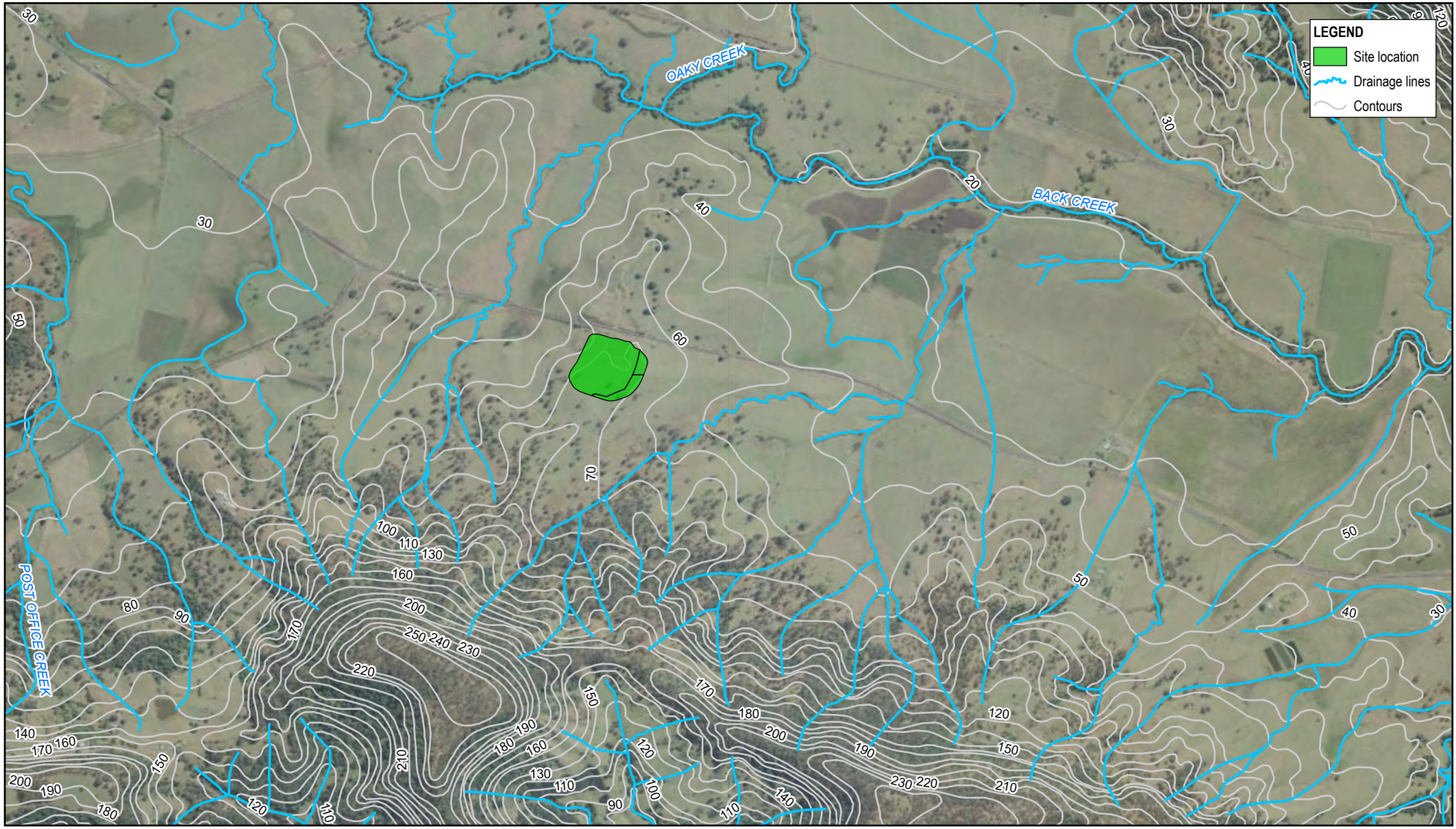
Bore ID	Purpose	Latitude	Longitude	Depth (m)	Lithology
GW305872	Water Supply	-28.8276	153.1105	54	Soil, basalt
GW305871	Water Supply	-28.8262	153.1097	42	Soil, clay, basalt
GW034577	Stock and Domestic	-28.7967	153.1819	21.3	Clay, rock, basalt, shale
GW067143	Water Supply	-28.7624	153.1572	42	
GW038365	Stock and Domestic	-28.8119	153.1386	7.9	Basalt
GW302693	Water Supply	-28.7644	153.1693	0	
GW300466	Water Supply	-28.7919	153.1503	7	
GW307963	Monitoring	-28.7801	153.1794	78	Basalt, clay
GW038735	Stock and Domestic	-28.7810	153.1802	17	Clay, sandstone
GW071765	Water Supply	-28.8264	153.1546	30.5	Soil, sand, clay, sandstone
GW300964	Water Supply	-28.7813	153.1553	42	Clay, basalt
GW305579	Water Supply	-28.8332	153.1272	20	
GW046093	Water Supply	-28.8315	153.1238	4.3	Soil, clay
GW306457	Water Supply	-28.7745	153.1419	42	Soil, clay, basalt
GW046236	Stock and Domestic	-28.8270	153.1169	1.7	Soil, rock
GW038734	Water Supply	-28.7924	153.1497	16.7	Clay, sandstone
GW038488	Water Supply	-28.8009	153.1058	15.2	Soil, basalt

3.7 Groundwater dependent ecosystems

There are no high priority GDEs, listed in the WSP, within the area potentially impacted by the project. The closest high priority GDEs are located east of Lismore within the Alstonville Basalt.

A search of the Groundwater Dependent Ecosystems Atlas (BOM 2019b) was undertaken to identify other potential GDEs near the site.

A map of the terrestrial and aquatic GDEs in the vicinity of the site, classified as either high, moderate or low potential GDEs, is shown in Figure 3-5. Some low potential terrestrial GDEs were identified over 1 km from the site to the south and west.



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Topology and watercourse

FIGURE 3-3

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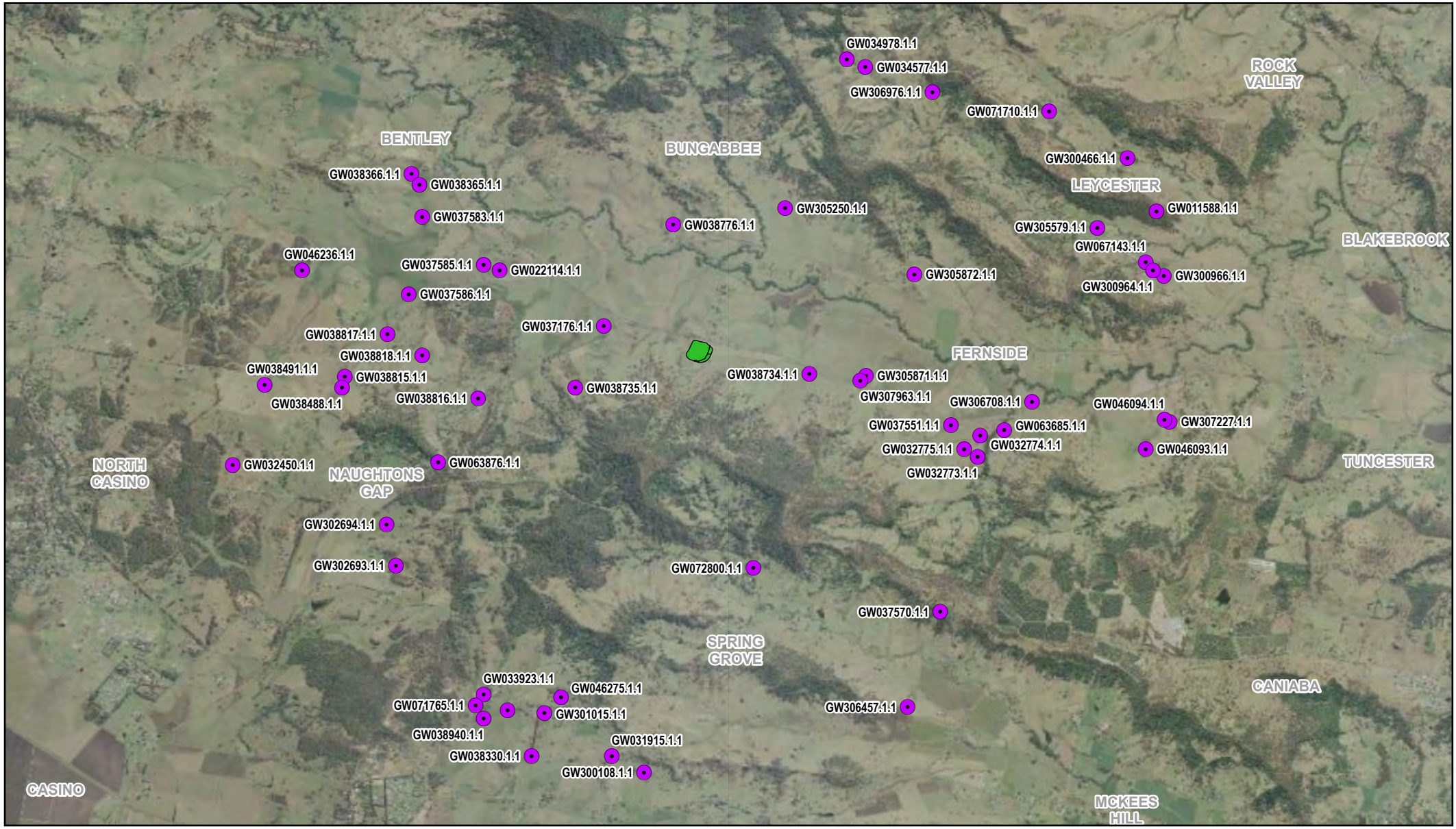

LEGEND

- Site location
- Registered bore

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Kilometers

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Registered Bore Search

FIGURE 3-4

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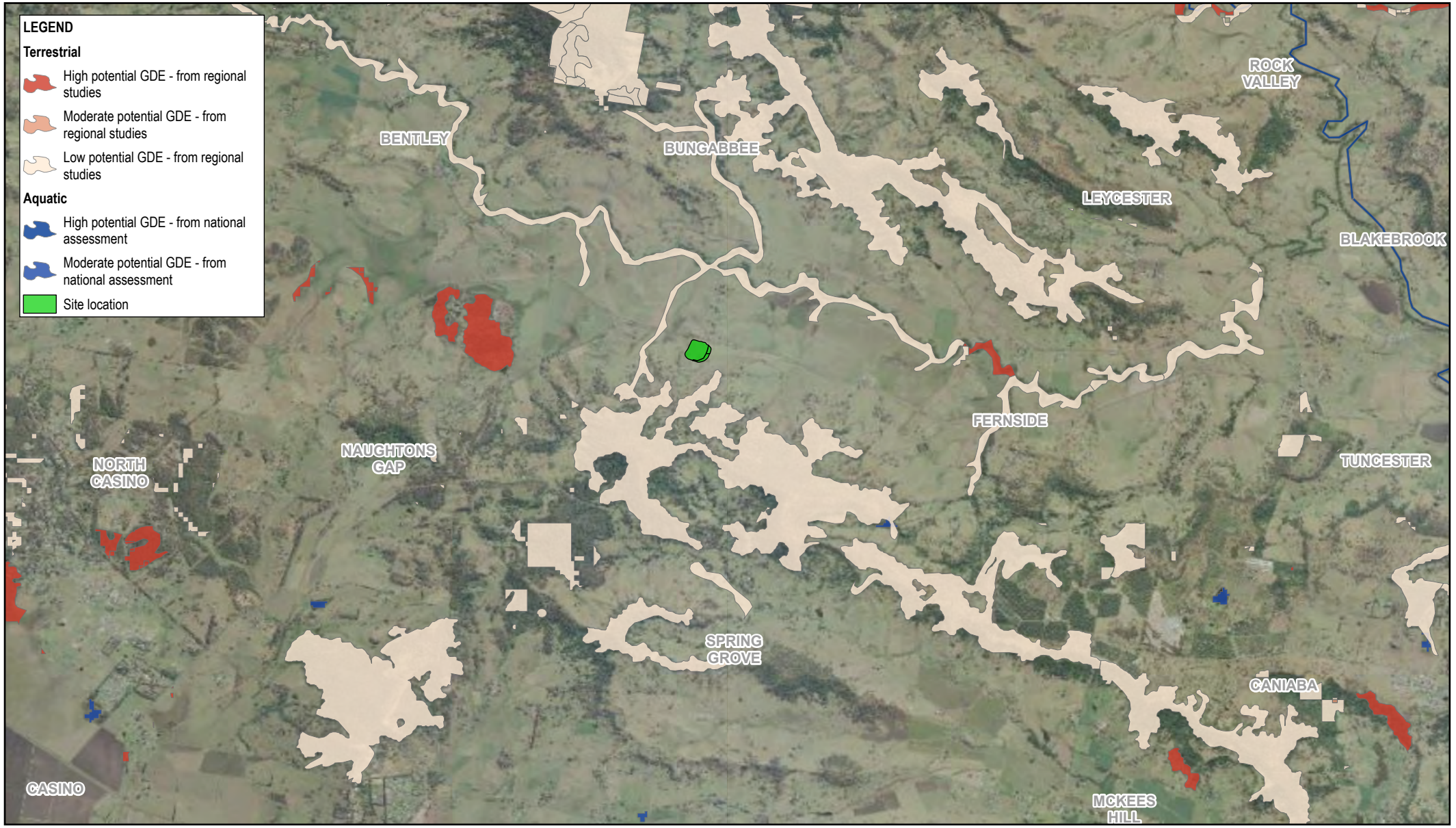
Data source: LPI: DTDB/DCDB, 20217. BOM: Registered bores, 2021. LPI NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



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Groundwater dependent ecosystems

FIGURE 3-5

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Data source: LPI: DTDB/DCDB, 20217. State of NSW (Department of Planning, Industry and Environment – Water): GDEs, 2021. LPI NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton

4. Proposed Water Management System

The proposed surface water management system includes perimeter screening bunds, sediment basins, and sumps. The proposed surface water management system is intended to manage clean and dirty (sediment laden) separately, thereby minimising the volume of clean water captured within the dirty water systems. Groundwater inflows into the quarry pit are expected to be low (refer Section 5.5) and will be managed by the dirty water system.

The proposed surface water management system is presented in Figure 4-1.

4.1 Clean Water Management System

Clean Water Management System consists of 2-3 high m perimeter screening bunds intended to divert overland surface flows around the quarry. Perimeter screening bunds are located on the western, eastern and southern areas of the project are designed to divert clean water runoff generated within the undisturbed areas upslope of the site.

4.2 Dirty Water Management System

Dirty Water Management System only consists of sump and sediment basin. Surface and groundwater flows from within the quarry pit would drain to the sump and sediment basin. The basin would naturally overflow to the west, via an open channel for Stages 1 and 2 and via pipe during Stages 3 and 4. The estimated dirty water catchment is 4.06 ha as shown in Figure 4-1.

Topsoil stockpiles will be temporarily considered as part of dirty water catchment until stabilised for duration of the project. Controls for the temporary disturbance of the stockpile area include diversion of clean water surrounding the stockpile area using temporary measures, such as sediment fence, sandbags or minor earthworks combined with a rolled erosion control product.

All sediment and erosion controls would be designed and implemented in accordance with the NSW Soils and Construction – Managing Urban Stormwater Volume 1 ‘the Blue Book’ (Landcom, 2004) and Volume 2E ‘Mines and Quarries’ (DECC 2008).

4.2.1 Sizing of Sediment Basins

The project has the potential to result in sediment runoff and scour as a result of ground disturbance and vegetation removal required for the operations. To minimise the potential impacts of the land disturbances from the quarry expansion, a Soil and Water Management Plan has been prepared based on NSW Soils and Construction – Managing Urban Stormwater Volume 1 ‘the Blue Book’ (Landcom, 2004) and Volume 2E ‘Mines and Quarries’ (DECC 2008).

Sediment basins are designed to manage sediment-laden runoff from disturbed areas and are typically constructed in areas where disturbance activities are expected to result in soil loss greater than 150 m^3/yr. The design of sediment basins should consider cleanout requirements, stable banks and pump out facilities. The water intercepted by the sediment basin will be reused for dust suppression or discharged off site via the drainage drain.

Table 4-1 presents the site constraints that have been considered in the computation of the RUSLE Two Month Calculated Soil Loss and settling zone capacity for the sediment basin.

Table 4-1 Constraints table

Aspect	Factor	Reference
Design rainfall depth	90th percentile, 5-day rainfall event– 60.2 mm	Blue Book, Table 6.3a for Lismore
Soil landscape	McKee (mc)	eSpade (DPIE, 2021)
Soil Type	F (fine dispersible material)	Blue Book, Appendix C - Table C2. Lismore-Ballina Soil Landscapes for McKee (mc)
Soil Hydrologic Group	C	Blue Book, Appendix C -Table C2. Lismore-Ballina Soil Landscapes for McKee (mc)
Soil Erodibility – K Factor	0.06	eSpade (DPIE, 2021)
Rainfall – R Factor	3500	Blue Book, Appendix B – Map 2: Rainfall Erosivity of the Tweed Heads
Volumetric Runoff Coefficient	0.7	Blue Book, Appendix F - Table F2

In the absence of site specific soil data, information on the likely soil type has been sourced from the Lismore-Ballina Soil Landscape section of the Blue Book (Appendix C – Table C2) for McKee (mc). Conservatively, soil type for the quarry has been adopted as 'Type F'.

The total volume of a 'Type F' sediment basin is the sum of the following two components:

– A settling zone, within which water is stored allowing the settlement of suspended sediment, and
– A sediment storage zone, where deposited sediment is stored until the basin is cleaned out.

The settling zone volume is determined from the 90th percentile, 5 day rainfall event of 60.2 mm, with a volumetric runoff coefficient (Cv) of 0.70. The adopted Cv is described to have a runoff potential of moderate to high. Contributing catchment areas to the sedimentation basin is shown in Figure 4-1.

The sediment storage zone is taken as either the:

– 50% of the settling zone capacity, or
– Two months soil loss as calculated with the Revised Universal Soil Loss Equation (RUSLE).

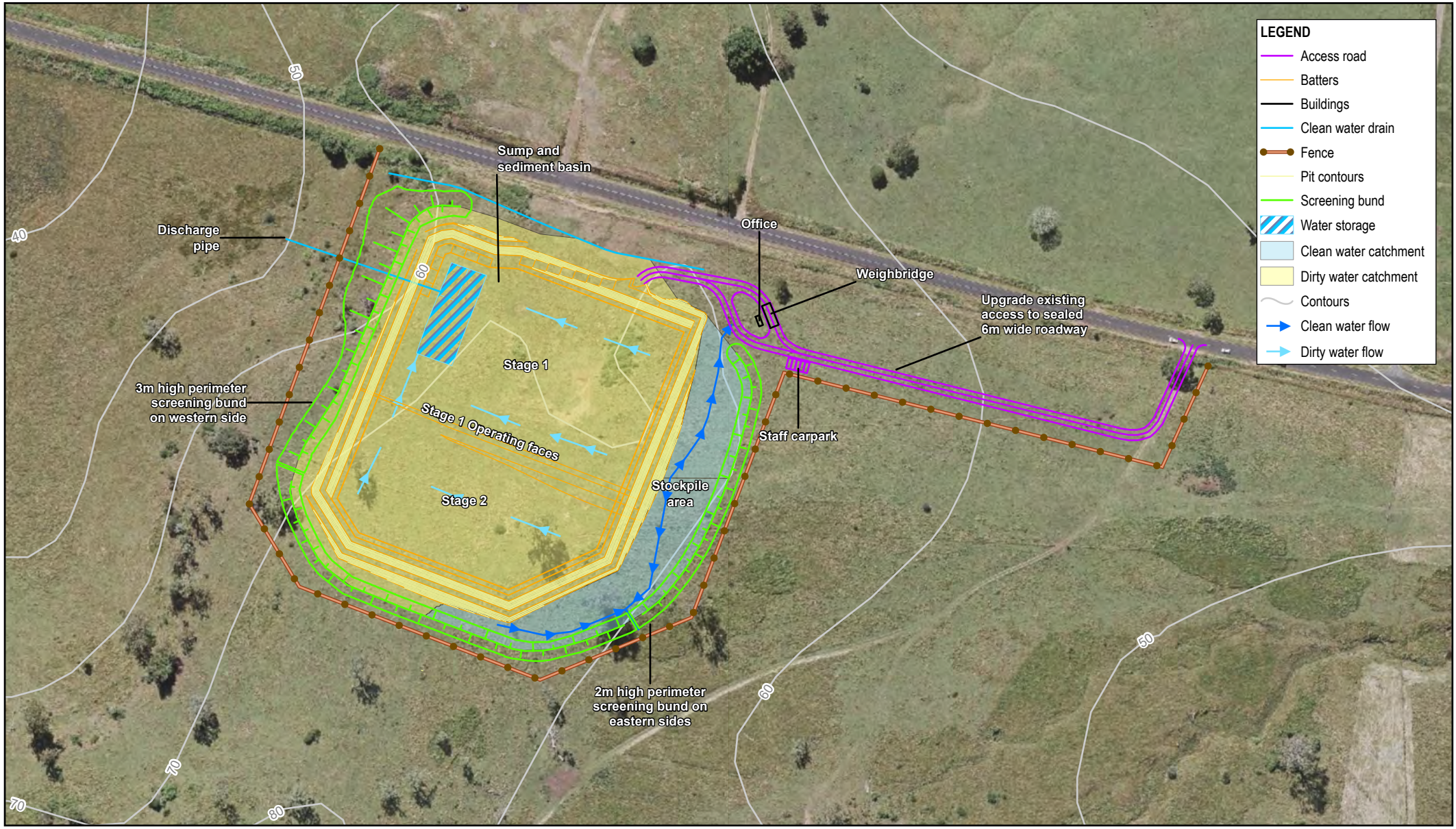
Results are summarised in Table 4-2.

Table 4-2 Sediment Basin sizing

Storage	5-day, 90th percentile rainfall event	Volumetric Runoff Coefficient, Cv	Catchment area (ha)	Required Settling Zone	Required Sediment Storage Zone			Required Sedimentation Basin Volume (m3)
					50% of Settling Zone volume (m3)	RUSLE Two Month Calculated Soil Loss (m3)	Adopted Sediment Storage Zone (m3)	
Sediment Basin	60.2	0.7	4.06	1712.7	856.3	287.3	856.3	2569

Results indicates that 50% of the settling zone capacity yields a larger storage volume compared to the RUSLE two month calculated soil loss and was therefore adopted for calculating the total sediment storage volume of 2,569 m^3.

This conservatism allows for a longer period between required desilting of the sediment basin.



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Metres

Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56

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Surface water management system

Figure 4-1

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5. Impact assessment

5.1 Surface water quality

As part of the project, the proposed water management system at Bentley Quarry will essentially include the following:

– Perimeter screening bunds to divert upslope catchment runoff around Bentley Quarry.
– Sump and sediment basins to collect catchment runoff from the disturbed area of the quarry.

The proposed surface water management system is expected to mitigate potential surface water impacts. The residual potential impacts of the project to surface water are considered low.

5.2 Surface water flow

The project has the potential to impact on flow regimes in watercourses due to changes to surface water runoff and baseflow contributions. The project will change the catchments of Oakey Creek and two unnamed tributaries of Back Creek.

Potential impacts on flow regimes in Oakey Creek and two unnamed tributaries of Back Creek have been assessed by comparing total catchment areas for each reporting location for proposed conditions.

The catchment areas of the reporting locations are summarised on Table 5-1. The proposed catchments exclude the areas within the dirty water management systems at Bentley Quarry. This is conservative for low flows, as it assumes all runoff from the quarry is intercepted and managed as part of the water management system. The catchments for proposed conditions are shown in Figure 1-1.

Table 5-1 Change in catchment area

Catchment	Existing catchment area (ha)	Proposed catchment area (ha)
Oakey Creek catchment	131.7	128.3
Unnamed creek tributary of Back Creek 1	56.4	56.2
Unnamed creek tributary of Back Creek 2	251	250.5
Bentley Quarry	1	4.1

Table 5-1 shows that the project is expected to reduce catchments of Oakey Creek by less than 3% of its existing catchment and unnamed creek 1 and 2 by less than 1% of its respective existing catchments. This reflects the relatively small disturbance areas of Bentley Quarry.

5.3 Flooding

There is no expected significant change to the extent of flooding and the stability of downstream water courses, due to changes to catchment area as a result of the project. The change in catchments, as discussed in Section 6.1, suggests that the project has a relatively small catchment area compared to the immediate downstream watercourses' catchments. These changes may be considered minor and are not expected to have a significant impact on the extent and depth of flooding.

Due to the elevated topography of Bentley Quarry with local relief of 30-40 m from its immediate downstream watercourse, the Bentley Quarry is not expected to be subject to regional or localised flooding.

5.4 Site Water Balance

A site water balance model was developed to quantify the potential impacts under a range of rainfall conditions. The model considers all major surface and groundwater interactions of the project site. The purpose of this section is to provide a brief summary of the key inputs and assumptions and to assess the potential impacts of the project based on the modelling results.

The model was used to estimate the average annual transfers between water cycle components of the project under proposed conditions. This represents the Stage 2 of the proposed operations as part of the project, as this reflects the 'worst case' scenario covering whole operational disturbance area of the quarry with shallower operational depth compared to other three stages.

The model was simulated using a historical time series of daily rainfall data extending over 132 years, from January 1889 to January 2021. A total of 132 realisations were applied, with each realisation modelling a different rainfall pattern from the record.

The principal sources of water at Bentley Quarry are:

– Catchment runoff from disturbed catchments captured in the sediment basin.
– Direct rainfall on the sediment basin.

The principal demands of water at Bentley Quarry are:

– Evaporation and evapotranspiration losses.
– Dust suppression demand.

Water demands at Bentley Quarry, such as dust suppression and evaporation losses, will vary in response to the climatic conditions. It is assumed that immediately after a rain event in each realisation, the basins will be dosed (with an appropriate dosing agent). Stored rainwater in the sediment basin is pumped out (controlled discharges) within 5 days to allow the 90th percentile, 5-day storm volume to remain free in the sediment basin. Remaining water in the sediment basin may be used for on-site dust suppression. The model was initialized with empty storage for the sediment basin.

5.4.1 Methodology

To estimate the runoff contributing to the surface water storages at the site, the Australian Water Balance Model (AWBM) was incorporated into the wider water balance model. The AWBM was adopted as the most suitable model as it is widely used throughout Australia in mine water balances, has been verified through comparison with large amounts of recorded streamflow data and literature is available to assist in estimating input parameters based on recorded streamflow data (Boughton and Chiew, 2003). Another advantage of the AWBM is the consideration of soil moisture retention when determining runoff.

5.4.2 Operational demands

Operational data relating to water management at Bentley Quarry were used to develop the water balance model. This site-specific information was used as input to the model (i.e. modelling parameters) and is listed in Table 5-2.

Table 5-2 Modelling parameters

Parameter	Description	Input
Dust suppression	Water sprayed to haul roads (from office to perimeter or the pit) to control and eliminate spread of dust and other fine particles in the air. Applied during dry days (evaporation > rainfall).	Estimated haul road length (from office to pit and along perimeter of pit) = 672 m Estimated haul road width = 5 m
Controlled discharge	Stored rainwater in the sediment basin that is pumped out within 5 days to allow the 90th percentile, 5-day storm volume to remain free in the sediment basin.	Pump rate = 0.3425 ML/day
Uncontrolled discharge	Sediment basin overflow	

5.4.3 Annual water transfers

The average annual forecast water transfers for the project for proposed conditions is summarised in Table 5-3.

Table 5-3 Annual average water transfers

Water management element	Proposed conditions (ML/year)
INPUTS	
Direct Rainfall	1
Catchment runoff	17
TOTAL INPUTS	**18**
OUTPUTS	
Evaporation	1
Dust suppression	3
Controlled discharges	7
Uncontrolled discharges (overflows)	7
TOTAL OUTPUTS	**18**
CHANGE IN STORAGE	
Surface water storages (sediment basin)	0
TOTAL CHANGE IN STORAGE	**0**
Inputs – outputs – change in storage	0

Table 5-3 shows that, on average, majority of the inflows at Bentley Quarry come from catchment runoff. This is mostly released either by controlled or uncontrolled discharge, reflecting the pumping out of stored stormwater to free up the 90th percentile, 5-day storm volume and sediment basin overflows during heavy rainfall events, respectively. A relatively minor volume of total inflow is used as on-site dust suppression or is lost as evaporation. No change in volume of water in sediment basin is expected reflecting the use of controlled discharge and the use of stored stormwater to supply for dust suppression.

5.4.4 Water security

The site water balance model simulated the annual exceedance probability (AEP) of total water deficit for dust suppression demands for the project for the proposed conditions, as shown in Figure 5-1. Annual exceedance probability of total water deficit is a performance measure that quantifies the expected likelihood of any total water deficit for dust suppression demands during a given year based on modelling results.

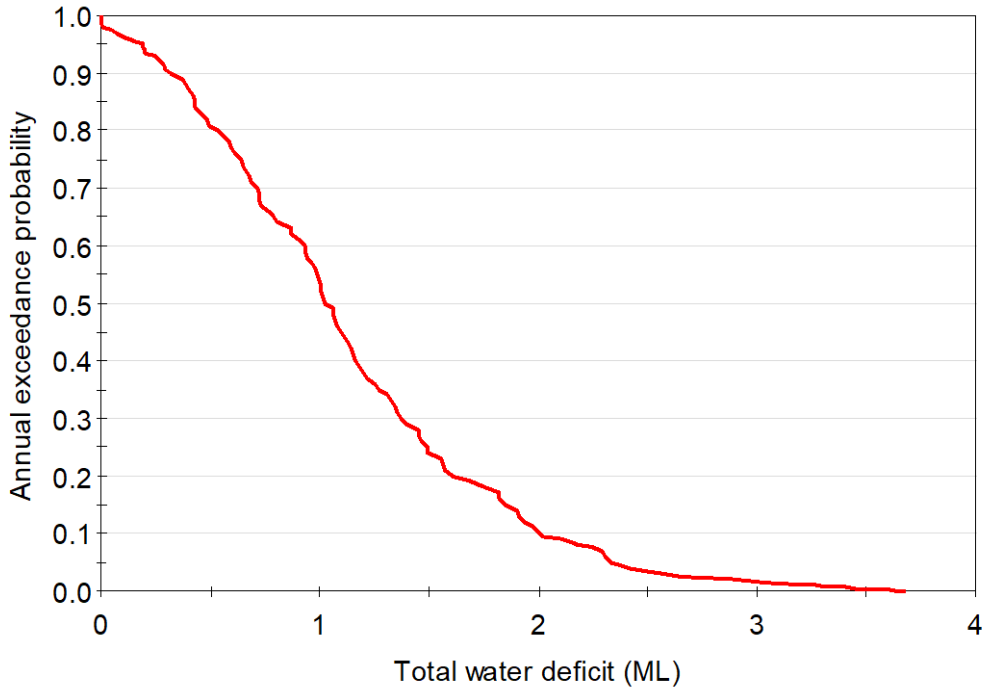


Figure 5-1 Annual exceedance probability of total water deficit

Figure 5-1 indicates that the average total water deficit for dust suppression demands is approximately 1 ML/year. Water security could be improved by increasing the size of the basin, so it is larger than is required for sediment control. The property is 214 hectares, so the maximum harvestable rights is 24.6 ML, so this could also be used to satisfy the calculated water deficit.

5.4.5 Off-site discharges

The annual average water balance results presented in Section 5.4 represents the average (mean) conditions but do not necessarily reflect the potential for off-site discharges due to rare rainfall events that exceeds the design capacity of the water management system.

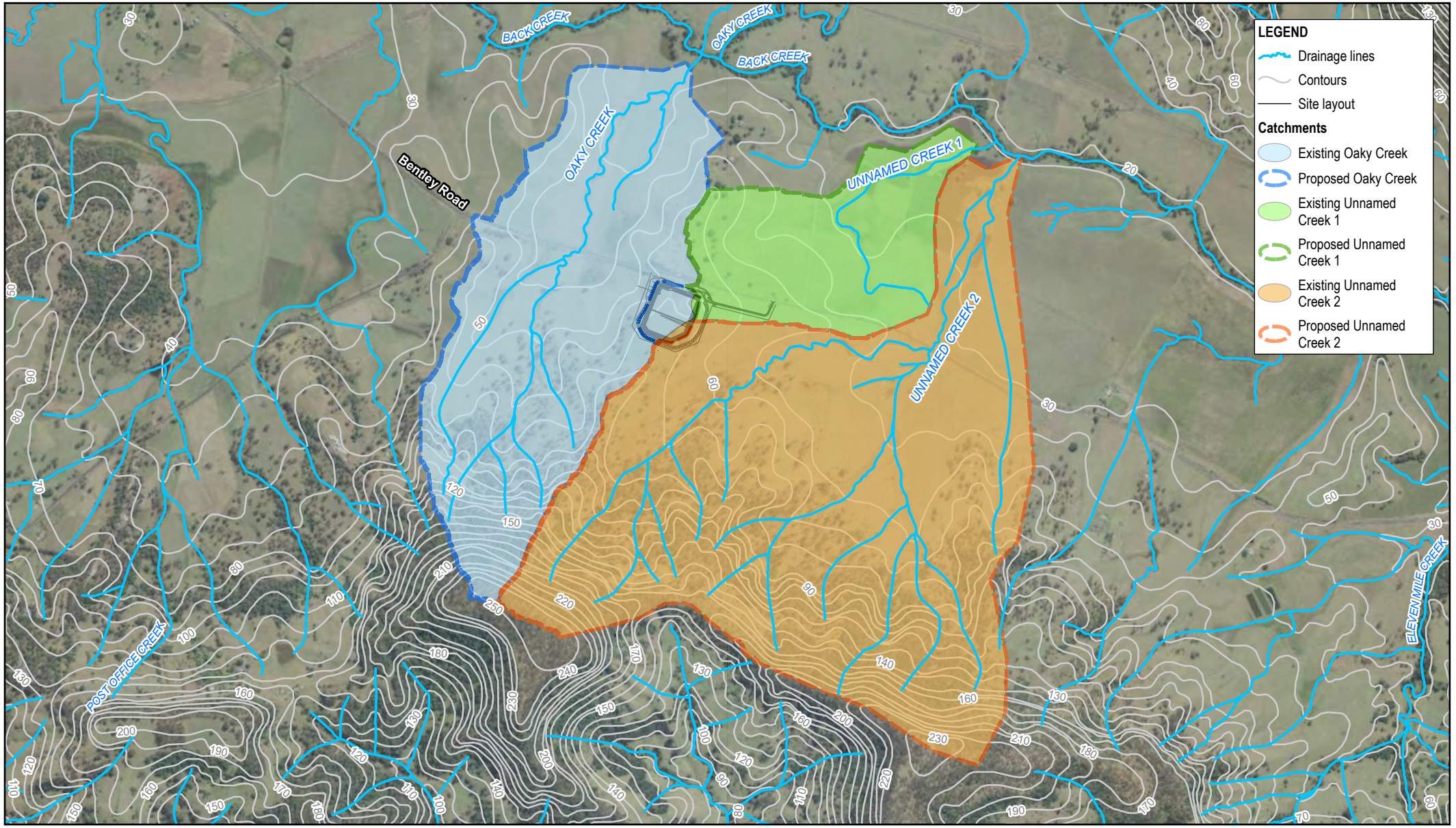
As per Table 6.2 of DECC (2008), the indicative average annual sediment basin overflow frequency is 2 to 4 spills per year for 90th percentile design storm event.

The average number of annual exceedances of offsite discharge for the sediment basin is summarised in .

Table 5-4 Summary of off-site discharges from sediment basin

Storage	Adopted Basin Volume (ML)	Average Number of Outflow Event Per Year	Maximum Outflow Volume Per Year (ML/year)
Sediment Basin	2.57	3	40

Table 5-4 indicates an average number of 3 outflow events per year from the sediment basin with a maximum outflow volume of 40 ML/day. This is acceptable to the spill frequency suggested in Table 6.2 of DECC (2008).



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Regional catchments

Figure 5-2

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5.5 Hydrogeology

Groundwater interception is expected during Stages 3 and 4 of the project with the lowering of the quarry floor to RL49m. Preliminary groundwater inflow and drawdown estimates have been carried out using the analytical equations and approach outlined in Marinelli and Niccoli (2000). The equations presented by Marinelli and Niccoli (2000) provide a simple means of estimating steady state or long-term average inflows to a pit or cutting.

The solutions presented consider:

– The effect of decreased saturated thickness near the pit walls.
– Distributed recharge to the water table.
– Upward flow through the pit bottom.

Separate flow calculations are carried out for inflow into the pit walls (Q1, Zone 1) and pit base (Q2, Zone 2) (refer Figure 5-3). Assumptions inherent in the flow calculation include:

– Pit walls are approximated as a circular cylinder.
– Groundwater flow is horizontal (Dupuit - Forchheimer approximation is valid).
– The static (pre-construction) water table is horizontal.
– Groundwater flow toward the pit is axially symmetric.
– Uniform distributed recharge occurs across the site as a result of surface infiltration.
– All recharge in the radius of influence is captured by the pit.
– The aquifer extends below the base of the pit.

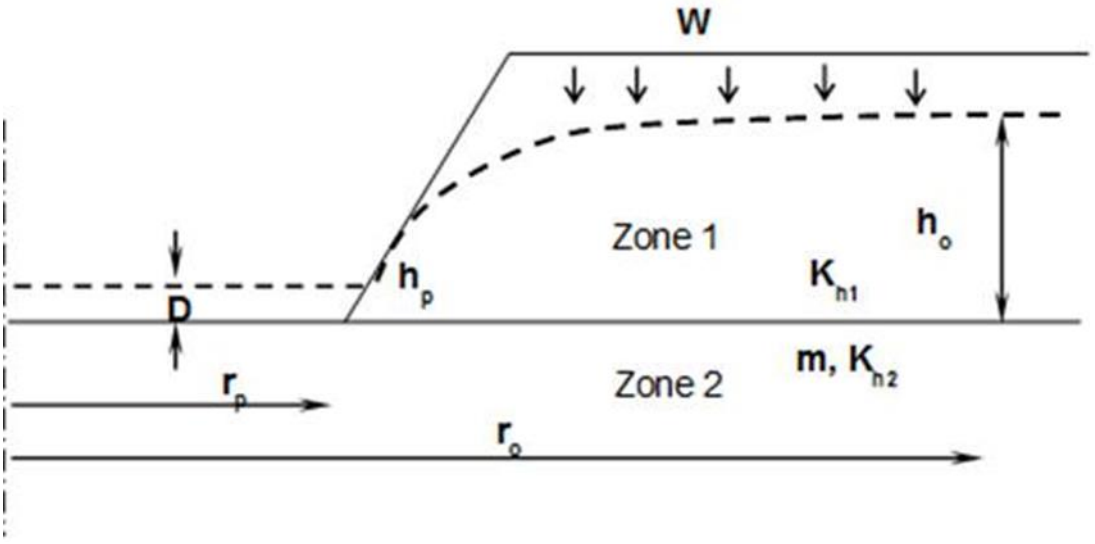

Figure 5-3 Conceptualisation of groundwater inflow into quarry pit

Relevant equations presented in Marinelli and Niccoli (2000) are:

$$h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left(r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \left(\frac{r_o^2 - r_p^2}{2}\right)\right)}$$

$$Q_1 = W\pi\left(r_o^2 - r_p^2\right)$$

Where:

– h_o = Initial (pre-excavation) saturated thickness (metres above base of pit) – adopted as 5.1 m based on a groundwater level of 54.1 mAHD.
– h_p = Saturated thickness at pit wall (metres above base of pit) – adopted as zero, excavation will be fully dewatered.

– W = Distributed recharge flux (m/s) – based on average rainfall data (refer Section 3.1) and rainfall recharge to groundwater is 8% of average rainfall.
– K_{h1} and K_{h2} = Horizontal hydraulic conductivity Zone 1 and Zone 2 (m/s) – 2 x 10^{-9} m/s based on slug test.
– K_{v2} = Vertical hydraulic conductivity Zone 2 (m/s) – 2 x 10^{-10} m/s (anisotropy value of 10).
– r_p = Effective pit radius (metres) – based on the area of the quarry floor at RL49m. The area was input into the formulae for the area of a circle (ie $A = \pi r_p^2$) in order to calculate the effective radius.
– r_o = Radius of influence (metres) – calculated as part of this assessment.
– d = Depth of the pit lake (metres) – adopted as zero, excavation will be fully dewatered.

The calculated groundwater inflow rate was 0.6 m^3/day or 0.23 ML/year. The radius of influence (groundwater drawdown) was calculated to extend approximately 94 m from the centre of the quarry pit, which indicates that groundwater drawdown will only extend a few metres from the boundary of the pit. Should the hydraulic conductivity of the basalt be an order of magnitude higher than calculated from the slug test, groundwater inflow would increase to 0.85 ML/year and the radius of influence would increase slightly to 103 m.

The potential impacts have been assessed in accordance with the NSW AIP . The AIP requires that potential impacts on groundwater sources, including their users and GDEs, be assessed against minimal impact considerations, outlined in Table 1 of the policy. If the predicted impacts meet the Level 1 minimal impact considerations, then these impacts will be considered as acceptable.

Based on the hydrogeological environment at the site where groundwater yields may exceed 5 L/s and the water quality is considered to be excellent, Level 1 minimal impact considerations for Highly Productive Fractured Rock Water Sources have been adopted for the groundwater impact assessment and are defined as follows:

– Water table: Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, at a distance of 40 m from any high priority GDE or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2 m water table decline cumulatively at any water supply work.
– Water quality: Any change in groundwater quality should not lower the beneficial use category of the groundwater source, beyond 40 m from the activity.

Due to the minimal groundwater inflow and drawdown predicted, it is not expected that the project will impact other groundwater users, GDEs or groundwater quality. As such, the groundwater impacts from the project are expected to meet the Level 1 minimal impact considerations and are therefore considered to be acceptable.

6. Mitigation, monitoring and management

6.1 Surface water quantity

Due to the minimal predicted impact, no monitoring of streamflow in watercourses is required.

The development of a discharge permit is recommended to manage the process and record discharges required during operation. Further management and monitoring requirements are discussed in section below.

The sediment basin discharge point is shown in Figure 4-1. Points of discharge may require areas of energy dissipation (e.g. placed rock).

It is recommended to construct a basin larger than is required for sediment control to provide added water security. In event of water deficit, external water sources such as water trucks or farm dams may be used to cover for the total water deficit. Extraction of surface water would need to be within harvestable rights or existing works approval/licence.

6.2 Surface water quality

Surface water quality would be managed by the proposed surface water management systems discussed above, including perimeter screening bunds, sediment basins, and sumps, as presented in Figure 4-1.

Discharge water quality monitoring is to be undertaken prior to any controlled release of water from sediment basins. All water quality monitoring is to be undertaken in accordance with the Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA 2004).

In the absence of adequate reference site monitoring data, a list of the DGVs recommended by ANZECC (2000) to assess water quality is presented in Table 6-1. It should be noted that there have been no hardness correction factors applied to the guideline values presented.

Table 6-1 Default guideline values for assessment of water quality

Parameter	Units	Guideline value	Comments (reference within ANZECC)
Electrical conductivity (EC)	µS/cm	300	NSW lowland river (Table 8.2.8)
pH	pH units	6.5-9.0	NSW lowland river (Table 8.2.9)
Total suspended solids (TSS)	Mg/L	50	NSW lowland river (Table 8.2.12)
Turbidity	NTU	50	NSW lowland river (Table 8.2.11)

Where monitoring indicates a water quality exceedance in discharges off site, an investigation will be undertaken and a notification to the EPA shall be undertaken as soon as practicable.

Following construction, the operational treatment devices that have been sized during the design process will seek to meet the above guideline values, the defined water quality objectives and load-based design criteria. These criteria would apply to all surface areas where runoff has been concentrated into defined outlet points of the drainage system.

6.3 Groundwater levels and quality

Groundwater inflows into the quarry pit should be metered (if possible), although the minimal flows are expected to evaporate from the pit walls before reaching the in-pit sump.

Groundwater monitoring (levels and quality) should be undertaken at the existing monitoring bore (BH01) to confirm the groundwater drawdown predictions. Monitoring should be undertaken on a quarterly basis before and during quarrying operations. Samples should be analysed for pH, EC, major ions (sodium, potassium, calcium, magnesium, chloride, sulfate and alkalinity) and dissolved metals.

6.4 Licensing

No surface water licences are expected to be required for the project.

The EPL for the site should include a licensed discharge point from the outlet of the sediment control dam.

Due to the calculated groundwater inflow into the quarry pit being less than 3 ML/year, a groundwater WAL is not expected to be required for the project.

7. References

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The Power of Commitment

Appendix H

Noise Impact Assessment

Bentley Quarry

Noise and Vibration Impact Assessment

R & S Contracting Pty Ltd

29 October 2021

→ **The Power of Commitment**

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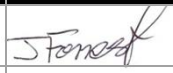
Printed date	29/10/2021 11:38:00 AM
Last saved date	29 October 2021
File name	https://projectsportal.ghd.com/sites/pp01_04/bentleyquarry/ProjectDocs/12547851-REP_NoiseImpactAsessment.docx
Author	Evelyn Potoczny
Project manager	Ben Luffman
Client name	R & S Contracting Pty Ltd
Project name	EIS for Bentley Quarry proposed expansion
Document title	Bentley Quarry | Noise and Vibration Impact Assessment
Revision version	Rev 0
Project number	12547851

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S04	0	E Potoczny	J Forrest		S Lawer		29/10/21

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Glossary

Term	Description
AHD	Australian Height Datum
ANFO	Ammonium Nitrate Fuel Oil
AS	Australian Standard
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).
AWS	Automated weather station
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 percent 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 7 days).
BoM	Bureau of Meteorology
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	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 Office of Environment and Heritage (OEH).
EPA	Environment Protection Authority
GHD	GHD Pty Ltd
ha	hectare
$L_{Aeq(period)}$	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.
$L_{A1(period)}$	The sound pressure level that is exceeded for one percent of the measurement period.
$L_{A10(period)}$	The sound pressure level that is exceeded for 10 percent of the measurement period.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90 percent of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
Mitigation	Reduction in severity.
R & S	R & S Contracting Pty Ltd
NIA	Noise Impact Assessment
Noise Sensitive Receptor	Noise sensitive land use that may be impacts by noise from the development.
NPI	Noise Policy for Industry
PPV	Peak particle velocity
PSNG	Project Specific Noise Goals
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

Term	Description
Sound Pressure Level (SPL or Lp)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where LP = 10 log10 (Pa/Po)2 dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20 x 10-6 Pa) for airborne sound. SPL varies with distance from a noise source.
Sound Power Level, LW	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.
Sound transmission Loss	The amount in decibels by which a random sound is reduced as it passes through a sound barrier.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.
tpa	Tonnes per annum
tpd	Tonnes per day
vtpd	vehicle trips per day

1. Introduction

1.1 Purpose of this report

GHD Pty Ltd (GHD) was engaged by R & S Contracting Pty Ltd (R & S Contracting) to prepare a Noise and Vibration Impact Assessment (NVIA) to address the potential noise and vibration impacts from the proposed quarry expansion at Bentley Quarry located at Lot 2 DP 1196757, Bentley Road, Bentley.

R & S Contracting proposes to construct and operate a hard rock quarry (Bentley Quarry) to extract up to 300,000 tonnes per annum (tpa) (2000 tonnes per day (tpd)) over 30 years, with a total disturbance area of approximately 6.5 hectares (ha) (the project). Bentley Quarry will predominantly supply materials for use as fill and for road construction and maintenance.

1.2 Scope of work

The scope of work to conduct the Noise Impact Assessment involved:

- Review of existing information including equipment lists, quarrying methodology and site layout.
- Undertake background noise monitoring at three sensitive receptor locations surrounding the quarry.
- Establish project specific noise goals (PSNG) and vibration limits for the proposed quarry expansion with consideration to the NSW *Noise Policy for Industry* (NPI) (EPA, 2017) and Australian and New Zealand Environment Council (ANZEC 1990) *Technical Basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.*
- Identify likely principal noise sources during operation and their sound power levels.
- Undertake one noise modelling scenario for the proposed operations using computer noise modelling software to predict sound pressure levels emanating from the site based on operations at the proposed production rate.
- Undertake a blasting impact assessment.
- Comment on predicted noise levels and provide recommendations for in-principal noise mitigation measures where exceedances are predicted. Possible noise mitigation measures will be discussed with R & S Contracting where required.
- Prepare a Noise Impact Assessment detailing the above.

1.3 Limitations

This report has been prepared by GHD for R & S Contracting Pty Ltd and may only be used and relied on by R & S Contracting Pty Ltd for the purpose agreed between GHD and R & S Contracting Pty Ltd as set out in Sections 1.1 and 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than R & S Contracting 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.

Specifically, this report does not take into account the effects, implications and consequences of or responses to COVID-19, which is a highly dynamic situation and rapidly changing. These effects, implications, consequences of and responses to COVID-19 may have a material effect on the opinions, conclusions, recommendations, assumptions, qualifications and limitations in this report, and the entire report must be re-examined and revisited in light of COVID-19. Where this report is relied on or used without obtaining this further advice from GHD, to the maximum extent permitted by law, GHD disclaims all liability and responsibility to any person in connection with, arising from or in respect of this report whether such liability arises in contract, tort (including negligence) or under statute.

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

In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.

2. Project description

2.1 Site description

The proposed quarry would be located at the existing quarry on Bentley Road, Bentley formally described as Lot 2 DP 1196757 as shown in Figure 2.1.

Main site access is via Bentley Road.

Paper Size ISO A4

0 25 50 75 100

Metres

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

N

GHD

R&S Contracting Pty Ltd
Bentley Quarry
Noise Impact Assessment

Development site

Project No. **12547851**
Revision No. **0**
Date **29/10/2021**

Figure 2-1

N:\AU\Coffs Harbour\Projects\22\12547851\GIS\Maps\12547851_NIA_0.aprx
Print date: 29 Oct 2021 - 09:50

Data source: LPI: DTDB, 2017. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Created by: tmorton

2.1.1 Project overview

The project involves a hard rock quarry, with an annual maximum extraction rate of 300,000 tpa and a maximum daily extraction rate of 2000 tpd. The total area of disturbance would be 6.5 ha with a pit of 3.65 ha. A maximum of 50,000 tpa of soil, topsoil and waste concrete would be imported to the site to be used for constructing landscape mounds, rehabilitation and blending with aggregate material.

The primary purpose of the project is to supply suitable aggregate resources for use as general fill and for the construction and maintenance of roads in the region.

The site has been used for extraction for many years, with obvious signs of benching from past operations. A small quarry operation continues at the site which operates under existing use rights. This limits the operation to 3000 m^3 (estimated to be 6000 tonnes based on a conversion of 2 tonnes per m^3) and a disturbance footprint of approximately 1 ha. No blasting or crushing occurs on-site. Due to increasing demand, it is proposed to increase the extraction rate and include blasting and crushing.

2.2 Site establishment

The site establishment phase of the quarry would be relatively short (i.e. about 2 months) period. The main activity would be the construction of the access road and the intersection of the access and Bentley Road. Other activities would include:

– Initial and progressive installation of environmental controls including erosion and sediment control measures.
– Vegetation clearance, soil stripping and stockpiling.
– Construction of temporary drainage controls.
– Importation of clean soil for landscape mounds to the east and west of the quarry.
– Construction of a site office and car parking area.

It is proposed to crush and screen material at the site following approval so it is suitable to use during the construction of the access road and intersection.

2.3 Operation

The quarry operations would be carried out in four stages and in response to demand. To minimise the initial impact of the proposed quarry, Stage 1 would encompass the existing footprint of the quarry and expand it at a depth of RL 63 m until the northern half of the proposed quarry is exhausted. Stage 2 continues at RL 63 m to the southern extent of the proposed quarry. Stage 3 will involve lowering the northern half of the proposed quarry to its final depth of RL 49 m. This will involve constructing a sediment basin and drainage pipe through the western wall of the quarry to the discharge location. Stage 4 would be the final stage which would continue at RL 49 m to the southern extent of the proposed quarry. A summary of the stages is outlined in Table 2.1 and the general layout is provided further in the report in Figure 7.1.

Table 2.1 Quarry stages

Stages	Volume (m^3)	Volume (tonnes[1])
1	107,000	214,000
2	148,000	296,000
3	188,000	376,000
4	190,000	380,000
Total	**633,000**	**1,266,000**

Note 1 – Based on a density of 2 tonnes per m^3

2.3.1 Stripping and stockpiling

Topsoil stripping would occur in stages prior to excavation. Generally, areas would be stripped immediately prior to quarrying. Overburden would be used to construct the perimeter bunds and landscaped to provide a visual screen.

2.3.2 Extraction and blasting

Overlying weathered material would be removed using dozers and excavators to a depth of about 5 m. Underlying fresh rock would require blasting.

Blasting would be strictly controlled and conducted by a suitably qualified blasting contractor who would bring explosives onto site as required and fill a series of holes that would be pre-drilled by a separate drilling contractor.

Bulk emulsion explosives such as Ammonium Nitrate Fuel Oil (ANFO) would be used. Following blasting, all blasting equipment and any unused explosives would be removed from site. No explosives would be stored on site. Blasting would be undertaken in 20,000-30,000 tonne shots. It is anticipated that up to one blast per month would be undertaken during peak periods of demand but on average 3-4 blasts would be required per year.

2.3.3 Crushing and screening

Contractors would crush and screen the extracted material using mobile plant positioned close to the extraction area. An excavator would feed the excavated rock into a mobile primary crusher. The primary crusher would then pass the crushed material to a secondary mobile crusher for further crushing, at which point the material would be passed through a screening plant to sort the crushed aggregate into different grades depending on market demand. The screening plant would discharge the crushed and screened aggregate into a stockpile area using a radial stacking conveyor.

2.3.4 Blending

Some of the extracted material would be blended with imported waste concrete and possibly clay and sand, depending on the specifications the ultimate client requires.

2.3.5 Stockpiling

Material would be stockpiled in designated areas within the pit. Material would be stored in various grades for sale or distribution.

Some imported materials may be stockpiled to the east of the pit.

2.3.6 Pre-coat operation

At times, pre-coated materials may be required to be provided. To satisfy this demand, a mobile pre-coat plant would periodically be used. This is a fully self-contained plant that would precoat the aggregates, which would be stockpiled within the quarry until sold.

2.3.7 Hours of operation

The hours of operation would generally be limited to the following times.

Table 2.2 Hours of operation

Period	Start time	Finish time
Monday to Friday	7:00 am	6:00 pm
Saturday	7:00 am	2:00 pm
Sunday & Public Holidays	No operations	

Staff may arrive and leave site before and after these times to ‘start-up’ and ‘shut-down’ the quarry but excavation, crushing or loading would not occur outside the times specified above. Blasting would only occur on weekdays between the hours of 10:00 am and 3:00 pm.

2.4 Quarry equipment

Table 2.3 lists the plant and equipment proposed to be operating on site and will be split up between the construction and operational phases of the project.

Table 2.3 Quarry equipment

Type	Typical make/model	Approximate number	Typical frequency of use	Description
Dozer	Caterpillar D6/D8	1	20%	Clearing and grubbing of vegetation and stripping of topsoil Construction of bunding Rehabilitation To be used mainly during construction
Excavator	Kobelco 350	2	100%	Excavating material and stockpiling Clearing and grubbing of vegetation and stripping of topsoil
Jaw, cone, and impact crusher	McClosky J50	1	80%	Crushing rock and waste concrete
Front end loader	Komatsu WA480 FE	1	100%	Loading material into the haul trucks and stockpiling material within the pit floor
Screen	Fast Trax FT6203	1	70%	Aggregate/gravel production and overburden screening Mixing imported waste concrete with aggregate
Grader	Komatsu	1	25%	Road and bund construction and maintenance To be used mainly during construction
Haul trucks	Truck and dog contractors	Up to 70 per day	100%	Delivery of materials to customers and carting, unsuitable material to rehabilitation areas, importing soil and importing waste concrete
Pre-coat plant	Various – similar to screen plant	1	20%	Used to produce pre-coated aggregate as required
Water cart	Komatsu	1	40%	To water pit floor and stockpiles
Water pump	Honda	2	40%	To dewater excavation / basin and to fill water cart from standpipe To water stockpiles and put moisture in products
Hand tools	Various	5	5%	General activities maintaining plant
Light vehicles	4x4 Vehicles	Up to 5	20%	Transporting staff to, from, and around site

It is anticipated that not all of the equipment listed above would be operational on-site at any one time.

2.5 Traffic generation

2.5.1 Workforce traffic

During operation it is likely that there would be a maximum of five workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 10 vehicle trips per day (vtpd). It is assumed the majority of the workforce would arrive between 6:30 am and 7:30 am and depart generally between 3:00 pm and 6:30 pm.

2.5.2 Heavy vehicle traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At maximum daily production (i.e. 2000 tonnes), the quarry is expected to generate about 70 truck and dog loads or 140 truck movements per day. The truck movements would start at 7:00 am and continue evenly throughout the day, until 6:00 pm, making about 7 truck loads or 14 movements per hour.

This rate of maximum truck movement is expected to be infrequent and for short durations. The average number of truck movements is expected to be a lot less and there would be times when no trucks would access the site.

The total truck movements would also include movements associated with importing materials or trucks using the weighbridge but not hauling materials to or from the quarry.

3. Sensitive receptors

Noise sensitive receptors are defined in the *Noise Policy for Industry* (NPI) based on the type of occupancy and the activities performed in the surrounding land uses. Sensitive noise and vibration receptors could include:

– Residences
– Educational facilities
– Hospitals and medical facilities
– Places of worship
– Passive and active recreational areas such as parks, sporting fields, golf courses (note that these recreational areas are only considered sensitive when they are in use or occupied)
– Commercial or industrial premises

Nearby sensitive receptors in the vicinity of the site are the following dwellings:

– A dwelling is located approximately 360 m south of the proposed quarry, which is owned and occupied by the applicant (R1).
– The closest dwelling that is not associated with the project is located 650 m north of the proposed quarry. Disputed Plains Homestead has been vacant since the 1990s (NSW State Heritage Inventory, N.D.) (R2).
– An occupied dwelling that is not associated with the project is located 1.27 km south-west of the proposed quarry (R3).
– The closest occupied dwelling to the east of the quarry is located 1.2 km to the east (R6).
– The closest commercial receptor is the Bentley Community Market shed approximately 800 m to the east of the quarry (R7).
– Although not included as a receptor in the operational noise assessment, R8 has been included as a receptor for the road traffic noise assessment in section 7.3. This receptor has been included due to the proximity of the building to Bentley Road.

There is also a proposed subdivision to the west of the quarry with two proposed house locations which have also been included as receptors (R4 and R5).

Table 3.1 below outlines locations of all receptors identified.

Table 3.1 Sensitive receptors

Receptor name	Receptor type	Easting (m)	Northing (m)
R1	Residential	512811	6815075
R2	Residential	513197	6815939
R3	Residential	511696	6814861
R4	Residential	512381	6815074
R5	Residential	511381	6814766
R6	Residential	514140	6814834
R7	Commercial	513852	6815332
R8	Residential	514654	6815032

Sensitive receptor locations are displayed in Figure 3.1.

Paper Size ISO A4

0 90 180 270 360

Metres

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

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R&S Contracting Pty Ltd
Bentley Quarry
Noise Impact Assessment

Sensitive receivers

Project No. **12547851**
Revision No. **0**
Date **29/10/2021**

Figure 3-1

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Print date: 29 Oct 2021 - 09:32

Data source: LPI: DCDB/DTDB, 2017. World Imagery: Maxar.
Created by: tmorton

4. Existing environment

GHD has undertaken long term unattended monitoring to determine the Rating Background Levels (RBLs) in accordance with the *Noise Policy for Industry*.

Noise logging was undertaken using three SVAN 977 noise loggers, which were all within current NATA accredited calibration. These instruments conform to the requirements of Type 1 as set out in AS 1259.2 (1990) *Acoustics – Sound Level Meters – Integrating – Averaging* or AS IEC 61672.1 (2013) *Electro Acoustics - Sound Level Meters Specifications.* Quarry activities ceased during the logging period in order to obtain a true background noise level without quarry activity.

The noise loggers were deployed on 3 August 2021 and were retrieved on 18 August 2021. This provided sufficient time to enable a full seven days of data to be captured, allowing for any periods of adverse weather during the survey to be excluded. The loggers were programmed to accumulate A-weighted, fast time response environmental noise data continuously over sampling periods of 15 minutes for the entire logging duration.

Pre-measurement calibration checks were performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dBA at 1 kHz. At completion of the measurements, the calibration was re-checked to ensure that the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 0.5 dBA.

Logged data was reviewed to exclude any anomalous data and data potentially affected by adverse weather conditions. Meteorological data for the monitoring period in 30-minute intervals was sourced from the Lismore Airport AWS.

Table 4.1 outlines the unattended noise monitoring locations and Table 4.2 outlines the Rating Background Level (RBL) results for each noise logger.

Table 4.1 Unattended noise monitoring locations

Logger ID	Representative Receptor ID	Equipment type and serial number	Date deployed and retrieved	Picture
L1	R1	SVAN 977 SN 45748	03/08/2021 – 18/08/2021	
L2	R2	SVAN 977 SN 36820	03/08/2021 – 18/08/2021	

Logger ID	Representative Receptor ID	Equipment type and serial number	Date deployed and retrieved	Picture
L3	R3	SVAN 977 SN 45746	03/08/2021 – 18/08/2021	

Table 4.2 Summary of rating background noise levels, dBA

Logger ID	Rating background level 90th percentile $L_{A90(15min)}$		
	Day[1,2]	Evening[1,2]	Night[1,2]
L1	31 (35)	19 (30)	18 (30)
L2	30 (35)	23 (30)	20 (30)
L3	28 (35)	19 (30)	12 (30)

Note:

1. Daytime 7:00 am to 6:00 pm; Evening 6:00 pm to 10:00 pm; Night-time 10:00 pm to 7:00 am.

   Sundays and Public Holidays, Daytime 8:00 am to 6:00 pm; Evening 6:00 pm to 10:00 pm; Night-time 10:00 pm to 8:00 am.
2. In accordance with the NPI, minimum RBLs apply. The daytime RBLs will increase to 35 dBA and evening and night-time RBLs will increase to 30 dBA.

5. Effects of meteorology on noise levels

5.1 Overview

Meteorological conditions may increase noise levels by focusing soundwave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level), and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receptor.

The NPI provides two options for a proponent to consider meteorological effects on noise levels:

1. Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receptor wind vectors for all receptors and F class temperature inversions with wind speeds up to 2 m/s at night.
2. Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30 percent determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30 percent of the time, standard meteorological conditions may be adopted for the assessment.

This assessment has used the option 1 approach and assumed a source to receptor wind and temperature inversion conditions to represent a conservative assessment of noise impacts.

5.2 Wind

Wind has the potential to increase noise at a receptor when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases, the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration. Where wind blows from the source to the receptor at speeds up to 3 m/s for more than 30 percent of the time in any season (NPI, 2017), then wind is considered to be a feature of the area.

Wind speed and direction data, among other parameters, have been measured at the Bureau of Meteorology (BoM) automated weather station (AWS) at Lismore (Station Number 94572) for many years. Thus, a detailed approach has been utilised for the purpose of this assessment.

In order to determine the prevailing conditions, weather data from the full calendar year of 2020 was obtained from the BoM AWS at Lismore (approximately 13 km south east of the project site).

In accordance with the NPI, this data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night-time period. The results of the wind analysis are provided in Table 5.1 presented graphically in Figure 5.1 to Figure 5.4. In each figure, the wind directions and percentage occurrence are those dominant during each season.

Seasonal wind records indicate that winds up to 3 m/s do not exceed the 30 percent threshold during the day periods. Prevailing winds are therefore not considered a feature of the area during the day and evening period and have not been considered as part of this assessment.

Table 5.1 Percentage occurrence of winds 0.5 m/s to 3 m/s

Wind direction	Percentage occurrence of winds between 0.5 m/s to 3 m/s (%)			
	Spring	Summer	Autumn	Winter
	Day	Day	Day	Day
N	10	7	9	10
NNE	2	2	1	1
NE	1	2	1	1
ENE	0	0	0	0
E	1	1	1	0
ESE	1	1	1	1
SE	1	1	1	1
SSE	1	2	2	2
S	2	4	3	2
SSW	1	1	2	3
SW	1	1	1	2
WSW	0	0	1	1
W	1	1	1	2
WNW	1	1	0	0
NW	2	2	1	1
NNW	2	4	3	3
Calm	13	16	20	18

Note:

1. 16-direction wind compass rose the percentage occurrence of light winds for each of the 16 directions is the arithmetic sum of the direction being reported and the four closest directions (that is, two on either side).

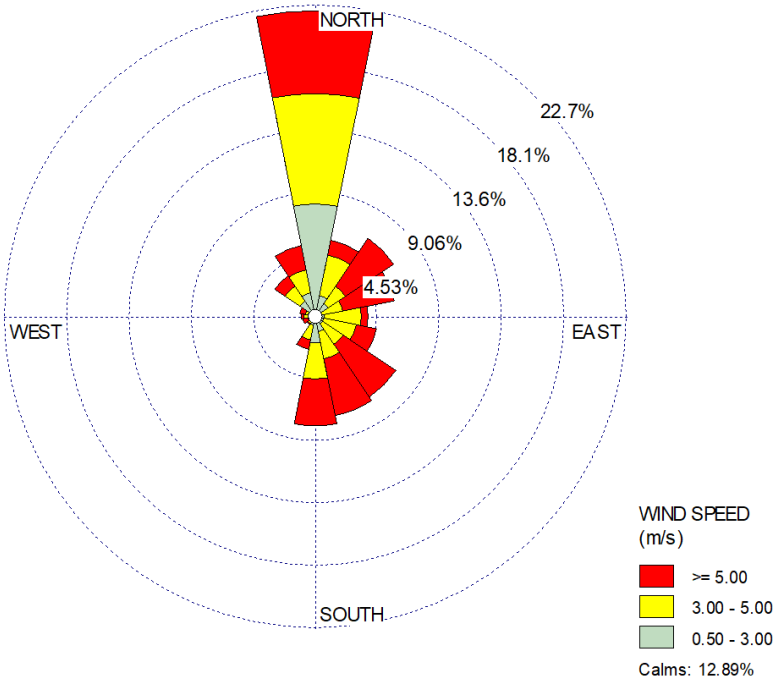


Figure 5.1 Daytime wind rose – Spring

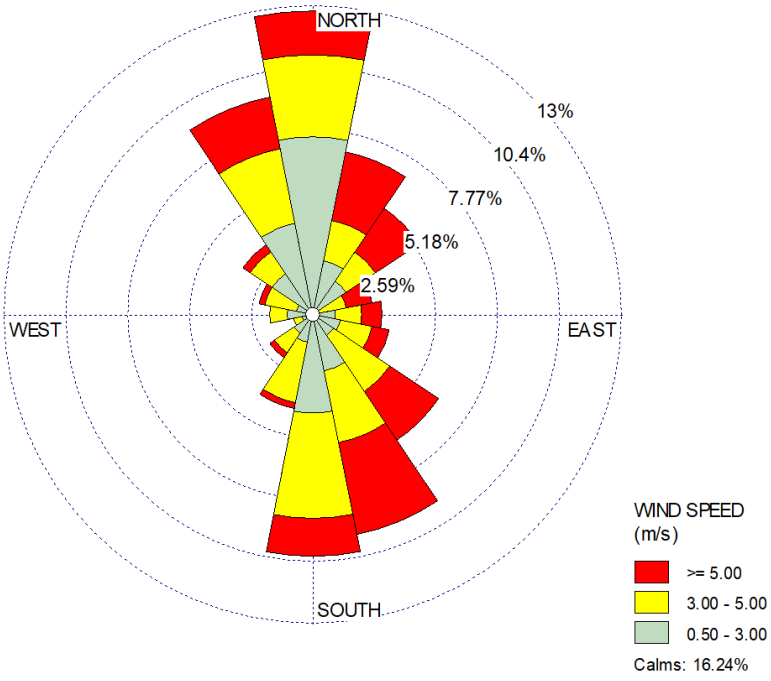


Figure 5.2 Daytime wind rose – Summer

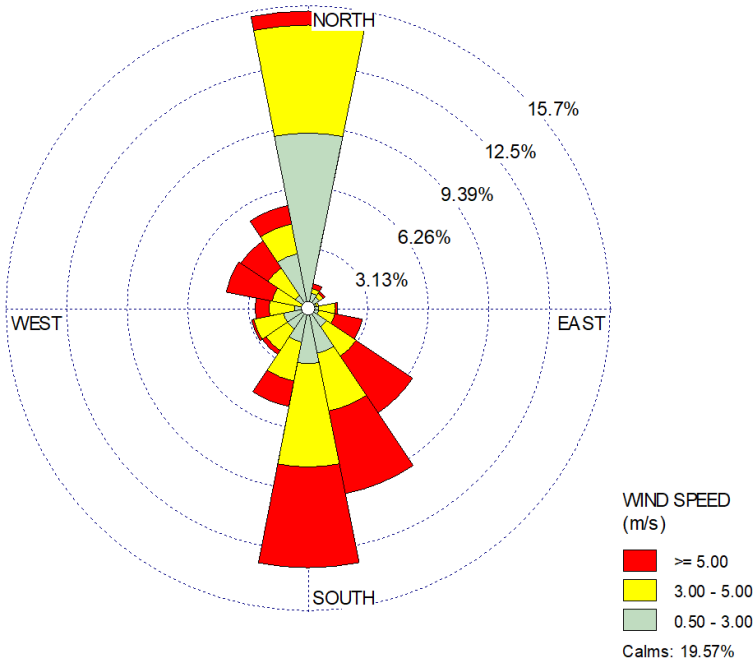


Figure 5.3 Daytime wind rose – Autumn

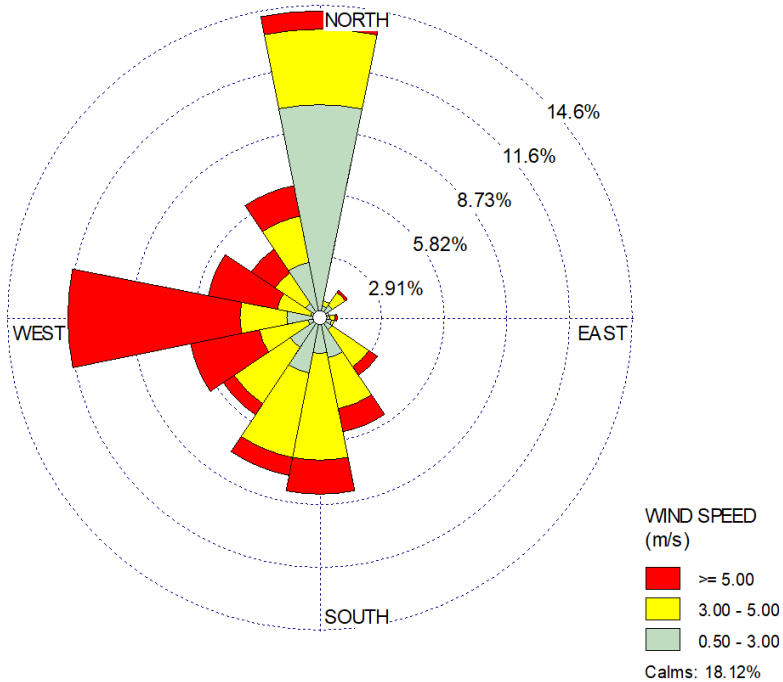


Figure 5.4 Daytime wind rose – Winter

6. Project specific noise and vibration goals

6.1 Noise Policy for Industry

The NSW EPA *Noise Policy for Industry* (NPI) provides guidance on the assessment of operational noise impacts. The guideline includes both intrusive and amenity goals that are designed to protect receptors from noise significantly louder than background level, and to limit the total noise level from all sources near a receptor.

The NPI noise goals are planning levels and are not mandatory limits required by legislation; however the noise goals assist regulatory authorities establish licensing conditions. Where noise goals are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise goals cannot be achieved, negotiation is required between the regulatory authority to evaluate the economic, social and environmental costs and benefits of the development against the noise impacts. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the development.

6.1.1 Intrusive noise goals

Intrusive noise goals control the relative audibility of operational noise compared to the background level at residential receptors. The intrusive noise goals are determined by a 5 dB addition to the measured (or adopted) background level. The NPI recommends that the intrusive noise goals for the evening period should not exceed the daytime period and the night-time period should not exceed the evening period. The intrusive noise goals are only applicable to residential receptors.

6.1.2 Amenity noise goals

The amenity noise goals limit the total level of extraneous noise for all receptor types and is based on the overall acoustic characteristics of the receptor area and the existing level of noise, excluding other sources that are uncharacteristic of the usual noise environment. Residential receptors are characterised into ‘urban’, ‘suburban’, ‘rural‘ or other categories based on noise criteria specific to land use and associated activities.

With consideration to the NPI ‘Noise Amenity Area’ Classification, the residential receptors identified in this assessment have been classified as ‘rural’.

The PSNG are outlined in Table 6.1 and reflect the most stringent noise level requirements derived from the intrusive and amenity noise goals.

The operational PSNG for all residential receptors (see Section 3) are based on measured background noise levels (see Table 4.2).

Table 6.1 Operational noise goals, dBA – Sensitive receptors

Sensitive receptors	Period[1]	Rating background noise level (RBL)	Intrusiveness noise level (INL)[2] $L_{Aeq(15minute)}$	Amenity noise level (ANL)[3] $L_{Aeq(15minute)}$	Project specific noise goals $L_{Aeq(15minute)}$
All residential	Day	35	40	48	40
	Evening	30	35	43	35
	Night	30	35	43	35
Commercial	When in use	-	-	65	65

Notes:

1. Day is defined as 7:00 am to 6:00 pm, Evening is defined as 6:00 pm to 10:00 pm and Night is defined as 10:00 pm to 7:00 am.
2. Intrusiveness noise level is $L_{Aeq,(15minute)}$ = RBL + 5.
3. Amenity noise level (ANL) is rural ANL (Table 2.2 NPI) minus 5 dBA plus 3 dBA to convert from a period level to a 15-minute level.

6.2 Traffic on public roads

GHD understand that rock material would be hauled from the site along Bentley Road. Therefore, the quarry has the potential to create additional traffic noise on Bentley Road.

The NSW *Road Noise Policy* (OEH, 2011) (RNP) provides non-mandatory road traffic noise target levels for land use developments with potential to create additional traffic on public roads.

Bentley Road has been considered a local road in accordance with the RNP. The road traffic noise target levels are presented in Table 6.2.

Table 6.2 RNP traffic noise target levels at residential receptors – dBA

Type of development	Day (7:00 am – 10:00 pm)	Night (10:00 pm – 7:00 am)
Existing residences affected by additional traffic on existing local roads generated by land use developments.	$L_{Aeq(1\ hour)}$ 55 (external)	$L_{Aeq(1\ hour)}$ 50 (external)

6.3 Corrections for annoying noise characteristics

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level. The *NSW Noise Policy for Industry* (2017) outlines correction factors that are to be applied to the source noise level at the receptor before comparison with the project specific noise levels, to account for the additional annoyance caused by these modifying factors. Table 6.3 sets out the corrections to be applied.

Table 6.3 Modifying factors corrections

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Tonal noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: – 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz – 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz – 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz	5 dB[2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: – Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period. – Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.	2 or 5 dB[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level.	The source noise heard at the receptor varies by more than 5 dBA and the intermittent nature of the noise is clearly audible.	5 dB	Adjustment to be applied for night-time only.

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Duration	Single-event noise duration may range from 1.5 min to 2.5 h.	One event in any assessment period.	0 to 20 dBA	The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3).
Maximum adjustment	Refer to individual modifying factors.	Where two or more modifying factors are indicated.	Maximum correction of 10 dBA[2] (excluding duration correction).	

Notes:

1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.

2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

Table 6.4 One-third octave low-frequency noise threshold

Hz/dBZ	One-third octave $L_{Zeq,15\text{-}min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dBZ	92	89	86	77	69	61	54	50	50	48	48	46	44

Notes:

- *dBZ = decibel (Z frequency weighted).*
- *For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to five metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler, 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.*
- *Low-frequency noise corrections only apply under the standard and/or noise-enhancing meteorological conditions.*
- *Where a receptor location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.*
- *Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or environment protection licence, and at locations nominated in the development consent or licence.*

Intermittent noise: noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dBA; for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.

Correction for duration: this is applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aeq,15min}$ equivalent noise criterion is shown in Table C3 for the duration of the event. This adjustment is designed to account for unusual and one-off events, and does not apply to regular and/or routine high-noise level events.

Table 6.5 Adjustment for duration

Allowable duration of noise (one event in any 24-hour period)	Allowable exceedance of $L_{Aeq,15\text{-}min}$ equivalent project noise trigger level at receptor for the period of the noise event, dBA	
	Daytime and evening (7:00 am – 10:00 pm)	Night-time (10:00 pm – 7:00 am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

Note: Where the duration of the noise event is smaller than the duration of the project noise trigger level (that is, less than 15 minutes) the allowable adjusted project noise trigger level becomes:

$$10Log_{10}\left(10^{\frac{PNTL}{10}} x \left(\frac{900 - duration}{900}\right) + \left(10^{\frac{PNTL+allowable\ exceedance\ (Table\ C3)}{10}} x\ duration\right)\right)$$

Maximum correction: the maximum correction to be applied to the predicted or the measured level where two or more modifying factors are present. The maximum adjustment is 10 dBA where the noise contains two or more modifying factors (excluding the duration correction).

6.4 Vibration targets

The following documents were used to establish the criteria to be used in this assessment:

- Australian and New Zealand Environment Council (ANZEC 1990) *Technical Basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*
- Australian Standard AS2187.2 (2006) *Explosives – Storage and use Part 2: Use of explosives*

– British Standards Institution 1993, BS7385.2 *Guide to damage levels from groundborne vibration*

6.4.1 Airblast overpressure

6.4.1.1 Human comfort criteria

Airblast overpressure impacts for human comfort criteria has been assessed in accordance with Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZEC 1990) which specifies recommended human comfort criteria for blasting activities.

The recommended maximum level for airblast overpressure is 115 dB(L) peak. This level may be exceeded on up to 5 per cent of the total number of blasts over a period of 12 months. However, the airblast overpressure must not exceed 120 dB(L) peak for any blast.

6.4.1.2 Structure damage

AS2187.2 (2006) recommends a limit of 133 dBL airblast overpressure on structures as research showed no damage (even cosmetic) occurs at airblast levels below this level. This assessment uses the aforementioned limit as the assessment criteria for structures.

6.4.2 Ground vibration

6.4.2.1 Human comfort criteria

Ground vibration impacts for human comfort criteria has been assessed in accordance with *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC 1990) which specifies recommended human comfort criteria for blasting activities.

Ground-borne vibration levels should not exceed a peak particle velocity of 5 mm/s. The recommended peak particle velocity of level may be exceeded on up to 5 per cent of the total number of blasts over a period of 12 months. However, the level should not exceed 10 mm/s.

6.4.2.2 Structure damage

AS2187.2 (2006) recommends adopting BS7385.2 values for the prevention of minor or cosmetic damage occurring in structures from ground vibration. It lists the vibration limit for residential type buildings as 15 mm/s at 4 Hz (ppv). This assessment uses the aforementioned limit as the assessment criteria for structures.

6.4.3 Criteria summary

Table 6.6 Blasting criteria

Criteria description	Criteria values
Airblast overpressure – Human comfort criteria	115 dB(L)$_{peak}$
Airblast overpressure – Structure damage (residential)	133 dB(L)$_{peak}$
Ground vibration – Human comfort criteria	5 mm/s
Ground vibration – Structure damage (residential)	15 mm/s

7. Operational noise impact assessment

7.1 Operational noise modelling

7.1.1 Modelling methodology

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within Datakustik's CadnaA modelling software (Version 2021), to predict noise emissions from the operation of the project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data (refer to Table 7.1), ground cover (assumed to be a combination of soft and hard 0.5??) and atmospheric information (refer to Section 7.1.5) to predict noise levels at the nearest sensitive receptors (assumed 1.5 m above ground level).

7.1.2 Acoustically significant sources

Sound power levels for acoustically significant items of plant and equipment operating during site operations have been obtained from manufacture data where possible. Where this was not possible data was obtained from a GHD noise source database of similar equipment. The L_{Aeq} sound power levels of relevant plant and equipment utilised for the purpose of predicting noise emission levels are provided in Table 7.1.

Table 7.1 Equipment sound power levels

Noise source	Octave centre frequency (Hz) dBA								Lw dBA	Source of data
	63	125	250	500	1k	2k	4k	8k		
Caterpillar D8 dozer	91	102	100	98	102	99	97	91	108	A
35 t excavator	75	93	94	101	101	99	94	87	106	A
Komatsu WA480 FE loader	76	90	101	101	104	99	93	85	108	B
McClosky Jaw J50	89	100	101	104	108	105	101	94	112	B
Secondary/tertiary cone/impact crushers	84	95	103	113	115	113	106	97	119	B
Screen FT6203 / pre-coat plant	79	91	105	106	105	102	98	91	111	B
Grader	108	107	103	99	104	98	94	85	112	A
Water cart	84	91	90	92	94	93	88	83	100	B
Haul trucks	92	99	96	104	103	102	96	90	109	A
Truck and dog	94	94	95	103	105	105	103	95	111	A
Light vehicles	69	74	75	78	80	80	73	70	86	B

Notes:

A. BS 5228.1-2009.

B. GHD database of similar plant.

7.1.2.1 Modifying factor corrections

Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency or dominant low-frequency content, it can cause greater levels of annoyance than other noise sources at the same noise level. The NPI provides correction factors which are to be applied to the predicted noise levels for when such sources exist.

A review of site noise sources has been undertaken. No on-site noise sources were found to contain low frequency or tonal characteristics. Intermittency characteristics need only be assessed where the noise source occurs during the night period. Since the project does not operate during the night-time period, intermittency was not assessed.

Since noise sources have been selected from either BS 5228 or the GHD database, it is recommended to review the noise spectrum of the actual equipment to be operating on site to ensure they contain no tonal or low frequency characteristics, and are in good working condition prior to commencement of Stage 1.

7.1.3 Traffic generation

The traffic generation associated with the project is summarised in Table 7.2.

Table 7.2 Traffic generation per day and in each peak hour for the project

Vehicle type	Vehicles per day (vehicle trips)	Daytime peak hour movements
Light vehicles	5 (10)	5 (5 in, 5 out)
Heavy vehicles	70 (140)	7 (7 in, 7 out)
Total	75 (150)	12 (12 in, 12 out)

7.1.4 Operational noise modelling scenarios

As the quarry progresses throughout its lifetime, the shape of the working area would change. For example, the pit walls would become larger, the equipment would eventually be situated well below ground level, and the location of the working area would move throughout various stages. The quarry is expected to operate over four stages, depicted in Figure 7.1.

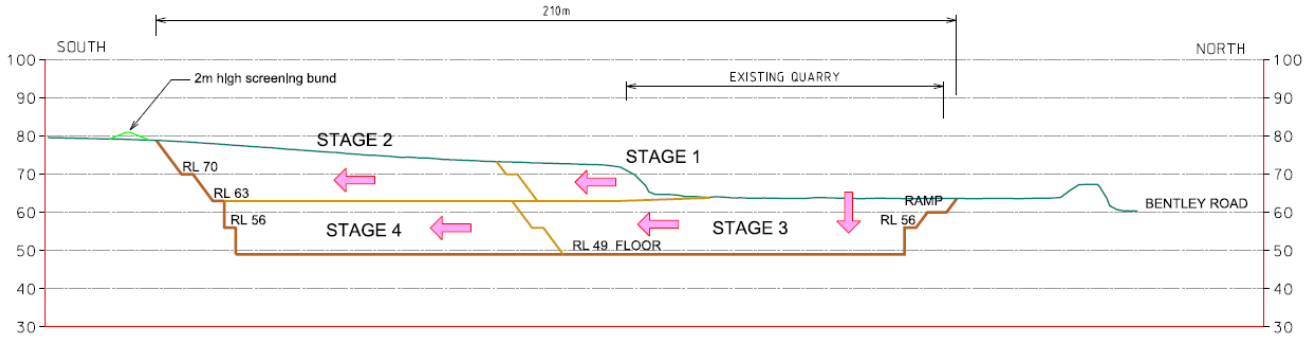


Figure 7.1 Proposed quarry stages section

Stages 1 and 2 have been modelled as it is anticipated these stages would produce the highest noise impact due to the landform being more elevated. The proposed working areas of Stages 1 and 2 are depicted in Figure 7.2.

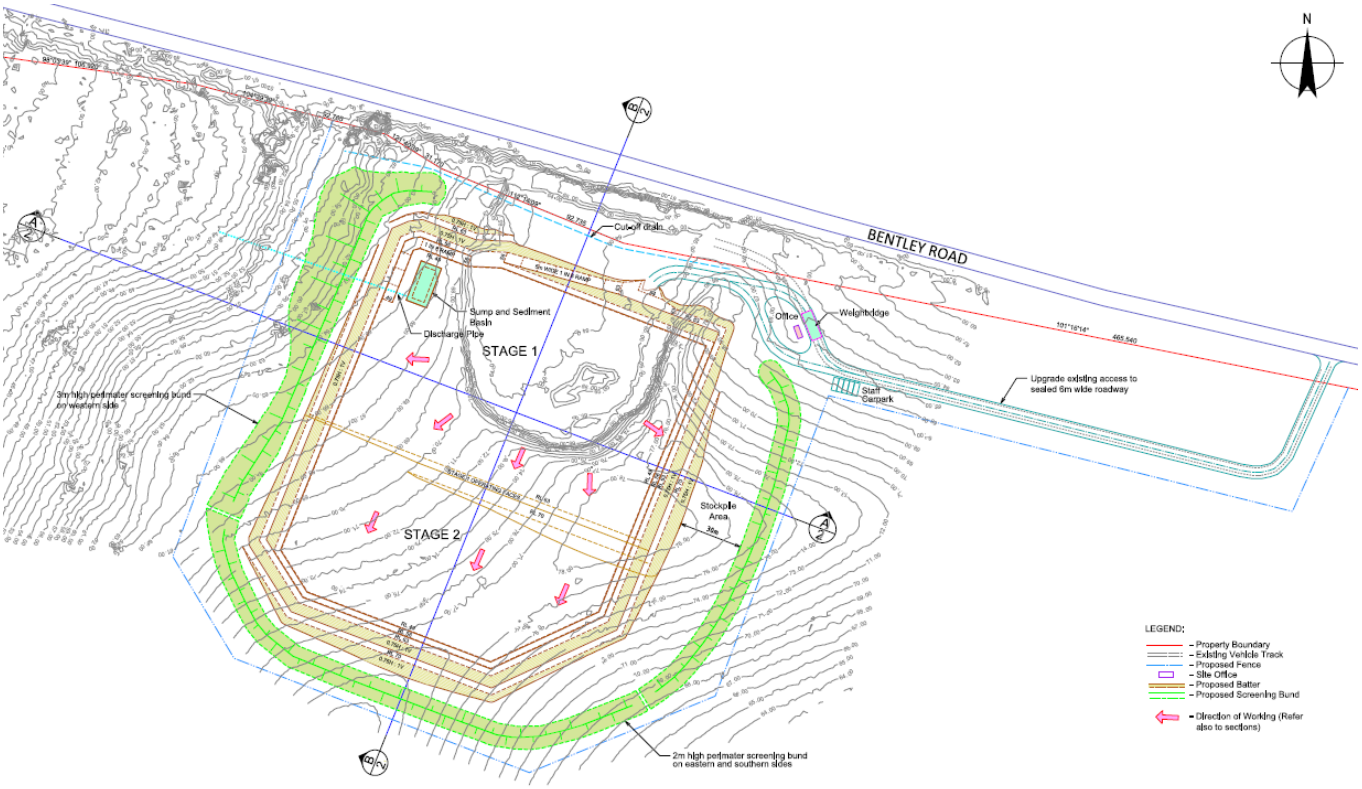


Figure 7.2 ***Proposed Stages 1 and 2 working areas***

An operational scenario (Scenario A) has been modelled and assessed for each stage for proposed operations at initial face of stage.

For this scenario, the noise impact of the quarry on surrounding receptors has been assessed at Maximum daily production, which is expected to generate about 70 truck and dog loads (140 movements) per day (worst case seven loads per hour).

The operational scenario modelled is summarised in Table 7.3. A tick (✓) indicates that the equipment is in operation during the scenario. A cross (×) indicates that the equipment is not in operation during the relevant scenario. It should be noted that the operational scenario modelled is likely to represent an acoustically worst case scenario as it is assumed all equipment is operational at once.

Table 7.3 ***Operational scenario considered in noise model***

Plant and equipment	Scenario A
Stage 1 and Stage 2	
Caterpillar D8 dozer	×
35T excavator x2	✓
Grader	×
Komatsu WA480 FE loader	✓
McClosky Jaw J50	✓
Secondary/tertiary cone/impact crushers	✓
Screen FT6203	✓
Pre-coat plant	✓
Haul trucks x7	✓
Light vehicles x5	✓

Plant and equipment	Scenario A
Stage 1 and Stage 2	
Truck and dog (on quarry property)	✓
Truck and dog (on local roads)	✓

The following assumptions were made regarding the model configuration:

– All acoustically significant plant and equipment operates simultaneously. This is considered a conservative worst case as this is unlikely to occur.
– Mobile noise sources, such delivery vehicles, were modelled at typical locations and assumed to operate in repetitive cycles.
– The scenarios were modelled for daytime only, as the quarry hours of operation are anticipated to be between 7:00 am and 6:00 pm only (during weekdays).

7.1.5 Atmospheric conditions

Prediction of noise emission levels was carried out under worst case prevailing atmospheric conditions, as per review of meteorological data presented in Section 5. Atmospheric parameters under which noise predictions were made are given in Table 7.4.

Table 7.4 Weather parameters used for noise modelling

Atmospheric condition	Air temperature	Relative humidity	Wind velocity and direction	Atmospheric stability class
Day – prevailing winds	20^0C	75%	3 m/s direct source to receptor	D

7.2 Operational noise model results

Noise levels were predicted for future operation based on the operating conditions outlined throughout section 7. The predicted noise levels for daytime site operations are shown in Table 7.5.

Model results indicate that noise levels generated from worst case quarry operations for Stage 1 are predicted to exceed criteria at R1 and R2 by 2.3 and 2.6 dB respectively. These exceedances are considered low risk as R1 is the quarry owner and R2 is the abandoned homestead which is uninhabited. Additionally, the NPI considers an exceedance of 2 dB to be negligible and does not warrant receptor-based treatments or controls.

Model results indicate that noise levels generated from worst case quarry operations for Stage 2 are predicted to exceed criteria at R1 and R2 by 0.6 and 0.4 dB respectively. These exceedances are considered marginal and also low risk based on the ownership as discussed above.

Contact has been made with the owners at R2 to explain predicted exceedances during Stages 1 and 2. Correspondence relating to this can be found in Appendix A.

Noise levels are predicted to comply with the NPI daytime noise criteria at all other residential and non-residential receptors.

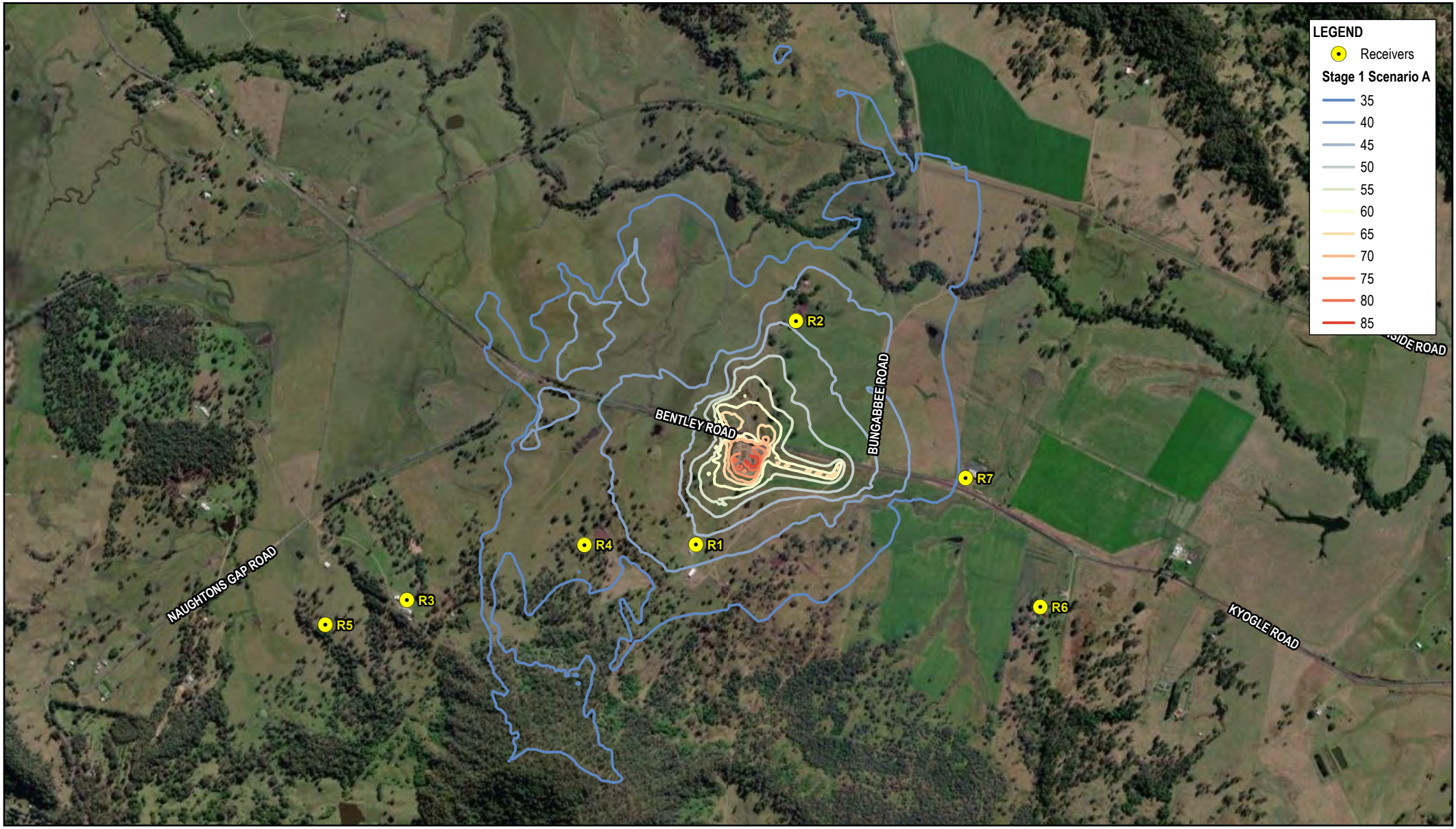
It should be noted that this assessment is considered conservative as it is based on all quarry equipment operating simultaneously, as well as all three crushing plants operating simultaneously, which is unlikely (typically only two are operational at any one time) and if it does occur, it would be infrequent. This conservative approach is likely to result in predicted operational noise levels being higher than actual noise levels. For example, if only two crushers are used the predicted noise levels would decrease by up to 2 dB at the closest receptors.

An assessment of noise mitigation measures has been provided in Section 8. It should be noted that the noise modelling is based on worst case operating conditions with conservative assumptions regarding site operations and equipment sound power levels.

Figure 7.3 and Figure 7.4 shows the predicted operational noise contour plots for Stages 1 and 2.

Table 7.5 Predicted operational noise levels

Sensitive receptor	Noise criterion L_{Aeq} dBA Daytime	Predicted noise level L_{Aeq} dBA	
		Stage 1	Stage 2
		Scenario A	Scenario A
R1	40	42.3	40.6
R2	40	42.6	40.4
R3	40	29.7	26.9
R4	40	37.0	33.7
R5	40	22.9	21.4
R6	40	26.7	26.5
R7	65	34.4	34.4



Paper Size ISO A4

0 160 320 480 640

Metres

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

N

GHD

R&S Contracting Pty Ltd
Bentley Quarry
Noise Impact Assessment

Predicted operational noise levels Stage 1 Scenario A

Project No. **12547851**
Revision No. **0**
Date **29/10/2021**

Figure 7-3

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Print date: 29 Oct 2021 - 09:32

Data source: LPI: DTDB, 2017. World Imagery: Maxar.
Created by: tmorton

Paper Size ISO A4

0 90 180 270 360

Metres

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

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GHD

R&S Contracting Pty Ltd
Bentley Quarry
Noise Impact Assessment

Predicted operational noise levels Stage 2 Scenario A

Project No. **12547851**
Revision No. **0**
Date **29/10/2021**

Figure 7-4

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Print date: 29 Oct 2021 - 09:33

Data source: LPI: DTDB, 2017. World Imagery: Maxar.
Created by: tmorton

7.3 Road traffic noise

Continuous traffic flow related noise is typically calculated using the United Kingdom Calculation of Road Traffic Noise (CoRTN) algorithm, however due to the non-continuous nature of the heavy vehicle movements to and from the site, the United States EPA's Intermittent Traffic Noise guidelines has been utilised to determine potential impacts. The following equation outlines the mathematical formula used in calculating the $L_{eq,T}$ noise level for intermittent traffic noise.

$$L_{eq},T = L_b + 10\log\left[1+\frac{ND}{T}\left(\frac{10^{(L_{max}-Lb)/10}-1}{2.3}-\frac{(L_{max}-L_b)}{10}\right)\right]$$

Where:

L_b is background noise level, dBA

L_{max} is vehicle maximum noise level, dBA

T is the time for each group of vehicles (min)

N is number of vehicle trips

D is duration of noise of each vehicle (min)

The parameters above were determined as follows:

– Background noise levels are based on the RBLs shown in Table 4.2
– The heavy vehicle maximum noise level of 109 dBA
– The duration of each vehicle passby was 30 seconds
– The time for each group of vehicles was 60 minutes
– Although it is anticipated that:
  - 60 percent of heavy vehicles would be arriving or departing the quarry from the east along Bentley Road
  - 10 percent would be arriving or departing the quarry from the west along Bentley Road
  - 30 percent would be arriving or departing the quarry from the west along Bentley Road then Naughtons Gap Road

  the calculations assume all vehicles would pass by each receptor as a worst case scenario.

Table 7.6 summarises the predicted road traffic noise levels at residential receptors from haul trucks travelling along the local roads when the quarry is operating at peak daily production and compares this against the RNP criteria.

Table 7.6 Predicted road traffic noise level during peak daily production at residential receptors

Sensitive receptor	Generated heavy vehicle movements per hour (peak daily production)	RNP criteria, day	Distance from road (m)	Predicted road noise level $L_{Aeq(1\ hour)}$ dBA[1]
R1	7	$L_{Aeq(1\ hour)}$ 55 (external)	450	35
R2			480	34
R3			480	34
R4			570	32
R5			360	36
R6			310	38
R8[2]			80	50

Notes:

1. Predicted results include a 2.5 dBA façade correction.

2. Although not included in the operational noise assessment as a receptor due to distance, an additional receptor (R8) has been included in the traffic noise assessment due to the close proximity to Bentley Road. Location of R8 is approximately 1.6 km east of the Quarry and 80 m from Bentley Road..

Table 7.6 shows that using this algorithm, road traffic noise from haul trucks travelling along local roads is expected to comply with the RNP criteria.

7.4 Vibration from blasting

Overlying weathered material would be removed using dozers and excavators to a depth of about 5 m, however underlying fresh rock would require blasting. It is anticipated that up to one blast per month would be undertaken during peak periods of demand but on average 3-4 blasts would be required per year.

Blasting would be strictly controlled and conducted by a suitably qualified blasting contractor who would bring explosives onto site as required and fill a series of holes that would be pre-drilled by a separate drilling contractor.

A general assessment of blasting has been undertaken to determine the maximum instantaneous charge (MIC) allowed to ensure compliance with the blasting criteria at the closest receptor. Estimations for typical ground vibration and air blast overpressure during blasting have been made with consideration to Australian Standard AS2187.2 (2006) *Explosives – Storage and use – Use of Explosives.*

Blasting is non-linear in nature and variability in ground type and meteorological conditions makes it difficult to accurately predict ground vibration and airblast overpressure without site specific measurement data therefore these blasting predictions should only be used as a guide. The values calculated in the assessment are based on no adverse meteorological conditions (i.e. calm wind conditions and no temperature inversions).

7.4.1 Estimation of air blast overpressure during blasting

Air blast overpressure can be estimated using the following equation:

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^a$$

Where:

P is the pressure (kPa)

R is the distance from charge (m)

Q is the maximum instantaneous charge (kg)

Ka is the site constant

a is the site exponent

For confined blast hole charges, AS2187-2 (2006) states that the site constant value is commonly in the range of 10 to 100. Due to the absence of data and blast design, a value of 50 has been adopted for this assessment.

For confined blast hole charges, AS2187-2 (2006) uses a good estimate of the site exponent value of -1.45. Due to the absence of data and blast design, this value has been used for the assessment.

Air blast overpressure propagation can be increased with unfavourable meteorological conditions and decreased with topographic shielding. Unconfined surface charges would considerably increase the air blast overpressure propagation.

7.4.2 Estimation of ground vibration during blasting

Ground vibration has been estimated using the following equation:

$$V = K_g \left(\frac{R}{Q^{1/2}} \right)^{-B}$$

Where:

V is the peak vector sum ground vibration peak particle velocity (mm/s)

R is the distance from charge (m)

Q is the maximum instantaneous charge (kg)

Kg is the site constant

B is the site exponent

For blasting carried out to a free face in average field conditions, AS2187-2 (2006) uses a site constant of 1140 and site exponent of 1.6. Due to the absence of data and blast design, these values have been used for the assessment. This resultant value can vary from 0.4 – 4 times depending on ground conditions and other factors.

7.4.3 Predicted blasting impact zones

Airblast overpressure and ground vibration has been predicted for a range of maximum instantaneous charge masses and are shown in Figure 7.5 and Figure 7.6 for varying distances and assumed site parameters. The distance to comply with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC, 1990) and AS2187.2 building damage criteria are also shown.

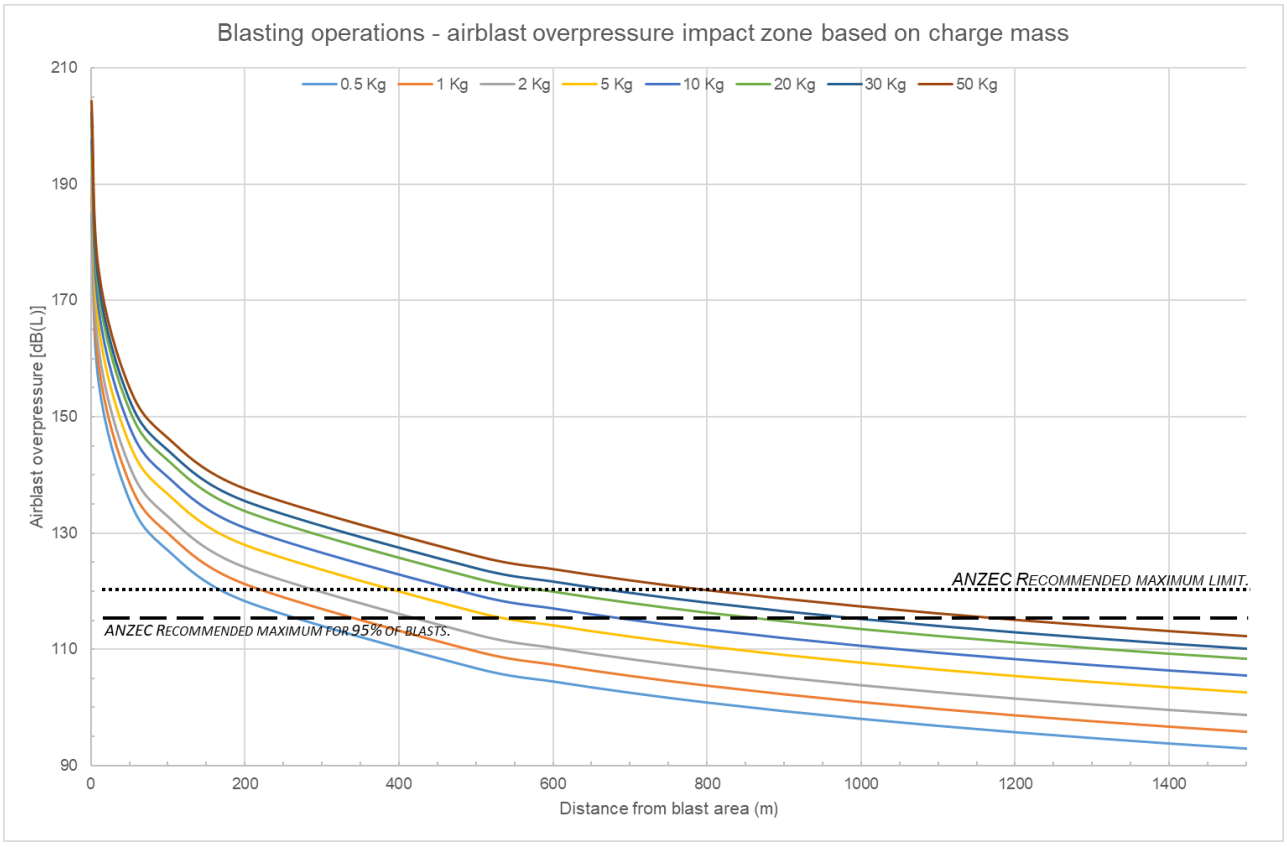

Figure 7.5 Airblast overpressure impact zone based on charge mass

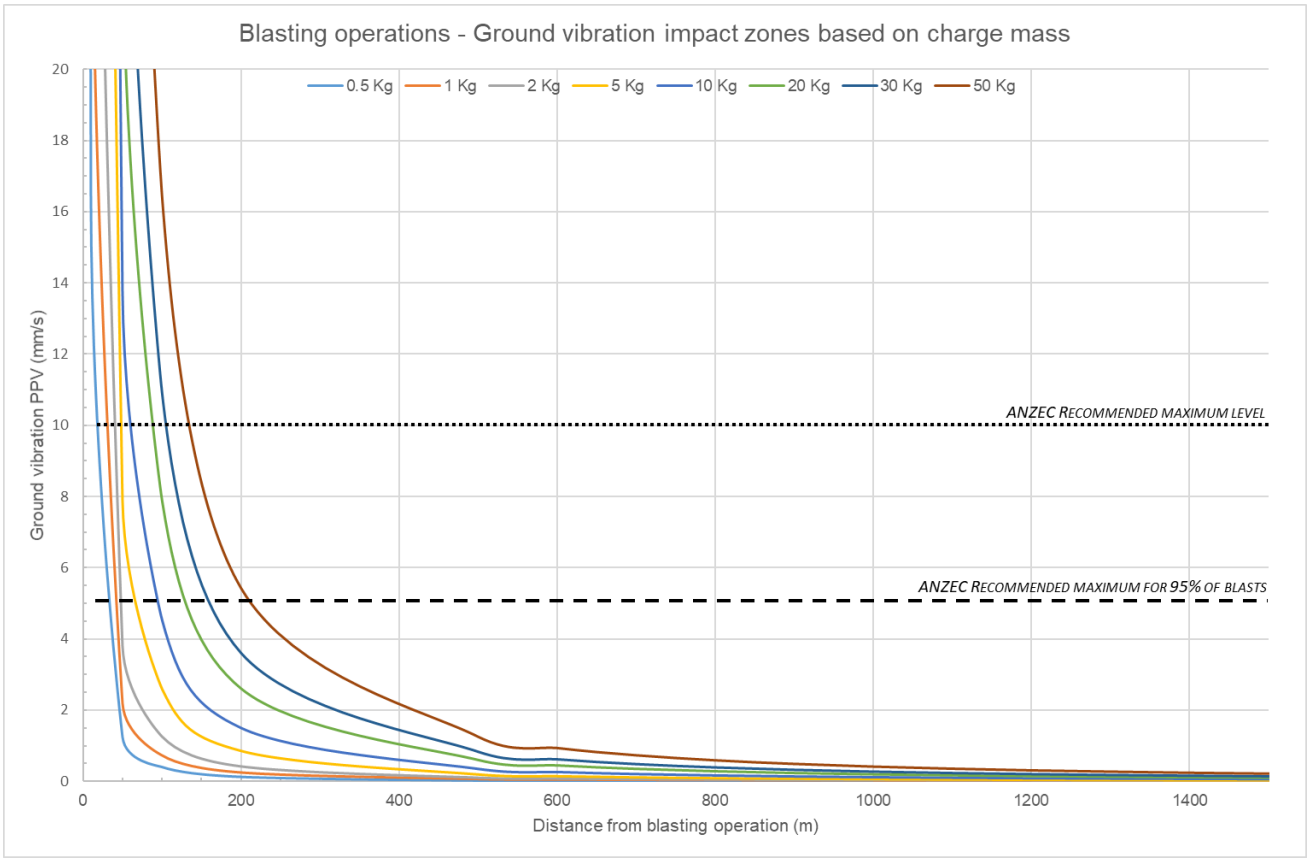

Figure 7.6 ***Ground vibration impact zone based on charge mass***

7.4.4 Assessment of blasting

It is noted that the current proposed blasting location is in a rural environment, with the nearest sensitive receptor approximately 360 m away (R1).

The predicted results shown in Figure 7.5 and Figure 7.6 indicate that blasting would be restricted by the air blast overpressure rather than the ground vibration levels.

7.4.4.1 Human comfort

Based on the calculated results, a maximum instantaneous charge of no more than 1.5 kg can be used in order to remain within the recommended 115 dB(L) criteria at the nearest identified sensitive receptor (R1).

If the closest occupied dwelling not associated with the quarry were used (R6 approximately 1.2 km away), a maximum instantaneous charge of no more than 50 kg can be used in order to remain with the recommended 115 dB(L) criteria.

Based on the calculated results, a maximum charge mass of no more than 145 kg can be used in order to remain within the recommended 5 mm/s PPV human comfort criteria at all sensitive receptors.

7.4.4.2 Structural damage

Since the human comfort criteria is the limiting criteria in terms of ground vibration, a residential building damage assessment will not be done.

Bentley Road is approximately 60 m from the current stage 1 starting point. If blasting is required during stage 1, although damage is not likely, it is recommended not to exceed the 15 mm/s maximum PPV building damage criteria at the road, which equates to approximately 22 kg MIC. When blasting in close proximity to the road (within 500 m) it is recommended to temporarily close Bentley Road to traffic while blasting is occurring.

7.4.4.3 Assessment limitations

Information regarding the site specific variables were not available for the blast overpressure and vibration calculations. Values used in calculations were assumed based on AS2187.2 (2006) recommendations. The calculations do not take into consideration meteorological conditions and assumes calm wind conditions.

It is recognised that the design of the blasting would be up to the blast contractor. The above results are based on assumed values in the absence of specific information regarding blasting at the proposed site.

8. Noise mitigation and management recommendations

Noise predictions have been based on several conservative assumptions and model configurations, such as peak production rate and haul truck movements, worst case source to receptor winds, and equipment operating simultaneously. For these reasons, it is likely that actual site noise on a day-to-day basis would be lower than the predicted values.

The following discussion around potential noise mitigation measures is provided to assist in achieving the adopted noise goals.

8.1 Work ethics

All site workers would be sensitised to the potential for noise impacts on local residents and encouraged to take practical and reasonable measures to minimise the impact during the course of their activities. This would include:

– Where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods.
– Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours.
– Avoid dropping materials from height and avoid metal to metal contact on material.
– All engine covers would be kept closed while equipment is operating.

8.2 Community relations

Consultation and cooperation with the neighbours to the site would assist in minimising uncertainty, misconceptions, and adverse reactions to noise. It is recommended that the quarry manager erects signage at the entrance of the quarry with a phone number and permanent site contact so that noise complaints can be received and addressed in a timely manner.

8.3 General noise mitigation options for industrial sources

Additional mitigation options that should be considered if required for noise control are:

– Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise. Bentley Quarry has already incorporated a screening bund around the west, southern and eastern sides of the proposed quarry pit to improve visual amenity and reduce noise impacts.
– Ensuring all equipment is not operating simultaneously, i.e. using only two pieces of crushing plant simultaneously instead of three would lower the predicted noise impacts at the closest receptors by up to 2 dB.
– Keeping equipment well maintained.
– Restricting truck speed on the site to reduce noise from the transport operation.
– Employing “quiet” practices when operating equipment (e.g. positioning and unloading of trucks in appropriate areas).
– Running staff-education programmes on the effects of noise and the use of quiet work practices.
– Using a non-acoustic warning method to warn if a vehicle is reversing or if this method does not prove satisfactory for safety reasons, adjusting the reversing alarm volume on heavy equipment to make them “smarter”, by limiting acoustic range to immediate danger area.
– Using pieces of equipment with efficient muffler design.

– Using vehicles with quieter engines.
– Active noise control.

8.4 Compliance noise monitoring program

To validate the predicted noise levels in this report, noise monitoring should be undertaken within three months of commencement of Stage 1 operation at a minimum of three representative locations during the day period. Truck passby monitoring should also be undertaken to ensure road traffic noise levels associated with Bentley Quarry are within the identified RNP road noise criteria.

Should the results of monitoring identify exceedances of the predicted noise levels, additional reasonable and feasible mitigation measures would be implemented in consultation with the client and affected property owners.

All acoustic instrumentation shall meet the requirements of AS IEC 61672 2004 *Electroacoustics - Sound Level Meters* (Parts 1, 2 & 3) and carry current National Association of Testing Authorities (NATA) and manufacturer calibration certificates. Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dB(A).

8.4.1 Reporting

A noise compliance assessment report shall be prepared, including all details of the noise monitoring. As a minimum, the compliance noise report should include the following items:

– Scope of work.
– Details of instrumentation and methodology.
– Noise criteria.
– Details of monitoring locations.
– Time, date, duration of measurements.
– Meteorological conditions during monitoring.
– A description of the quarry operations during monitoring.
– L_{Amax}, L_{A1}, L_{A10}, L_{A90}, L_{Aeq} levels over the measurement period, including noise levels (SPL) of events attributed to Interchange operations as well as other noise sources.
– High level assessment of noise environment including dominant noise sources. Noise contribution from quarry operations should be estimated.
– Statement of compliance/non-compliance.
– Recommendations for additional mitigation measures if required.

8.5 General blast mitigation options

– The closest residential sensitive receptors to Bentley Quarry (R1 and R6) will be notified 2 days prior to any blasting being undertaken at the site.
– A maximum instantaneous charge of no more than 1.5 kg can be used in order to remain within the recommended 115 dB(L) human comfort overpressure criteria at the nearest identified sensitive receptor (R1).
– A maximum instantaneous charge of no more than 50 kg can be used in order to remain within the recommended 115 dB(L) human comfort overpressure criteria at the nearest identified sensitive receptor not associated with the Quarry (R6).
– Based on the calculated results, a maximum charge mass of no more than 145 kg can be used in order to remain within the recommended 5 mm/s PPV human comfort ground vibration criteria at all sensitive receptors.
– If blasting during stage 1 operations, it is recommended not to exceed the 15 mm/s maximum PPV structural damage criteria at Bentley Road, which equates to approximately 22 kg MIC. When blasting in close proximity to the road (within 500 m) it is recommended to temporarily close Bentley Road to traffic while blasting is occurring.

8.6 Blast monitoring

Initial blast monitoring should be conducted where one or more sensitive sites may be exposed to airblast and or ground vibration (i.e. R1 and R6) to ensure that the blasting program is able to comply with the prescribed criteria. This will enable changes to be made to the blasting methods if it is found that the levels do not comply with the criteria. This monitoring should be done over enough blasts to show consistent results, usually a minimum of five. These tests should be done at the most affected sensitive sites in two or more directions. The closest residential sensitive receptors to Bentley Quarry are R1 and R6.

Regular ongoing monitoring should be continued at the closest sensitive receptors to confirm overpressure and ground vibration targets are met. This should be outlined in an appropriate Blast Management Plan. Where the initial monitoring shows that vibration targets are easily met at the closest receptors, ongoing monitoring may not be required, however any changes to blasting methods or MIC amounts would warrant a restart of the monitoring program.

9. Conclusion

An assessment of the potential noise impacts from future operations at Bentley Quarry has been undertaken. This assessment has led to the following conclusions, which are subject to the limitations outlined in Section 1:

– The proposed quarry is in a rural environment. Measured RBL levels at all locations were all minimum assessable background levels as per the NPI.

– An operational daytime noise criterion of 40 dBA $L_{eq(15\ min)}$ was adopted for residential receptors and 65 dBA for commercial receptors.

– The noise assessment indicates that the noise levels due to operation of the quarry are expected to exceed criteria at R1 and R2 by up to 2.6 dB during stage 1 worst case operating conditions, and marginally exceed criteria by up to 0.6 dB during stage 2 worst case operating conditions. R1 and R2 can be considered low risk receptors as R1 is the quarry owner and R2 is an abandoned uninhabited homestead.

– The noise impacts are predicted to comply at all other sensitive receptors in the area when operating under worst case conditions.

– The operational noise assessment has been undertaken based on a worst case operating scenario, with all equipment operating at maximum sound power levels and simultaneously. For these reasons, it is likely that actual site noise on a day-to-day basis would be lower than the predicted values.

– Further recommendations have been provided in Section 8 to assist in minimising potential noise impacts.

– The predicted growth in quarry traffic along local roads due to peak production operations was investigated using the United States EPA's Intermittent Traffic Noise guidelines. This model indicated road noise along the local roads would comply with the RNP criteria at all assessed sensitive receptors.

– A blasting assessment has been undertaken and shows that:

  - A maximum instantaneous charge of no more than 1.5 kg can be used in order to remain within the recommended 115 dB(L) criteria at the nearest identified sensitive receptor (R1).
  - A maximum instantaneous charge of no more than 50 kg can be used in order to remain within the recommended 115 dB(L) criteria at the nearest identified sensitive receptor not associated with the quarry (R6).
  - Based on the calculated results, a maximum charge mass of no more than 145 kg can be used in order to remain within the recommended 5 mm/s PPV human comfort criteria at all sensitive receptors.
  - If blasting during stage 1 operations, it is recommended not to exceed the 15 mm/s maximum PPV building damage criteria at Bentley Road, which equates to approximately 22 kg MIC. When blasting in close proximity to the road (within 500 m) it is recommended to temporarily close Bentley Road to traffic while blasting is occurring.

10. References

Australian and New Zealand Environment Council (ANZEC 1990) *Technical Basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.*

Australian Standard AS2187.2 (2006) *Explosives – Storage and use Part 2: Use of explosives.*

British Standards Institution 1993, BS7385.2 *Guide to damage levels from groundborne vibration.*

British Standards Institution, 2014, British Standard 5228.2-2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites*

Committee AV-002, 2004, *Australian Standard Electroacoustics—Sound level meters, Part 1: Specifications, Standards Australia.*

Committee AV/5, 1997, *Australian Standard 1055 Description and Measurement of Environmental Noise.*

Department of Environment, Climate Change and Water NSW (DECCW), 2011, NSW *Road Noise Policy.*

Environment Protection Authority (EPA), 2000, NSW *Industrial Noise Policy.*

Hessler GF, Hessler DM, Brandstatt P and Bay K 2008, *Experimental study to determine wind-induced noise and wind screen attenuation effects on microphone response for environmental wind turbines and other applications*, Noise Control Engineering Journal, vol 56(4), pp. S.300-309.

Appendices

Appendix A

Correspondence relating to R2 exceedances

Ben Luffman

From: Robbie Graham <robbieggraham@activ8.net.au>
Sent: Wednesday, 27 October 2021 11:50 AM
To: Ben Luffman
Cc: rob@bentleyquarry.com.au
Subject: noise modelling at Bentley

Ben Luffman

Dear Ben

Thank you for your report on the noise modelling at our house Lot 1 DP122850 Bentley Road, Bentley.
We understand that the noise modelling for the proposed Bentley Quarry at Lot 2 DP1196757 indicates a 2.6dB exceedance at our house when 3 crushers are operating during Stage 1. While this is based on a worst case senario it is understood it would not occur on a frequent bases and the noise levels would reduce as the quarry progresses to Stage 2 3 and 4. While the house is currently unoccupied, this may not always be the case and with in house living this 2.6 exceedance would be cancelled out, and there for we do not object to the exceedance.

Robert Graham

For Robert Shirley & Peter Graham.
1480 Bentley Road

ghd.com

→ The Power of Commitment

Appendix I

Air Quality Impact Assessment

Bentley Quarry

Air Quality Impact Assessment

R & S Contracting Pty Ltd

29 October 2021

→ **The Power of Commitment**

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Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	R Browell	D. Craggs	*Danny Craggs*	S. Lawer		29/10/2021

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1. Introduction

1.1 Purpose of this report

GHD was engaged by R & S Contracting Pty Ltd (R & S Contracting) to prepare an Air Quality Impact Assessment (AQIA) to address the potential air quality impacts from the proposed quarry expansion at Bentley Quarry, located at Lot 2 DP 1196757.

Bentley Quarry proposes to construct and operate a hard rock quarry to extract up to 300,000 tonnes per annum (tpa) over 30 years, with a total disturbance area of approximately 6.5 hectares (the Project). The project will predominantly supply materials for use as fill and for road construction and maintenance.

1.2 Scope of work

The following scope of work was undertaken as part of the AQIA:

- A review was undertaken of background information, in particular, sensitive receivers, site location, access roads, prevailing meteorology and available background air quality, using DPIE monitoring network
- A dust emission inventory for the proposed quarry expansion has been developed based on key quarry operations and equipment. This was based on a maximum quarry throughput. Emission rates for TSP, PM_{10} and $PM_{2.5}$ was characterised using emission factors published in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Mining V 3.1.
- A screening level dust modelling scenario using site specific meteorology and the atmospheric dispersion model AERMOD was undertaken.
- Recommended in-principle mitigation and management measures to reduce dust impacts and, if warranted, air quality monitoring programmes.

1.3 Limitations

This report: has been prepared by GHD for R & S Contracting Pty Ltd and may only be used and relied on by R & S Contracting Pty Ltd for the purpose agreed between GHD and R & S Contracting Pty Ltd as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than R & S Contracting 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.

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

GHD has prepared this report on the basis of information provided by R & S Contracting Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD 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.

2. Project description

2.1 Site description

The project would be located at the existing hard rock quarry on Bentley Road, Bentley described as Lot 2 DP 1196757 and shown on Figure 2.1. The main access to the site is via Bentley Road.

The project would involve the operation of a hard rock quarry, with an annual maximum extraction rate of 300,000 tonnes per annum and a maximum daily extraction rate of 2,000 tonnes per day. The total area of disturbance would be 6.5 hectares with a pit of 3.65 hectares. A maximum of 50,000 tonnes per annum of soil, topsoil and waste concrete would be imported to the site to be used for initially constructing landscape mounds and rehabilitation as well as ongoing blending with aggregate material to meet relevant technical specifications.

The primary purpose of the project is to supply suitable aggregate resources for use as general fill and for the construction and maintenance of roads in the region.

The site has been used for rock extraction for many years, with obvious signs of benching from past operations. A small quarry operation continues at the site under existing use rights. This limits the operation to 3,000 m^3 per annum (estimated to be 6,000 tonnes based on a conversion of 2 tonnes per m^3) and a disturbance footprint of approximately 1 hectare. No blasting and crushing occurs on-site at present. Due to increasing demand, it is proposed to increase the extraction rate and include blasting and crushing as part of the project.

2.2 Site establishment

The site establishment phase of the quarry would be relatively short (i.e. about 2 months) period. The main activity would be the construction of the access road and the intersection of the access and Bentley Road. Other activities would include:

- Initial and progressive installation of environmental controls including erosion and sediment control measures.
- Vegetation clearance, soil stripping and stockpiling.
- Construction of temporary drainage controls.
- Importation of clean soil for landscape mounds to the east and west of the quarry.
- Construction of a site office and car parking area.

It is proposed to crush and screen material at the site following approval so it is suitable to use during the construction of the access road and intersection.

Paper Size ISO A4

0 25 50 75 100

Metres

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

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GHD

R&S Contracting Pty Ltd
Bentley Quarry
Noise Impact Assessment

Development site

Project No. **12547851**
Revision No. **0**
Date **29/10/2021**

Figure 2-1

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Print date: 29 Oct 2021 - 09:50

Data source: LPI: DTDB, 2017. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Created by: tmorton

2.3 Operation

The quarry operations would be carried out in four stages and in response to demand. To minimise the initial impact of the proposed quarry, Stage 1 would encompass the existing footprint of the quarry and expand it at a depth of RL63 m until the northern half of the proposed quarry is exhausted. Stage 2 continues at RL63 m to the southern extent of the proposed quarry. Stage 3 will involve lowering the northern half of the proposed quarry to its final depth of RL49 m.. Stage 4 would be the final stage which would continue at RL49 m to the southern extent of the proposed quarry. A summary of the stages is outlined in Table 2.1.

Table 2.1 Quarrying stages

Stages	Total extracted volume (m^3)	Throughput (tonnes[1])
1	107,000	214,000
2	148,000	296,000
3	188,000	376,000
4	190,000	380,000
Total	**633,000**	**1,266,000**

Note 1 – Based on a density of 2 tonnes per m^3

2.3.1 Stripping and stockpiling

Topsoil stripping would occur in stages prior to excavation. Generally, areas would be stripped immediately prior to quarrying. Overburden would be used to construct the perimeter bunds and landscaped to provide a visual screen.

2.3.2 Extraction

Overlying weathered material would be removed using bulldozers and excavators to a depth of about 5 m. Underlying fresh rock would require blasting.

Blasting would be strictly controlled and conducted by a suitably qualified blasting contractor who would bring explosives onto site as required and fill a series of holes that would be pre-drilled by a separate drilling contractor.

Bulk emulsion explosives such as Ammonium Nitrate Fuel Oil (ANFO) would be used. Following blasting, all blasting equipment and any unused explosives would be removed from site. No explosives would be stored on site. Blasting would be undertaken in 20,000-30,000 tonne shots. It is anticipated that up to one blast per month would be undertaken during peak periods of demand but on average 3-4 blasts would be required per year.

2.3.3 Crushing and screening

Contractors would crush and screen the extracted material using mobile plant positioned close to the extraction area. An excavator would feed the excavated rock into a mobile primary crusher. The primary crusher would then pass the crushed material to a secondary mobile crusher for further crushing, at which point the material would be passed through a screening plant to sort the crushed aggregate into different grades depending on market demand. The screening plant would discharge the crushed and screened aggregate into a stockpile area using a radial stacking conveyor.

2.3.4 Blending

Some of the extracted material would be blended with imported waste concrete and possibly clay and sand, depending on the specifications the client requires.

2.3.5 Stockpiling

Material would be stockpiled in designated areas within the pit. Material would be stored in various grades for sale or distribution. Some imported materials may be stockpiled to the east of the pit.

2.3.6 Pre-coat operation

At times, pre-coated materials may be required to be provided. To satisfy this demand, a mobile pre-coat plant would periodically be used. This is a fully self-contained plant that would precoat the aggregates, which would be stockpiled within the quarry until sold.

2.3.7 Hours of operation

The hours of operation would generally be limited to the following times.

Table 2.2 Hours of operation

Period	Start time	Finish time
Monday to Friday	7:00 AM	6:00 PM
Saturday	7:00 AM	2:00 PM
Sunday & Public Holidays	No operations	

Staff may arrive and leave site before and after these times to 'start-up' and 'shut-down' the quarry but excavation, crushing or loading would not occur outside the times specified above. Blasting would only occur on weekdays between the hours of 10 am and 3 pm.

2.4 Quarry equipment

Table 2.3 lists the plant and equipment proposed to be operating on site and will be split up between the construction and operational phases of the project.

Table 2.3 Quarry equipment

Type	Typical make/model	Approximate number	Typical frequency of use	Description
Dozer	Caterpillar D6/D8	1	20%	Clearing and grubbing of vegetation and stripping of topsoil. Construction of bunding. Rehabilitation. To be used mainly during construction.
Excavator	Kobelco 350	2	100%	Excavating material and stockpiling. Clearing and grubbing of vegetation and stripping of topsoil.
Jaw, cone, and impact crusher	McClosky J50	1	80%	Crushing rock and waste concrete.
Front End Loader	Komatsu WA480 FE	1	100%	Loading material into the haul trucks and stockpiling material within the pit floor.
Screen	Fast Trax FT6203	1	70%	Aggregate/gravel production and overburden screening. Mixing imported waste concrete with aggregate.
Grader		1	25%	Road and bund construction and maintenance. To be used mainly during construction.
Haul trucks	Truck and dog contractors	Up to 70 per day	100%	Delivery of materials to customers and carting, unsuitable material to rehabilitation areas, importing soil and importing waste concrete.
Pre-coat plant	Various – similar to screen plant	1	20%	Used to produce pre-coated aggregate as required.
Water cart	Komatsu	1	40%	To water pit floor and stockpiles.

Type	Typical make/model	Approximate number	Typical frequency of use	Description
Water pump	Honda	2	40%	To dewater excavation / basin and to fill water cart from standpipe. To water stockpiles and put moisture in products.
Hand tools	Various	5	5%	General activities maintaining plant.
Light vehicles	4x4 Vehicles	Up to 5	20%	Transporting staff to, from, and around site.

It is anticipated that not all of the equipment listed above would be operational on-site at any one time.

2.5 Traffic generation

2.5.1 Workforce traffic

During operation it is likely that there would be a maximum of 5 workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 10 vehicle trips per day (vtpd). It is assumed the majority of the workforce would arrive between 6:30 am and 7:30 am and depart generally between 3:00 pm and 6:30 pm.

2.5.2 Heavy vehicle traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At maximum daily production (i.e. 2,000 tonnes), the quarry is expected to generate about 70 truck and dog loads or 140 truck movements per day. The truck movements would start at 7 am and continue evenly throughout the day, until 6 pm.

This rate of maximum truck movement is expected to be infrequent and for short durations. The average number of truck movements is expected to be a lot less and there would be times when no trucks would access the site.

The total truck movements, includes any movements associated with importing materials or trucks using the weighbridge but not hauling materials to or from the quarry.

3. Existing environment

3.1 Sensitive receptors

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (EPA, 2016) defines sensitive receptors as locations where people are likely to work or reside and may include a dwelling, school, hospital, office or recreation area.

Nearby sensitive receptors in the vicinity of the site are the following dwellings:

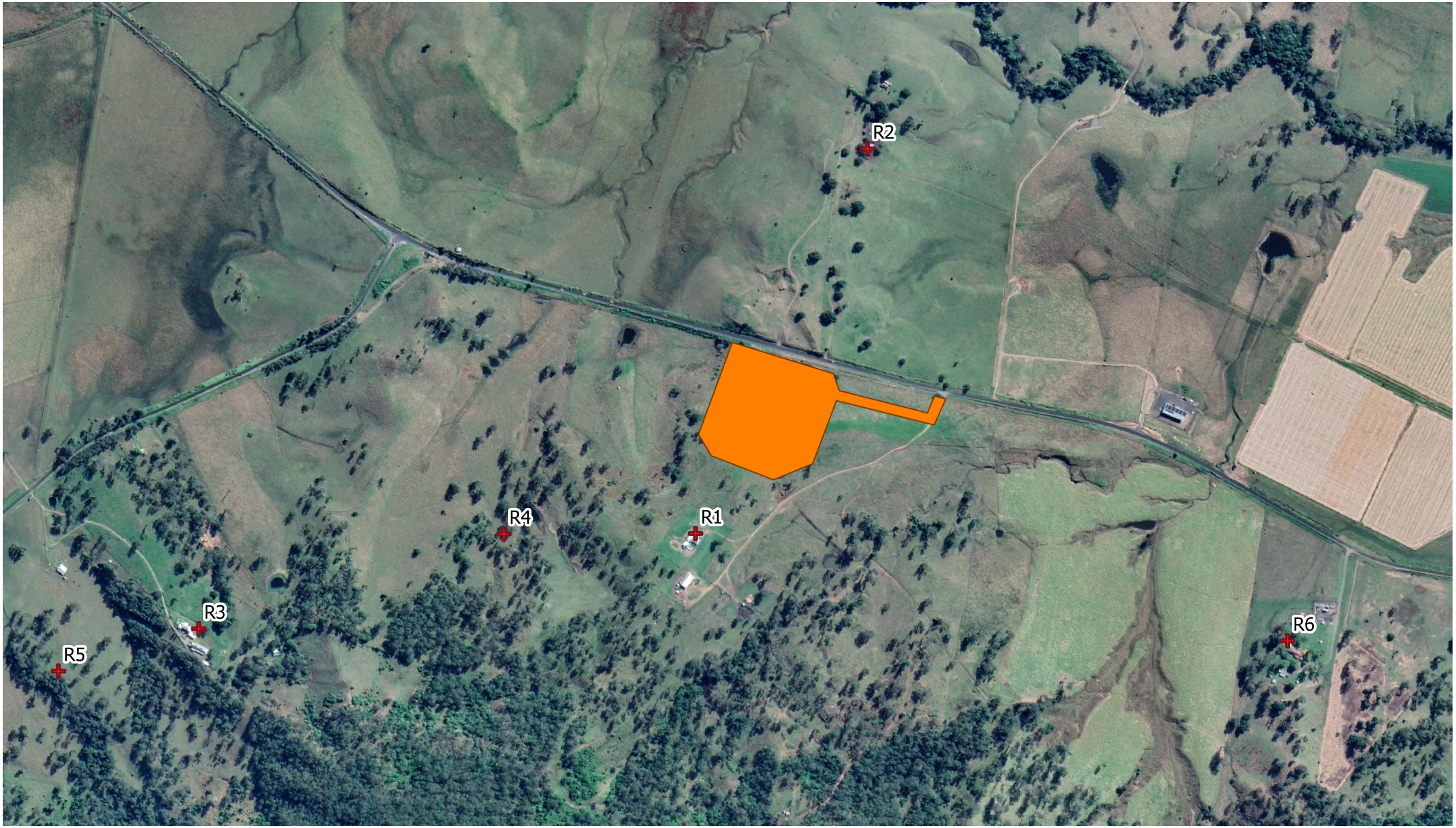
– A dwelling is located approximately 360 m south of the proposed quarry, which is owned and occupied by the applicant (R1).
– The closest dwelling (Disputed Plains Homestead) that is not associated with the proposal is located 650 m north of the proposed quarry. Disputed Plains Homestead has been vacant since the 1990s (NSW State Heritage Inventory, N.D.) (R2).
– An occupied dwelling that is not associated with the proposal is located 1.27 km south-west of the proposed quarry (R3).
– The closest occupied dwelling to the east of the quarry is located 1.2 km to the east (R6).
– There is also a proposed subdivision to the west of the quarry with two proposed houses which have also been included as receivers (R4 and R5).

The table below outlines locations of all receivers identified.

Table 3.1 Sensitive receptors

Receiver name	Receiver type	Easting (m)	Northing (m)
R1	Residential	512811	6815075
R2	Residential	513197	6815939
R3	Residential	511696	6814861
R4	Residential	512381	6815074
R5	Residential	511381	6814766
R6	Residential	514140	6814834

The sensitive receptor locations are displayed in Figure 3.1.



Legend

Sensitive receptors Bentley Quarry

Paper Size ISO A4

0 200 400 m

N

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

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Bentley Quarry
Air Quality Impact Assessment

Sensitive receptors

Project No. **12547851**
Revision No. **-**
Date. **15/10/2021**

FIGURE 3.1

Document Path: \\ghdnet\ghd\AU\Coffs Harbour\Projects\22\12547851\Tech\Air Quality\04_modelling\Bentley.qgz
Print Date: 15/10/2021

Data Source:Google Earth Imagery 2021.
Created By: rbrowell

3.2 Relevant pollutants

Air quality may be impacted by a number of air pollutants, which may come from a range of different emission sources and have varying effects on human health and the environment.

Dust and particular matter were identified as the pollutants most likely to impact nearby sensitive receptors during the construction and operation of the project (further discussion is provided in Section 5). The assessment of dust and particulate matter considered the following pollutants:

– Total suspended particulates (TSP).
– Particulate matter smaller than 10 microns in diameter (PM_{10}).
– Particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$).

3.3 Ambient air quality

The NSW Department of Planning, Industry and Environment (DPIE) operates ambient air quality monitoring stations in selected areas around NSW.

There is no regular ambient air quality monitoring data available for the site location or its immediate surrounds. The nearest AQMS station to the site with sufficient data is the Armidale station, approximately 230 km southwest of the site. Due to the large separation distance the particulate levels monitored at this station cannot be determined to be entirely representative of the project site.

A review of the environment and industry surrounding the project site has been undertaken to develop an understanding of the potential ambient dust levels. The area is a rural farming area with little industrial activity. It is anticipated that the ambient dust levels in the area are moderate to low.

The average PM_{10} concentration in rural areas across the state (2010-2019) was 18 µg/m^3, as reported in the *NSW Annual Compliance Report 2019* (DPIE, 2019).

3.4 Climate and meteorology

The Bureau of Meteorology (BoM) operates Automatic Weather Stations (AWS) at various locations around Australia. The nearest stations to the project site are Casino Airport AWS, approximately 12.5 km south, and Lismore Airport AWS, approximately 13.2 km southeast. Due to the surrounding terrain features, is has been determined that the conditions in Casino are likely to match more closely to the project site conditions. Five years (2016-2020) of meteorological data from Casino Airport AWS has been analysed for this assessment and annual and seasonal wind roses are presented below. Cloud cover data has been supplemented from Lismore Airport AWS in order to calculate the atmospheric stability.

3.4.1 Annual wind patterns

Figure 3.2 shows the 5-year (2016-2020) annual average wind rose at Casino AWS, and the following features can be seen:

– Annual average wind speed of 2.8 m/s.
– Winds are most prevalent from the northwest, south and southeast sectors.
– Winds are least prevalent for the northeast sector.
– Light winds (< 3 m/s) occur predominantly from the northwest.
– The observed wind speed distribution indicates that the largest proportion of high wind speeds (> 5 m/s) are from the southeast.

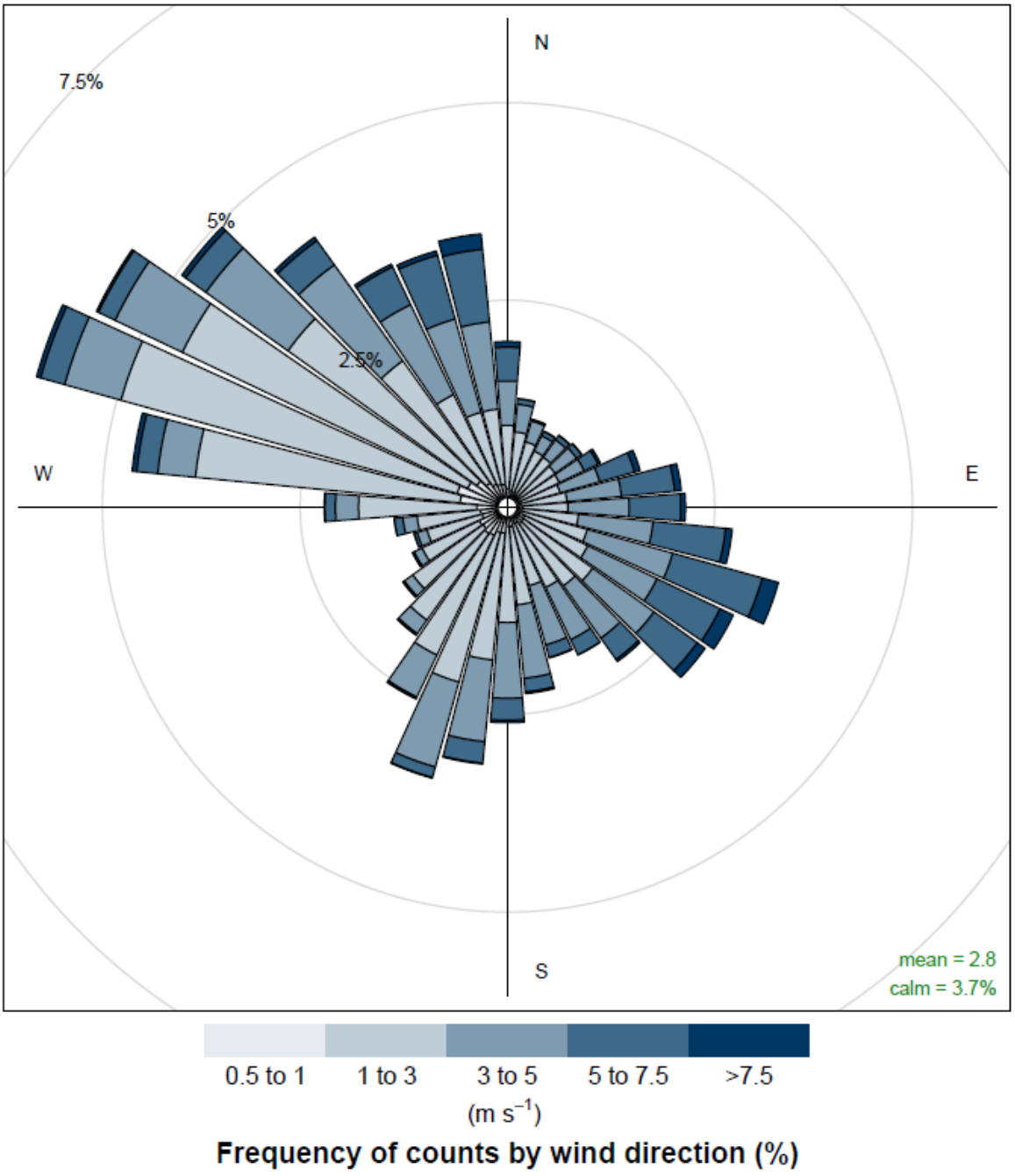


Figure 3.2 *Annual wind rose at Casino AWS (average wind speed = 2.8 m/s)*

3.4.2 Seasonal variation in wind patterns

The five-year seasonal wind roses are presented in Figure 3.3 and show that:

– During summer the predominant wind direction is from the southeast.
– During winter the predominant wind direction is from the northwest.
– Autumn and spring are transitional periods. During these seasons both summer and winter patterns are observed.
– The greatest proportion of light (< 3 m/s) winds occur during winter.
– The greatest proportion of high (> 5 m/s) winds occur during spring and summer.

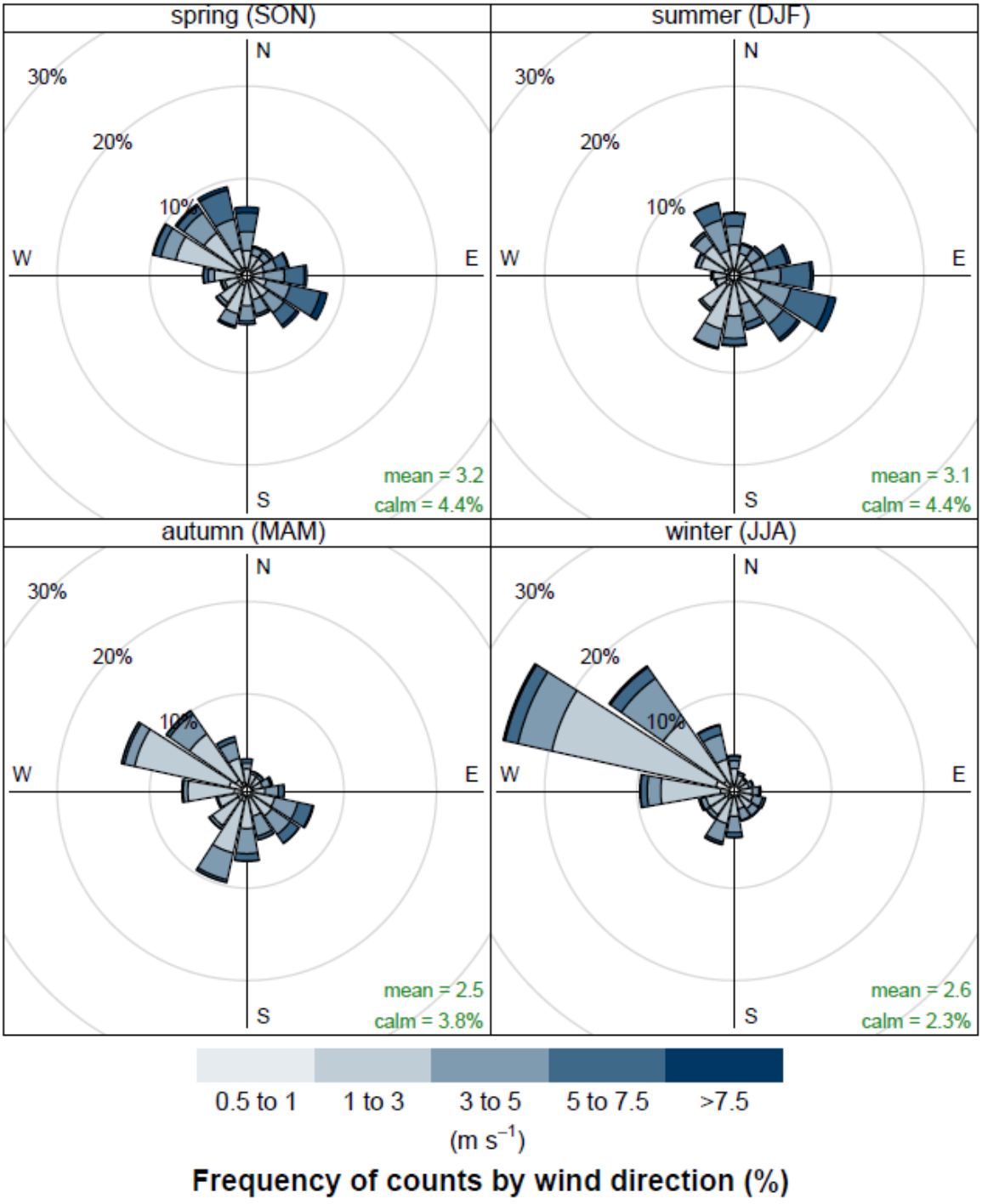


Figure 3.3 Seasonal wind roses at Casino AWS

4. Air quality criteria

4.1 Legislative and policy context to the assessment

The relevant legislation and government guidance for the air quality assessment of the potential impacts of the project are:

– *Protection of the Environment Operations Act 1997* (POEO Act).
– Protection of the Environment Operations (Clean Air) Regulation 2010 (Clean Air Regulation).
– National Environment Protection (Ambient Air Quality) Measure (2015) (Air NEPM).
– Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2016) (Approved Methods).

The POEO Act provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. Companies and property owners are legally bound to control emissions from construction sites under the POEO Act. Activities undertaken onsite must not contribute to environmental degradation, and pollution and air emissions must not exceed the standards.

The Clean Air Regulation provides regulatory measures to control emissions from motor vehicles, fuels, and industry. The project would be operated to ensure it complies with the Clean Air Regulation.

The Air NEPM sets national standards for the six key air pollutants to which most Australians are exposed: Carbon monoxide (CO), Ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead and particulates. Under the Air NEPM, all Australians have the same level of air quality protection.

The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above-mentioned legislation and provides pollutant assessment criteria.

4.2 Assessment criteria

Assessment criteria has been taken from the Approved Methods. These criteria should be met at existing or future off-site sensitive receptors. The assessment criteria are provided as cumulative impacts, where the predicted impact of the project (incremental) is added to the existing levels (background) in order to assess the resulting pollutant impacts (cumulative). To determine the level of air quality impacts, emissions from the project must be assessed against the assessment criteria as shown in Table 4.1.

Table 4.1 Air quality impact assessment criteria

Pollutant	Averaging period	Statistic	Assessment location	Assessment criteria (µg/m^3)
TSP (total suspended particulates)	Annual	Average	Sensitive receptors	90
PM_{10}	24 hour	Maximum	Sensitive receptors	50
	Annual	Average	Sensitive receptors	25
$PM_{2.5}$	24 hour	Maximum	Sensitive receptors	25
	Annual	Average	Sensitive receptors	8

5. Emission estimation

The air quality assessment of the project focused on the highest-risk potential impacts, this section details the anticipated air emissions during the operation of the quarry.

The project would extract up to 300,000 tonnes of material per annum. The actual extraction rate would be dictated by demand requirements; however, extraction would not exceed 300,000 tonnes in any twelve-month period. An average hourly extraction rate of 150 tonnes per hour has been calculated from this maximum yearly throughput.

Dust and particulate matter were identified as the primary emissions to air expected during operation of the project. The processes that may generate significant amounts of particulate matter (dust) were identified to be:

– Stripping of topsoil.
– Extraction by excavation.
– Screening and crushing of material.
– Loading of materials to trucks.
– Internal haulage routes.
– Wind erosion of topsoil and product stockpiles.

Other air emissions such as combustion products (e.g. vehicle exhaust) will also be present within the quarry, however due to the small number of vehicles, the potential for impact from these emissions is negligible. Therefore, vehicle exhaust emissions have not been considered further in this assessment.

A detailed breakdown of all activities and equipment included in this assessment for each area is provided in Table 5.1. The following additional operational assumptions and mitigation measures were included as part of the air quality assessment:

– A worst-case scenario in which all daily extracted material is crushed and screened on site. Water sprays of these activities has been included in the model.
– Haul truck travels approximately 360 m into site via the internal sealed access road at a frequency of 3 trucks (6 movements) per hour for all operating hours. Based on a truck and dog trailer combinations with a capacity of about 32 tonnes.
– Level 2 watering (> 2 litres/m_2/h) present across all internal access roads.
– The use of a water truck has been assumed not to generate dust emissions, as its use will act to suppress emissions. Therefore, the water truck is not included in the emissions inventory.

The emission rates shown in Table 5.1 include the use of the mitigation measures discussed above.

Table 5.1 Particulate emissions inventory

Emission source	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Unit	Control factor - TSP	Control factor - PM10	Source activity	TSP emission rate (g/s)	PM_{10} emission rate (g/s)	$PM_{2.5}$ emission rate (g/s)
Stripping	0.029	0.0073	0.0018	kg/t	0.75	0.53	Scrapers (removing topsoil) [NPI EETM for Mining[1]]	0.030	0.014	0.004
Stockpiling	0.4	0.2	0.05	kg/ha	0.75	0.75	Wind erosion [NPI EETM for Mining]	0.014	0.0069	0.0017
Extraction - excavation	0.025	0.012	0.003	kg/t	0.50	0.05	Excavators/Shovels/Front-end loaders (on overburden) [NPI EETM for Mining]	0.52	0.48	0.119
Crushing	0.0054	0.0024	0.0006	kg/t	0.50	0.50	Tertiary crushing [AP-42 Section 11.19[2]]	0.23	0.10	0.025
Screening	0.013	0.0043	0.0011	kg/t	0.50	0.50	Screening [AP-42 Section 11.19[2]]	0.26	0.09	0.022
Loading trucks	0	0.0005	0.00013	kg/t	0	0	Truck loading: conveyor: crushed stone [AP-42 Section 11.19[2]]	0.000	0.021	0.0052
Haulage route	2.2	0.42	0.11	kg/VKT	0.75	0.75	Wheel generated dust from paved roads [AP-42 Section 13.2[3]]	0.35	0.067	0.017

Note 1 – National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Mining V 3.1
Note 2 – AP-42 Section 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing
Note 3 – AP-42 Section 13.2.1 Paved Roads

6. Operational impact assessment

6.1 Modelling methodology

Air quality dispersion modelling was undertaken using AERMOD version 9.5.0. AERMOD is the approved dispersion model recommended by the US EPA and is recognised by the Victoria EPA as a suitable and advanced dispersion model that improves upon Ausplume. Ausplume is listed in the NSW EPA Approved Methods. AERMOD is not explicitly mentioned in the Approved Methods but has been approved for use by the NSW EPA in numerous air quality dispersion assessments.

AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrains.

AERMOD was configured using site-representative meteorological data as described in section 5.1 and in accordance with EPA Victoria AERMOD modelling guidance (publications 1550 and 1551):

– Meteorological data for the period January 2016 – December 2020 from weather observations measured at Casino Airport AWS (BoM) and cloud cover measured at Lismore Airport AWS (BoM). The measured data was processed along with local land use characteristics using AERMET, the meteorological pre-processor for AERMOD.
– The effects of terrain were included by the model which utilised terrain data at a 30 m resolution.
– Six sensitive receptors, as identified in Section 2.2, were included in the model.
– Model results were exported as 24-hour (100^{th} percentile) and annual (100^{th} percentile) averaging periods.

6.2 Predicted impacts

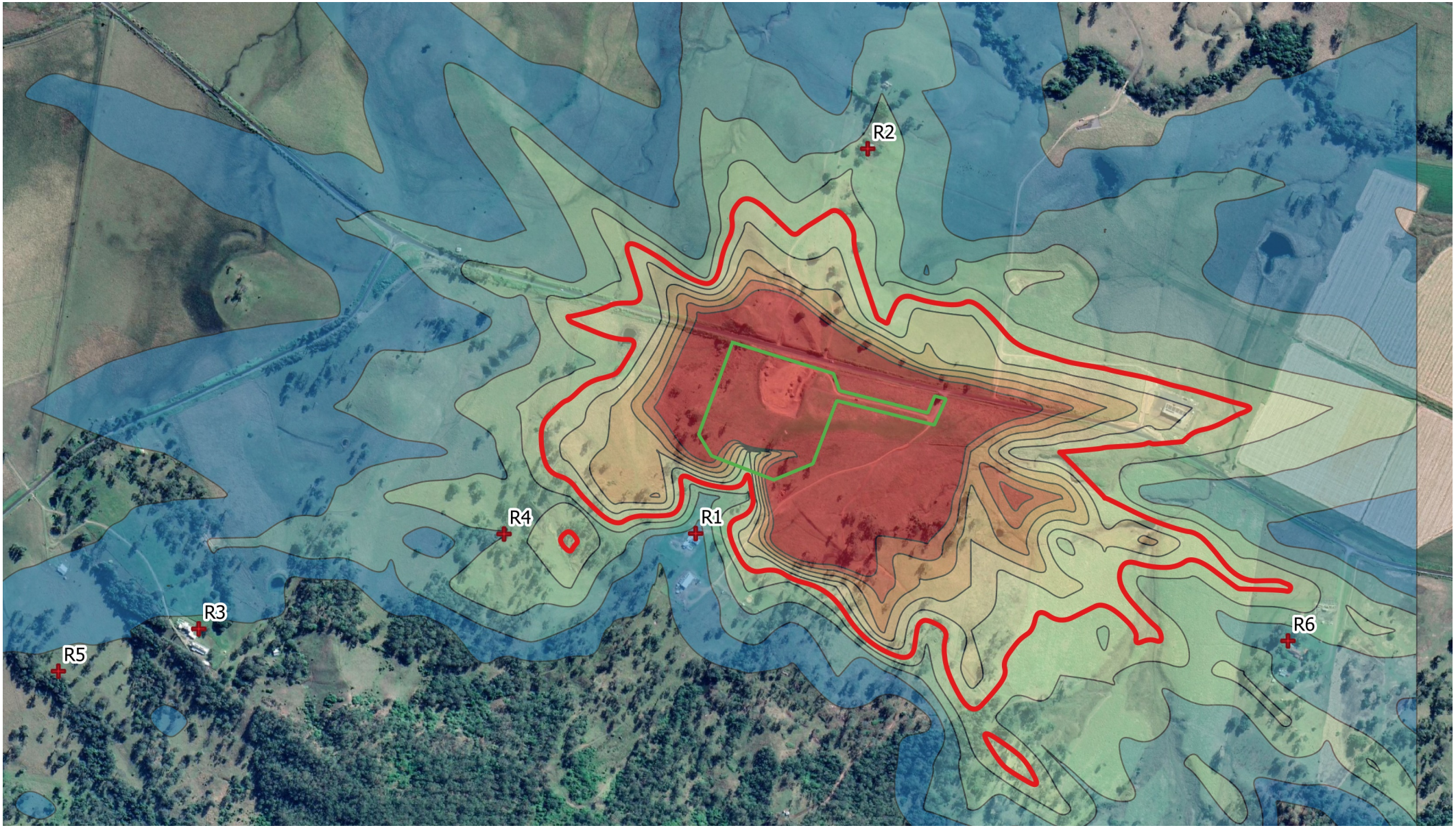
The predicted particulate (TSP, PM_{10} and $PM_{2.5}$) impacts were assessed at nearby sensitive receptors during the operation of the quarry. The predicted concentrations were assessed against the assessment criteria provided in Table 4.1.

6.2.1 Predicted incremental concentrations

The predicted maximum incremental 24-hour impacts (impacts from quarry operations only) and incremental annual average impacts are presented in Table 6.1. There are no predicted incremental exceedances of the assessment criteria. The worst case impact is at R02, where the maximum incremental 24-hour PM_{10} concentration is approximately 76% of the criteria. A contour plot showing incremental PM_{10} dispersion (worst case pollutant) is provided in Figure 6.1.

Table 6.1 Predicted incremental particulate concentrations

Receptor	Annual average (µg/m³)			Maximum 24 – hour (µg/m³)	
	TSP	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Assessment criteria	**90**	**25**	**8**	**50**	**25**
R01	0.73	0.45	0.11	16	4.0
R02	0.68	0.36	0.091	38	9.5
R03	0.09	0.054	0.013	5.8	1.5
R04	0.43	0.25	0.061	29	7.4
R05	0.072	0.039	0.0094	5.7	1.4
R06	1.1	0.59	0.15	24	6.1



Legend

- Bentley Quarry
- Sensitive receptors

24 hour criteria level - 50 µg/m3

PM10 concentration (µg/m3)

10	30	70	
20	40	80	
	50	90	
	60	>100	

Paper Size ISO A4

0 200 400 m

N

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

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Bentley Quarry
Air Quality Impact Assessment

PM10 maximum 24 hour incremental concentration

Project No. **12547851**
Revision No. **-**
Date. **20/10/2021**

FIGURE 6.1

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Print Date: 20/10/2021

Data Source:Google Earth Imagery 2021.
Created By: rbrowell

6.2.2 Cumulative impacts

Cumulative impacts are an assessment of the impact from the proposal in the context of the existing air quality environment. No representative air quality data are available for the proposal site, however the average particulate levels for rural areas across the state shows an average concentration of 18 µg/m^3 for PM_{10} (DPIE, 2019).

Maximum 24-hour $PM_{2.5}$ concentrations and annual average concentrations are low for all pollutants and no cumulative impacts are anticipated.

The highest risk of cumulative impacts is likely associated with short term (24-hour) PM_{10} concentrations. Cumulative 24-hour PM_{10} impacts could occur in the unlikely scenario where worst case quarrying impacts occur simultaneously with elevated PM_{10} concentrations (such as during bushfires or dust storms). The ten highest predicted 24-hour incremental average for PM_{10} at each receptor are presented in Table 6.2. The figures presented show the incremental concentrations, from quarrying activities only, and should the average background level be added some exceedances may occur. However, the results show a steep degradation of impacts from rank 1 (maximum) to rank 10 (tenth highest), and therefore the potential for cumulative impacts to occur is low.

Table 6.2 First 10 ranked incremental PM_{10} 24-hour average concentrations at sensitive receptors

Rank	R01	R02	R03	R04	R05	R06
1	16	38	5.8	29	5.7	24
2	16	37	4.4	23	3.0	22
3	15	16	3.5	20	2.9	22
4	15	16	3.4	19	2.9	21
5	12	12	2.5	17	2.8	15
6	11	10	2.4	13	1.8	14
7	11	8.5	2.4	12	1.7	14
8	11	7.6	2.2	11	1.2	13
9	10	7.4	1.7	10	1.1	13
10	10	6.6	1.7	10	1.0	13

7. Mitigation and management recommendations

The activities associated with the operation of Bentley Quarry have the potential to generate emissions to air (dust). The following management measures are recommended to minimise any potential air quality impacts during the operation of the project:

- Following control measures as outlined in Section 5 must be implemented:
  - Water sprays of crushing and screening activities.
  - Level 2 watering (> 2 litres/m_2/h) present across all access roads.
- Visual dust monitoring will be performed on a routine basis, and all staff will be trained to look out for visible dust leaving the worksite in the direction of sensitive receptors. If the works are creating visible dust plumes that are leaving the site boundary, the works will be modified or stopped until the dust hazard is reduced to an acceptable level.
- Ambient dust levels should be considered and care taken on days when high ambient dust levels are high, such as days when bushfires or hazard reduction burns are nearby. Production, especially high dust generating activities, should be actively minimised on these days to avoid cumulative dust impacts.
- Dust suppression will be undertaken as required, using level 2 watering (> 2 L/m^2/h) via water sprays and water carts:
  - Unpaved work areas subject to traffic or wind.
  - Topsoil and aggregate stockpiles.
  - During the loading and unloading of dust generating materials.
- Maintain an orderly and clean work site.
- If complaints are received relating to dust, works will be reviewed to identify opportunities to reduce potential impacts from dust.
- Should complaints persist a dust monitoring system will be implemented to determine dust levels at receptors.

8. Conclusions

An assessment of the potential air quality impacts from future operations at Bentley Quarry has been undertaken. A number of residential receptors are located in the area surrounding the quarry and particulate matter was identified as the key pollutant likely to cause impacts to these receptors.

Dispersion modelling was undertaken for proposed quarrying activities including extraction, crushing and screening, stockpiling of topsoil and aggregate and trucks entering and exiting the site in accordance with the Approved Methods.

The assessment of dust impacts on surrounding residential receptors showed that no incremental impacts are predicted for TSP, PM_{10} or $PM_{2.5}$. While no ambient air quality levels are available, due to the low incremental levels predicted, no cumulative impacts are anticipated. However, care should be taken on days of known high background air quality.

Mitigation and management recommendations are provided in Section 7. These should be implemented in order to maintain low levels of particulate matter.

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→ The Power of Commitment

Appendix J

Biodiversity Assessment Report

Biodiversity Assessment Report

Bentley Quarry Expansion

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Prepared for: GHD

UPR	*Description*	*Date Issued*	*Issued By*
4071-1003	First issue Draft	30/9/2021	Troy Jennings
4071-1010	Final issue	19/10/2021	Troy Jennings

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Executive Summary

This Biodiversity Assessment Report (BAR) has been prepared for Ben Luffman (GHD Consulting) on behalf of the client to support a development application for construction and expansion of Bentley Quarry at Lot 2 DP1196757 located at 1465 Bentley Road, Bentley, NSW ('the site'). The BAR will be included as a supporting document to an Environmental Impact Statement (EIS) submitted to Richmond Valley Council (RVC).

The site is located at 1465 Bentley Road, Bentley, NSW, a rural landholding approximately 15 km west of Lismore CBD. The site is zoned RU1 Primary Production in the Richmond Valley Local Environmental Plan 2012. The site occurs adjacent to Bentley Road and comprises predominately agricultural land which has undergone some past clearing and modification, with an existing quarry (approximately 1 ha in size).

The Proposal is for the expansion of the existing hard rock quarry with an estimated total area of disturbance, proposed to be 6.5 ha with a pit approximately 3.65 ha in size. The site does not contain any areas of land mapped as being of Biodiversity Value (as per the Biodiversity Values Map and Threshold Tool). Native vegetation removal for the Proposal (approximately 0.23 ha) will not exceed the clearing threshold of 1 ha, therefore the Biodiversity Offsets Scheme (BOS) is not triggered and a Biodiversity Development Assessment Report (BDAR) is not required.

Results of field assessment are as follows:

- Small patches of dry sclerophyll forest on the site (within the development footprint) most closely align with the Plant Community Type (PCT) 841: Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion as described in the OEH Vegetation Classification system
- No threatened flora species were recorded at the site
- No threatened ecological communities (TECs) occur at the site
- Three threatened fauna were recorded utilising the site these include, Little Bent-winged Bat, Large Bent-winged Bat & Yellow-bellied Sheathtail-bat

Impacts of the Proposal include:

- Loss of native vegetation including approximately 0.23 ha of PCT 841 Forest Red Gum grassy open forest.
- Loss of 8 hollow-bearing trees
- Potential impacts to 8 threatened fauna that have potential to occur on site or were recorded utilising the site
- Potential for injury or mortality of fauna during clearing works.
- Weed dispersal

Review of statutory instruments relevant to the proposed subdivision was completed as follows:

- State Environmental Planning Policy (SEPP) Koala Habitat Protection 2020: potential Koala habitat does not occur, and the Policy does not apply.

- *Biodiversity Conservation Act 2016* (BC Act):

  - habitat for threatened species would not be significantly affected by the Proposal.

- Due to the area of vegetation requiring removal being below clearing thresholds, the Biodiversity Offsets Scheme (BOS) in the BC Act is not triggered; and a Biodiversity Development Assessment Report (BDAR) is not required.

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

  - no impact on any listed threatened ecological communities listed under EPBC Act
  - no impact any threatened flora species listed under the EPBC Act
  - the proposal is unlikely to lead to a significant impact on any threatened species and/or their habitat listed under the EPBC Act

1. Introduction and Background

1.1 Introduction

This Biodiversity Assessment Report (BAR) has been prepared for Ben Luffman (GHD Consulting) on behalf of the client to support a development application for construction and expansion of Bentley Quarry at Lot 2 DP1196757 located at 1465 Bentley Road, Bentley, NSW ('the site'). The BAR will be included as a supporting document to an Environmental Impact Statement (EIS) submitted to Richmond Valley Council (RVC).

This assessment has been prepared to:

- Identify the biodiversity values of the site (particularly habitat for threatened species or communities listed in the *Biodiversity Conservation Act 2016* (BC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Identify any significant habitat features of biodiversity importance
- Examine the Proposal against relevant statutory requirements.

1.2 The Site

The site occurs in Lot 2 DP1196757 located at 1465 Bentley Road, Bentley, NSW, a rural landholding approximately 15 km west of Lismore CBD (refer to **Illustration 1.1**). The site is zoned RU1 Primary Production in the Richmond Valley Local Environmental Plan 2012. The site occurs adjacent to Bentley Road and comprises predominately agricultural land which has undergone some past clearing and modification, with an existing quarry (approximately 1 ha in size) and driveway located within the site (refer to **Illustration 1.2**).

The site occurs within the Scenic Rim subregion of the South Eastern Queensland Bioregion as per the Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (refer (Thackway & Cresswell 1995)).

1.3 The Proposal

The Proposal is for the expansion of the existing hard rock quarry, with an annual maximum extraction rate of 300,000 tonnes per annum and a maximum daily extraction rate of 2,000 tonnes per day. The total area of disturbance is proposed to be 6.5 ha with a pit approximately 3.65 ha in size. In addition, a maximum of 50,000 tonnes per annum of soil, topsoil and waste concrete is proposed to be imported to the site to be used for constructing landscape mounds, rehabilitation and blending with aggregate material.

1.4 Assessment Pathway

The NSW Department of Planning, Industry and Environment (DPIE) has provided the Secretary's Environmental Assessment Requirements (SEARs) for the Environmental Impact Statement (EIS). This BAR aims to provide the supporting information and assessment for the biodiversity requirements outlined under SEARs – ID 1589.

The site does not contain any areas of land mapped as being of Biodiversity Value (as per the Biodiversity Values Map and Threshold Tool; version 11 accessed 08/09/2021(NSW Government 2021)) (**Figure 1.1**). The site is allocated a minimum lot size of 40 ha in the Richmond Valley LEP 2012, therefore up to 1 ha of native vegetation may be cleared without triggering the Biodiversity Offset Scheme (BOS) in the BC Act and the requirement for the Biodiversity Development Assessment Report (BDAR) not required.

Native vegetation removal for the Proposal (approximately 0.23 ha) will not exceed the clearing threshold of 1 ha, therefore the BOS is not triggered and a BDAR is not required.

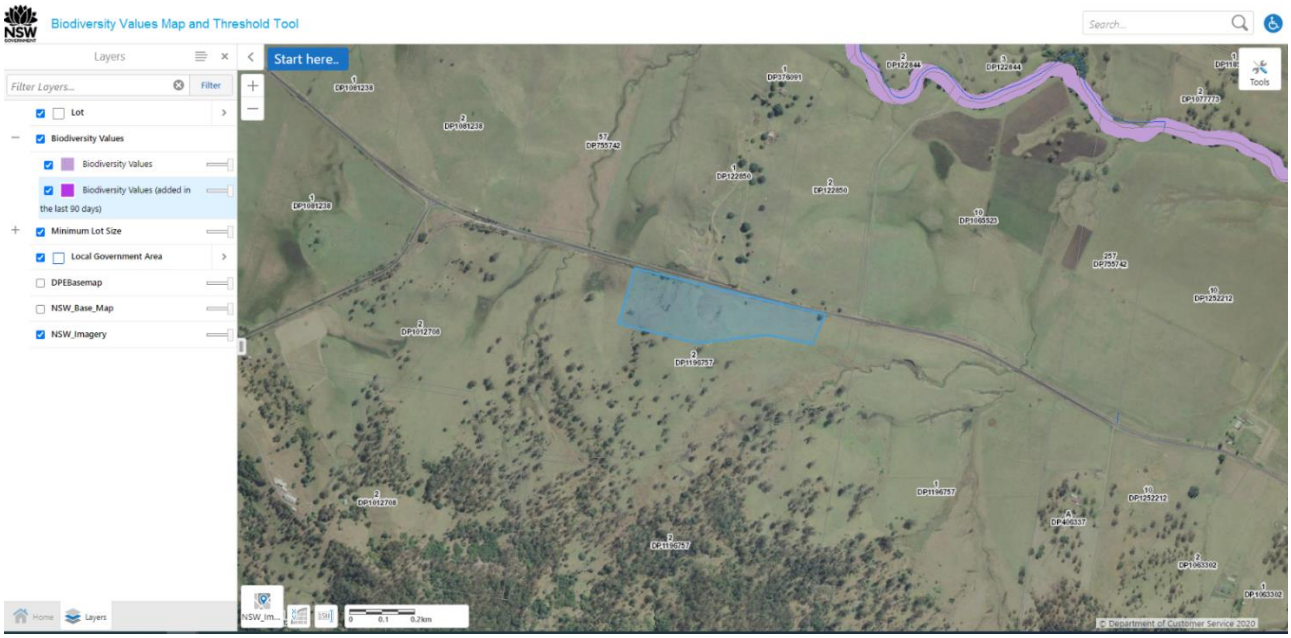


Figure 1.1 Biodiversity Values Map and site context – accessed 8th September 2021

1.5 Definitions used in this report

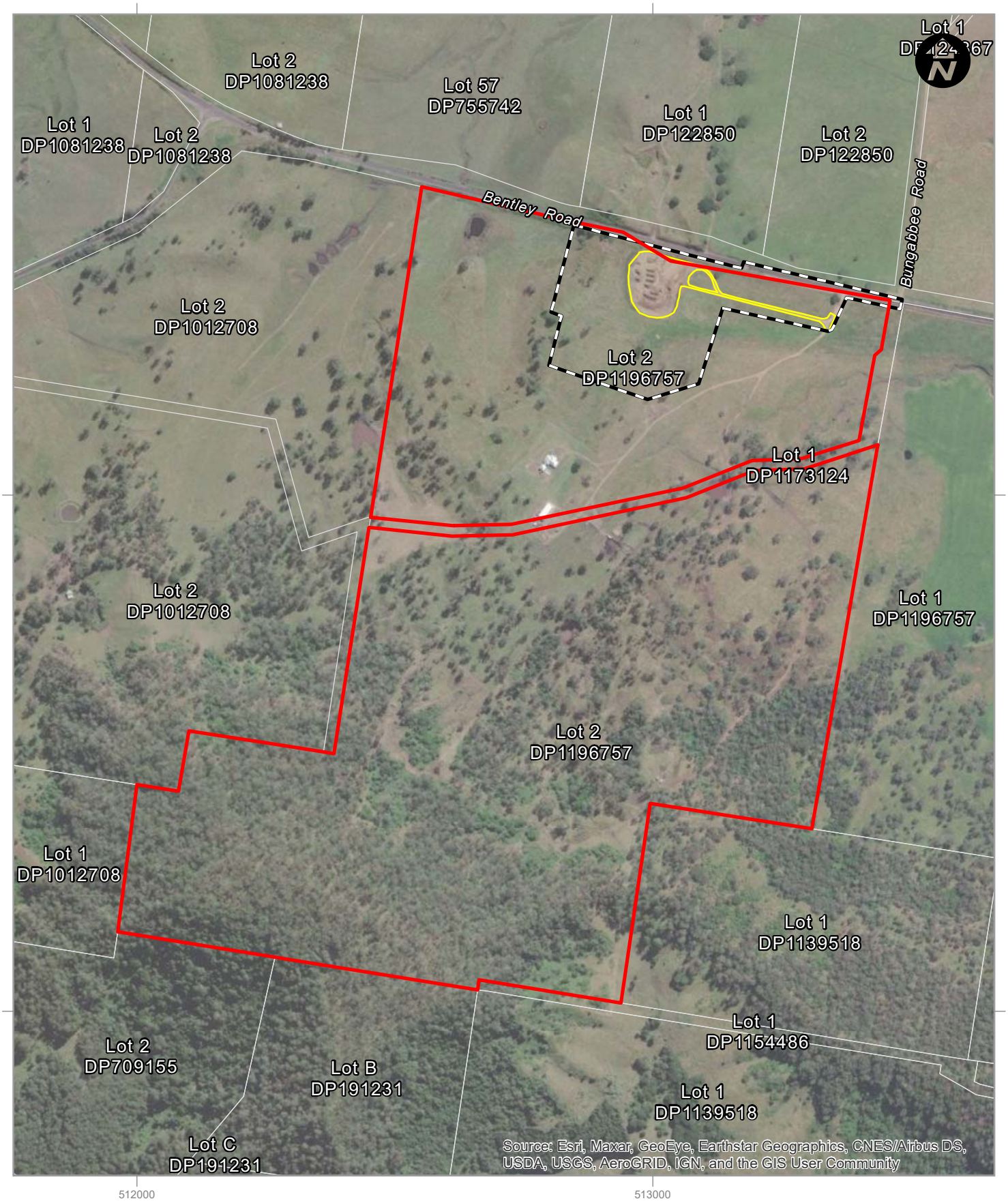
The following definitions have been used throughout this BAR:

- **The Proposal** – as described in Section 1.3
- **The Site** – the land in which The Proposal occurs within (i.e. Lot 2 DP1196757)
- **Study area** – the impact area and adjacent areas of vegetation and associated habitat surveyed as part of this investigation that may be subject to direct or indirect impacts as a result of the Proposal
- **Impact area** – this includes all areas to be directly impacted by the Proposal, including the direct impact area of proposed design and construction footprint and associated ancillary infrastructure
- **The locality** – a 10 km buffer on the study area

0 3 Km

Locality Plan - Illustration 1.1

Information shown is for illustrative purposes only
Drawn by: AB Checked by: TLJ Reviewed by: DGH
Source of base data: Open Street Map
Date: 22/09/2021



GDA 1994 MGA Zone 56

LEGEND

- Lot boundary
- Cadastre
- Study area
- Existing quarry footprint

0 200 Metres

The Site - Illustration 1.2

Information shown is for illustrative purposes only
Drawn by: AB Checked by: TLJ Reviewed by: DGH
Source of base data: ESRI World Imagery
Date: 15/10/2021

2. Methodology

2.1 Desktop assessment

The desktop assessment included analysis of the following information sources:

- Aerial photographic imagery
- NSW Mitchell Landscapes (Planning Industry and Environment 2016)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) (Thackway & Cresswell 1995)
- Biodiversity Values mapping (as per the Biodiversity Values Map and Threshold Tool)(NSW Government 2021)
- Directory of Important Wetlands of Australia (Department of Agriculture 2021)
- Priority weed listings for the North Coast region (Department of Primary Industries 2021a)
- Broad-scale vegetation mapping of the locality specifically the State Vegetation Type Map: CRAFTI North Coast vegetation mapping (Department of Planning Industry and Environment 2005)

2.1.1 Database searches

Table 2.1 outlines the desktop database searches completed prior to field assessment.

Table 2.1 Threatened species database searches

Database	*Search date*	*Area search*	*Reference*
PlantNET Spatial Search	30/08/2021	Richmond Valley LGA search	(Royal Botanic Gardens 2021)
BioNet Atlas species sighting search	30/08/2021	20km x 20km centred on the study area	(Environment Energy and Science 2021a)
EPBC Protected Matters Search Tool	30/08/2021	25km buffer on the study area	(Department of Agriculture Water and the Environment 2021)
NSW Department of Primary Industries (Fishing and Aquaculture) spatial data	30/08/2021	Richmond Valley LGA	(Department of Primary Industries 2021b)

3. Field assessment

The study area was inspected during daylight and nocturnal hours by ecologist, Troy Jennings on 2nd and 9th September 2021. The field assessment sought primarily to identify key biodiversity constraints by assessing the type, extent and condition of vegetation and fauna habitat, especially as it pertained to threatened species and ecological communities.

3.1 Personnel

The contributors to the preparation of this report, their qualifications and roles are provided in Table 3.1.

Table 3.1 Personnel

Name	*Qualifications*	*Position*	*Role*
David Havilah	■ Bachelor of Science (Major Biology) ■ Accredited BAM Assessor (BAAS18129)	Senior Ecologist	Technical review
Troy Jennings	■ Bachelor of Biodiversity and Conservation ■ Masters of Wildlife Management ■ Cert III Conservation and Land Management ■ Accredited BAM Assessor (BAAS18172)	Ecologist	Reporting and field surveys
Anna Barca	■ Associate Degree of Spatial Science	GIS specialist	Spatial data management and figure preparation

3.2 Weather conditions

Weather conditions during the field survey were mild and warm (7 – 27℃), with a moderate to strong wind. No rainfall was recorded during the field assessment (Table 3.2).

Table 3.2 Weather conditions during field assessment

Date	*Temperature (°C)*		*Rainfall (mm)*	*Wind (direction/ speed)*
	Minimum	Maximum		
02/09/2021	15.2	24.4	0	ESE 39
09/09/2021	7.5	27	0	NNW 39

Source: *Bureau of Meteorology (2021): Casino Airport (weather station: 058208).*

3.3 Vegetation survey methods

The flora survey focused on mapping any native and non-native vegetation types and assessing the likelihood of threatened flora species to occur within habitats available within the study area. This was completed using a combination of the following methods:

- random meanders
- rapid point assessments
- vegetation integrity plots

A detailed overview of terrestrial flora survey methods is presented below. Vegetation surveys completed within the study area were carried out as described below and where applicable, considering the methodology detailed in the following guidelines:

- *Field survey methods for environmental consultants and surveyors when assessing proposed developments or other activities on sites containing threatened species* (Department of Planning Industry and Environment 2016)
- *NSW Guide to Surveying Threatened Plants* (Department of Planning Industry and Environment 2020)
- *NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (Department of Environment and Conservation 2004)

3.3.1 Definition of native vegetation

Native vegetation is defined in Section 1.6 of the BC Act, which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013*. Part 5A 60B of the *Local Land Services Act 2013* defines the meaning of native vegetation as any of the following types of plants native to New South Wales:

- trees (including any sapling or shrub or any scrub)
- understorey plants
- groundcover (being any type of herbaceous vegetation)
- plants occurring in a wetland.

A plant is native to New South Wales if it was established in New South Wales before European settlement. As such, all areas containing native vegetation, including previously disturbed areas, have been assessed.

3.3.2 Existing vegetation mapping and verification

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation. The regional vegetation mapping (Department of Planning Industry and Environment 2005) does not map any native vegetation within the study area but maps vegetation in the locality.

Analysis of aerial photographs was used to identify areas of disturbance, vegetation structure and likely native versus exotic species composition throughout the study area. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.

Data on geology, dominant canopy species, native species richness, vegetation structure and condition was collected across the study area during field surveys to validate and refine this existing

vegetation classifications to determine their associated PCT in accordance with the BioNet Vegetation Classification System (Environment Energy and Science 2021b). Vegetation conditions were identified and mapped following the BAM (Department of Planning Industry & Environment 2020).

3.3.3 Random meander survey

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (Cropper 1993), whereby the recorder walks in a random meander throughout the study area recording dominant and key plant species (e.g. threatened species, priority weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

Random meander surveys were conducted to undertake flora and fauna habitat assessments, vegetation mapping and opportunistically search for threatened species within areas of suitable habitat.

3.3.4 Rapid data point assessment

Three Rapid Data Point (RDP) assessments were completed to validate and refine this existing vegetation classification to determine their associated PCT in accordance with the BioNet Vegetation Classification System(Environment Energy and Science 2021b). Data on geology, dominant canopy species, native species richness, vegetation structure and condition were collected at rapid point assessment locations. Three rapid point assessments were conducted in the study area (**Illustration** 3.1).

3.3.5 Vegetation integrity survey plots

One vegetation integrity survey plot were completed within the study area in accordance with the field procedure contained in BAM 2020 (Department of Planning Industry & Environment 2020). Vegetation Integrity Plots were used primarily to quantify the native species content and cover of the grassland areas and to determine and assign Plant Community Types (PCTs).

3.3.6 Condition of vegetation

Vegetation in the study area was firstly assessed to a PCT (if possible) and then aligned to a condition state, which is defined in the BAM as ‘an area of native vegetation on the subject land that is the same PCT and has a similar broad condition state’(Department of Planning Industry & Environment 2020). A broad condition state infers that the vegetation has a similar tree cover, shrub cover, ground cover, weediness or combinations of these attributes which determine vegetation condition.

The broad condition states which were applied to vegetation in the study area are summarised in Table 3.3. These factors were defined by using factors such as levels of disturbance, weed invasion and resilience.

Table 3.3 Vegetation broad condition states

Condition category	*Description*
Poor	Vegetation structurally and floristically shows some characteristic of assigned vegetation community. Vegetation is structurally modified and exhibits some regrowth as a result of historic clearing. Presence of a few canopy species and a sparse midstory present.
Miscellaneous ecosystems – disturbed areas	Highly disturbed areas with no or limited native vegetation. Canopy is either absent or sparse with a sparse midstory present, dominated by exotic species.
Miscellaneous ecosystems – grassland	Highly disturbed areas with no or limited native vegetation. No canopy species present, presence of some native groundcover but mainly dominated by exotic herbs and grasses.

3.4 Fauna survey methods

This section outlines the fauna survey effort completed for species that have habitat suitable within the study area based on database searches. Fauna surveys for threatened species were undertaken during 2nd and 9th September 2021. Survey methods are described below, and the location of fauna survey effort is shown in **Illustration 3.1.**

Threatened fauna surveys completed within the study area were carried out as described below and where applicable, considering the methodology detailed in the following guidelines:

- *NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)*(Department of Environment and Conservation 2004)
- *Survey Guidelines for Australia's Threatened Birds* (Magrath et al. 2010)
- *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability Environment Water Population and Communities 2004)
- *Threatened Species survey and assessment guidelines: field survey and methods for fauna- Amphibians* (Department of Environment and Climate Change 2009)
- *'Species credit' threatened bats and their habitats- NSW survey guide for the BAM* (Office of Environment & Heritage 2018).

3.4.1 Fauna habitat assessment

Fauna habitat assessments were undertaken to assess the likelihood of a threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the study area. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species were likely to occur within the study area. Fauna habitat characteristics assessed included:

- structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources
- presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, large forest owls, birds and reptiles
- presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians
- presence of waterways (ephemeral or permanent) and water bodies.
- presence of man-made structures (e.g. culverts) for roosting/breeding microbats.

The criteria used to evaluate the condition of habitat values is outlined in Table 3.4.

Table 3.4 Fauna habitat assessment evaluation criteria

Habitat value	*Evaluation criteria*
Good	A full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
Moderate	Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
Poor	Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

3.4.2 Diurnal bird surveys

Four formal 20-minute diurnal bird searches were completed at two locations within the study area. Bird surveys were completed by actively walking through the nominated site (transect) over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls. Bird surveys were completed during different times of the day, but generally occurred during morning or late afternoon hours. Birds were also recorded opportunistically during all other surveys and site visits.

3.4.3 Spotlighting

Spotlighting was used to target arboreal, flying and ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. Spotlighting was completed after dusk (9 September 2021) and completed on foot by an ecologist using high-powered headlamps and hand torches. Sighted animals were identified to the species level.

3.4.4 Microbat surveys

Passive Ultrasonic Anabat Bat detection (Anabat Express unit -Titley Scientific, Brendale QLD) was used to record and identify the echolocation calls of microchiropteran bats foraging within the study area. Passive monitoring of survey sites was achieved by setting Anabat bat detectors to record throughout the night for five continuous nights (9 September – 14 September 2021).

Calls were analysed using Analook (Version 4.7) software with reference to ‘Bat Calls of NSW: Region Based Guide to the Echolocation Calls of Microchiropteran Bats’ (Pennay et al. 2004).

3.4.5 Exit surveys

One exit survey was undertaken at dusk in areas where roosting/ denning habitat (i.e. identified hollow-bearing trees) was identified within the study area (9 September 2021). The aim of the exit survey was to identify hollow-bearing tree dependant fauna, including microchiropteran bats, that may have been using hollow-bearing trees as habitat in the study area for roosting or breeding purposes. Following the exit survey, spotlighting was undertaken near potential roosting/ denning habitat.

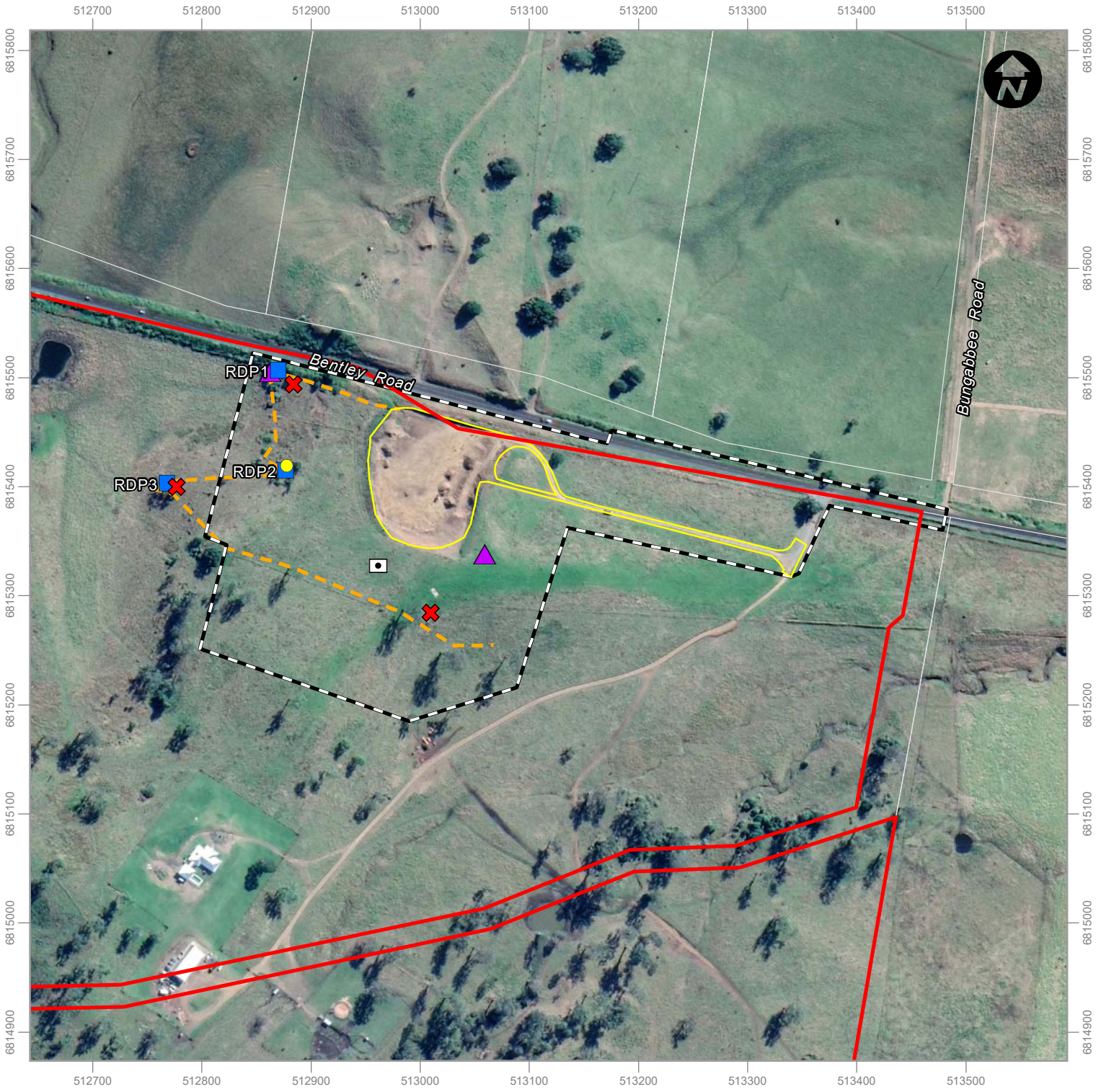
3.4.6 Koala spot assessment technique (SAT)

In addition to habitat assessment, targeted survey for the Koala was completed in the study area in areas of suitable habitat where Koala feed trees were identified. The study area provided one Koala Schedule 2 feed tree - *Eucalyptus tereticornis* (Forest Red Gum). At each sampling point, Spot Assessment Technique (SAT) methodology (Biolink Ecological Consultants 2009) was employed, which involved actively searching for Koala faecal pellets for approximately one metre around the trunk of 30 trees (where possible); specifically targeting feed tree species where possible.

3.4.7 Opportunistic recording of fauna species and evidence of fauna activity

Opportunistic sightings of animals were recorded during field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows was also noted. This provided indirect information on animal presence and activity. During these surveys, a hand-held GPS was used to record the locations of:

- hollow-bearing trees
- aquatic habitat
- rock outcrops.



GDA 1994 MGA Zone 56

LEGEND

- Lot boundary
- Cadastre
- Study area
- Existing quarry footprint
- Spotlight transect
- Rapid data point
- Fauna habitat assessment
- Bird survey
- Anabat survey
- BAM plot

0 100 Metres

Field Survey Effort Within Study Area - Illustration 3.1

GeoLINK environmental management and design

Biodiversity Assessment Report - Bentley Quarry Expansion
4071-1006

Information shown is for illustrative purposes only
Drawn by: AB Checked by: TLJ Reviewed by: DGH
Source of base data: Google Earth 2021
Date: 15/10/2021

4. Existing Environment

This section provides an overview of the existing environment and potential ecological constraints of the study area based on the desktop analysis and field assessment completed.

4.1 Landscape context

An overview of landscape features associated with the study area are presented in Table 4.1.

Table 4.1 Landscape features and planning information

Landscape feature	*Occurrence in study area*
IBRA bioregion	South Eastern Queensland
IBRA subregion	Scenic Rim
NSW landscape regions (Mitchell landscapes)	Lamington Volcanic Slopes
Local Government Area (LGA)	Richmond Valley Council (RVC)
Local Land Service (LLS) region	North Coast
Botanical subregion	North Coast (NNC)
Rivers, streams and estuaries	No mapped rivers, streams or estuaries occur in study area.
Important and local wetlands	No important or local wetlands occur in study area.
Connectivity features	Overall, the landscape has been cleared which has resulted in fragmentation and isolation from remnant patches of vegetation due to agricultural practices (i.e. clearing for livestock grazing). No remnant vegetation or habitat links occur with the study area.
Areas of geological significance and soil hazard features	No areas of geological significance and soil hazard features occur in the study area.
Areas of outstanding biodiversity value	No areas of outstanding biodiversity values occur in the study area.

4.2 Plant community types

The study area is heavily disturbed, and the majority of original vegetation has been cleared as a result of agricultural and quarrying practices within the site and locality. One native vegetation community aligned with the plant community types (PCTs) outlined in BioNet Vegetation Classification system.

Native vegetation extent within the study area is described in

Table 4.2 and aligned with PCTs in the BioNet Vegetation Classification system where relevant.

Vegetation mapping is provided at **Illustration 4.1**. Photographs of vegetation at the site are provided in **Appendix B**; a flora inventory is provided at **Appendix C**.

Table 4.2 Plant Community Types

Plant Community Type	*Condition*	*Area within study area (ha)*
Native vegetation		
PCT 841: Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion	Poor	0.25
Miscellaneous ecosystems		
Highly disturbed areas with no or limited native vegetation – Exotic dominated vegetation		0.28
Highly disturbed areas with no or limited native vegetation – Exotic dominated grassland		8.59
Total vegetation		**9.13**

4.2.1 PCT 841 Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion

The study area contains several small patches of *PCT 841: Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion*. Based on landscape position and woodland being present in similar situations in the locality, it is likely that the study area would have once contained a woodland dominated by *Eucalyptus tereticornis* with this previously existing woody canopy vegetation (shrubs and trees) having been largely removed. Presence of *Corymbia intermedia* (Pink Bloodwood) still persist, with *Eucalyptus tereticornis* (Forest Red Gum) and *Angophora subvelutina* (Broad-leaved Apple) also occurring scattered in the study area.

A summary of the characteristics of PCT 841 within the study area is in provided in Table 4.3 and depicted in **Plate 4.1** and **Plate 4.2**. The extent of PCT 841 within the study area is shown in **Illustration 4.1**.

Table 4.3 Summary of PCT 841: Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion

Description	
PCT	Upper stratum consists of *Eucalyptus tereticornis* (Forest Red Gum), *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus siderophloia* (Grey Ironbark) and *Corymbia intermedia* (Pink Bloodwood). Middle stratum consists of *Breynia oblongifolia* (Coffee Bush). Ground stratum consists of *Dianella caerulea* (Blue Flax-lily), *Dichondra repens* (Kidney Weed), *Lomandra longifolia* (Spiny-headed Mat-rush), *Themeda australis* (Kangaroo Grass) & *Imperata cylindrica* var. *major* (Blady Grass).
% cleared	50
Extent in study area	0.25 ha

Description	
Condition in study area	Poor condition within the study area, heavily disturbed understorey with exotic grasses dominating.
Canopy species in plot	*Corymbia intermedia* (Pink Bloodwood)
Midstory/shrub species in plot	*Notelaea longifolia* (Large Mock-olive), *Streblus brunonianus* (Whalebone Tree) & *Alphitonia excelsa* (Red Ash)
Ground layer species in plot	Groundcover generally includes *Lomandra multiflora* (Many-flowered Mat-rush), *Cenchrus caliculatus* (Hillside Burrgrass), *Paspalum dilatatum** (Paspalum*), *Melinis repens** (Red Natal Grass*), *Cenchrus clandestinus** (Kikuyu Grass*), *Chloris ventricose* (Tall Chloris), *Imperata cyclindrica* (Blady Grass) and *Themeda triandra* (Kangaroo Grass).
Exotic species in plot	*Paspalum dilatatum** (Paspalum*), *Melinis repens** (Red Natal Grass*), *Bidens pilosa** (Cobblers Pegs), *Phytolacca octandra** (Inkweed*), *Asclepias curassavica** (Blood Flower*), *Tecoma stans** (Yellow Bells*), *Verbena bonariensis** (Purpletop*) & *Cenchrus clandestinus** (Kikuyu Grass*).
Notes	Based on landscape position and presence of *Eucalyptus tereticornis* & *Eucalyptus siderophloia* dominated forest being present in similar situations in the locality and in other patches in the study area, it is likely that the study area would have once contained larger patches of forest dominated by *Eucalyptus tereticornis* and other associated canopy species (mentioned above) this previously existing woody canopy vegetation (shrubs and trees) has been removed. Community present within the study area is likely to be disturbed representation of PCT 841. Floristic composition present in plot is provided below.

Plate 4.1 Small patch of regrowth Pink Bloodwoods with disturbed understorey within RDP 2.

Plate 4.2 Vegetation occurring within RDP 2 and occurrence of Pink Bloodwoods with disturbed understorey.

4.2.2 Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation – exotic vegetation

Areas within the study area that were dominated with exotic herbs, groundcover and midstorey were classed as 'highly disturbed areas with no or limited native vegetation – exotic vegetation'. These areas were identified within patches surrounding the existing quarry pit and also along the roadside boundary associated with Bentley Road reserve. Presence of some native ground cover and canopy species were present however overall these areas were dominated with exotic species. Rapid data points undertaken in these areas identified a canopy which included *Ligustrum sinense** (Small-leaved Privet*), *Mallotus philippensis* (Red Kamala), *Jagera pseudorhus* (Foam Bark Tree), *Solanum mauritianum** (Wild Tobacco Bush*) and *Solanum chrysotrichum** (Devil's Fig*). The midstorey and ground vegetation consists of *Lantana camara** (Lantana*), *Ageratina adenophora** (Crofton Weed*), *Ageratina riparia** (Mistflower*), *Imperata cylindrica* (Blady Grass), *Paspalum dilatatum** (Blady Grass), *Cenchrus caliculatus** (Kikuyu Grass*) and *Themeda triandra* (Kangaroo Grass).

These areas are shown in **Plate 4.3** and **Plate 4.4**. The extent and occurrence within the study area is shown in **Illustration 4.1.**

Plate 4.3 Miscellaneous ecosystems - Highly disturbed areas with no or limited native vegetation

Plate 4.4 Miscellaneous ecosystems - Highly disturbed areas with no or limited native vegetation (presence of native trees along boundary of road reserve)

4.2.3 Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation – exotic grasslands

The majority of the study area was dominated by exotic grasses and other weeds; these areas were classed as 'Highly disturbed areas with no or limited native vegetation – exotic grasslands'.

A vegetation integrity plot was undertaken to quantify native species richness and percentage cover to identify if these areas were a 'derived native grassland' of any associated PCTs identified in the area. The vegetation was dominated by exotic species, particularly *Cenchrus clandestinus** (Kikuyu Grass*), *Paspalum dilatatum** (Paspalum*), *Melinis repens** (Red Natal Grass*) and *Sporobolus africanus** (Parramatta Grass*). These areas are shown in **Plate 4.5** and **Plate 4.6**.

The Interim Grasslands and other Groundcover Assessment Method (IGGAM) was undertaken for grassland areas to determine the conservation value of the groundcover associated with grassland habitat. Based on the IGGAM calculator output the grassland identified within the study area was calculated to be of 'low conservation value' and be consistent with category 1-exempt land under the Section 60H (1) of the *Local Land Services Act 2013*.

Plate 4.5 Miscellaneous ecosystems - Highly disturbed areas with no or limited native vegetation (exotic grasslands)

Plate 4.6 Miscellaneous ecosystems - Highly disturbed areas with no or limited native vegetation (exotic grasslands)

GDA 1994 MGA Zone 56

LEGEND

- Lot boundary
- Cadastre
- Study area
- Existing quarry footprint
- Miscellaneous ecosystem - highly disturbed areas with no or liminted native vegetation (exotic vegetation)
- Miscellaneous ecosystem - highly disturbed areas with no or limited native vegetation (exotic grasslands)
- PCT 841 Forest Red Gum grass open forest
- Hollow-bearing tree

0 100 Metres

Vegetation and Habitat Features Within Study Area - Illustration 4.1

Information shown is for illustrative purposes only
Drawn by: AB Checked by: TLJ Reviewed by: DGH
Source of base data: Google Earth 2021
Date: 15/10/2021

4.3 Priority and high threat weeds

The study area is considerably disturbed due to previous agricultural practices and consequently weed species are common. A total of 25 exotic species were recorded throughout the study area (refer to **Appendix C**).

Exotic grasses included *Paspalum dilatatum*, Cenchrus clandestinus*, Melinis repens** and *Sporobolus africanus*.* Other weeds common to disturbed areas are prevalent, including *Senecio madagascarensis*, Bidens pilosa*, Ageratum houstonianum*, Lantana camara*, Salvia verbenaca*, Bidens subalternans*, Ageratina adenophora*, Cirsium vulgare*, Ageratina adenophora*, Ageratina riparia*, Phytolacca octandra*,* and *Gomphocarpus physocarpus**. Identified exotic trees included *Solanum chrysotrichum*, Solanum mauritianum*, Tecoma stans*, Ligustrum sinense** and *Ligustrum lucidum**.

The following species were identified as 'High Threat' weeds:

- *Tecoma stans** (Yellow Bells)
- *Senecio madagascariensis** (Fireweed)
- *Paspalum dilatatum** (Paspalum)
- *Ligustrum sinense** (Small-leaved Privet)
- *Ligustrum lucidum** (Large-leaved Privet)
- *Lantana camara** (Lantana)
- *Ageratina riparia** (Mistflower)
- *Ageratina adenophora** (Crofton Weed)

Four weed species identified in the study area during the field assessment are listed as priority weeds listed under the *Biosecurity Act 2015* for the North Coast region:

- *Lantana camara** (Lantana)
- *Solanum chrysotrichum** (Devil's Fig)
- *Senecio madagascariensis** (Fireweed)
- *Tecoma stans** (Yellow Bells)

Two weed species identified in the study area are listed as Weeds of National Significance (WoNS) under the National Weeds Strategy, these include *Senecio madagascariensis** (Fireweed*) and *Lantana camara** (Lantana*).

4.4 Fauna species recorded

A total of 41 fauna species were recorded during field surveys, including two amphibians, 28 birds, 5 mammals and one reptile. Three threatened fauna species listed under the BC Act and/or the EPBC Act were recorded during field surveys (**Table 4.4**). A comprehensive list of fauna species recorded within the study area is provided in **Appendix C**. In addition, microbat call sequences recorded via Anabat detectors are provided in **Appendix F**.

Table 4.4 Recorded threatened fauna

Scientific name	*Common Name*	*BC Act*	*EPBC Act*	*Notes*
Miniopterus australis	Little Bent-winged Bat	V	-	Recorded by Anabat detectors
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	

V = Vulnerable

4.5 Fauna habitat

4.5.1 Habitat Values

The site provides minimal habitat for fauna species due to the highly disturbed nature as a result of historical clearing and agricultural disturbances. Overall, fauna habitat within the study area was considered to be of poor condition based on the criteria outlined in Table 3.4. Habitat values of the site are summarised as follows:

- Majority of the study area is highly disturbed and dominated with exotic vegetation. Small patches where trees and shrubs occur do provide potential shelter and foraging (fruit, nectar, pollen, insect) opportunities for birds, reptiles and terrestrial mammals, however, due to the sites limited connectivity these patches are likely only utilised by highly mobile species (i.e. birds or large macropods) or species which are well adapted to disturbed environments.
- Exotic pastureland dominated by the presence of exotic grasses and herbaceous weeds, surrounding the majority of the existing quarry. Exotic pasture habitat is predominately utilised by open country bird and mammal species for foraging purposes. These patches were heavily dominated with exotic species and as a result were in a low condition states as they lacked the important microhabitat features such as native tussocks, open rocky patches, fallen timber and old growth trees with large hollows.
- Presence of a small patches of Pink Bloodwood (*Corymbia intermedia*), Forest Red Gum (*Eucalyptus tereticornis)*, and Grey Ironbark (*Eucalyptus siderophloia*) trees, which occur in the impact area, provide potential foraging (fruit, nectar, pollen, insect) resources for locally occurring birds, microbats and flying-foxes. These trees were identified to contain small hollows (5-10cm) which may be utilised by hollow dependant fauna species (i.e. microbats). Due to the site's isolation and lack of connectivity from remnant native vegetation, it is likely that utilisation of these hollows would be limited to fauna species which are highly mobile and well adapted to disturbed and open country environments (i.e. birds and bats).
- Despite exit surveys and spotlight surveys being undertaken at the identified hollow-bearing trees, no microbats or other hollow-dependant fauna species were observed emerging or utilising hollows at the time of survey. Despite this, hollows may still be utilised by hollow-dependant fauna species on an intermittent basis.

4.5.2 Connectivity

The study area is not within any mapped wildlife corridors as per Fauna Corridors for North East NSW (Department of Planning Industry and Environment 2010). Due to the lack of remnant vegetation and isolation from larger intact vegetation patches the site does not provide any connectivity value to the surrounding landscape.

5. Threatened Biodiversity

This section provides an overview of the threatened species, populations and communities recorded or considered likely to use habitat in the study area. Threatened biodiversity is listed as Vulnerable, Endangered or Critically Endangered under the NSW BC Act and FM Act. Threatened biodiversity listed under the Commonwealth EPBC Act is detailed in Section 6.

5.1 Threatened ecological communities

BioNet search results identified habitat for twelve threatened ecological communities listed under the BC Act within the search area (refer to **Appendix A**).

Based of field assessments, no Threatened Ecological Communities (TECs) listed under the BC Act occur within the study area.

5.2 Threatened flora species

BioNet search results identified records of 5 threatened flora species listed under the BC Act within the search area. Supplementary database searches including PlantNet identified 32 threatened flora species listed under the BC Act that have the potential to occur within the study area (refer to **Appendix A**).

Based on field assessments, no threatened flora species were detected within the study area.

5.3 Threatened fauna species

BioNet search results identified records of 11 threatened fauna species listed under the BC Act within the search area (refer to **Appendix A).**

Three threatened fauna species were confirmed at the site during the field assessments (**Table 4.4**). Based on the desktop analysis and habitat present, species assessed as having a moderate or higher likelihood of occurrence within the study area were further considered (refer to **Table 5.1** and potential occurrence assessment in **Appendix D**).

Tests of significance have been completed for the species recorded or assessed has having a moderate or higher likelihood of occurrence within the study area (refer to **Table 5.1** and **Appendix E**).

Table 5.1 Threatened fauna listed under BC Act recorded or with moderate - higher likelihood of occurrence in study area

Scientific Name	*Common Name*	*BC Act*[1]	*Likelihood of occurrence*
Blossom nomads			
Glossopsitta pusilla	Little Lorikeet	V	**Moderate -** potential foraging habitat in the form of blossom eucalypts.
Pteropus poliocephalus	Grey-headed Flying-fox	V	**Moderate** - potential foraging habitat in the form of blossom eucalypts.
Arboreal mammals			
Phascolarctos cinereus	Koala	V	**Moderate –** marginal habitat present in form of small stands of native *Corymbia* and Forest Red Gum species in study area. BioNet records within close proximity to study area.
Microbats			
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	**Moderate -** Potential foraging habitat present in patches of native vegetation stands with canopy cover
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	**Recorded** – Anabat detector
Miniopterus australis	Little Bent-winged Bat	V	
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	

(1) V = Vulnerable under the BC Act

6. Matters of National Environmental Significance

Matters of National Environmental Significance (MNES), listed under the EPBC Act, are addressed in this section. The following biodiversity MNES protected under the EPBC Act were considered for their relevance to the Proposal:

- wetlands of international importance (Ramsar) (EPBC Act sections 16 and 17B)(Department of Agriculture 2021)
- listed threatened species and communities (EPBC Act sections 18 and 18A)
- listed migratory species (EPBC Act sections 20 and 20A).

6.1 Wetlands of International importance

No wetlands of international importance occur within the study area or broader locality. As such, the Proposal will not impact any wetlands of international importance.

6.2 Listed EPBC Act threatened ecological communities

Results of the Protected Matters Database Search Tool (PMST) identified habitat for two threatened ecological communities within the search area.

Field assessments did not record any threatened ecological communities listed under the EPBC Act to occur within the study area.

6.3 Listed EPBC Act threatened flora species

The database searches identified 29 threatened flora species listed under the EPBC Act that have the potential to occur in the locality of the study area (refer to potential occurrence assessment at **Appendix D**).

Field assessments did not record any threatened flora species listed under the EPBC Act to occur within the study area.

6.4 Listed EPBC Act threatened fauna species

The database searches identified 38 threatened fauna species listed under the EPBC Act that have the potential to occur in the locality of the study area. Of these, two threatened fauna species were assessed as having a moderate likelihood of occurring in the study area based on available habitat, mobility and known occurrences in the wider locality (**Table 6.1)**.

Table 6.1 Threatened fauna listed under the EPBC Act with a moderate or higher likelihood of occurrence in study area

Scientific Name	*Common Name*	*EPBC Act*[1]	*Likelihood of occurrence*
Pteropus poliocephalus	Grey-headed Flying-fox	V	**Moderate** - potential foraging habitat in the form of blossom eucalypts.
Phascolarctos cinereus	Koala	V	**Moderate –** marginal habitat present in form small stands of native *Corymbia* and Forest Red Gum species in study area. BioNet records within close proximity to study area.

(1) V = Vulnerable under the EPBC Act

6.4.1 EPBC Koala Habitat Assessment

The Koala was not recorded in the study area during the field assessment informing this report, however recent (<5yrs) records for this species were returned from the Atlas of NSW Wildlife database(Environment Energy and Science 2021a). In addition, whilst the study area is predominately disturbed, presence of *Eucalyptus tereticornis* occurred within the study area. *Eucalyptus tereticornis* is listed as a Schedule 2 Koala food tree (Koala SEPP 2020) species. Despite not recording any individuals within the study area, due to records of the species within the locality and as a precautionary measure an EPBC Koala Habitat Assessment was undertaken.

Koala Habitat Assessment Tool

The Koala Habitat Assessment Tool within the '*EPBC Act referral guidelines for the vulnerable Koala*' (Department of the Environment 2014) was used to determine whether Koala habitat in the study area classifies as '*habitat critical to the survival of the Koala*' (Figure 6.1). To be classified as habitat critical to the survival of the Koala vegetation must score 5 or above using the habitat assessment tool. A summary of the key assessment criteria (coastal population criteria) and scoring for the study area against the referral guidelines is provided in Table 6.2 and illustrated in Figure 6.1.

Koala habitat in the study area scored 3 out of 10 (**Table 6.2**) using the Koala Habitat Assessment Tool. Therefore, habitat in the study area is not likely to constitute habitat critical to the survival of the species.

Table 6.2 EPBC Koala habitat assessment tool

Attribute	*Score*	*Habitat appraisal*	
Koala occurrence	1	**Desktop**	Recent records (<5 yrs) exist within the locality (10km) of the site (BioNet 2021)
		On-site	No Koala individuals or traces of Koalas (scats, scratching etc.) were recorded in the study area during field surveys
Vegetation structure and composition	1	**Desktop**	Not applicable
		On-site	Field assessment identified one Koala SEPP 2020 food tree species; *Eucalyptus tereticornis* (Forest Red Gum) which occurred within study area.
Habitat connectivity	0	The study area is not part of contiguous landscape ≥500 ha	

Attribute	Score	Habitat appraisal	
Key existing threats	1	**Desktop**	Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack in locality (10km)
		On-site	The status of wild dog populations and level of predation is not known. No evidence of Koala activity or mortality from vehicle strike was observed in the study area during field surveys.
Recovery value	0	The study area consists of a highly disturbed agricultural / pastureland, which contained isolated *Corymbia intermedia,* Eucalyptus *siderophloia* and *Eucalyptus tereticornis* trees. The study area is subject to existing edge effects and fragmentation, with large expanses of habitat cleared in the Proposal locality for agricultural land use, effectively isolating the study area from large habitat remnants.	
Total score	**3**	**Decision: a score of 3 obtained, therefore study area is not likely to contain critical habitat for Koala.**	

A comparison of the Proposal's potential impacts was assessed against Figure 2 of the '*EPBC Act referral guidelines for the vulnerable Koala'* (Department of the Environment 2014) to determine where impacts were likely to be adverse. As illustrated in **Figure 6.1**, it was concluded that the Proposal is unlikely to have an adverse impact on the habitat critical for the species due to the following:

- Study area does not occur in an '*Area of Regional Koala Significance*'(Department of Environment and Energy, 2021)
- The study area is disturbed and fragmentation, with large expanses of habitat cleared in the Proposal locality for agricultural land use, effectively isolating the study area from large habitat remnants
- The Proposal will not fragment or impact habitat that is important to the recovery objectives for the species within the locality.

The EPBC Act significant impact assessment concluded that the Proposal is unlikely to have a significant impact on the Koala (**Appendix E**).

Attribute	Score	Inland	Coastal
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of one or more koalas within the last 2 years.
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.
	0 (low)	None of the above.	None of the above.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	Has forest or woodland with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	Has forest or woodland with only 1 species of known koala food tree present.
	0 (low)	None of the above.	None of the above.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	Area is part of a contiguous landscape ≥ 500 ha.
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.
	0 (low)	None of the above.	None of the above.
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	

Figure 6.1 Assessment of habitat critical to the survival of the Koala

6.5 Listed migratory species

Migratory species are protected under international agreements to which Australia are a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered MNES and are protected under the EPBC Act.

Based on EPBC protected matters area search and other desk-top database searches, 16 migratory species have been recorded or have suitable habitat within the wider locality of the study area.

The PMST retrieved a number bird species that are estuarine or freshwater wetland frequenting species and for which there is no suitable habitat within the study area. Two species of swift were also retrieved from database searches, and although these species are considered likely to occur intermittently above the study area during seasonal movements in the locality, they are unlikely to use terrestrial habitats within the study area.

If any migratory species were to occur within the study area, the site would not be classed as 'important habitat' as defined by the '*Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*' (Department of the Environment 2013) as the site did not contain:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecological significant proportion of the population of the species
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

Due to the highly disturbed vegetation and the lack of important habitat features (i.e. wetlands) that are often utilised by most migratory species, no listed migratory species were identified to have a moderate or higher likelihood of occurrence within the study area.

As such, it is unlikely that the Proposal would significantly affect any migratory species and therefore migratory species have not been considered further.

7. Impacts and Mitigation

This section contains a description of the impacts of the Proposal on biodiversity and the required mitigation measures for the Proposal.

7.1 Impacts of the Proposal

Based on the results of the field assessment, biodiversity impacts of the Proposal are relatively low, particularly with the low impacts on native vegetation. The proposed development may result in potential biodiversity impacts as follows:

- Removal of native vegetation
- Loss of hollow-bearing trees
- Potential for injury or mortality of fauna during clearing works.
- Weed dispersal

7.1.1 Removal of vegetation

The construction of the Proposal will require the removal of approximately 0.23 ha of native vegetation in the form of PCT 841. Approximately 5.72 ha of highly disturbed areas with no or limited native vegetation would also be impacted (**Table 7.1**).

Table 7.1 Vegetation communities to be impacted

Plant Community type	*Condition*	*Area in impact area (ha)*
Native vegetation		
PCT 841: Forest Red Gum grassy open forest of the coastal ranges of the NSW North Coast Bioregion	Poor	0.23
Non-native vegetation		
Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation – exotic vegetation		0.04
Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation – exotic grasslands		5.74
Total vegetation (native & non-native) impacted		**6.02**

7.1.2 Removal of hollow-bearing trees

The Proposal is likely to include the loss of 8 hollow-bearing trees and has the potential to affect native animals such as:

- hollow-nesting and canopy-nesting birds
- hollow-dependent bats
- arboreal mammals and reptiles.

7.1.3 Injury and mortality

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur. The extent of this impact would be proportionate to the extent of vegetation that is cleared. Less mobile species (e.g. ground dwelling reptiles and frogs), or those that are nocturnal and nest or roost in trees during the day (e.g. arboreal mammals and microchiropteran bat species), may find it difficult to rapidly move away from the clearing when disturbed.

Owing to the proposed vegetation to be removed being predominately disturbed habitat, the utilisation by fauna species is considered to be low. Therefore, vehicle strike during and after construction works is not likely to be significant.

7.1.4 Weed dispersal

The Proposal has the potential to further disperse weeds into nearby areas of native vegetation and adjacent properties. The greatest potential for weed dispersal and establishment associated with the Proposal would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery where these are utilised within or adjacent to retained vegetation. The clearing of native vegetation for the Proposal, including earthworks would increase the potential for weed invasion into adjacent patches of native vegetation. Management measures would be required to minimise the risk of introduction and spread of weeds. With appropriate weed management, the overall impact of weed invasion within surrounding areas is likely to decrease in the medium to long term.

GDA 1994 MGA Zone 56

LEGEND

- Lot boundary
- Cadastre
- Study area
- Existing quarry footprint
- Miscellaneous ecosystem - highly disturbed areas with no or liminted native vegetation (exotic vegetation)
- Miscellaneous ecosystem - highly disturbed areas with no or limited native vegetation (exotic grasslands)
- PCT 841 Forest Red Gum grass open forest
- Offset planting and nest box area
- Proposed quarry layout
- Hollow-bearing tree

0 100 Metres

Proposal Footprint - Illustration 7.1

Information shown is for illustrative purposes only
Drawn by: AB Checked by: TLJ Reviewed by: DGH
Source of base data: Google Earth 2021
Date: 15/10/2021

7.2 Mitigation

In order to address the impacts of the Proposal on biodiversity, the mitigation measures outlined in **Table 7.2** are prescribed.

Table 7.2 Mitigation measures

Impact / issue	*Mitigation*
Vegetation and habitat loss	■ Mark the limits of clearing and install temporary fencing around the construction footprint area prior to construction activities commencing to avoid unnecessary vegetation and habitat removal/disturbance ■ Prior to clearing commencing a suitably qualified ecologist is to undertake a pre-clearing survey to ensure no fauna are present within clearing area ■ Implement clearing protocols, including: – Marking trees to be removed and preparing an inventory of trees and hollows to be removed – Checking hollow-bearing trees for the presence of bird nests and arboreal mammals, such as possum and bats, prior to felling – Animals found to be occupying trees should be safely removed before the clearing of trees if possible and relocated into nearby woodlands.
	■ A Vegetation Management Plan (VMP) will be prepared and will incorporate the following: – Protocols and implementation scheduled of weed control and management in accordance with the *Biosecurity Act 2015* surrounding the Proposal area – Compensatory / offset planting of native trees species which will include: • A ratio of 5:1 native tree planted (a total of 50) for the removal of 10 mature *Eucalyptus spp* and *Corymbia* spp trees impacted • Compensatory/offset trees will be planted within a designated area within the Site (refer to **Illustration 7.1**) and be a combination of *Eucalyptus tereticornis, Eucalyptus siderophloia* and *Corymbia intermedia* – Replacement of hollow-bearing trees with microbat nest boxes, with a removal ratio 2 (nest boxes):1 (hollow-bearing tree removed). Nest boxes are to be designed for microbat use and positioned in mature trees within a designated area within the Site (refer to **Illustration** 7.1).
Erosion and sedimentation	■ Best practice erosion and sediment controls should be implemented in accordance with Volume 2D of Managing Urban Stormwater: soils and construction (Department of Environment and Climate Change 2008). Design temporary scour protection and energy dissipation measures to protect receiving environments from erosion.
Weeds	■ Measures must be implemented during construction to ensure the potential for the introduction of weed propagules to the site is minimised ■ Priority weeds within the study area would be managed in accordance with the *Biosecurity Act 2015.*
Rehabilitation and Landscaping	■ Landscaping and screen bunding should aim to utilise endemic native species (where possible).

8. Statutory Requirements

The following sections examine the findings of the site assessment with regard to relevant statutory requirements which require consideration for the development application.

8.1 State Environmental Planning Policy (SEPP) (Koala Habitat Protection) 2020 & 2021

State Environmental Planning Policy (Koala Habitat Protection) 2021 (Koala SEPP) commenced 17 March 2021. This Policy aims to encourage the conservation and management of areas of natural vegetation that provides habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline.

The Koala SEPP 2021 reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 Local Government Areas (LGA) in NSW. At this stage:

- In nine of these LGAs – Metropolitan Sydney (Blue Mountains, Campbell Town, Hawkesbury, Ku-Ring-Gai, Liverpool, Northern Beaches, Hornsby, Wollondilly) and the Central Coast LGA – Koala SEPP 2021 applies to all zones.
- In all other identified LGAs, Koala SEPP 2021 does not apply to land zoned RU1 Primary Production, RU2 Rural Landscape or RU3.

The site resides in Richmond Valley LGA and the land zoning is RU1 – Primary Production Land, as a result Koala SEPP 2020 applies to the site. This is an interim measure while new land management and private native forestry codes are developed. Based on the above, the following assessment has been completed.

Circular B35 (Department of Urban Affairs and Planning, 1995) underpins SEPP 44 and sets out the framework for Koala SEPP assessments over several steps as indicated in **Figure 8.1** (see below).

Is the Land 'potential Koala habitat'?

The Koala SEPP 2020 defines potential Koala habitat as "*areas of native vegetation where Schedule 2 trees constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*". With regard to potential and core Koala habitat assessment, Section 1.5 of Circular B35 states that:

- "*In relation to affected DAs it is the intention of the policy that investigations for 'potential' and 'core' koala habitats be limited to those areas which it is proposed to disturb habitat*."

On this basis, this Koala SEPP 2020 assessment pertains to the impact area on site and associated adjacent vegetation within the study area, hence allowing for disturbance during construction and operation of the Proposal. Within the study area, one Schedule 2 tree species occurs – *Eucalyptus tereticornis* (Forest Red Gum). These trees occur in the study area in isolation and constitute at least 15% of the total number of trees in the upper or lower strata of the tree component across the study area. On this basis, potential Koala habitat does occur within the impact area.

Is the Land 'core Koala habitat'?

In regard to the definition of ‘core Koala habitat’, SEPP 2020 defines potential Koala habitat as “*an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population*”.

Despite targeted surveys, including SAT surveys, nocturnal surveys and lack of direct observations, no Koalas were identified within the impact area. Although Koala’s may occur within the locality and there is possibility that individuals may intermittently occur within the impact area in order to move and access greater quality habitat in the locality, it is unlikely that the impact area is ‘core habitat’ for Koalas. Due to the impact area highly disturbed nature, lack of high-density Koala feed trees and its isolated and fragmented position in the landscape from higher quality habitats, makes it unlikely to provide habitat that is reliant on a local residential Koala population with breeding females. Furthermore, as addressed under the Koala EPBC Habitat Assessment (Section 6.4.1), it is unlikely that the impact area contains ‘critical Koala habitat’ which would be important to the recovery objectives for the species within the locality. Under this basis, the Proposal does not contain ‘core Koala habitat’ and in accordance with Circular B35, the Policy requires no further consideration.

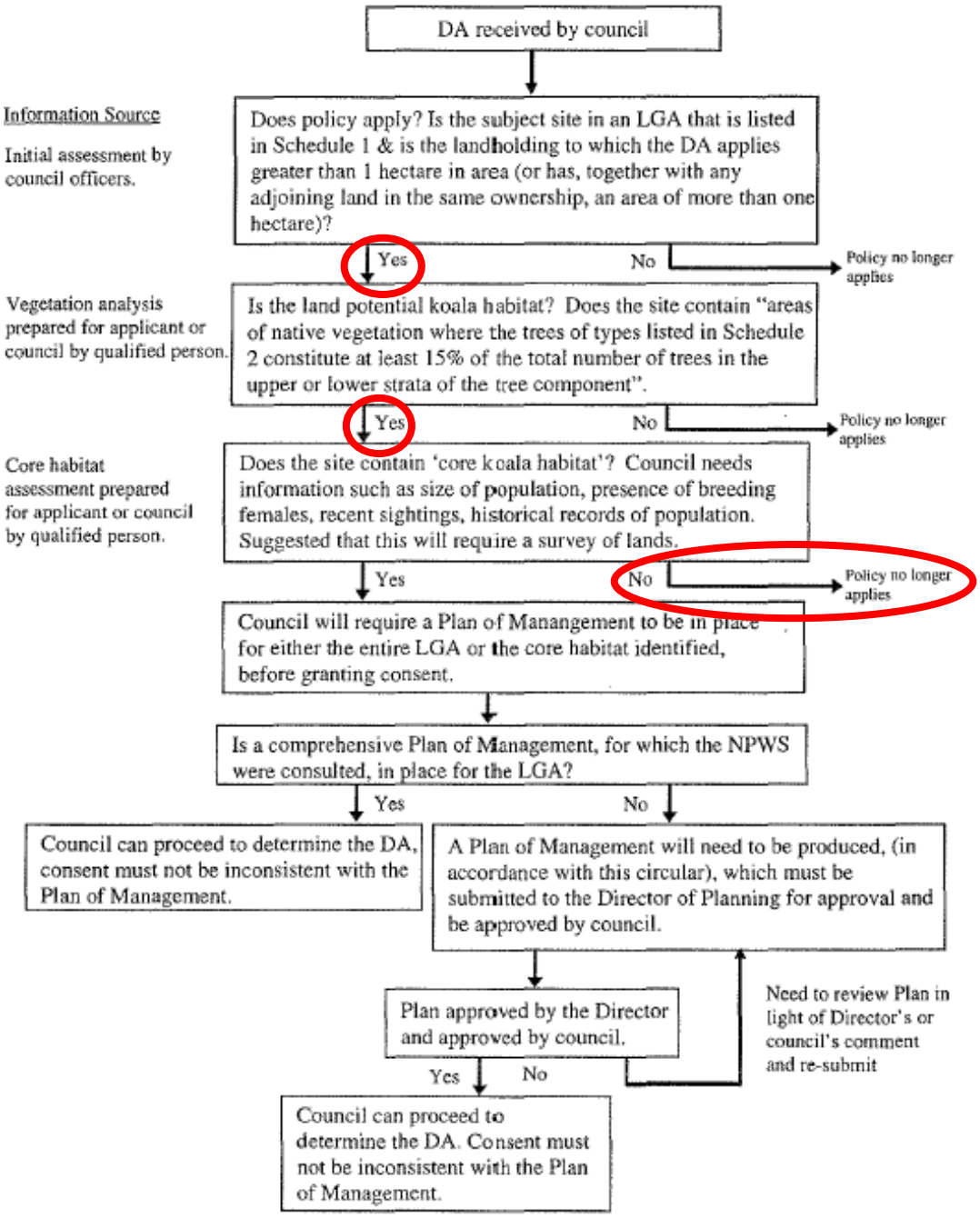


Figure 8.1 Koala SEPP 2020 Policy Guideline (as per Circular B35)

8.2 Biodiversity Conservation Act 2016 (BC Act)

The BC Act requires a test of significance (five-part test) when assessing whether an action, development or activity is likely to significantly affect threatened species, ecological communities or their habitats. As there is potential for a number of threatened fauna species to occur at the site, tests of significance have been completed (refer to **Appendix E**).

The tests of significance concluded that habitat for threatened species and communities would be unlikely to be significantly affected by the Proposal. Native vegetation loss does not exceed clearing

thresholds in the BOS in the BC Act. On this basis, development of the site (as proposed) does not require a BDAR.

8.3 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The objective of the EPBC Act is to ensure that actions likely to cause a significant impact on MNES undergo an assessment and approval process. Under the EPBC Act, a person must not take an action that has, will have or is likely to have a significant impact on any of the MNES without approval from the Australian Government Minister for the Environment (the Minister). Proposed 'actions' that have the potential to significantly impact on matters of MNES must be referred to the Australian Minister for the Environment for assessment. The purpose of the referral process is to determine whether or not a proposed action will need formal assessment and approval under the EPBC Act, and what assessment method will apply. If the Minister determines that a referred project is a 'controlled action' under the EPBC Act, the approval of the Minister would be required. MNES relevant to this report include threatened species, ecological communities and migratory species.

The EPBC Act has been considered in this assessment through:

- desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the project and hence could occur, subject to the habitats present
- field surveys for listed threatened entities including migratory species
- assessment of potential impacts on threatened and migratory species, including assessments of significance in accordance with the EPBC Act significant impact guidelines (Department of the Environment 2013) where relevant
- identification of suitable impact mitigation and environmental management measures for threatened and migratory species, where required.

This biodiversity assessment identified that the Proposal's impacts are not likely to have a significant impact on any threatened biodiversity listed under the EPBC Act. Accordingly, an EPBC Act Referral is not considered a requirement for the Proposal.

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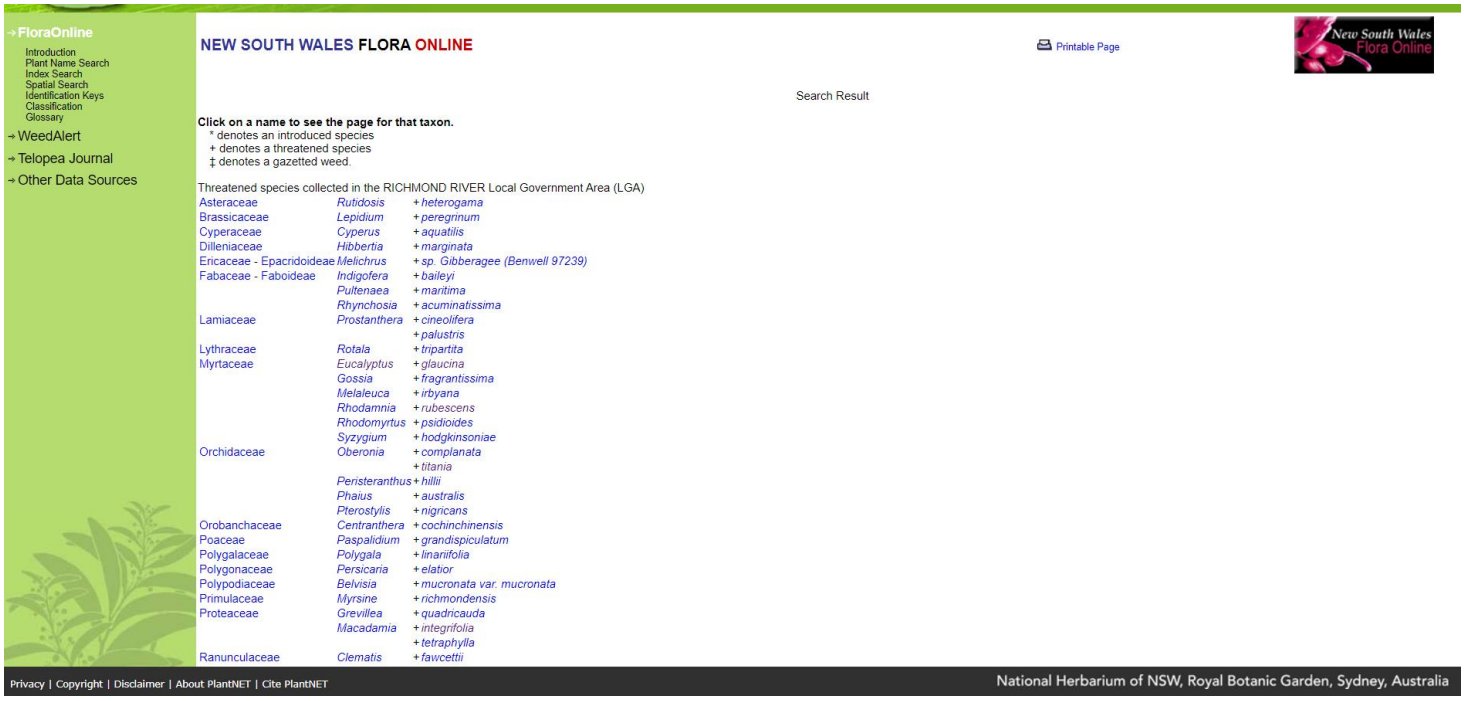
Appendix A

Database Search Results

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Search criteria : Licensed Report of all Valid Records of Threatened (listed on BC Act 2016) ,Commonwealth listed ,CAMBA listed ,JAMBA listed or ROKAMBA listed Entities in selected area [North: -28.74 West: 153.08 East: 153.18 South: -28.84] returned a total of 112 records of 16 species.
Report generated on 30/08/2021 1:56 PM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Aves	Casuariidae	0001	Dromaius novaehollandiae		Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1	
Animalia	Aves	Ciconiidae	0183	Ephippiorhynchus asiaticus		Black-necked Stork	E1,P		5	
Animalia	Aves	Jacanidae	0171	Irediparra gallinacea		Comb-crested Jacana	V,P		1	
Animalia	Aves	Cacatuidae	0265	^^Calyptorhynchus lathami		Glossy Black-Cockatoo	V,P,2		12	
Animalia	Aves	Strigidae	0248	Ninox strenua		Powerful Owl	V,P,3		2	
Animalia	Aves	Neosittidae	0549	Daphoenositta chrysoptera		Varied Sittella	V,P		3	
Animalia	Mammalia	Phascolarctidae	1162	Phascolarctos cinereus		Koala	V,P	V	37	
Animalia	Mammalia	Pseudocheiridae	1133	Petauroides volans		Greater Glider	P	V	6	
Animalia	Mammalia	Pteropodidae	1280	Pteropus poliocephalus		Grey-headed Flying-fox	V,P	V	11	
Animalia	Mammalia	Miniopteridae	1346	Miniopterus australis		Little Bent-winged Bat	V,P		1	
Animalia	Mammalia	Miniopteridae	3330	Miniopterus orianae oceanensis		Large Bent-winged Bat	V,P		1	
Plantae	Flora	Fabaceae (Caesalpinioideae)	8772	Senna acclinis		Rainforest Cassia	E1		1	
Plantae	Flora	Fabaceae (Faboideae)	2833	Desmodium acanthocladum		Thorny Pea	V	V	17	
Plantae	Flora	Myrtaceae	4283	Rhodamnia rubescens		Scrub Turpentine	E4A		11	
Plantae	Flora	Poaceae	4776	Arthraxon hispidus		Hairy Jointgrass	V	V	1	
Plantae	Flora	Ranunculaceae	5494	Clematis fawcettii		Northern Clematis	V	V	2	



Australian Government

Department of Agriculture, Water and the Environment

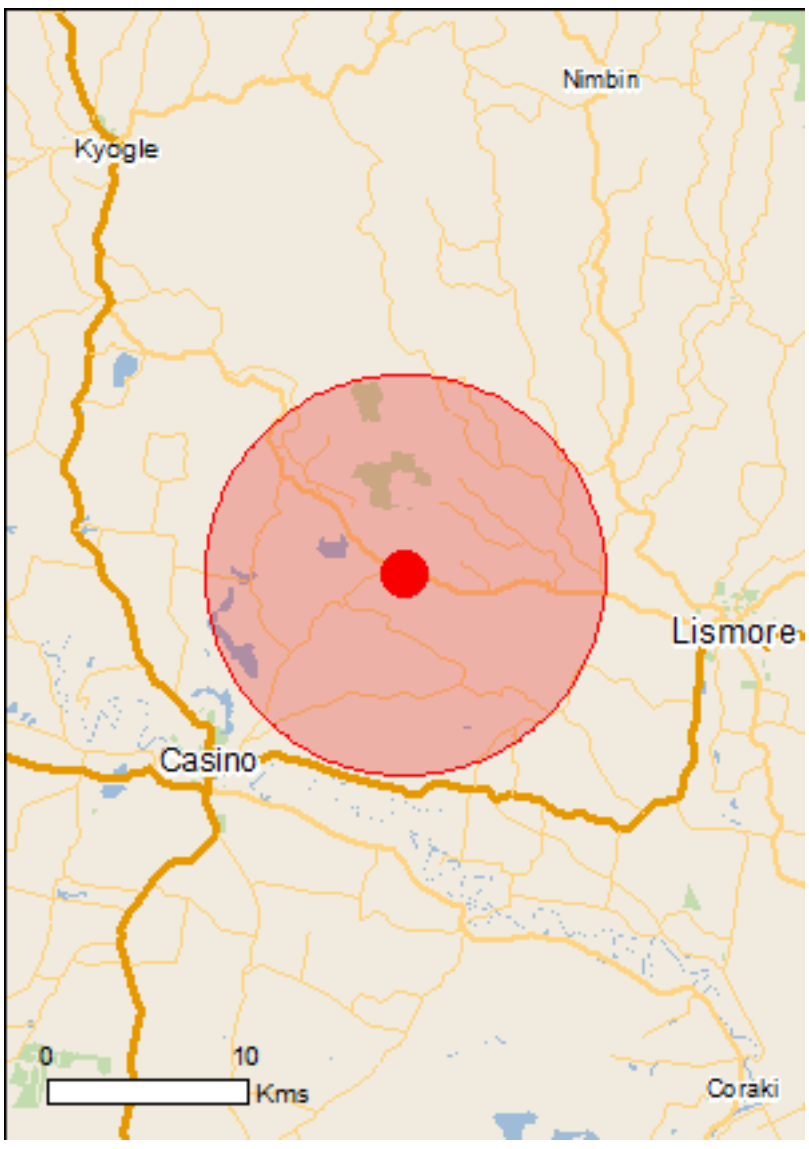
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

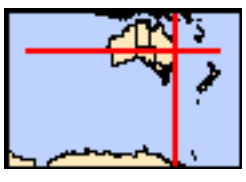
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 30/08/21 14:34:03



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	60
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	34
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Atrichornis rufescens Rufous Scrub-bird [655]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Fish		
Maccullochella ikei Clarence River Cod, Eastern Freshwater Cod [26170]	Endangered	Species or species habitat may occur within area
Frogs		
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area
Mixophyes fleayi Fleay's Frog [25960]	Endangered	Species or species habitat may occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Phyllodes imperialis smithersi Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
[Pseudomys oralis](#) Hastings River Mouse, Koontoo [98]	Endangered	Species or species habitat may occur within area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
[Arthraxon hispidus](#) Hairy-joint Grass [9338]	Vulnerable	Species or species habitat known to occur within area
[Bosistoa transversa](#) Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
[Bulbophyllum globuliforme](#) Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat may occur within area
[Clematis fawcettii](#) Stream Clematis [4311]	Vulnerable	Species or species habitat likely to occur within area
[Corchorus cunninghamii](#) Native Jute [14659]	Endangered	Species or species habitat known to occur within area
[Cryptocarya foetida](#) Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
[Cynanchum elegans](#) White-flowered Wax Plant [12533]	Endangered	Species or species habitat may occur within area
[Desmodium acanthocladum](#) Thorny Pea [17972]	Vulnerable	Species or species habitat known to occur within area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat may occur within area
[Endiandra floydii](#) Floyd's Walnut [52955]	Endangered	Species or species habitat may occur within area
[Eucalyptus glaucina](#) Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
[Floydia praealta](#) Ball Nut, Possum Nut, Big Nut, Beefwood [15762]	Vulnerable	Species or species habitat may occur within area
[Gossia fragrantissima](#) Sweet Myrtle, Small-leaved Myrtle [78867]	Endangered	Species or species habitat known to occur within area
[Lepidium peregrinum](#) Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within area
[Macadamia integrifolia](#) Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
[Macadamia tetraphylla](#) Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat may occur within area
Myrsine richmondensis Purple-leaf Muttonwood, Lismore Muttonwood [83888]	Endangered	Species or species habitat may occur within area
Owenia cepiodora Onionwood, Bog Onion, Onion Cedar [11344]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Plectranthus nitidus Nightcap Plectranthus, Silver Plectranthus [55742]	Endangered	Species or species habitat likely to occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat likely to occur within area
Sarcochilus fitzgeraldii Ravine Orchid [19131]	Vulnerable	Species or species habitat may occur within area
Sophora fraseri [8836]	Vulnerable	Species or species habitat known to occur within area
Syzygium hodgkinsoniae Smooth-bark Rose Apple, Red Lilly Pilly [3539]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Tylophora woollsii [20503]	Endangered	Species or species habitat may occur within area
Reptiles		
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Name	Threatened	Type of Presence
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bungabbee	NSW
Muckleewee Mountain	NSW
UNE Special Management Zone No1	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-28.78871 153.13329

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B

Photographs

Plate B.1 Western edge of existing quarry – facing south-east

Plate B.2 Western edge of existing quarry – facing south

Plate B.3 Western edge of existing quarry – facing west

Plate B.4 Access road into existing quarry – facing east

Plate B.5 Southern edge of existing quarry – facing west

Plate B.6 Exotic dominated grassland on southern side of existing quarry

Appendix C

Flora and Fauna Inventory

Table C.1 Flora inventory

Family	Scientific Name	Common Name	Native / Exotic	BC Act	EPBC Act
Apiaceae	*Centella asiatica*	Indian Pennywort	N		
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery	E		
Apocynaceae	*Asclepias curassavica*	Blood Flower	E		
Araliaceae	*Hydrocotyle digitata*	-	N		
Asparagaceae	*Lomandra multiflora*	Many-flowered Mat-rush	N		
Asteraceae	*Ageratina adenophora*	Crofton Weed	E		
Asteraceae	*Ageratina riparia*	Mistflower	E		
Asteraceae	*Ageratum houstonianum*	-	E		
Asteraceae	*Bidens pilosa*	Cobblers Pegs	E		
Asteraceae	*Cirsium vulgare*	Spear Thistle	E		
Asteraceae	*Geitonoplesium cymosum*	Scrambling Lily	N		
Asteraceae	*Senecio madagascariensis*	Fireweed	E		
Bignoniaceae	*Tecoma stans*	Yellow Bells	E		
Convolvulaceae	*Dichondra repens*	Kidney Weed	N		
Euphorbiaceae	*Mallotus philippensis*	Red Kamala	N		
Fabaceae	*Acacia spp.*	-	N		
Fabaceae	*Trifolium repens*	White Clover	E		
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn	N		
Moraceae	*Streblus brunonianus*	Whalebone Tree	N		
Myrtaceae	*Acmena smithii*	Lilly Pilly	N		
Myrtaceae	*Angophora subvelutina*	Broad-leaved Apple	N		
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood	N		
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	N		
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	N		
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet	E		
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	E		
Oleaceae	*Notelaea longifolia*	Large Mock-olive	N		
Passifloraceae	*Passiflora edulis*	Common Passionfruit	E		
Passifloraceae	*Passiflora suberosa*	Cork Passionflower	E		
Passifloraceae	*Passiflora subpeltata*	White Passionflower	E		

Family	Scientific Name	Common Name	Native / Exotic	BC Act	EPBC Act
Phytolaccaceae	*Phytolacca octandra*	Inkweed	E		
Poaceae	*Bothriochloa spp.*	-	N		
Poaceae	*Cenchrus clandestinus*	Kikuyu	E		
Poaceae	*Chloris spp.*	-	N		
Poaceae	*Chloris ventricosa*	Plump Windmill Grass	N		
Poaceae	*Dichanthium tenue*	Small Bluegrass	N		
Poaceae	*Echinopogon spp.*	-	N		
Poaceae	*Imperata cylindrica*	Blady Grass	N		
Poaceae	*Melinis repens*	Red Natal Grass	E		
Poaceae	*Paspalum dilatatum*	Paspalum	E		
Poaceae	*Setaria spp.*	-	N		
Poaceae	*Sporobolus africanus*	Parramatta Grass	E		
Poaceae	*Themeda triandra*	Kangaroo Grass	N		
Rhamnaceae	*Alphitonia excelsa*	Red Ash	N		
Rosaceae	*Rubus rosifolius*	Native Rasberry	N		
Sapindaceae	*Jagera pseudorhus*	Foambark	N		
Solanaceae	*Solanum chrysotrichum*	Devil's Fig	E		
Solanaceae	*Solanum mauritianum*	Wild Tobacco Bush	E		
Verbenaceae	*Lantana camara*	Lantana	E		
Verbenaceae	*Verbena bonariensis*	Purpletop	E		
Verbenaceae	*Verbena rigida*	Veined Verbena	E		

Table C.2 Fauna inventory

Scientific Name	Common Name	Native / Introduced	BC Act	EPBC Act
Amphibians (2)				
Litoria nasuta	Rocket Frog	N		
Litoria caerulea	Green Tree Frog	N		
Birds (28)				
Acridotheres tristis	Common Myna	I		
Anthus novaeseelandiae	Australasian Pitpit	N		
Cacatua galerita	Sulphur-crested Cockatoo	N		
Cacatua sanguinea	Little Corella	N		
Cincloramphus cruralis	Brown Songlark	N		
Cisticola exilis	Golden-headed Cisticola	N		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	N		
Corvus coronoides	Australian Raven	N		
Corvus orru	Torresian Crow	N		
Cracticus nigrogularis	Pied Butcherbird	N		
Dacelo novaeguineae	Laughing Kookaburra	N		
Elanus axillaris	Black-shouldered Kite	N		
Eolophus roseicapilla	Galah	N		
Falco cenchroides	Nankeen Kestrel	N		
Glossopsitta concinna	Musk Lorikeet	N		
Grallina cyanoleuca	Magpie-lark	N		
Gymnorhina tibicen	Australian Magpie	N		
Hirundo neoxena	Welcome Swallow	N		
Malurus cyaneus	Superb Fairy-wren	N		
Malurus melanocephalus	Red-backed Fairy-wren	N		
Neochmia temporalis	Red-browed Finch	N		
Ocyphaps lophotes	Crested Pigeon	N		
Pardalotus striatus	Striated Pardalote	N		
Petrochelidon nigricans	Tree Martin	N		
Rhipidura leucophrys	Willie Wagtail	N		
Sphecotheres vieilloti	Australasian Figbird	N		
Threskiornis spinicollis	Straw-necked Ibis	N		
Vanellus miles	Masked Lapwing	N		
Mammals (10)				
Austronomus australis	White-striped Mastiff Bat	N		
Bos taurus	Cow	I		
Felis catus	Cat	I		
Macropus giganteus	Eastern Grey Kangaroo	N		
Miniopterus australis	Little Bent-winged Bat	N	V	
Miniopterus orianae oceanensis	Large Bent-winged Bat	N	V	

Scientific Name	Common Name	Native / Introduced	BC Act	EPBC Act
Rhinolophus megaphyllus	Eastern Horseshoe Bat	N		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	N	V	
Vespadelus pumilus	Eastern Forest Bat	N		
Vulpes vulpes	Fox	I		
Reptiles (1)				
Cryptoblepharus virgatus	Wall Skink	N		

Appendix D

Threatened Species Potential Occurrence Assessment

Potential of Occurrence Assessment

A potential of occurrence assessment was completed to assess the likelihood of occurrence of each threatened species or population identified with the in the study area. All threatened biodiversity identified in background research were considered. The assessment is based on the habitat profile for the species and other habitat information in the Threatened Species Profile Database (Environment Energy and Science Group). The assessment also takes into consideration the dates and locations of nearby records and information about species populations in the locality.

Threatened Flora Potential Occurrence Assessment

For this proposed activity, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table D.1.

Table D.1 Potential of occurrence criteria for threatened flora species and populations

Potential of occurrence	*Criteria*
Known	The species was observed in the study area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: ■ the study area contains or forms part of a large area of high-quality suitable habitat that has not been subject to recent disturbance (e.g. fire), the species is known to form a persistent soil seedbank and the species has been recorded recently (within 10 years) in the locality ■ the species is a cryptic flowering species that has been recorded recently (within 10 years) in the locality and has a large area of high-quality potential habitat within the construction footprint that was not seasonally targeted by surveys.
Moderate	A species has a moderate likelihood of occurrence if: ■ the species: – has a large area of high-quality suitable habitat in the study area that has not been subject to recent disturbance (e.g. fire) – the species is known to form a persistent soil seedbank, but – the species has not been recorded recently (within 10 years) in the locality ■ the species: – has a small area of high-quality suitable habitat or a large area of marginal habitat in the study area That has not been subject to recent disturbance (e.g. fire) – the species is known to form a persistent soil seedbank – the species has been recorded recently (within 10 years) in the locality – the species is a cryptic flowering species, with a small area of high-quality potential habitat or a large area of marginal habitat within the Proposal footprint, that was not seasonally targeted by surveys.
Low	A species has a low likelihood of occurrence if: ■ it is not a cryptic species, nor a species known to have a persistent soil seedbank species and was not detected despite targeted searches ■ the species is a cryptic flowering species, with a small area of high-quality potential habitat or a large area of marginal habitat within the Proposal footprint, that was not seasonally targeted by surveys as the species has not been recorded within 50 years in the locality.

None	Suitable habitat is absent from the study area.

Table D.2 Threatened flora potential occurrence assessment

Scientific Name	*Common Name*	*Status*		*Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)*	*Suitability of Site Habitat*	*Potential Occurrence and need for Assessment of Significance*
		BC Act	*EPBC Act*			
Arthraxon hispidus	Hairy-joint Grass	V	V	Moist shady places in or on the edges of rainforest and wet eucalypt forest, often near creeks or swamps.	Low	No suitable habitat occurs. Not considered further.
Belvisia mucronata	Narrow-Leaf Fern	E	-	Forms small clumps on trees or rocks in dry rainforest or along creeks in moist open forest.	Low	No suitable habitat occurs. Not considered further.
Bosistoa transversa	Yellow Satinheart	V	V	Lowland subtropical rainforest up to 300 m in altitude, from Maryborough in Queensland to Nightcap Range (north of Lismore) in NSW.	Low	No suitable habitat occurs. Not considered further.
Bulbophyllum globuliforme	Hoop Pine Orchid	V	V	Found almost exclusively in the McPherson Range between NSW and Queensland, at altitudes between 300 and 600 m. It also occurs at Maleny and Noosa in south-east Queensland. Grows on Hoop Pines (*Araucaria cunninghamii*) in upland subtropical rainforest.	Low	No suitable habitat occurs. Not considered further.
Centranthera cochinchinensis	Swamp Foxglove	E	-	Occurs in northern Australia and south-east Asia and known from NSW north from Wooli. Uncommon in swampy areas and other moist sites.	Low	No suitable habitat occurs. Not considered further.
Clematis fawcettii	Northern Clematis	V	V	Found in widely dispersed areas in southern Queensland and in north-east NSW north from Lismore. Found in drier rainforest, usually near streams.	Low	No suitable habitat occurs. Not considered further.
Corchorus cunninghamii	Native Jute	E	E	Occurs from the Richmond River in north-east NSW to the Brisbane River in Queensland. In NSW populations occur at Bungabbee and Toonumbar. Occurs in ecotones between wet eucalypt forest and dry to dry-subtropical rainforest on sheltered slopes and gullies, and grassy, open forest on exposed slopes and ridges.	Low	No suitable habitat occurs. Not considered further.
Cryptocarya foetida	Stinking Cryptocarya	V	V	Coastal south-east Queensland and north-east NSW south to Iluka. Found in littoral, warm temporate and subtropical rainforest, wet sclerophyll forest and *Camphor laurel* forest usually on sandy soils, but mature trees are also known on basalt soils.	Low	No suitable habitat occurs. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Assessment of Significance
		BC Act	EPBC Act			
Cynanchum elegans	White-flowered Wax Plant	E	E	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia subsp. integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	Low	No suitable habitat occurs. Not considered further.
Cyperus aquatilis	Water Nutgrass	E	-	In NSW, known only from a few sites north from Grafton. Grows in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs, in sandstone areas.	Low	No suitable habitat occurs. Not considered further.
Desmodium acanthocladum	Thorny Pea	V	V	Occurs only in north-east NSW. It is found in the Lismore area, and there are also records from near Grafton, Coraki, Casino and the Mount Warning area. Found in dry rainforest and fringes of riverine subtropical rainforest.	Low	Records within locality, however, habitat highly disturbed and no suitable habitat occurs. Not considered further.
Dichanthium setosum	Bluegrass	-	V	In NSW, occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Low	Not identified during field assessment. More commonly known on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW. Not considered further.
Endiandra floydii	Crystal Creek Walnut	E	E	Confined to the Tweed and Brunswick Valleys and Byron Bay area of north-east NSW, and to one or two locations in south-east Queensland. Warm temperate, subtropical rainforest or wet sclerophyll forest with Brush Box overstorey, and in and Camphor Laurel forest. The species can occur in disturbed and regrowth sites.	Low	No suitable habitat occurs. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Assessment of Significance
		BC Act	EPBC Act			
Eucalyptus glaucina	Slaty Red Gum	V	V	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	Low	Not identified during field assessment. Not considered further.
Floydia praealta	Ball Nut	V	V	Small, scattered populations distributed from Gympie in Queensland to the Clarence River in north-east NSW. Riverine and subtropical rainforest, usually on soils derived from basalt.	Low	No suitable habitat occurs. Not considered further.
Gossia fragrantissima	Sweet Myrtle	E	E	Occurs in south-east Queensland and in north-east NSW south to the Richmond River. Mostly found on basalt-derived soils. Dry subtropical and riverine rainforest.	Low	No suitable habitat occurs. Not considered further.
Grevillea quadricauda	Four-tailed Grevillea	V	V	Gravelly loam in understorey of dry eucalypt forest near creeks.	Low	Not identified during field assessment. Not considered further.
Hibbertia marginata	Bordered Guinea Flower	V	V	Occurs only in north-east NSW, where it is restricted to the southern Richmond Range between Casino and Grafton. Grassy or shrubby dry open eucalypt forest at low altitudes on sandstone.	Low	Not identified during field assessment. Not considered further.
Indigofera baileyi	Bailey's Indigo	E	-	Open woodlands on loam and clay loam soils, typically from granite or basalt, but also from sediments in the Clarence lowlands.	Low	Not identified during field assessment. Not considered further.
Lepidium peregrinum	Wandering Pepper Cress	E	E	Occurs in scattered refugia in north-eastern NSW (near Tenterfield) and south-eastern Queensland. The largest site containing most of the known *Lepidium peregrinum* population is in a designated Travelling Stock Reserve. Occurs in an open riparian forest on the banks of the Tenterfield creek at Clifton.	Low	No suitable habitat occurs. Not considered further.
Macadamia integrifolia	Macadamia Nut	-	V	While specimens have been collected from the North Coast of NSW (e.g. Lismore, Gross 1995), this species is not known to occur naturally in NSW. Grows in remnant rainforest, preferring partially open areas such as rainforest edges	Low	No suitable habitat occurs. Not considered further.
Macadamia tetraphylla	Rough-shelled Bush Nut	V	V	Subtropical rainforest usually near the coast.	Low	No suitable habitat occurs. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Assessment of Significance
		BC Act	EPBC Act			
Marsdenia longiloba	Clear Milkvine	E	V	Subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	Low	No suitable habitat occurs. Not considered further.
Melaleuca irbyana	Weeping Paperbark	E	-	Found in only a few places in north-east NSW, including near Coraki, Casino and Coutts Crossing south of Grafton. Also occurs in near Ipswich in south-east Queensland. Only two populations are recorded in conservation reserves in NSW, these are Warragai Creek Nature Reserve and Bungawalbin National Park. Open eucalypt forest in poorly drained, usually clay, sandstone or alluvial soils.	Low	No suitable habitat occurs. Not considered further.
Melichrus sp. Newfoundland State Forest	Hairy Melichrus	E	E	Dry sclerophyll and eucalypt forest on sandstone where there is a well-developed shrub layer of many species.	Low	No suitable habitat occurs. Not considered further.
Myrsine richmondensis	Ripple-leaf Muttonwood	E	E	Subtropical and dry rainforest and swamp forest on creek flats and slopes on basalt derived soil.	Low	No suitable habitat occurs. Not considered further.
Oberonia complanata	Yellow-flowered King of the Fairies	V	-	Grows on trees and rocks in littoral rainforest, subtropical rainforest, dry rainforest, wet or dry eucalypt forests, dunes (including stabilised sands), stream-side areas, swampy forests and mangroves.	Low	No suitable habitat occurs. Not considered further.
Oberonia titania	Red-flowered King of the Fairies	V	-	Occurs in littoral and subtropical rainforest and paperbark swamps, but it can also occur in eucalypt-forested gorges and in mangroves.	Low	No suitable habitat occurs. Not considered further.
Owenia cepiodora	Onion Cedar	V	V	North from the Richmond River in north-east NSW extending just across the border into Queensland. Subtropical and dry rainforest on or near soils derived from basalt.	Low	No suitable habitat occurs. Not considered further.
Paspalidium grandispiculatum	-	V	V	Restricted to poor sandy soils on sandstone. It has been found in open forest of Turpentine (*Syncarpia glomulifera*) on undulating topography as well as in drier forest types on ridges.	Low	No suitable habitat occurs. Not considered further.
Peristeranthus hillii	Brown Fairy-chain Orchid	V	-	Restricted to coastal and near-coastal environments, particularly Littoral Rainforest and Lowland Rainforest on Floodplain. The species is an epiphyte, growing in clumps on tree trunks and thick vines. Flowers appear during September and October.	Low	No suitable habitat occurs. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Assessment of Significance
		BC Act	EPBC Act			
Persicaria elatior	Tall Knotweed	V	V	Damp or swampy situations and sometimes with *Melaleuca linariifolia*.	Low	No suitable habitat occurs. Not considered further.
Phaius australis	Southern Swamp Orchid	E	E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest mostly in coastal areas.	Low	No suitable habitat occurs. Not considered further.
Plectranthus nitidus	Nightcap Plectranthus	E	E	Grows on rocky cliff-faces and boulders, in the shelter and shade provided by the adjacent rainforest and dry rainforest.	Low	No suitable habitat occurs. Not considered further.
Polygala linariifolia	Native Milkwort	E	-	Sandy soils in dry eucalypt forest or woodland with sparse understorey.	Low	No suitable habitat occurs. Not considered further.
Prostanthera palustris	Swamp Mint-bush	V	V	Only known from the Jerusalem Creek area in the north of Bundjalung National Park, near Evans Head. Grows in in wet shrubland to heathland subject to extended waterlogging in poorly drained white siliceous sandy soil with a high organic content.	Low	No suitable habitat occurs. Not considered further.
Pterostylis nigricans	Dark Greenhood	V	-	Coastal heathland with Heath Banksia *(Banksia ericifolia*) and lower growing heath with lichen encrusted soil surfaces, sandy soils.	Low	No suitable habitat occurs. Not considered further.
Pultenaea maritima	Coast Headland Pea	V	-	Grasslands on exposed coastal headlands.	Low	No suitable habitat occurs. Not considered further.
Rhodamnia rubescens	Scrub Turpentine	CE	CE	Subtropical rainforests, warm temperate rainforests, littoral rainforests, and wet sclerophyll forests. It may also occur as a pioneer in adjacent areas of dry sclerophyll and grassy woodland associations.	Low	No suitable habitat occurs. Not considered further.
Rhodomyrtus psidioides	Native Guava	CE	CE	Rainforest and its margins with sclerophyll vegetation, often near creeks and drainage lines. Pioneer species in disturbed environments such as regrowth and rainforest margins.	Low	No suitable habitat occurs. Not considered further.
Rhynchosia acuminatissima	Pointed Trefoil	V	-	In or near dry rainforest dominated by Hoop Pine (*Araucaria cunninghamii*). Other associated species include Brush Box (*Lophostemon confertus*), Grey Ironbark (*Eucalyptus siderophloia*), Rough-leaved Elm (*Aphananthe philippinensis*) and Native Holly (*Alchornea ilicifolia*).	Low	No suitable habitat occurs. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Assessment of Significance
		BC Act	EPBC Act			
Rotala tripartita	-	E	-	*Rotala tripartita* is a riparian species that often grows in free-standing water with sedges. There appear to be extreme fluctuations in abundance of the species, with plants observed to germinate prolifically and establish in large numbers after substantial rainfall. Individuals disappear above-ground during dry periods and may only persist during these times in the soil seed-bank.	Low	No suitable habitat occurs. Not considered further.
Rutidosis heterogama	Heath Wrinklewort	V	V	North coast populations between Wooli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	Low	No suitable habitat occurs. Not considered further.
Sarcochilus fitzgeraldii	Ravine Orchid	V	V	North-east NSW, north of the Macleay River, to Maleny in south-east Queensland. Grows mainly on rocks, amongst organic matter, in cool, moist, shady ravines, gorges and on cliff faces in dense subtropical rainforest at altitudes between 500 and 700 m. Occasional clumps are found on the bases of fibrous-barked trees.	Low	No suitable habitat occurs. Not considered further.
Senna acclinis	Rainforest Cassia	E	-	Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows on the margins of subtropical, littoral and dry rainforests.	Low	No suitable habitat occurs. Not considered further.
Sophora fraseri	Brush Sophora	V	V	Occurs north from the Casino district in north-east NSW, where it is very rare. Also in south-east Queensland where it is widespread but not common. Usually found in wet situations in wet sclerophyll forest or vine forest, often near rainforest.	Low	No suitable habitat occurs. Not considered further.
Syzygium hodgkinsoniae	Red Lilly Pilly	V	V	A restricted range from the Richmond River in north-east NSW to Gympie in Queensland. Locally common in some parts of its range, but otherwise sparsely distributed. Usually found in riverine and subtropical rainforest on rich alluvial or basaltic soils.	Low	No suitable habitat occurs. Not considered further.
Thesium australe	Austral Toadflax	V	V	Grassland or grassy eucalypt woodland where *Themeda australis* is predominant, on grassy headlands.	Low	No suitable habitat occurs. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Assessment of Significance
		BC Act	EPBC Act			
Tylophora woollsii	Cryptic Forest Twiner	E	E	Moist eucalypt forest, moist sites in dry eucalypt forest and rainforest margins.	Low	No suitable habitat occurs. Not considered further.

V = Vulnerable; E = Endangered; CE = Critically Endangered

Threatened Fauna Potential Occurrence Assessment

For this proposed activity, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table D.3.

Table D.3 Potential of occurrence criteria for threatened fauna species and populations

Potential of occurrence	*Criteria*
Known	The species was observed in the study area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: ■ the study area contains or forms part of a large area of high-quality suitable habitat ■ important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are abundant within the study area ■ the species has been recorded recently in similar habitat in the locality ■ the study area is likely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if: ■ the study area contains or forms part of a small area of high-quality suitable habitat ■ the study area contains or forms part of a large area of marginal habitat ■ important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the study area ■ the study area is unlikely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.
Low	A species has a low likelihood of occurrence if: ■ potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. the species is considered to be locally extinct) ■ the species is considered to be a rare vagrant, likely only to visit the study area very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	Suitable habitat is absent from the study area.

Table D.4 Threatened fauna potential occurrence assessment*

***Pelagic marine species identified in the search results are not assessed as no habitat occurs at the site**

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Test of Significance
		BC Act	EPBC Act			
Amphibians						
Mixophyes balbus	Stuttering Frog	E	V	Cool rainforest, moist eucalypt forest and occasionally along creeks in dry eucalypt forest. Typically, at elevations between 200 and 1420m above sea level in their northern range.	None	No suitable habitat occurs. Not considered further.
Mixophyes fleayi	Fleay's Barred Frog	E	E	Rainforest and wet eucalypt forest of the escarpment and foothills, close to gravely streams.	None	No suitable habitat occurs. Not considered further.
Mixophyes iteratus	Giant Barred Frog	E	E	Deep, damp leaf litter in rainforests, moist eucalypt forest and near dry eucalypt forest.	None	No suitable habitat occurs. Not considered further.
Fish						
Maccullochella ikei	Eastern Freshwater Cod	E (FM Act)	E	Permanent clear rocky streams with instream cover and deep pools. Native to only the Clarence and Richmond Rivers in northern New South Wales.	None	No suitable habitat occurs. Not considered further.
Avifauna						
Anthochaera phrygia	Regent Honeyeater	CE	CE	Dry open forest and woodland with an abundance of nectar-producing eucalypts, particularly box-ironbark woodland, swamp mahogany forests, and riverine sheoak woodlands.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Atrichornis rufescens	Rufous Scrub-bird	V	E	Subtropical, warm temperate, cool temperate rainforest and moist eucalypt forest with rainforest mid-storey. Moist, densely vegetated lower levels with deep leaf litter.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Botaurus poiciloptilus	Australasian Bittern	E	E	Permanent freshwater wetlands with tall dense vegetation, particularly bullrushes and spikerushes.	None	No suitable habitat occurs. Not considered further. Not considered further.
Calidris ferruginea	Curlew Sandpiper	E	CE	Tidal mudflats, sandy ocean shores and occasionally inland freshwater or salt-lakes.	None	No suitable habitat occurs. Not considered further. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Test of Significance
		BC Act	EPBC Act			
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Sheoaks in coastal forests and woodlands, timbered watercourses, and moist and dry eucalypt forests of the coast and the Great Divide up to 1000 m.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Cyclopsitta diophthalma coxeni	Coxen's Fig-parrot	CE	E	Drier rainforests and adjacent wet eucalypt forest, wetter lowland also wetter lowland rainforests.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Daphoenositta chrysoptera	Varied Sittella	V	-	Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Dromaius novaehollandiae	Emu population in the NSW North Coast Bioregion and Port Stephens LGA	E	-	Open forest, woodland, coastal heath, coastal dunes, wetland areas, tea tree plantations and open farmland, and occasionally in littoral rainforest.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Swamps, mangroves, mudflats, dry floodplains.	None	No suitable habitat occurs. Not considered further. Not considered further.
Erythrotriorchis radiatus	Red Goshawk	CE	V	Open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water. Typically found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. Population in NSW is naturally small (probably only one pair) and lies at extreme of the natural range of the species in Australia.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Test of Significance
		BC Act	EPBC Act			
Falco hypoleucos	Grey Falcon	E	V	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	Low	No suitable habitat occurs. No BioNet records within locality. Not considered further.
Glossopsitta pusilla	Little Lorikeet	V	-	Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also sources food in *Angophora, Melaleuca* and other tree species.	**Moderate**	Potential foraging habitat in the form of blossom eucalypts. Considered further in report.
Grantiella picta	Painted Honeyeater	V	V	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	Low	Lack of preferred habitat occurs i.e. large presence of mistletoes. Not considered further. Not considered further.
Hirundapus caudacutus	White-throated Needletail	-	V	Almost exclusively aerial, occurring most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy. Breeding does not occur in Australia.	Low	May irregularly occur flying over the study area during seasonal movements. Unlikely to rely on habitat in study area. Not considered further.
Irediparra gallinacea	Comb-crested Jacana	V	-	Among vegetation floating on slow-moving rivers and permanent lagoons, swamps, lakes and dams.	None	No suitable habitat occurs. Not considered further. Not considered further.
Lathamus discolor	Swift Parrot	E	E	On mainland Australia foraging occurs where eucalypts are flowering profusely or where abundant lerp infestations occur. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta)*, Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C.gummifera*), Forest Red Gum (*E.tereticornis*), Mugga Ironbark (*E.sideroxylon*), and White Box (*E.albens*). Commonly used lerp infested trees include Inland Grey Box (*E.macrocarpa*), Grey Box (*E.moluccana*), Blackbutt (*E.pilularis*) and Yellow Box (*E.melliodora*).	Low	Lack of preferred habitat and lack of substantial blossom/lerp eucalypt woodlands within study area. May occur in locality in higher quality habitat areas. Not considered further.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Test of Significance
		BC Act	EPBC Act			
Ninox strenua	Powerful Owl	V	-	Woodland and open forest to tall moist forest and rainforest. Requires large tracts of forest or woodland habitat but may also occur in fragmented landscapes.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Numenius madagascariensis	Eastern Curlew	-	CE	Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats and sometimes saltmarsh of sheltered coasts.	None	No suitable habitat occurs. Not considered further. Not considered further.
Rostratula australis	Australian Painted Snipe	E	E	Well-vegetated shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, and open timber.	None	No suitable habitat occurs. Not considered further. Not considered further.
Turnix melanogaster	Black-breasted Button-quail	V	V	Drier rainforests and vine scrubs, often in association with Hoop Pine and a deep moist leaf litter layer.	None	No suitable habitat occurs. Not considered further. Not considered further.
Tyto novaehollandiae	Masked Owl	V	-	Dry eucalypt forest and woodlands.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitat areas. Not considered further.
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Sandstone cliffs and fertile woodland valley habitat within close proximity of each other.	Low	No suitable habitat occurs. Not considered further.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Dry and moist eucalypt forests and rainforests, fallen hollow logs, large rocky outcrops.	None	No suitable habitat occurs. Not considered further.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts in tree hollows.	**Moderate**	Potential foraging habitat present in patches of native vegetation stands with canopy cover. Considered further in report.
Miniopterus australis	Little Bent-winged Bat	V	-	Moist eucalypt forest, rainforest and dense coastal scrub.	**Recorded**	Recorded by Anabat detector.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Forest or woodland, roost in caves, old mines and stormwater channels.	**Recorded**	Recorded by Anabat detector.

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Test of Significance
		BC Act	EPBC Act			
Myotis macropus	Southern Myotis	V	-	Bodies of water, rainforest streams, large lakes, reservoirs.	Low	No suitable habitat occurs. Not considered further.
Petauroides volans	Greater Glider	-	V	Wide range of habitats including tall open woodland, eucalypt forests and low woodlands.	Low	No suitable habitat occurs. Not considered further.
Petrogale penicillata	Brush-tailed Rock Wallaby	E	V	North-facing cliffs and dry eucalypt forest and woodland, inhabiting rock crevices, caves, overhangs during the day, and foraging in grassy areas nearby at night.	Low	No suitable habitat occurs. Not considered further.
Phascolarctos cinereus	Koala	V	V	Appropriate food trees in forests and woodlands, and treed urban areas.	**Moderate**	Marginal habitat present in form small stands of native *Corymbia* and Forest Red Gum species in study area. BioNet records within close proximity to study area. Considered further in report.
Potorous tridactylus	Long-nosed Potoroo	V	V	Cool temperate rainforest, moist and dry forests, and wet heathland, inhabiting dense layers of grass, ferns, vines and shrubs.	Low	No suitable habitat occurs. Not considered further.
Pseudomys novaehollandiae	New Holland Mouse	V	V	Occurs in open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Low	No suitable habitat occurs. Not considered further.
Pseudomys oralis	Hastings River Mouse	E	E	Dry open forests with dense, low groundcover with diverse mix of ferns, grass, sedges and herbs.	Low	No suitable habitat occurs. Not considered further.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	**Moderate**	Potential foraging habitat in the form of blossom eucalypts. Considered further in report.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Forages in a variety of habitats, roosts in tree hollows and buildings.	**Recorded**	Recorded by Anabat detector.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	**Moderate**	Potential foraging habitat present in patches of native vegetation stands with canopy cover. Considered further in report.
Invertebrates						

Scientific Name	Common Name	Status		Habitat Requirement (EPBC Act SPRAT and/ or DPIE/EES Threatened Species Profiles websites)	Suitability of Site Habitat	Potential Occurrence and need for Test of Significance
		BC Act	EPBC Act			
Argynnis hyperbius	Australian Fritillary	E	CE	Open swampy coastal habitat where the caterpillar's food plant, Arrowhead Violet (*Viola betonicifolia*) occurs.	Low	No suitable habitat occurs. Not considered further.
Phyllodes imperialis southern subspecies	Pink Underwing Moth	E	E	Undisturbed subtropical rainforest below 600 m. Breeding habitat is restricted to areas where the caterpillar's food plant, a native rainforest vine, *Carronia multisepalea*, grows in a collapsed shrub-like form.	Low	Lack of preferred habitat within study area. May occur in locality in larger higher quality habitats. Not considered further.
Reptiles						
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	V	E	Rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. The Three-toed Snake-tooth Skink lives in loose soil, leaf litter and rotting logs, and feeds on earthworms and beetle grubs.	Low	No suitable habitat occurs. Not considered further.
Delma torquata	Collared Delma	-	V	Usually inhabits eucalypt dominated woodland and open forest where it is associated with suitable micro-habitats i.e. exposed rocky outcrops.	Low	Lack of preferred habitat within study area. May occur in locality in higher quality habitats. Not considered further.

V = Vulnerable; E = Endangered; CE = Critically Endangered

Appendix E

Tests of Significance

BC Act Assessments of Significance

The proposed works would be assessed under Section 5.5 of the EP&A Act. As such, Section 7.3 of the BC Act outlines the 'test of significance' that is to be undertaken to assess the likelihood of significant impact upon threatened species or ecological communities listed under the BC Act.

Assessments of significance have been completed for the following threatened species listed under the BC Act:

- Blossom Nomads (Little Lorikeet and Grey-headed Flying-fox)
- Koala
- Microbats (Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Yellow-bellied Sheathtail-bat & Greater Broad-nosed Bat)

Blossom Nomads

The Grey-headed Flying-fox (*Pteropus poliocephalus*), and Little Lorikeet (*Glossopsitta pusilla*) have been grouped for assessment owing to similarities in ecology and habitat preference. These threatened opportunistic blossom nomads loosely share similar habitat requirements; threats that affect their recovery; and potential impacts as a result of the proposed action (refer Table E 1). Under the BC Act, The Grey-headed Flying-fox and Little Lorikeet are listed as Vulnerable. Under the EPBC Act the Grey-headed Flying-fox is listed as Vulnerable.

Table E 1 Ecology of threatened blossom nomads

Common Name	*BC Act*	*EPBC Act*	*Habitat & distribution*	*Threatening processes*
Grey-headed Flying-fox	V	V	A distribution that typically extends approximately 200 km from the coast of Eastern Australia, from Rockhampton in Queensland to Adelaide in South Australia. Foraging areas include subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines, as well as from cultivated gardens and orchards. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	■ Clearing of woodlands for agriculture ■ Loss of roosting and foraging sites ■ Electrocution on powerlines, entanglement in netting and on barbed-wire ■ Heat stress ■ Conflict with humans ■ Incomplete knowledge of abundance and distribution across the species' range. ■ Climate change and reduction in resources due to drought.
Little Lorikeet	V	-	Forages in the canopy of open eucalypt forest and woodland, utilising *Eucalyptus*, *Angophora, Melaleuca* and other tree species. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year. Riparian habitats are particularly used, due to higher	■ Clearing of woodlands for agriculture ■ Loss of old hollow-bearing trees ■ Competition with the introduced Honeybee ■ Infestation of habitat by invasive weeds

			soil fertility and hence greater productivity. The species feeds mostly on nectar and pollen, but occasionally also on native fruits such as mistletoe. Nests are generally located (within hollows) in proximity to feeding areas if possible and entrances are small (three centimetres) and usually high above the ground (two to 15 metres). Nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees are often chosen, including species like *Allocasuarina*.	■ Inappropriate fire regimes ■ Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners ■ Climate change impacts including reduction in resources due to drought ■ Degradation of woodland habitat and vegetation structure due to overgrazing.

Specific Impacts

The Proposal would result in the removal of 0.23 ha of PCT 841 Forest Redgum - Pink Bloodwood open forest. The impacted vegetation comprises a relatively minor amount of potential foraging and dispersal habitat for both species in the context of the site and adjacent areas of suitable habitat. A small number of hollow bearing trees which may be utilised by the Little Lorikeet in a local context will be impacted as a result of the Proposal. No roosting habitat for Grey-headed Flying-fox would be affected.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Grey-headed Flying-fox was not recorded utilising habitat within the study area, however, recent records (BioNet) are known in the locality. This species is known to travel long distances to forage and utilise fruit and blossom resources. For this reason, the Grey-headed Flying-fox is likely to intermittently occur within the study area utilising blossoming eucalypts and fruiting trees. During field investigations no roosting camps were identified and none are known to occur in the locality. On this basis the Proposal is unlikely to have an adverse effect on the life cycle of Grey-headed Flying-fox.

The Little Lorikeet was not recorded during field assessments. However, the study area does provide potential foraging resources in the form of blossom resources. It is likely that the study area would have potential for the species to occur on a seasonal basis or intermittent basis during the occurrence of food availability. A small number (3) hollow-bearing trees, which provide small hollows (5-10cm diameter) will be impacted as a result of the Proposal. Despite some potential breeding habitat being impacted for Little Lorikeet, due to the small number of trees; the undesirable location of hollows within open paddock and the availability of higher quality habitat within the greater locality (i.e Bungabbee State Forest and Nature Reserve) it is unlikely that the impact of these trees would have adverse effect on the life cycle of for the species.

Approximately 0.23 ha of potential habitat is likely to be affected by the proposed action. Although the proposed action will represent the loss of potential foraging and breeding (hollows for Little Lorikeet) habitat, the proposed action area would only be a small component of locally occurring resources that would be accessible to these species within the greater locality. On this basis it would be highly unlikely that an adverse effect on the life cycle of the of either species would occur such that a viable local population of the species is likely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community—

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Approximately 0.23 ha of suitable habitat would be affected by the Proposal.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Habitat connectivity is not likely to be affected by the Proposal. The majority of the Proposal area occurs in a previously disturbed and highly modified landscape (agricultural land). Approximately 0.23 ha of habitat is likely to be affected by the Proposal with vegetation removal limited to removal of a small isolated disturbed patch of PCT 841. The Proposal would not significantly exacerbate fragmentation than what already exists due to historic clearing for primary production. Furthermore, given that blossom nomad species are highly mobile, the Proposal would not present a significant barrier to these species. It is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing in the study area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The habitat to be removed (0.23 ha of PCT 841) is minor in a local context where grassy woodlands occur extensively. No barriers to dispersal for any of the subject species would be created due to the Proposal. The habitat to be removed is unlikely to be of any significant importance to the subject species. In addition, these species would not only be limited to this area but to a much greater region. Owing to the small extent of potential habitat likely to be affected, the Proposal is unlikely to affect the long-term survival of these species.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The Proposal will not impact on any declared area of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to threatened blossom nomads, the proposed action is consistent with three key threatening processes under the BC Act:

- Clearing of Native Vegetation
- Loss of hollow-bearing trees (in case of Little Lorikeet only)
- Removal of dead wood and dead trees

As native vegetation clearing is required the Proposal would incrementally contribute to clearing of native vegetation. This also applies to loss of hollow-bearing trees and removal of dead wood and

dead trees (three hollow-bearing trees). Given the proposed extent of clearing and the large extent of native vegetation in the greater locality, impacts are unlikely to be significant. The degree that the Proposal would contribute to any threatening process is not considered likely to place the local population of any of the mentioned species at significant risk of extinction.

Conclusion

The extent of native vegetation clearing and habitat removal associated with the proposed action is small (0.23 ha) in terms of the available habitat for these species within the surrounding landscape. Although the loss of foraging habitat for blossom nomads is considered to be an incremental loss of potential habitat locally, the proposed action is not likely to have a significant impact upon these species that might lead to their extinction locally.

Koala

The Koala was not recorded in the study area during the field assessment informing this report, however, recent (<5yrs) records for this species were returned from the BioNet (Department of Planning Industry and Environment, 2021). In addition, whilst the study area is predominately disturbed, presence of isolated *Eucalyptus tereticornis* trees occurred within the study area. *Eucalyptus tereticornis* is listed as a Schedule 2 Koala food tree species for the species. Due recent records of the species within the locality and as a precautionary measure an Assessment of Significance was undertaken.

Habitat and Ecology

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales it mainly occurs on the central and north coasts, with populations on the western side of the Great Dividing Range.

Habitat consists of eucalypt woodlands and forests, in which the Koala feeds on more than 70 eucalypt species and 30 non-eucalypt species. Preferred browse species are different across regions. Koalas are inactive for most of the day and do most of their feeding and moving during the night. Although predominantly arboreal, Koalas would descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size.

Threatening processes for this species include:

- Loss, modification and fragmentation of habitat
- Predation by feral and domestic dogs
- Intense fires that scorch or kill the tree canopy
- Road-kills
- Climate change and reduction in resources due to drought.

Specific Impacts

The Proposal would result in the removal of 0.23 ha of PCT 841 Forest Redgum - Pink Bloodwood open forest. Whilst the study area is predominately disturbed, presence of *Eucalyptus tereticornis* occurred within the study area. *Eucalyptus tereticornis* is listed as a Schedule 2 Koala food tree species for the species. *Eucalyptus tereticornis* occur as isolated paddock trees within the study area, the removal of these trees represents a minor reduction of potential foraging and temporary refuge habitat which may be utilised by Koalas in the locality on an opportunistic basis. The Proposal would not result in barriers to Koala movement nor significantly increase the likelihood of vehicle strike to Koalas in the locality.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Koala was not recorded in the study area during the field assessment informing this report, however, records for this species occur within the locality of the study area. Whilst the study area is predominately disturbed, small patches of PCT 841 Forest Redgum - Pink Bloodwood open forest with presence of *Eucalyptus tereticornis* occurred. *Eucalyptus tereticornis* is listed as a Schedule 2 Koala food tree species. The Proposal would impact on approximately 0.23 ha of habitat in the form of PCT 841 (poor and isolated trees condition). Any population of Koala potentially using the study area are likely to be part of a viable population extending throughout the locality and are likely to be present in other parts of the locality. The proportional impact to this potential habitat is very small and would constitute <1% of available habitat for the species. Due to the Proposal occurring within disturbed agricultural pastureland, it is considered unlikely that local population of Koala would be restricted to the study area and the Proposal is not likely to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community—

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

It is estimated that Proposal would impact on approximately 0.23 ha of potential habitat for the Koala in the form of PCT 841 Forest Redgum - Pink Bloodwood open forest (poor condition and isolated trees).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Habitat within the study area is already fragmented at a local scale by the agricultural and primary production. Landscape scale fragmentation is unlikely to occur from the Proposal as the work would involve removing vegetation from small, isolated patches rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the Proposal would not result in the breaking apart of large blocks of high-quality habitats. No further habitat fragmentation on a landscape scale would occur because of the Proposal. Loss of small amount of potential habitat is likely to increase by a small extent.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The habitat in the study area is not likely to be important to the long-term survival of the Koala. The study area does not occur in a mapped 'Area of Regional Koala Significance'. Potential habitat recorded in the study area is not considered important to the long-term survival of the species, with the Proposal likely to impact approximately 0.23 ha of poor condition habitat in an existing highly disturbed agricultural landscape. Although the loss of native vegetation would be an incremental loss of local

habitat, the quality and importance are not considered to be significant to the long-term survival of any local population of Koala.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The Proposal will not impact on any declared area of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A KTP is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. With respect to the Koala, the Proposal is consistent with one KTP; being clearing of native vegetation. The extent of native vegetation clearing and habitat removal associated with the Proposal is relatively small in terms of the available habitat for these species within the Proposal locality.

Conclusion

In summary, the Proposal is considered unlikely to result in a significant effect on the Koala. Whilst approximately 0.23 ha of potential habitat will be impact, Koalas using the study area are likely to use habitat that extends through the locality and due to the small extent of impact expected within an existing disturbed area, it is considered unlikely that local population of Koala would be restricted to the study area. Given the extent of potentially suitable habitat that exists in the locality and the very small proportional impact likely to occur from the Proposal, any impacts to the Koala are unlikely to be significant.

Threatened Microbats

Threatened microchiropteran bat species have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the proposed action. Threatened microchiropteran bats considered for this impact assessment are:

- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Shealthtail-bat (*Saccolaimus flaviventris*)

These species have been assessed as a guild because of their similarity in habitat usage and habits, which are described in Table E 2.

Table E 2 Ecology of threatened microbats

Common Name	*BC Act*	*EPBC Act*	*Habitat & distribution*	*Threats*
Eastern Freetail-bat	V	-	Thought to live in Sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge	■ Loss of hollow-bearing trees ■ Loss of foraging habitat ■ Application of pesticides in or adjacent to foraging areas ■ Artificial light sources spilling onto foraging and/or roosting habitat ■ Large scale wildfire or hazard reduction burns on foraging and/or roosting habitat.

Common Name	BC Act	EPBC Act	Habitat & distribution	Threats
				■ Climate change and reduction in resources due to drought.
Little Bent-winged Bat	V	-	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	■ Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic. ■ Destruction of caves that provide seasonal or potential roosting sites. ■ Changes to habitat, especially surrounding maternity/nursery caves and winter roosts. ■ Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals. ■ Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges. ■ Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges ■ Introduction of exotic pathogens such as the White-nosed fungus. ■ Hazard reduction and wildfire fires during the breeding season. ■ Large scale wildfire or hazard reduction can impact on foraging resources. ■ Poor knowledge of reproductive success and population dynamics.
Large Bent-winged Bat	V	-	Hunt in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	■ Disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding. ■ Loss of high productivity foraging habitat. ■ Introduction of exotic pathogens, particularly white-nose fungus. ■ Cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances. ■ Hazard reduction and wildfire fires during the breeding season. ■ Predation by feral cats.
Greater Broad-nosed Bat	V	-	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically, it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings	■ Disturbance to roosting and summer breeding sites ■ Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions ■ Loss of hollow-bearing trees ■ Pesticides and herbicides may reduce the availability of insects or result in the accumulation of toxic residues in individuals' fat stores ■ Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

Common Name	BC Act	EPBC Act	Habitat & distribution	Threats
				■ Climate change and reduction in resources due to drought.
Yellow-bellied Shealthtail Bat	V	-	Yellow-bellied Sheathtail Bats are wide ranging in distribution and habitat type preferences. They forage high and fast through the canopy in taller forest types, flying lower through the strata in shorter forest types. They feed on insects and are nocturnally active. Typically, they roost in groups of 1 – 6 individuals in tree hollows and buildings. In treeless areas they have been recorded roosting in mammal burrows.	■ Disturbance to roosting and summer breeding sites. ■ Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions. ■ Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat. ■ Pesticides and herbicides may reduce the availability of insects or result in the accumulation of toxic residues in individuals' fat stores. ■ Climate change and reduction in resources due to drought.

Specific Impacts

The Proposal would result in the removal of 0.23 ha of PCT 841 - Forest Redgum - Pink Bloodwood open forest. The impacted vegetation comprises a relatively minor amount of potential foraging and dispersal habitat for threatened microbats in the context of the site and adjacent areas of suitable habitat. In addition to vegetation to be cleared, approximately 8 hollow-bearing trees are expected to be impacted by the Proposal. In regards to Bent-wing bats, no maternity caves or significant roosting habitat will be impact. Habitat to be impacted provides foraging, potential roosting and breeding resources for these species.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The study area contains native vegetation communities that occur as a small patches or isolated trees within open agricultural pastureland. Approximately 0.23 ha of vegetation to be impacted provides foraging and roosting for microchiropteran bats, 8 hollow-bearing trees will be removed as part of the Proposal and avoidance has been made where possible.

Whilst 0.23 ha of foraging and potential roosting habitat may be removed as part of the Proposal, an abundance of similar or high-quality roosting opportunities occur in the wider locality. The removal of 0.23 ha would represent <1% of available habitat for these species. In addition, the removal of 8 hollow-bearing trees is likely to constitute only a small amount of breeding habitat for these species.

While vegetation to be removed represents foraging opportunities for microchiropteran bats, it is considered unlikely that the removal of this vegetation will significantly affect locally occurring microchiropteran bat populations, due to the small scale of the study area and the availability of similar and higher quality habitat adjacent to the study area and in the wider locality.

The action proposed is unlikely to have an adverse effect on the life cycle of hollow-dwelling microchiropteran bats to the point that these species are likely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community—

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Approximately 8 hollow-bearing trees and 0.23 ha of native vegetation representing potential habitat for these species is likely to be affected by the proposed action.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Habitat connectivity is not likely to be affected by the Proposal. The majority of the study area occurs on previously disturbed land associated with agricultural pastureland. Approximately 0.23 ha of native vegetation is likely to be affected in the study area and vegetation removal will be largely limited to previously disturbed areas. Consequently, it is considered unlikely that the proposed action would significantly isolate or fragment potential habitat beyond which currently exists within the study area. As the Proposal will result in disturbance to disturbed agricultural pastureland, and given the species high mobility, the proposed action is unlikely to represent significant increases to habitat isolation and or fragmentation.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

A relatively small area of potential foraging and roosting habitat (0.23 ha & 8 hollow-bearing trees) will be affected by the proposed action. The Proposal would not impact habitat considered critical (i.e. large maternity roosting areas) to the long-term survival of populations in the locality and is unlikely to further create a barrier to movement for these species.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The Proposal will not impact on any declared area of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to microchiropteran bats, the Proposal is consistent with three key threatening processes under the BC Act:

- clearing of native vegetation
- loss of hollow-bearing trees (hollow-dependant microbats0
- removal of dead wood and trees.

The extent of native vegetation clearing and habitat removal associated with the Proposal is considered relatively small, 0.23 ha of marginal and fragmented habitat. Although the Proposal will represent the loss of potential foraging and roosting habitat (approximately 8 hollow-bearing trees),

such habitat would only be a small component of locally occurring resources accessible to these species (<1% of available in 10 kms of the study area).

Conclusion

Approximately 0.23 ha potential habitat in the form of PCT 841 containing hollow-bearing trees (8), which may be used by these species for foraging and roosting purposes. Habitat to be impacted occurs as disturbed land associated with agricultural pastureland. The Proposal will not increase fragmentation, and given the high mobility of assessed species, the Proposal is unlikely to represent significant increases to habitat isolation and or fragmentation to these species. The habitat is not considered critical habitat to long term survival of these species within the locality. Given this, the Proposal is considered unlikely to lead to a significant impact on these species their habitat.

EPBC Significance Assessments

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). These significance assessments have been prepared for the following community and threatened species:

- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Koala (*Phascolarctos cinereus)*

Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus)* is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1. Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

Is this part of an important population:

Grey-headed Flying-foxes occur across a range of wooded habitats where their favoured food, eucalypt blossom occurs. They set up roosting camps in association with blossom availability, which are usually situated in dense vegetation and associated with water. Grey-headed Flying-foxes can migrate up to 75 km north during the winter and during this time young flying-foxes establish camps.

With reference to DoEE's National Flying-fox monitoring viewer, there are no recorded Flying-fox camps within the study area (DoEE 2021). The closest significant recorded camps in relation to the study area include:

- Lismore (Rotary Park camp #255) - about 15km to the east of the study area, according to the National Flying Fox monitoring viewer this camp includes 2500+ individuals in 2020
- Casino (camp #26) - about 12km to the south-west of the study area, according to the National Flying Fox monitoring viewer this camp includes between 10,000+ individuals from surveys in 2019

Occurrences of this species within the study area are not at the limits of the species' distribution, nor are any maternity camps present in the study area, and as such the habitat within the study area can only be considered to represent a part of the foraging range of widely occurring individuals. However, the Grey-headed Flying-fox has no separate or distinct populations (DoE 2014a). The species constantly exchanges genetic information between camps throughout its geographic range. Therefore, the species occurs as one population and therefore any individuals that occur in the study area would be considered to form part of 'an important population'.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

- **Lead to a long-term decrease in the size of an important population of a species**

The proposal would impact about 0.23 ha of potential foraging habitat in the form of PCT 841 poor condition classes. Due to the nomadic nature of Grey-headed Flying-fox and their ability to forage up to 50 km from roost sites, the Grey-headed Flying-fox would not be restricted to habitat in the study area. Grey-headed Flying-fox are likely to be present in other parts of the locality as there is a large amount of potentially suitable habitat in the form of PCT841 mapped as occurring in the locality.

Although the proposal will add incrementally to the loss of a small amount (0.23 ha) of potential foraging habitat in the locality, the proportional impact is very small. Therefore, the proposal is not likely to lead to a long-term decrease in the size of the Grey-headed Flying-fox population.

- **Reduce the area of occupancy of an important population**

The project would result in the removal of up to 0.23 ha of potential foraging habitat in the form of PCT 841 poor condition classes. The removal of 0.23 ha of vegetation, that contains varying sources of blossom and fruit trees that form part of the Grey-headed flying fox diet, does not comprises a significant proportion of foraging habitat available to the species in the surrounding locality. The removal of this 0.23 ha of potential foraging habitat would have a minimal impact on the area of occupancy of the species.

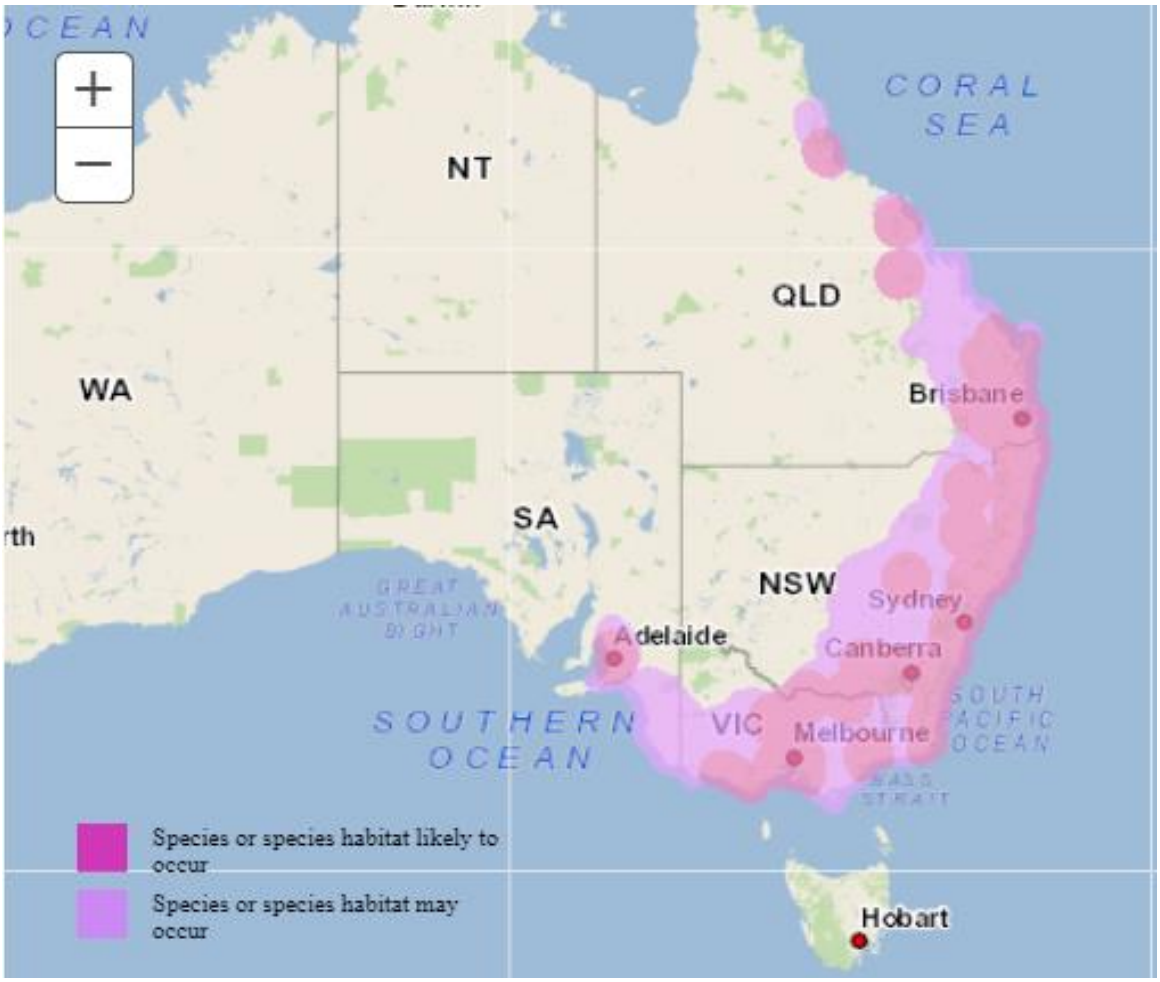


Figure E.1 Distribution map for Grey-headed Flying-fox (Department of the Environment, 2021)

- **Fragment an existing important population into two or more populations**

Habitat connectivity is not likely to be affected by the Proposal. The majority of the study area occurs within disturbed land (agriculture / pastureland). About 0.23 ha of potential foraging habitat is likely to be affected by the Proposal with vegetation removal largely limited removal of isolated paddock trees. As the study area is disturbed in nature and doesn't disturb significant vegetation, the Proposal would not further fragment or isolate any previously undisturbed patches of habitat than what already exists in the study area and locality. Furthermore, given that the Grey-headed Flying-fox is highly mobile and nomadic, the Proposal would not present a significant barrier. It is not considered likely that habitat

would become further isolated or fragmented significantly beyond that currently existing in the study area.

- **Adversely affect habitat critical to the survival of a species**

The foraging habitat within the study area meets the DECCW (2009) criteria for habitat critical for the survival of Grey-headed Flying-fox due to its proximity to existing camps (within 50km) but removal of 0.23 ha of isolated paddock trees of poor condition PCT 841 foraging habitat is unlikely to significantly impact on this species, given the abundance of higher quality myrtaceous foraging habitat within the greater locality.

- **Disrupt the breeding cycle of an important population**

No roost sites/camps occur within the study area nor would the proposed action affect any roosts/camps in the locality. Therefore, it is unlikely that the proposed action would disrupt the breeding cycle of the population of Grey-headed Flying-fox.

- **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

No. The action proposed would only affect about 0.23 ha of potential foraging habitat for this species. As this species is known to forage up to 50 km from roost sites, the action proposed is unlikely to significantly affect the availability of quality habitat for this species.

- **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

It is not likely that invasive species (such as introduced predators) that are harmful to the Grey-headed Flying-fox would become further established as a result of the proposed action.

- **Introduce disease that may cause the species to decline**

No. There are no known diseases that are likely to increase in the area as a result of the proposed action.

Australian flying-foxes, including the Grey-headed Flying-fox, are natural reservoirs for at least three diseases- Australian Bat Lyssavirus (ABL), Hendra virus and Menangle virus. While injured and orphaned Grey-headed Flying-foxes have a higher chance of testing positive for ABL, it is unlikely the proposed action will introduce this disease.

White-nosed syndrome, a fungal disease causing widespread concern due to its impact upon bat populations in North America, has only been identified in microbats. The disease has not been identified in Australia.

- **Interfere substantially with the recovery of the species**

Due to the relatively small foraging habitat likely to be affect by the proposed action (about 0.23 ha) and as no roost camps are located in the study area, the proposed action is not likely to interfere with the recovery of this species.

Conclusion

The Grey-headed Flying-fox frequents habitats that contain eucalypt blossom and native fruits such as figs, which are their favoured foods. The study area contains eucalypt species, these include those that are utilised by this species for blossom resources. A relatively small amount of foraging habitat 0.23 ha will be affected by the proposed action, although this is unlikely to be significant to local

populations, due to the abundance of similar and greater quality foraging habitat elsewhere within the study area and in the wider locality. There are no Grey-headed Flying-fox camps within the study area.

The proposed action is not considered to fragment any locally occurring populations, disrupt their breeding cycles, introduce disease that may cause the species to decline or interfere with the recovery of the species. The proposed action therefore considered unlikely to have a significant impact on the Grey-headed Flying-Fox.

Koala

The Koala (*Phascolarctos cinereus)* is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1. Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

Is this part of an important population?

North-eastern NSW is often held to be the stronghold of Koalas in NSW. The site occurs within 5-10km of Lismore and adjacent to the mapped Areas of Regional Koala Significance (ARKS), as such it is likely that any individuals which may occur within the study area form part of the north-eastern NSW important population. Individuals from these areas are likely to be important for breeding and dispersal and necessary for maintaining genetic diversity. Therefore, any individuals which may occur within the study area are likely to be part of an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

- **Lead to a long-term decrease in the size of an important population of a species**

The Koala was not recorded in the study area during the field assessment informing this report, however, records for this species occur within the locality of the study area. Whilst the study area is predominately disturbed, small patches of PCT 841 Forest Redgum - Pink Bloodwood open forest with presence of *Eucalyptus tereticornis* occurred. *Eucalyptus tereticornis* is listed as a Koala SEPP 2020 Schedule 2 Koala food tree species. The Proposal would impact on approximately 0.23 ha of habitat in the form of PCT 841 (poor condition and isolated trees). Any population of Koala potentially using the study area are likely to be part of a viable population extending throughout the locality and are likely to be present in other parts of the locality. The proportional impact to this potential habitat is very small and would constitute <1% of available habitat for the species. Due to the Proposal occurring within disturbed agricultural pastureland, it is considered unlikely that local population of Koala would be restricted to the study area. It is unlikely that the impact of 0.23 ha would lead to a long-term decrease in the size of the important population for Koala.

- **Reduce the area of occupancy of an important population**

The Proposal would impact on approximately 0.23 ha of habitat in the form of PCT 841 (poor condition and isolated trees). The proportional impact to this potential habitat is very small and would constitute <1% of available habitat for the species. Due to the Proposal occurring within disturbed agricultural pastureland, it is considered unlikely that local population of Koala would be restricted to the study area. It is unlikely that the impact of 0.23 ha of habitat would result in significant reduction in area of occupancy for the population.

- **Fragment an existing important population into two or more populations**

Habitat within the study area is already fragmented at a local scale by the agricultural and primary production. Landscape scale fragmentation is unlikely to occur from the Proposal as the work would involve removing vegetation from small, isolated patches rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the Proposal would not result in the breaking apart of large blocks of high-quality habitats. No further habitat fragmentation on a landscape scale would occur because of the Proposal. Loss of small amount of potential habitat is likely to increase by a small extent. It is unlikely that the Proposal would fragment the existing population into two or more populations.

- **Adversely affect habitat critical to the survival of a species**

No critical habitat is listed for the Koala under the EPBC Act. However, the Koala Habitat Assessment Tool within the '*EPBC Act referral guidelines for the vulnerable Koala'* was used to determine whether Koala habitat in the study area classifies as '*habitat critical to the survival of the Koala'* (Figure 6.1). To be classified as habitat critical to the survival of the Koala vegetation must score 5 or above using the habitat assessment tool. A summary of the key assessment criteria and scoring for the study area against the referral guidelines is provided in Table 6.2 and illustrated in **Figure 6.1** of the main report body.

Koala habitat in the study area scored 3 out of 10 (Table 6.2) using the Koala Habitat Assessment Tool. Therefore, habitat in the study area is not likely to constitute habitat critical to the survival of the species. A comparison of the Proposal's potential impacts was assessed against Figure 2 of the '*EPBC Act referral guidelines for the vulnerable Koala'* (Department of the Environment, 2014) to determine where impacts were likely to be adverse. As illustrated in **Figure 6.1**, it was concluded that the Proposal is unlikely to have an adverse impact on the habitat critical for the species due to the following:

- Study area does not occur in an '*Area of Regional Koala Significance*'(Department of Environment and Energy, 2021)
- The study area is disturbed and fragmentation, with large expanses of habitat cleared in the Proposal locality for agricultural land use, effectively isolating the study area from large habitat remnants
- The Proposal will not fragment or impact habitat that is important to the recovery objectives for the species within the locality.
- the Proposal is likely to impact relatively small area (0.23 ha) of potential Koala habitat.

It is unlikely that the impact of 0.23 ha of potential habitat for Koala in the study area will adversely affect the survival of the important local Koala population.

- **Disrupt the breeding cycle of an important population**

Due to the Proposal occurring within disturbed agricultural pastureland, it is considered unlikely that local population of Koala would be restricted to the study area. Habitat within the study area is already fragmented at a local scale by the agricultural and primary production. The impact of XX ha of potential Koala habitat is unlikely to exacerbate movement or significantly reduce area of occupancy of breeding individuals for the population. It is unlikely the Proposal would significantly disrupt the breeding cycle of the population of Koalas.

- **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The habitat in the study area is not likely to be important to the long-term survival of the Koala. The study area does not occur in a mapped 'Area of Regional Koala Significance'. Potential habitat recorded in the study area is not considered important to the long-term survival of the species, with the

Proposal likely to impact approximately 0.23 ha of poor condition habitat in an existing highly disturbed agricultural landscape. Although the loss of native vegetation would be an incremental loss of local habitat, the quality and importance are not considered to be significant to the long-term survival of the population of Koala. While a small amount potential marginal foraging habitat would be impacted, it is unlikely to be of an extent that would cause this species to decline.

- **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

It is unlikely that invasive species (such as introduced predators) that are harmful to the Koala would become further established as a result of the Proposal.

- **Introduce disease that may cause the species to decline**

It is unlikely that the Proposal would significantly fragment a koala population to the point where dispersal is limited and therefore disease transmission between individuals is increased. As *Chlamydia* bacteria in Koalas and Koala Retrovirus is primarily transmitted between Koala individuals (DECC, 2008), it is unlikely that the Proposal would introduce disease that may cause the species to decline.

- **Interfere substantially with the recovery of the species**

A recovery plan for the Koala has not been prepared under the EPBC Act.

The Proposal would not significantly interfere with the Saving Our Species recovery strategies or Approved NSW Recovery Plan (DECC, 2008). The study area does not occur within any priority management or koala management areas for the species (OEH, 2021). As a result the proposed action is unlikely to adversely interfere with the recovery of this species.

Conclusion

The Proposal is considered unlikely to result in a significant effect on the Koala. Whilst approximately 0.23 ha of potential habitat will be impact, Koalas using the study area are likely to use habitat that extends through the locality and due to the small extent of impact expected within an existing disturbed area, it is considered unlikely that local population of Koala would be restricted to the study area. Given the extent of potentially suitable habitat that exists in the locality and the very small proportional impact likely to occur from the Proposal, any impacts to the Koala are unlikely to be significant.

Appendix F

Anabat call analysis

Microbat Call Identification Report

Prepared for ("Client"):	GeoLINK
Survey location/project name:	1465 Bentley Road, Bentley, NSW
Survey dates:	9-12 September 2021
Client project reference:	
Job no.:	GEO-2102
Report date:	7 October 2021

Methods

Data received & post processing

Balance Environmental received one data.dat file, containing bat-call data recorded with an Anabat SD1 detector. Zero-crossing analysis bat-call sequence files (ZC files) were extracted from the data.dat file using CFCread Version 4.6c (Corben 2018).

Call analysis and species identification

All ZC files were processed manually in *Anabat Insight* (version 2.0.0; Titley Scientific, Brisbane). Bat calls were identified by reviewing call spectrograms and derived metrics and comparing them with regionally relevant reference calls and published call descriptions (Reinhold *et al.* 2001; Pennay *et al.* 2004).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at http://www.ausbats.org.au/.

Species nomenclature follows Armstrong *et al.* (2020).

Results & Discussion

The detector status file, generated during the data conversion process, indicates the detector was activated on 9th September and remained on until 17th September; however, a continuous series of "power down" and "restart" log entries commencing early on the evening of 11th September suggests the battery was flat. Consequently, the detector ceased recording after it detected a single call at 6:02 PM the night of 11th September.

Forty-four of the 157 ZC sequence files extracted from the data.dat file contained only non-bat background noise. The other 113 files contained 114 identifiable bat calls, 78 of which were positively identified to six distinct species (**Table 1** upper section).

The other 36 calls represented at least two additional species but could not be reliably identified (see lower portion of **Table 1**). It is likely the majority of these calls belonged to *Chalinolobus gouldii*, but their characteristics were intermediate between that species and *Ozimops ridei*. Four very brief calls, with weak, steep linear pulses could have been made by *Myotis macropus* or one of the *Nyctophilus* species, three of which (*N. bifax, N. geoffroyi, N. gouldi*) potentially occur in the study area.

Sample call spectrograms of all recorded call types are shown in **Appendix 1**.

Table 1 Bats recorded at the Bentley site, 9-11 September 2021.
Number of calls identified per species per night

Night:	9/09/2021	10/09/2021	11/09/2021	Species Total
Positively identified calls				
Austronomus australis	1	1		2
Miniopterus australis	20	21		41
Miniopterus orianae	16	16		32
Rhinolophus megaphyllus		1		1
Saccolaimus flaviventris	1			1
Vespadelus pumilus		1		1
Unresolved calls				
Chalinolobus gouldii or *Ozimops ridei*	22	9	1	32
Nyctophilus sp. or *Myotis macropus*	2	2		4
Detector-night Total	62	51	1	114

References

Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera. Australasian Bat Society. Version 2020-06-09. URL: http://ausbats.org.au/species-list/4593775065

Churchill, S. (2008). Australian Bats. Jacana Books, Allen & Unwin; Sydney.

Corben, C. (2018). *CFCread Storage ZCAIM interface*. Version 4.6c, 20 June 2018.

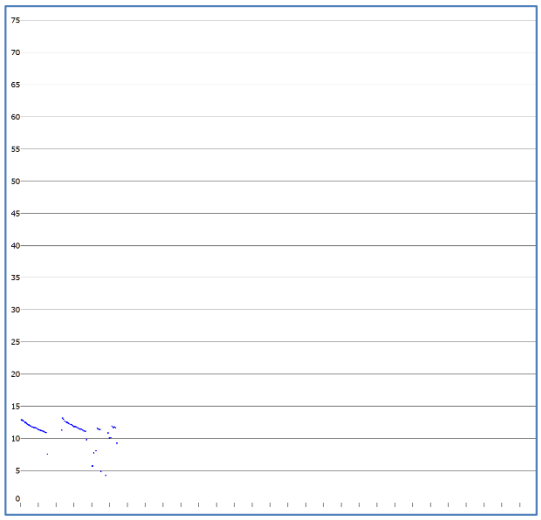
Pennay, M., Law, B., and Reinhold, L. (2004). Bat calls of New South Wales: Region based guide to echolocation calls of Microchiropteran bats. NSW Department of Environment and Conservation, Hurstville.

Reardon, T. (2003). Standards in bat detector based surveys. Australasian Bat Society Newsletter 20, 41-43.

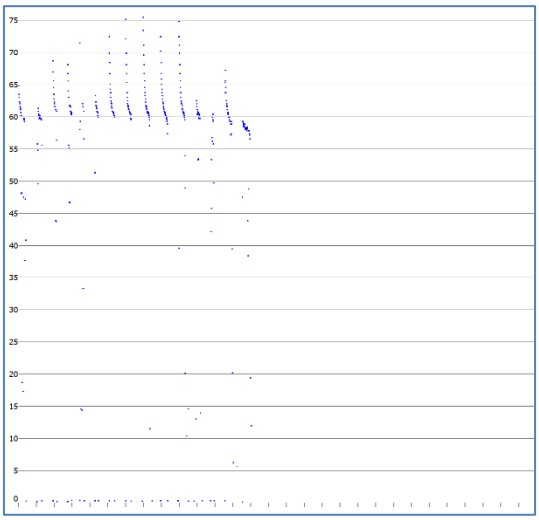
Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). Key to the bat calls of south-east Queensland and north-east New South Wales. Department of Natural Resources and Mines, Brisbane.

van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). Field Companion to the Mammals of Australia. New Holland; Sydney.

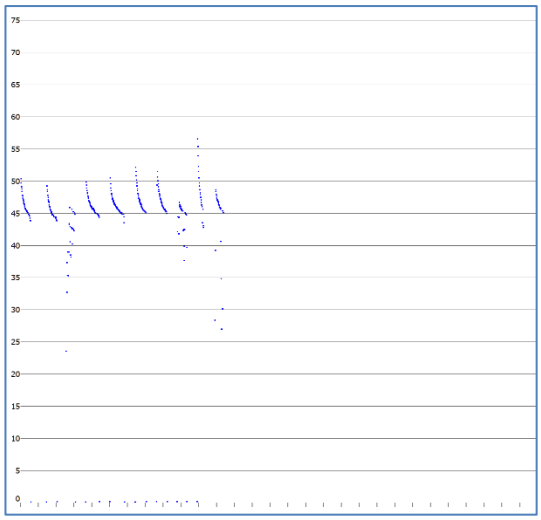
Appendix 1 Representative sonograms from the Bentley data set.
X-axis (time)=10 msec per tick; time between pulses removed



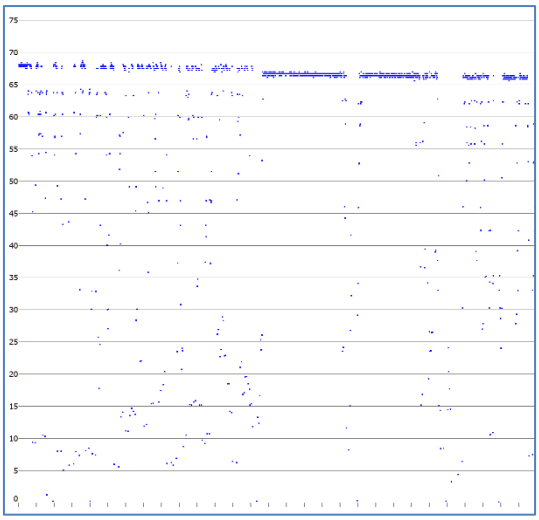
Austronomus australis



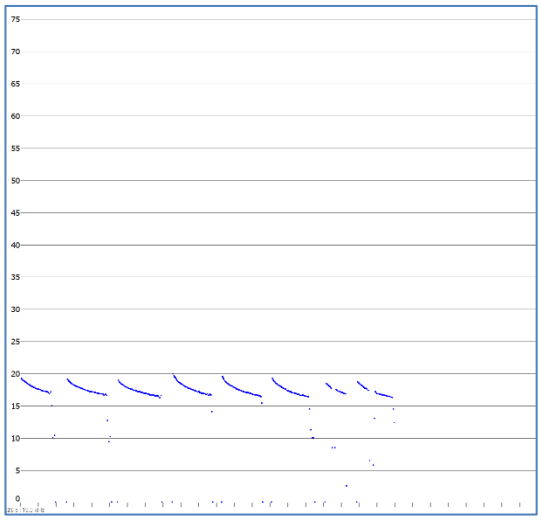
Miniopterus australis



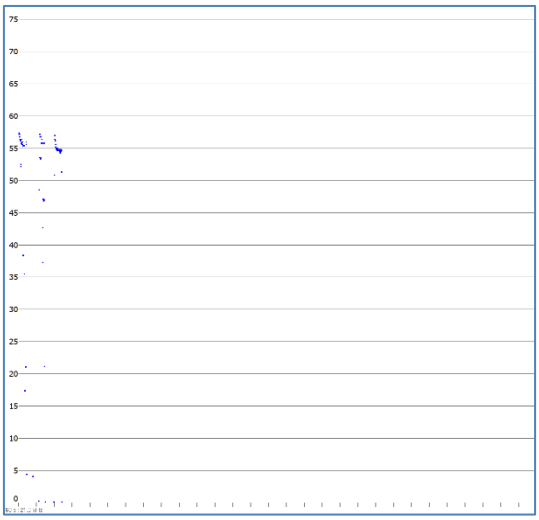
Miniopterus orianae



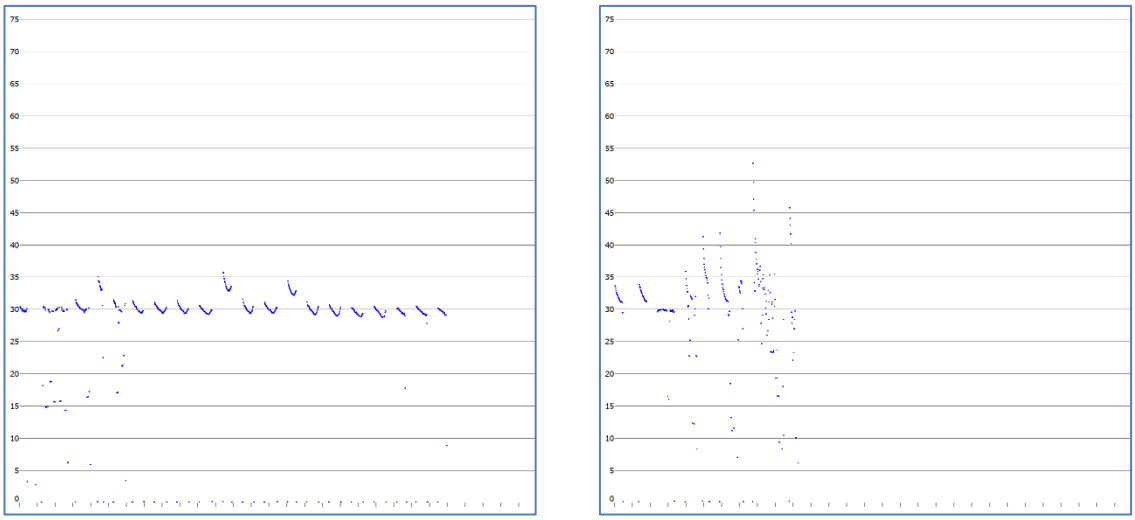
Rhinolophus megaphyllus



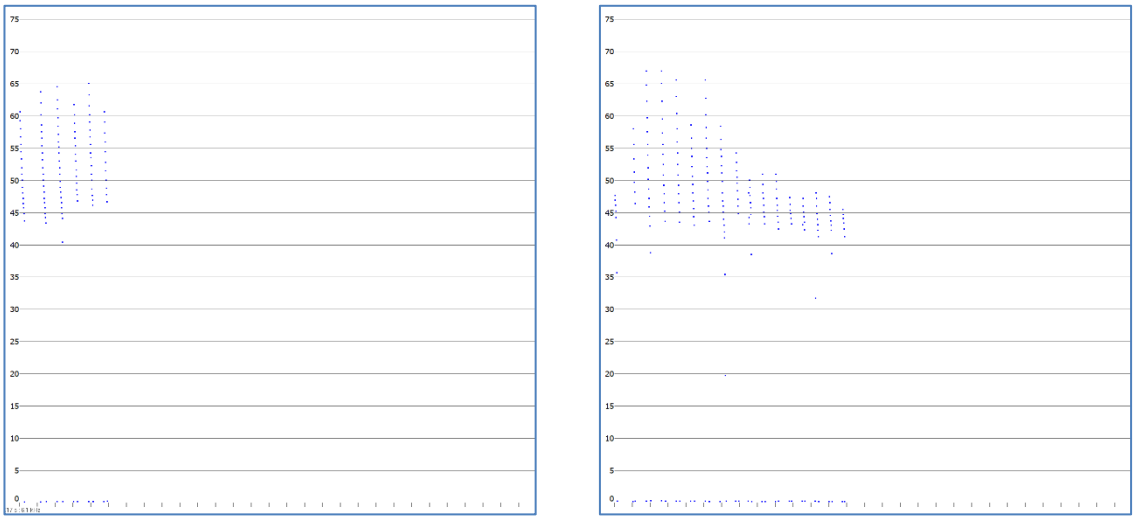
Saccolaimus flaviventris



Vespadelus pumilus



Chalinolobus gouldii or Ozimops ridei



Nyctophilus sp. or Myotis macropus

Appendix K

Traffic Impact Assessment

Traffic Impact Assessment

Bentley Quarry

R & S Contracting Pty Ltd

29 October 2021

→ **The Power of Commitment**

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Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	R. Green	M. Adikari		S. Lawer		29/10/2021

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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) has been engaged by R & S Contracting Pty Ltd (R & S Contracting) to assess the construction impacts and operations of the proposed Bentley Quarry expansion in Bentley, New South Wales (NSW). Bentley Quarry will be a hard rock quarry and proposes to extract up to 300,000 tonnes per annum and 2,000 tonnes per day over 30 years, with a total disturbance area of approximately 6.5 hectares. Bentley Quarry will predominantly supply materials for use as fill and for road construction and maintenance.

The site is Lot 2 DP 1196757, 1465 Bentley Road, Bentley which is owned by SL McKenzie & RG McKenzie and is located approximately 14 kilometres west of Lismore. Currently the quarry operates through existing use rights with an extraction rate of 3,000 cubic metres and an extraction area of approximately one hectare.

1.2 Purpose of this report

The purpose of this report is to assess the potential traffic impacts of the proposed expansion of the Bentley Quarry on the local road network and review the most appropriate site access arrangements. This will form part of an Environmental Impact Statement (EIS) to support a development application for the proposed expansion under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.3 Scope and limitations

1.4 Assumptions

The following assumptions have been made during the assessment of potential traffic impacts:

- Naughtons Gap Road is currently closed due to a landslip. It is assumed for the purposes of this assessment that the road will be returned to its pre-landslip conditions and that it may be used as a haulage route between the quarry and Casino.
- The construction phase is assumed to generate a maximum of 100 vehicle movements per day evenly over a 10-hour period.
- The source, destination and route of light and heavy vehicles accessing the quarry is difficult to predict, however it is assumed they would travel via various routes to projects and customers around the area via Bentley Road. R & S Contracting has indicated that approximately 60% of operation traffic will travel to and from the site via Bentley Road east of the site, approximately 30% will travel to and from the site via Naughtons Gap Road, and 10% will travel to and from the site via Bentley Road west of the site. It is assumed that these indicative proportions are representative of vehicle movements during both construction and operation phases.
- The operating speed on the site access road is assumed to be 50 km/h.
- The quarry site access road approach to the Bentley Road intersection is assumed to have a flat grade of 0%.
- The 85th percentile speed is assumed to be constant between 2014 and 2032.
- On Bentley Road it is assumed that 60% of through movements are westbound and 40% are eastbound.
- The proposed upgrade of the intersection of Bentley Road and the site access road is assumed to contain no splitter island.

2. Existing conditions

2.1 Site location

Bentley Quarry is located within the Richmond Valley local government area in NSW and is shown in Figure 2.1. The site is located within a rural area approximately 14 km west of Lismore. The surrounding land use is primarily agricultural and forestry. The study area extends to include the connecting road network.

Figure 2.1 Site location of the proposed Bentley Quarry site

2.2 Site access

Currently there is one existing access point to the site via Bentley Road, as shown in Figure 2.2. This site access road is unsealed and its intersection with Bentley Road permits all movements however it does not have any turn treatments (such as a basic left-turn (BAL) or a basic right-turn (BAR) treatment).

Figure 2.2 Existing site access location via Bentley Road

Base image source: Google Maps, accessed July 2021

2.3 Road network

Key roads considered in the study area are shown in Figure 2.3. Key roads and their function within the transport network are discussed in the following sections.

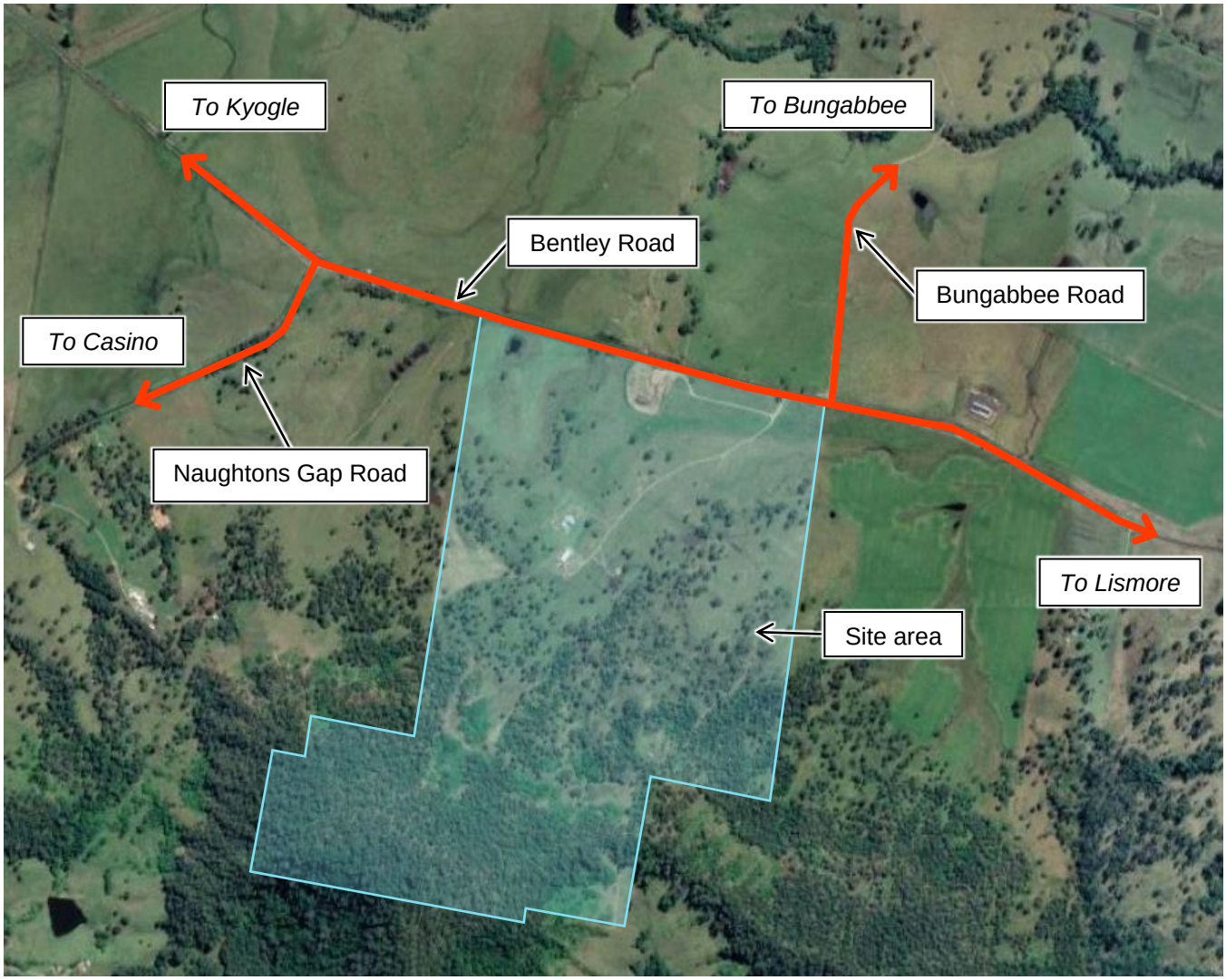


Figure 2.3 Local road network

Base image source: Google Maps, accessed July 2021

2.3.1 Bentley Road

Bentley Road is a regional arterial road managed by Richmond Valley Council and connects Summerland Way in the north-west to Kyogle Road in the south-east. Bentley Road forms part of the east-west route between Lismore and Kyogle. It is a two-way two-lane sealed line marked road with a posted speed limit of 100 km/h in the vicinity of the site. No parking, kerb and guttering, active transport infrastructure or street lighting is provided on Bentley Road in the vicinity of the site. Bentley Road is approximately 6.3 metres wide near the site area.

Traffic volume data has been obtained from Richmond Valley Council for 2006 and 2014 in the vicinity of the site. The locations of the counters used to collect this data are shown in Figure 2.4.

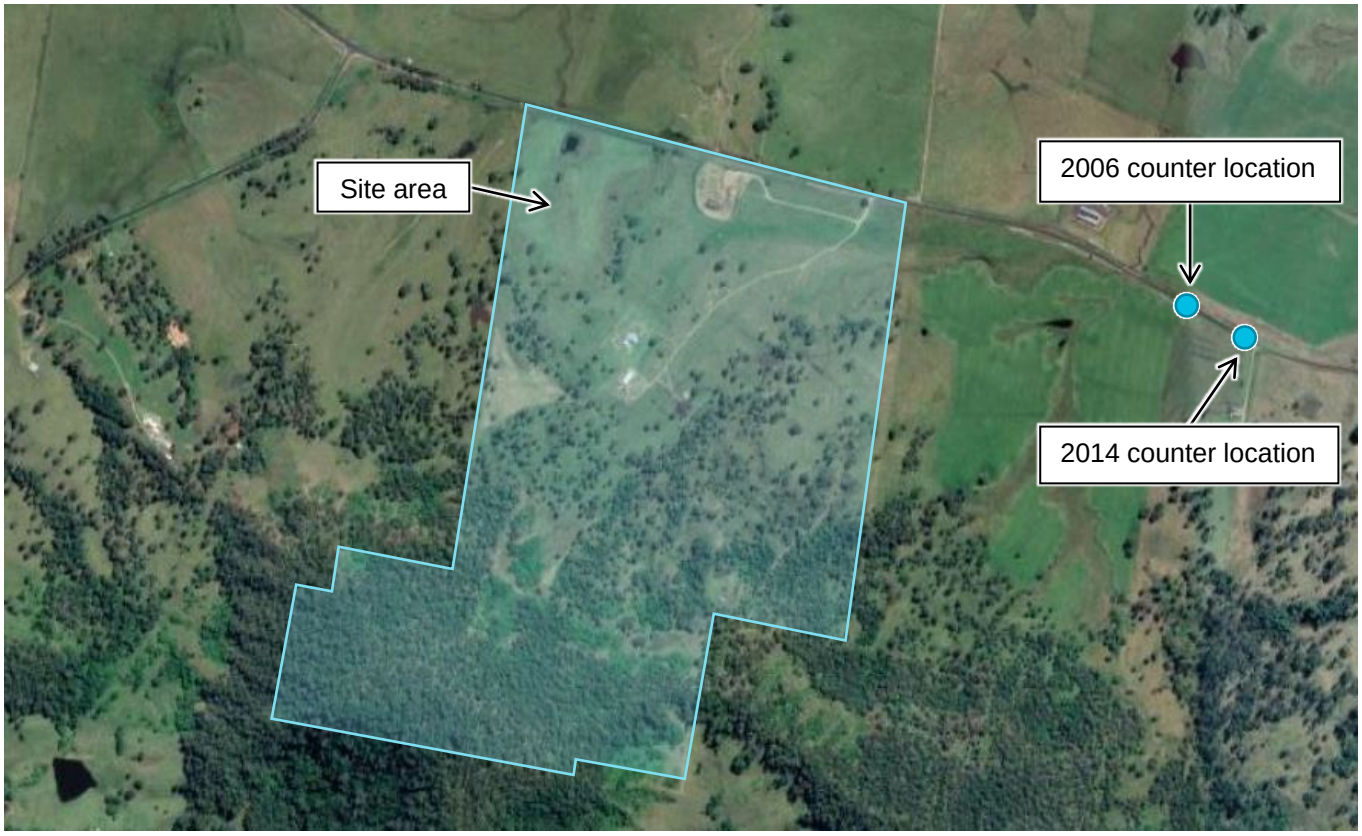


Figure 2.4 Bentley Road traffic counter locations

Base image source: Google Maps, accessed July 2021

In the vicinity of the site, Bentley Road carried approximately 3,500 vehicles per day (two-way) in 2014. The heavy vehicle component of traffic was approximately 5.7%. The 85th percentile speed on Bentley Road was approximately 97 km/h in 2014. During weekdays the average morning (AM) peak hour occurred between 8 AM and 9 AM, and the average evening (PM) peak hour occurred between 4 PM and 5 PM. The traffic profile of Bentley Road during an average weekday in 2014 is shown in Figure 2.5.

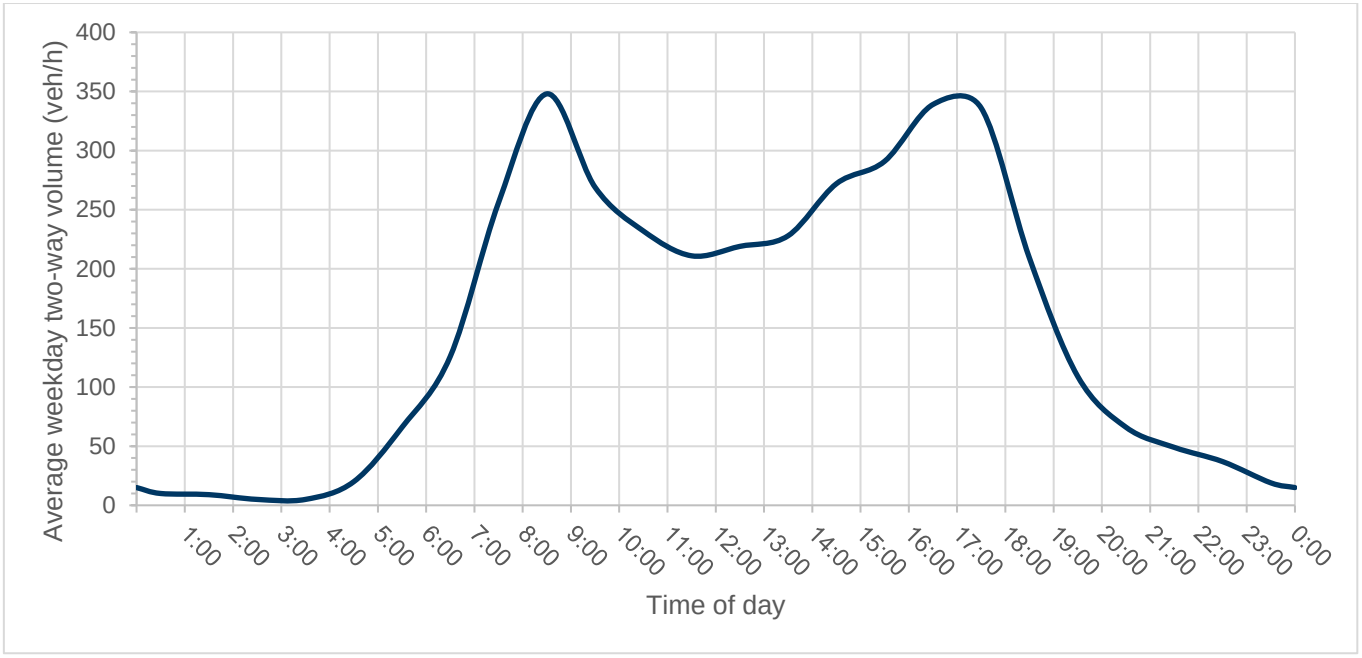


Figure 2.5 Bentley Road average weekday traffic profile 2014

Data source: Richmond Valley Council, accessed July 2021

Figure 2.6 shows photos of different views along Bentley Road captured during a site inspection on 18 March 2021.

Figure 2.6 Bentley Road (left image showing east of site access, right image showing west of site access)

2.3.2 Naughtons Gap Road

Naughtons Gap Road is a local road managed by Richmond Valley Council and connects Bentley Road in the north to Spring Grove Road, Casino in the south via Naughtons Gap and North Casino. It is a two-lane two-way road sealed road with a posted speed limit of 100 km/h in the vicinity of the site. Near the site, Naughtons Gap Road is unmarked with the exception of its intersection with Bentley Road. No parking, kerb and guttering, active transport infrastructure or street lighting is provided on Naughtons Gap Road in the vicinity of the site. Naughtons Gap Road is approximately 5.5 metres wide near the site area.

Traffic volume data has been obtained from Richmond Valley Council for 2005 and 2014 in the vicinity of the site. The locations of the counters used to collect this data are shown in Figure 2.7.

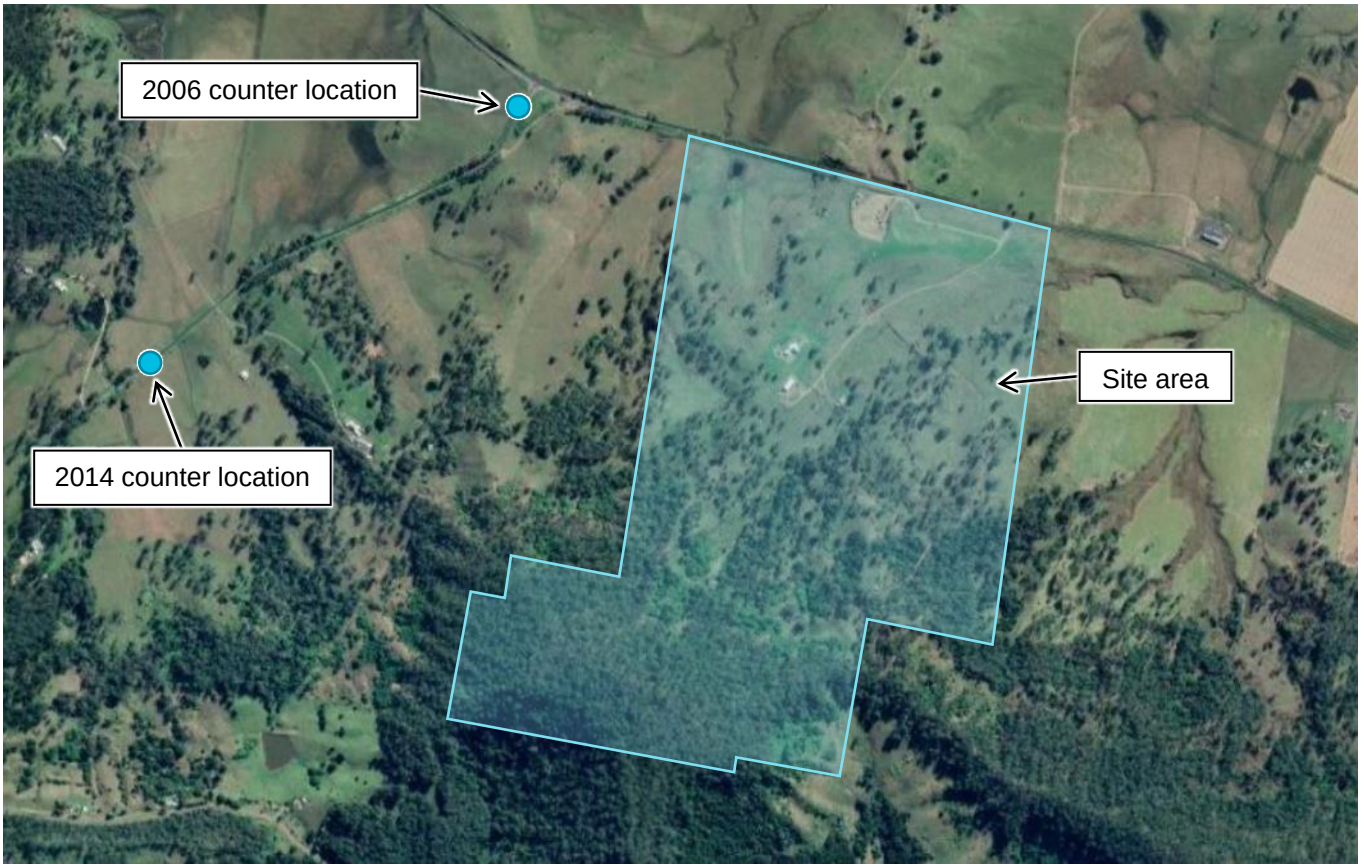


Figure 2.7 Naughtons Gap Road traffic counter locations

Base image source: Google Maps, accessed July 2021

In the vicinity of the site, Naughtons Gap Road carried approximately 660 vehicles per day two-way in 2014. The heavy vehicle component of traffic was approximately 57.4%. The 85th percentile speed on Naughtons Gap Road was approximately 119 km/h in 2014. During weekdays the average AM peak hour occurred between 8 AM and 9 AM, and the average PM peak hour occurred between 4 PM and 5 PM. The traffic profile of Naughtons Gap Road during an average weekday in 2014 is shown in Figure 2.8.

Figure 2.8Figure 2.8 Naughtons Gap Road average weekday traffic profile 2014

Data source: Richmond Valley Council, accessed July 2021

2.3.3 Bungabbee Road

Bungabbee Road is a local road managed by Richmond Valley Council and is a gated single lane unsealed road providing access from Bentley Road to Bungabbee in the north. It does not have a posted speed, and it is likely that only low speed travel is possible on the unsealed surface. No parking, kerb and guttering, active transport infrastructure or street lighting is provided on Bungabbee Road.

2.4 Crash history

Crash data covering the five year period between 2015 to 2019 was obtained from Transport for New South Wales for the study area. Over this period there were 13 recorded crashes. Approximately 62% resulted in serious injury, 23% in non-casualty (tow-away) and 15% in moderate injury. The locations of the crashes in the study area and their severities are shown in Figure 2.9. A summary of the crash data is provided in Table 2.1.

Five crashes were recorded at the intersection of Bentley Road and Naughtons Gap Road. Four of the five crashes resulted in serious injury, three of which were 'right near' type crashes, and one was a 'cross traffic' type crash. The other crash was a 'right near' type crash that resulted in moderate injury. Four of the five crashes occurred during daylight, and the other occurred during dark conditions. The severity of these crashes may be attributed to the high speed zones on both of these roads and poor gap selection when making right turns.

Three crashes were recorded on the north-western approach of Bentley Road to the Bentley Road / Naughtons Gap Road intersection. The severity of all three of these crashes was non-casualty (tow-away). Two were 'struck animal' type crashes, both of which occurred during dark conditions, and the other was an 'off road to left into object' type crash which occurred during daylight.

Three crashes were recorded on the south-eastern approach of Bentley Road to the Bentley Road / Naughtons Gap Road intersection. Two of these crashes resulted in serious injury. The one closest to the Bentley Road / Naughtons Gap Road intersection was an 'off road to left into object' type crash that occurred during dark conditions, and the other was an 'off road to right' type crash that occurred during daylight. The third crash on this approach was a 'rear end' type crash that occurred during daylight and resulted in moderate injury.

Two crashes were recorded on Naughton Gap Road, both of which occurred during daylight and resulted in serious injury. One was an overtaking 'cutting in' type crash and the other was an 'off right/left bend into object' type crash.

No crashes were recorded on Bungabbee Road, at the intersection of Bentley Road and Bungabbee Road or at the intersection of Bentley Road and the site access road during this period.

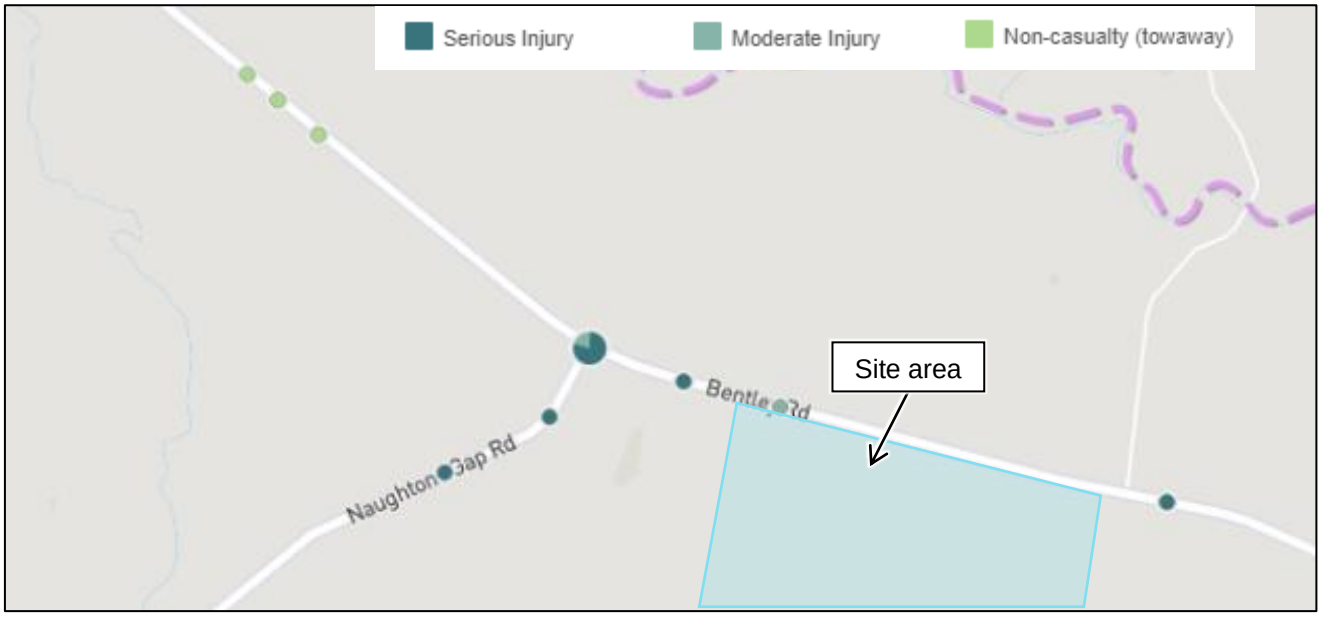


Figure 2.9 Crashes in the study area (2015 – 2019)

Image source: Interactive Crash Statistics, Transport for New South Wales, accessed July 2021

Table 2.1 Crash data summary (2015 – 2019)

Location	Number of crashes		Crash type(s)
	Total	Casualty	
Intersection			
Bentley Road / Naughton Gap Road	5	5	Right near (4), cross traffic (1)
Midblock			
Bentley Road	6	3	Struck animal (2), off road to left into object (2), rear end (1), off road to right (1)
Naughton Gap Road	2	2	Cutting in (1), off right/left bend into object (1)
TOTAL	**13**	**10**	

3. Proposed development

The proposed Bentley Quarry expansion involves a hard rock quarry with an expected annual maximum extraction rate of 300,000 tonnes per annum and a maximum daily extraction rate of 2,000 tonnes per day. The total area of disturbance would be 6.5 hectares with an extraction pit of 3.65 hectares. A maximum of 50,000 tonnes per annum of soil, topsoil and waste concrete would be imported to the site to be used for constructing landscape mounds, rehabilitation and blending with aggregate material on an ongoing basis.

The primary purpose of the quarry is to supply suitable aggregate resources for use as general fill and for the construction and maintenance of roads in the region.

The site has been used for resource extraction for many years, with obvious signs of benching from past operations. A small quarry operation continues at the site which operates under existing use rights. This limits the operation to 3,000 cubic metres (estimated to be 6,000 tonnes based on a conversion of 2 tonnes per cubic metre) and a disturbance footprint of approximately 1 hectare. No blasting or crushing occurs on-site. Due to increasing demand, it is proposed to increase the extraction rate and include blasting and crushing as part of the operation.

As part of the proposed expansion, it is proposed that the intersection of the site access road and Bentley Road be upgraded to better cater for the increased activity. The site access road would also be sealed to provide a stable surface for traffic and minimise dirt being tracked onto Bentley Road.

3.1 Construction phase

The construction phase of the Bentley Quarry expansion would be undertaken over one month. The main activity during this phase would be the construction of the site access road intersection with Bentley Road. Other activities would be as follows:

– Progressive installation of environmental controls including erosion and sediment control measures.
– Vegetation clearance, soil stripping and stockpiling.
– Construction of temporary drainage controls.
– Importation of clean soil for landscape mounds to the east and west of the quarry.
– Construction of a site office and car parking area.

A dozer, excavator and haul trucks are the main items of equipment likely to be required during the construction phase. Other equipment may include the following:

– Roller.
– Grader.
– Water cart.
– Compactor.
– Light vehicles.
– Hand tools.

3.2 Operation phase

The quarry operations are expected to be carried out in stages and in response to demand.

Topsoil stripping would occur in stages prior to excavation. Generally, areas would be stripped immediately prior to quarrying. Overburden would either be stockpiled for future rehabilitation works or placed in final location as voids are created.

The main activities during operation of the quarry would include the following:

– Drilling and blasting.
– Crushing and screening.
– Blending.
– Stockpiling.

The main items of equipment likely to be required during the operation phase include the following:

- Dozer.
- Excavators.
- Jaw, cone and impact crusher.
- Screen.
- Front-end loader.
- Grader.
- Haul trucks.
- Water cart.
- Water pump.
- Light vehicles.
- Hand tools.

4. Traffic impacts

4.1 Construction phase

4.1.1 Trip generation

During the construction phase the traffic generated would primarily consist of heavy vehicle movements, mostly relating to the construction of the intersection of Bentley Road and the site access road. A few light vehicles would also access the site daily during the construction works. The traffic generated during construction is anticipated to be less than that generated during operation of the quarry. For the purposes of this assessment, it is assumed that the construction period will generate a peak rate of 100 vehicle trips per day that would occur evenly over a 10-hour period each weekday.

4.1.2 Trip distribution

The source, destination and route of light and heavy vehicles accessing Bentley Quarry is difficult to predict, however it is assumed that vehicles would travel via various routes around the area via Bentley Road. R & S Contracting has indicated that approximately 60% of operation traffic will travel to and from the site via Bentley Road east of the site, approximately 30% will travel to and from the site via Naughtons Gap Road, and 10% will travel to and from the site via Bentley Road west of Naughtons Gap Road. The construction phase trip distribution has been estimated assuming these indicative proportions are also representative of construction vehicle movements and is summarised in Table 4.1.

The traffic volumes on Bentley Road and Naughtons Gap Road were extrapolated for the opening year of 2022 using growth rates calculated between the traffic survey years of 2006 to 2014 for Bentley Road and 2005 to 2014 for Naughtons Gap Road. The proportions of construction traffic movements were then added to the 2022 volumes to estimate the future volumes on each road.

Table 4.1 Construction phase trip distribution (vehicles per hour)

Road section	Time period	2014 volume	Estimated 2022 volume	2022 volume with construction traffic	
Bentley Road	Daily	3,731	5,025	5,125	(+100)
	AM peak	348	433	443	(+10)
	PM peak	339	440	450	(+10)
Naughtons Gap Road	Daily	714	944	974	(+30)
	AM peak	85	157	160	(+3)
	PM peak	65	74	77	(+3)

4.1.3 Network impact

According to the Transportation Research Board's *Highway Capacity Manual* (2016), the typical lane capacity of two-lane two-way rural roads and highways is 1,700 passenger cars per hour per direction of travel. This is nearly independent of the directional distribution of traffic. That is, the capacity of two-lane two-way rural roads and highways per direction is almost unaffected by the proportion of vehicles travelling in each direction.

As shown in Table 4.1, the peak traffic volumes on Bentley Road during the construction phase are expected to be a maximum of 450 vehicles per hour (occurring during the PM peak in 2022), which is well within the typical capacity per direction, regardless of the directional distribution of traffic. Similarly, the peak traffic volumes on Naughtons Gap Road during the construction phase are expected to be a maximum of 160 vehicles per hour (occurring during the AM peak in 2022), which is also well within the typical capacity per direction, regardless of the directional distribution of traffic. The construction is expected to have no noticeable impact on Bungabbee Road. Therefore, the proposed expansion works of the quarry and the access road intersection are expected to have minimal impact on the mid-block capacity of the local network during the construction phase.

The safety of the local network during the construction phase is not expected to be negatively affected, provided that the works are carried out with appropriate and compliant temporary traffic management. Construction works are expected to have some negative impact on travel times on Bentley Road due to reduced speed zones, however construction would be carried out over a brief period and therefore the effect on local traffic is not expected to be significant.

4.2 Operation phase

4.2.1 Trip generation

4.2.1.1 Workforce traffic

During operation of the Bentley Quarry, it is assumed there would be a maximum of five workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 10 vehicle trips per day. It is assumed that five entry trips will occur during the AM peak hour and five exit trips will occur during the PM peak hour. Operating hours of the quarry have been assumed as follows:

– Monday to Friday: 7:00 AM to 6 PM.
– Saturday: 7:00 AM to 2 PM.
– Sunday or Public Holiday: Closed.

It is anticipated the majority of the workforce would arrive between 6:30 AM and 7:30 AM and depart generally between 3:00 PM and 6:30 PM on weekdays.

4.2.1.2 Heavy vehicle traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At maximum daily production (i.e. 2,000 tonnes), the quarry is expected to generate about 70 truck and dog loads or 140 truck movements per day. The truck movements are anticipated to start at 7 AM and continue evenly throughout the day until 5 PM on weekdays (i.e. 14 trips per hour). This rate of maximum truck movements is expected to be infrequent and for short durations. The average number of movements is expected to be significantly less and there would be times when no trucks would access the site.

4.2.2 Trip distribution

The source, destination and route of vehicles accessing Bentley Quarry is difficult to predict, however it is assumed they would travel via various routes to projects and customers around the area via Bentley Road. As discussed in Section 4.1.2, the construction phase trip distribution was calculated using the same proportions assumed for the operation phase. The traffic volumes for the opening of the quarry expansion and a 10-year horizon have been extrapolated and summarised in Table 4.2.

Table 4.2 Operation phase trip distribution (vehicles per hour)

Road section	Time period	2014 volume	Estimated 2022 volume	2022 volume with operation traffic		Estimated 2032 volume	2032 volume with operation traffic	
Bentley Road	Daily	3,731	5,025	5,175	(+150)	7,946	8,096	(+150)
	AM peak	348	433	452	(+19)	625	644	(+19)
	PM peak	339	440	459	(+19)	674	693	(+19)
Naughtons Gap Road	Daily	714	944	989	(+45)	1,216	1,261	(+45)
	AM peak	85	157	163	(+6)	301	307	(+6)
	PM peak	65	74	80	(+6)	86	92	(+6)

4.2.3 Network impact

As shown in Table 4.2, the peak traffic volumes on Bentley Road during the operation phase are expected to be a maximum of 693 vehicles per hour (occurring during the PM peak in 2032), which is well within the typical capacity for a two-lane two-way rural road or highway. Similarly, the peak traffic volumes on Naughtons Gap Road during the operation phase are expected to be a maximum of 307 vehicles per hour (occurring during the AM peak in 2032), which is also well within the typical capacity. The operation of Bentley Quarry is expected to have no noticeable impact on Bungabbee Road. Therefore, the proposed operations of the quarry are expected to have minimal impact on the mid-block capacity of the local network during the operation phase.

As discussed in Section 2.4, the crash history in the vicinity of the study area does not indicate a history of crashes at the existing intersection. Increased vehicle movements turning in and out of the site may increase the potential for 'cross traffic' type crashes, particularly as Bentley Road is a high-speed road. However, provided the appropriate sight distances and turn treatments are met (see Section 4.3), the safety of traffic on the local network is not expected to be significantly impacted by the operation phase.

The increase in traffic on the local network during the operation phase is approximately 3% and is considered relatively low and within the typical hourly capacity of such roads, therefore the impact on local traffic is expected to be minimal. The classification of roads within the road hierarchy in NSW is based on their function, that is the role of the road in the regional network context. The function of roads in the local network is not expected to be altered by the small increase in traffic during the operation phase. The truck and dog trailer combinations with a capacity of approximately 32 tonnes that will be used during the operation phase comply with the General Mass Limit provided in Roads and Maritime Services' *Heavy vehicles chart*, and therefore have unrestricted access to the NSW road network. Therefore, the proposed access routes to and from the site are considered suitable to accommodate the specified type of haulage vehicles.

4.3 Access arrangements

As part of the Bentley Quarry expansion, it is proposed that the intersection of the site access road with Bentley Road be upgraded to facilitate safe passage of the expected vehicle trips.

4.3.1 Sight distance requirements

4.3.1.1 Approach Sight Distance

Approach Sight Distance (ASD) for cars is the minimum sight distance that must be available on minor road approaches to all intersections. This distance is measured from the driver's eye height (1.1 metres) to the pavement level at the holding line. ASD for trucks is the distance required for trucks approaching the intersection at 85th percentile operating speed to stop safely. It is measured from the driver's eye height (2.4 metres) to the pavement level at the holding line and is numerically equal to truck stopping sight distance. Trucks require a longer distance to stop than light vehicles, therefore the minimum requirements are assessed for trucks.

The required ASD for trucks for the site access road intersection with Bentley Road was calculated in accordance with Table 5.6 in the Austroads *Guide to Road Design Part 3: Geometric Design* (AGRD03-16, 2021). The operating speed on the site access road was conservatively assumed to be 50 km/h, the reaction time was taken as the desirable value of 2.5 seconds in accordance with AGRD03-16, and a flat grade of 0% was assumed. Therefore, the required ASD was determined to be 69 metres on approach to Bentley Road.

In constructing the intersection and any upgrade to the existing site access road it is recommended that the alignment of the site access road be such that this ASD is achieved.

4.3.1.2 Safe Intersection Sight Distance

Safe Intersection Sight Distance (SISD) is the minimum sight distance that should be provided on major road approaches to all intersections. This distance is measured along the carriageway from the conflict point to the approaching vehicle. It is measured from the driver's eye height (1.1 metres) to a point 1.25 metres above the road (representing the driver seeing the upper part of a car), assuming the driver on the minor approach is 7 metres from the conflict point, as per the Austroads *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (AGRD04A-17, 2021).

The SISD for the Bentley Road and site access road intersection was calculated in accordance with Equation 2 in the AGRD04A-17. The operating speed (V) on Bentley Road was assumed to be 97.2 km/h based on 2014 traffic data obtained from Richmond Valley Council. The reaction time was taken as the desirable value of 2.5 seconds in accordance with AGRD03-16, which was combined with an observation time of 3 seconds to produce a decision time (D_T) of 5.5 seconds. The coefficient of deceleration (d) for trucks was taken as 0.29 in accordance with AGRD03-16. On the eastbound approach, a downhill grade of 3.44% was calculated based on measurements taken onsite. Therefore, the required SISD on the eastbound approach of Bentley Road was calculated to be 294 metres.

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)} = \frac{5.5 \times 97.2}{3.6} + \frac{97.2^2}{254 \times (0.29 + 0.01 \times -3.44)} = 294.0 \text{ metres}$$

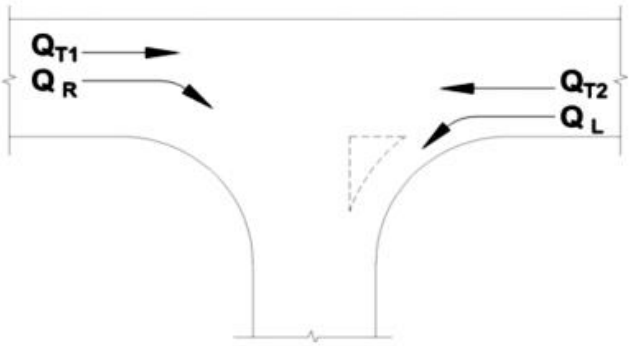
On the westbound approach of Bentley Road, an uphill grade of 3.44% was taken. Therefore, the required SISD on the westbound approach was calculated to be 263.2 metres.

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)} = \frac{5.5 \times 97.2}{3.6} + \frac{97.2^2}{254 \times (0.29 + 0.01 \times 3.44)} = 263.2 \text{ metres}$$

Sight distances measured on site determined that the eastbound sight distance is approximately 312.65 metres, and the westbound sight distance is approximately 467.28 metres with the intersection in its current location. These sight distances are in excess of the calculated SISD requirements, and therefore the intersection location is considered appropriate in this respect.

4.3.2 Turn treatments

The Austroads *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management* (AGTM06-20, 2020) includes guidance on the selection of turn treatments on a major road at unsignalised intersections. The major road volume parameter, Q_M, is calculated according to Figure 4.1.



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}

Figure 4.1 Calculation of the major road traffic volume parameter

Source: Figure 3.26, Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management 2020, accessed August 2021

The maximum peak hour access movements to the site are anticipated to occur during the AM peak, according to data provided by R & S Contracting in relation to vehicles entering the site. Therefore, turning and through movements at the intersection of the site access road and Bentley Road were estimated based on traffic data obtained from Richmond Valley Council and trip generation and distribution data for the AM peak (see Section 4.2). These AM peak turning and through movements were applied in the determination of required turn treatments.

On Bentley Road the estimated 2032 two-way through movement volume during the AM peak is 625 vehicles per hour (refer to Table 4.2) with an anticipated volume of 12 vehicles per hour entering the site (i.e. five light vehicles and seven heavy vehicles). The directional split of the through traffic on Bentley Road is unknown. For the purposes of this assessment, it has been assumed that 60% of these through movements are westbound (Q_{T2}), and 40% are eastbound (Q_{T1}) to obtain a conservative value of Q_M for the left turn. To obtain a conservative value of Q_M for the right turn, it has been assumed that there will be no splitter island at the intersection. The turning volumes and major road traffic volume parameters for each turn movement are summarised Table 4.3.

Table 4.3 Bentley Road and site access road intersection volume parameters

	Q_{T1}	Q_{T2}	Q_L	Q_R	Q_M
Left turn	250	375	8	-	375
Right turn	250	375	-	5	633

Figure 4.2 provides guidance for turn treatments for design speeds greater than or equal to 100 km/h. As the speed limit on Bentley Road is 100 km/h, this guidance has been applied. The estimated turn movements have been used to determine the appropriate turn treatments as per Figure 4.2.

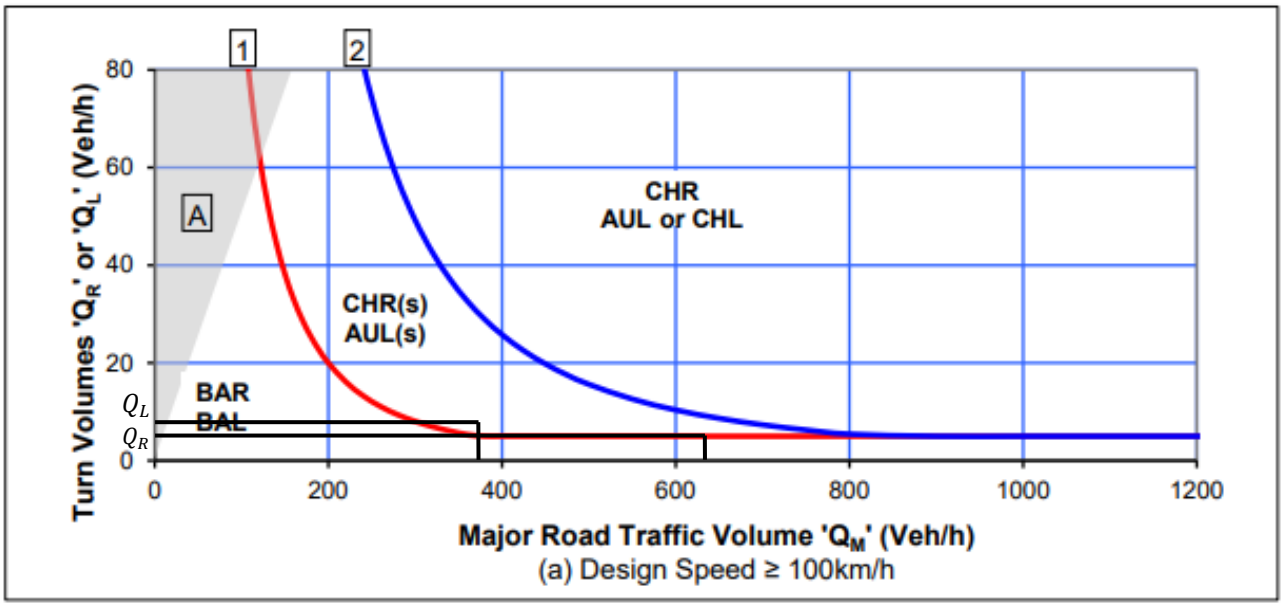


Figure 4.2 Warrants for turn treatments on the major road at unsignalised intersections for design speeds ≥100 km/h

Source: Figure 3.25, Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management, 2020, accessed August 2021

As shown in Figure 4.2, the traffic volumes warrant turn treatments for the right turn from Bentley Road to the site access road as a channelised right-turn (CHR(S)), and for the left turn as an auxiliary left-turn (short lane) (AUL(S)). An example of a CHR(S) turn treatment for a rural road is shown in Figure 4.3, and an example of an AUL(S) turn treatment for a rural road is shown in Figure 4.4.

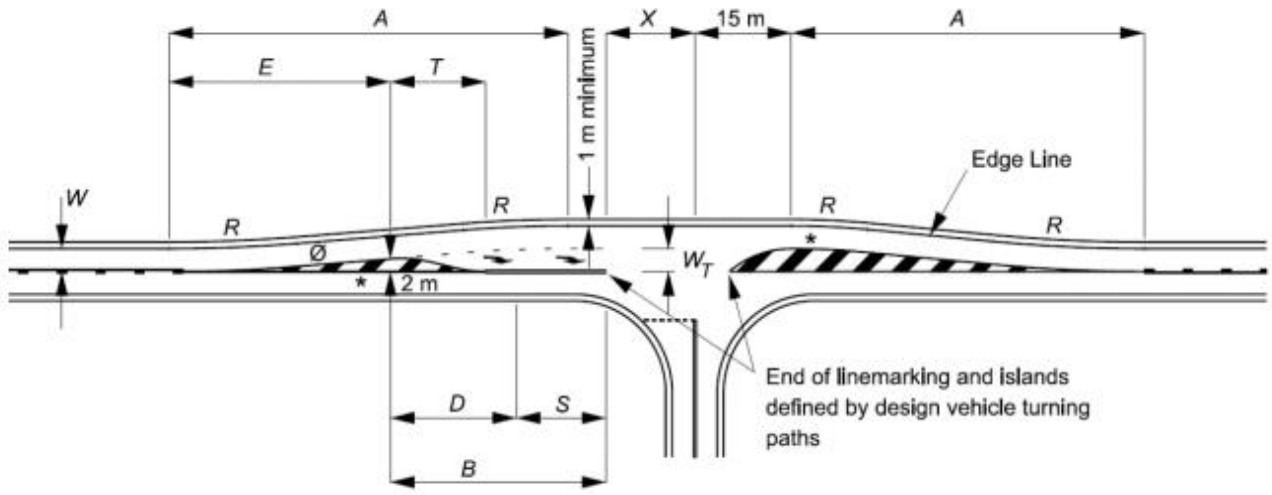


Figure 4.3 Channelised right-turn short lane (CHR(S)) treatment on a two-lane rural road

Image source: Figure A7, Austroads Guide to Road Design Part 4: Intersections and Crossings - General 2021, accessed August 2021

In Figure 4.3, A represents the lateral movement length, D represents the diverge/deceleration length, R represents the desirable radius and T represents the taper length. The Austroads *Guide to Road Design Part 4: Intersections and Crossing – General* (AGRD04-17, 2021) Table A4 provides dimensions of CHR(S) treatments for various design speeds. As the posted speed limit of Bentley Road is 100 km/h, the design speed is considered to be 110 km/h as per Table 3.2 in AGRD03-16. Therefore, according to AGRD04-17 Table A4, A is 95 m, D is 102 m (where a grade correction of - 4% has been applied as per AGRD04A-17 Table 5.3), R is 500 m and T is 30 m. These values are based on a turn lane width of 3.0 m, a diverge rate of 1 m/s, a 20% reduction in through road speed at the start of the taper to a stopped condition and deceleration of 3.5 m/s^2, as per AGRD04-17. These values would be confirmed, or adjusted where necessary, during the design stages of the intersection.

Also in Figure 4.3, W represents the nominal lane width, E represents the distance from start of taper to 2.0 m width, B represents the total length of the auxiliary lane including taper, diverge/deceleration and storage, S represents the storage length to cater for one design turning vehicle, X represents the distance based on design vehicle turning path, and W_T represents the nominal width of turn lane, including widening for curves based on the design turning vehicle. The values of these dimensions would be determined in the design stages of the intersection.

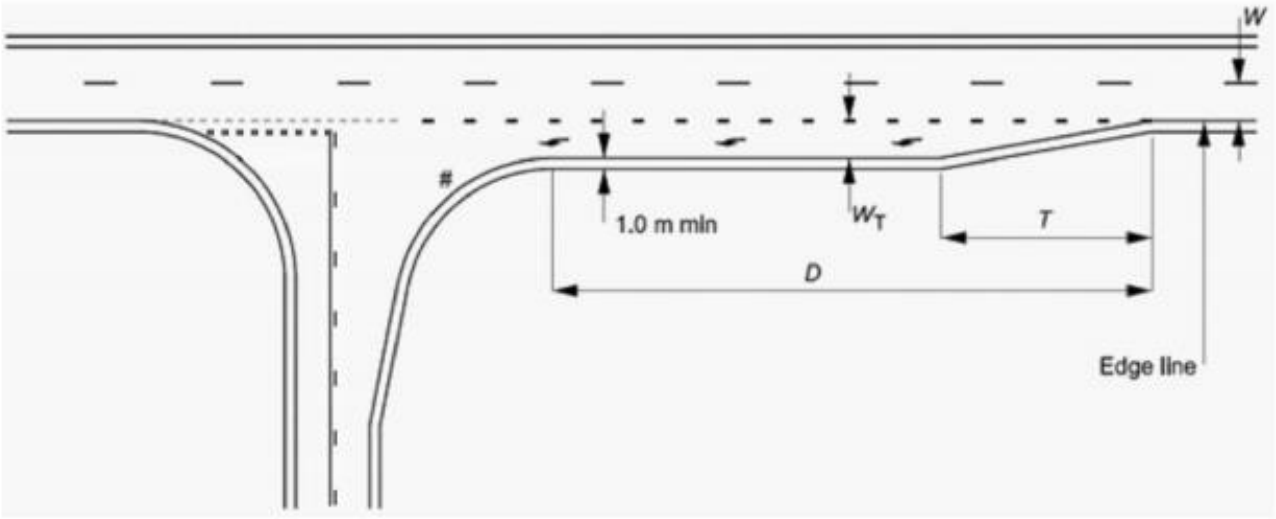


Figure 4.4 Auxiliary left-turn short lane AUL(S) treatment on a two-lane rural road

Image source: Figure 8.3, Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, 2021, accessed August 2021

In Figure 4.4, D represents the diverge/deceleration length and T represents the taper length. AGRD04A-17 Table 8.2 provides dimensions of AUL(S) treatments for various design speeds. As the posted speed limit of Bentley Road is 100 km/h, the design speed is considered to be 110 km/h. Therefore, according to AGRD04A-17 Table 8.2, D is 76.5 m (where a grade correction of +4% has been applied as per AGRD04A-17 Table 5.3) and T is 30 m. These values are based on a turn lane width of 3.0 m, a 20% reduction in through road speed at the start of the taper and deceleration of 3.5 m/s^2, as per AGRD04A-17. These values would be confirmed, or adjusted where necessary, during the design stages of the intersection.

Also in Figure 4.4, W represents the nominal lane width and W_T represents the nominal width of turn lane, including widening for curves based on the design turning vehicle. The values of these dimensions would be determined in the design stages of the intersection.

The CHR(S) and AUL(S) turn treatment dimensions have been adopted in the intersection upgrade concept design provided in Appendix A.

Additionally, as the site access road is required to accommodate the turning movements of truck and dog trailer combinations, the swept paths of these vehicles will need to be considered in the design of both treatments.

5. Summary

This TIA has assessed the potential traffic impacts of the proposed expansion of Bentley Quarry on the local road network and reviewed the most appropriate site access arrangements. The conclusions and recommendations of the assessment are summarised as follows:

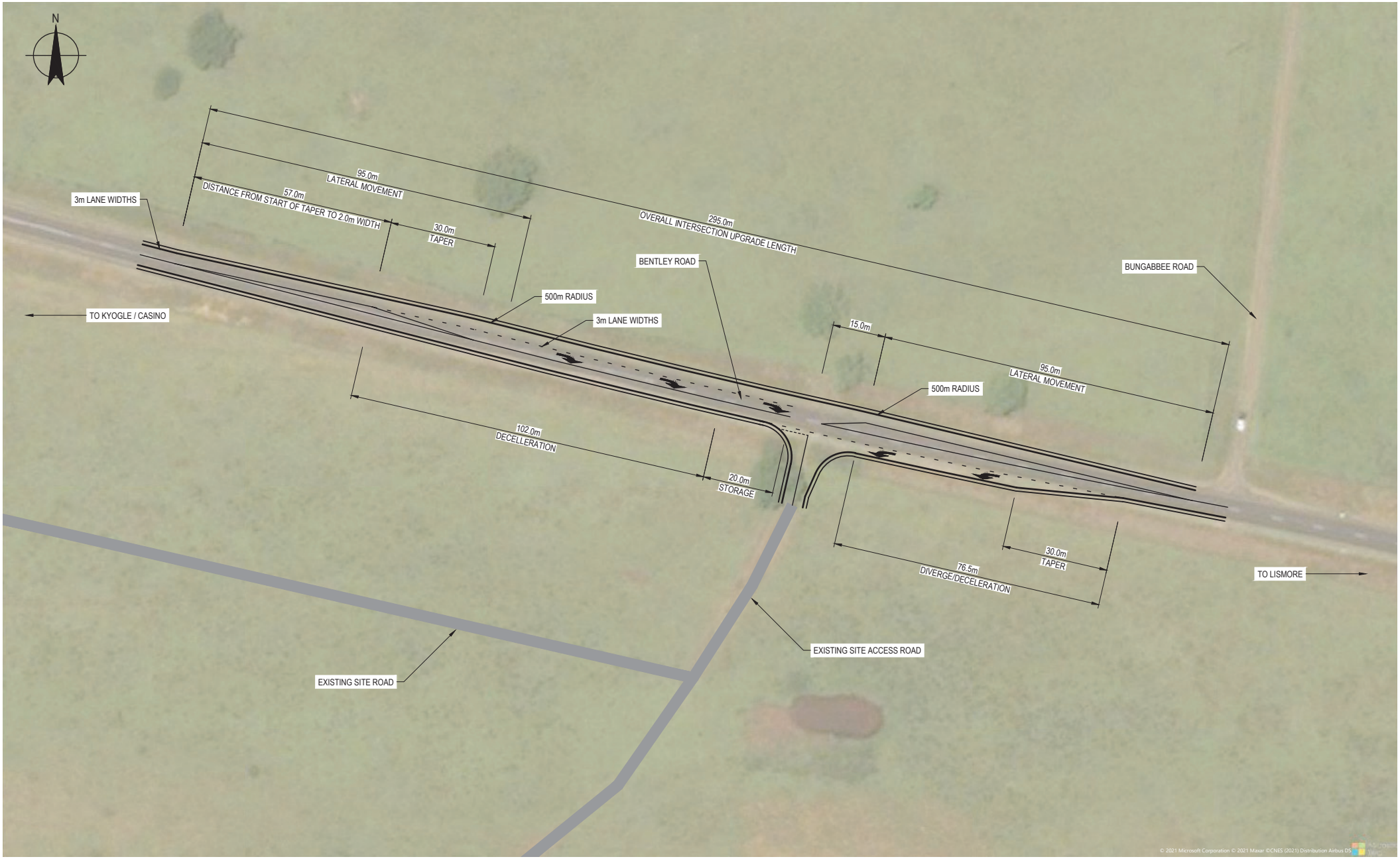
– The proposed construction phase is anticipated to have minimal impact on the mid-block capacity, safety and traffic on the local network.
– The proposed operation phase is anticipated to have minimal impact on mid-block capacity, safety, functionality of the road hierarchy and traffic on the local network.
– The proposed access routes to and from the site are considered suitable to accommodate the specified type of haulage vehicles.
– In constructing the intersection and any upgrade to the existing site access road it is recommended that the alignment of the site access road be such that an ASD of 69 metres is achieved on approach to Bentley Road.
– Sight distances on Bentley Road are in excess of SISD requirements.
– The traffic volumes warrant a turn treatment for the right turn from Bentley Road to the site access road with a CHR(S) treatment.
– The traffic volumes warrant a turn treatment for the left turn from Bentley Road to the site access road with an AUL(S) treatment.
– The swept paths of the proposed haulage vehicles will need to be considered in the design of the intersection.

Based on the findings of this report, and subject to the recommendations outlined above, the proposed expansion of Bentley Quarry is supported on traffic grounds.

Appendices

Appendix A

Proposed Bentley Road Site Access Intersection Upgrade Design



Rev	Description	App'd	Date
A	ISSUED FOR REVIEW AND COMMENT	BL	08.10.21

0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

GHD
230 Harbour Drive Coffs Harbour
NSW 2450 Australia
T 61 2 6650 5600 F 61 2 6650 5601
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www.ghd.com
Scale 1:1000 for A3

Status code S3
Project No. 12547851

R & S CONTRACTING Pty Ltd
BENTLEY QUARRY
SITE ACCESS
BENTLEY ROAD INTERSECTION
PLAN - SHEET 1 OF 1

Size A3
Sketch no. 12547851-SKT-0001
Rev no. A

Plot Date: 8 October 2021 - 9:17 AM Plotted by: Isaac Smith
File Name: \\ghdnet\ghd\AU\Coffs Harbour\Projects\22\12547851\CADD\Drawings\12547851-SKT-0001.dwg

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Appendix L

Heritage information

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : Bentley

Client Service ID : 579896

GHD - Coffs Harbour

Date: 29 March 2021

230 Harbour Drive
Coffs Harbour New South Wales 2450

Attention: Callista Harris

Email: callista.harris@ghd.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 2, DP:DP1196757 with a Buffer of 50 meters, conducted by Callista Harris on 29 March 2021.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

3 Marist Place, Parramatta NSW 2150
Locked Bag 5020 Parramatta NSW 2220
Tel: (02) 9585 6380 Fax: (02) 9873 8599

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

Casino Bolangle LALC

Address – 93 Barker st, Casino

Phone – (02) 66626286

Email – ceo@cblalc.com.au

Cultural Heritage Assessment by –

Marcus Ferguson, CBLALC Heritage Officer

Survey Date – *19.10.2021*

Location – *Bentley Quarry proposed expansion*

Dear Sir/Madam,

The objectives of the ACHA was to investigate and assess the impact the proposed Bentley quarry expansion would have on known and potential Aboriginal objects and places and cultural heritage values within the proposed quarry expansion area and provide appropriate management and mitigation strategies and recommendations.

Casino Bolangle heritage officers conducted a survey on the 19.10.2021 over the proposed Bentley quarry expansion area. Locating any visual evidence of aboriginal objects or occupation sites was limited due to the long grass. The proposed quarry is part of a natural landscape feature or terminating ridge spur that was commonly used by aboriginal people to move to and from larger features in the landscape such as hills and mountain tops to conduct their seasonal cultural ceremonies.

As a result of this investigation, Casino Bolangle LALC recommends –

1) *That the CBLALC Aboriginal Heritage Officers are present during the initial stages when the grass and top soil to a depth of 5 – 10 cm's is removed.*

2) In the event that an unexpected aboriginal object is exposed during the removal of the top soil a proposed stop work procedure (**SWP**) is to accure.

Stop work – Immediately, upon becoming aware of a potential cultural heritage object.
Contact – the Bolangle LALC and site officer (if they are not already on site)
Notify – the Casino Bolangle LALC & aboriginal site officer present and advise OEH as soon as possible. If bones or potential human remains are discovered. Police must be notified immediately. Police must provide written notification to proceed. If human remains are identified as Aboriginal, OEH will provide written notification of required actions.
Assess - A cultural heritage professional in conjunction with OEH and the Casino Bolangle site officer should assess the significance of the resource and recommend a course of action e.g. Protect and avoid; or Investigate, in accordance with the Code of Practice for Archaeological Investigation; or Develop, management strategies to inform an AHIP to regulate the unavoidable harm to Aboriginal objects.
Action – Identification of a previously unrecorded cultural heritage object will require registration as an Aboriginal site on the OEH AHIMS database. Registration is required as soon as practicable.
Apply – To OEH for an AHIP if necessary.
Recommence – Only when OEH has approved a course of action and/or provided conditions of approval for an AHIP.


Proposed Extraction area


Proposed Extraction area


Proposed Extraction Area


Proposed Extraction Area

Bentley Proposed Quarry Expansion

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