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North Star Quarry

Environmental Impact Statement

Prepared for:
Regional Quarries Australia Pty Ltd

Date:
July 2021

File Ref:
documents / 2542.DA1.005

Document Control

Project/ Report Details

Document Title:	North Star Quarry Environmental Impact Statement
Principal Author:	James John Lawler
Client:	Regional Quarries Australia Pty Ltd
Ref. No.	2542 DA1 005

Document Status

Issue	*Description*	*Date*	*Author*	*Reviewer*
0	Final	July 2021	J.Lawler	D.Doolan

Distribution Record

Recipient	*Distribution method*
Regional Quarries Australia Pty Ltd	1 x electronic
Gwydir Shire Council	1 x electronic

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Author's Certification

for the submission of an Environmental Impact Statement prepared in accordance with the *Environmental Planning and Assessment Act 1979*

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applicant name:	Regional Quarries Australia Pty Ltd
applicant address:	PO Box 4921 Dubbo NSW 2830

c) EAR Number: 1494

d) Address/land details

Properties to be developed Land Description:

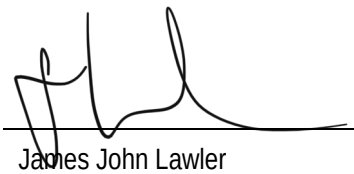
Lot Number	Deposited Plan
7	755984
1	1227212

e) Project Outline: The proposal is to establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects and then a maximum of 150,000t/yr for a period of ten (10) years to service the general market in the local area.

f) Assessment of Environmental Impact: The assessment of environmental impacts of this project includes the matters referred to in the Secretary's Environmental Assessment Requirements provided to the Applicant on 15 January 2021 under Schedule 2, Part 2 of the *Environmental Planning and Assessment Regulation 2000.*

g) Declaration: I, James John Lawler, hereby declare that I have overseen the preparation of the contents of this assessment and to the best of my knowledge:

i) this EIS has been prepared in accordance with the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*;
ii) the document contains all available information that is relevant to the environmental assessment of the proposed development; and
iii) that the information contained in the document is neither false nor misleading.

Signature: 

Name: James John Lawler Date: 13 August 2021

Table of Contents

Executive Summary viii

1. Introduction 1
   1.1. Scope 1
   1.2. Approvals Required 2
   1.3. Format of the Report 2
   1.4. The Applicant 2
   1.5. Background and need for the Proposal 3
   1.6. Capital Investment Value 3
   1.7. Consideration of Alternatives 3
   1.8. Proposal Refinements 6
   1.9. Consultation 6
   1.10. Surrounding Landowners 6
   1.11. Management of Investigations 7

2. Description of the Proposal 9
   2.1. Objectives of the Proposal 9
   2.2. Overview of the Proposal 9
   2.3. Quarry Site Layout 10
   2.4. Resources and Products 11
      2.4.1. Geology 11
      2.4.2. Products 11
      2.4.3. Production Rates 11
   2.5. Site Establishment and Construction Activities 11
   2.6. Extraction and Processing Operations 11
   2.7. Access, Traffic and Material Transportation 12
      2.7.1. Access 12
      2.7.2. Haulage Routes 13
      2.7.3. Inland Rail Project and Newell Highway Project trip generation 14
      2.7.4. Ongoing Operations to the general market trip generation 15
   2.8. Water Management 15
   2.9. Waste Management 15
   2.10. Infrastructure, Utilities and Services 16
   2.11. Employment 16
   2.12. Hours of Operation and Project Life 16
   2.13. Rehabilitation 16

3. Planning and Legislative Context 18
   3.1. Introduction 18
   3.2. Commonwealth Legislation 18
   3.3. NSW Legislation 18
      3.3.1. Environmental Planning and Assessment Act 1979 18
      3.3.2. Protection of the Environment Operations Act 1997 18
      3.3.3. Biodiversity Conservation Act 2016 19
      3.3.4. National Parks and Wildlife Act 1974 19
      3.3.5. The Heritage Act 1977 19
      3.3.6. Water Management Act 2000 19

Table of Contents

3.4. State Environmental Planning Policies 19
State Environmental Planning Policy – State and Regional Development 2011 ..... *19*
State Environmental Planning Policy – Mining, Petroleum Production and Extractive Industries 2007 ..... *20*
State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) *23*
State Environmental Planning Policy (Koala Habitat Protection) 2021 ..... *23*
State Environmental Planning Policy (Primary Production and Rural Development) 2019 ..... *23*
State Environmental Planning Policy N. 55 – Remediation of Land *24*
State Environmental Planning Policy – Infrastructure 2007 ..... *24*
3.5. Local Planning Issues 24
Gwydir Local Environmental Plan 2013 ..... *24*
3.6. New England North West Regional Plan 2036 25
3.7. Other Environmental Policies, Guidelines and Plans 25

4. Environmental Setting 26
4.1. Topography and Drainage 26
4.2. Meteorology 26
4.2.1. Introduction *26*
4.2.2. Temperature and Humidity *26*
4.2.3. Rainfall and Evaporation *27*
4.2.4. Wind *28*
4.3. Land Ownership and Surrounding Residences 30

5. Assessment and Management of Environmental Issues 31
5.1. Traffic and Transport 31
5.1.1. Introduction *31*
5.1.2. Existing and Future Road Transport Environment *31*
5.1.3. Traffic Generation and Distribution *37*
5.1.4. Management and Mitigation Measures *39*
5.1.5. Assessment of Impacts *40*
5.1.6. Conclusion *44*
5.2. Biodiversity 45
5.2.1. Introduction *45*
5.2.2. Assessment Methodology *45*
5.2.3. Landscape context *48*
5.2.4. Management and Mitigation Measures *57*
5.2.5. Assessment of Impacts *58*
5.2.6. Biodiversity Credit and Offset Report *61*
5.2.7. Conclusion *62*
5.3. Air Quality 63
5.3.1. Introduction *63*
5.3.2. The Existing Environment *63*
5.3.3. Criteria for Assessment *66*
5.3.4. Identified Potential for Emissions to Air *67*
5.3.5. Assessment Methodology *67*
5.3.6. Proposed Management and Monitoring Measures *68*
5.3.7. Assessment of Impacts *70*
5.3.8. Conclusion *73*
5.4. Noise and Vibration 73
5.4.1. Introduction *73*
5.4.2. The Existing Environment *74*

Table of Contents

5.4.3. Criteria for Assessment 74
5.4.4. Assessment Methodology 75
5.4.5. Proposed Management and Monitoring Measures 77
5.4.6. Assessment of Impacts 77
5.4.7. Conclusion 80
5.5. Water 80
5.5.1. Introduction 80
5.5.2. Existing Environment 82
5.5.3. Proposed Management and Monitoring Measures 83
5.5.4. Assessment of Impacts 85
5.5.5. Conclusion 87
5.6. Cultural Heritage 88
5.6.1. Introduction 88
5.6.2. Aboriginal Cultural Heritage 88
5.6.3. Historic Heritage 88
5.6.4. Management and Mitigation Measures 88
5.6.5. Assessment of Impacts 89
5.6.6. Conclusion 90
5.7. Land Resources 90
5.7.1. Introduction 90
5.7.2. Existing Environment 90
5.7.3. Management and mitigation Measures 92
5.7.4. Impact Assessment 94
5.8. Visual Amenity 95
5.8.1. Introduction 95
5.8.2. The Existing Visual Landscape 95
5.8.3. Management and Mitigation Measures 95
5.8.4. Assessment of Impacts 95
5.9. Public Safety Hazards 95
5.9.1. Introduction 95
5.9.2. Existing Environment – Bushfire 95
5.9.3. Management and Mitigation Measures 96
5.9.4. Assessment of Impacts 97
5.10. Social and Economic 98
5.10.1. Introduction 98
5.10.2. The Existing Social and Economic Setting 98
5.10.3. Management and Mitigation Measures 99
5.10.4. Impact Assessment 99

6. Evaluation and Justification of the Proposal 103
6.1. Introduction 103
6.2. Ecological Sustainable Development 103
6.3. Consequences of not proceeding with the proposal 104
6.4. Cumulative Impacts 104
6.5. Object of the EP&A Act 104
6.6. Conclusion 105

Table of Contents

TABLES

Table 1 – Nearby Sensitive Receptors....6
Table 2 – Environmentally Sensitive Area of State significance....20
Table 3 – Temperature Summary – Texas Post Office 041100 (1969 - present)....27
Table 4 – Humidity Summary – Texas Post Office 041100 (2019 - present)....27
Table 5 – Rainfall Summary – BoM North Star (Wolonga) 053095 (1972 - present)....27
Table 6 – Evaporation Summary – BoM Inverell Research Centre 056018 (2019 - present)....27
Table 7 – Nearby Sensitive Receptors....30
Table 8 – Recommended Biodiversity Management Measures....57
Table 9 – Discrete Sensitive Receptor Locations for the AQIA....64
Table 10 – Greenhouse Gas Management....69
Table 11 – Sediment Basin Storage Requirements....86
Table 12 – Water Balance Assessment Results (Above Average Rainfall)....87
Table 13 – Water Balance Assessment Results (Below Average Rainfall)....87
Table 14 – Population Statistics (ABS 2016)....98
Table 15 – Employment....99
Table 16 – Checklist of Matters Assessment....100

FIGURES

Figure 1 – Site Location Plan....ix
Figure 2 – Site and Surrounds Plan....x
Figure 3 – Conceptual Site Layout Plan....xi
Figure 4 – Conceptual Quarry Development Plan....xii
Figure 5 – Conceptual Final Land Form....xv
Figure 6 – Conceptual Final Land Form (Cross Sections)....xvi
Figure 7 – Rehabilitation Management Plan....xvii
Figure 8 – Conceptual Quarry Development Visualisation....xviii
Figure 9 – ARTC Inland Rail Project Maps....4
Figure 10 – Surrounding Landholders Map....8
Figure 11 – Newell Highway Projects Haul Routes....14
Figure 12 – Watercourse Mapping....26
Figure 13 – Vegetation zones, plot locations and ecologist's survey track....47
Figure 14 – Site Map showing the IBRA Subregions and Mitchell (NSW) Landscapes....49
Figure 15 – Extent of native vegetation cover....50
Figure 16 – Polygon for threatened flora assumed present....55
Figure 17 – Polygon for threatened fauna assessment present....56
Figure 18 – Amended proposal to avoid impacts to remnant woodland....59
Figure 19 – Population density and sensitive receptors surrounding the site....64
Figure 20 – 3-dimensional representation of topography surrounding the site....66
Figure 21 – Incremental 24-hour PM10 concentrations....72
Figure 22 – Incremental 24-hour PM2.5 concentrations....72
Figure 23 – Noise modelling results, LAeq(15min) – Stage 1 (Day)....78
Figure 24 – Noise modelling results, LAeq(15min) – Stage 1 (Morning Shoulder)....79
Figure 25 – Stormwater Management Plan (Figure 1 of the SWA)....81
Figure 26 – Watercourses in relation to the proposal....82
Figure 27 – Great Soil Group Soil Type Map of NSW (source SEED 2020)....91
Figure 28 – SEED Database Land and Soil Capability....92
Figure 29 – Bushfire Prone Land (NSW Planning Portal)....96

Table of Contents

PLATES

Plate 1 Minilya Road 31
Plate 2 Sight distance facing north along Croppa Creek Road 32
Plate 3 Sight distance facing south along Croppa Creek Road 32

DIAGRAMS

Diagram 1 – Conceptual On-site Extraction Operations 12
Diagram 2 – Wind Roses – BoM Texas Post Office (station 041100) – Summer 2020 28
Diagram 3 – Wind Roses – BoM Texas Post Office (station 041100) – Autumn 2020 29
Diagram 4 – Wind Roses – BoM Texas Post Office (station 041100) – Winter 2020 29
Diagram 5 – Wind Roses – BoM Texas Post Office (station 041100) – Spring 2020 30

DRAWINGS

2542 DRG 001	Site Location Plan
2542 DRG 002	Site and Surrounds
2542 DRG 003 R1	Conceptual Site Layout Plan
2542 DRG 004 R1	Conceptual Quarry Development Plan
2542 DRG 005 R1	Conceptual Final Landform
2542 DRG 005A R1	Conceptual Final Landform Cross Sections
2542 DRG 006 R1	Surrounding Landholder Map
2542 DRG 007 R1	Rehabilitation Management Plan
2542 DRG 010 R1	Conceptual Quarry Development Visualisation

APPENDICES

Appendix 1	Application for Development Consent
Appendix 2	Secretary's Environmental Assessment Requirements
Appendix 3	Coverage of Secretary's Environmental Assessment Requirements
Appendix 4	ARTC Inland Rail Project Maps
Appendix 5	Site Office and Toilet
Appendix 6	Resource Investigation
Appendix 7	Traffic Impact Assessment
Appendix 8	Biodiversity Development Assessment Report
Appendix 9	Air Quality Impact Assessment
Appendix 10	Noise and Vibration Impact Assessment
Appendix 11	Surface Water Assessment
Appendix 12	Aboriginal Due Diligence & Historic Heritage Assessment Report
Appendix 13	Groundwater Impact Assessment

Executive Summary

Introduction

This Environmental Impact Statement (EIS) has been prepared by Groundwork Plus Pty Ltd on behalf of Regional Quarries Australia Pty Ltd (RQA) (the applicant) which is part of the Regional Group Australia (RGA). This document has been prepared to accompany a development application for the establishment of the North Star Quarry (the proposal).

The proposal is to establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects and then a maximum of 150,000t/yr for a period of ten (10) years to service the general market in the local area.

The proposal is located at located at 5535 North Star Road, North Star, NSW, 2408 on Lot 7 DP755984 and Lot 1 DP1227212 (the site). The site is 6km East of the Inland Rail Project site, approximately 6km South of North Star, 76 North East of Moree and 65km North North West of Warialda, in Northern New South Wales. (refer Figure 1 – Site Location Plan and Figure 2 – Site and Surrounds Plan). The site is rural, freehold land registered to Doolin Minilya Pty Ltd (the landowner).

The proposal is classified as designated development as it would exceed criteria identified by Clause 19 of Schedule 3 of the *Environmental Planning and Assessment Regulation 2000*. The proposal is classified as regional development under Clause 7(a) of Schedule 7 of the State Environment Planning Policy (SEPP) (State and Regional Development) 2011. The proposal is classified as integrated development under Section 4.46 of the *Environmental Planning and Assessment Act 1979*.

This EIS has been prepared to support the development application for development consent for Extractive industry at the site. Gwydir Shire Council (Council) is to accept, exhibit and assess the application. The Northern Joint Regional Planning Panel are to determine the application. This EIS has been prepared in accordance with the Secretary's Environmental Assessment Requirements (EAR 1494) which were accompanied by additional assessment requirements provided by various government departments.

The applicant

The applicant for the proposal is Regional Quarries Australia Pty Ltd, a company based in Dubbo which operates regional quarries including but not limited to the West Wyalong Quarry, Dubbo Quarry and Forbes Quarry.

Objectives of the proposal

The applicant's objectives for the proposal are to:

- provide a high quality, economical source of hard rock quarry products for construction of the Inland Rail Project and associated road upgrade projects in the short term; and
- provide a high quality, economical source of hard rock quarry products for local road projects and the general market in the longer term; and
- minimise to the greatest extent possible, impact to the local environment, community and stakeholders; and
- provide a final post extraction landform suitable for rural activities including but not limited to cattle grazing; and
- ensure the operation of the proposal is safe, reliable and cost effective, contributing to the delivery of the Inland Rail Project and the economy of the region.

Description of the proposal

The proposal is to establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects and then a maximum of 150,000t/yr for a period of ten (10) years to service the general market in the local area (refer Figure 3 – Conceptual Site Layout Plan and Figure 4 – Conceptual Quarry Development Plan).

Figure 1 – Site Location Plan

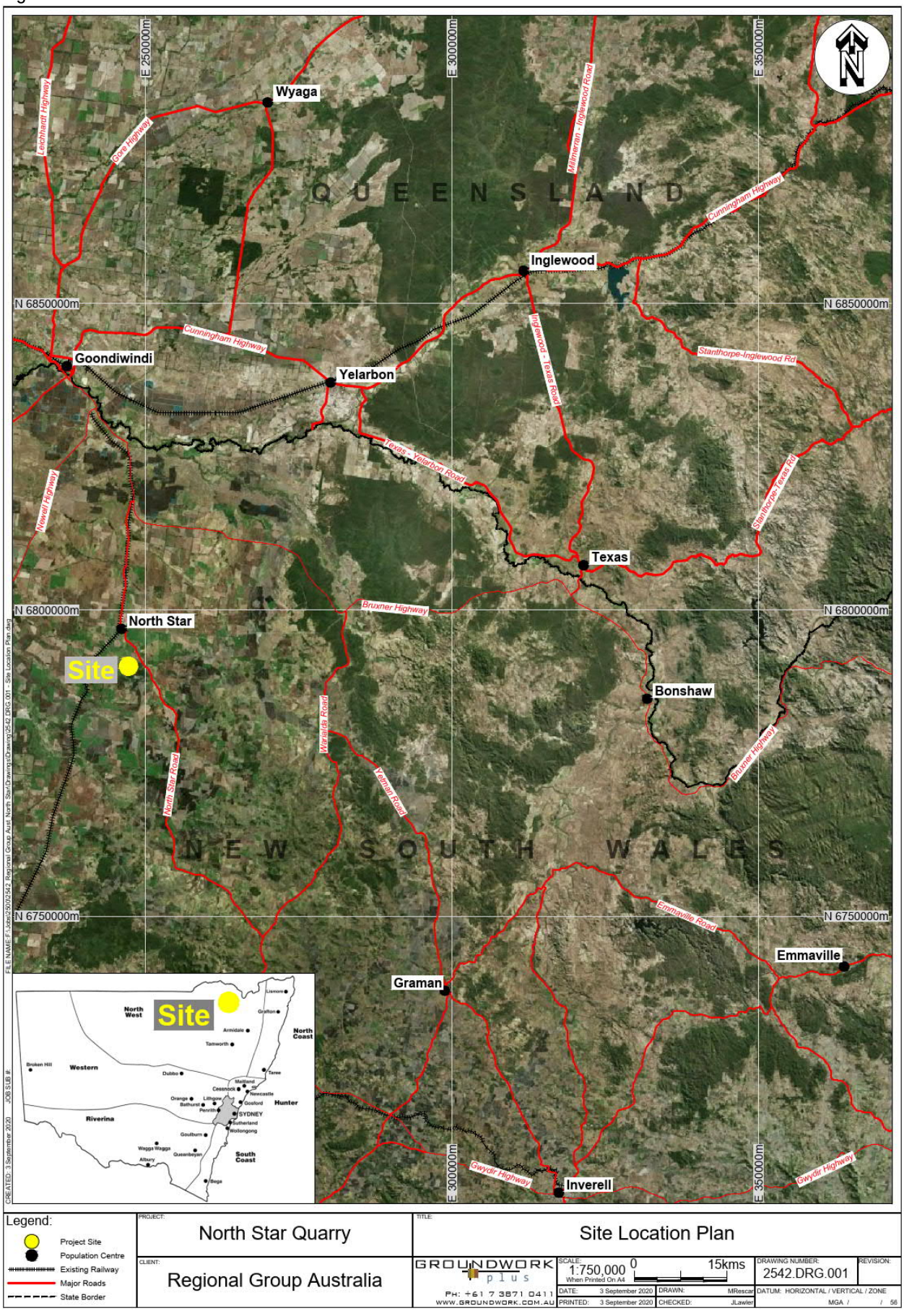


Figure 2 – Site and Surrounds Plan

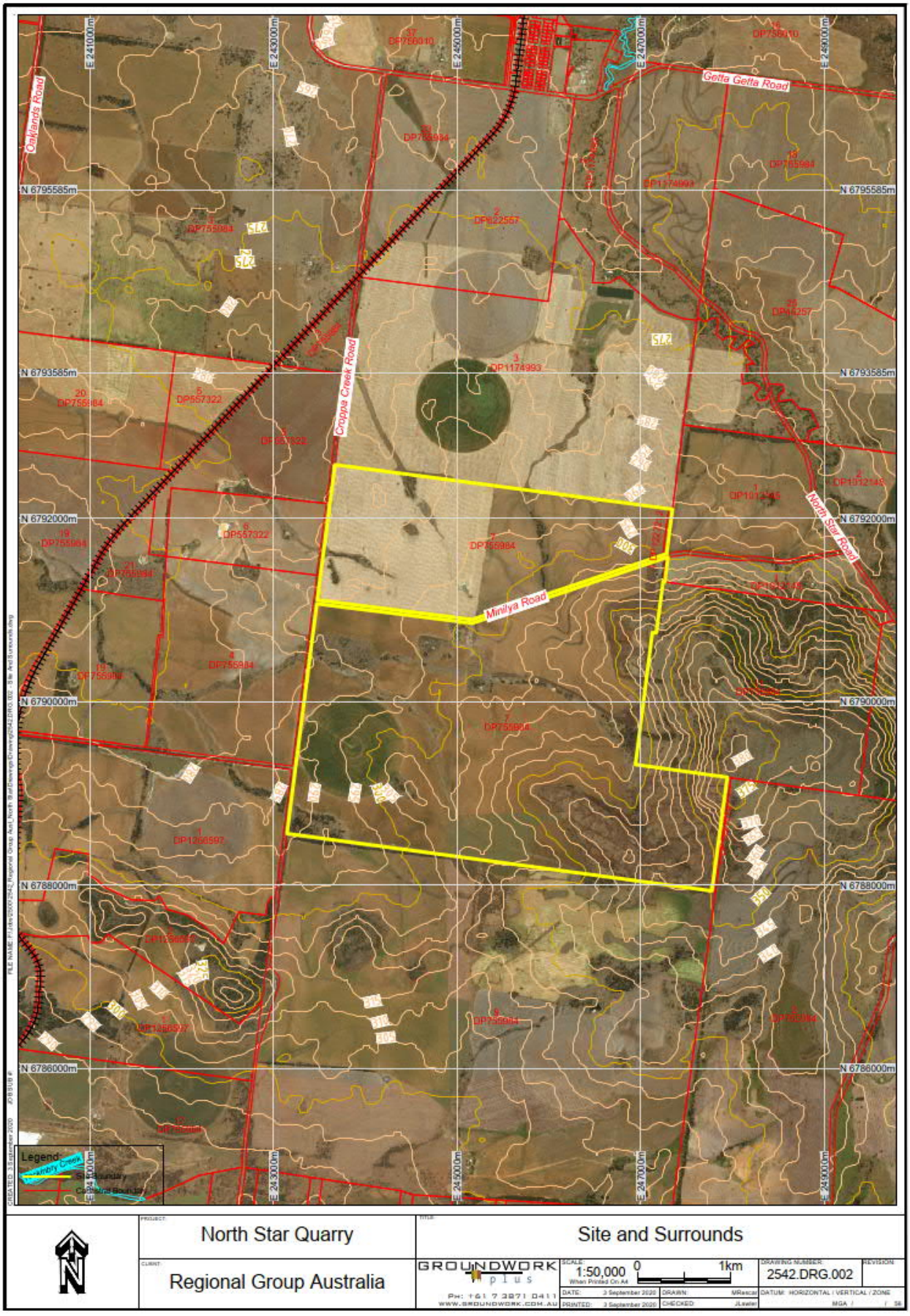


Figure 3 – Conceptual Site Layout Plan

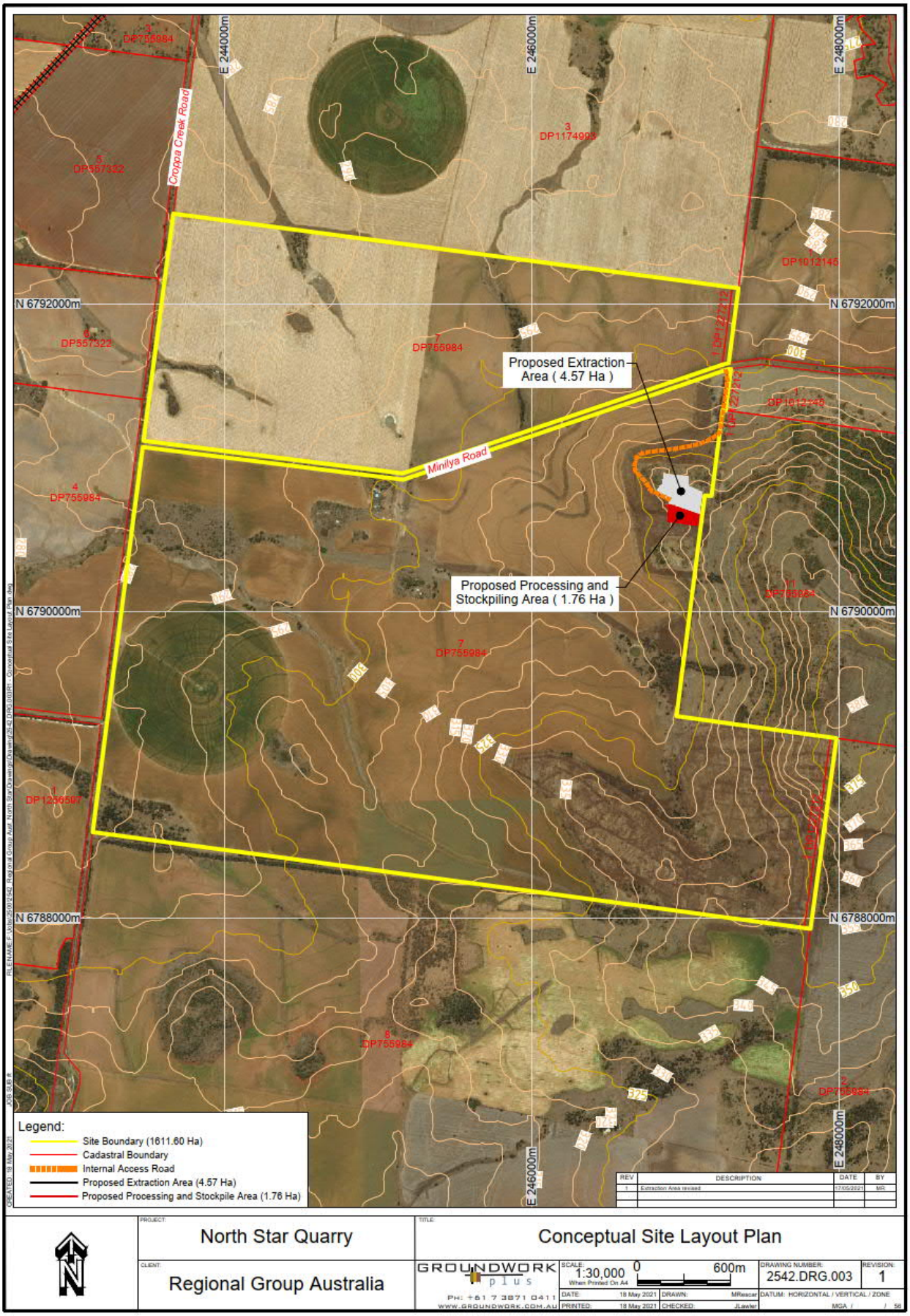
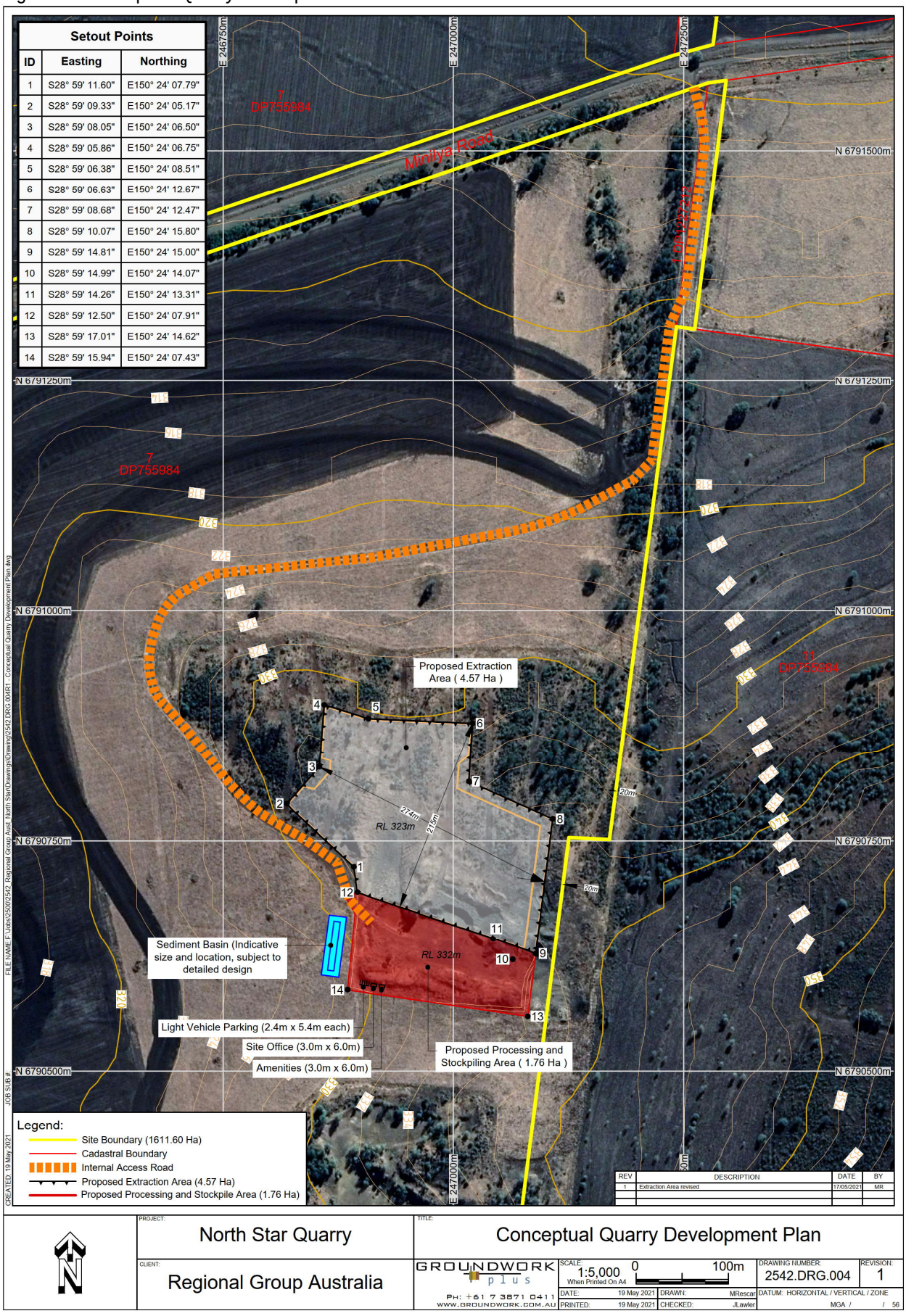


Figure 4 – Conceptual Quarry Development Plan



The proposal will include:

- Extraction of a maximum of 490,000t/yr for a period of 5 years, and then extraction of a maximum of 150,000t/yr for a period of 10 years;
- A maximum depth of extraction of RL 323m AHD;
- Conventional drill and blast techniques to extract the hard rock resource;
- Mobile plant to crush and screen the extracted material to produce a range of quarry products, including aggregates, railway ballast, road base and general fill;
- Processing and stockpiling of quarry products;
- Loading and transportation of quarry products via the internal access road to the local road network via Minilya Road and Croppa Creek Road;
- Surface water management measures including sediment basins, diversion bunds and drains;
- Ancillary infrastructure, including temporary demountable site office and amenities;
- Progressive rehabilitation of the site to achieve a post extraction landform suitable for rural activities including but not limited to cattle grazing (refer Figure 5 – Conceptual Final Land Form and Figure 6 – Conceptual Final Land Form (Cross Sections) and Figure 7 – Rehabilitation Management Plan).

The site is approximately 1611.60ha and the total area of the proposal is 6.45ha including:

- An extraction area of 4.57ha;
- A processing and stockpiling area of 1.76ha;
- A sediment basin and associated surface water management measures; and
- The internal access road.

The proposed hours of operation are:

- Extraction and processing, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Truck loading and dispatch, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Blasting, 9am to 3pm Monday to Friday;
- No operations on Sundays or Public Holidays.

Between 5 and 10 staff are anticipated to be required for the proposal. Staff will be sourced locally where possible and if staff or support crews come from the wider region they will be accommodated in the local towns or Moree.

Traffic

Construction traffic generated for the commissioning and decommissioning of the quarry site will be minimal consisting of vehicle movements for floating plant and equipment to and from the site.

The proposal would supply quarry materials to the Inland Rail Project and associated road projects. It is anticipated that access to the Inland Rail construction corridor would be available via Minilya Road to Croppa Creek Road, with trucks using the rail corridor to access any Inland Rail construction or stockpile sites. A mix of vehicle types would be used for product haulage, typically truck and trailer combinations, and B-doubles and Type 1 A-double road trains where approved routes are available. The payload capacity of these vehicles varies, and for the purpose of this assessment, an average payload of 38t has been assumed, which is typical of the truck and trailer combinations.

Haulage of 490,000t of material per year would require approximately 12,900 laden truck loads per year. Assuming continuous operation throughout the 50 operating weeks per year, this would be equivalent to an average of approximately 46 laden truck loads per operating weekday, and equivalent to an average of 4 laden truck loads per hour exiting the site. As haulage would occur on a campaign basis to meet fluctuating demands of the infrastructure projects being supplied, the number of trips on any particular day would vary. The peak daily haulage to address short term demands for construction materials for the Inland Rail Project or other time-critical works is assumed to be in the order of 5,000t on any one day. This would require approximately 132 laden truck loads per day, equivalent to an average of 8 to 11 laden loads per hour over a weekday. Peak operating days such as these would be offset by periods of lower activity, such as during lower construction activity or wet weather.

The traffic generation assumed for the purpose of this assessment of “busy day” conditions is therefore:

- 20 light vehicle trips per day; and
- 264 heavy vehicle trips per day (maximum 24 heavy vehicle trips per hour).

By comparison, the average weekday daily traffic generation would be:

- 20 light vehicle trips per day; and
- 92 heavy vehicle trips per day (maximum 24 heavy vehicle trips per hour).

Once the IRP has finished the proposal would supply quarry materials to the general market. It is anticipated that access to the general market would be via Minilya Road to Croppa Creek Road. A mix of vehicle types would be used for product haulage, typically truck and trailer combinations, and B-doubles and Type 1 A-double road trains where approved routes are available. The payload capacity of these vehicles varies, and for the purpose of this assessment, an average payload of 38t has been assumed, which is typical of the truck and trailer combinations.

Haulage of 150,000t of material per year would require approximately 3,950 laden truck loads per year. Staff numbers are likely to reduce to five (5) in this scenario. Assuming continuous operation throughout the 50 operating weeks per year, this would be equivalent to an average of approximately 14 laden trucks loads per day or about 1 laden truck per hour exiting the site. Therefore, the traffic generation assumed for the average week daily traffic generation for 150,000t/yr would be:

- 10 light vehicle trips per day; and
- 28 heavy vehicle trips per day.

Figure 5 – Conceptual Final Land Form

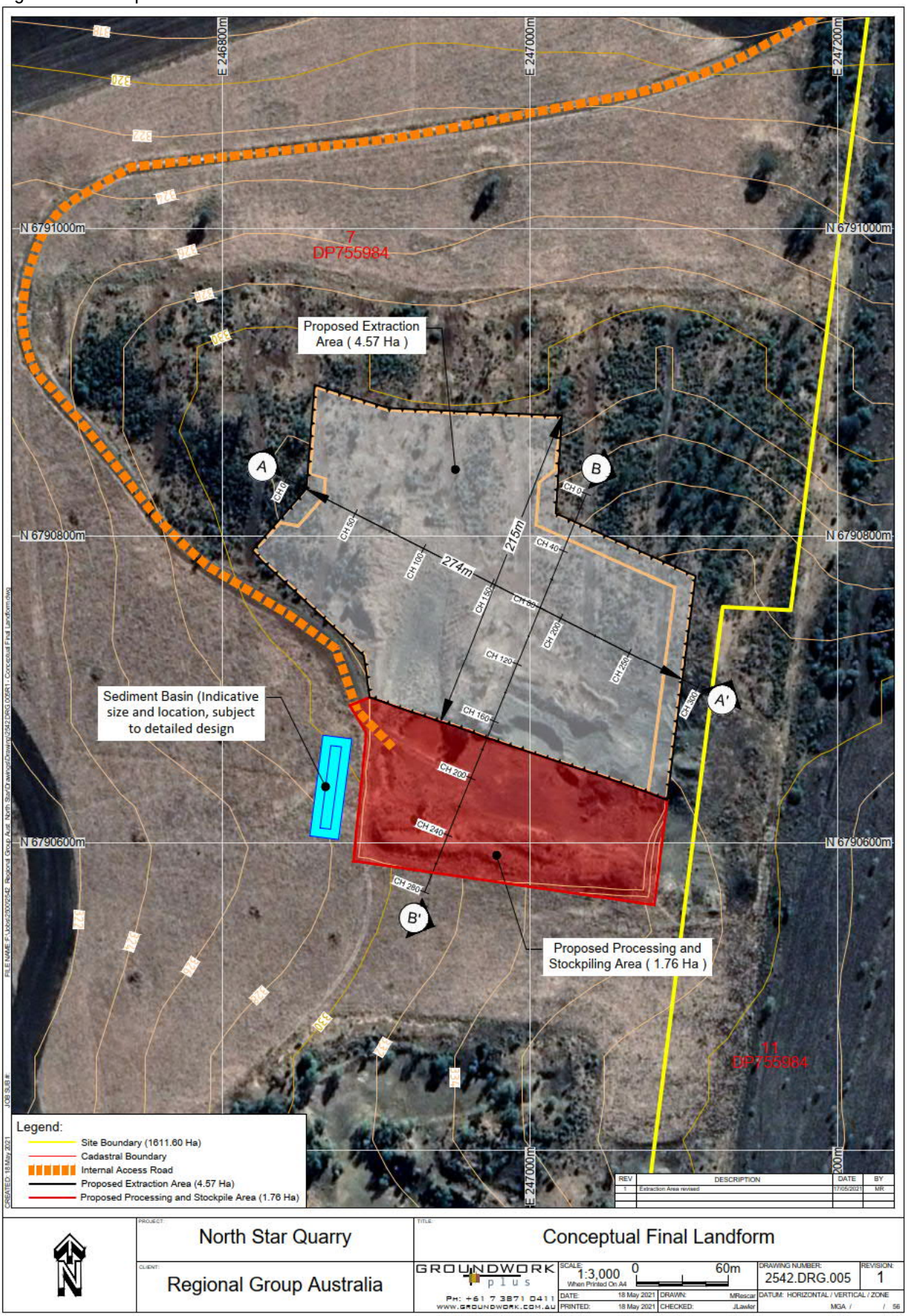


Figure 6 – Conceptual Final Land Form (Cross Sections)

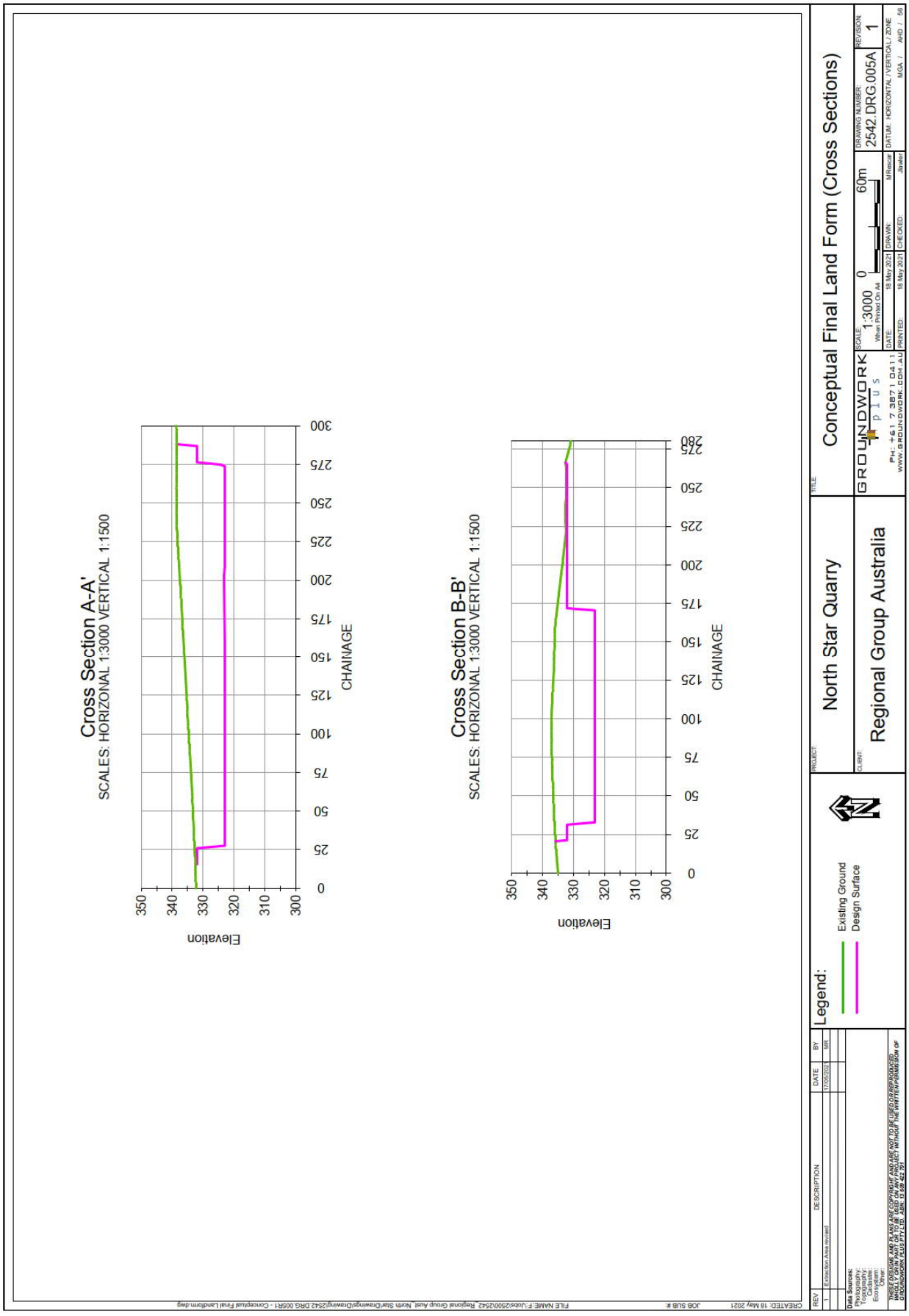


Figure 7 – Rehabilitation Management Plan

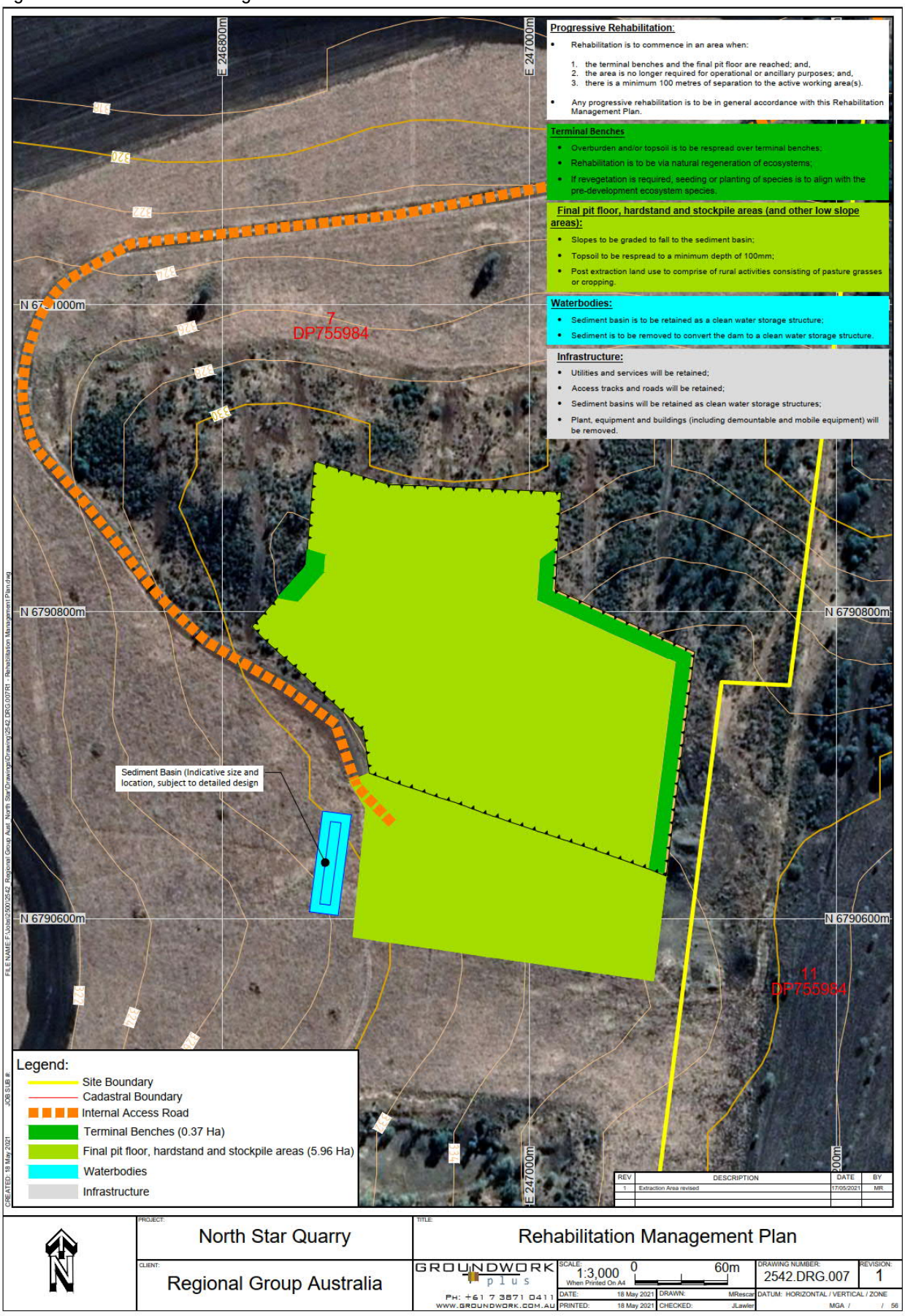


Figure 8 – Conceptual Quarry Development Visualisation



Resource description

Resource investigations conducted between 2017 and 2020 indicate that the site is in an area of Cainozoic Mafic Volcanics commonly occurring as basalt lava flows (up to 65 million years old). The basalt sits above a Jurassic Sedimentary sequence of rocks (145 to 201 million years old) including sandstone and clay. The resource on the site consists of two low lying hills on the eastern site boundary. The remainder of the site to the west is used for cropping and rural activities. The basalt hills expand and rise to the east in the adjoining properties. The site has previously been quarried. The basalt layer was thicker and fresher to the east, thinning and weathering to the west. Drilling confirms that claystone and sandstone exists below the basalt. Typically, 1m of overburden exists over 2 to 3m of weathered to moderately weathered basalt before intersecting fresh basalt. The total resource within the proposed pit design is estimated to be approximately 1,700,000t consisting of overburden, moderately weathered basalt, fresh basalt and sandstone suitable for production of fill, pavements, sealing and asphalt aggregates and ballast.

Legislative context

The site is in the Gwydir Local Government Area. The Gwydir Local Environmental Plan 2013 (GLEP) is the current local government planning policy for land administered by Gwydir Shire Council. The site is in the RU1 'Primary Production' zone which permits Extractive industry with consent. The proposal is consistent with the objectives of the zone RU1, which 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 minimise conflict between land uses within this zone and land uses within adjoining zones.

The proposal will be developed and operated in accordance with the following State planning instruments:

- State Environmental Planning Policy – State and Regional Development 2011
- State Environmental Planning Policy – Mining, Petroleum Production and Extractive Industries 2007
- State Environmental Planning Policy – Infrastructure 2007
- State Environmental Planning Policy N. 55 – Remediation of Land

In addition to the development consent the proposal will require an Environment Protection Licence and is likely to require a Section 138 Permit under the Roads Act 1993. The Section 138 Permit will be sought subject to receiving development consent for the proposal.

Assessment and management of key environmental issues

The existing environment surrounding the site have been assessed and the proposal designed to avoid or minimise impacts on the environment as much as reasonably possible. The key aspects of the surrounding environment, the proposed management measures and the level of impact of the proposal are as follows.

Traffic

SMK Consultants were commissioned to prepare a Traffic Impact Assessment (TIA) for the proposal. The TIA considered the potential impacts of the proposal upon traffic on site and within the wider region. The proposed site access and internal roads within Minilya will require upgrades to be suitable for the potential peak traffic movements. This will include construction of an appropriate intersection into Minilya and widening of Minilya Road to either a 2-lane haul road or installation of "Whale berms" to allow empty trucks to wait on the side of the road for loaded trucks to pass with a TCP in place.

The Minilya Road-North Star Road intersection will require upgrading to provide a safe entry-exit intersection for trucks. Work will include extending the bitumen seal on Minilya Road to approximately 30m in length and re-alignment of the intersection to meet Austroad standards for the trucks to use this road safely. A standard rural intersection is considered a minimum to provide safe entry and exit for up to 8-trucks per hour either leaving or entering this road.

The increase in traffic along the local road network is considered significant. Road condition of sealed roads is generally suitable for this increase in truck movements, but specific sections have been identified to have minor issues in relation to road foundations and roughness of the roads. The result of such poorer quality sections will include a reduction in truck speed, rather than a traffic safety issue. Road shoulder damage is predicted to increase in these rougher sections. Some intersection points at present, show dilapidation at stop points.

The use of local gravel paved roads will require close management due to the presence of relatively poor sections of gravel pavement. Some sections of these local roads would be considered as dry weather roads only due to the lack of gravel pavement depth. It is recommended that the quarry operator adopt a wet weather protocol to ensure the integrity of these gravel roads is maintained. This will include variation to haul routes during and for several days after a rainfall event. A figure of 10mm of rain may be required as a formal trigger for stopping the use of certain roads. Quarry management will need to continue an active program to avoid road damage in wet weather. The alternative is that Council closes unsealed roads to quarry trucks to prevent use of these roads to ensure access is retained for local landholders.

A Traffic Management Plan (TMP) would be developed subject to development consent for the proposal. Provided the proposal manages dust and noise effectively and addresses concerns of sensitive rural receptors the potential for heavy vehicle traffic to adversely impacts on the amenity of rural areas is considered to be minimal.

The proposal is subject to the Gwydir Shire Council and Moree Plains Shire Council heavy haulage contribution policies which are typically used to cover the costs of maintenance, repair and reconstruction of roads as a result of damage caused by heavy vehicles generated by development. Proposed contribution rates for the IRP are:

a) $0.387/tonne to Gwydir Shire Council
b) $0.129/tonne to Moree Plains Shire Council

However, it is noted that Australian Rail Track Corporation (ARTC) have been consulting with impacted local government authorities during the planning of the Inland Rail Project (IRP) it is understood that Council would have been informed by the ARTC that ARTC will take on the burden of maintaining the local road network during delivery of the IRP. For example, the Narrabri to North Star Phase 1 approval (SSI 7474) provides the local road authorities with assurance that all road maintenance will occur / or compensation be provided for impacts to local roads from construction traffic (including quarry haulage vehicles) based on the following condition:

E40 - If damage to roads occurs as a result of the construction of CSSI, the Proponent must, within six months of the completion of construction, either (at the landowner or relevant road authority's discretion):

(a) compensate the relevant road authority(ies) and landowner for the damage so caused. The amount of compensation may be agreed with the relevant road authority(ies) and landowners, but compensation must be paid even if no agreement is reached;
(b) rectify the damage to restore the road to at least the condition it was in at the time of the dilapidation survey; or
(c) where other agreements are in place, leave, maintain or remunerate for damages to these roads in accordance with these agreements.

The issue of cumulative traffic increases has been identified during this investigation. Subject to the outcome of this proposal, there will be three quarries in the local area potentially operated by RQA, being the Tikitere, Pearlman and North Star Quarry. If all three quarries become operational at the same time, truck traffic frequency on the local road network would be significant. However, it is anticipated that RQA will coordinate the delivery from all three quarries to meet the fluctuating demand from the IRP. It is recommended that if this occurs, a traffic management plan is developed for all three quarries to work together to ensure road safety can be maintained, road maintenance can be managed by Councils and other users can safely use their local road network. This is identified to be a significant issue that will need cooperation during grain harvest periods when additional local trucks are hauling grain around the district.

Based on this assessment, use of the local road network will result in some damage. Appropriate contributions need to be paid to Councils to cover the cost of repairs which may include an increased presence of road repair gangs for pot hole repairs on a weekly basis. As a whole, no specific road safety issues were identified that need immediate action prior to North Star Quarry operations commencing other than works on the Minilya Road.

<u>Biodiversity</u>

OzArk Environment & Heritage (OzArk) prepared a Biodiversity Assessment Report (BDAR) for the proposal. The assessment seeks to address the requirements of the Biodiversity Conservation Act 2016 in relation to biodiversity assessment and the NSW Biodiversity Offset Scheme. The report applies the Biodiversity Assessment Method (BAM) (OEH 2020) to calculate the number of ecosystem and species credits generated by the proposal requiring offset.

The native vegetation to be cleared has been identified as 6.45 ha of one Plant Community Type (PCT):

- PCT 445 Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion.

The vegetation within the modified quarry footprint as of May 2021 includes partially cleared and degraded areas. The vegetation on the site is not of sufficient condition to be part of any of the TEC associated with the Brigalow vegetation in the surrounding woodland areas.

In total 16 potential ecosystem credit species were predicted for the PCT and condition as a derived grassland. Woodland areas around the quarry site were excluded from the development footprint after the design was modified, as part of avoidance measures. Due to the low VI scores for each zone, no ecosystem credits either for the PCT or for the 16 predicted species are required to be offset.

Ten candidate species credit species were determined from the BAM calculations. The following species have been excluded and are considered not impacted due to habitat requirements not being present in the subject land (suitable habitat trees, flora species, and intact native vegetation not present).

- Absent: Pale Imperial Hairstreak (Jalmenus eubulus), Grey-headed Flying-fox (Pteropus poliocephalus), Koala (Phascolarctos cinereus), Masked Owl (Tyto novaehollandiae).

The following species have been assessed as 'assumed present', due to there being no justifiable reason for excluding them from the site, and no targeted surveys completed in this study.

- Present: Ooline (Cadellia pentastylis), Large-eared Pied Bat (Chalinolobus dwyeri), Belson's Panic (Homopholis belsonii), Large Bent-winged Bat (Miniopterus orianae oceanensis), Barking Owl (Ninox connivens), Eastern Cave Bat (Vespadelus troughtoni).

The proponent is obligated to offset the impacts of the development on potential threatened species (species credit species) by purchasing and retiring species credits on the open market or by making a payment to the Biodiversity Conservation Fund.

The following threatened species present or assumed present on the subject land have been assessed in relation to potential SAII on the species, as per section 9.1.2 of the BAM manual.

- Large-eared Pied Bat (Chalinolobus dwyeri), Large Bent-winged Bat (Miniopterus orianae oceanensis), Eastern Cave Bat (Vespadelus troughtoni).

The significance of the proposed impact to EPBC Listed threatened, migratory, wetland and marine species predicted to occur within a 10 km search area was assessed. No significant impact to a threatened, migratory, wetland or marine species likely to result in the extinction of a local population was identified. The residual ecological impacts of the project would be adequately mitigated using the management actions recommended. Therefore, a referral of the project to the Federal Department of Agriculture, Water and the Environment for these matters is not required.

Air quality

Northstar Air Quality assessed the potential air quality impacts of the proposal.

Emissions of particulate matter associated with construction phase and operational phase activities have been estimated, including a number of emission control measures proposed to be adopted. To ensure that the assessment provides an appropriately conservative approximation of the potential impacts at surrounding receptor locations, certain control measures which are proposed to be adopted have not been included in the assessment, specifically the watering of exposed areas. In this way, the predicted incremental impacts can be viewed as worst-case.

The assessment considers the impacts of activities associated with the maximum operational activity of the Quarry at 490,000t/yr to service the Inland Rail Project. After the peak, the extraction rate is anticipated to reduce to 150,000t/yr, and as such the assessment at the peak annual rate will address the risks of lower activity rates. An assessment of the potential air quality impacts along off-site transportation routes has also been provided. The AQIA has used a quantitative dispersion modelling approach, performed in accordance with the relevant NSW guidelines. The results of the assessment are presented as predicted incremental change, and as a cumulative impact accounting for the prevailing background air quality conditions.

The results of the AQIA indicate that at the peak extraction rate, the air quality criteria can be achieved. In periods when water may not be readily available, haul road watering may be restricted, and low silt aggregate may be used along internal haul roads, in conjunction with a lowering of vehicle speeds, to result in similar off-site impacts. As previously noted, the assessment of wind erosion has assumed that no control is applied, with the results indicating that control of this source of emissions is not critical to compliance with air quality criteria. It is stressed that watering of exposed areas will be performed when possible.

A Trigger Action Response Plan (TARP) would be developed which would link visible dust generation from all activities with wind conditions experienced at the Quarry site. A range of actions would be listed which would be adopted to reduce visible dust generation, until such time as the adopted trigger levels have reduced. It is noted that the adoption of a TARP is not critical to ensure compliance with the adopted air quality criteria, and its use should result in impacts being less than those predicted within this AQIA.

It is demonstrated that the proposal can be operated in such a manner as to ensure compliance with all adopted air quality criteria, and the development should not be refused on the grounds of air quality.

Noise and vibration

Muller Acoustic Consulting assessed the potential noise and vibration impacts of the proposal. The assessment has quantified potential construction and operational noise emissions pertaining to extraction, processing, drilling and dispatch via road trucks, as well as blasting noise and vibration emissions. The results of the assessment that construction and operational noise levels would achieve the relevant criteria for all assessment periods at each assessed receiver location during noise enhancing meteorological conditions. An assessment of maximum noise levels demonstrated that noise emissions from the proposal are predicted to remain below the EPA trigger levels for sleep disturbance at all receiver locations. The assessment demonstrates that quarry related road traffic noise levels will meet the objectives of the RNP for the nearest residential receivers on Edward Street, North Star Road and Buckie Road, Croppa Creek. Airblast overpressure and vibration levels are also predicted to meet the criteria at all assessed receivers for blasts up to 300kg MIC. Based on the assessment results, there are no noise or blasting related issues which would prevent the approval of the quarry. The results of the assessment show compliance with the relevant operational and road noise criteria. Additionally, the results of the assessment demonstrate compliance with the relative EPA and DECCW policies, without ameliorative measures being required.

Surface water

Groundwork Plus prepared a surface water assessment to consider potential surface water impacts of the proposal. The assessment includes a detailed site water balance and description of the proposed surface water management system and identified the proposed water quality parameters in the event that water is discharged from the sediment basins.

The proposal will manage the disturbed areas of the proposal by diverting all surface water to sediment basins. In order to meet the requirements of the EIS, the sediment basins are proposed to be designed, constructed and operated to retain the disturbed area runoff at the site in accordance with DECC (2008) Managing Urban Stormwater - Soils and Construction (Volume 2E). The water balance assessment results confirm a surplus of water in an above average rainfall but a shortfall in a below average rainfall year. However, it is anticipated the proposal will be self-sufficient for water by relying on the proposed sediment basin and clean water dam for the proposal. During the days in the year where water could not be sourced from the sediment basins or clean water dam, the quarry would need to import water for dust suppression. In those events, water would be sourced from an appropriately authorised and licenced water supplier such as Gwydir Shire Council.

It is noted that dams that are solely for the capture, containment and recirculation of drainage and/or effluent, consistent with best management practice or required by a Government agency or Local Government to prevent contamination of a water source, are exempt from both the requirement of holding a water supply work approval & from the requirements of the Harvestable Rights Order.

Groundwater

The Ground Doctor prepared a ground water impact assessment for the proposal.

The site is located within an area with two groundwater management units. Water occurring in the Great Artesian Basin (GAB) is part of the GAB “Eastern Recharge Zone” Groundwater Management Unit (GMU). Geological units beneath the near surface basalt at the site are part of the GMU. Geological units not within the GAB are within the Murray Darling Basin Fractured Rock “New England Fold Belt” GMU.

The assessment included a search of the NSW Water groundwater works database for registered groundwater works located within an approximate 2km radius of the proposal. In additional the assessment drilled three boreholes at the site to assess depth to groundwater within the proposed extraction area. The boreholes were advanced to at least 5m below the maximum depth of the proposal and reached depths ranging from 308m AHD to 316m AHD. Data collected indicates that groundwater will not be encountered by the proposal.

Aboriginal heritage

OzArk Environment & Heritage (OzArk) were engaged to complete an Aboriginal Archaeological Impact Assessment (AAIA) and Historic Heritage Impact Assessment (HHIA) of the proposal. The fieldwork component of this assessment was undertaken by OzArk Archaeologist, Taylor Foster, on Monday 19 April 2021. A visual inspection was conducted by the Toomelah LALC on 17 May 2021. The entirety of the survey area was assessed by pedestrian transects. No Aboriginal sites, sensitive landforms or potential archaeological deposits were recorded during the survey. Further, no items of historic heritage significance were recorded. Recommendations concerning Aboriginal cultural values and historical values within the study area are as follows:

1) The proposed work may proceed at North Star Quarry without further archaeological investigation under the following conditions:
    a) All land and ground disturbance activities must be confined to within the archaeological survey area, as this will eliminate the risk of harm to Aboriginal objects in adjacent landforms. Should the parameters of the proposal extend beyond the assessed areas, then further archaeological assessment may be required.
    b) All staff and contractors involved in the proposed work should be made aware of the legislative protection requirements for all Aboriginal sites and objects.
2) This assessment has concluded that there is a low likelihood that the proposed work will adversely harm Aboriginal cultural heritage sites. However, if Aboriginal objects are identified during the construction and operation of the proposal, all work should cease and the procedures in the Unanticipated Finds Protocol should be followed.
3) In the event of skeletal remains being identified during the construction and operation of the proposal, the Unanticipated Skeletal Remains Protocol should be followed.
4) Inductions for work crews should include a cultural heritage awareness procedure to ensure they recognise Aboriginal artefacts and are aware of the legislative protection of Aboriginal objects under the National Parks and Wildlife Act 1974 and the contents of the Unanticipated Finds Protocol.
5) In the unlikely event that historical relics or deposits are unearthed during the proposed works, the Historical Heritage Unanticipated Finds Protocol should be followed.

Inspection of the study area confirmed no items of historic heritage significance exist or are likely to exist in the study area.

Other impacts

Bushfire, soil and land capability, agriculture and visual amenity impacts associated with the proposal would be negligible.

Evaluation and justification of the proposal

The potential impacts to the environment and potential benefits to the community of the proposal has been assessed with regard to a wide range of environmental, social and economic issues. The proposal has first sought to avoid potential impacts and where avoidance is not possible to minimise, manage and mitigate (if necessary, through offsets) the impacts. The evaluation of the proposal has considered the potential impacts to the environment following implementation of the recommended management measures. The evaluation has found that the proposal achieves a sustainable outcome for the environment subject to the implementation of the recommended management measures.

Conclusion

The proposal has to the greatest practicable extent, been designed to avoid, minimise and mitigate potential impacts and address the environmental, social and economic issues identified by the relevant government agencies through the EAR. The proposal incorporates the extraction, processing and transportation of quarry products to the Inland Rail Project and associated road projects in the short term and over the longer term to the general local market. Given the contribution that the proposal can make to the delivery of the Inland Rail Project and the local market the socio-economic impacts of the proposal are positive. On that basis, the proposal could operate in compliance with the relevant statutory provisions, conditions and criteria and within reasonable community expectations.

1. Introduction

1.1. Scope

This Environmental Impact Statement (EIS) has been prepared by Groundwork Plus Pty Ltd on behalf of Regional Quarries Australia Pty Ltd (the applicant) on behalf of Doolin Minilya Pty Ltd (the landowner). This document has been prepared to accompany a development application for the establishment of the North Star Quarry (the proposal).

The development application is supported by the following Appendices:

Appendix 1	Application for Development Consent
Appendix 2	Secretary's Environmental Assessment Requirements
Appendix 3	Coverage of Secretary's Environmental Assessment Requirements
Appendix 4	ARTC Inland Rail Project Maps
Appendix 5	Site Office and Toilet
Appendix 6	Resource Investigation
Appendix 7	Traffic Impact Assessment
Appendix 8	Biodiversity Development Assessment Report
Appendix 9	Air Quality Impact Assessment
Appendix 10	Noise and Vibration Impact Assessment
Appendix 11	Surface Water Assessment
Appendix 12	Aboriginal Due Diligence & Historic Heritage Assessment Report
Appendix 13	Groundwater Impact Assessment

The development application is supported by the following Drawings:

2542 DRG 001	Site Location Plan
2542 DRG 002	Site and Surrounds
2542 DRG 003 R1	Conceptual Site Layout Plan
2542 DRG 004 R1	Conceptual Quarry Development Plan
2542 DRG 005 R1	Conceptual Final Landform
2542 DRG 005A R1	Conceptual Final Landform Cross Sections
2542 DRG 006 R1	Surrounding Landholder Map
2542 DRG 007 R1	Rehabilitation Management Plan
2542 DRG 010 R1	Conceptual Quarry Development Visualisation

This EIS has been prepared in accordance with the Secretary's Environmental Assessment Requirements (EAR 1494) (refer Appendix 2) which were accompanied by additional assessment requirements provided by various government departments. A list of the assessment requirements and where they have been addressed is provided in Appendix 3.

The proposal is located at 5535 North Star Road, North Star, NSW, 2408 on Lot 7 DP755984 and Lot 1 DP1227212 (the site). The site is 6km East of the Inland Rail Project site, approximately 6km South of North Star, 76 North East of Moree and 65km North North West of Warialda, in Northern New South Wales (refer Figure 1 – Site Location Plan and Figure 2 – Site and Surrounds Plan).

The proposal is to establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects and then a maximum of 150,000t/yr for a period of ten (10) years to service the general market in the local area (refer Figure 3 – Conceptual Site Layout Plan and Figure 4 – Conceptual Quarry Development Plan and Figure 8 – Conceptual Quarry Development Visualisation).

The proposal will include:

- Extraction of a maximum of 490,000t/yr for a period of 5 years, and then extraction of a maximum of 150,000t/yr for a period of 10 years;
- A maximum depth of extraction of RL 323m AHD;
- Conventional drill and blast techniques to extract the hard rock resource;

- Mobile plant to crush and screen the extracted material to produce a range of quarry products, including aggregates, railway ballast, road base and general fill;
- Processing and stockpiling of quarry products;
- Loading and transportation of quarry products via the internal access road to the local road network via Minilya Road and Croppa Creek Road;
- Surface water management measures including sediment basins, diversion bunds and drains;
- Ancillary infrastructure, including temporary demountable site office and amenities;
- Progressive rehabilitation of the site to achieve a post extraction landform suitable for rural activities including but not limited to cattle grazing (refer Figure 5 – Conceptual Final Land Form and Figure 6 – Conceptual Final Land Form (Cross Sections) and Figure 7 – Rehabilitation Management Plan).

1.2. Approvals Required

In accordance with Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) a development application is to be lodged with Gwydir Shire Council. An EIS is required as the proposed development is 'Designated Development' as described in Part 1, Section 19 of Schedule 3 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) for 'Extractive Industries' as the annual threshold for extractive material (30,000m^3) would be exceeded. The application is classified as 'Regional Development' and is to be determined by the relevant Joint Regional Planning Panel under the State Environmental Planning Policy (State and Regional Development) 2011.

Pursuant to Section 4.46 of the EP&A Act, the assessment is classified as 'Integrated Development' as approvals from other government agencies are required. Protection of the Environment Operations Act 1997 (POEO Act), Schedule 1 'Scheduled Activities' identifies activities triggering an Environment Protection Licence (EPL). The proposal would constitute a scheduled activity under the POEO Act pursuant to Clause 16 'Crushing, grinding or separating' and Clause 19 'Extractive activities'. Therefore, the proposal is classified as integrated development under Section 4.46 of the *Environmental Planning and Assessment Act 1979* because it would require an EPL.

In addition the proposal is likely to require a Section 138 Permit under the Roads Act 1993 which will be sought subject to receiving development consent for the proposal.

1.3. Format of the Report

The information presented in this EIS covers all aspects of the proposal. The EIS has been prepared to address the EAR for the proposal. The EIS has been prepared as a single document of several sections and appendices as follows:

- Section 1 introduces the proposal, providing background information and how the investigations for the EIS were undertaken.
- Section 2 provides a description of the proposal, including the objectives of the proposal and describes the operation of the proposal in a practical way, including an overview of the rehabilitation and post extraction landform.
- Section 3 reviews the proposal against the relevant legislative requirements.
- Section 4 presents the environmental context of the site.
- Section 5 assesses the proposal and proposed management, maintenance and monitoring requirements for various aspects of the proposal.
- Section 6 reviews the proposal against the environmental, economic and social considerations, goals and guidelines of Ecologically Sustainable Development and provides the conclusion for the EIS.
- Drawings – Includes the key proposal plans supporting the EIS
- Appendices – Includes the appendices supporting the EIS.

1.4. The Applicant

The applicant for the proposal is Regional Quarries Australia Pty Ltd, a company based in Dubbo which operates regional quarries including but not limited to the West Wyalong Quarry, Dubbo Quarry and Forbes Quarry.

1.5. Background and need for the Proposal

The Narrabri to North Star (N2NS) and North Star to Boarder (NS2B) section of the Inland Railway Project includes upgrade and refurbishment of the existing rail corridor as well as construction of new sections of rail. The site is near the alignment of the Inland Rail Project as shown on Appendix 4 and Figure 9 below.

The construction materials requirements for the N2NS have been confirmed and are being quantified for the NS2B. An extensive amount of material will be required for roads to service the construction, rail pad formation and track ballast. Specifically, the materials required by the Inland Rail project will include structural fill, capping layers and ballast products. In parallel to the Inland Rail project RMS are undertaking are series of upgrade works to the Newell Highway under the fixing the country roads initiative. These projects are to enable improved access to the Inland Rail corridor and associated intermodal hubs located in a number of locations throughout the Gwydir Shire. Other road upgrades include heavy duty pavements, shoulder widening and additional overtaking lanes to be installed between Moree and Goondiwindi.

1.6. Capital Investment Value

The proposal is expected to require a capital investment of $26,320 excluding GST. This investment includes the works to establish the site such as the earthworks associated with the construction of the sediment basin, site access and rehabilitation costs. All plant and equipment associated with the project have a lifecycle beyond the operational life of the project and will be redeployed from the site once the construction projects in the region are complete.

1.7. Consideration of Alternatives

Section 7.5.1 of the Environmental Impact Statement prepared by ARTC for the NS2B section of the Inland Rail Project, outlines a number of borrow pits proposed by ARTC to supply general and structural fill. Site 1 of the identified borrow pits is located to the east of the site and is proposed to yield potentially 400,000m3 of material.

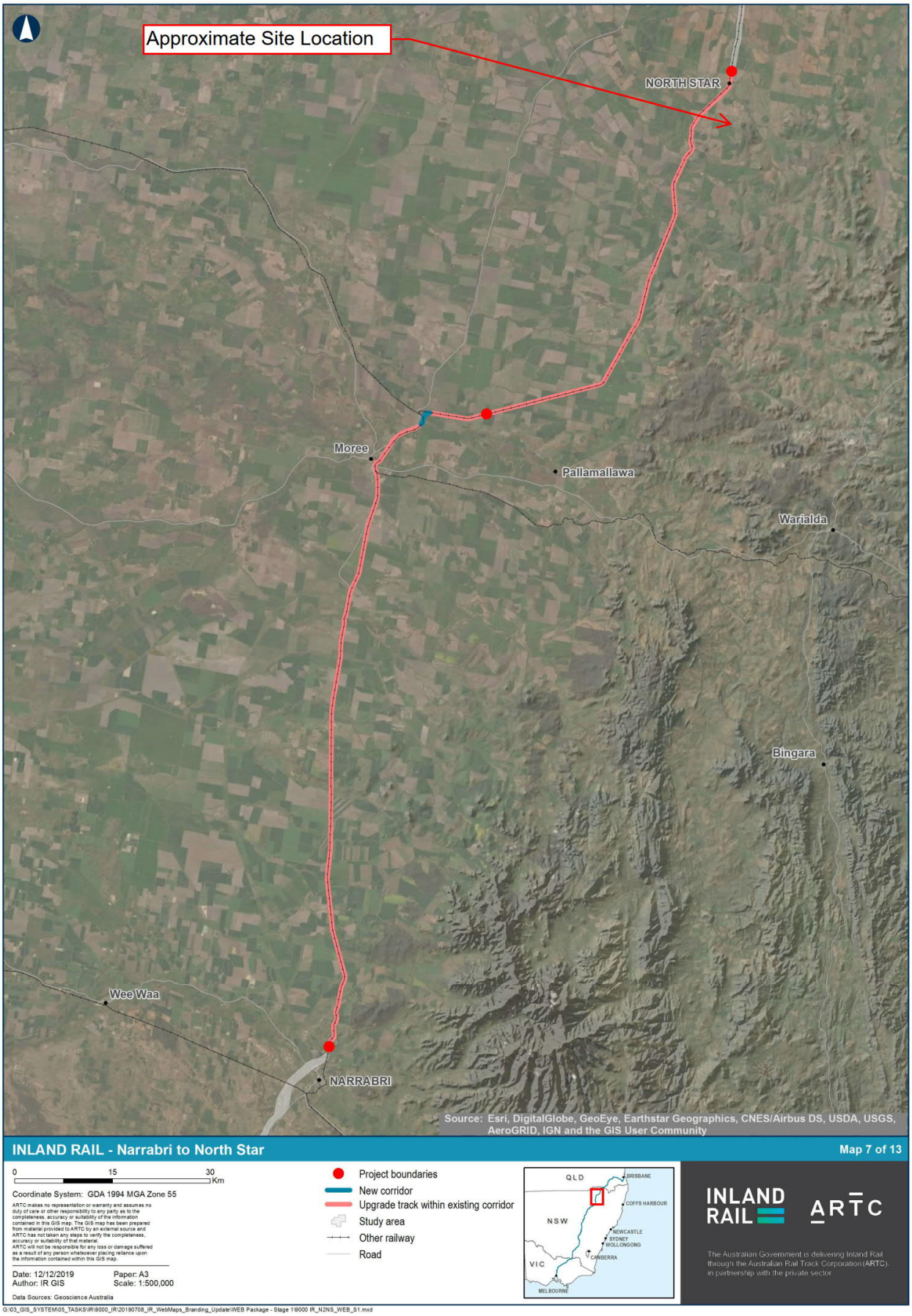
Section 7.5.2 of the same document indicates that more than 400,000t of ballast and capping will be required to be obtained from suitably licenced quarries. The document identifies the Johnstone Concrete and Quarries at Pallamallawa, the Inglewood Quarry and the Tikitere Quarry.

The Environmental Impact Statement prepared by ARTC for the N2N section of the Inland Rail Project also identifies significant quantities of quarry materials are required for that section of the project.

The proposed North Star Quarry is closer to this section of the Inland Rail Project than both the Pallamallawa and Inglewood Quarry. The Tikitere and Pearlman Quarry to be operated by RQA are located to the south west of the site. RQA intends to operate all three quarries to jointly supply material to the Inland Rail Project.

It is likely that the material needs of the N2N and NS2B section of the project could be met by the proposed ARTC borrow pits and Pallamallawa, Inglewood and Tikitere Quarry. However, the proposal would provide an additional source of suitable quarry materials closer to the construction alignment of the Inland Rail Project. Being located closer would directly reduce potential impacts associated with the construction of the Inland Rail Project including traffic impacts, pavement impacts on State and Local roads and greenhouse gas emissions.

Figure 9 – ARTC Inland Rail Project Maps




Barwon Hwy
Leichhardt Hwy
Cunningham Hwy
Boundary Rd
Albert St
Goondiwindi
GOONDIWINDI
Boggabilla
Toomelah
Keetah Rd
30
25
20
15
10
5
MOREE PLAINS
Tucka Tucka Rd
Newell Hwy
Approximate Site Location
Bruxner Way
INVERELL
GWYDIR
IB Bore Rd
North Star
Getta Getta Rd
Crappa Creek Rd
North Star Rd
Blue Nobby Rd
Downs Rd
Buckie Rd
Hibernia Rd
Major roads
Local Government
Toowoomba
Brisbane
Ipswich
Grandchester
Warwick
Goondiwindi
Narrabri
Figure 1: Overview of the proposal
NORTH STAR TO NSW/QLD BORDER
9km
Coordinate System: GDA 1994 MGA Zone 56
ARTC makes no representation or warranty and assumes no duty of care or other responsibility to any party as to the completeness, accuracy or suitability of the information contained in this GIS map. The GIS map has been prepared from material provided to ARTC by an external source and ARTC has not taken any steps to verify the completeness, accuracy or suitability of that material.
ARTC will not be responsible for any loss or damage suffered as a result of any person whatsoever placing reliance upon the information contained within this GIS map.
Date: 29/10/2019
Paper: A4
Author: FFJV GIS
Scale: 1:300,000
LEGEND
5 Chainage (km)
Localities
Existing rail (operational)
Existing rail (non-operational)
NSW/QLD border
North Star to NSW/QLD border alignment
Adjoining alignments
ARTC
InlandRail
The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation, in partnership with the private sector.
Map by: LCT Z:\GIS\GIS_270_NS2B\Tasks\270-ECH-201910161017_Overview_of_the_proposal\270-EAP-201910161017_Figure1_Overview_of_the_proposal_ARTC_rev2.mxd Date: 8/11/2019 13:43

1.8. Proposal Refinements

During the preparation of the biodiversity development assessment report the proposal was refined to reduce the proposed area of disturbance to avoid areas of mapped biodiversity value. This also reduced the total estimated resource from approximately 2,500,000t to 1,700,000t. As a result, some of the earlier technical reporting (eg Noise and Vibration, Air Quality and Traffic) supporting this EIS refer to a larger quarry footprint and total resource. It was considered there was no need to update those technical assessments to reflect the reduced area of disturbance on the basis that the reduction in the area of disturbance would be unlikely to increase the potential impacts above what had already been assessed.

1.9. Consultation

A briefing paper was prepared and submitted to the Department of Planning, Industry and Environment requesting the EARs for the proposal. The Department of Planning, Industry and Environment received assessment requirements from the following agencies:

- Biodiversity and Conservation Division (BCD) of the Department.
- Crown Lands Division of the Department.
- Geological Survey of NSW Land Use Team.
- Resources Regulator Division of the Department.
- Department of Primary Industries – Agriculture.
- Department of Primary Industries – Fisheries.
- NSW EPA
- NSW Rural Fire Service
- Transport for NSW

The Department Planning, Industry & Environment did not receive any assessment requirements from Gwydir Shire Council.

The Department Planning, Industry & Environment issued the EARs dated 15 January 2021. The EIS addresses the requirements of the EARs.

The landowner did contact the Gwydir Shire Council prior to lodgement of the application. The landowner also spoke with surrounding landowners prior to lodgement of the application.

1.10. Surrounding Landowners

The town of North Star is located approximately 6km North of the site. Review of aerial photography and property records has identified the nearby sensitive receptors as outlined in Table 1 below. Much of the land surrounding the site is owned by the Doolin family. The nearest sensitive receptor that is not owned by the Doolin family is Sensitive Receptor No.4 owned by William and Dianne Thompson approximately 3km to the east of the site. It is noted that Sensitive Receptors 3 and 5, which are 2km from the proposal are both owned by Doolin Minilya Pty Ltd which is the landowner for the proposal. The nearby sensitive receptors have been identified on Figure 10 – Surrounding Landholders Map below.

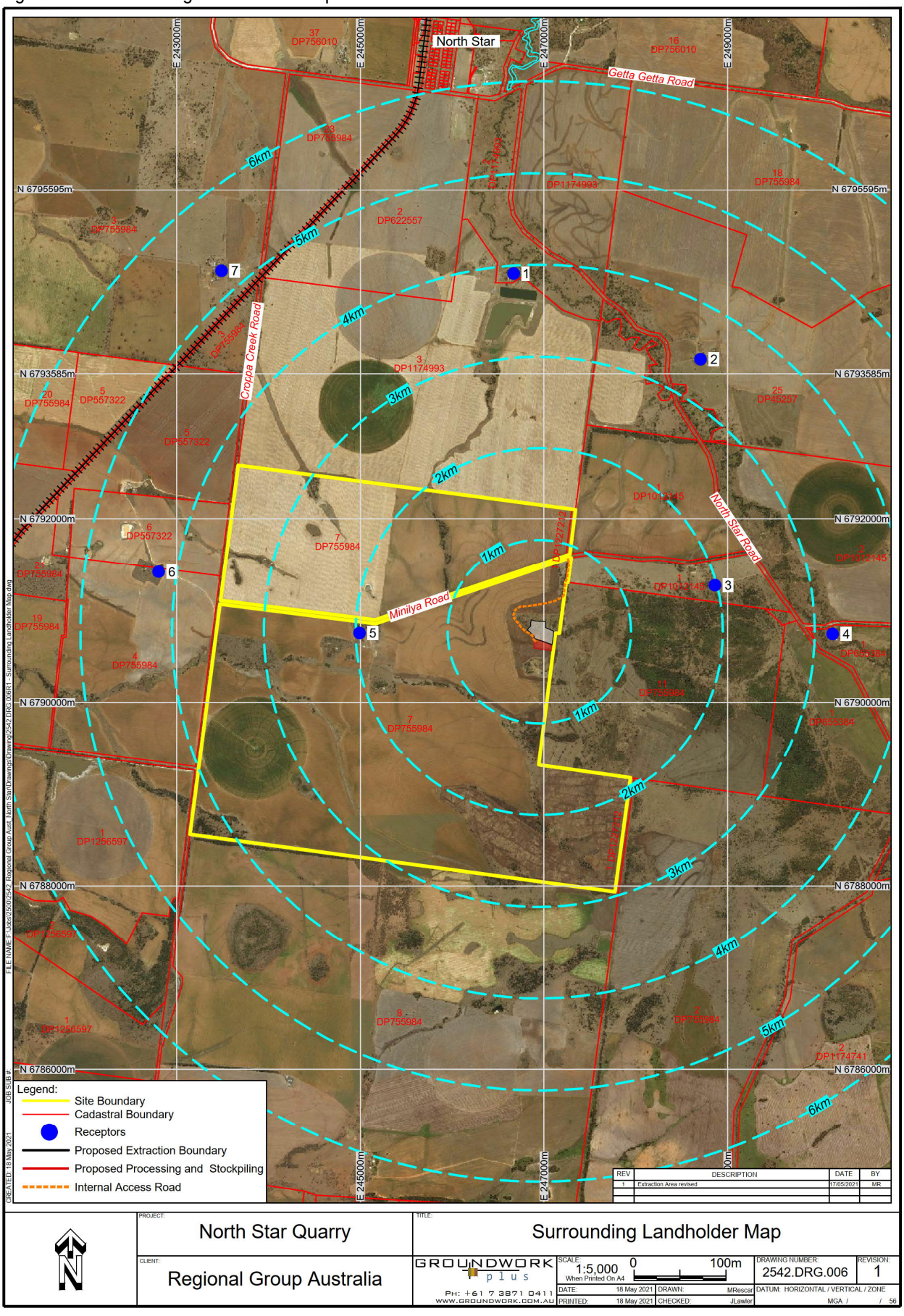
Table 1 – Nearby Sensitive Receptors

Number	Name	Property Description	Distance
Site	Doolin Minilya Pty Ltd	Lot 7 DP755985 & Lot 1 DP1227212	-
1	S & S Doolin Pty Ltd	Lot 2 DP1174993	4km
2	Malcolm & Jennifer Doolin	Lot 25 DP45257	3.5km
3	Doolin Minilya Pty Ltd	Lot 1 DP1012145	2km
4	William & Dianne Thompson	Lot 1 DP655384	3km
5	Doolin Minilya Pty Ltd	Lot 7 DP755985 & Lot 1 DP1227212	2km
6	Coppymurrumbilla Station Pty Limited	Lot 4 DP755985	4km
7	James Smith	Lot 3 DP755984	5km

1.11. Management of Investigations

The EIS has been prepared by Mr James John Lawler (BBlt Env (Urb&RegPlan)), Project Director and Associate of Groundwork Plus Pty Ltd. Internal peer review of the EIS was undertaken by David Doolan (Bachelor Applied Science (Env. Science and Env. Management), Associate, Groundwork Plus Pty Ltd. Information regarding the proposal was provided by Mr Scott Lancaster and Mr Richard Tompkins of Regional Group Australia. A range of supporting technical reports were prepared by, Muller Acoustic Consulting (Noise and Vibration), OzArk (Biodiversity, Aboriginal and Historic Heritage), Northstar Air Quality (Air) and SMK Consultants (Traffic). Mr Mark Folker, Senior Environmental Engineer of Groundwork Plus prepared the Surface Water Assessment. Mr Troy Lowien, Principal Resource Consultant of Groundwork Plus prepared the Resource Investigation.

Figure 10 – Surrounding Landholders Map



2. Description of the Proposal

2.1. Objectives of the Proposal

The principal objective of the proposal is to obtain development consent to enable the operation of the proposed North Star Quarry. The proposal would enable the applicant to supply quarry products to the Inland Rail Project in the short term and then the general market over the longer term. The applicant's objectives for the proposal are to:

- provide a high quality, economical source of hard rock quarry products for construction of the Inland Rail Project and associated road upgrade projects in the short term; and
- provide a high quality, economical source of hard rock quarry products for local road projects and the general market in the longer term; and
- minimise to the greatest extent possible, impact to the local environment, community and stakeholders; and
- provide a final post extraction landform suitable for rural activities including but not limited to cattle grazing; and
- ensure the operation of the proposal is safe, reliable and cost effective, contributing to the delivery of the Inland Rail Project and the economy of the region.

2.2. Overview of the Proposal

The proposal will include:

- Extraction of a maximum of 490,000t/yr for a period of 5 years, and then extraction of a maximum of 150,000t/yr for a period of 10 years;
- A maximum depth of extraction of RL 323m AHD;
- Conventional drill and blast techniques to extract the hard rock resource;
- Mobile plant to crush and screen the extracted material to produce a range of quarry products, including aggregates, railway ballast, road base and general fill;
- Processing and stockpiling of quarry products;
- Loading and transportation of quarry products via the internal access road to the local road network via Minilya Road and Croppa Creek Road;
- Surface water management measures including sediment basins, diversion bunds and drains;
- Ancillary infrastructure, including temporary demountable site office and amenities;
- Progressive rehabilitation of the site to achieve a post extraction landform suitable for rural activities including but not limited to cattle grazing.

The site is approximately 1611.60ha and the total area of the proposal is 6.45ha including:

- A extraction area of 4.57ha;
- A processing and stockpiling area of 1.76ha;
- A sediment basin and associated surface water management measures; and
- The internal access road.

The proposed hours of operation are:

- Extraction and processing, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Truck loading and dispatch, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Blasting, 9am to 3pm Monday to Friday;
- No operations on Sundays or Public Holidays.

Between 5 and 10 staff are anticipated to be required for the proposal. Staff will be sourced locally where possible and if staff or support crews come from the wider region they will be accommodated in the local town or Moree.

Traffic

Construction traffic generated for the commissioning and decommissioning of the quarry site will be minimal and consisting of vehicle movements for floating plant and equipment to and from the site.

The proposal would supply quarry materials to the Inland Rail Project and associated road projects. It is anticipated that access to the Inland Rail construction corridor would be available via Minilya Road to Croppa Creek Road, with trucks using the rail corridor to access any Inland Rail construction or stockpile sites. A mix of vehicle types would be used for product haulage, typically truck and trailer combinations, and B-doubles and Type 1 A-double road trains where approved routes are available. The payload capacity of these vehicles varies, and for the purpose of this assessment, an average payload of 38t has been assumed, which is typical of the truck and trailer combinations.

Haulage of 490,000t of material per year would require approximately 12,900 laden truck loads per year. Assuming continuous operation throughout the 50 operating weeks per year, this would be equivalent to an average of approximately 46 laden truck loads per operating weekday, and equivalent to an average of 4 laden truck loads per hour exiting the site. As haulage would occur on a campaign basis to meet fluctuating demands of the infrastructure projects being supplied, the number of trips on any particular day would vary. The peak daily haulage to address short term demands for construction materials for the Inland Rail Project or other time-critical works is assumed to be in the order of 5,000t on any one day. This would require approximately 132 laden truck loads per day, equivalent to an average of 8 to 11 laden loads per hour over a weekday. Peak operating days such as these would be offset by periods of lower activity, such as during lower construction activity or wet weather.

The traffic generation assumed for the purpose of this assessment of “busy day” conditions is therefore:

- 20 light vehicle trips per day; and
- 264 heavy vehicle trips per day (maximum 24 heavy vehicle trips per hour).

By comparison, the average weekday daily traffic generation would be:

- 20 light vehicle trips per day; and
- 92 heavy vehicle trips per day (maximum 24 heavy vehicle trips per hour).

Ongoing haulage of 150,000t of material per year would require approximately 3,950 laden truck loads per year. Staff numbers are likely to reduce to five (5) in this scenario. Assuming continuous operation throughout the 50 operating weeks per year, this would be equivalent to an average of approximately 14 laden trucks loads per day or about 1 laden truck per hour exiting the site. Therefore, the traffic generation assumed for the average week daily traffic generation for 150,000t/yr would be:

- 10 light vehicle trips per day; and
- 28 heavy vehicle trips per day.

2.3. Quarry Site Layout

The quarry site layout is displayed on Figure 3 – Conceptual Site Layout Plan and Figure 4 – Conceptual Quarry Development Plan. The site is approximately 1611.60ha and the total area of the proposal is 6.45ha including:

- An extraction area of 4.57ha;
- A processing and stockpiling area of 1.76ha;
- A sediment basin and associated surface water management measures; and
- The internal access road.

The extraction area would be developed in a single stage and would be centred on the small hill defined through the resource investigation undertaken by the applicant. The proposal will extract the resource from the surrounding agricultural plains with subsequent access to deeper resources resulting in a final landform of a self-contained pit at RL 323m AHD with surrounding terminal benches of approximately 10m in height.

The processing and stockpiling area will be established at about RL 332m AHD adjacent to the extraction area and would incorporate areas for the mobile processing plant, raw feed stockpiles and product stockpiles. The number of plant and equipment deployed on-site is anticipated to vary. A mobile crushing and screening plant would be established at the site to process the extracted material. Types of major plant and equipment deployed on-site may include, but not be limited to a bulldozer, grader, excavator, drill rig, off-road haul trucks, front-end loader and on-road haul trucks. Amenities will be provided onsite including a small demountable site office, lunchroom and washroom (refer Appendix 5).

2.4. Resources and Products

The site consists of a basalt resource identified during the resource investigation (refer Appendix 6). The low elevations, resource distributions, weathering profile and confining topography of the site is well suited to simple lateral quarrying progressions effectively slicing the targeted elevated resource from the surrounding agricultural plains with subsequent access to deeper resources.

2.4.1. Geology

Resource investigations conducted between 2017 and 2020 indicate that the site is in an area of Cainozoic Mafic Volcanics commonly occurring as basalt lava flows (up to 65 million years old). The basalt sits above a Jurassic Sedimentary sequence of rocks (145 to 201 million years old) including sandstone and clay. The resource on the site consists of two low lying hills on the eastern site boundary. The remainder of the site to the west is used for cropping and rural activities. The basalt hills expand and rise to the east in the adjoining properties. The site has previously been quarried. The basalt layer was thicker and fresher to the east, thinning and weathering to the west. Drilling confirms that claystone and sandstone exists below the basalt. Typically, 1m of overburden exists over 2 to 3m of weathered to moderately weathered basalt before intersecting fresh basalt. The proposal would include a total resource of approximately 1,700,000t consisting of overburden, moderately weathered basalt, fresh basalt and sandstone suitable for production of fill, pavements, sealing and asphalt aggregates and ballast.

2.4.2. Products

The resource is predicted to produce quarry products including fill, pavements, sealing and asphalt aggregates and ballast.

2.4.3. Production Rates

The proposal would extract a maximum of 490,000t/yr for a period of 5 years, and then a maximum of 150,000t/yr for a period of 10 years.

2.5. Site Establishment and Construction Activities

Site establishment and construction activities would be undertaken for the proposal to enable the commencement of the quarry operations. Site establishment and construction activities would include:

- Marking out disturbance areas with highly visible permanent markers;
- Construction of the internal access road;
- Construction of the access onto Minilya Road to the required standard;
- Progressive vegetation clearing and soil removal within the areas approved for disturbance. Vegetation would be chipped for use in rehabilitation of the site. Any soil, where present and recoverable, would be stripped and either stockpiled for future use in rehabilitation activities or directly transferred to an area to be revegetated. Soil that is not immediately applied to active rehabilitation areas would be stockpiled, most likely within the processing and stockpile area, from where it would be easily accessed, when required. Topsoil that needs to be stockpiled for more than one month would be seeded to establish a stabilising groundcover.
- Construction of the sediment basin and surface water management measures;
- Construction of the processing and stockpile area;
- Delivery of the mobile processing plant and other mobile equipment; and
- Delivery and establishment of the site office and amenities and other ancillary components.

2.6. Extraction and Processing Operations

Extraction would use standard quarrying methodologies that involve clearing, topsoil and overburden stripping, drilling and blasting, extraction, processing and stockpiling with the final products sold for use in the construction industry, refer to Diagram 1 – Conceptual On-site Extractive Operations. The number of plant and equipment deployed on-site is anticipated to vary. Types of major plant and equipment deployed on-site may include, but not be limited to a bulldozer, grader, excavator, drill rig, off-road haul trucks, front-end loader and on-road haul trucks. Blasts would typically fragment between 20,000 to 50,000t per blast but would fluctuate according to demand and safety requirements. Blasting would

typically occur once per month but possibly up to once a week during peak periods. A mobile crushing and screening plant would be established at the site to process the extracted material.

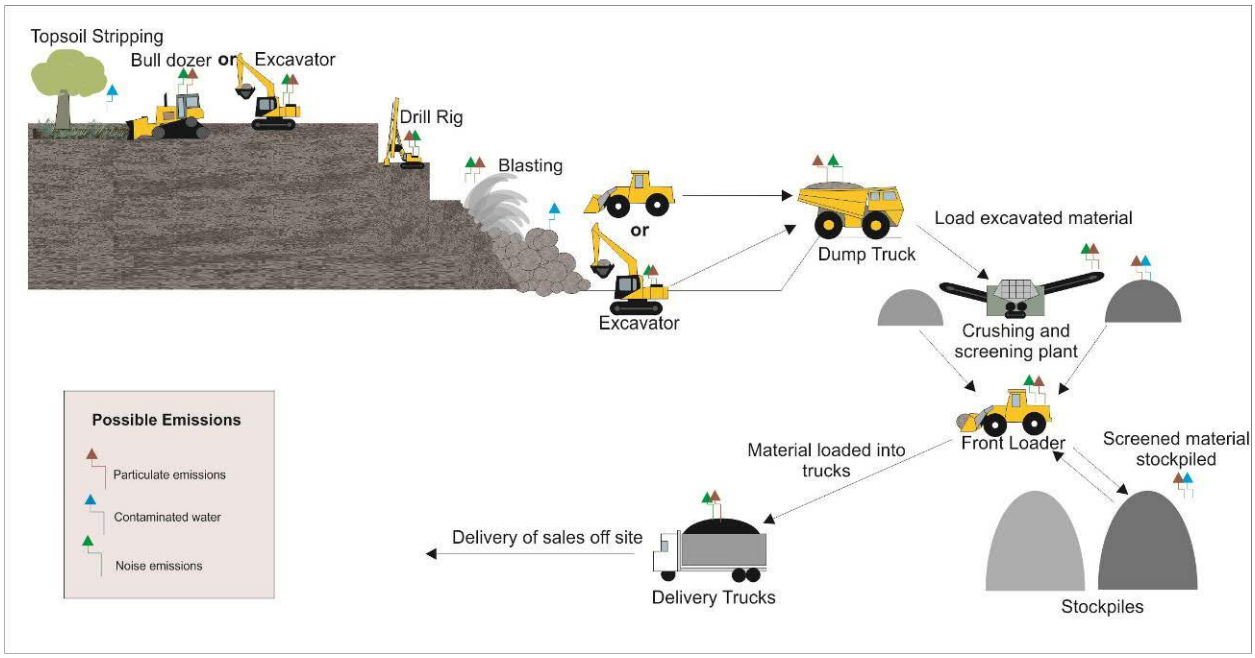


Diagram 1 – Conceptual On-site Extraction Operations

2.7. Access, Traffic and Material Transportation

2.7.1. Access

The site has operated as a farm quarry for an extended period. No construction work is required to commence operations on the site other than delivery of a dozer to win the gravel, an excavator to assist with stockpiling and loading, and a front-end loader. A site office and amenity building would also be established on-site. These would be portable buildings. Construction would involve possibly 5-low loader movements to the site.

The internal access will utilise an existing farm road. This will be reconstructed as a two-lane road between the quarry and Minilya Road. Trucks will enter the stockpile area to be loaded and then despatched. The internal layout within the stockpile area will vary according to stockpile size, the range of processed material to be delivered and delay time within the quarry to load trucks. The intent will be to load trucks as they arrive and despatch immediately. Holding areas for trucks will be available within the stockpile area. Internal traffic routes will be marked and operate as a single one-way lane between the entrance road and within the stockpile area. The internal road layout can be varied according to stockpile arrangements.

Once loaded, trucks will exit the site onto Minilya Road and travel west to the Croppa Creek-North Star road. Trucks will then move either north or south along Croppa Creek-North Star road to deliver the aggregate to the respective project. At present, the prediction is that movements will be evenly distributed between north and south.

Minilya Road is a Council road that has some gravel but sections of minimal gravel depth. Some of the gravel has been applied by the property owner of Minilya to improve truck access to a grain storage facility on the property. Minilya Road has a limited pavement width which is insufficient for two trucks to pass without one truck moving onto the road shoulder. The road is not considered as all-weather and therefore work would be required to increase the depth of pavement and provide suitable options for two-trucks to pass safely, in addition to upgrading the intersection into the gravel road to cater for 26m long vehicles as a minimum. The road can be utilised by road trains, subject to Council approval.

Minilya Road carries no non-local traffic. This road is mainly used for inter-property access and as a link between the Croppa Creek Road and the North Star-Warialda Road. The road is utilised for grain haulage in harvest periods between November and December.

2.7.2. Haulage Routes

The Quarry is expected to supply material to two significant infrastructure projects, mainly:

- Inland Railway Project (Northern Section): Scheduled to commence in 2021 and continue for approximately 18-months to 3 years.
- Newell Highway Project: Commenced in 2019 and to continue as a range of new projects over the next 5-years or more.

The two projects may overlap for a period. Other smaller projects will also be serviced. This may include local roadworks undertaken by Council and private landowners.

After the conclusion of those projects, it is anticipated demand will reduce to mainly be local road projects and ongoing development in the general area.

Inland Rail Project Haulage Route

The proposed haulage route from the development site will utilise internal roads before entering Minilya Road onto the Croppa Creek-North Star Road and then proceeding either north or south as required to provide material to stockpile sites to be established by Inland Rail. The haul routes will be variable and subject to agreements between the Quarry Operator, Inland Rail and Councils. Agreements currently being discussed include additional funding for Council/s to upgrade sections of key haul routes that will be used for construction of the Inland Rail line. The following provides a list of Primary and Secondary haul routes.

Primary Roads

- Croppa Creek – North Star Road
- North Star - Boggabilla Road
- County Boundary Road

Secondary Roads

- IB Bore Road
- Boonery Park Road
- Tumba Road
- Buckie Road
- Crooble Road (Gil Gil Creek Road)
- Alma Lane
- Calimpa Road

It is noted that the Rail corridor will be developed for access along the rail. This will be managed by the rail contractor and may supply key access along the rail route where the local road network is unsuitable to carry trucks and rail associated traffic.

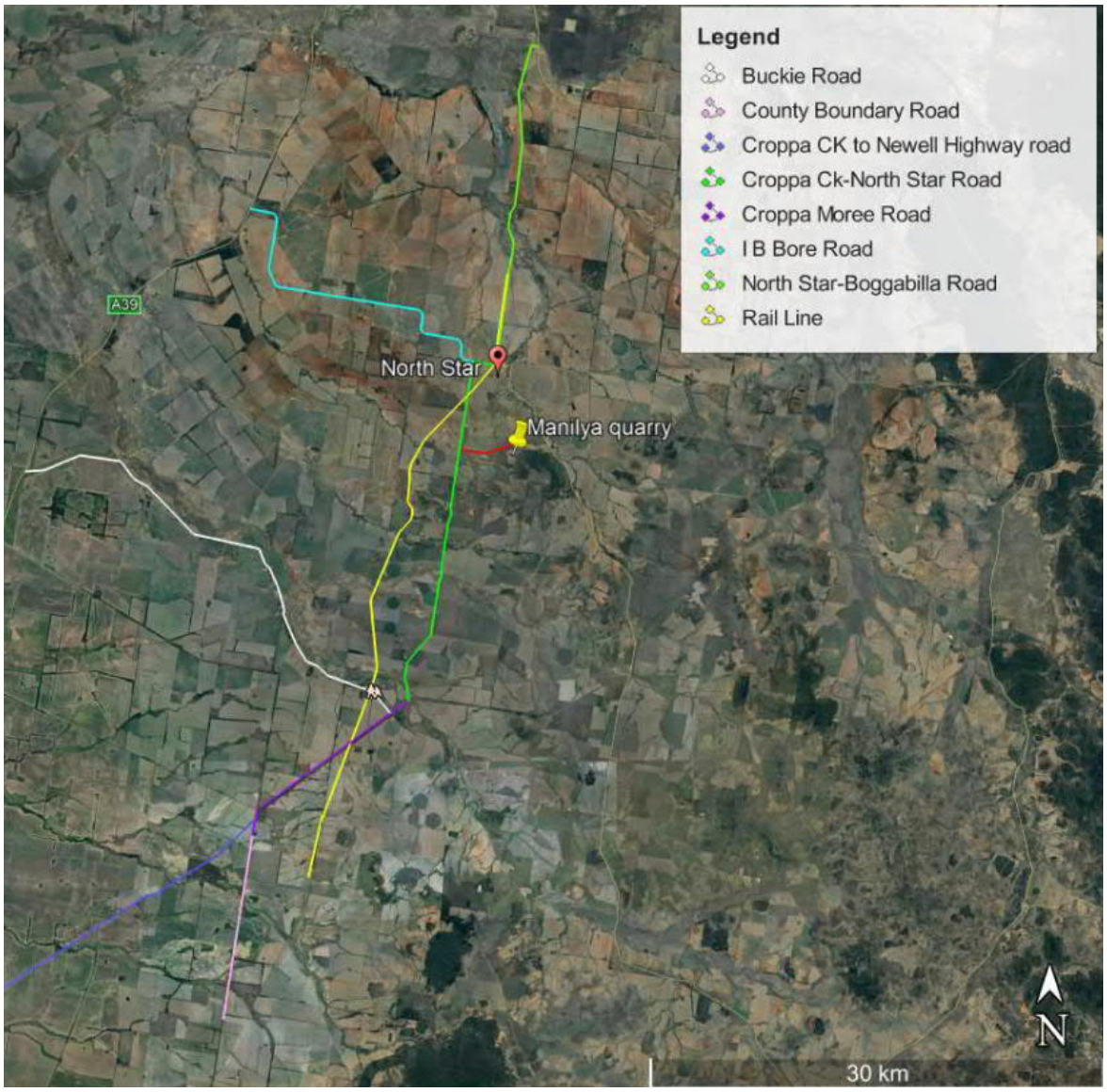
Newell Highway Projects

The proposed haulage route from the development site will utilise internal roads before entering Croppa Creek Road and proceeding north to the Croppa Creek Road/I B Bore Road T-intersection. Traffic would then proceed west along I B Bore Road to the Newell Highway. Use of the IB Bore Road would be subject to Council agreement due to the varied condition of this road. It is noted that Council has recently obtained a grant to seal this road and create a 2-lane road. An alternative route for northern traffic to the Newell Highway would include the North Star – Boggabilla Road. This a bitumen sealed road leading to the Bruxner Highway. Trucks would travel via Boggabilla to access the Newell Highway if this route is used.

Buckie Road to the west of Croppa Creek village presents an alternative road to access the Newell Highway. Buckie Road provides access to the highway approximately 56 km north of Moree. This road is in variable condition including sections of low-quality pavement and therefore use of this road would be subject to approval from both Moree Plains and Gwydir Councils. This would be a dry weather road only. More southern Newell Highway projects may utilise the Croppa Creek – Moree Road to enter the Newell Highway. This is a fully bitumen sealed road providing the main haul route for trucks from the Croppa Creek – North Star area to access Moree. Once trucks reach the Newell Highway, they would enter the Newell Highway and travel either north or south, as required, to provide material to a range of Newell Highway Projects.

These haul routes are mapped in the TIA and represented in Figure 11 below.

Figure 11 – Newell Highway Projects Haul Routes



2.7.3. Inland Rail Project and Newell Highway Project trip generation

Haulage of 490,000t of material per year would require approximately 12,900 laden truck loads per year. Assuming continuous operation throughout the 50 operating weeks per year, this would be equivalent to an average of approximately 46 laden truck loads per operating weekday, and four laden truck loads per hour. The laden truck departures would be matched by an equivalent number of empty truck arrivals.

As haulage would occur on a campaign basis to meet fluctuating demands of the infrastructure projects being supplied, the number of trips on any particular day would vary from the averages above. During Stage 1, the peak daily haulage to address short term demands for construction materials for the Inland Rail Project or other time-critical works would be in the order of 5,000t on any one day. Haulage of 5,000t would require approximately 132 laden truck loads, equivalent to an average of eight (8) to eleven (11) laden loads per hour over a weekday. Peak operating days such as these would be offset by periods of lower activity, such as during lower construction activity or wet weather.

The implications of the maximum haulage of 5,000t per day have been considered, generating 132 laden truck departures on a weekday. The laden truck departures would be matched by an equivalent number of empty truck arrivals. Departures

of trucks would be managed to minimise the potential for convoys or queues forming on the public roads, with a minimum five-minute headway to be imposed between departing trucks. This headway restriction would limit the trip generation to a maximum of 12 laden truck departures in any one hour. The return of empty trucks would generate a maximum of 24 heavy vehicle trips during the peak hour on the busiest day.

Without allowing for any car sharing, the 10 workers would generate up to 20 light vehicle trips per day, being 10 arrivals in the morning and 10 departures in the evening. The workforce would tend to arrive prior to the start of haulage and leave following completion of haulage, and so would not travel at the same time as the haulage trucks.

The traffic generation assumed for the purpose of this assessment of "busy day" conditions is therefore:
- 20 light vehicle trips per day; and
- 264 heavy vehicle trips per day (maximum 24 heavy vehicle trips per hour).

By comparison, the average weekday daily traffic generation would be:
- 20 light vehicle trips per day; and
- 92 heavy vehicle trips per day (maximum 24 heavy vehicle trips per hour).

2.7.4. Ongoing Operations to the general market trip generation

Ongoing haulage of 150,000t of material per year would require approximately 3,950 laden truck loads per year. Staff numbers are likely to reduce to five (5) in this scenario. Assuming continuous operation throughout the 50 operating weeks per year, this would be equivalent to an average of approximately 14 laden trucks loads per day or about 1 laden truck per hour exiting the site. Therefore, the traffic generation assumed for the average week daily traffic generation for 150,000t/yr would be:
- 10 light vehicle trips per day; and
- 28 heavy vehicle trips per day.

2.8. Water Management

Operational water would be required for dust suppression operations. This water would be sourced primarily from the sediment basin. If the sediment basin was dry, alternative water sources are available within the site subject to access being granted by the landowner or could be sourced from an appropriately authorised and licenced water supplier. In order to meet the requirements of the EIS, the sediment basin would be designed, constructed and operated to retain the disturbed area runoff at the site in accordance with DECC (2008) Managing Urban Stormwater - Soils and Construction (Volume 2E).

Water storage devices that are solely for the capture, containment and recirculation of drainage and/or effluent, consistent with best management practice or required by a Government agency or Local Government to prevent contamination of a water source, are exempt from both the requirement of holding a water supply work approval & from the requirements of the Harvestable Rights Order.

An Erosion and Sediment Control Plan would be prepared prior to the commencement of the site establishment and construction of the proposal in accordance with:
- Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004).
- Managing Urban Stormwater: Soils and Construction – Volume 2C – unsealed roads (DECC, 2008a).
- Managing Urban Stormwater: Soils and Construction – Volume 2E – mines and quarries (DECC, 2008b).

2.9. Waste Management

The proposal is expected to produce a negligible amount of waste. The principal wastes may include, but are not necessarily limited to:
- liquid wastes
- general solid wastes (putrescible and non-putrescible)
- waste batteries, oil filters, waste oil/hydrocarbons and containers, oil/water emulsions and tyres;
- domestic wastewaters;
- steel/used equipment; and
- plant debris from clearing.

Site wastes will be managed in the following manner:

- establishing waste stations around the site, including all bin types required for appropriate segregation of wastes generated during the activity;
- storing wastes in a neat and orderly manner and clearly signed as waste materials, where wastes have to be temporarily stored on-site;
- emptying waste skips prior to reaching the point of overflowing;
- covering waste skips and bin types that have no lids to prevent any wind blown litter;
- segregating wastes on-site into scrap metal, oily wastes, recyclable wastes (paper/cardboard and aluminium), tyres, batteries and general wastes;
- removing wastes from Site for disposal or recycling by appropriate licensed operator(s); and
- no burning or burying wastes on-site unless approved by the Administering Authority.

2.10. Infrastructure, Utilities and Services

There are currently limited infrastructure, utilities or services located at the site. Electricity would be sourced from diesel generators. Potable water would be sourced from rainwater tanks or a licenced water supplier. Water for dust suppression will be sourced from the sediment basin. Telecommunications would be provided by mobile phone. Sewer would be via a pump out facility serviced by a licenced waste contractor. A small diesel tank may be stored on site in a self-bunded container and in accordance with AS 1940-2017 The Storage and Handling of Flammable and Combustible Liquids.

2.11. Employment

Between 5 and 10 staff are anticipated to be required for the proposal. Staff will be sourced locally where possible and if staff or support crews come from the wider region they will be accommodated in the local town or Moree.

2.12. Hours of Operation and Project Life

The proposed hours of operation are:

- Extraction and processing, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Truck loading and dispatch, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Blasting, 9am to 3pm Monday to Friday;
- No operations on Sundays or Public Holidays.

It is anticipated the proposal would commence operation to supply the construction of the Inland Rail Project which is anticipated to commence in late 2021. The proposal would operate for a maximum of 15 years, excluding time to complete rehabilitation of the site.

2.13. Rehabilitation

The objective for rehabilitation of the proposal are to a post extraction landform suitable for rural activities including but not limited to cattle grazing (refer Figure 5 – Conceptual Final Land Form and Figure 6 – Conceptual Final Land Form (Cross Sections) and Figure 7 – Rehabilitation Management Plan). As outlined on the rehabilitation management plan, the following measures are proposed:

Progressive Rehabilitation:
Rehabilitation is to commence in an area when:

1. the terminal benches and the final pit floor are reached; and,
2. the area is no longer required for operational or ancillary purposes; and,
3. there is a minimum 100 metres of separation to the active working area(s).

Terminal Benches:

- Overburden and/or topsoil is to be respread over terminal benches;
- Rehabilitation is to be via natural regeneration of ecosystems;
- If revegetation is required, seeding or planting of species is to align with the pre-development ecosystem species.

Final pit floor, hardstand and stockpile areas (and other low slope areas):

- Slopes to be graded to fall to the sediment basin;
- Topsoil to be respread to a minimum depth of 100mm;
- Post extraction land use to comprise of rural activities consisting of pasture grasses or cropping.

Waterbodies:

- Sediment basin is to be retained as a clean water storage structure;
- Sediment is to be removed to convert the dam to a clean water storage structure.

Infrastructure:

- Utilities and services will be retained;
- Access tracks and roads will be retained;
- Sediment basins will be retained as clean water storage structures;
- Plant, equipment and buildings (including demountable and mobile equipment) will be removed.

As the site approaches the end of its lifecycle, topsoil resources, earth moving equipment and labour will already be available on the site and can be utilised for rehabilitation. Therefore, the rehabilitation costs reflected will mainly relate to the purchase of seed and fertiliser for the reestablishment of grasses suitable to the continuation of rural uses of the site.

3. Planning and Legislative Context

3.1. Introduction

The proposed development is 'Designated Development' and 'Integrated Development' under Part 4 of the *Environmental Planning Assessment Act, 1979.* The following section of the report describes how the proposed development will address and/or comply with the local planning policies; state and federal legislation and relevant guidelines. The applicable policy and/or objects of each piece of legislation is provided, followed by a statement outlining how the development will address and/or comply with the planning policies; and state and federal legislation.

3.2. Commonwealth Legislation

Under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), referral is required to the Australian Government for proposed actions that have the potential to significantly impact on Matters of National Environmental Significance (MNES) or the environment of Commonwealth land. The assessment of the proposal's impact on MNES and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant MNES or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment and Energy (DoEE) under the EPBC Act.

3.3. NSW Legislation

3.3.1. Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* provides the framework for NSW Planning Legislation. Under this Act, local councils prepare Local Environment Plan (LEPs) that specify planning controls for specific parcels of land. The Act also provides for State Environmental Planning Policies (SEPPs) and Regional Environmental Plans (REPs). Applicable SEPPs are discussed in the section below.

Development consent is required for the proposal pursuant to Part 4 of the EP&A Act. The proposal is classified as Regional Development and will be determined by the Joint Regional Planning Panel (JRPP) under the provisions of the *State Environmental Planning Policy (State and Regional Development) 2011.*

Pursuant to Section 4.10 of the Act and Schedule 3(1)(19) of the *Environmental Planning and Assessment Regulation 2000,* the proposal is identified as 'Designated Development' as a land based extractive industry which seeks to extract, process or store more than 30,000m^3 of extractive material per year and will disturb a total surface area of more than 2ha of land.

The proposed development is also classified as 'Integrated Development' pursuant to Section 4.46 of the Act as approval from the NSW Environmental Protection Authority is required.

The EIS has been prepared in accordance with the requirements of the EP&A Act. It provides an environmental impact assessment and details of how the proposal will be developed and operated to protect the environment, the community and provide for ecologically sustainable development.

3.3.2. Protection of the Environment Operations Act 1997

Protection of the Environment Operations Act 1997 (POEO Act), Schedule 1 'Scheduled Activities' identifies activities triggering an Environment Protection Licence (EPL). The proposal would constitute a scheduled activity under the POEO Act pursuant to Clause 16 'Crushing, grinding or separating' and Clause 19 'Extractive activities'. Therefore, the proposal is classified as integrated development under Section 4.46 of the *Environmental Planning and Assessment Act 1979* because it would require an EPL. The Environment Protection Authority (EPA) administers the management of EPLs. A license will be applied for once development consent is granted.

3.3.3. Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act 2016) provides a framework for the management of flora and fauna on lands within NSW. Under this Act the principles of ecologically sustainable development are used to achieve the conservation and protection of biodiversity values. In conjunction with this the BC Act 2016 the Biodiversity Assessment Method (BAM) is a model for undertaking biodiversity assessments on all major projects. The BAM provides a classification and credit system to ensure that there is no net loss of biodiversity values across the state. As the proposed clearing is above the thresholds under clause 7.23 of the *Biodiversity Conservation Regulation 2017* a full assessment has been conducted against the relevant provisions of the BAM. This assessment has calculated the biodiversity credits required to be retired as part of the proposed ground disturbance. All credits will be retired to ensure that the project will not have a net impact to the biodiversity values of NSW.

3.3.4. National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (the NPW Act) aims to conserve and manage natural resources and aboriginal heritage. The proposal has been prepared in accordance with the requirements of this Act. There are no national parks, nature reserves, regional parks, state conservation areas, historic sites, karst conservation areas or Aboriginal areas within the proposal.

3.3.5. The Heritage Act 1977

The *Heritage Act 1977* (the Heritage Act) aims to conserve and manage the States Heritage, whether they are places, buildings, works, relics, movable objects or precincts of Local or State Heritage significance. A property is a heritage item if it is listed in the heritage schedule of the Local Council's Local Environmental Plan or on the State Heritage Register, a register of places and items of particular importance to the people of NSW. If an item of heritage value was identified, then consultation would be undertaken with the relevant agency and an assessment undertaken in accordance with OEH guidelines for Assessing Heritage Significance (Heritage Office 2001). As part of this assessment checks for indigenous and non-indigenous have been carried out which have concluded that there are no known heritage items present at the site.

3.3.6. Water Management Act 2000

The objective of the *Water Management Act 2000* is the sustainable and integrated management of the State's water sources for the benefit of both present and future generations by applying the principles of ecologically sustainable development to protect, enhance and restore water sources and their associated ecosystems, ecological processes and biological diversity and their water quality. The objectives of this Act were considered throughout the planning and design phases of this development because a quarry requires a secure and reliable water supply to operate. The watercourses and groundwater in the vicinity of the property will be protected through design and management practices, including diversion banks and sediment basins.

3.4. State Environmental Planning Policies

State Environmental Planning Policy – State and Regional Development 2011

The State and Regional Development SEPP identifies significant development and infrastructure and confer functions on Joint Regional Planning panels to determine development applications. The proposal is classified as 'Regional development' and will be assessed by the Gwydir Shire Council and determined by the Joint Regional Planning Panel under the State Environmental Planning Policy (State and Regional Development) 2011. The *SEPP (State and Regional Development) 2011* designates certain development as State Significant Development (SSD). The relevant sections of the *SEPP (State and Regional Development) 2011* are provided below:

Section 8 Declaration of State significant development: section 4.36
(1) Development is declared to be State significant development for the purposes of the Act if:
- *(a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and*
- *(b) the development is specified in Schedule 1 or 2.*

Schedule 1 State Significant Development – General (7) Extractive Industry

(1) Development for the purpose of extractive industry that:

(a) extracts more than 500,000 tonnes of extractive materials per year, or

(b) extracts from a total resource (the subject of the development application) of more than 5 million tonnes, or

(c) extracts from an environmentally sensitive area of State significance.

Pursuant to Schedule 1 of *SEPP (State and Regional Development) 2011*, the proposed extractive industry operation does not constitute a State Significant Development as:

1. Less than 500,000 tonnes of material will be extracted per year.
2. Site geological assessments estimates that the resource is less than 5 million tonnes.
3. The extraction will not be from an environmentally sensitive area of State significance (Table 2 below).

Table 2 – Environmentally Sensitive Area of State significance

Criteria	Response
(a) coastal waters of the State, or	The site does not comprise coastal waters of the State.
(b) land to which State Environmental Planning Policy No 14—Coastal Wetlands or State Environmental Planning Policy No 26—Littoral Rainforests applies, or	The State Environmental Planning Policy No 14—Coastal Wetlands or State Environmental Planning Policy No 26—Littoral Rainforests does not apply.
(c) land reserved as an aquatic reserve under the Fisheries Management Act 1994 or as a marine park under the Marine Parks Act 1997, or	The site does not contain aquatic reserves or marine parks.
(d) a declared Ramsar wetland within the meaning of the Environment Protection and Biodiversity Conservation Act 1999 of the Commonwealth, or	The site does not contain a declared Ramsar wetland.
(e) a declared World Heritage property within the meaning of the Environment Protection and Biodiversity Conservation Act 1999 of the Commonwealth, or	The site is not a declared World Heritage property.
(f) land identified in an environmental planning instrument as being of high Aboriginal cultural significance or high biodiversity significance, or	The site is not identified as containing high Aboriginal cultural significance or high biodiversity significance.
(g) land reserved as a state conservation area under the National Parks and Wildlife Act 1974, or	The site does not contain a state conservation area.
(h) land, places, buildings or structures listed on the State Heritage Register under the Heritage Act 1977, or	No heritage sites are listed for the site.
(i) land reserved or dedicated under the Crown Lands Act 1989 for the preservation of flora, fauna, geological formations or for other environmental protection purposes, or	The site is not reserved or dedicated under the *Crown Lands Act 1989.*
(j) land identified as being critical habitat under the Threatened Species Conservation Act 1995 or Part 7A of the Fisheries Management Act 1994.	The site does not contain critical habitat.

State Environmental Planning Policy – Mining, Petroleum Production and Extractive Industries 2007

The Mining, Petroleum Production and Extractive Industries SEPP recognises the importance of mining, petroleum production and extractive industries to NSW and aims to provide for the proper management and the orderly development of land containing minerals, petroleum products and extractive materials. The SEPP aims to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment and sustainable management of these resources.

Clause 12AB 'Non-discretionary development standards for mining', is not applicable in this instance as the proposal is not for a mine.

Clause 12 'Compatibility of proposed mine, petroleum production or extractive industry' is applicable as follows.

12 Compatibility of proposed mine, petroleum production or extractive industry with other land uses.

Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must—

(a) consider—

(i) the existing uses and approved uses of land in the vicinity of the development, and

(ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and

(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and

(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).

Section 4 of this EIS outlines that the surrounding land use of the site which are rural in nature. Section 5 of this EIS provides an assessment of the potential environmental impacts of the proposal and outlines the measures that will be implemented to minimise those potential environmental impacts. Section 5.7 specifically addresses the matter of land use conflict. Section 5.10 evaluates and compares the public benefits of the development. This EIS concludes that the proposal is compatible with the rural setting of the site and the surrounding rural land uses.

Clause 12A 'Consideration of voluntary land acquisition and mitigation policy' is not applicable in this instance as the proposal is not State Significant Development.

Clause 13 'Compatibility of proposed development with mining, petroleum production or extractive industry' is not applicable because the proposal is not for development adjacent to mining, petroleum production or extractive industry.

Clause 14 'Natural resource management and environmental management', is applicable as follows.

14 Natural resource management and environmental management

1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following—

a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,

b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,

c) that greenhouse gas emissions are minimised to the greatest extent practicable.

2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.

3) Without limiting subclause (1), in determining a development application for development for the purposes of mining, the consent authority must consider any certification by the Chief Executive of the Office of Environment and Heritage or the Director-General of the Department of Primary Industries that measures to mitigate or offset the biodiversity impact of the proposed development will be adequate.

Section 5.5 addresses how potential surface water impacts are minimised to the greatest extent practical and how potential groundwater impacts are avoided by not intercepting groundwater and not relying on groundwater for operational water for the proposal. Section 5.2 addresses how potential impacts to threatened species and biodiversity are minimised to the greatest extent practicable and where there is a significant residual impact how it will be offset in accordance with the relevant State legislative requirements. Section 5.3 addresses how greenhouse gas emissions will be minimised to the greatest extent practicable by the proposal.

Clause 15 'Resource recovery' is applicable as follows.

15 Resource recovery

1) *Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.*
2) *Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.*
3) *The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.*

Section 5.9 addresses the waste anticipated to be generated by the proposal. The resource assessment identifies that there is minimal overburden. On that basis, large overburden stockpiles are unlikely to be required and any surplus overburden materials will be reused onsite for construction safety bunds and erosion and sediment controls, internal roads. Overburden and topsoil materials will also be reused in the rehabilitation of the site at the end of life of the proposal. On that basis, the proposal will recover the extractive materials in an efficient manner and will minimise the creation of waste.

Clause 16 'Transport' is applicable as follows.

16 Transport

1) *Before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following—*
   a) *require that some or all of the transport of materials in connection with the development is not to be by public road,*
   b) *limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,*
   c) *require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.*
2) *If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within 7 days after receiving the development application, provide a copy of the application to—*
   a) *each roads authority for the road, and*
   b) *the Roads and Traffic Authority (if it is not a roads authority for the road).*
      1. *Note—*
      2. *Section 7 of the Roads Act 1993 specifies who the roads authority is for different types of roads. Some roads have more than one roads authority.*
3) *The consent authority—*
   a) *must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application, and*
   b) *must provide them with a copy of the determination.*
4) *In circumstances where the consent authority is a roads authority for a public road to which subclause (2) applies, the references in subclauses (2) and (3) to a roads authority for that road do not include the consent authority.*

Section 5.1 addresses traffic and access impacts for the proposal including interactions with school buses. The matters in clause 16 2), 3) and 4) are matters for Council to address.

Clause 17 'Rehabilitation' is applicable as follows.

> *17 Rehabilitation*
> *1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.*
> *2) In particular, the consent authority must consider whether conditions of the consent should—*
> *a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or*
> *b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or*
> *c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under clause 3 of Schedule 6 to the Act and the Contaminated Land Management Act 1997), or*
> *d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.*

This EIS sets outs that the proposal will be rehabilitated to a suitable landform for continuing rural activities.

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

Hazardous and offensive industries, and potentially hazardous and offensive industries, relate to industries that, without the implementation of appropriate impact minimisation measures, would, or potentially would, pose a significant risk in relation to the locality, to human health, life or property, or to the biophysical environment.

The hazardous substances and dangerous goods to be held or used within the site are required to be identified and classified in accordance with the risk screening method contained within the document entitled Hazardous and Offensive Development Application Guidelines – Applying SEPP 33 (DP&I, 2011). Hazardous materials are defined within DP&I (2011) as substances falling within the classification of the Australian Code for Transportation of Dangerous Goods by Road and Rail (Dangerous Goods Code), (National Transport Commission, 2011). The substances relevant to this policy are primarily diesel and ammonium nitrate.

The proposal would involve the use of diesel fuel, a Class 3 C1 combustible liquid, and small amounts of other hydrocarbons including lubricating oils and combustible liquids. As the diesel fuel and lubricating oils and greases would not be stored permanently on site, SEPP 33 does not require these to be considered further.

Ammonium nitrate would not be stored on site, rather it would be transported to the site on the day of the blast by the blasting contractor under their relevant licences and authorities.

Because no hazardous materials would be stored on the site, no further consideration of SEPP 33 is required.

State Environmental Planning Policy (Koala Habitat Protection) 2021

The SEPP encourages the conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. Schedule 1 identifies the local government areas (LGA) subject to assessment under the policy of which Gwydir LGA is included, making assessment for koala habitat a requirement for the proposed development. An assessment of potential koala habitat on site was conducted as part of the ecological impact assessment carried out as part of the BDAR. Accordingly, the assessment concluded that the proposed development is not potential koala habitat or core koala habitat as no Koalas were recorded during the field work and no koala food trees are present on site. Therefore, Council is not prevented from granting consent to the development application by the SEPP.

State Environmental Planning Policy (Primary Production and Rural Development) 2019

The aims of this SEPP is to facilitate development on rural land that is orderly and economic, promotes the social, economic and environmental welfare of the State and avoids land use conflicts with existing agriculture. It also allows government authorities to identify State significant agricultural land and ensure the ongoing viability of agriculture in the State.

The objectives of the Primary Production and Rural Lands SEPP are to provide for the protection of agricultural land;

- that is of State or regional agricultural significance, and
- that may be subject to demand for uses that are not compatible with agriculture, and
- if the protection will result in a public benefit.

The proposal is considered with respect to these aims.

- The land that would be affected by the proposal has not been identified as State or regionally significant agricultural land by Schedule 1 of the Primary Production and Rural Lands SEPP.
- The proposal would not impact on any additional land currently managed for agriculture. As demonstrated at numerous other quarry sites where agricultural activities are undertaken concurrently within extractive industry, the proposal would not be incompatible with continued agricultural land use of the site.
- The protection of the land that is the subject of the proposal would not provide any public benefit. In fact, the employment and local economic stimulus that would be generated by the proposal is considered to be of wider public benefit.

As a result, the Primary Production and Rural Lands SEPP is not considered further in this document.

State Environmental Planning Policy N. 55 – Remediation of Land

The SEPP 55 promotes the remediation of contaminated land for the purpose of reducing the risk of harm to human health or other aspects of the environment. SEPP 55 requires consideration of whether there have been activities carried out on the land in the past that may have resulted in contamination. If contamination may be present, the proponent is required to undertake suitable investigation and, if necessary, remediation works. A search of the NSW contaminated land register was undertaken. The site is not considered as contaminated land as it has not historically been subjected to any contaminating activities. Upon the cessation of resource extraction, the proposal will involve full rehabilitation of the site including removal of infrastructure.

State Environmental Planning Policy – Infrastructure 2007

The infrastructure SEPP provides a consistent planning regime for infrastructure and the provision of services and public works across NSW, along with providing for consultation with relevant public authorities during the assessment process. The proposed development is not identified in Schedule 3 of the SEPP as traffic generating development to be referred to the Roads and Maritime Services. The proposed development is therefore taken to be 'Any other purpose' under Schedule 3 and it will not generate 200 or more motor vehicle movements per hour.

3.5. Local Planning Issues

Gwydir Local Environmental Plan 2013

The site is in the Gwydir Local Government Area. The Gwydir Local Environmental Plan 2013 (LEP) is the current local government planning policy for land administered by the Council. The site is located in the RU1 'Primary Production' zone. The proposed land use is defined as 'extractive industry' under the LEP:

"extractive industry means the winning or removal of extractive materials (otherwise than from a mine) by methods such as excavating, dredging, tunnelling or quarrying, including the storing, stockpiling or processing of extractive materials by methods such as recycling, washing, crushing, sawing or separating, but does not include turf farming"

An extractive industry land uses within the RU1 Primary Production zone is a permissible land use with development consent.

The objectives of the zone RU1 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 minimise conflict between land uses within this zone and land uses within adjoining zones.

The proposed development is for extractive industry, which is permissible, with development consent, within the RU1 Primary Production zone. The protection of natural resources and places has been considered by the proposal. The proposed use of the land for extractive industry provides productive use of these natural resources. The site would be returned to rural and agricultural uses at the end of life of the proposal with no significant change in land capability. The continued utilisation of the balance of the site for rural and agricultural uses will minimise potential fragmentation and alienation of agricultural land. The proposal is not considered to conflict with the adjoining land uses based on the assessments undertaken as part of this EIS. The proposed development is therefore considered to be both compatible and consistent with the surrounding land uses and meets the objectives of the RU1 Primary Production zone.

3.6. New England North West Regional Plan 2036

The New England North West Regional Plan 2036, includes four (4) regionally focused goals:

- A strong and dynamic regional economy
- A healthy environment with pristine waterways
- Strong infrastructure and transport networks for a connected future
- Attractive and thriving communities

This EIS provides evidence that the proposal will support the development of a strong and dynamic regional economy by supplying materials to the Inland Rail Project in the short term and the general market over the long term. The proposal will support a healthy environment by avoiding biodiversity impacts and management of surface water to avoid impacts to waterways. The proposal will include necessary road upgrades and payment of pavement impact contributions to the relevant local government authorities to ensure that the impacts on road infrastructure are mitigated so that the proposal can provide quarry materials to the Inland Rail Project which is a national building transport infrastructure project. The proposal will provide local employment opportunities supporting the goal for attractive and thriving communities.

3.7. Other Environmental Policies, Guidelines and Plans

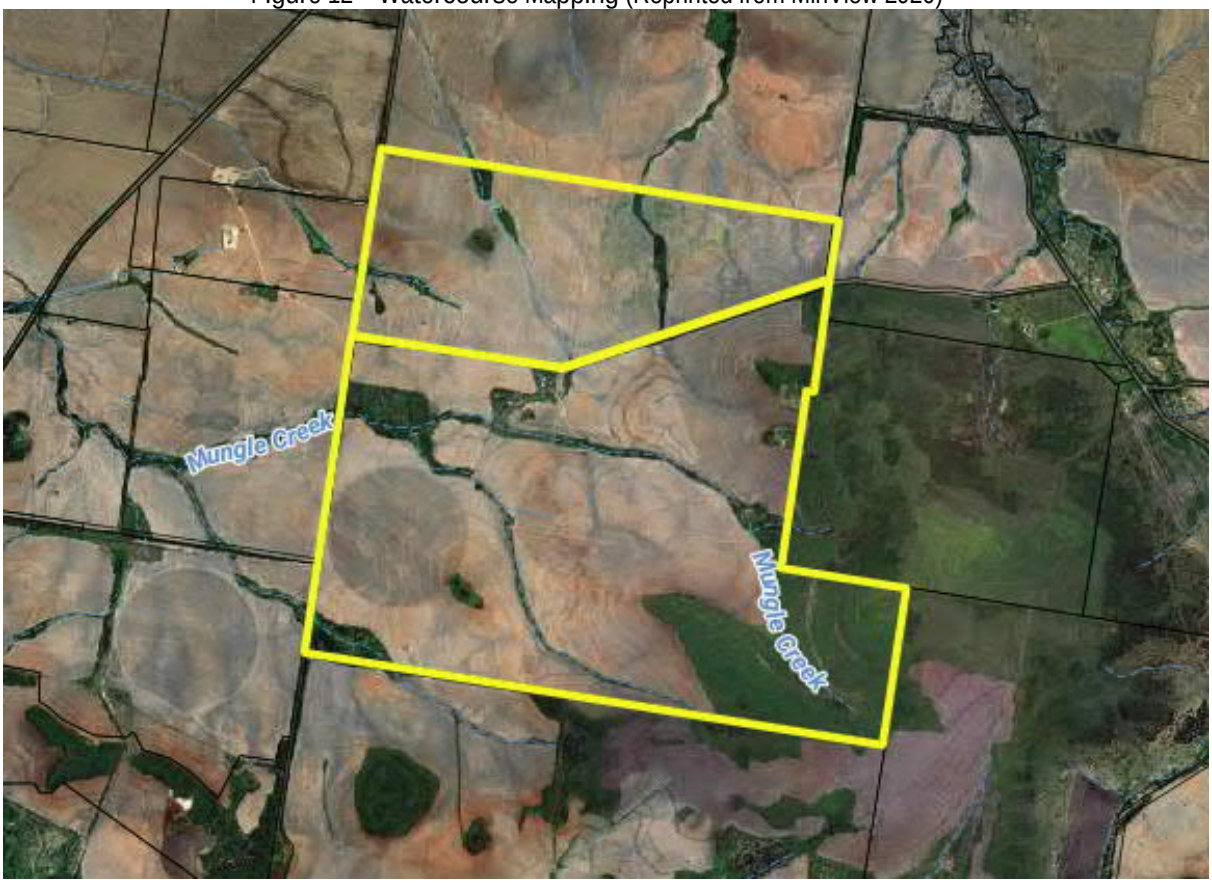
The SEARs require that in assessing the identified key assessment requirements, reference be made to any relevant guideline documents. Where appropriate, the relevant guidelines are addressed in the relevant section(s) of this EIS, including the Appendices.

4. Environmental Setting

4.1. Topography and Drainage

The site's topography generally has low-lying hills towards the eastern boundary. Elevations within the site boundary range from 290m to 335m AHD. Generally, the landscape within the site boundary and surrounding area becomes steeper further south east. As shown in Figure 12, Mungle Creek is a watercourse that flows within the site's boundary (MinView 2020).

Figure 12 – Watercourse Mapping (Reprinted from MinView 2020)



4.2. Meteorology

4.2.1. Introduction

Climatic conditions influence the environmental impacts and management of quarrying operations, particularly water and air quality. A review of data from the Bureau of Meteorology (BoM) has been undertaken to provide an assessment of potential climatic conditions experienced at the site, such as rainfall, temperature, humidity, evaporation and wind.

4.2.2. Temperature and Humidity

For the site, the following climatic data has been sourced from the Bureau of Meteorology (BoM) Texas Post Office 041100 station, which is the closest BOM station that could provide temperature and humidity data to 2020. Temperature and humidity data are summarised in Table 3 and Table 4 below.

Table 3 – Temperature Summary – Texas Post Office 041100 (1969 - present)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Mean	33.9	32.7	31.2	27.5	23.0	19.5	18.9	20.9	24.6	28.1	30.6	32.9	27.0
Lowest	30.4	28.4	28.4	24.5	19.3	16.5	15.8	18.0	19.6	23.9	26.8	28.6	25.4
5th %ile	31.3	29.9	29.0	25.4	21.1	17.8	17.1	18.4	21.3	25.0	27.5	29.6	25.7
10th %ile	31.7	30.1	29.3	25.6	21.7	18.0	17.5	18.9	21.8	25.8	28.3	30.4	25.9
Median	34.0	32.8	31.1	27.5	22.9	19.7	18.9	20.8	24.6	27.9	30.6	32.9	27.0
90th %ile	36.1	34.9	32.8	29.3	24.7	20.7	20.4	22.4	27.2	30.7	33.5	35.2	28.0
95th %ile	36.7	35.4	33.7	29.7	24.8	21.0	20.7	23.2	27.8	31.0	33.7	36.6	28.2
Highest	37.2	36.2	34.9	30.2	25.3	21.4	21.3	24.2	28.6	31.7	34.7	37.5	29.1

The mean maximum temperature varies between 18.9°C in July and 33.9°C in January, while the mean minimum temperature varies between 15.8°C in July and 30.4°C in January. The annual average temperature is 27.0°C.

Table 4 – Humidity Summary – Texas Post Office 041100 (2019 - present)

Statistic 9am	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Relative Humidity %	54	71	63	68	76	81	79	72	55	54	49	42

The mean relative humidity percentage was higher during the morning across winter months. June had the highest percentage (81%) of humidity.

4.2.3. Rainfall and Evaporation

The site is located within the Australian Climate Zone 4 which is characterised by hot dry summers and cool winters. For the site, the following rainfall data has been sourced from the BoM North Star (Wolonga) 053095 station, which is the closest BoM station that provided rainfall data to 2020. Rainfall data for the area is summarised below.

Table 5 – Rainfall Summary – BoM North Star (Wolonga) 053095 (1972 - present)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Mean	78.7	73.4	65.0	35.0	39.0	31.9	39.3	30.8	33.0	55.4	72.4	73.1	636.0
Lowest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	337.5
5th %ile	5.4	5.2	3.6	0.0	0.9	3.0	0.9	0.1	0.6	10.5	14.8	9.6	468.7
10th %ile	10.4	11.8	8.6	0.0	2.3	8.6	3.2	2.2	1.8	20.8	19.8	14.0	475.1
Median	55.4	61.8	55.0	17.4	28.5	25.4	33.0	24.4	22.5	46.4	59.7	71.8	612.8
90th %ile	185.2	137.9	128.0	83.9	73.8	58.6	74.8	57.6	73.7	104.2	127.7	120.3	875.5
95th %ile	206.1	146.6	150.9	120.6	97.7	66.3	97.3	62.0	84.1	120.5	133.9	174.0	919.1
Highest	337.0	369.4	197.4	282.0	168.2	162.0	177.0	183.2	103.0	133.3	219.0	212.0	1006.4

Generally, the rainfall is higher during the warmer months. The average annual rainfall is 636.0mm, with the highest mean rainfall during January with 78.7mm and the lowest mean rainfall during August with 30.8mm. For the site, the following evaporation data has been sourced from BoM Inverell Research Centre 056018 station, which is the closest BoM station that provided evaporation data to 2020. The mean daily evaporation data for the area is summarised below.

Table 6 – Evaporation Summary – BoM Inverell Research Centre 056018 (2019 - present)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (mm)	7.9	6.2	4.4	3.5	2.2	2.0	1.9	2.6	3.9	5.0	7.1	9.3

Predictively, the mean daily evaporation is higher in the warmer months, with highest level during December with a mean daily evaporation of 9.3mm.

4.2.4. Wind

Wind direction and speed are used to determine potential dust dispersion. Data sourced from the BoM Texas Post Office 041100 station shows the seasonal predominant wind direction. See Diagrams 2 to 5 – Wind Roses – BoM Texas Post Office (Station 041100) – Summer 2020, Autumn 2020, Winter 2020 and Spring 2019. The predominant wind direction during Summer and Spring were north westerlies, and Autumn and Winter south westerlies.

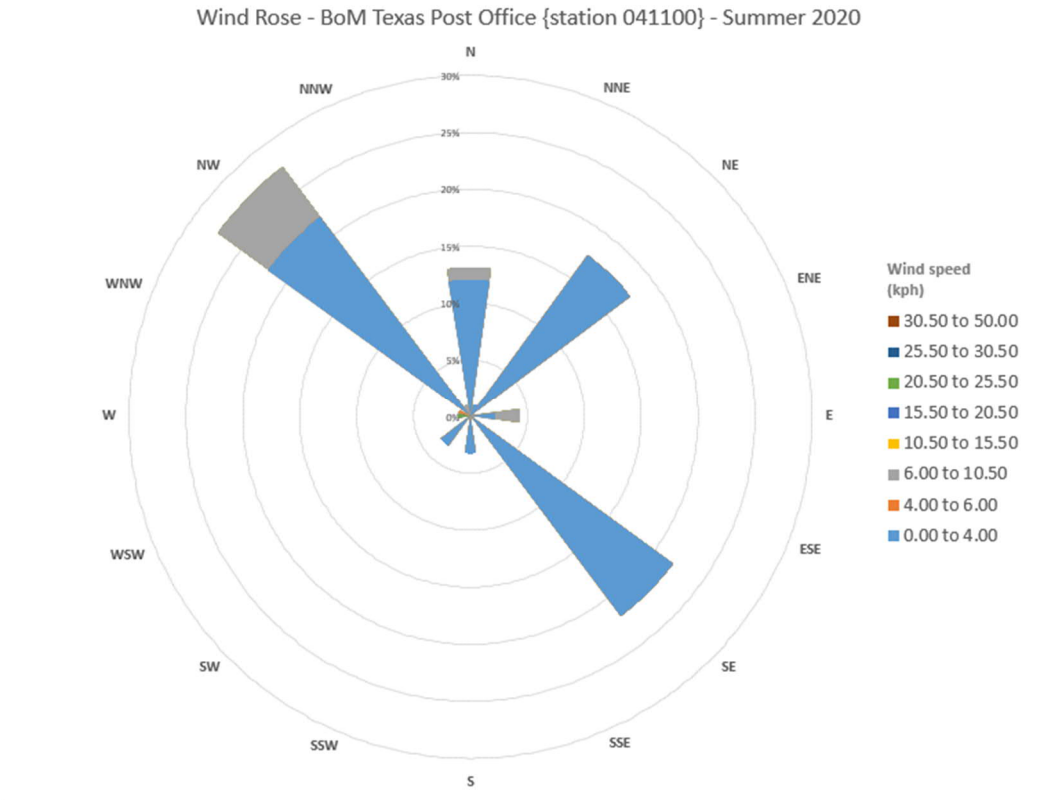


Diagram 2 – Wind Roses – BoM Texas Post Office (station 041100) – Summer 2020

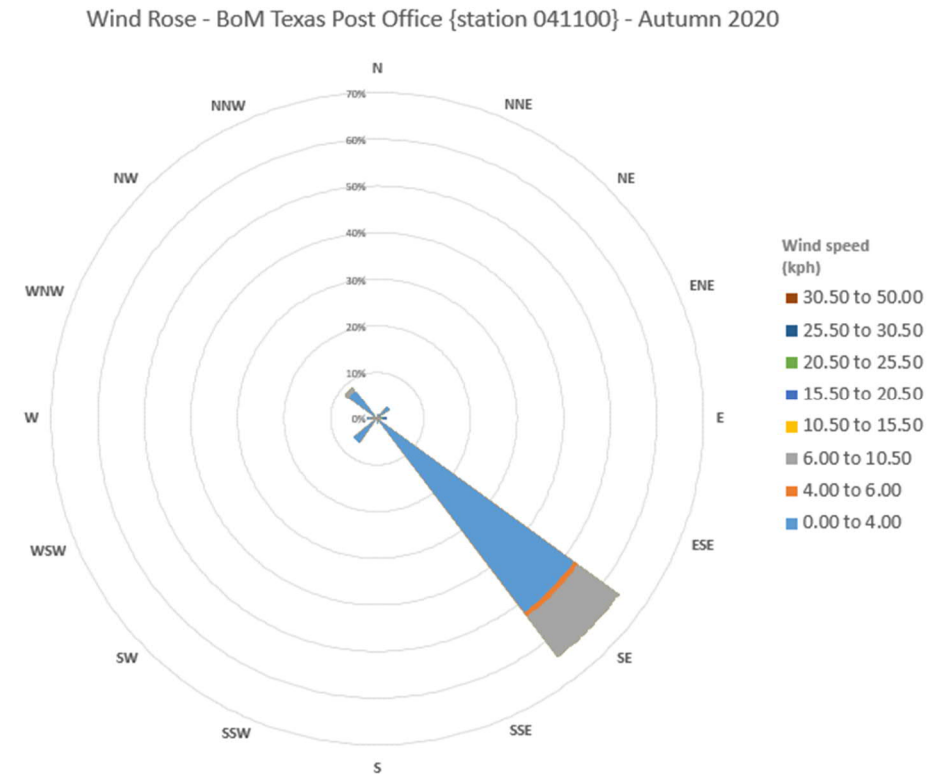


Diagram 3 – Wind Roses – BoM Texas Post Office (station 041100) – Autumn 2020

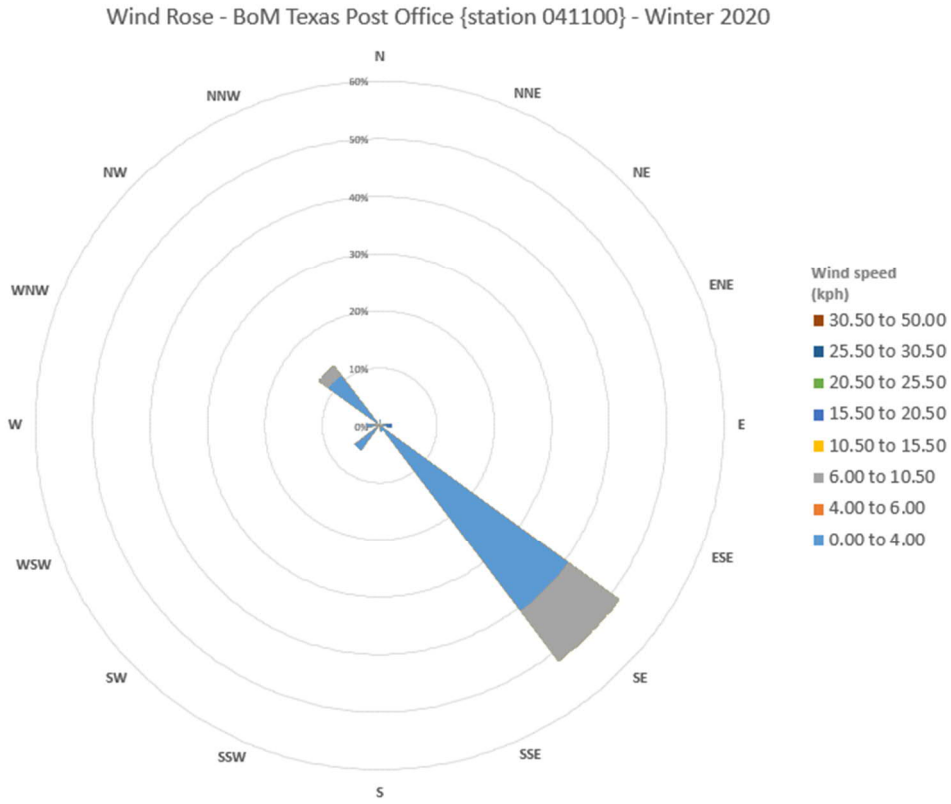


Diagram 4 – Wind Roses – BoM Texas Post Office (station 041100) – Winter 2020

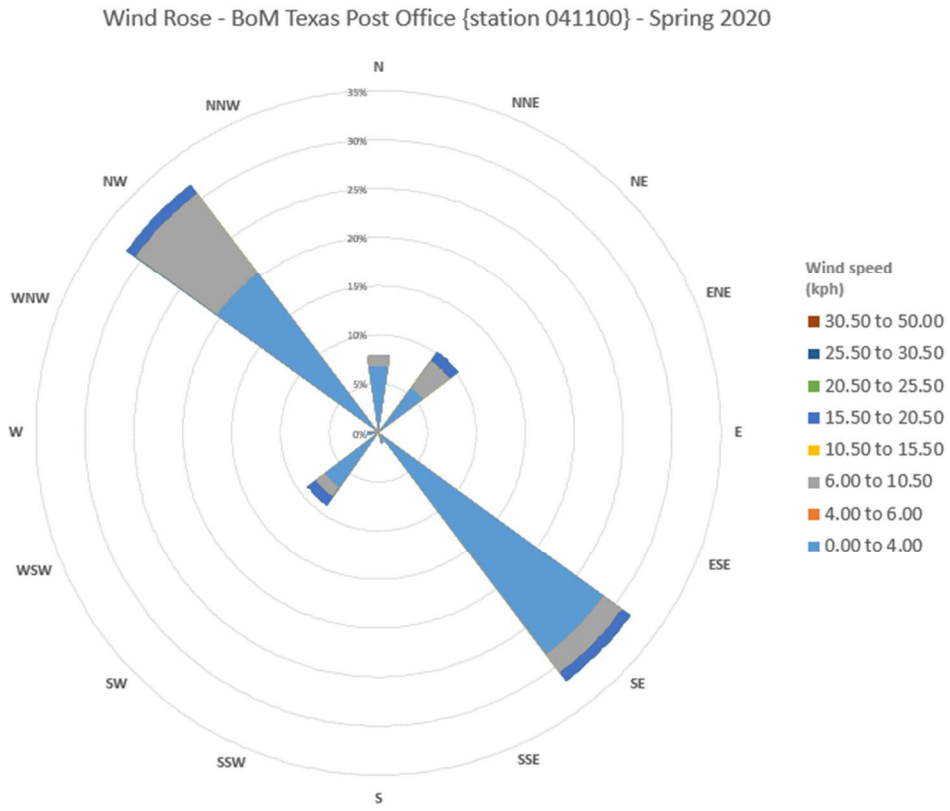


Diagram 5 – Wind Roses – BoM Texas Post Office (station 041100) – Spring 2020

4.3. Land Ownership and Surrounding Residences

The town of North Star is located approximately 6km North of the site. Review of aerial photography and property records has identified the nearby sensitive receptors as outlined in Table 7 below. Much of the land surrounding the site is owned by the Doolin family. The nearest sensitive receptor that is not owned by the Doolin family is Sensitive Receptor No.4 owned by William and Dianne Thompson approximately 3km to the east of the site. It is noted that Sensitive Receptors 3 and 5, which are 2km from the proposal are both owned by Doolin Minilya Pty Ltd which is the landowner for the proposal. The nearby sensitive receptors have been identified on Figure 10 – Surrounding Landholders Map.

Table 7 – Nearby Sensitive Receptors

Number	Name	Property Description	Distance
Site	Doolin Minilya Pty Ltd	Lot 7 DP755985 & Lot 1 DP1227212	-
1	S & S Doolin Pty Ltd	Lot 2 DP1174993	4km
2	Malcolm & Jennifer Doolin	Lot 25 DP45257	3.5km
3	Doolin Minilya Pty Ltd	Lot 1 DP1012145	2km
4	William & Dianne Thompson	Lot 1 DP655384	3km
5	Doolin Minilya Pty Ltd	Lot 7 DP755985 & Lot 1 DP1227212	2km
6	Coppymurrumbilla Station Pty Limited	Lot 4 DP755985	4km
7	James Smith	Lot 3 DP755984	5km

5. Assessment and Management of Environmental Issues

5.1. Traffic and Transport

5.1.1. Introduction

A Traffic Impact Assessment has been undertaken by SMK Consultants (refer Appendix 7). The SEARs for the Proposal require an assessment of potential impacts associated with traffic and transportation including the following:

- 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;

5.1.2. Existing and Future Road Transport Environment

The site has operated as a farm quarry for an extended period. Minilya Road is a Council road that has some gravel but sections of minimal gravel depth. Some of the gravel has been applied by the property owner of Minilya to improve truck access to a grain storage facility on the property. Minilya Road has a limited pavement width which is insufficient for two trucks to pass without one truck moving onto the road shoulder. The road is not considered as all-weather and therefore work would be required to increase the depth of pavement and provide suitable options for two-trucks to pass safely, in addition to upgrading the intersection into the gravel road to cater for 26m long vehicles as a minimum. The road can be utilised by road trains, subject to Council approval. Minilya Road carries no non-local traffic. This road is mainly used for inter-property access and as a link between the Croppa Creek Road and the North Star-Warialda Road. The road is utilised for grain haulage in harvest periods between November and December. The SMK TIA provides photos of Minilya Road which are reproduced below for ease of reference.

Plate 1 Minilya Road



Plate 2 Sight distance facing north along Croppa Creek Road



Plate 3 Sight distance facing south along Croppa Creek Road



Existing Road Network

SMK Consultants conducted a visual pavement inspection of the proposed haulage routes. The inspection was completed over a number of days in variable weather conditions. The roads were driven in both directions. No geotechnical investigation of the existing pavement has been undertaken as part of this investigation. Pavement depths and road condition have been visually determined. The photos included in Appendix 1 of the TIA are taken at key points along proposed haulage routes.

North Star Road – North of Minilya Road

North Star Road is a bitumen sealed two-way road maintained by GSC. The road services the farming community and several other smaller arterial roads. The road is trafficable in all weather conditions apart from times of extreme flood events. The section impacted by the quarry involves 24.6 kilometres in length. The following notes have been made on this road:

- The average road width is 6.0 metres with a minimum of 4.8 metres of sealed pavement.
- Culvert width is generally >8.6 metres, with the narrowest culvert width of 8.1 metres.
- There is no line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.

- North Star Road is part of a school bus route.
- ADT Data is available on this road which is summarised in Table 2 of the TIA.
- Road pavement has been upgraded in sections.

The southern end of this road includes a 2.5 km long section which has historically been subject to pavement deformation. This section of road has been reconstructed on several occasions over the past 30-years. The subgrade materials appear to have moisture issues due to either a local spring or weathered rock material. The deformation leads to some pot-holing of the bitumen. Most vehicles travel this section of road at slower speeds due to the rough surface.

The remainder of the road between Croppa Creek and North Star is considered in good condition with only light patching of potholes. Road alignment is relatively straight and therefore no sight distance issues were identified at bends, corners or crest areas along this road. This section of road is subject to other quarry traffic from two quarry sites located on the property of Tikitere in addition to traffic from the Myola and Tullin Tulla feedlots. The Tikitere Quarry entrance is located approximately 3.5 km south of the Minilya Road. The feedlots are located along the southern section of the North Star road.

The road shoulders along this section of road remain in good condition. This reflects road width and smoothness of the road. Trucks passing each other generally do not need to place wheels off the edge of the bitumen which would cause pavement failure along the edge of the seal. Sections of this road require some limitations on truck speed due to undulations in the subgrade areas causing small depressions but not potholing or loss of bitumen pavement.

Sections of this road are subject to spider cracking of the seal. This may lead to potholing and some deformation if moisture enters the subgrade material. Some intersections and stop points (rail crossing in North Star) have existing conditions where vehicle pressure or scraping of tyres is damaging the pavement. This is possibly a hot weather issue during summer. An increase in heavy vehicle numbers may lead to an exacerbation of this road damage.

Croppa Moree Road

Croppa Moree Road is a bitumen sealed two-way road maintained by both the Gwydir Shire Council (GSC) and Moree Plains Shire Council (MPSC). For general purposes, this road commences at the southern end of the Croppa Creek-North Star Road and continues to the Newell Highway.

This road provides a sealed connection between Croppa Creek and the Newell Highway. The road services the farming community and several other smaller arterial roads. The road is trafficable in all weather conditions apart from times of extreme flood events.

The section impacted by the quarry includes sections within both local Shires:

- The average road width is 6.7 metres with a minimum of 6.5 metres of sealed pavement.
- Culvert width is generally >12 metres, with the narrowest culvert width (11.5 metres) located approximately 600 metres south of the T-intersection with Buckie Road.
- Line marking varies but is limited to short sections.
- The road is generally raised above surrounding natural surface.
- Croppa Moree Road is a B-double and Road Train (with conditions) approved route.
- Croppa Moree Road is part of a school bus route.
- ADT Data is available on this road and summarised in Table 2 of the TIA.

The Croppa Creek – Moree Road consists of approximately 27 km of bitumen road administered by the Moree Plains Council with the remaining 14 km managed by Gwydir Shire. Sections of the road have been recently upgraded, including causeways and some re-sheeting. Sections of the pavement include areas of deformation due to movement in the black soil sub-grade. The road is generally in good condition for the volume of traffic utilising the road. Some shoulder deformation is present due to mainly trucks moving off the edge of the road in narrower or rougher sections. This is more prevalent in the section of road between Croppa Creek and the County Boundary Road.

Sections of the road to the east of the Crooble Road intersection are subject to shallow ponding or drainage water after rainfall events. Under such conditions, Council generally establish warning signs and vehicle speed is reduced. The ongoing use of this section of road under such conditions has not to date resulted in any significant deformation or break-down of the pavement and bitumen seal.

Croppa Creek – Moree road crosses the County Boundary road at the Shire boundary. The road crossing consists of an "S" bend over approximately 630m with the give-way signs located on Croppa Creek – Moree Road. This can be considered as un-conventional as the Croppa Creek – Moree intersections are not perpendicular to the County Boundary Road. The main flow of traffic is along the Croppa Creek – Moree Road. Sight distances are extensive. The configuration of this cross-over of the two roads is considered to create a minor safety issue. This intersection would need to be identified in a driver induction if this road is used as a haul route for gravel trucks.

The section of road between County boundary road and the Croppa Creek turn-off includes four dips (causeways) and some narrow sections of road. The dips are considered severe and require slowing of all vehicles. This section of road is not smooth due to the black soil sub-grade. The deformation results in reduced speeds. The bitumen seal remains in good condition with only minor patching.

The intersections at Buckie Road and the North Star Road are perpendicular and both have give-way signs. Sight distance is sufficient at both intersections and is considered safe.

The intersection of this road onto the Newell Highway has been upgraded to cater for road trains. A right-hand turn lane is present from the Newell Highway and road width is sufficient for a left-hand turn lane from the Highway. Visibility at this intersection exceeds 300m in all directions and therefore no safety issues are considered to exist at this major intersection.

IB Bore Road (SR9)

IB Bore Road is a gravelled two-way road maintained by both the GSC and MPSC. The section impacted by the quarry involves 22.1 kilometres in length (3.1 kilometres within the MPSC and 19 kilometres within the GSC) with the following characteristics:

- The average road width is 6.0 metres of formed gravel road.
- Culvert width is generally >8.6 metres, with the narrowest culvert width (8.1 metres) located at a drainage line approximately 1.7 kilometres west of the T-intersection with the North Star road.
- The road is relatively flat with several significant bends.
- There is no line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- IB Bore Road is a B-double and Road Train (with conditions) approved route.
- IB Bore Road is part of a school bus route.
- ADT Data is available on this road which is summarised in Table 2 of the TIA.

The condition of IB Bore road is variable. Some sections have 150mm to 300mm depth of gravel pavement. Other sections have exposed black soil subgrade. This is not an all-weather road due to a lack of gravel on sections. A large part of this road has a white rock gravel base. The white rock is soft and subject to weathering and then wind-borne losses of gravel dust.

This road is utilised for haulage of grain from local farms onto the Newell Highway. The road has also been utilised as a key haulage route for delivery of gravel from North Star quarries to Newell Highway projects. For truck operations, this road should be considered as a dry weather road only.

It is noted that Gwydir Shire has received grant funding to upgrade this road into a 2-lane bitumen sealed road. It is assumed that this will then be approved for road train access into the North Star area from the Newell Highway.

Buckie Road

Buckie Road is maintained by both the GSC and MPSC. The road connects Croppa Creek directly with the Newell Highway. The western 14.5 km of this road has a bitumen seal. The remainder is gravel pavement until it enters Croppa Creek. The section between Croppa Creek and the Croppa Creel-Moree Road is bitumen sealed. For deliveries of Inland Rail gravel, the eastern section between Croppa Creek Road and Croppa Creek village would be utilised to access the rail line through Croppa Creek. For Newell Highway works, the whole road may be utilised to access sections of the Newell Highway. The haulage route therefore may extend across both Shires.

Details of the road are as follows:

- The average road width is 6.8 metres with a minimum of 5.4 metres of sealed pavement between Croppa Creek Road and Croppa Creek village.

- Culvert width is generally >14 metres, with the narrowest culvert width (12.2 metres) located to the west of the Railway Crossing.
- The road is relatively flat and straight.
- There is no line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- Buckie Road contains a school zone within Croppa Creek and is part of a school bus route.
- Buckie Road is a B-double and Road Train (with conditions) approved route.
- There were no available traffic counts for this road.
- Gravelled sections have varying quality and depth of pavement.
- Bitumen sealed sections show minimal deformation or pot-holing.
- The central gravelled sections include sections of minimal gravel which have exposed black soil subgrade.
- The western sealed section is 7m or more in width and relatively new bitumen seal pavement.

The limitation on this road is the gravelled section. Gravel depth is limited to 150mm to 200mm with some minor sections where little or no gravel is present. Road width through the gravelled sections reflects the road condition with vehicles occasionally using the road shoulder to drive around problematic sections. In general terms, this road should be considered as a dry weather road only for trucks.

The intersections onto the Croppa Creek Road and Newell Highway are considered as standard rural intersections with no right or left-hand turning lanes. This reflects the normal traffic volumes on these roads. Sight distance at both intersections is extensive (>300m) and therefore considered to conform to safe traffic flows.

Bruxner Highway

Bruxner Way is a bitumen sealed two-way road maintained by Council with State funding. This section of road provides the connection between the northern end of the North Star Road into Boggabilla. The road is trafficable in all weather conditions apart from times of extreme flood events. This road may be used on occasions to haul gravel to the Inland Rail section north of North Star and to either the Newell or Bruxner highways for roadwork. The section that may be utilised by North Star Quarry has the following characteristics:

- The average road width is 7.8 metres with a minimum of 7.1 metres of sealed pavement.
- Culvert width is generally >11.8 metres.
- The road is relatively flat and straight.
- There is limited line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- Bruxner Way is a B-double and Road Train (with conditions) approved route.
- ADT Data is available on this road between Boggabilla and Tucka Tucka Road which recorded 190.57 ADT in 2013 with 12.3% heavy vehicles.
- These volumes are within the capacity of the existing >7 metres sealed pavement width generally provided along Bruxner Way.

Bruxner Way is currently in moderate condition with some light patching and sections recently replaced and upgraded in gravel foundation and width.

County Boundary Road

The County Boundary Road is a major local road managed by both Moree Plains and Gwydir Shires. The road provides the primary north-south access between the Gwydir Highway at the southern end and onto the Croppa Creek Road. Road width is variable. The southern section has a bitumen seal width of between 6.5m and 7m with some sections showing edge/shoulder damage because of wheel damage along the edge of the road. The northern 12km is not sealed. The gravel formation has been upgraded to ensure the road remains trafficable in wet conditions. It is noted that grant funding has been provided to upgrade this road but details of specific sections to be upgraded have not been clearly identified to date.

Local Roads for Inland Rail Access

Quarry operations aim to provide a range of gravel materials to the various sections of the proposed N2NS Inland Rail project via the above more major roads. The primary section for which the applicant will seek contracts includes the section of rail between Milguy and North Star. Roads that provide access from more major local roads along this section include:

- Alma Lane
- Gil Gil Creek Road
- Crooble Road
- Plevna Road
- Tumba Road
- Boonery Park Road

These are local road administered by the Gwydir Shire. The roads vary in quality from lightly gravelled to black soil tracks. Alma Lane (Makims Road) provides access to several adjoining properties. Road width is sufficient to allow two trucks to pass, but road construction is limited to servicing this local traffic. Pavement depth is minimal, and trucks may need to pull-over onto the road shoulder to allow another truck to pass in sections. This would be considered a dry weather road.

Gil Gil Creek Road has a gravel pavement with a section of bitumen seal across the Gil Gil Creek floodplain. The road carries only minor local farm related traffic. The road supports heavy grain traffic in dry conditions. In wet conditions, traffic is generally minimised to light vehicles only due to issues of gravel pavement depth and reduced farm access.

Crooble Road is a dry weather road only. The road services local farms and the village of Crooble. The road can be classified as a black soil road and therefore wet weather access is limited to 4WD only. The road runs parallel to approximately 6km of rail line and would therefore provide access to a rail section between Crooble and Croppa Creek Road at the northern end.

Plevna Road has a gated entrance to the properties it services and the local landowner appears to provide access by permission only. This suggests that use of this road would be subject to agreement with the landowner. The road consists of a single lane lightly gravel road with black soil at the western end.

Tumba Road is a narrow black soil road between the North Star Road and the rail line to the west. This road is a dry weather road only. Road width is approximately 3m and therefore would limit two-way truck access unless one truck parks on the road shoulder.

Boonery Park Road is a minor Gwydir Shire road providing access to several properties from the North Star Road. The road has some gravel but is not considered as an all-weather road for truck access. The road is single lane with a black soil side-track.

All local roads have relatively narrow intersections onto the adjoining main road. None of these intersections have been constructed in accordance with Austroad standards involving the minimum curve radius into the local road to allow truck access without the truck needing to use the whole width of the adjoining road during the turning process to enter the local road.

Current and proposed roadworks and traffic management works

There are no current roadworks or traffic management works, apart from routine maintenance, which will be affected by the development. It is noted that funding is available to undertake upgrades of some of the potential haul routes. The dates for this work have not been published by road authorities.

Traffic Safety

The NSW Centre for Road Safety provides crash statistics for all reportable accidents to occur within both the Gwydir Shire and Moree Plains Shire areas from 2015-2019. Mapping of reportable accidents is presented in Figure 7 of the TIA. Mapping indicates that a low number of traffic incidents occur on rural roads in the vicinity of the development site. This is likely to be a result of low traffic density of these roads. By contrast, roads with higher traffic densities (such as the Newell Highway) experienced a greater number of collisions during this time period.

From 2015 to 2019, one (1) minor reportable incident occurred on the Backspear Road near the boundary of the Gwydir Shire and the Moree Plains Shire. No other reportable incidents occurred on any rural roads in close proximity to the development site. Given the lack of traffic incidents within the region, it is unlikely that any particular section of roads in the vicinity of the North Star Quarry presents a traffic hazard.

The Newell Highway may be utilised as a transport route for the proposed Quarry if materials were supplied to the Newell Highway Project. A number of incidents occurred on this section of the Newell Highway from 2015 to 2019, yet as these incidents occurred at different locations along the highway, it appears that no particular locations along the highway present a hazard to road safety.

Proposed developments in the vicinity

The GSC and MPSC were contacted to discuss any proposed traffic generating developments within the vicinity of North Star Quarry.

Council has clearly advised that the Inland Rail development is considered as a traffic generating development as a result of vehicles associated with its construction in addition to trucks delivering gravel to the works. The scheduling of works for rail construction is unknown at present.

Seasonal activities in the region include crop harvest periods. These are considered as a traffic generating activity. For example, during grain harvest periods between October and December, most farms will generate multiple truck movements for delivery of grain to local grain storage facilities. A significant quantity of on-farm grain storage has been built in the past 10-years. This has resulted in a reduction of peak traffic numbers during grain harvest. This peak has been replaced with daily haulage operations from the farms over an extended period.

Other local developments include adjoining quarries which have been expanded or obtained approval for supply of gravel and other products to Inland Rail, Newell Highway projects or local road projects. These adjoining quarries have a similar capacity to the proposed North Star Quarry operation. However, these adjoining quarries will be competing for the same contracts as North Star Quarry and therefore the overall quantity of gravel produced from all local quarries will be shared between the quarries. The result will involve a similar or the same number of trucks in total as described for one of the quarries at peak production. On occasions, all quarries may operate simultaneously to supply a peak short-term demand at a construction site.

Public Transport and Pedestrians

School Bus routes from Croppa Creek Public School (CCPS) and North Star Public School (NSPS) travel along Croppa Creek Road, Croppa Moree Road, North Star Road and I B Bore Road. Under the current bus routes, the CCPS bus travels as far north as the intersection between Croppa Creek Road and Baroma Downs Road, and as far south as the intersection between Croppa Moree Road and the County Boundary Road. The NSPS route currently reaches as far south as Bonny Ridge, as far north as Scotts Road off the North Star Road and as far west as Nullin Nulla along I B Bore Road. These bus routes may vary from year to year as a result of changes in on-farm staff for local properties and whether they have children that go to school locally. School buses are on the road shortly before and after school hours, Monday to Friday during the school term.

There is no public transport within the supply area of North Star Quarry.

It is exceedingly rare to have pedestrian traffic or cyclists along the main local shire roads. Pedestrians may be present within local villages including North Star and Croppa Creek. Both villages have speed limits of 50 km/h in addition to school zones of 40 km/h to control traffic speed. Such speed limitations are considered appropriate to manage vehicle interactions where the presence of pedestrians or cyclists may occur.

5.1.3. Traffic Generation and Distribution

The proposal involves the development of a hard rock quarry with a peak production capacity of 490,000 tonnes per year. Once the Inland Rail project is completed, the intent is to reduce the maximum annual extraction limits to 150,000 tonnes per year for a period of 10-years to service the general market in the local area.

To establish the impact of the development on the adjacent road network and assess the need for improvements to accommodate traffic generated based on the proposed North Star Quarry, traffic generation and trip distribution to the proposed developments have been estimated by the proponent. This is based on extraction and haulage of the whole 490,000 tonnes of quarry material during peak operations.

The components of traffic generation for the proposed development are:

- Staff trips
- Visitor trips
- Haulage of equipment
- Haulage of quarry materials

Light Vehicle Movements

The site will have 10 full time equivalent (FTE) staff and will therefore utilise 5 light vehicles per day. The employees will be based in either North Star or Croppa Creek, dependent on accommodation. They will need to utilise the North Star Road to access the site via Minilya Road. Additional light traffic will occur from other company staff including project managers and planners. Light traffic will also be generated by service and repair vehicles in addition to several fuel trucks each week of operations.

Heavy Vehicle Movements

The aim of the applicant is to supply a range of markets. The major initial works will involve supplying a range of gravel material for construction of the Inland Rail upgrade between mainly Milguy and North Star. This may extend to the Qld border as a second phase on the N2NS rail project. Other projects will include upgrades to the Newell Highway undertaken by the NSW Government. A range of projects have been presented by government, but no fixed dates or contracts have been developed.

The initial period of extraction may generate an average of 46 laden trucks leaving the quarry per day at a rate of 4-trucks per hour. This will generate one truck leaving the site every 15-minutes and one truck returning to the site every 15-minutes. The proponent has predicted that on a "busy day", truck numbers may consist of up to 24-truck trips per hour for one or two days.

Once the Inland Rail proposal is completed, the quarry aims to provide local projects with a range of road base and foundation type gravel materials. These projects will include Council and private on-farm developments. The quarry aims to maintain a long-term annual extraction limit of 150,000 tonnes. Average truck movements would decline to an estimated 14 laden trucks leaving the site per day at a rate of approximately 1-truck per hour. Such operation may involve only two or three trucks operating from the site for normal supply conditions.

Inland Rail Project

The Inland Rail project is expected to extend over a period of 3-years. The traffic generated by the development will include heavy-vehicle traffic carrying materials, and light vehicles transporting employees, visitors and service personnel.

Supplying the Inland Rail project with quarry material will involve stockpiling quarry materials at selected locations along the rail route. Stockpiled material would then be moved by rail contractors along the rail corridor. Haulage from the quarry will therefore result in selected haul routes along agreed side roads from the more major local roads.

Road traffic from North Star quarry would be distributed evenly north and south from the Minilya Road access on Croppa Creek Road. It is expected that quarry material from this site will mostly be utilised in the rail section between Milguy and North Star.

The current projected start date for construction of the Narrabri to North Star section of the Inland Railway is April 2021 for the Stage 2 section from Penny's Lane to Moree. No specific date has been set for the Moree to North Star section.

Normal Heavy Vehicle Movements

Projected haulage distribution has been provided by Regional Quarries Australia. The following assumptions have therefore been made with regards to traffic calculations:

- Haulage vehicles will typically be truck & dog configurations.
- The General Mass Limit (GML) is 55.95 tonnes for truck & dog configurations.
- A 38-tonne haulage capacity per trip has been assumed.
- Hours of operation for loading of trucks to haul material are 6am to 6pm Monday to Friday and 7am to 1pm Saturday. Allowing for loading times it is assumed that trucks will only be operational for 11 hours a day.
- There will be 50 working weeks/year.
- There will be 6 working day/week.
- Movement calculations are based on one-way (i.e. a truck entering and leaving is considered two movements).

Predicted truck movements are:

- Tonnes processed = maximum of 490,000t/yr = average of 9,800t/week = average of 1,633t/day (6 days)
- Laden trucks (38t loads) = 12,895 loads/yr = average of 258 loads/week = average of 46 loads/day.

Note: These figures have been rounded up to the nearest whole number. These calculations do not include the use of Double Road Trains – Prime Mover Hauling Unit's. These vehicles may be used on occasion and would reduce the number of truck movements calculated above.

Peak Heavy Vehicle Movements

The haulage of gravel will be subject to contractual issues of supply. As discussed above, an average of 1,633 tonnes per day of gravel is likely to be hauled from the site. On occasion, the Proponent may be required to supply additional gravel due to project deadlines and schedules in addition to issues such as weather delays. Inland Rail has the option to work 24-hours subject to approvals.

The quarry may therefore haul 5,000 tonnes per day for short periods or single day operations. This would generate up to 132 two-way truck movements under such conditions. The limitation on this would be the ability to load and process the trucks at the quarry site. This would involve a 15-minute turn-around within the quarry. Based on this time, each loading unit would be capable of loading up to 44-trucks per day, thus requiring multiple loading units and potentially two weighbridges on this site. Peak operating days would be offset by periods of lower activity.

Once the Inland Rail project is completed, the proponent has indicated that quarry activity will reduce to 14-laden trucks per day on average for local deliveries.

Newell Highway Projects

Regional Quarries Australia has been approached to supply material for the Newell Highway Corridor Strategy project which involves key upgrades between Moree and Goondiwindi with the aim of increasing productivity for freight operators and improving safety for all road users. The Australian Government is investing $9.3 billion for the delivery of the Inland Rail project and the Newell Highway Corridor Strategy will investigate opportunities to better integrate the Newell Highway with rail operations. No specific detail is available to determine potential locations for Newell Highway projects.

5.1.4. Management and Mitigation Measures

A Traffic Management Plan (TMP) would be developed for the heavy vehicle transport associated with the proposal. The TMP, would address operational protocols relating to driver behaviour and interaction with other roads users. The TMP would form part of the employee contract or transport contractual arrangements and would be prepared in consultation with the relevant authorities prior to commencement of the operation of the proposal. It is expected that the movement of trucks to and from the Inland Rail Project would be governed by a TMP specific to the Inland Rail activity. This is likely to outline specific details regarding the management of the proposal heavy vehicles, access points for the Inland Rail Project, travel requirements, and would address any relevant consent conditions for the Inland Rail Project.

Where relevant, the TMP would be consistent with the Inland Rail Project TMP. The TMP would address such matters as:

- The proponent will consult with the residences located between 100m and 400m of a haul route prior to operation to discuss acceptable mitigation measures and resolve concerns related to noise and dust impacts.
- Regional Quarries Australia will also implement dust and noise mitigation measures in accordance with the Environmental Management Plan.
- compliance with access routes;
- road rules, laws and regulations, including the use of mobile phones;
- respecting the rights of other road users and displaying courtesy to other motorists;
- maintaining a minimum five minute headway between departures of laden trucks;
- maintaining safe following distances between vehicles, and increasing separation in poor weather;
- vehicle condition and maintenance;
- medical fitness of the driver;
- covering of loads;
- reporting of any unsafe driving practices or incidents;
- maintaining communication with other drivers to minimise the potential for delays to traffic on the public road near the site access; and

- driver behaviour expectations at any specific locations or situations on the public road network including near schools.
- The designated school bus routes routes and operating times will form part of all operator inductions when engaged by the quarry. Any change to school bus routes will be presented at the morning induction procedure. Such changes may occur after a rainfall event or during school holidays.

Key components of the Drivers Code of Conduct and Induction procedures will include:

- Speed limits – speed limits are to be adhered to. The limits of speed through village areas, along gravel roads, adjacent to homesteads within 100m of the gravel road, and importantly school bus hour operations;
- Approved haulage routes – use only approved haulage routes;
- Abide by Drug and Alcohol Policy under North Star Quarry HSE Policy;
- Adhere to site operation conditions for traffic management of noise and dust emissions;
- Adhere to approved operating hours;
- Report all incidents and complaints to Quarry management;
- Ensure there is no loading over registered mass;
- Appropriately cover and secure loads before leaving the quarry and check for loose material on trailers before leaving delivery site;
- Always drive in a manner that is in accordance with road conditions;
- Reduce engine brake noise to respect community;
- In the event of an environmental incident, make sure every endeavour is taken to contain and minimise environmental harm;
- Adhere to professional and appropriate use of two-ways and maintain communication with other road users via two-way when required;
- Acknowledge courteous acts by others.

Payment of heavy haulage contributions would be made to the relevant local government authorities.

5.1.5. Assessment of Impacts

Impact on Traffic Volumes

North Star Quarry is located in a rural region, in which high traffic volumes and traffic congestion are not significant issues throughout the majority of the year. Peak traffic volumes on the road network are typically experienced in association with periods of crop harvest.

The TIA calculated the total heavy vehicle movements predicted to occur per day along the haulage routes for both the Inland Railway and Newell Highway projects. This includes the predicted percentage increase in movements. It should be noted that these calculations assume trucks utilise the entire haulage route and as such should be viewed as extremely conservative.

Table 4 of the TIA assumes normal operations involving 100% of materials being delivered to the railway or the Newell Highway via the road network. The traffic data used in these calculations indicates relatively low daily heavy vehicle movements based on the available ADT data. This is expected for a rural area where trucks are only generated from local farms. The trucks are generally required to haul grain during harvest periods only. This is reflected in the data. For example, the IB Bore Road carries as few as 2-trucks per day during non-harvest periods. This can be compared to the more major North Star Road which is used as a regional haul route to and from Qld. Daily truck movements range from 49 to 56 truck movements per day. This is associated with cattle and grain movements to and from farms and local feedlot operations.

The exception to this is the Newell Highway which is the main freight route between Qld, NSW, Vic and SA in addition to WA. Daily truck movements on this road are in excess of 1,200 movements.

The addition of up to 92-two-way truck movements per day from the quarry is therefore significant in relation to the current level of local traffic. It is noted that these daily traffic figures do not include any period since other local quarries were approved after 2018. Other local quarries are known to generate a similar level of traffic that is predicted for North Star Quarry. However, it is noted that the quarries will share quarry material contracts and therefore the truck movements will vary according to each quarry winning contracts.

Impacts on Road Condition

The proposed haulage routes include both sealed and unsealed roads. The sealed roads include the route between Boggabilla-North Star-Croppa Creek and the Croppa Creek-Moree Road to the Newell Highway. The remaining haul roads have minor sections of bitumen seal, but mostly consist of gravel pavement in varying condition.

The bitumen sealed roads are considered in good condition as a result of regular patching and replacement of sections by both Gwydir and Moree Plains Shires. The important components relating to bitumen sealed roads includes gravel depth, drainage and bitumen seal width. This assessment has determined that the majority of the bitumen sealed haul routes have sufficient gravel sub-grade to support the current truck traffic impacts during peak periods of grain harvest. This is evident in the more recent 2020 grain harvest which was a large grain harvest for the region. Bitumen sealed roads supported these trucks with minimal road damage or pavement failure.

Drainage is an issue during wet periods or after storm events where ponding of water on roads can result is soakage into subgrades, leading to failure of the sealed surface. Councils appear to be fully aware of this and maintain programs to minimise sections of road where water cannot drain away from the road shoulder.

Road width is a significant factor in whether bitumen sealed roads survive minor or major heavy vehicle use. The issue relates to shoulder damage where passing trucks need to place their passenger wheels onto the road shoulder to ensure safe passing. For the haul roads assessed for North Star Quarry, road width throughout the majority of bitumen sealed haul roads is sufficient to allow two trucks to pass without the need to place wheels over the edge of the bitumen. Small sections of bitumen seal where the black soil subgrade has made the road uneven show some signs of shoulder damage. These sections result in truck and trailer combinations being slightly unsteady and therefore drivers allow additional width between vehicles when passing. On occasions, the passenger side wheels travel on the road edge, resulting in some edge damage to the bitumen seal. Such sections are restricted to the 10km section of Croppa Creek Road to the south of Croppa Creek and approximately 3km of the northern end of the North Star-Croppa Creek Road.

The southern end of the North Star Croppa Creek Road is currently considered in a rough surface condition. The bitumen seal in this southern section between the causeway located approximately 750m north of the Croppa-Moree Road intersection and the top of the hill adjacent to Plevna Road (Murgo Access Road), has historically been an issue of possibly poor subgrade or soil issues at depth. The bitumen becomes rough and therefore some pavement failure occurs on a regular basis. Heavy vehicles would exacerbate potential development of pot holes and pavement failure. Heavy vehicles generally reduce speed in this section as a result of the rough surface. Road width is satisfactory and therefore shoulder damage is generally not an issue.

Most of the unsealed roads included in potential haul roads are in variable condition. Most of the roads include sections where clay subgrade material is exposed as a result of loss of gravel pavements. This renders the road to dry weather conditions only for trucks. It should be noted that the gravel carting operations would generally be limited to dry weather conditions only as a result of limitations of access on unpaved roads at the stockpiling sites. This would result in a limited need for North Star Quarry haulage trucks to use local minor roads during wet weather. The critical period for such roads is during a rainfall event when trucks are en route during haulage operations. It would be recommended that alternative access routes (sealed) be adopted once a rainfall event occurs on local gravelled roads to avoid damage in sections with limited pavement depth. After a rainfall event, quarry management would need to inspect the haul routes on such roads before providing permission for trucks to travel such routes. The outcome of either scenario is that the heavy vehicles would bog through the surface and complete pavement failure would occur, making sections of the roads unusable. This would require maintenance to be provided by Councils, being the local road authorities.

On this basis, it is recommended that the quarry operator instigates a wet weather protocol within the overall project management plan to ensure that when gravel roads are used for haulage to sites, damage from truck use in wet or rainy weather can be avoided.

The development is subject to both the Gwydir Shire Council “Section 94 Development Contribution Plan No.1 – Traffic Generating Development” (April 2011) (DCP) and the Moree Plains Shire Council “Section 94 Development Contribution Plan – Traffic Generating Development” (April 2016). The contribution plans allow the Councils to levy contributions from traffic generating developments under Section 7.11 (previously Section 94) of the Environmental Planning and Assessment Act 1979. These contributions are typically utilised to cover the costs of maintenance, repair and reconstruction of roads as a result of damage caused by heavy vehicles generated by the development.

The payment of contribution fees is therefore considered essential to compensate the Councils for any impacts on existing road condition as a result of the proposed development. Council does not collect such contributions from local road users such as farming operations where no development consent is present, being the planning instrument, which triggers the opportunity for Council to secure contributions for specific operations. Landholders pay rates to Council in lieu of road contributions.

Impact on Traffic Safety

A review of traffic safety has been undertaken. This has mainly included inspections of intersections to be used by trucks from the quarry and general road geometry, including speed and any sharp corners on the local road network.

Minilya Road is currently a relatively narrow property road. This will require an upgrade to form a two-lane gravel pavement or installation of "whale berms" under a TCP to ensure the safe movement of trucks and other local vehicles during haulage campaigns. The property intersection will require appropriate treatment in the form of a standard property access with two lanes. A requirement to bitumen seal the Minilya property intersection will depend on the quarry management adopting an appropriate standard of road watering. This intersection will become dusty as a result of extensive road fines and powdered dirt. Such an issue would result in a dust cloud being generated as a truck leaves or enters the site. Such a cloud would impact visibility. Adequate selection of course gravel in addition to road watering or dust sealant application would avoid or minimise this safety risk. The alternative would involve bitumen sealing up to 50m at the road entrance on both the internal access road and part of Minilya Road.

The proposed site access onto the North Star Croppa Creek Road has appropriate sight distances. At present, the intersection has a short section of poor-quality bitumen approach on Minilya Road. This will need to be lengthened to approximately 30m to ensure dust and dirt does not create a safety issue at the intersection. The entry into this road from North Star is impacted by a power pole and associated stay wire on the northern side. The stay wire extends into the intersection and therefore has created a minor alignment issue. This is considered a minor issue, but any reconstruction of this intersection will need to align the road accordingly to avoid this stay wire if it cannot be removed. Alignment would require perpendicular entry into the intersection. It is expected that a Rural Basic Left Turn (Figure 8.2 Guide to Road Design Part 4A) will satisfy the requirement for this intersection. The speed control along the North Star Road is 100 km/h. Safe intersection sight distance is calculated to be a maximum of 318m. This sight distance is available in both directions.

A review of all other roads that may be utilised by North Star Quarry traffic did not identify any specific safety issues that may result from either intersection sight distances or road geometry in corners/bends in the roads. Sight distance is considered greater than the minimum requirement at all intersections to be used by haulage trucks. The only minor exception to this is the sight distance toward Baroma Road-Myall Downs Road from the southern end of the Croppa Creek-North Star Road. The issue with this intersection is that Myall Downs Road has a sweeping bend commencing at a distance of approximately 220m from the Croppa Creek-North Star Road and the road side vegetation can on occasion limit sight distance to this distance. The geometry of Myall Downs Road would ensure vehicles are travelling slower than the 100 km/h limit and therefore this issue is considered relatively minor.

The road geometry at the intersections of the Moree-Croppa Creek Road across the County Boundary Road has been discussed above. To date, this intersection has not resulted in any severe road safety issue. The introduction of non-local truck drivers for hauling of quarry product may require the quarry management to include a precaution in driver induction protocols if this road is to be used as a haul road. This would be exacerbated during construction of the Inland Rail where a significant increase in traffic is anticipated. The major increase in traffic may occur from the southern section of County Boundary Road as it runs parallel with the rail line. Give way signs are present but due to the angles of approach onto the County Boundary road, some issues remain for vehicles travelling either east or west along the Croppa Creek-Moree Road.

Impact on Traffic Noise and Air Quality

The proposed development will result in a net increase in traffic volumes on the public road network. Therefore, the development will increase traffic noise and dust production throughout the local road network.

Dust is not considered to be an issue on the bitumen sealed roads. Gravel and dirt roads are expected to generate dust for a brief period after each heavy vehicle. Busy intersections on gravel pavement haul roads present a risk which needs to be addressed in relation to truck frequency. The alternative dust management strategy would involve road watering or the use of dust stabilisation fluids.

Provided the Operator manages dust and noise effectively and addresses the concerns of sensitive rural receptors the potential for heavy vehicle traffic to adversely impact the amenity of rural areas within the vicinity of the freight routes to be utilised by North Star Quarry is considered minimal.

Cumulative Traffic Impacts

It is noted that the North Star Quarry is one of three quarries seeking or have obtained approval in the North Star area for supply of quarry material to both Inland Rail and Newell Highway projects. Each site aims to obtain an approval for up to 490,000 to 500,000 tonnes of gravel per annum during construction of the Inland Rail project. Additional smaller quarries of up to 30,000 tonne per annum have approvals in the local area.

Data published by Trans4m Rail suggests a total requirement for approximately 700,000 tonnes of quarry material for construction of the Inland Rail between Moree and North Star. Some of this quarry material will be obtained from these northern quarries but not all. The issue identified in this assessment is the cumulative impact if all three local quarries generate up to 92 or more trucks per day. Each site may have an average of 92-one way truck movements each day when averaging total permissible extractions over a 50-week period each year. This would potentially create significant traffic issues relating to road safety and pavement wear and tear.

The three quarries operating at once would add to the existing local businesses such as the feedlots and farming operations. During a major grain harvest period, the cumulative impact of all operations needing to use local roads, may require development of a traffic management plan to cater for the significant increase in local traffic. Such a plan would require cooperation of all local quarries to ensure efficiencies can be maintained for haulage operations. Councils would need input in such a plan as they will be responsible for road maintenance. It is envisaged that this plan will need to include speed control and traffic management protocols to ensure all vehicles comply with their individual traffic management plans to minimise congestion at intersections and stockpiling points. Such a plan/s is beyond the scope of this assessment as the specific haul routes and daily concentration of delivery points is not available. The outcome of such a plan will need to include specific TCPs for management and signage to be deployed for delivery points for larger haulage or stockpile sites. It is noted that road work along the Newell Highway deploys extensive TCPs, including variable speed controls. Inland Rail is yet to commence operations; however, they will be subject to similar responsibilities and therefore require specific TCPs for entry points to stockpile sites along the local road network.

Other existing quarries in the local area will require a traffic management plan as part of their approvals. The Plans are designed as an adaptive tool for operation of the quarry. On this basis, these plans, including the plan that will be prepared for North Star Quarry are considered as an appropriate tool to manage the impacts of cumulative traffic impacts on the local road network.

Calculation of Expected Development Contribution Rates

The method of calculating contribution rates is based on the reconstruction costs, average road maintenance costs and the length of road likely to be used by vehicles associated with the development. The impact is calculated on the Equivalent Standard Axle (ESA) loading on the road per vehicle as a proportion of the total loadings on the road. This is then converted to a total cost per tonne (1,000 kilograms) per kilometre. The designated haulage route will form the length of road upon which the contribution will be levied. Where the designated haulage route involves the use of more than one road then each road will be treated separately in terms of the road maintenance contribution. Therefore, the total contribution payable for the development will be the sum of all the calculated contribution rates for all the individual roads on the designated haulage route/s.

The Gwydir Shire development contribution rates are as follows:

- Unsealed Roads: 0.19c/tonne/kilometre
- Sealed Local Road: 1.29c/tonne/kilometre.

For the potential Newell Highway Project haul route, the TIA calculates a contribution of $42,441 ($0.0129 x 350,000t x 9.4km). The final rates will need to be negotiated with Council.

For the potential Inland Rail Project haul routes, the TIA calculates a contribution of $0.387/tonne ($0.0129 x 490,000tpa x 30km). This contribution rate would be payable on every tonne out the gate regardless of the trip length or road type. The measurement of tonnes moved would be the responsibility of the operator via weighbridge dockets or receival receipts.

The above figure provides an estimated contribution rate. The final rate will need to be negotiated with Council during final discussions to determine approved haulage routes and road conditions at the time that this occurs.

The MPSC contribution rate is calculated to be $0.129/tonne ($0.0129 x 490,000tpa x 10km). The final rate will need to be calculated during discussions with Council in relation to approved haulage routes and roads conditions.

It should be noted that all local haul roads subject to use by Inland Rail will also be the responsibility of the Inland Rail Contractor. This obligation is presented in the approval for this project. Such obligations will include road dilapidation studies prior to commencement of the project in addition to repair and maintenance of haul or access roads during and after the project. The potential is that quarries supplying gravel to the Inland Rail project will be contributing to road maintenance and this will be duplicated through the Inland Rail Project. This should be to the benefit of Council in that the roads will receive active maintenance during the Inland Rail Project. This is not applicable to the Newell Highway upgrade projects. Once the Inland Rail project is completed, this duplication will cease and therefore this contribution will be paid by the quarry operators and passed on to their customers.

5.1.6. Conclusion

SMK Consultants were commissioned by Regional Quarries Australia to prepare a Traffic Impact Assessment to be lodged as part of an EIS to obtain consent for development and operation of the North Star Quarry. This Traffic Impact Assessment has considered the potential impacts of the proposed North Star Quarry upon traffic on site and within the wider region.

The proposed site access and internal roads within Minilya will require upgrades to be suitable for the potential peak traffic movements. This will include construction of an appropriate intersection into Minilya and widening of Minilya Road to either a 2-lane haul road or installation of “Whale berms” to allow empty trucks to wait on the side of the road for loaded trucks to pass with a TCP in place.

Roads to be constructed or modified in association with the proposed development should be constructed in accordance with relevant standards to ensure that the site will be operated and maintained at a high standard.

The Minilya Road-North Star Road intersection will require upgrading to provide a safe entry-exit intersection for trucks. Work will include extending the bitumen seal on Minilya Road to approximately 30m in length and re-alignment of the intersection to meet Austroad standards for the trucks to use this road safely. A standard rural intersection is considered a minimum to provide safe entry and exit for up to 8-trucks per hour either leaving or entering this road.

The increase in traffic along the local road network is considered significant. Road condition of sealed roads is generally suitable for this increase in truck movements, but specific sections have been identified to have minor issues in relation to road foundations and roughness of the roads. The result of such poorer quality sections will include a reduction in truck speed, rather than a traffic safety issue. Road shoulder damage is predicted to increase in these rougher sections. Some intersection points at present, show dilapidation at stop points.

The use of local gravel paved roads will require close management due to the presence of relatively poor sections of gravel pavement. Some sections of these local roads would be considered as dry weather roads only due to the lack of gravel pavement depth. It is recommended that the quarry operator adopt a wet weather protocol to ensure the integrity of these gravel roads is maintained. This will include variation to haul routes during and for several days after a rainfall event. A figure of 10mm of rain may be required as a formal trigger for stopping the use of certain roads. Quarry management will need to continue an active program to avoid road damage in wet weather. The alternative is that Council closes unsealed roads to quarry trucks to prevent use of these roads to ensure access is retained for local landholders.

Both Moree Plains and Gwydir Shires have a road contribution policy. This will enable Councils to impose an appropriate contribution rate for road maintenance and potentially road upgrades once North Star Quarry operations reduce to 150,000 tonnes per annum when the Inland Rail project is completed.

Regional Quarries Australia would commit to:

- Paying all heavy haulage contribution fees within 30 days from the end of the month.
- Continued liaison with the community along the haulage route.

- The construction of a new Intersection from Minilya Road and upgrading of Minilya Road to accommodate heavy vehicles in accordance with the Austroads specifications and bitumen sealed for a minimum of 35m metres from the North Star Road.
- Comply with all the conditions of approval as issued by Gwydir Shire Council.

The issue of cumulative traffic increases has been identified during this investigation. Three or more other quarries in the local area will be vying for gravel contracts to supply either Inland Rail or Newell Highway projects. If all three quarries become operational at the same time, truck traffic frequency on the local road network would be significant. It is recommended that if this occurs, a traffic management plan is developed for all three quarries to work together to ensure road safety can be maintained, road maintenance can be managed by Councils and other users can safely use their local road network. This is identified to be a significant issue that will need cooperation during grain harvest periods when additional local trucks are hauling grain around the district. Based on this assessment, use of the local road network will result in some damage. Appropriate contributions need to be paid to Councils to cover the cost of repairs which may include an increased presence of road repair gangs for pot hole repairs on a weekly basis. As a whole, no specific road safety issues were identified that need immediate action prior to North Star Quarry operations commencing other than the Minilya Road.

5.2. Biodiversity

5.2.1. Introduction

A Biodiversity Development Assessment Report (BDAR) was prepared for the proposal by OzArk Environmental & Heritage and is presented as Appendix 8. The BDAR was prepared by Dr Crystal Graham, Senior Ecologist, OzArk Environment & Heritage and Dr Kate Hammill, KHS Ecology & Bushfire, BAM Accredited Ecologist (BAAS 18022). The following sections summarise the assessment.

The SEARs for the proposal require an assessment of potential biodiversity impacts associated with the proposal the following:

- 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

In addition, assessment requirements relating to biodiversity values were received from the Biodiversity and Conservation Division of the Department of Planning, Industry & Environment.

5.2.2. Assessment Methodology

A preliminary assessment identified the need for a Biodiversity Development Assessment Report (BDAR), due to the proposed area of native vegetation clearing, which exceeds the threshold for entry into the NSW Biodiversity Offset Scheme (BOS) under the NSW *Biodiversity Conservation Act 2016* (BC Act). The BDAR documents the assessment, which has been completed in accordance with the Biodiversity Assessment Method (BAM), and calculates the number of ecosystem and species credits of the proposal, and the biodiversity offset requirement.

In accordance with section 6.8 of the BC Act, The BAM is to exclude the assessment of impacts of any clearing of native vegetation and loss of habitat on Category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3.

The Native Vegetation Regulatory Assessment of Category 1 land has not been applied in this case, instead the credits have been assessed for the vegetation condition as surveyed in the field. No credits are incurred for land that has been farmed and cropped in the past due to the vegetation integrity being under the threshold that produces credits.

The BDAR has been prepared in accordance with the NSW Biodiversity Assessment Method (BAM) (NSW Government 2020). The assessment uses a site-based approach using a buffer of 1500 m around the development footprint to define the study area and landscape context. The assessment was carried out in three stages:

- Desktop searches and review of ecological databases and information to identify threatened species, populations or ecological communities listed in the BC Act or the EPBC Act that have the potential to occur in the study area.
- Field survey of the subject land to collate species lists for the purposes of identifying the vegetation communities present and habitat for predicted threatened species and ecological communities. Where a threatened species or community or habitat feature is identified, document the nature and extent of the protected matter and describe its 'viable local population' or occurrence.
- Preparation of a BDAR that describes the impacts of the proposed activity on native vegetation and threatened species, populations and ecological communities, including measures to avoid and minimise impacts. Residual (unavoidable) impacts are mitigated by the ecosystem credits and species credits required to be offset by the development, which are detailed in this report.

One ecologist was present on site over two days on 18-19 March 2021 and completed the site assessment, habitat observations and collection of Vegetation Integrity data. The location of the Vegetation Integrity plots and the ecologist's GPS survey tracks are mapped in Figure 13 below (Figure 1-5 of the BDAR).

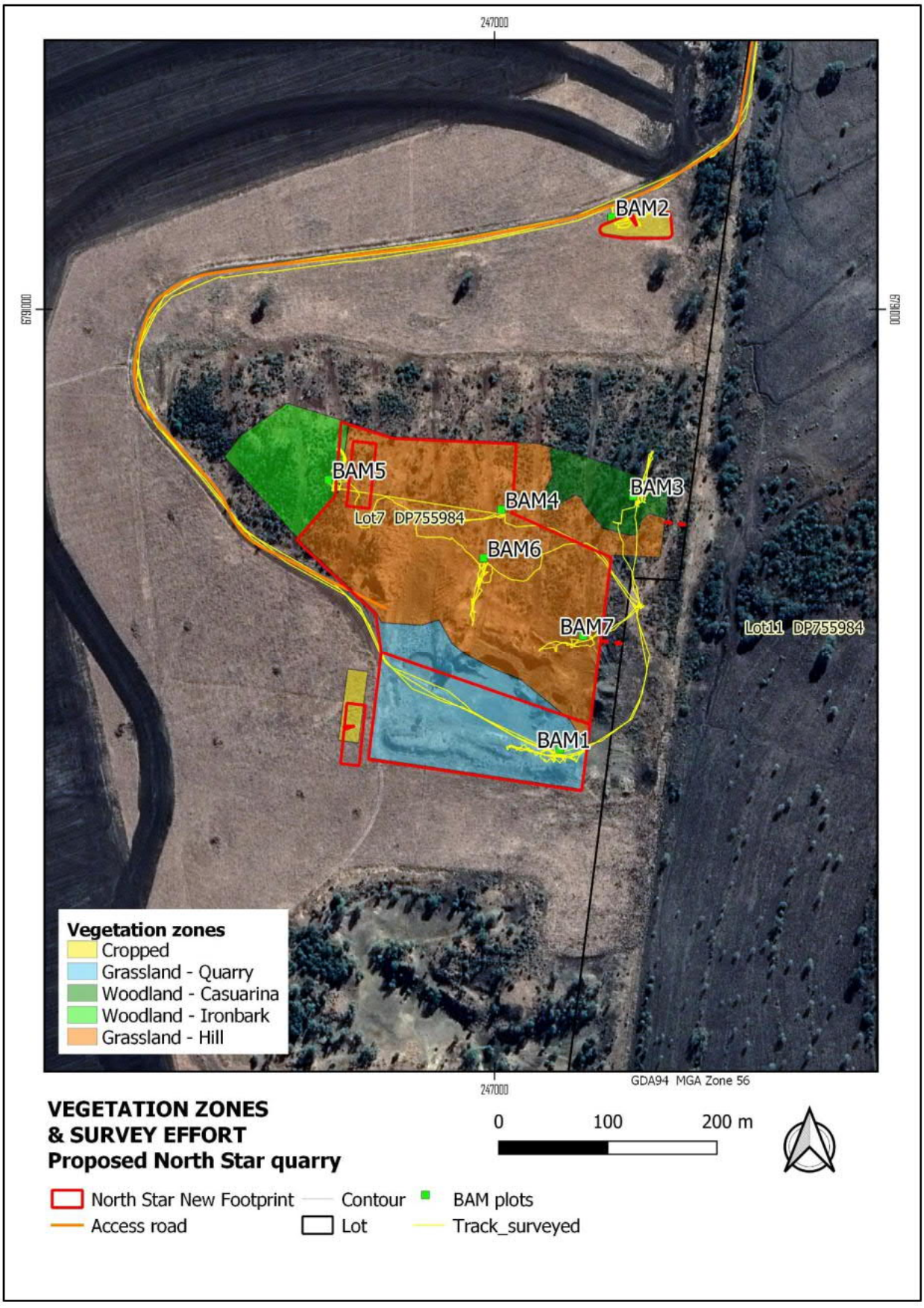
Vegetation Integrity surveyed was completed according to the BAM as follows:

- A total of seven (7) plots of size 20m x 50m were located randomly within vegetation zones across the subject land and replicated for the zone size. The details of the vegetation zones and plot locations are provided in Section 3.2 of the BDAR.
- Species composition and structure was surveyed within each nested 20m x 20m plot, and Vegetation function (size and number of trees, presence of hollow-bearing trees and woody debris) was surveyed within each 20m x 50m plot.
- Percent litter cover was recorded within five 1m x 1m squares positioned at 5m, 15m, 25m, 35m and 45m along the 50m midline of the plot.
- The plots were positioned with random locations and orientation of the midline within the vegetation zones mapped for the subject land and their locations were recorded by handheld GPS (GDA 94 / MGA Zone 56). Data were collected on paper field sheets and entered into excel after the field survey was completed, for upload into the BAM calculator.

The plot locations were randomly selected within vegetation zones to provide the required number of plots for the zone area, as per the BAM, as shown in Table 1-2 of the BDAR. The impact footprint of the subject land has been modified by the client to avoid areas of high-quality woodland, and the biodiversity credits have been calculated for the layout provided 9 May 2021. All vegetation plot data has been reported in this BDAR to provide site context and demonstrate the avoid and minimise approach.

No targeted threatened fauna species surveys were carried out for this assessment. The assessment includes observations of the presence/absence of suitable habitat for threatened species on the subject land based on the observations and data collected during the traverses across the site by the ecologist. In the absence of targeted threatened species surveys, species that have no suitable habitat on the subject land have been excluded from the credit calculations; while species with potential suitable habitat have been retained in the calculations as 'Assumed present, not surveyed'.

Figure 13 – Vegetation zones, plot locations and ecologist's survey track



The survey was conducted in early Autumn (March) 2021, during mild to warm fine weather. The surveys followed a wetter than average period in 2020 and early 2021. The weather records for Tulloona weather station 28.7km from North Star (Bureau of Meteorology station 053041; (Bureau of Meteorology, 2021)) show there was above average rainfall in February, October and December 2020 (Figure 1-6 of the BDAR), and also in January and March 2021 (Figure 1-7 of the BDAR) leading into the survey period in March 2021.

The BDAR is based upon the species data available at the time of the field investigation, and the environmental conditions, season, and time constraints imposed by the project for the field survey. Specific limitations on this study include the following.

- The BAM vegetation field survey was completed over two days in March 2021. Certain flora species which are undetectable at the time due to not being in flower or fruit (which can be essential for identification of some species) may not have been
- observed during the field survey.
- A 'precautionary approach' for species presence has been adopted, whereby a species is assumed present if suitable habitat for the species is present on the site and the conditions for targeted survey were not suitable or able to be met (e.g. due to
- conditions or timing of targeted surveys).
- The above-mentioned constraints were also considered when preparing the recommendations of avoiding, minimising and mitigating potential impacts.

5.2.3. Landscape context

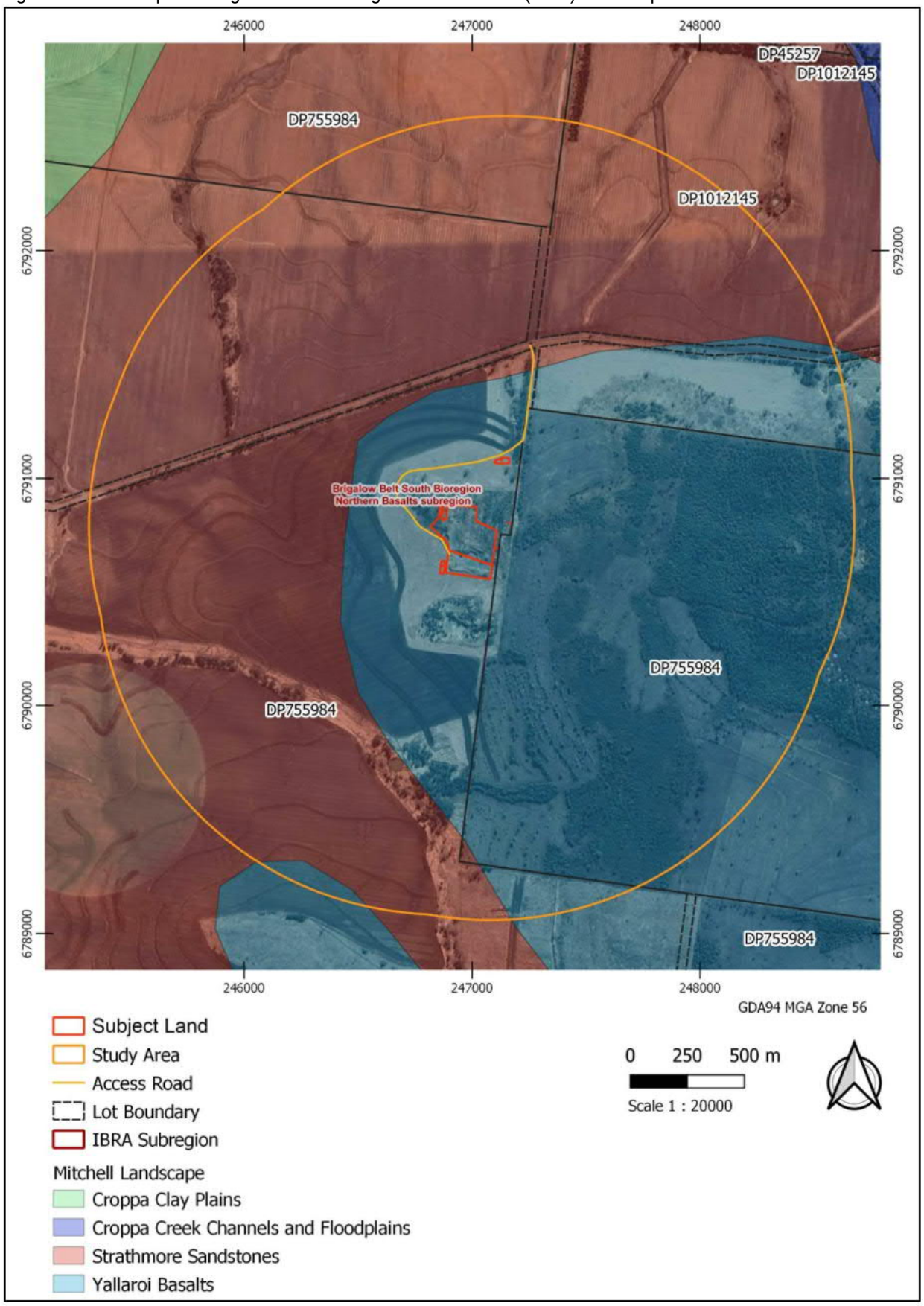
The study area is in the Northern Basalts subregion of the Brigalow Belt South bioregion, according to the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway & Cresswell, 1995). The Northern Basalts subregion is characterised as follows:

- Geology: Tertiary basalts over Jurassic quartz sandstones and alluvial sediments derived from these.
- Landform: Undulating low stony hills, long slopes with sandy wash and heavy clays in the valley floors.
- Soils: Black loams on basalt ridges, deep sands on sandstones and texture sediments contrast soils on slopes. Heavy grey clay on alluvial flats.
- Vegetation: Vegetation on the northern basalts includes brigalow, belah, whitewood, wilga, budda and poplar box on the hills, with river red gum, belah, myall (Acacia pendula) and poplar box on the flats. White box with silver-leaved ironbark, white wood, bull oak and brigalow are present on alluvial clays. River red gum occurs on all streams.

The study area is located within the NSW (Mitchell) Landscape Yallaroi Basalts (Mitchell, 2002) as shown on Figure 14 below (Figure 2-1 of the BDAR). The landscape is described as:

Rolling hills and flat top ridges on Tertiary basalt flows over Jurassic quartz and lithic sandstone. General elevation 300 to 530m, local relief 100m. Shallow stony, red or brown, well-structured clays with high nutrient values. Similar but thicker soils on the slopes and the valley floors. Woodland and open forest of; white box (Eucalyptus albens), with silver-leaved ironbark (Eucalyptus melanophloia), white wood (Atalaya hemiglauca), bull oak (Allocasuarina luehmannii), ironbarks (Eucalyptus sp.), brown bloodwood (Corymbia trachyphloia) and brigalow (Acacia harpophylla) on alluvial clays. River red gum (Eucalyptus camaldulensis) on all streams (Mitchell, 2002).

Figure 14 – Site Map showing the IBRA Subregions and Mitchell (NSW) Landscapes



Native vegetation cover and connectivity

The subject land is surrounded by highly disturbed landscape within a predominantly agricultural landscape. However native vegetation remains along roadsides and the nearby hill to the east of the subject site connecting the site to a larger area of remnant native vegetation. The extent of native vegetation within the study area (i.e. within the 1500m buffer) is mapped in Figure 15 below (Figure 2-2 of the BDAR). Some of the subject land has been cleared in the past for agricultural and mining purposes. A summary of the vegetation cover assessment is provided below:

- Area of the 1500 m assessment circle: 979 ha
- Area of woodland/forest in assessment circle: 225 ha
- Percent vegetation cover: 22.98%

For the purposes of the BAM, the native vegetation cover class has been determined as >10-30% native vegetation cover.

Figure 15 – Extent of native vegetation cover



Rivers, streams and wetlands

The Strahler stream order and associated riparian buffer distance of each watercourse that occurs within the study area was determined using Appendix 3 of the BAM Manual (OEH, 2020) (refer also to Figure 15 above). There are no major watercourses or wetlands within the subject land. A number of first order streams occur at the outer edges of the 1500m buffer area, and one second order stream traverses the southwestern part of the study area, approximately 800 m from the subject land.

Karst, caves, crevices, cliffs and areas of geological significance

There are no areas of geological significance in the study area or on the subject land. There are no cliffs or previously mapped karst or cave systems in the study area. Due to past mining / quarrying activity on the site, there are some areas of rock cutting and outcropping with crevices that might represent potential habitat for threatened fauna. This has been considered in relation to the assumption of presence of threatened microbats in the credit calculations.

Areas of Outstanding Biodiversity Value (OBV)

There are no areas of outstanding biodiversity value listed under the BC Act in the subject land, or study area.

SEPP Koala habitat projection 2020 and 2021

The State Environmental Planning Policy Koala Habitat Protection (Koala SEPP) encourages the 'proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline'. Currently two versions of the Koala SEPP apply in NSW as follows:

- Koala SEPP 2021 applies to all zones in nine LGAs: Metropolitan Sydney (Blue Mountains, Campbelltown, Hawkesbury, Ku-Ring-Gai, Liverpool, Northern Beaches, Hornsby, Wollondilly) and the Central Coast LGA.
- Koala SEPP 2020 applies to all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast. This is an interim measure while new land management and private native forestry codes are developed in line with the NSW Government's announcement on 8 March 2021.

The subject land is on RU1 zoned land within Gwydir Shire LGA. The land is within the Northwest Slopes Koala Management area. Gwydir Shire LGA is included in the Schedule 1 of Koala SEPP 2020 and the land therefore is required to be assessed as to whether it is potential Koala habitat.

Under the Koala SEPP 2020, 'potential koala habitat' means areas of native vegetation where trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

'Core koala habitat', is defined under Koala SEPP 2020 as:

a) An area of land where Koalas are present, or
b) An area of land
    i. Which has been assessed by a suitably qualified and experienced person in accordance with the guidelines as being highly suitable Koala habitat, and
    ii. Where Koalas have been recorded as being present in the previous 18 years.

The preference of the Koala is to inhabit woodland and forest areas including riparian corridors with suitable feed trees. The subject land is not considered to be core koala habitat because it is largely cleared with few feed trees. None of the feed tree species listed in Schedule 2 of the Koala SEPP 2020 are present on site. Specifically, feed tree species listed in Schedule 2 of the Koala SEPP 2020 are: Eucalyptus tereticornis, Eucalyptus microcorys, Eucalyptus punctata, Eucalyptus viminalis, Eucalyptus camaldulensis, Eucalyptus haemastoma, Eucalyptus signata, Eucalyptus albens, Eucalyptus populnea, Eucalyptus robusta.

There are five records for Koala within 10 km of the subject land, from 2006 to 2019. All of the records have minimal location and sighting notes, so it is not possible to determine exactly where the records were made. The location descriptions for the records are provided as 'Suburb only, North Star'.

Plant species

The vegetation survey recorded a total of 74 plant species across all Vegetation Integrity plots, comprising 50 native species and 24 non-native species (Appendix C of the BDAR). Plant identification followed nomenclature in the Royal Botanic Gardens PlantNet online database (Royal Botanic Gardens and Domain Trust, 2021). Growth form types are defined in the accompanying data with the NSW Government's BAM resources.

Of the native species recorded per growth form type, there were 4 native tree species, 12 native shrub species, 18 native forbs species, 12 grass and grass-like species, no ferns and 4 other growth form species (Appendix C of the BDAR).

The trees comprised Alstonia constricta (Quinine Bush), Casuarina cristata (Belah), Eucalyptus melanophloia (Silver-leaved Ironbark), and Notelaea microcarpa (Native Olive). Other trees near the subject land (not within the subject land and therefore not within any plots) include Acacia harpophylla (Brigalow) and Eucalyptus populnea (Poplar Box).

In the understorey, common shrubs included Abutilon oxycarpum (Straggly Lantern-bush), Beyeria viscosa (Sticky Wallaby Bush), Croton phebalioides, Geijera parviflora (Wilga), Rhagodia spinescens (Thorny Saltbush), Salsola australis, Sclerolaena muricata (Black Rolypoly).

Grasses and forbs included species such as: Atriplex muelleri, Bergia trimera, Calotis lappulacea, Chloris divaricata, Dactyloctenium radulans, Dysphania pumilio, Einadia nutans, Enteropogon acicularis, Eriochloa pseudoacrotricha, Homopholis belsonii, Portulaca oleracea, Tetragonia tetragonioides, Tribulus micrococcus, Vittadinia cuneata.

Fauna species
No fauna species were recorded during the field survey.

Vegetation communities
Vegetation communities have been identified in accordance with the current NSW vegetation classification system for Plant Community Types (PCTs) published on BioNet. This classification system is used for ecological and development assessments in NSW and describes over 1,500 PCTs across the state, also classified to vegetation Class and Formation as per Keith (2004).

One PCT (in four condition states) was identified within the subject land namely:

- PCT 445 Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion.

PCT 445 occurs on basalt on hills and low hills in the Moree Plains, Gwydir and Inverell LGAs, within the Northern Basalts; Northern Outwash; Kaputar; Peel IBRA subregions. The community is described as a very tall mid-dense to dense open forest or very tall shrubland dominated by Brigalow (Acacia harpophylla) with other trees including Belah (Casuarina cristata), Eucalyptus melanophloia or Eucalyptus populnea subsp. bimbil with a shrub layer of semi-evergreen vine thicket species such as Notelaea microcarpa var. microcarpa, Carissa ovata, Spartothamnella juncea, Jasminum lineare, Breynia cernua, Psydrax odorata, Santalum acuminatum and Croton phebalioides.

A description of the identified PCT and justification for identifying the PCT on the subject land is provided in Table 3-1 of the BDAR. Existing vegetation mapping of the Border Rivers Gwydir / Namoi Regional Native Vegetation mapping of the study area is shown in Appendix J of the BDAR.

Vegetation zones and patch size
Native vegetation PCTs and broad condition states were mapped across the subject land and have been assigned to vegetation zones according to the BAM. This was done using a combination of review of the existing PCT mapping (Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping SVT map), interpretation of aerial imagery over the study area and field observations during the site survey. Broad condition states were determined by the presence or absence of the key structural elements of the respective PCT and evidence of disturbance and weeds.

The patch size for each vegetation zone was identified as connected areas of native woody and non-woody vegetation extending beyond the subject land. Individual patches are defined under the BAM as areas of native vegetation separated by less than 100 m for woody vegetation or 30 m for non-woody vegetation.

Threatened ecological communities
TECs that are known to occur in the Northern Basalt subregion have been assessed for potential presence at the subject site. The presence of a TEC was assessed by referring to the relevant Scientific Committee listing criteria and identification guides in relation to the site observations and vegetation identified. TECs associated with PCT 445 are:
EPBC Act, Endangered: Brigalow-Gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions;

- BC Act, Endangered: Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions;
- EPBC Act, Endangered: Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions.

The assessment of whether the native vegetation on the subject land is part of a TEC is provided in Table 3-3 of the BDAR. The assessment considers only the land that is proposed to be developed within the modified quarry plans of May 2021. It is assumed that there will be no vegetation clearing along the existing access track to the quarry site, as this area is likely to contain a remnant of TEC vegetation. Other areas of semi-cleared and remnant woodland nearby, not on the immediate subject land, are likely to be part of a TEC. It is concluded that parts of the site have characteristics of the following two TECs:

- Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions – on the lower slopes of the hill including along the edges of the access track where Acacia harpophylla and Casuarina cristata are present.
- Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions – on the basalt rock hilltop where the quarry is proposed, with scattered trees of Eucalyptus melanophloia (Silver-leaved Ironbark) over a mesic tall shrub/small tree layer.

However, when the vegetation within the subject site is assessed against the identification criteria for each of these TECs, it is concluded that the vegetation on the immediate subject land is not consistent with either TEC due to the degraded nature of these sites. The proposed development has been reduced in area to avoid the remnant woodland and scrubby vegetation that is likely part of these TECs.

Weeds

Five BAM listed 'High Threat Exotics' (HTE) weeds were recorded on the subject land. Some of these weeds are also listed under the NSW Biosecurity Act 2015 and have a biosecurity duty for control.

- Alternanthera pungens (Khaki Weed), a common environmental weed, that alters native vegetation by smothering groundcover. Carries a General Biosecurity Duty under the NSW Biosecurity Act 2015 for all of NSW.
- Cenchrus ciliaris (Buffel Grass), likely introduced as pasture for grazing. An environmental weed but not listed under the NSW Biosecurity Act 2015 due to its use as a pasture species.
- Lycium ferocissimum (African Boxthorn), present mainly under trees. The Biosecurity Duty under the NSW Biosecurity Act 2015 for this weed in Northwest NSW is 'Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. Land managers reduce impacts from the plant on priority assets.'
- Xanthium occidentale (Noogoora Burr), competes with summer crops and pasture. Carries a General Biosecurity Duty under the NSW Biosecurity Act 2015 for all of NSW.
- Xanthium spinosum (Bathurst Burr), the most common and economically serious weeds in Australian agriculture affecting livestock and crops. Carries a General Biosecurity Duty under the NSW Biosecurity Act 2015 for all of NSW.

Threatened species

A search of the BioNet Wildlife Atlas database on 14/07/2021 returned a total of 15 records of six threatened species within 10km of the subject land. These records are included in Appendix A of the BDAR and a summary is provided below.

- Speckled Warbler (Chthonicola sagittata). One record for this species in 1979, described as being from the Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940.
- Varied Sittella (Daphoenositta chrysoptera). Two records for this species in 1979, described as being from the Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940.
- Little Eagle (Hieraaetus morphnoides). Two records for this species in 1979, described as being from the Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940.
- Belson's Panic (Homopholis belsonii). Two records for this species in 1988, described as `Warivan', 7.4 km from North Star on Warialda Road. Sighting notes include: 'Basalt hills. Acacia harpophylla - Allocasuarina cristata closed forest. Very rocky red brown friable loam.' and 'Tall caespitose grass located on basalt hills with very rocky red brown friable loam in Acacia harpophylla/Allocasuraina cristata closed forest.'
- Koala (Phascolarctos cinereus). Five records for Koala from 2004 to 2019. Suburb only provided with the records as being North Star, NSW. No further location notes or sighting descriptions provided with the records.
- Grey-crowned Babbler (eastern subspecies; Pomatostomus temporalis temporalis). Three records for this species from 2019 and 2020. Described as being at Croppa Creek Rd, North Star and Wolonga Camp TSR North Star, recorded during the LLS NW Goondiwindi survey 2020.

Ecosystem credit species

In total, 16 ecosystem credit species were predicted to occur on the subject land based on the PCT 445 Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion and other site features. These species are listed in Table 4-1 of the BDAR and the habitat assessment is provided in Appendix E of the BDAR. Of these 16 species, 12 were assumed present and four were assumed absent based on habitat constraints (Appendix E of the BDAR).

Species credit species

In total, 10 species credit species are predicted and required to be assessed as being present or absent on the subject site. Assessment for each species is based on determining whether suitable habitat is present based on observations made during the field assessment, in relation to the habitat constraints and requirements for each the species. No targeted species searches were undertaken and hence species are assumed present, where they cannot be reasonably excluded due to lack of habitat. The species credit species requiring assessment are listed in Table 4-2 of the BDAR and the habitat assessment for each species is provided in Appendix E of the BDAR.

In summary, the following species have been assessed as 'present' and impacted, due to their being no justifiable reason for excluding them from occurring the site, i.e. potential habitat is present.

- Present: Ooline (Cadellia pentastylis), Large-eared Pied Bat (Chalinolobus dwyeri), Belson's Panic (Homopholis belsonii), Large Bent-winged Bat (Miniopterus orianae oceanensis), Barking Owl (Ninox connivens), Eastern Cave Bat (Vespadelus troughtoni).

Species polygons for the species credit flora and fauna assumed present are shown in Figure 16 and 17 below (Figure 4-1 and Figure 4-2 of the BDAR), respectively.

The following species have been excluded and are considered not impacted due to habitat requirements not being present in the subject land (suitable habitat trees and intact native vegetation not present).

- Absent: Pale Imperial Hairstreak (Jalmenus eubulus), Grey-headed Flying-fox (Pteropus poliocephalus), Koala (Phascolarctos cinereus), Masked Owl (Tyto novaehollandiae).

Figure 16 – Polygon for threatened flora assumed present



Figure 17 – Polygon for threatened fauna assessment present



5.2.4. Management and Mitigation Measures

The proposal must offset the impacts of the proposal prior to commencement of each stage by purchasing or retiring the correct number and type of species credits on the open market based on the like-for-like options. If the correct credits cannot be sourced, the proposal may offset by paying an amount directly to the Biodiversity Conservation Trust. This is discussed in further detail below.

The following avoidance measures have been integrated into the design and/or are suggested for the implementation of the proposal:

- The proposed impact area was reduced to avoid identified biodiversity values.

In addition, the following minimisation methods have been or will be implemented:

- Before starting work, erect a physical vegetation clearing boundary with a suitable material such as temporary fencing, flagging tape, or similar.
- Vegetation will be removed in a manner that avoids damage to surrounding vegetation, ensuring disturbance to vegetation and soil is kept to a minimum.
- A Site Based Environmental Management Plan will be prepared.

Table 8 outlines the recommended management measures to reduce impacts on vegetation, soil and biodiversity.

Table 8 – Recommended Biodiversity Management Measures

Impact	Management measure	Timing
Clearing and prevention of over-clearing	• All personnel are to be inducted to be aware that disturbance of any stand of native vegetation outside the development footprint, or otherwise unauthorised disturbance, could have legislative consequences if done without approval. Evidence of all personnel receiving an induction would be kept on file (signed induction sheets). • Before start of work, clearly identify the extent of permitted vegetation clearing and areas to be retained as native vegetation. • A pre-clearing process and unexpected threatened species finds procedure is recommended. Any fauna found during the disturbance are to be allowed (or assisted) to relocate into adjoining habitat. • Vegetation will be removed in such a way to avoid unnecessary damage to surrounding vegetation. • Where possible, vegetation to be removed will be mulched on-site and re-used to stabilise disturbed areas. • Natural regeneration of any bare soil or cleared areas will be encouraged through retention of native vegetation material on site and brush-matting.	Pre-construction
Bushfire protection	• Ensure vegetation management for bushfire protection is consistent, as far as practicable, with biodiversity protection and remove only the necessary vegetation to achieve fuel reduction.	Ongoing
Soil management	• An erosion and sediment control plan will be developed to comply with Council requirements and/or Landcom's Managing Urban Stormwater, Soils & Construction Guidelines 'The Blue Book' (Landcom, 2004).	Pre-construction
Damage to native vegetation outside of impact zone	• Stockpile and compound sites are to be located within the assessed subject site and preferentially according to the following criteria: o At least 40 m away from the nearest waterway. o In areas of low ecological conservation significance (i.e. previously disturbed land). o On relatively level ground.	Construction

Impact	Management measure	Timing
	• Stockpiling of materials and equipment, and parking of vehicles, is to be avoided within the dripline (extent of foliage cover) of any tree.	
Introduction and spread of significant weeds and pathogens	• Inspection and control of environmental weeds in accordance with a site environmental management plan and subject to requirements of Council. • Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be clean, and soil- and weed-free, before entry to the work site. • Any herbicide use is to be in accordance with the requirements on the label. Any person carrying out herbicide application would be appropriately trained and competent in its use.	Construction
Disturbance to fallen timber, dead wood and bush rock	• All bush rock encountered on site is to be relocated to the edge of the disturbance area to enhance habitat and regeneration. • If threatened bats are detected, stop work immediately and either leave the area undisturbed until the individuals have dispersed or engage suitably qualified personnel to attempt their removal.	Pre-construction Construction
Threatened species	• No new tracks to be cleared without further assessment, as threatened flora species may occur in any unassessed impact area. • If the impact footprint changes from the current extent assessed in the study, re-assessment of the potential impact of the activity would be needed to ensure impacts to threatened species are not inadvertently caused, given that suitable habitat for threatened species occurs elsewhere on the property. • Enforce driver code of conduct, including 40 km/h speed limits on access roads to reduce the risk of vehicle strikes.	Construction

Other management measures that are described in this EIS would also manage and mitigate impacts to biodiversity values including:

- Surface water management measures
- Waste management measures
- Bushfire management measures
- Rehabilitation management measures

5.2.5. Assessment of Impacts

The impact footprint of the subject land has been modified by the client to avoid areas of high-quality woodland, and the biodiversity credits have been calculated. All vegetation plot data has been reported in this BDAR to provide site context and demonstrate the avoid and minimise approach. The following avoidance measures have been integrated into the design of the project:

- The proposed impact footprint has been reduced in the planning phase to minimise impact on biodiversity. The original and revised (reduced) footprint is shown in Figure 18 below (Figure 5-1 of the BDAR). The amended plan has resulting in the area of avoided clearing and associated avoided habitat loss of approximately 8100m2 on the western side and 10150m2 on the northeastern side.
- Implementation of additional recommended environmental safeguards outlined in Section 5.2 of the BDAR and Section 5.2.4 of the EIS above.

Figure 18 – Amended proposal to avoid impacts to remnant woodland



Offset scheme thresholds

The project will not impact on land mapped on the Biodiversity Values Map (refer to Appendix A of the BDAR). The project has been assessed against the relevant vegetation clearing thresholds under the BOS. The subject land is currently zoned RU1 (primary production), with a minimum lot size of 200 ha. Clearing of 1 ha or more of native vegetation will require entry into the BOS. The project will clear more than 1ha of native vegetation; thus, entry into the BOS is required. Due to the area of clearing being exceeded and triggering the BOS in this case, the Test of significance (5-part tests) for threatened species are not required.

Impacts to wetlands, watercourses and aquatic habitat

There are no wetlands on the subject land or within the study area. Any potential for indirect impact to nearby watercourses from erosion and sedimentation related to construction activities will be avoided and minimised by developing and implementing an erosion and sediment control plan.

Impacts to native vegetation

This assessment has mapped one vegetation type, PCT 244 Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion, within the subject land occurring in three condition classes.

PCT 244 Cropped

- Cropped areas near the base of the hill proposed for sediment basin and the clean water dam.
- Area of impact = 0.26ha
- VI Score = 0.5

PCT 244 Derived grassland

- Cleared areas with mixed native and exotic shrubby grassland, generally lacking trees.
- Area of impact = 6.19ha
- VI Score = 5.5

PCT 244 Woodland (not within the subject land)

- Areas of remnant viney open-woodland adjacent to the subject land. These areas have been excluded from the development area as part of the avoid and minimise process and modification to the quarry layout.
- Area of impact = Nil
- VI Score = 30.8

Serious and Irreversible Impacts (SAII)

The Guidance to assist a decision-maker to determine a serious and irreversible impact (NSW Office of Environment and Heritage, 2017) and the NSW threatened species data collection has been used to inform the following further assessment for species at risk of Serious And Irreversible Impacts (SAII).

Based on the assessment described in this report, the following threatened species require assessment in relation to potential SAII, as per section 9.1.2 'Additional impact assessment provisions for threatened species at risk of an SAII' of the BAM 2020 manual: These are the species at risk of an SAII that are assumed present on the subject land.

- Large-eared Pied Bat (Chalinolobus dwyeri),
- Large Bent-winged Bat (Miniopterus orianae oceanensis),
- Eastern Cave Bat (Vespadelus troughtoni).

The BDAR assessed that considering the small area of proposed impact in low-quality disturbed vegetation (that does not contain caves) and that the amended site layout avoids impacting the patches of woodland at the site, it is unlikely that the development will cause any substantial loss of habitat or lead to a SAII for any of these three species.

Prescribed Impacts

The Biodiversity Regulation 2017 lists nine impacts as prescribed impacts that must be avoided, minimised and mitigated. These are addressed in detail in Section 5.7 of the BDAR. In summary, the BDAR identified that:

1. No karsts, caves, crevices, cliffs or other features of geological significance are present on the subject land or known within the study area.

2. Previous quarry/mine workings may provide rock crevices that could be inhabited by threatened bats. These are not considered features of geological significance however. Species credits have been incurred for the predicted threatened bats which are assumed present in the absence of targeted survey.

3. No human made structures occur within the subject land.

4. Areas of non-native dominated vegetation have been cropped and are highly degraded and contained no or very few native species. It is not likely that any species relies on the non-native areas of cropped land due to its lack of structure and habitat resources. The predicted species would, at best, fly over or pass through the areas of non-native vegetation, rather than inhabit or rely upon it for survive or breeding.

5. The proposed quarry is at the western end of a short section of low hills in the landscape that is otherwise highly modified and cleared for agriculture. The proposed quarry site will impact an existing disturbed portion of these low hills, on the west end of the hills, at a site that has already been cleared and fragmented by past mining and agricultural activity. There is an adjoining larger area of native vegetation to the east on these hills. The proposed will reduce connectivity by a minimal amount, between a small fragment of native woodland on the western side of the proposed quarry site and the larger areas of native vegetation to the east. However the subject land in its current state is already cleared and modified. Overall there will be minimal new fragmentation caused with no new areas of fragmentation been created. The road vegetation corridor will still be a viable passage for fauna which may use it to access adjoining native vegetation. Wooded vegetation within the subject land is no less than 70 m from connecting wooded corridors, therefore contributing minimal value to connectivity.

6. The subject land potentially contains foraging habitat for a number of threated bird species, and bats, however the project will not significantly alter connectivity of native woodland within the landscape due to the site being on an existing disturbed area that has been previously mined/quarried.

7. The project will not impact any watercourses, there are no watercourses within the subject land. A second order stream is situated 800 m to the southwest of the subject land, but will not be impacted by the proposal. The proposed includes a stormwater management plan for sediment retention and clear water dam, which should retain all surface flows from the site. No wetlands occur within the subject site.

8. The quarry does not include any wind turbines and therefore there is no risk of wind turbine strikes on protected animals.

9. The risk of vehicle strikes on native animals is minimal, but is possible both during the construction and operational phases of the project. The main areas of operational risk would be along the access road to the quarry site which goes through a corridor of remnant native vegetation.

Indirect Impacts

The main impacts of the project are expected to be contained within the subject land, provided there is adequate demarcation between the construction and non-construction areas. Disturbance from machinery and construction activities will occur, such as noise and dust. However, these impacts will be minimised by following the environmental safeguards proposed throughout this EIS. There is also the risk of biosecurity associated with vehicle movements through farmland and waste management, however the operations should comply with the Protection of the Environment Operations Act 1997, Environmental Planning & Assessment Act, Environmental Planning & Regulation 2000, Gwydir Local Environmental Plan 2013 and Contaminated Land Management Act 1997 to ensure these impacts are controlled appropriately.

Matters of National Environmental Significance (MNES)

Section 5.9 of the BDAR provides an assessment of MNES. It was concluded that no MNES will be significantly impacted by the proposal.

5.2.6. Biodiversity Credit and Offset Report

The BAM considers future vegetation condition of different areas of the development footprint when calculating biodiversity credits and offsets. It has been assumed that all vegetation within the development footprint will be cleared and, therefore, the offset calculations have assumed one future management zone, where there will be complete loss of native vegetation.

Vegetation integrity (VI) scores have been calculated by the BDAR for each vegetation zone based on patch size, area to be impacted, vegetation composition, structure and function, as defined below. Data required for the calculation was collected in the field using the BAM, as described above. The VI assessment for each vegetation zone including the loss of VI due to the proposal, averaged across the construction and APZ areas, is shown in Table 6-1 of the BDAR.

It was determined that no Ecosystem Credits are required to offset the proposal.

It was determined that a total of 126 Species Credits require offsetting for the following species:

- Ooline (Flora) – 17 Species credits
- Large-eared Pied Bat (Fauna) – 25 Species credits
- Belson's Panic (Flora) – 17 Species credits
- Large Bent-winged Bat (Fauna) – 25 Species credits
- Barking Owl (Fauna) – 17 Species credits
- Eastern Cave Bat (Fauna) – 25 Species credits

The proponent is obligated to offset the impacts of the development on potential threatened species (species credit species) by purchasing or retiring species credits on the open market or by making a payment to BCT.

5.2.7. Conclusion

The native vegetation consists of one Plant Community Type:

- PCT 445 Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion.

PCT 445 is associated with the following threatened ecological communities (TECs):

- EPBC Act, Endangered: Brigalow-Gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions;
- BC Act, Endangered: Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions;
- EPBC Act, Endangered: Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions.

However, based on the cleared and degraded nature of the subject land, this assessment finds that the vegetation on the site is not of sufficient condition to be part of any of the above TECs. In total 16 potential ecosystem credit species were predicted for the PCT and condition as a derived grassland. Woodland areas around the quarry site were excluded from the development footprint after the design was modified, as part of avoidance measures. Due to the low VI scores for each zone, no ecosystem credits either for the PCT or for the 16 predicted species are required to be offset.

Ten candidate species credit species were determined from the BAM calculations. The following species have been excluded and are considered not impacted due to habitat requirements not being present in the development footprint (suitable habitat trees and intact native vegetation not present).

- Absent: Pale Imperial Hairstreak (Jalmenus eubulus), Grey-headed Flying-fox (Pteropus poliocephalus), Koala (Phascolarctos cinereus), Masked Owl (Tyto novaehollandiae).

The following species have been assessed as 'assumed present', due to there being no justifiable reason for excluding them from the site, and no targeted surveys completed in this study.

- Present: Ooline (Cadellia pentastylis), Large-eared Pied Bat (Chalinolobus dwyeri), Belson's Panic (Homopholis belsonii), Large Bent-winged Bat (Miniopterus orianae oceanensis), Barking Owl (Ninox connivens), Eastern Cave Bat (Vespadelus troughtoni).

The proponent is obligated to offset the impacts of the development on potential threatened species (species credit species) by purchasing or retiring species credits on the open market or by making a payment to BCT.

The following threatened species assumed present on the subject land have been assessed in relation to potential SAII on the species, as per section 9.1.2 of the BAM (2020).

- Large-eared Pied Bat (Chalinolobus dwyeri)
- Large Bent-winged Bat (Miniopterus orianae oceanensis)
- Eastern Cave Bat (Vespadelus troughtoni)

The likelihood of a SAII occurring for any of these bat species will be determined by the consent authority. The significance of the proposed impact to EPBC Listed threatened, migratory, wetland and marine species predicted to occur within a 10 km search area was assessed. No significant impact to a threatened, migratory, wetland or marine species likely to result in the extinction of a local population was identified. The residual ecological impacts of the project would be adequately mitigated using the management actions recommended. Therefore, a referral of the project to the Federal Department of Agriculture, Water and the Environment for these matters is not required.

5.3. Air Quality

5.3.1. Introduction

An Air Quality Impact Assessment (AQIA) was prepared for the proposal by Northstar Air Quality Pty Ltd and is presented as Appendix 9. The AQIA was prepared by Martin Doyle of Northstar Air Quality Pty Ltd. The following sections summarise the assessment conducted by the AQIA.

The SEARs for the proposal require an assessment of potential air quality impacts associated with the proposal the following:

- 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;

In addition, assessment requirements relating to air quality were received from Council, the EPA and the Department of Planning, Industry & Environment.

The AQIA presents an assessment of the impacts of activities associated with the construction/site establishment phase and operational phases of the proposal. An assessment of the potential air quality impacts along off-site transportation routes has also been provided. The AQIA has used a quantitative dispersion modelling approach, performed in accordance with the relevant NSW guidelines. The results of the assessment are presented as predicted incremental change, and as a cumulative impact accounting for the prevailing background air quality conditions.

5.3.2. The Existing Environment

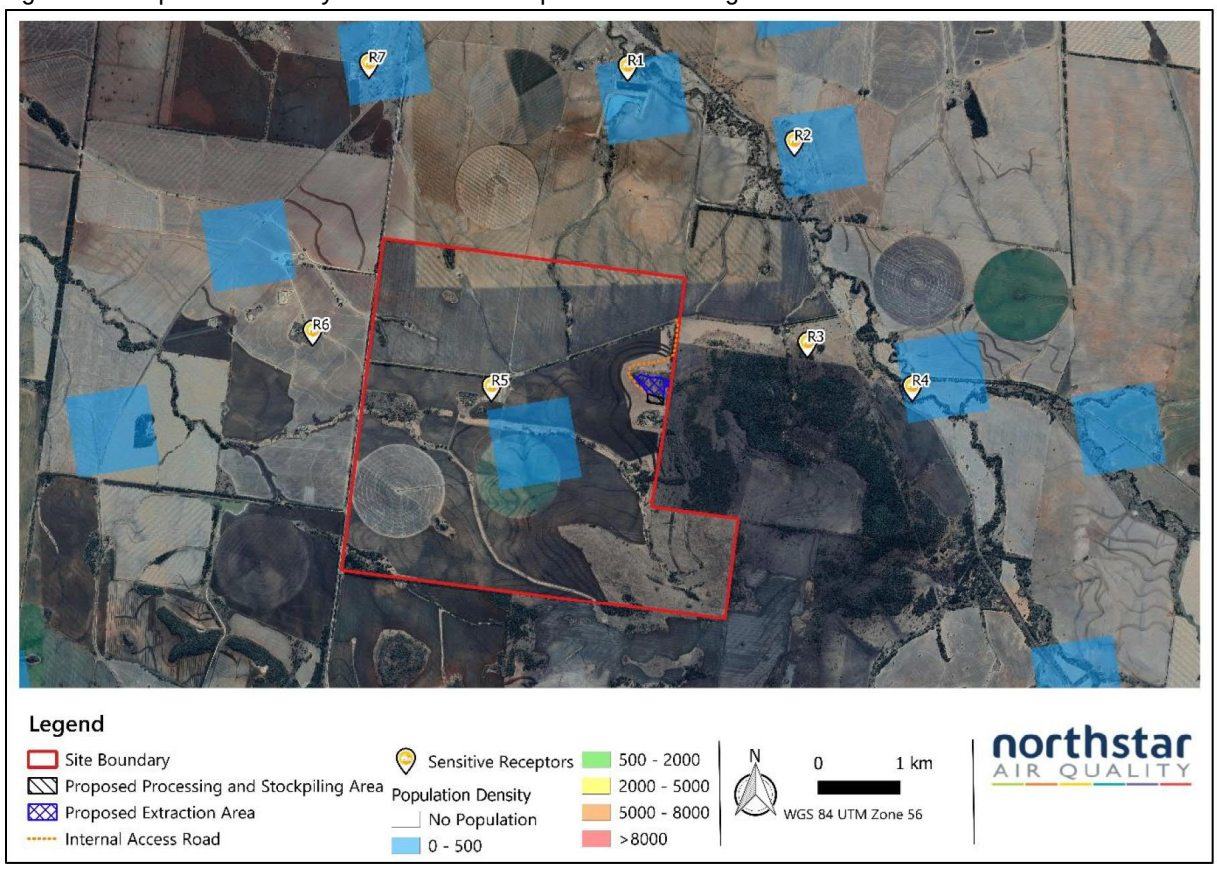
Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed. Typically, these locations are identified as residential properties although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

It is noted that in addition to the identified 'discrete' receptor locations, the entire modelling area is gridded with 'uniform' receptor locations (see Section 4.1.2 of the AQIA) that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location sensitive to changes in air quality does not render the AQIA invalid, or otherwise incapable of assessing those potential risks.

To ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the proposal site reside, population density data has been examined. Population density data based on the 2016 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km2) grid, covering mainland Australia (ABS, 2017). Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities.

Using ABS data in a GIS, the population density of the area surrounding the Proposal site are presented in Figure 19. The Quarry site is located in an area of low to very low population density (between 0 and <500 persons·km^{-2}). A number of residential locations surrounding the site have been identified and these receptors have been adopted for use within this AQIA as presented in Table 4 of the AQIA which is summarised in Table 9 below.

Figure 19 – Population density and sensitive receptors surrounding the site



Note: Areas with no colour represents a 1 km^2 grid cell with zero population

Table 9 – Discrete Sensitive Receptor Locations for the AQIA

Receptor	Name	Address	Land Use
R1	S&S Doolin Pty Ltd	Lot 2 DP1174993	Residential
R2	Malcolm and Jennifer Doolin	Lot 25 DP45257	Residential
R3	Doolin Minilya Pty Ltd	Lot 1 DP1012145	Residential
R4	William & Diane Thompson	Lot 1 DP655384	Residential
R5	Doolin Minilya Pty Ltd	Lot 7 DP755985 & Lot 1 DP1227212	Residential
R6	Coppymurrumbilla Station Pty Ltd	Lot 4 DP755985	Residential
R7	James Smith	Lot 3 DP755984	Residential

In accordance with the requirements of the NSW EPA Approved Methods, the AQIA is required to describe and account for the influence of the prevailing meteorological conditions.

The meteorology experienced within an area can govern the generation (in the case of wind dependent emission sources), dispersion, transport and eventual fate of pollutants in the atmosphere. The meteorology of the area surrounding the Quarry site has been examined using data collected by the Australian Government Bureau of Meteorology (BoM) at the Moree Aero Automatic Weather Station (AWS), which is approximately 75 km southwest of the Quarry site. This AWS is considered the most representative station for the area surrounding the Quarry site for air quality impacts. To provide a characterisation of the meteorology which would be expected at the Quarry site, a meteorological modelling exercise has been performed.

Data from the year 2017 have been selected for use in the AQIA to provide an approximation of 'representative' conditions surrounding the Quarry. This year has been selected through examination of meteorology and background air quality conditions for the five-year period 2016 to 2020. The year 2017 was selected as being most representative as wind speed and direction measured at Moree Aero AWS in 2017 were considered to be most representative of the five-year period examined. A summary of the inputs and outputs of the meteorological modelling assessment, including model validation, is presented in Appendix B of the AQIA. This analysis includes a discussion of data availability and variability.

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional and global). The relative contributions of sources at each of these scales to the air quality at a location will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant should also be assessed. This 'background' (sometimes called 'baseline') air quality will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

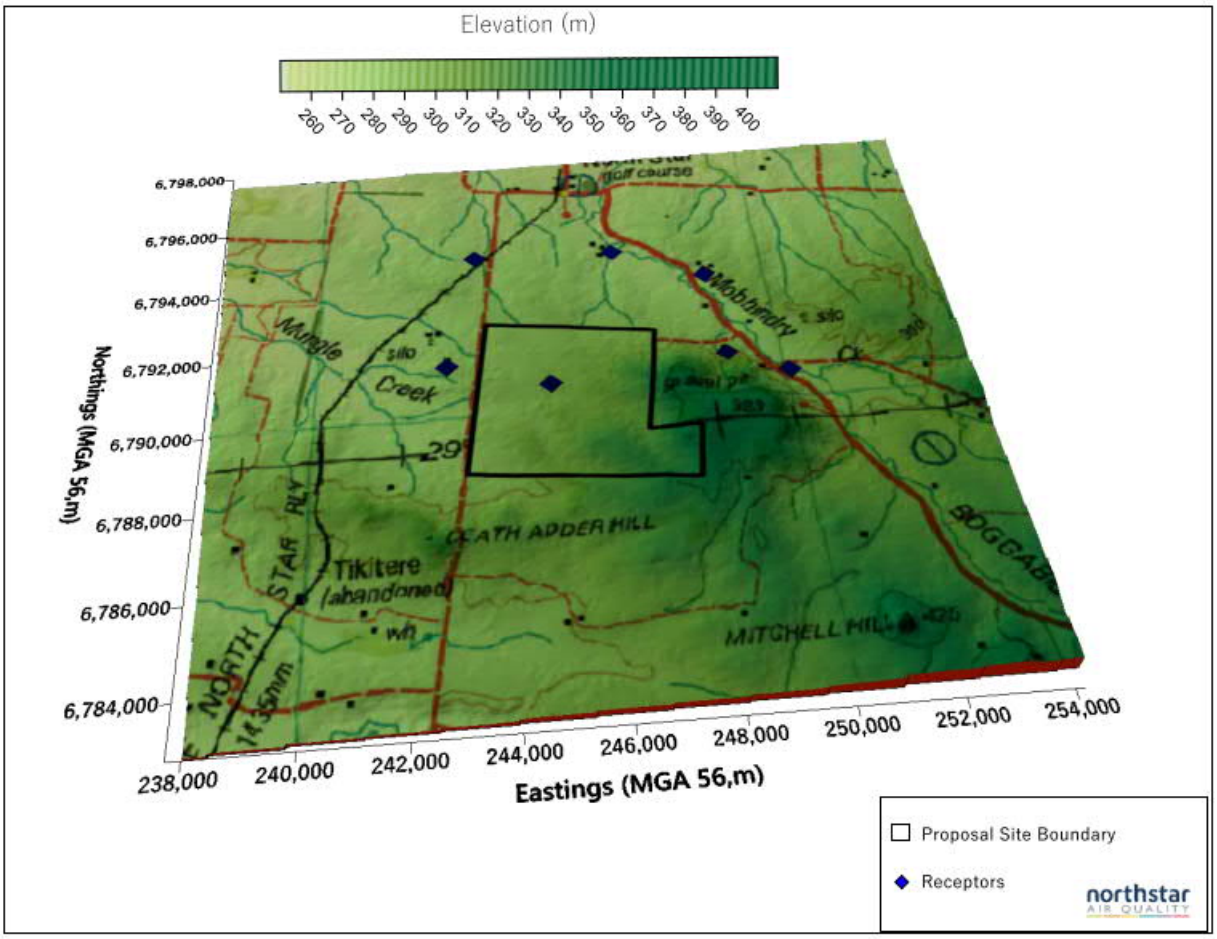
The site is located at significant distance from any of the air quality monitoring stations (AQMS) operated by NSW DPIE. The locations of the nearest AQMS (listed by proximity) are briefly summarised in Table 6 and presented in Appendix C of the AQIA.

The closest representative AQMS with data available for the assessment year (see below) of 2017 is noted to be located at Tamworth and is considered to be the monitoring location most reflective of the conditions at the Quarry site. The adoption of air quality monitoring data, often collected at significant distances from proposed projects, to represent conditions at those locations is a routinely adopted approach in NSW. NSW DPIE operates an extensive air quality monitoring network, generally reflective of the most populated areas of the State. Site specific air quality monitoring funded by proponents can sometimes be used, although for the purposes of use within an AQIA, at least a full year of continuous measurement is required.

Data from the year 2017 have been selected for use in the AQIA to provide an approximation of 'representative' conditions surrounding the Quarry (see Section 4.2 of the AQIA). This year has been selected through examination of meteorology and air quality for the five-year period 2016 to 2020. In terms of background air quality, the year 2017 was selected as being most representative as PM10 data measured at the Tamworth AQMS in 2017 were statistically shown to be most representative of the five-year median particulate distribution at that location, especially when considering the full data distribution (see Figure 5 of the AQIA).

The elevation of the Quarry site is between approximately 290 m and 350 m AHD. The topography between the Quarry site and nearest sensitive receptor locations is uncomplicated. A 3-dimensional representation of the topography surrounding the Quarry site is presented in Figure 20.

Figure 20 – 3-dimensional representation of topography surrounding the site.



Source: Northstar Air Quality

5.3.3. Criteria for Assessment

NSW EPA Approved Methods

State air quality guidelines adopted by the NSW EPA are published in the 'Approved Methods for the Modelling and Assessment of Air Quality in NSW' (NSW EPA, 2017) (the Approved Methods) which has been consulted during the preparation of this assessment report.

The Approved Methods lists the statutory methods that are to be used to model and assess emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria to be applied.

The criteria listed in the Approved Methods are derived from a range of sources (including National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC], Department of Environment [DoE], and World Health Organisation [WHO]).

The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW.

Protection of the Environment Operations Act 1997

The Protection of the Environment Operations (POEO) Act (1997) sets the statutory framework for managing air quality in NSW, including establishing the licensing scheme for major industrial premises and a range of air pollution offences and penalties.

Should the proposal gain approval the operations would be defined as a scheduled activity under the POEO Act. As such, an Environment Protection Licence (EPL) would be required to be obtained from NSW EPA and once issued would contain a range of conditions related to minimisation of emissions from the site.

Protection of the Environment (Clean Air) Regulation 2010

The Protection of the Environment Operations (POEO) (Clean Air) Regulation (2010) sets standards of concentration for emissions to air from both scheduled and non-scheduled activities. For the proposal activities, the POEO (Clean Air) Regulation provides general standards of concentration for scheduled premises which are:

- Solid particles (total) – Any activity or plan (except listed below) – 50mg m^3
- Solid particles (total) – Any crushing, grinding, separating or materials handling – 20mg m^3

Further to the requirements above Part 4 Clause 15 of the POEO (Clean Air) Regulation requires that motor vehicles do not emit excessive air impurities which may be visible for a period of more than 10-seconds when determined in accordance with the relevant standard. Schedule 8 of the POEO (Clean Air) Regulation indicates that burning of vegetation is prohibited, except with approval in the council area. No burning of materials would be performed as part of the construction or operation of the proposal.

All vehicles, plant and equipment to be used either at the proposal or to transport materials to and from the site will be maintained regularly and in accordance with manufacturers' requirements, where these vehicles are under the operational control of the operator.

5.3.4. Identified Potential for Emissions to Air

The processes which may result in the emission of pollutants to air during the construction phase would include:

- Removal of overburden, loading of haul trucks, transport, unloading, and storage of overburden;
- Drilling and blasting to establish the initial bench;
- Loading of haul trucks, transport, unloading, and storage of rock;
- Use of grader and roller on disturbed areas and for haul road construction;
- Wind erosion of parts of the extraction area and processing area; and,
- Emissions from vehicle and generator exhaust.

During the operational phases, emissions of pollutants to air would include:

- Drilling and blasting;
- Loading of haul trucks, transport, unloading, and storage of rock and overburden;
- Processing of rock, and storage in stockpiles;
- Loading product trucks with rock, and haulage offsite;
- Wind erosion of the extraction and processing areas; and,
- Emissions from vehicle, equipment, and generator exhaust.

The specific pollutants of interest associated with those activities are:

- Total suspended particulate (TSP);
- Particulate matter with an aerodynamic diameter of 10 microns (PM10); and
- Particulate matter with an aerodynamic diameter of 2.5 microns (PM2.5).

Emissions of oxides of nitrogen (NOX) would be anticipated from blast fume, and (primarily) emissions of NOX, carbon monoxide (CO) and sulphur dioxide (SO2) related to diesel combustion would also be experienced (in addition to particulates considered above). Given the distances between the proposal and nearest sensitive receptors (approximately 2 kilometres ([km]), the frequency of blasting, and the quantity of equipment operating on site, it is not anticipated that emissions associated with diesel combustion, other than particulate matter which have been assessed, would be an issue of concern and have not been addressed further. In relation to blast fume, the timing of any blasts would be managed to ensure that meteorological conditions are appropriate for those to occur.

5.3.5. Assessment Methodology

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF atmospheric dispersion model. The modelling has been performed in CALPUFF 3-dimensional (3-D) mode, adopting a 'No-Obs' meteorological

modelling simulation, in accordance with NSW DPIE guidance (Barclay & Scire, 2011) (please refer to Appendix B of the AQIAfor further information). This approach allows the inclusion of topographical features which are present in the area surrounding the site.

An assessment of the impacts of the operation of the proposal has been performed which characterises the likely day-to-day operation, approximating average operational characteristics which are appropriate to assess against longer term (annual average) criteria for particulate matter. The likely peak activities have also been characterised to allow comparison of potential impacts against shorter term (24-hour) criteria for particulate matter.

The modelling scenarios provide an indication of the air quality impacts of the operation of activities at the site. Added to these impacts are background air quality concentrations which represent the air quality which may be expected within the area surrounding the site, without the impacts of the proposal itself. The following provides a description of the determination of appropriate emissions of air pollutants resulting from the proposal.

Emissions Estimation

The estimation of emissions from a process is typically performed using direct measurement or through the application of factors which appropriately represent the processes under assessment. This assessment has adopted emission factors for drilling, blasting, materials handling processes, movement of trucks on unpaved site roads, crushing and screening, and wind erosion contained within the US EPA AP-42 emission factor compendium (US EPA, 1995 and updates) to represent the emission of particulate matter resulting from the proposal as described in Section 2.2 of the AQIA. These factors are appropriate for adoption in Australia and are routinely adopted in the assessment of operations of this nature.

Two scenarios have been constructed which cover emissions associated with the operation of the Quarry at the maximum production rate. One scenario reflects activities at their average rate, with impacts compared against annual average air quality criteria, and a further scenario reflects activities at peak daily activity rates, with impacts compared against 24-hour air quality criteria.

The potential emissions along offsite unpaved transportation routes, during the period of anticipated peak daily haulage have been quantified. Associated impacts have been assessed against the short term (24-hour) impact assessment criteria. Impacts of offsite transportation have been assessed in a different manner to the activities at the Quarry. Predicted incremental impacts along a nominal 500 m stretch of unsealed road leading from the Quarry site have been modelled to determine the impacts at distance from the road. Discussion is provided in relation to the potential distances of receptors from that transportation route. A full description of the emission sources included in the assessment, and the emission factors and assumptions adopted are presented in Appendix D of the AQIA.

A full description of the emission sources included in the assessment, and the emission factors and assumptions adopted are presented in Appendix D of the AQIA.

5.3.6. Proposed Management and Monitoring Measures

Emissions controls will be employed at the site. The application of these controls results in quantifiable reductions in the quantity of particulate matter being emitted as part of the proposal.

It is not anticipated that any air quality monitoring would be required to be performed, although it is recommended that regular audits are performed to ensure that the site is implementing the air quality control measures appropriately, as outlined within this report.

A Environmental Management Plan would be prepared and include a Trigger Action Response Plan (TARP) which would link visible dust generation from all activities with wind conditions experienced at the quarry site. A range of actions would be listed which would be adopted to reduce visible dust generation, until such time as the adopted trigger levels have reduced.

A summary of the emissions reductions measures that would be adopted during the construction and operation is presented below. These emission reductions are outlined in the NPI EETM for Mining (NPI, 2012) and relevant AP-42 documentation (US EPA, 1995).

- Dust control on drill rig

- Application of water on haulage routes (internal)
- Application of water sprays on materials crushing operations
- Application of water sprays on materials screening operations
- Retention of particulate matter within the pit for activities occurring in the pit
- Covering loads with a tarpaulin
- Limit load sizes to ensure material is not above the level of truck sidewalls
- Minimising travel speeds and distances

It is noted that the proponent proposes to continually apply water to all exposed areas of the quarry using the water truck. These emissions reductions have not been applied in any stage of construction or operation in the air quality modelling assessment. The continual application of water to large areas is likely to be unmanageable in periods of water shortage, and therefore the assessment seeks to provide assurances that the air quality criteria can be met at all surrounding sensitive receptor locations, without this additional level of control.

Watering of unpaved haulage routes on site has been assumed to occur continuously and an emission reduction of 50 % has been applied. Should water availability become an issue at the quarry, or should visible dust be observed to be emitted from haulage routes, the proponent would implement additional management measures such as reducing the speeds of vehicles along those routes. In this way, the emission reduction efficiencies associated with haulage route watering applied within this assessment can be maintained, even in conditions of water shortage.

The application of water sprays on processing equipment will be maintained continuously throughout the quarry lifetime.

The proposal will result in the production of greenhouse gas emissions. By limiting greenhouse gases production through the use of the following measures the impacts to air quality can be minimised.

Table 1 – Greenhouse Gas Management

Aspect	Control
Procurement:	• Procurement guidelines will consider a suite of environmental sustainability requirements prior to product acceptance at the site which may include but not limited to: - Consideration of the energy efficiency ratings of equipment. - Fit for purpose plant and equipment - Sustainability to be adopted into whole of lifecycle asset management strategy - Identification of waste streams and quantities of waste being generated through the sourcing of imported materials. - Waste minimisation strategy which has developed targets commitment to reducing waste. - Opportunities to source hybrid plant and equipment or those that use alternative fuels such as biodiesel. - Sourcing of materials from local suppliers to minimise traveling time.
Vehicles, Traffic and Transport Panning	• Implementation of vehicle operating guidelines to encourage correct and efficient operation of vehicles that seeks to; • Reduce the number of vehicles and/or trips required for transport • Uses buses for transportation of large numbers of personnel to minimise number of vehicles operating • Implementation of a wider fuel management strategy which encourages use of more efficient plants and vehicles, planning, logistics, driver education and maintenance • Driver and operator training in relation to efficient operation of vehicles, plant and equipment. • Sustainability to be adopted into whole of lifecycle asset management strategy • Workforce awareness to be raised around driver behaviour that minimises diesel consumption and wear and tear on parts. • Undertake daily prestart checks to flag any faults with the plant and equipment that may lead to excessive air quality pollutants. • Regularly service vehicles, plant and equipment such that exhaust systems and fuel consumption comply with manufacturers' specifications. • Minimise transportation distances within the site wherever possible.

Aspect	Control
	• Operate and maintain air conditioning systems in accordance with manufacturer's instructions and Guide to Best Practice Maintenance & Operation of HVAC Systems for Energy Efficiency (Council of Australian Governments National Strategy on Energy Efficiency January 2012 • Provide workforce bus to ensure carpooling between nearest township and the worksite can occur.
Waste	• The site will be planned to ensure products such as overburden and topsoil are stockpiled efficiently around the site to ensure that onsite reuse can occur with the minimum of fuel consumption and product handling subsequently reducing the amount of vehicle movements and overall fuel usage during the quarry lifecycle. • Offsite disposal of waste is unlikely however the nearest lawful place of disposal will be identified based on the waste stream being generated.
Communications	• Use of teleconferencing and video conferencing to reduce travel to and from offices and associated gaseous emissions from fuel combustion.
Vegetation Clearing	• Vegetation clearing will be restricted to the required footprint only and will be done progressively in a staged approach.

5.3.7. Assessment of Impacts

This section presents the results of the dispersion modelling assessment and uses the following terminology:

- Incremental impact – relates to the concentrations predicted as a result of the construction and operation of the quarry in isolation.
- Cumulative impact – relates to the incremental concentrations predicted as a result of the construction and operation of the quarry PLUS the background air quality concentrations.

The results are presented in this manner to allow examination of the likely impact of the proposal in isolation and the contribution to air quality impacts in a broader sense.

Particulate Matter – Annual Average PM10 and PM2.5

The predicted annual average particulate matter concentrations (as TSP, PM10 and PM2.5) resulting from the operations at 490 000tyr at the Quarry site are presented in Table 9 of the A QIA. The results indicate that predicted incremental concentrations of TSP, PM10 and PM2.5 at receptor locations are low (less than (<) 1 % of the annual average TSP criterion, <2.1 % of the annual average PM10 criterion and less than or equal to (≤) 0.1 % of the PM2.5 criterion).

The addition of existing background concentrations (refer Section 4.3 of the AQIA) results in predicted concentrations of annual average TSP being less than 41.5 % and annual average PM10 being less than 64.5 % of the relevant criteria at the nearest receptors. Annual average PM2.5 is predicted to be 7.8 µg·m-3, but not be exceeding the annual average criterion at the nearest receptors. The existing high background concentration of PM2.5 is shown to already be greater than (>) 98.1 % of the relevant criterion.

Particulate Matter – Annual Average Dust Deposition Rates

An assumed background dust deposition of 2 g·m-2·month is presented in Table 10 of the AQIA, although comparison of the incremental concentration with the incremental criterion of 2 g·m-2·month is also valid (as discussed within Section 1 of the AQIA). In either case, the resulting conclusions drawn are identical. Annual average dust deposition is predicted to meet the criteria at all receptors surrounding the Quarry where the predicted impacts at 490 000 tpa are <0.1% of the incremental criterion at receptor locations.

No contour plots of annual average dust deposition are presented, given the minor predicted contribution from the operations at the Quarry at the nearest sensitive receptors.

Particulate Matter – Maximum 24-hour Average

The predicted incremental concentration of PM10 and PM2.5 are demonstrated to be minor. At the receptor where the maximum 24-hour PM10 impact is expected to occur in any stage (receptor R3), operation of the quarry at 490,000tpa would contribute up to 24.9% of the relevant criterion. Similarly, at the receptor where the maximum 24-hour PM2.5 impact is

expected to occur (receptor R3) operation of the quarry at 490,000tpa would contribute up to 5.6% of the relevant criterion. The assessment confirms the quarry will not result in any exceedances of the 24-hour particulate criteria, even taking into account existing background conditions.

The above information is illustrated below in Figure 21 and Figure 22.

Emissions Associated with Offsite Transportation

As required within the EARs, an assessment of the impact of offsite transportation is required to be provided. Given that offsite transportation would be likely to peak in Stage 1 operations, with up to 132 peak daily vehicles trips occurring between the hours of 6am and 6pm, this is the scenario which has been selected for assessment.

The results indicate that concentrations of PM10 and PM2.5 resulting from offsite transportation of product during peak periods in Stage 1 operations may be significant at distance from the road if uncontrolled. Receptor locations are identified at distances of approximately 160 m from Minilya Road (receptor R5), should trucks head west, and approximately 695 m from Croppa Creek Road (receptor R6) should trucks head east, once at the North Star Road junction.

It is noted that the predicted impacts result from 132 vehicles leaving the Quarry each day during peak operations and therefore represent a worst-case scenario. Impacts during average operations would be likely to represent around a third of those impacts over the long term.

It is recommended that a management plan is constructed which enforces vehicle speed restrictions when within 500 m of any residence which is located within a distance of 200 m of the offsite haulage route and road signs are placed at the appropriate locations to help enforce that control.

Should complaints be received by residents along the transport route, or should excessive dust be observed to be generated, surface treatments/improvements such as paving should be investigated and employed for those particular stretches of road. In reality, the paving of road surfaces should result in significantly greater than 90 % control of particulate emissions, although the road surfaces would be required to be constructed with sufficient camber to allow any silt which may settle to be flushed during any rainfall events. It is considered that particulate matter generation during offsite transportation of product can be adequately managed through a combination of the above controls.

Figure 21 – Incremental 24-hour PM10 concentrations

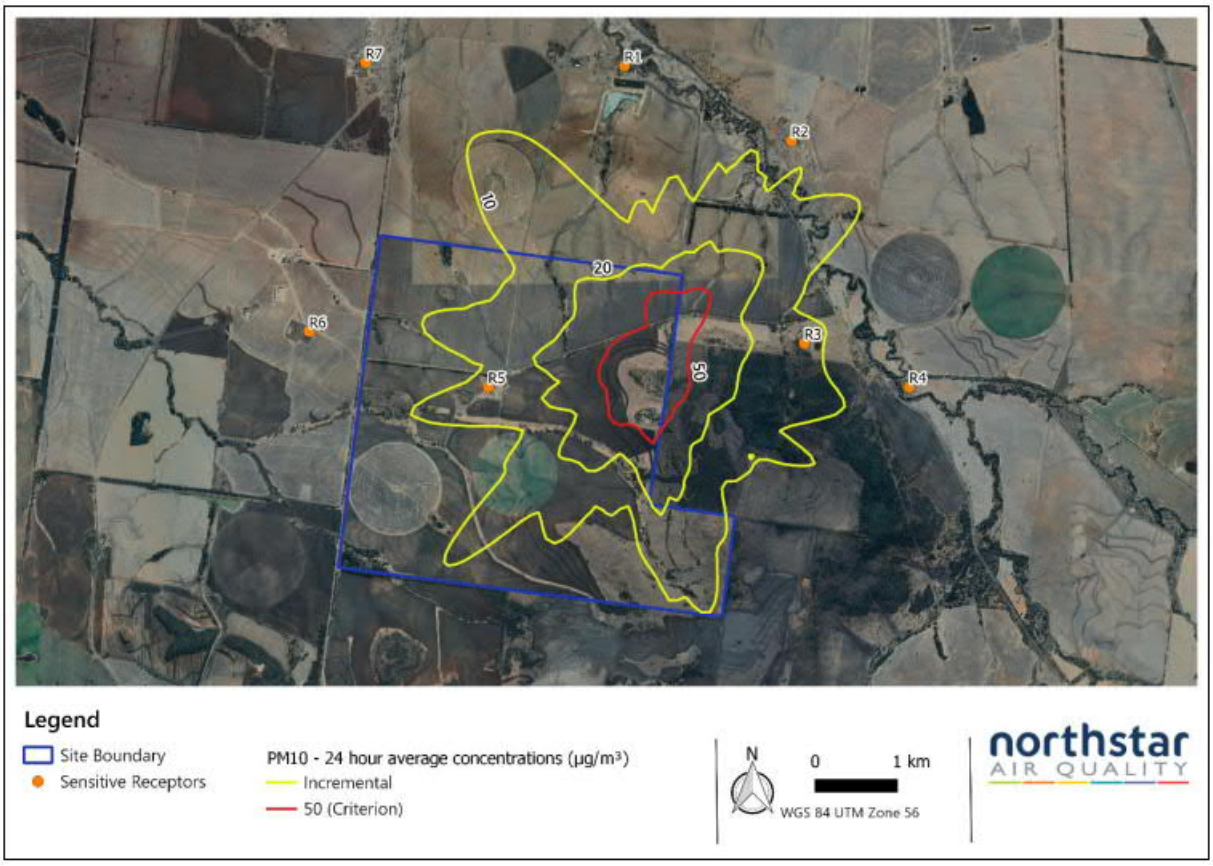
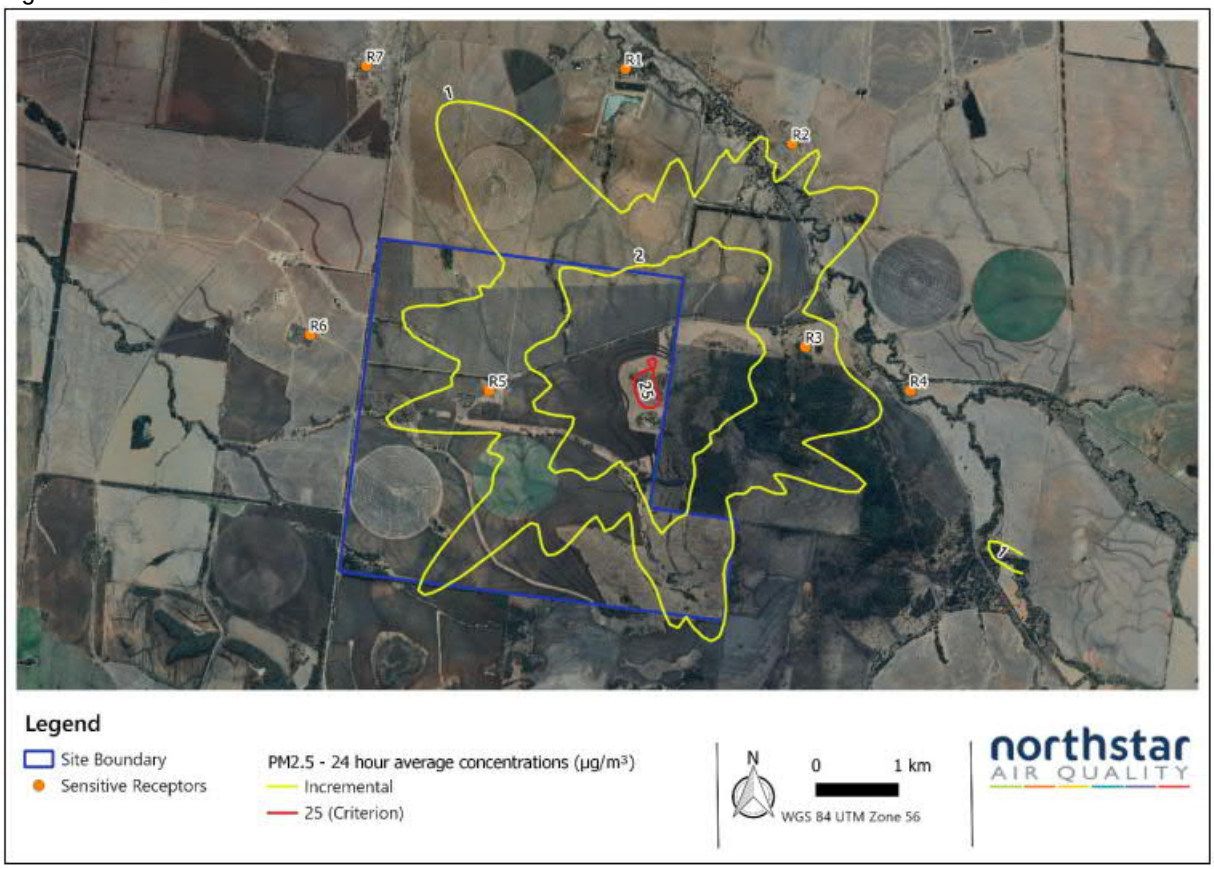


Figure 22 – Incremental 24-hour PM2.5 concentrations



5.3.8. Conclusion

Emissions of particulate matter associated with construction phase and operational phase activities have been estimated, including a number of emission control measures proposed to be adopted. To ensure that the assessment provides an appropriately conservative approximation of the potential impacts at surrounding receptor locations, certain control measures which are proposed to be adopted have not been included in the assessment, specifically the watering of exposed areas. In this way, the predicted incremental impacts can be viewed as worst-case.

The AQIA presents an assessment of the impacts of activities associated with the maximum operational activity of the Quarry at 490 000 tyr to service the Inland Rail Project, which is anticipated to occur on a single year within the first five years. After the peak year, the extraction rate is anticipated to reduce to 150 000 tyr, and as such the assessment at the peak annual rate will address the risks of lower activity rates. An assessment of the potential air quality impacts along off-site transportation routes has also been provided. The AQIA has used a quantitative dispersion modelling approach, performed in accordance with the relevant NSW guidelines. The results of the assessment are presented as predicted incremental change, and as a cumulative impact accounting for the prevailing background air quality conditions.

The results of the AQIA indicate that at the peak extraction rate, the air quality criteria can be achieved. In periods when water may not be readily available, haul road watering may be restricted, and low silt aggregate may be used along internal haul roads, in conjunction with a lowering of vehicle speeds, to result in similar off-site impacts. As previously noted, the assessment of wind erosion has assumed that no control is applied, with the results indicating that control of this source of emissions is not critical to compliance with air quality criteria. It is stressed that watering of exposed areas will be performed when possible.

It is demonstrated that the quarry can be operated in such a manner as to ensure compliance with all adopted air quality criteria. Offsite haulage for the peak period will be carried out by contractors associated with the Inland Rail Project and subject to the management plans and conditions of approval of the Inland Rail Project and therefore will be appropriately regulated through those mechanisms.

A Trigger Action Response Plan (TARP) would be developed as part of the Environmental Management Plan which would link visible dust generation from all activities with wind conditions experienced at the Quarry site. A range of actions would be listed which would be adopted to reduce visible dust generation, until such time as the adopted trigger levels have reduced. It is noted that the adoption of a TARP is not critical to ensure compliance with the adopted air quality criteria, and its use should result in impacts being less than those predicted within this AQIA.

It is demonstrated that the Quarry can be operated in such a manner as to ensure compliance with all adopted air quality criteria, and the development should not be refused on the grounds of air quality.

5.4. Noise and Vibration

5.4.1. Introduction

A Noise and Vibration Impact Assessment (NIA) was prepared for the proposal by Muller Acoustic Consulting Pty Ltd (MAC) and is presented as Appendix 10. The NIA was prepared by Dale Redwood of MAC. The following sections summarise the assessment conducted by the NIA.

The SEARs for the proposal require an assessment of potential air quality impacts associated with the proposal the following:

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;

In addition, assessment requirements relating to air quality were received from Council, the EPA and the Department of Planning, Industry & Environment.

The NIA was completed to quantify potential acoustic impacts associated with the construction and operation of the proposal on the surrounding community. The NIA has been prepared in accordance with the following policies and guidelines:

- Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment and Climate Change (DECC), Interim Construction Noise Guideline (ICNG), 2009;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011;
- Australian Standard AS2187.2-2006 (AS2187.2) – Explosives-Storage and Use Part 2: Use of Explosives; and
- Australian and New Zealand Environment Conservation Council (ANZECC), 1990, Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.

5.4.2. The Existing Environment

Receivers in the locality are categorised as rural residential. The nearest potentially affected residential receivers to the proposal are summarised in Table 1 and Figure 10 and shown in Table 2 and Figure 2 of the NIA.

5.4.3. Criteria for Assessment

Construction Noise Management Levels
Noise management levels (NMLs) for construction activities for all residential receivers are 45dB LAeq(15min) (RL +10dB). Construction activities are planned for standard hours.

Operational Criteria
The project intrusiveness noise levels for the proposal are 35dBLAeq(15min) for the morning shoulder and 40dB LAeq(15min for the day.

The project amenity noise levels for the proposal are 43dBLAeq(15min) for the morning shoulder and 53dB LAeq(15min for the day.

The project noise trigger levels are the lower of the above and are therefore, 35dBLAeq(15min) for the morning shoulder and 40dB LAeq(15min for the day.

The maximum noise trigger levels (applicable to transient noise events that have the potential to cause sleep disturbance are 40 dB LAeq(15min) and 52 dB LAmax.

Road Traffic Noise Criteria
In accordance with the RNP, this assessment has adopted the 'Freeway/arterial/sub-arterial road' category for the designated inbound and outbound transport routes, consistent with the classification of the haulage route as a 'principal haulage route'.

Therefore, the road traffic noise assessment criteria is 60dB LAeq(15hr) for the day (7am to 10pm) and 55dB LAeq(9hr) for the night (10am to 7am).

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

Relative Increase Criteria
In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered. A criteria of +12dB (external) to existing traffic LAeq(15hr and 9hr) is applicable respectively for the day and night period.

ANZEC Guideline Blasting Limits

The ANZEC blasting limits for air-blast ovepressure and ground vibration are presented in Table 13 of the NIA and in summary are:

- Overpressure – 120db max and 115db for 95% of all blasts; and
- Ground vibration – 10mm/s max and 5mm/s for 95% of all blasts.

5.4.4. Assessment Methodology

A computer model was developed to quantify Project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2019.1) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

Construction Noise Modelling Parameters

Quarry development will occur with the initial construction phase consisting of haul road improvements, establishment of erosion and sediment controls, operational area cleared and grubbed, plant and equipment and infrastructure established on site. To establish the operational area of the quarry, drill and blast activity will be required on the surface to enable to establishment of the first bench. Once the first bench is established, the quarry is considered to be in operation phase.

Construction activities are typically considered to be progressive and will occur at several different locations simultaneously. Noise emissions were modelled for the following three scenarios:

- Scenario 1 – Haul road upgrade works;
- Scenario 2 – Clearing and grubbing of operational area; and
- Scenario 3 – Bulk earthworks including construction of surface water management measures and processing and stockpile area.
- Scenario 4 – Delivery and establishment of ancillary components.

Noise emission data and assumptions used in this assessment are summarised in Table 14 of the NIA. The duration of the construction period mobilisation will be three to six weeks and will be undertaken during recommended standard construction periods. It is noted that the construction phase noise model assumed all plant operating at peak capacity for 100 per cent of the assessment period. It is therefore considered that the predicted noise levels represent worst-case operating conditions.

Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the fixed plant and surrounding area, as derived from the proposal plans superimposed onto the surrounding land base topography. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions, which increase noise levels by focusing soundwave propagation paths at a single point. Meteorological conditions that can enhance received noise levels include source to receiver winds and the presence of temperature inversions.

The NPI prescribes two options for the consideration of meteorological effects:

- Adopt the default noise-enhancing meteorological conditions for all assessment periods for noise impact assessment without an assessment of how often these conditions occur; or
- Determine the significance of noise-enhancing conditions through assessing the occurrence of prevailing winds and temperature inversions.

The significance of noise-enhancing meteorological conditions is based on a threshold of occurrence of 30% for source to receiver wind component speeds up to 3m/s during any seasonal period or F and G class stability categories for night periods over the winter months.

In accordance with the NPI, data collected from weather monitoring stations are typically considered relevant for assessing meteorological conditions for a radius of 30km from the station, provided the surrounding area is in the same topographical basin as the station. A review of Bureau of Meteorology (BOM) stations identifies that the nearest weather monitoring station to the quarry site is the Goondiwindi Airport station (ID: 041560) approximately 52km to the north. Hence, default noise-enhancing meteorological conditions have been applied as per Table D1 of the NPI.

Operational Noise Modelling Scenarios

For the purpose of the noise modelling, the extraction operations of the quarry would be undertaken over two stages. Stage 1 operations would involve the extraction of up to 490,000tpa over 5 years to supply hard rock material to the Inland Rail Project and associated road upgrade projects. Stage 2 operations, to begin following the completion of the Inland Rail Project, would involve the extraction of up to 150,000tpa over 10 years to service local markets.

The scenario is summarised below:

- Stripping of soil by bulldozer or excavator to expose the basalt resource. Soil would be either stockpiled within the Processing and Stockpile Area for future use in rehabilitation activities or directly transferred to an area to be revegetated;
- The in-situ rock would be fragmented using conventional drill and blast techniques;
- Extracted quarry material would be loaded into off-road haul by front-end loader or excavator and transported to the Processing and Stockpile Area;
- A mobile crushing unit (MCU), fed by front-end loader, will crush and screen the extracted material to produce a range of quarry products;
- After crushing, the quarry products would be distributed to stockpiles within the Processing and Stockpile Area; and
- Road trucks would transport the material offsite via the private haul road.

Mobile plant noise emission data used in modelling for this assessment were obtained from the MAC database. The noise emission levels used in modelling are summarised in Table 16 of the NIA. It is noted that the noise predictions assumed all plant operating at peak capacity for the entirety of the assessment period. Noise sources were modelled at the most exposed locations for each operational scenario. It is therefore considered that the noise predictions represent the worst-case operational scenarios.

Road Noise Assessment Methodology

The proposal would supply quarry materials to the Inland Rail Project and associated road projects. It is anticipated that access to the Inland Rail construction corridor would be available via Minilya Road to Croppa Creek Road, with trucks using the rail corridor to access any Inland Rail construction or stockpile sites. A mix of vehicle types would be used for product haulage, typically truck and dog trailer combinations and B-doubles and Type A-double road trains where approved routes are available.

It is anticipated that haulage would occur on a campaign basis to meet fluctuating demands of the infrastructure projects. The peak daily haulage to address short term demands for construction material for the Inland Rail Project or other time-critical works is assumed to be up to 132 laden truck loads per day (264 movements) during Stage 1 operations. During Stage 2 operations traffic generation assumed for average week daily traffic would be up to 14 laden truck loads per day (28 movements).

A review of the proposed haulage routes identified that the minimum setback of receptors from the centreline of the adjacent road are approximately 12m for residences adjacent to Edward Street in the township of North Star, and approximately 35m for residences adjacent to Buckie Road in the township of Croppa Creek. The assessment assumed up to 75% of project-related vehicles would travel in either direction to North Star or Croppa Creek per day.

The United States (US) Environment Protection Agency's road traffic calculation method was used to predict the LAeq noise levels from proposal related trucks travelling past existing receivers on Ostlers Lane. This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

Blasting and Vibration Assessment Methodology
Calculation of overpressure was completed using the relevant AS2187.2 equation. Estimations for vibration were completed using the relevant AS2187.2 equation.

5.4.5. Proposed Management and Monitoring Measures

Construction activities will generally be completed within the standard hours for construction activities from Monday to Friday, with works on Saturday only as required. There are no out-of-hours construction work proposed. The proposed hours of operation are:

- Extraction and processing, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Truck loading and dispatch, 6am to 6pm Monday to Friday and 7am to 1pm Saturdays;
- Blasting, 9am to 3pm Monday to Friday;
- No operations on Sundays or Public Holidays.

No specific noise and vibration monitoring is recommended over and above that which would be ordinarily imposed as a condition of approval of the EPL by the EPA.

5.4.6. Assessment of Impacts

Construction Phase Noise Results
The results of the analysis show that noise emissions from each of the construction scenarios are predicted to satisfy the relevant noise management levels at all receiver locations.

Operational Scenarios
The results of the model show that noise emissions from operations during Stage 1 satisfy relevant criteria during the early morning shoulder and day periods at all receiver locations as shown in Figure 23 and 24 below. The results of the model show that noise emissions from operations during Stage 2 satisfy relevant criteria during the early morning shoulder and day periods at all receiver locations.

Maximum Noise Level Assessment
In assessing sleep disturbance, a typical LAmax noise source of 117dB was used to represent transient events such as loading trucks with aggregate, to the nearest residential receivers. Results identify that maximum level screening criterion will be satisfied for all residential receivers. It is noted that predictions are below the EPA screening criteria, hence no further assessment or detailed analysis is required.

Road Traffic Noise Results
The results of the road traffic noise calculations indicated that for the closest residential receiver to the proposed haul route, on Edward Street, North Star and Buckie Road, Croppa Creek, the road traffic noise contribution from the proposal is predicted to remain below the relevant day and night assessment criteria.

Blasting Assessment Results
There are no items of significant infrastructure in the locality of the quarry. The closest sealed public road is North Star Road approximately 2.4km to the east of the quarry. Vibration levels at North Star Road are calculated to be below 5mm/s. Hence there are no significant vibration effects from blasting on public infrastructure. Results of modelling identify that blasting would satisfy the relevant criteria.

Effects of blasting on Animals and Livestock
Blast effects resulting from the quarry are predicted to be, at worst for overpressure up to 112dBZ, and for vibration up to 0.69mm/s at the nearby residential receiver locations. The calculated blast over pressure and vibration levels are well below the regulatory criteria and considerably lower than other sources of overpressure that horses or livestock are likely to be already subjected to such as lightning strikes which are typically between 120dBZ and 130dBZ.

Figure 23 – Noise modelling results, LAeq(15min) – Stage 1 (Day)

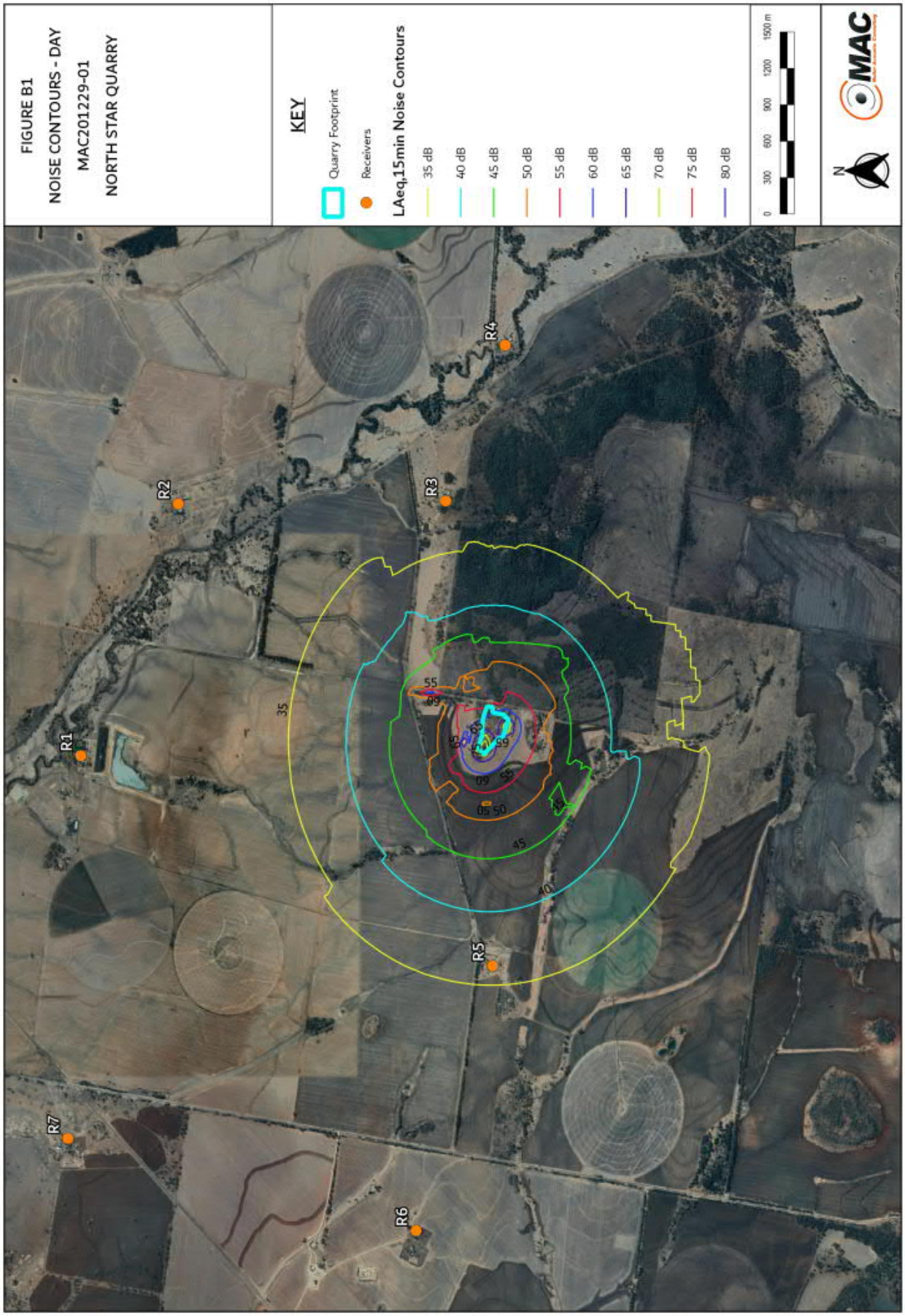
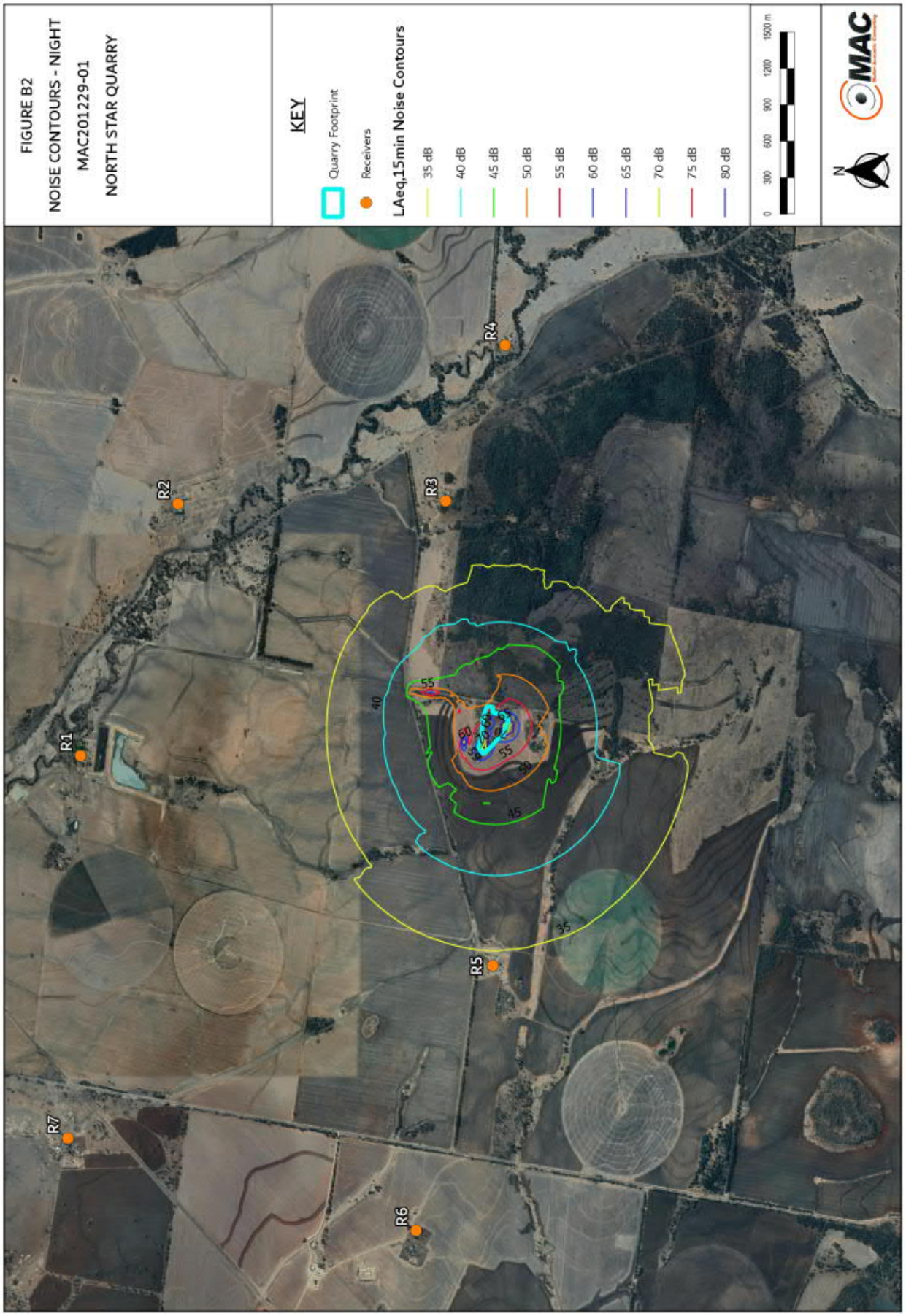


Figure 24 – Noise modelling results, LAeq(15min) – Stage 1 (Morning Shoulder)



5.4.7. Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a NVIA of potential impacts from the proposed North Star Quarry near North Star, NSW. The assessment has quantified potential construction and operational noise emissions pertaining to extraction, processing, drilling and dispatch via road trucks, as well as blasting noise and vibration emissions.

The results of the NVIA demonstrate that construction and operational noise levels would achieve the relevant ICNG and NPI criteria for all assessment periods at each assessed receiver location during noise enhancing meteorological conditions.

An assessment of maximum noise levels demonstrated that noise emissions from the proposal are predicted to remain below the EPA trigger levels for sleep disturbance at all receiver locations.

The NVIA demonstrates that quarry related road traffic noise levels will meet the objectives of the RNP for the nearest residential receivers on Edward Street, North Star Road and Buckie Road, Croppa Creek.

Airblast overpressure and vibration levels are also predicted to meet the criteria at all assessed receivers for blasts up to 300kg MIC.

Based on the NVIA results, there are no noise or blasting related issues which would prevent the approval of the quarry. The results of the assessment show compliance with the relevant operational and road noise criteria. Additionally, the results of the assessment demonstrate compliance with the relative EPA and DECCW policies, without ameliorative measures being required.

5.5. Water

5.5.1. Introduction

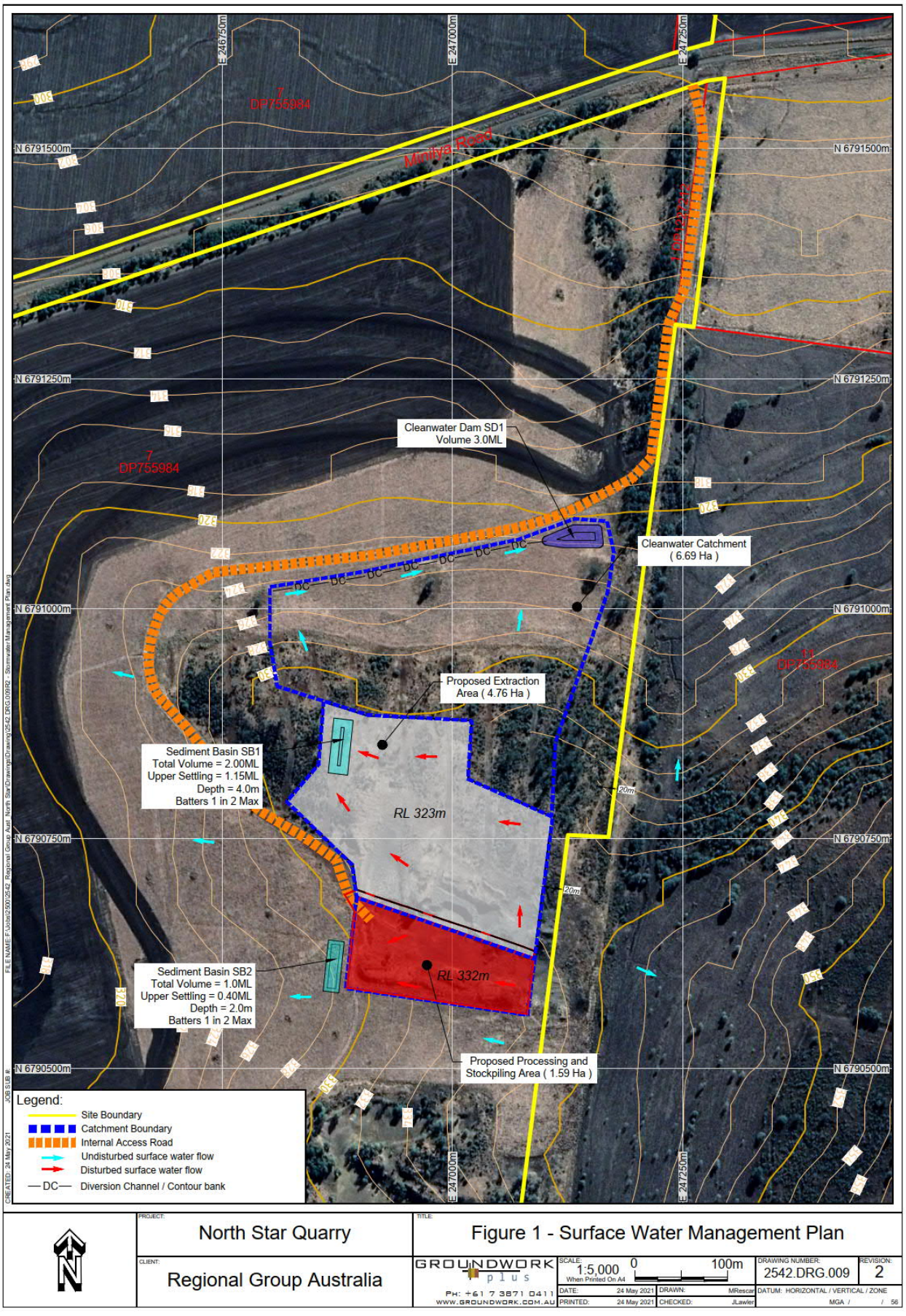
A Surface Water Assessment (SWA) was prepared for the proposal by Mark Folker of Groundwork Plus Pty Ltd and is presented as Appendix 11. The proposed surface water management plan is shown on Figure 25 below which is Figure 1 of the SWA. A Groundwater Impact Assessment (GIA) was prepared for the proposal by the Ground Doctor Pty Ltd and is presented as Appendix 13.

The following sections summarise the assessment conducted by the SWA and GIA. The SEARs for the proposal require an assessment of the following:

- 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;

In addition, assessment requirements relating to air quality were received from Council, the EPA and the Department of Planning, Industry & Environment.

Figure 25 – Stormwater Management Plan (Figure 1 of the SWA)



5.5.2. Existing Environment

The site is situated within an agricultural property (Minilya) that is mostly open space that has been cleared and used for broadacre cropping and livestock grazing. The site use is predominantly dryland cropping. Two centre pivot irrigators are located in the central and south west portions of the site. The irrigation systems rely on groundwater from on site groundwater bores.

Rock has previously been extracted from the southern side of the proposed extraction area and from an outcrop located approximately 160m south of the proposed extraction area. These parts of the site include former excavations and stockpiles of overburden or extracted material.

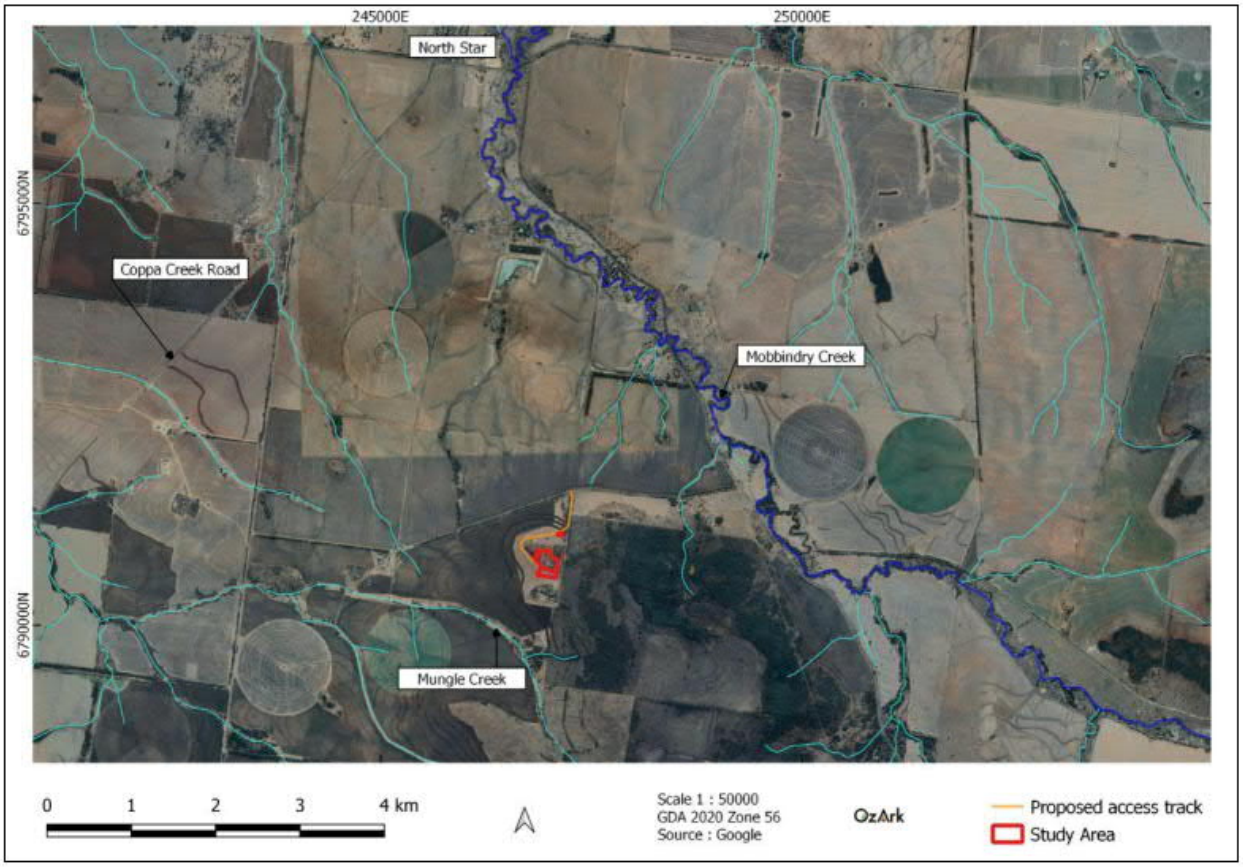
The site is not located in a flood prone area identified by Council. The site is not affected by the "Flood Planning" layer under the under the NSW Planning Portal. The likelihood of a flood inundating the site is low.

Surface Water

The site has a regional gradient from south east to north west. The south east corner is the highest part of the site reaching an elevation of approximately 380m AHD. The north west corner and mid-western boundary are the lowest parts of the site with elevations of less than 290m AHD.

Mungle Creek rises in the south east corner of the site and flows in a west north west direction, leaving the site approximately mid-way along the western boundary as shown in Figure 26 below. Two unnamed drainage lines run from the centre of the site toward the north west and west north west.

Figure 26 – Watercourses in relation to the proposal



From the highest points of the proposed extraction area surrounding land slopes to the north on the northern side, to the south west and west on the western side with an average gradient of approximately 5-10%. The average gradient decreases with distance away from the ridgeline.

Rainfall data was sourced from the Bureau of Meteorology (BoM) for North Star station (53095) for the water balance, which is 13km from the site. To inform the calculations of the water balance daily rainfall records were downloaded and used for the for a higher degree of accuracy.

The above average rainfall year selected was 1998 as it has 100% data available for the year and received an annual rainfall depth of 774mm which is above average (627mm).

A second water balance scenario was selected against using the 2003 rainfall data, as it was a drier year at around 567mm (below the average 627mm).

Site specific water quality information is not currently available therefore the default discharge criteria has been adopted which is an approach consistent with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000), that is pH of 6.5 to 8.5 and Total suspended soils of 50mg/L.

Ground Water

The site is located within the Great Artesian Basin "Eastern Recharge Zone" groundwater management unit. Geological units not within the GAB are within the Murray Darling Basin Fractured Rock "New England Fold Belt" groundwater management unit.

The GIA included a search of registered groundwater works relative to the site and proposed extraction and stockpiling area. The search identified two registered groundwater works within a 2km search radius. The GIA identified an additional 6 nearby groundwater works which included 4 groundwater works located within the site.

The identified works were installed into geological units of the GAB Eastern Recharge Zone. Groundwater work summary forms indicated that bore depths ranged from 187m to 375m below surface level. Recorded standing water levels ranged 30m to 113m below ground level. Estimates of relative groundwater elevations ranged from 239m AHD to 270m AHD, more than 50m below the maximum proposed depth of excavation of the proposed development of 323m AHD.

The GIA included three additional boreholes drilled at the site to assess depth to groundwater within the proposed extraction area. Boreholes were drilled on 28 and 29 January 2021 using air rotary methods with a down hole hammer (90mm bit). Based on digital elevation model surface contours boreholes reached depths ranging 308m AHD to 316m AHD which were at least 7m below the proposed maximum depth of excavation of the proposed development of 323m AHD. All holes were recorded as 'dry'.

Groundwater dependent ecosystems (GDEs) are defined as ecosystems which have their species composition and their natural ecological processes determined by groundwater. The biodiversity field work conducted by OzArk did not identify any GDEs in the study area.

5.5.3. Proposed Management and Monitoring Measures

The following management and mitigation measures to mitigate the potential for adverse groundwater-related impacts.

- Refuel all equipment within designated, sealed areas of the site where practicable.
- Ensure that all hydrocarbons and any other chemicals stored on site are stored within a bunded and covered storage area or in self bunded tanks.

The stormwater management plan included within the SWA, includes but is not limited to the following management and mitigation measures for potential adverse surface water impacts.

Erosion and Sediment Control

Strategies/mitigation measures for the management of surface water runoff and erosion and sediment transport from the site will be implemented in accordance the relevant approval conditions. Erosion and Sediment Control (ESC) measures for the site have been provided below for each main consideration when discussing ESC / Stormwater Management.

Site Management

Land-disturbing activities must be undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to:

- Allow stormwater to pass through the Site in a controlled manner and at non-erosive flow velocities up to the specified design storm discharge.
- Minimise soil erosion resulting from rain, water flow and/or wind.
- Minimise adverse effects of sediment runoff, including safety issues.
- Prevent, or at least minimise, environmental harm resulting from work-related soil erosion and sediment runoff.
- Ensure that the use of land/properties adjacent to the development (including roads) are not diminished as a result of the adopted ESC measures.\

Land Clearing

- Land clearing must be delayed as long as practicable and must be undertaken in conjunction with development of each stage of the quarry.
- Bulk tree clearing must occur in a manner that minimises disturbance to existing ground cover (organic or inorganic).
- Disturbance to natural watercourses (including bed and banks) and their associated riparian zones must be limited to the minimum practicable extent and be accompanied by the relevant approval.
- No land clearing shall be undertaken unless preceded by the installation of adequate drainage and sediment control measures, unless such clearing is required for the purpose of installing such measures, in which case, only the minimum clearing required to install such measures shall occur.
- Prior to land clearing, areas of protected vegetation, and significant areas of retained vegetation must be clearly identified (e.g. with high-visibility tape, or light fencing) for the purposes of minimising the risk of unnecessary land clearing.
- All reasonable and practicable measures must be taken to minimise the removal of, or disturbance to, those trees, shrubs and ground covers (organic or inorganic) that are intended to be retained.
- All land clearing must be undertaken in accordance with the Federal, State and Local Government Vegetation Protection/Preservation requirements and/or policies.
- Land clearing is limited to the minimum practicable extent during those periods when soil erosion due to wind, rain or surface water is possible.

Clean Water Diversion Drain

- Clean water diversion drains are to have greater than 90% vegetation coverage in those areas where rock armouring has not been designated. This coverage is required to be in-place prior to the designated wet season.
- Should the drain not naturally regenerate before the wet season, gully and sheet erosion may occur. Additional measures to promote vegetation growth will be required (as per IECA 2008).
- Seeding of the exposed areas using native grass species. The grass species will be required to have the following characteristics (as per IECA 2008).
  - Plants with a fibrous root system.
  - Plants that primarily grow horizontal rather than upright clumping plants.
  - Leguminous plants.
  - Non-invasive plants.
  - Avoid clumping or tussock forming grasses.
- Heavy rain during establishment period will likely cause erosion and sediment loss off-site. Additional measures may be required such as introduction of additional ground coverage over the area to reduce impact from water movement.

Site Access

- Site exit points must be appropriately managed to minimise the risk of sediment being tracked onto sealed, public roadways.
- Stormwater runoff from access roads and stabilised entry/exit points must drain to an appropriate sediment control device.

Topsoil Management

- All reasonable and practicable measures must be taken to obtain the maximum benefit from existing topsoil.
- The top 100 mm of in-situ soils is to be stripped and stockpiled separately to subsoil materials for use in rehabilitation.

Stockpile Management

Stockpiles of erodible material that has the potential to cause environmental harm if displaced, must be:

- Adequately protected from wind, rain, concentrated surface flow and excessive upslope stormwater surface flows.
- Located at least 5 m from any hazardous area, retained vegetation or concentrated drainage line.
- Located up-slope of an appropriate sediment control system.
- A suitable flow diversion system must be established immediately up-slope of a stockpile.

Drainage Control

- Wherever reasonable and practicable, stormwater runoff entering the Site from external areas, and non-sediment laden (clean) stormwater runoff entering a work area or area of soil disturbance, must be diverted around or through that area in a manner that minimises soil erosion and the contamination of that water for all discharges up to the specified design storm discharge.
- All reasonable and practicable measures must be implemented to control flow velocities in such a manner than prevents soil erosion along drainage paths and at the entrance and exit
- Wherever reasonable and practicable, "clean" surface waters must be diverted away from sediment control devices and any untreated, sediment-laden waters.
- The internal drainage channel shall be constructed with silt traps. Such silt traps shall be cleared at regular intervals.
- Quarry and working benches shall be drained to the central drainage channel via channelling which shall have rubble placed in them to minimise the speed of water flow.

Sediment Control

- Efforts shall be employed to trap sediment within the Site, and as close as practicable to its source.
- Sediment traps must be installed and operated to both collect and retain sediment.
- The potential safety risk of proposed sediment control devices to Site workers, visitors and the public must be given appropriate consideration, especially those devices located within commonly accessible areas.
- All reasonable and practicable measures must be taken to prevent, or at least minimise, the release of sediment from the Site.
- Suitable all-weather maintenance access must be provided to all sediment control devices.
- Sediment control devices must be de-silted and made fully operational as soon as reasonable and practicable after a sediment-producing event, whether natural or artificial.
- Materials, whether liquid or solid, removed from sediment control devices during maintenance or decommissioning, must be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

Site Maintenance

- All erosion and sediment control measures, including drainage control measures, must be maintained in proper working order at all times during their operational lives.
- Washing/flushing of sealed roadways must only occur where sweeping has failed to remove sufficient sediment and there is a compelling need to remove the remaining sediment (e.g. for safety reasons). In such circumstances, all reasonable and practicable sediment control measures must be used to prevent, or at least minimise, the release of sediment into receiving waters. Only those measures that will not cause safety and property flooding issues shall be employed. Sediment removed from roadways must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm.
- Sediment removed from sediment traps and places of sediment deposition must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm.
- Maintenance mowing must be done in a manner that will not damage the profile of formed, soft edges, such as the crest of earth embankments.

5.5.4. Assessment of Impacts

Groundwater

As discussed above, data collected during the GIA indicates that groundwater will not be encountered by the proposal. As groundwater will not be encountered, groundwater dependant ecosystems are unlikely to be impacted. The proposal is not an aquifer interference activity. The proposal will not penetrate an aquifer, will not interfere with water in an aquifer, will not obstruct the flow of water and will not require dewatering of an aquifer. The proposal does not propose to use groundwater as part of the water supply. The proposal involves blasting, crushing and screening of rock therefore the proposal has little if any potential to add contaminants that could adversely impact groundwater quality.

Surface water

It is proposed to manage the disturbed quarry area by diverting all surface water to a sediment basin within each stage of quarry development as shown on Figure 25 – Stormwater Management Plan which is Figure 1 of the SWA. In order to meet the requirements of the EIS, the sediment basins are proposed to be designed, constructed and operated to retain the disturbed area runoff at the site in accordance with DECC (2008) *Managing Urban Stormwater - Soils and Construction (Volume 2E).* As outlined in DECC (2008), the total upper settling storage requirements for sediment basins are calculated based on the following formula:

$Vs = 10 * R_{Y\%, 5\text{-}day} * Cv * A$, where:
A = Catchment Area (m^2)
C_v = Coefficient of Discharge
$R_{Y\%, 5\text{-}day}$ = 5 day rainfall depth (m) not exceeded for Y percent of rainfall events

In addition to the upper settling volume, a sediment storage zone is required to be accommodated based on a 2 month soil volume loss using the Revised Universal Soil Loss Equation (RUSLE):

$V_{SED} = [0.17 \times A (R . K . LS \times 1.3 \times 1.0)] / 1.3$
A = Disturbed Catchment Area (m^2)
R, LS and K = RUSLE factors as per DECC

The quarry proposes to harvest surface water for reuse in operations through construction of the sediment basins. The sediment basins are proposed to be used for the treatment of surface water and also for reuse into quarry operations.

Table 11 – Sediment Basin Storage Requirements details the upper settling, sediment storage and subsequent total sediment basin storage requirements for the site, for capture of a 38.2 mm rainfall event, deemed the 5-day 90th percentile as per DECC 2008. Detailed calculations are included in Attachment 1 – Sediment Basin Calculations of the SWA.

Table 11 – Sediment Basin Storage Requirements

Basin ID	Catchment area (ha)	Upper Settling Req'd Volume (ML)	Sediment Storage Req'd Volume (ML)	Total Required Volume (ML)	Proposed Volume (ML)
SB1	4.76	1.15	0.57	1.72	2.00
SB2	1.59	0.38	0.19	0.57	1.00

Based on the above, the total required sediment basin volumes are considered appropriate for erosion and sediment control management for the development. An additional clean water dam is proposed as a future option to the north of the extraction area, to maximise the site potential to capture and reuse available surface water. The clean water dam is to be constructed at the discretion of the quarry should additional surface water harvesting be sought or required for operations. The extraction area will ultimately capture all rainfall events due to the proposed quarry extents below the natural surface, with excess water being reused into operations and/or treated to suitable water quality standards prior to releasing back into the receiving environment.

It is noted that dams that are solely for the capture, containment and recirculation of drainage and/or effluent, consistent with best management practice or required by a Government agency or Local Government to prevent contamination of a water source, are exempt from both the requirement of holding a water supply work approval & from the requirements of the Harvestable Rights Order.

Water Balance Assessment

For the purpose of the water balance, the operations are anticipated to occur 5.5 days per week (Monday to Saturday morning, 50 weeks per year. The applicant intends to operate based on a daily water usage of 155kL which is proposed to be achieved through water saving strategies including implementation of a proprietary produce that can reduce water usage for the purposes of dust mitigation (Haulage DC by Polo Citrus Australia Pty Ltd). Based on the proposed strategy, the annual water usage (including losses) is therefore estimated to be 59.5 ML per year, with a supply of 67.7 ML and 49.5 ML for above and below average rainfall years respectively. Refer to Attachment 2 – Water Balance Assessment of the SWA for a comprehensive daily breakdown of the water balance assessment. A summary of the results are shown for each scenario in the tables below.

Table 12 – Water Balance Assessment Results (Above Average Rainfall)

Inputs	Overland Flow into Sediment Basins	41.8	Values are in ML/year
	Overland Flow into Clean water dam	25.9	
Total water inputs		67.7	
Outputs	Evaporation from Dams	2.9	
	Total water required for processing *(includes dust suppression and operations)*	56.6	
Total water outputs		59.5	
Estimated Water Surplus		8.2	

Table 13 – Water Balance Assessment Results (Below Average Rainfall)

Inputs	Overland Flow into Sediment Basins	30.6	Values are in ML/year
	Overland Flow into Clean water dam	18.9	
Total water inputs		49.5	
Outputs	Evaporation from Dams	2.9	
	Total water required for processing *(includes dust suppression and operations)*	56.6	
Total water outputs		59.5	
Estimated Water Shortfall		10.0	

In the driest scenario, the water balance indicates water will need to be imported 63 days per year. In the above average rainfall scenario, the water balance indicates water will need to be imported 14 days per year. It is noted that these scenarios assume a total dam volume of 6ML, with additional surface water being able to be held in the quarry pit. To further reduce reliance on external supplies, additional surface water could be harvested by increasing the sediment basin and/or clean water dams, or a larger sump in the quarry pit to harvest additional surface water.

Based on the above it is expected that the quarry will be moderately self-sufficient in water supply, hence construction and operation of the development can be undertaken with any additional water requirements being reasonably obtained from an appropriately authorised and reliable licensed water supplier. The quarry will be responsible to ensure that any licensing requirements and other approvals required under the Water Act 1912 and/or Water Management Act 2000 are obtained.

During the days in the year where water could not be sourced from the quarry dam, the quarry would need to import up to 155m^3 (155,000L) of water for dust suppression (per day). In these events if the sediment basin is dry, water would be sourced from an appropriately authorised and licenced water supplier.

As demonstrated in Attachment 2 – Water Balance Assessment of the SWA, there are 10 days per annum expected where water will be discharged due to the sediment basin and/or clean water dam exceeding capacity in the above average rainfall scenario, and 0 days per annum expected in the below average rainfall scenario.

5.5.5. Conclusion

This assessment outlines the appropriate treatment measures and operational procedures to be adopted to integrate adequate stormwater management into daily operations and Site activity. Specifically, this document has prepared to ensure that appropriate measures have been developed to meet the requirements of the EIS for the development. Operational procedures outlined will assist to ensure compliance as a minimum standard.

5.6. Cultural Heritage

5.6.1. Introduction

An Aboriginal Archaeological & Historic Heritage Impact Assessment has been undertaken by OzArk and is presented as Appendix 12. The SEARs for the proposal require an assessment of potential impacts associated with aboriginal cultural heritage and historic heritage matters including the following:

- 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 of the EARs.

In addition, assessment requirements relating to traffic were received from Department Planning, Industry & Environment, BCD Division.

5.6.2. Aboriginal Cultural Heritage

OzArk Environment & Heritage (OzArk) has been engaged by Groundworks Plus, on behalf of Regional Quarries Australia Pty Ltd (the proponent) to complete an Aboriginal Archaeological Impact Assessment (AAIA) and Historic Heritage Impact Assessment (HHIA) of 5535 North Star Road which has the potential to be impacted by the proposed hard rock quarry at North Star (the proposal). The proposal is in the Gwydir Shire Council Local Government Area. The fieldwork component of this assessment was undertaken by OzArk Archaeologist, Taylor Foster, on Monday 19 April 2021. A visual inspection was conducted by the Toomelah LALC on 17 May 2021. The entirety of the survey area was assessed by pedestrian transects.

No Aboriginal sites, sensitive landforms or potential archaeological deposits were recorded during the survey.

5.6.3. Historic Heritage

No items of historic heritage significance were recorded.

5.6.4. Management and Mitigation Measures

Recommendations concerning Aboriginal cultural values and historical values within the study area are as follows:

1) The proposed work may proceed at North Star Quarry without further archaeological investigation under the following conditions:
   a) All land and ground disturbance activities must be confined to within the archaeological survey area, as this will eliminate the risk of harm to Aboriginal objects in adjacent landforms. Should the parameters of the Proposal extend beyond the assessed areas, then further archaeological assessment may be required.
   b) All staff and contractors involved in the proposed work should be made aware of the legislative protection requirements for all Aboriginal sites and objects.
2) This assessment has concluded that there is a low likelihood that the proposed work will adversely harm Aboriginal cultural heritage sites. However, if Aboriginal objects are identified during the construction and operation of the proposal, all work should cease and the procedures in the Unanticipated Finds Protocol (Appendix 2 of the AAIA) should be followed.
3) In the event of skeletal remains being identified during the construction and operation of the proposal, the Unanticipated Skeletal Remains Protocol (Appendix 3 of the AAIA) should be followed.
4) Inductions for work crews should include a cultural heritage awareness procedure to ensure they recognise Aboriginal artefacts (see Appendix 4 of the AAIA) and are aware of the legislative protection of Aboriginal objects under the National Parks and Wildlife Act 1974 and the contents of the Unanticipated Finds Protocol.
5) In the unlikely event that historical relics or deposits are unearthed during the proposed works, the Historical Heritage Unanticipated Finds Protocol (Appendix 6 of the AAIA) should be followed.

5.6.5. Assessment of Impacts

Standard archaeological field survey and recording methods were employed in this study (Burke & Smith 2004). The pedestrian survey followed the Code of Practice. The historic archaeological survey was undertaken in tandem with the Aboriginal archaeological survey. The entirety of the survey area was assessed by pedestrian transects. This excludes the area of the existing quarry extraction, as these areas have already been heavily disturbed and modified. This also excludes the steeply sloping landform within the north-western portion of the study area as it was unable to reasonably be traversed. Panasonic GPS tablets were used during the pedestrian survey to capture spatial data. General notes pertaining to the survey and ground cover were kept by the archaeologist.

High levels of disturbance from quarrying are present in the central portion of the study area, and across all the study area, approximately 40% has been affected by previous ground disturbing activities associated with quarrying and agriculture. Rock piles and evidence of dumping are located to the immediate south, east, and west of the quarry. Within these areas, piles of basalt cobbles, some with facets, are present. However, the facets are not of Aboriginal origin, and appear to be cobbles broken during quarrying, and not exhibiting Aboriginal flaking characteristics. This conclusion was reached due to the high amount of landform modification in the vicinity of these piles and the lack of surface artefacts that would be expected to be present if this were the result of Aboriginal quarrying. Three main landforms are present outside areas of disturbance and these were divided into three survey units. These three units consist of elevated ridge landforms, slope landforms and flat, plain landforms.

No Aboriginal objects were recorded within the study area during the visual inspection and no landforms were identified as having potential to contain Aboriginal objects in subsurface archaeological deposits. The lack of recorded sites is thought to be correlative with the distance of the study area to sources of reliable water. No areas of outcropping stone showed any evidence of Aboriginal quarrying activates.

In addition, the large amount of disturbance due to previous quarrying and related ground disturbing works within the study area may have disturbed and/or dispersed sites had they once been present. Additional disturbances in the study area which were not able to be identified at a desktop level included some pre-existing dirt tracks throughout the study area, some ploughing in the far southwest, and minor rubbish dumping.

Furthermore, areas of low disturbance are located within steeply sloping landforms that have a lower archaeological potential due to their unsuitability as occupation sites.

As a result of their inspection of the study area, the Aboriginal community identified three trees with scarring along the north-western boundary of the study area, along the slope landform (see Figure 6-3 and Figure 6-4 o the AAIA). These scars are not believed to be the result of cultural marking, but rather natural trauma to the trees. However, it is still recommended that mature trees are not impacted where possible.

Social or cultural value refers to the spiritual, traditional, historical, or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them.

Places of social or cultural value have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods, or events. Communities can experience a sense of loss should a place of social or cultural value be damaged or destroyed.

There is not always consensus about a place's social or cultural value. Because people experience places and events differently, expressions of social or cultural value do vary and, in some instances, will be in direct conflict. When identifying values, it is not necessary to agree with or acknowledge the validity of each other's values, but it is necessary to document the range of values identified.

Social or cultural value can only be identified through consultation with Aboriginal people. This could involve a range of methodologies, such as cultural mapping, oral histories, archival documentation, and specific information provided by Aboriginal people specifically for the investigation.

The inspection of the study area by Mr Malcom Peckham, from the Toomelah LALC did not identify any other potential archaeological sites or specific cultural values within the study area. A letter received by OzArk from Mr Rex Weribone and

Mr Peckham on the 6 June 2021 read, “The survey went well and we didn’t find anything of cultural values within the new study area. We feel that this particular site holds no cultural materials of significance to the local tradition owner groups.”

No significant historic items were recorded within the study area and the potential for historic values to be present is considered very low.

5.6.6. Conclusion

The undertaking of the assessment concluded that proposal is unlikely to have an impact on heritage values. The inspection of the study area confirmed that no items of heritage significance exist or are likely to exist in the study area.

5.7. Land Resources

5.7.1. Introduction

The SEARs require the EIS to include an assessment of the potential impacts of the proposal on 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;

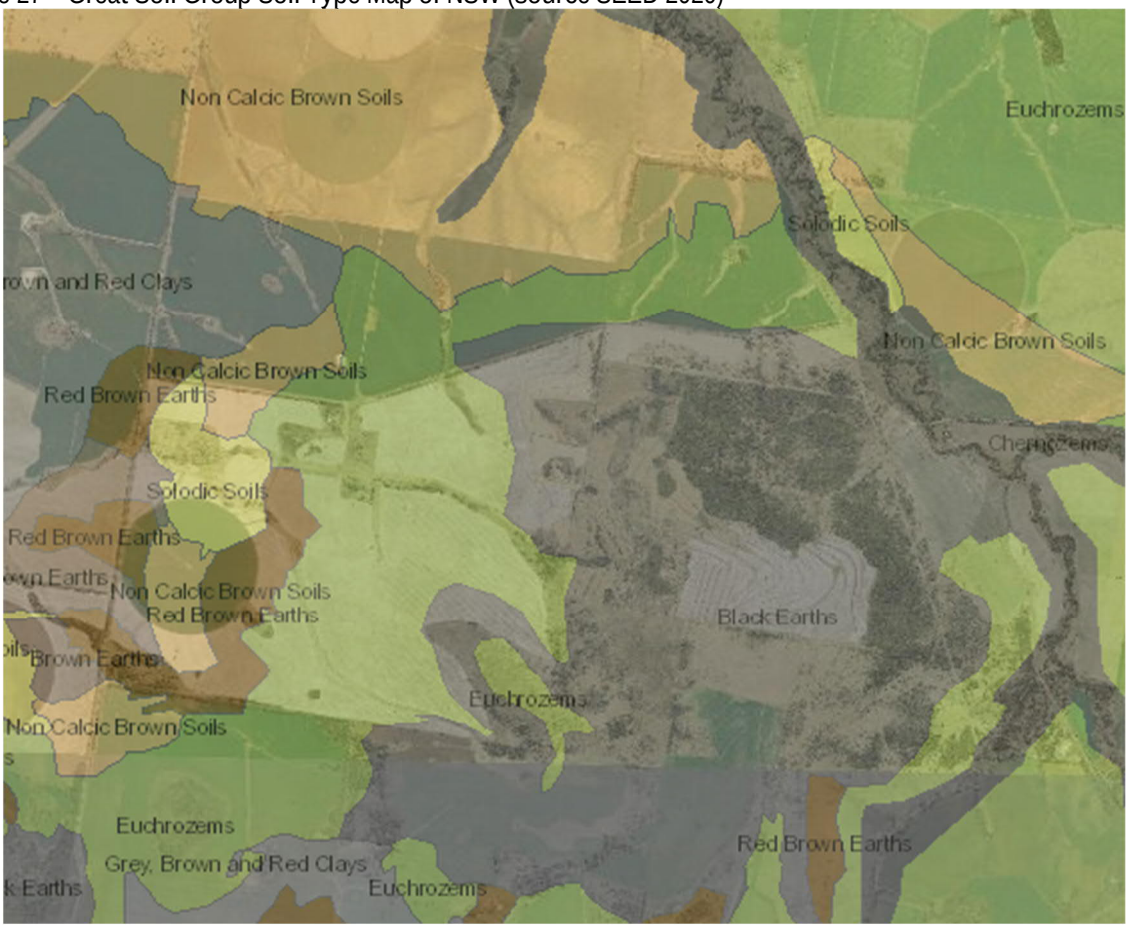
In addition, land resource-related requirements for inclusion in the EIS were provided by the Department of Primary Industries and Council.

5.7.2. Existing Environment

A review of available mapping, and information from site visits and resource investigations have been used to inform the description of the existing soils of the site. The NSW SEED Database has been referred to for assessing the likely soil conditions for the site. No soil landscape mapping is available from the SEED website however the classification of the proposal area under the Great Soil Group Soil Type Map of NSW is provided below in Figure 27. The proposal is contained within the Black Earths soil type area.

The Aboriginal Archaeological and Historic Heritage Impact Assessment by OzArk identified that, the site is located within the Yallaroi Basalts landscape unit soils which generally consist of shallow stony, red or brown, well-structured clays. Slopes and valley floors consist of similar, but thicker, soil. A small ridge is located along the southern-most portion of the study area and a moderate amount of basalt outcrop was present among black soil. Immediately north of the ridge, the area has been previously quarried and therefore soil and geological information cannot be determined. The northern portion of the study area, located within a ridge landform, has soils largely consisting of a black silty soil with occasional areas of brown silty loam and moderate amounts of basalt outcrop to the northwest within a slope landform.

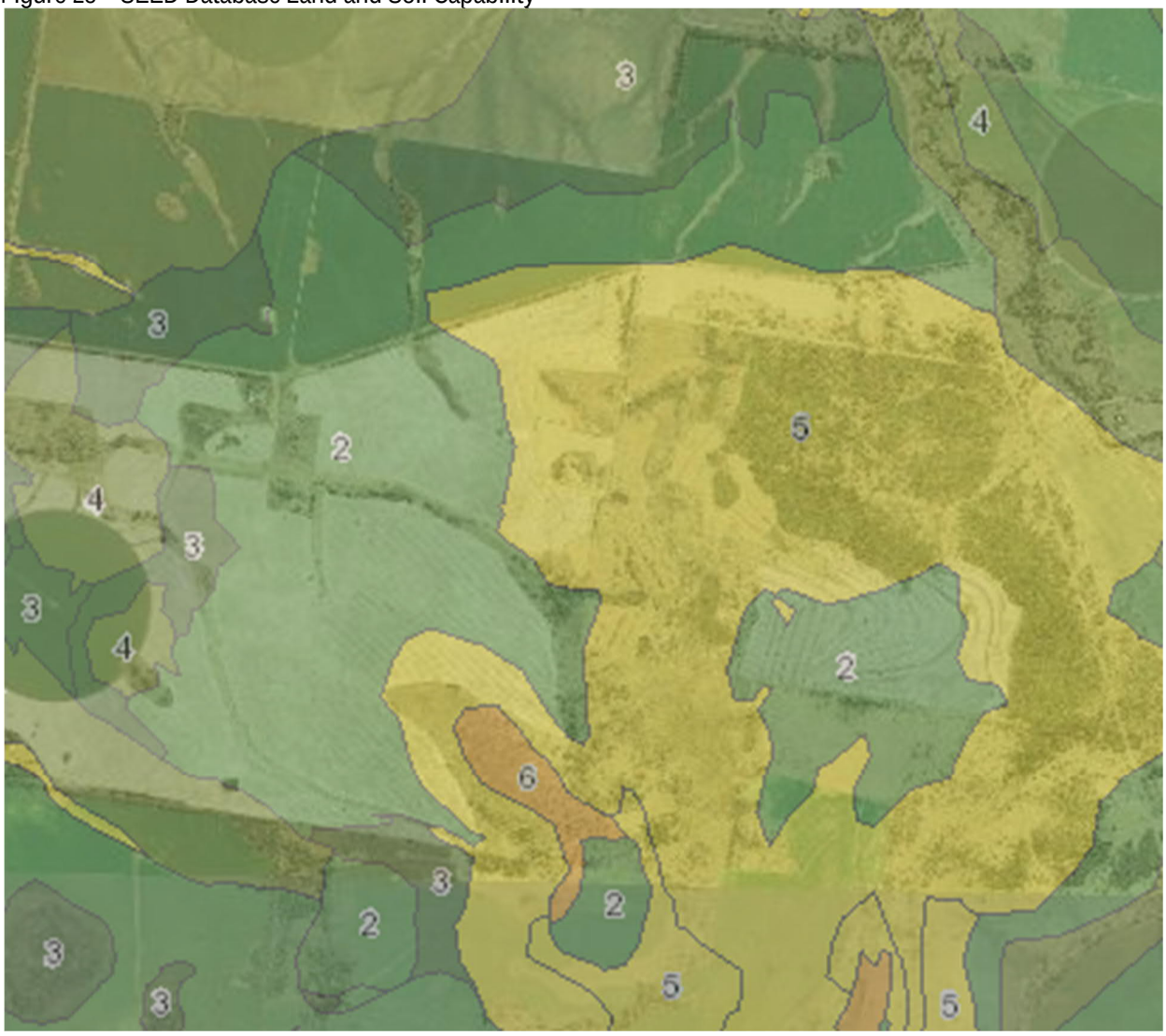
Figure 27 – Great Soil Group Soil Type Map of NSW (source SEED 2020)



In addition to the above soil type characteristics, other considerations with regard to soil resources have been assessed, and the following information is noted:

- The site is not mapped as containing Acid Sulfate Soils (ASS), and given its inland location and geological characteristics, these soil characteristics would not be present in this region.
- The proposal is not mapped as comprising Biophysical Strategic Agricultural Land (BSAL) which is normally characterised of areas of higher quality soil and water resources capable of sustaining productive levels of agriculture. BSAL is mapped within the wider allotment to the west of the proposal. The proposal will not impact on mapped BSAL.
- The soils within the proposal have been mapped on the SEED Database as Class 5 – Severe limitations. Class 5 land has severe limitations for high impact land management uses such as cropping. There are few management practices generally available to overcome these limitations. However, highly specialised land management practices can overcome some limitations for high value crops or products. This land is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment.

Figure 28 – SEED Database Land and Soil Capability



The surrounding land uses in the local setting of the site are dominated by similar agricultural land uses comprised by broadacre crop production. Sensitive receptors in the area are rural dwellings on the surrounding farms. The locations of the nearest sensitive receptors are identified in Section 4.3 of this EIS. The noise and dust impact assessment identified that the proposal would not detrimentally impact on the nearest sensitive receptors.

5.7.3. Management and mitigation Measures

Conservation of soil resources will be required during the operation of the site, and for those areas requiring disturbance, management of the soil resource and associated potential impacts will be required to be undertaken. Likewise, at the cessation of quarrying activities the site will be required to be rehabilitated to restore the cultivation capacity of the disturbance areas. The following management and mitigation measures would be implemented for the proposal.

Erosion and Sediment Controls
Implement the management plan included within the Surface Water Assessment.

Soil Management
Topsoil Stripping

- A nominal stripping depth of 100 mm has been allowed for the proposed quarry area.
- The operator shall remove topsoil from within the limits of disturbance to a depth of 100 mm unless determined otherwise through the site validation.

- All grass, root fibre, decayed vegetable matter and any other organic or deleterious material shall be removed and stockpiled for use in rehabilitation.

Prior to Stripping Commencing

- Topsoil stripping depths will be determined and marked on site for earthmoving plant operators to follow.
- Earthmoving plant operators are to be made aware of stripping depths and the topsoil stripping management plan.
- Prior to stripping activities, Aboriginal cultural heritage clearance approvals will need to be in place.
- Suitable stockpile areas (as required) will be nominated.
- Suitable areas for direct return of topsoil (if available) will be nominated.

Stripping

- The topsoil removed shall be applied directly on to a prepared rehabilitation area. If no rehabilitation areas exist topsoil shall be stockpiled at appropriate locations.
- Topsoil will be recovered using appropriate equipment. Depending on compaction and recovery rates, deep ripping may be required to maximise topsoil recovery with care taken not to mix topsoil with problematic subsoil.
- It is preferable for material to be stripped when it is in a lightly moist condition.
- Contractors bringing machinery onto the site will be required to present such machinery in a weed-free condition.
- Disturbance areas will be stripped progressively, as required, in order to reduce erosion and sediment generation, to reduce the extent of topsoil stockpiles and to utilise stripped topsoil as soon as possible for rehabilitation.
- Rehabilitation of disturbed areas, such as roads, embankments and batters, will be undertaken as soon as practicable after these structures are completed / no longer required or as areas are no longer required for quarrying purposes.

Stockpiling

- Topsoil shall be stockpiled in low mounds.
- The side slopes of stockpiles shall not be steeper than 1 vertical in 4 horizontals.
- Surface drainage of the stockpiles shall be managed to minimise loss of material through erosion. Stockpiles shall not be located so as to impede the drainage from upstream catchment areas.
- Stockpile locations will be subject to the following management actions.
- Grazing stock, machinery and vehicles will be excluded.
- Overland water flow onto or across stockpile site will be kept to a practical minimum.
- Where possible, stockpile sites will be selected to maximise protection from `the prevailing winds, particularly if the material is friable in nature (e.g. sand or silt).
- Drainage from higher areas will be diverted around stockpile areas to prevent erosion.
- As required, sediment controls will be installed downstream of stockpile areas to collect any run-off.
- Topsoil stockpile locations will be strategically located to assist the sequence of future rehabilitation.

Respreading of Topsoil

- Topsoil shall be respread evenly over the rehabilitated area and access tracks on completion of operations.
- Balance the topsoil requirement for rehabilitation areas against stored stockpile inventories and proposed stripping volumes.
- Maximise the opportunities for direct placement of topsoil from pre-strip to rehabilitation areas.
- During removal of soils from the stockpiles, take care to minimise structural degradation of the soils.
- Respread topsoil material in even layers at a thickness appropriate for the landform and land capability of the area to be rehabilitated.
- Contour rip to encourage rainfall infiltration and minimise run-off.
- Soon after respreading, plant cotton, to return the disturbance area to the pre-disturbance use (cotton cultivation).
- Construct contour banks in accordance with the applicable landform design criteria to limit slope lengths and control run-off.
- Construct collection drains and sedimentation dams to collect run-off and remove suspended sediment.
- Regularly inspect and maintain rehabilitation areas to facilitate sediment and erosion control and revegetation success.
- Regularly inspect rehabilitated areas for declared plants and environmental weeds, and control significant weed outbreaks using chemical or mechanical control methods.

Rehabilitation

Removal of Infrastructure

- Site buildings, plant and equipment will be removed at the cessation of the extraction activities.
- There are no site services that will require rehabilitation at closure as these services will be made available through alternative means (i.e. generator for power, rainwater or bore water for water use, satellite phones for communications etc.).
- Roadways and haul roads that are not required post quarrying land use will be decommissioned and rehabilitated. These areas will be reprofiled to match surrounding rehabilitation profile, ripped and seeded to encourage vegetation regrowth.
- All refuelling will be done via service truck to eliminate the need to store large quantities of fuel onsite. If necessary, any contaminated soils will be preferentially treated on-site in accordance with the recommendations of an Environmental Management Plan (EMP) or any recommendations from the site-specific contaminated land assessment.

Rehabilitation of Sediment Basins

- Any sediment basins will be retained as agricultural dams
- Alternatively, sediment basins may be filled to a level consistent with the surrounding landform.

Landform Shaping

- When the floor level for a working area has been excavated to its final extraction level and is no longer required for ongoing quarry activities, the floor will be graded to encourage water drainage in the appropriate direction.
- Once desired landform shape has been achieved the area will be top soiled and seeded to achieve ground cover and stable landform.

Soil Preparation

- Remove any weed species which may be present in the overburden and topsoil stockpiles prior to using in the rehabilitation works.
- Carry out soil tests to determine whether any soil ameliorants (e.g. nutrients, lime, gypsum) are required to improve the quality of the topsoil and overburden for supporting vegetative growth.
- Spread topsoil a minimum depth of 0.1 m. The topsoil should be moist but not wet when spread.
- Incorporate any required soil ameliorants during the spreading works.
- Topsoil is to be levelled to achieve an even but roughened surface.
- If the operational requirements permit, topsoil and overburden materials can be placed directly over quarry floor areas as an alternative to stockpiling these materials.

Revegetation

- Return the land to a condition capable of sustaining the ongoing rural land uses.

Environmental Management Plan

An Environmental Management Plan for the proposal would be prepared and include Erosion and Sediment Control Plan (prepared in accordance with DECC, 2008 *Managing Urban Stormwater Soils and Construction vol 2E*) and a Rehabilitation Management Plan and the management measures identified in the Surface Water Assessment.

5.7.4. Impact Assessment

Whilst the proposal will disturb the land, appropriate mitigation measures will manage the potential impacts. Erosion and sediment controls will minimise potential impacts to water and air quality, and rehabilitation of the site as a free draining landform suitable for the continuation of agricultural activities will also ensure that the land capability is restored.

The proposal will alter the topography and soil resource as a result of the disturbance activities. The activity will be limited to the area mapped as Land Capability Class 5, and not in areas of highly productive agricultural land. Rehabilitation of the proposal will be progressive as areas become available for restoration. All disturbed areas will be rehabilitated to a final condition suitable of supporting the ongoing rural use of the land such as cattle grazing.

The potential impacts for land use conflicts with sensitive receptors are typically caused by environmental nuisance in the form of dust, noise, odour and visual impacts. These aspects have been assessed by the EIS and it is considered that the

proposal will not detrimentally impact the amenity of nearby sensitive receptors. Furthermore, the proposal achieves the minimum buffer distances recommended by the Department Primary Industries of 1000m. The nearest sensitive receptor is over 1km away from the proposal. As such a suitable and safe buffer is provided between the proposal and the surrounding sensitive receptors.

The proposal is considered permissible within the current zoning and complies with all recommended separation distances. With the implementation of the proposed mitigation and management measures, the proposed development will not introduce any new impacts, to such an extent as to unacceptably reduce the amenity of surrounding sensitive land uses and rural residents. The proposal is therefore considered to be compatible with surrounding land uses.

5.8. Visual Amenity

5.8.1. Introduction

The SEARs require the EIS to include an assessment of the potential impacts of the proposal on visual amenity 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. Visual amenity matters were raised by Council and the Department of Primary Industries.

5.8.2. The Existing Visual Landscape

The nearest sensitive receptor that is not owned by the Doolin family is Sensitive Receptor No.4 owned by William and Dianne Thompson approximately 3km to the east of the site. Booraba Ridge separates the proposal from Sensitive Receptor No.4. The proposal is in a rural area. The sites vegetation is mostly cropping and with some sparse tracts of vegetation. The surrounding landscape is mildly undulating rising to the east (Booraba Ridge). The proposal has the potential to be visible from viewpoints to the West but not the East.

5.8.3. Management and Mitigation Measures

The proposal has been located where it will have the least visibility to nearest sensitive receptor not owned by the Doolin family to avoid potential impacts to the greatest practical extent possible.

5.8.4. Assessment of Impacts

The proposal will not be visible to the nearest sensitive receptor not owned by the Doolin family and thus will not have a significant adverse visual amenity impact.

5.9. Public Safety Hazards

5.9.1. Introduction

The SEARs require the EIS to include an assessment of the potential impacts of the proposal on:

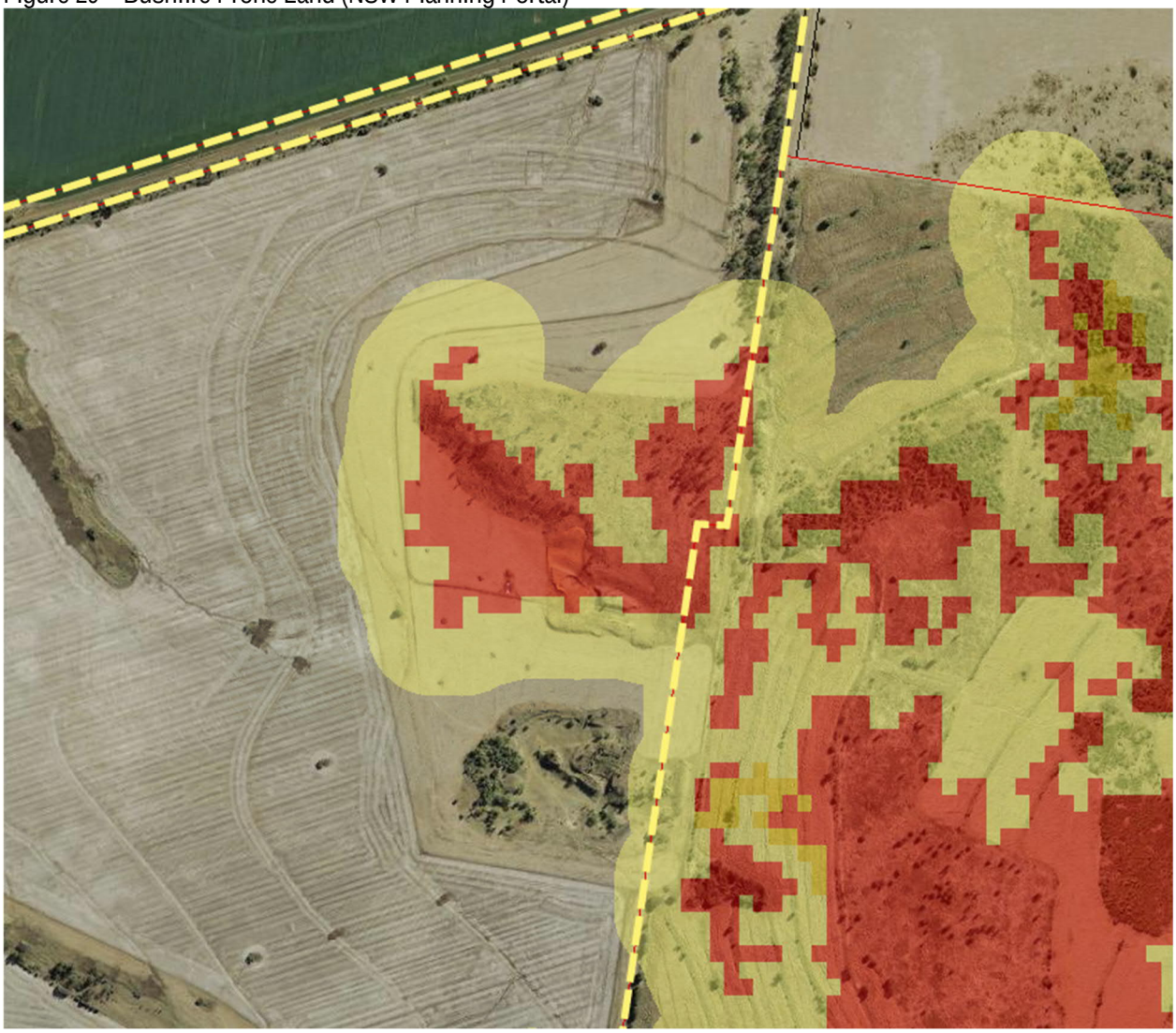
- *Waste – including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams; and*
- *Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks and the transport, storage, handling and use of any hazardous or dangerous goods.*

These matters were also raised in comments from Department of Primary Industries, Rural Fire Service (RFS), Council and the EPA.

5.9.2. Existing Environment – Bushfire

The site is mapped as comprising bushfire prone land as shown on Figure 29.

Figure 29 – Bushfire Prone Land (NSW Planning Portal)



5.9.3. Management and Mitigation Measures

The proposal would implement the following management and mitigation measures to minimise the potential for public safety, waste and hazard related impacts.

Bushfire Hazard
A bush fire management plan would be prepared in consultation with the local Rural Fire Service and include the following:

- A review of bush fire hazards and identification.
- A summary of controls and management measures including fire response equipment and locations.
- Emergency contact details.
- Training requirements.

Furthermore, the proposal would:

- Ensure that the site remains fenced and the entrance is locked when the site is not occupied.
- Store hydrocarbons and hazardous materials in bunded, impervious areas undercover in accordance with the relevant Australian Standard, including AS1940 – The Storage and Handling of Flammable and Combustible Liquids.
- Ensure that fuel loads in undisturbed sections of the site are managed to minimise the potential for bushfire.
- Ensure that all plant is fitted with appropriate fire suppression equipment.

- Ensure that a water cart is available during all extraction campaigns, thereby providing firefighting capabilities if required.
- In the event that the site is threatened by a bushfire, site personnel would be evacuated to the nearest safest place.

Unauthorised Access
The proposal would ensure that the site remains fenced and the entrance is locked when the site is not occupied. Appropriate signage alerting the public to the quarry would be placed at the entrance to the access to the proposal.

Waste
A waste management plan would be included in the Environmental Management Plan. The waste management plan section of the Environmental Management Plan would include the following:

- Appropriate waste receptacles must be provided for the segregation and storage for waste.
- All wastes will be segregated onsite and disposed of with specific licensed waste services providers.
- Waste storage areas would be more than 150m from mapped bushfire prone land.
- Bins and storage areas must be maintained so they are free of vermin (mice, rats, cockroaches, flies).
- Littering is not permitted. All worksites must be free of litter, including cigarette butts.
- No waste is to be burnt on site.
- Store hydrocarbons and hazardous materials in bunded, impervious areas undercover in accordance with the relevant Australian Standard, including AS1940 – The Storage and Handling of Flammable and Combustible Liquids.
- All waste streams are to be removed off site by a licensed waste contractor to a lawful point of disposal.
- The Environmental Management Plan would incorporate a waste management strategy.

5.9.4. Assessment of Impacts

The proposal will utilise standard operational measures that are typical to the industry and the specific hazard related impacts associated with extractive industries such as this proposal are well known and therefore require an assessment focused on:

- The handling, storage and disposal of hydrocarbons and wastes.
- Potential for bushfire.
- Potential for unauthorised access to the site.

Bushfire Hazard
Section 4.14 of the EP&A Act 1979 requires development located in bushfire prone land to conform to the specifications and requirements of the document entitled 'Planning for Bush Fire Protection' (FRS, 2006). The procedure detailed in that document has been adopted to identify the potential hazards for the proposal. The assessment has considered the description of the local vegetation provided in the BDAR for this EIS.

It should be noted that no permanent buildings will be constructed for the proposal and thus the objectives have been considered in relation to the areas which would be most likely to be populated during the day to day operations of the proposal. Therefore, the assets considered most at risk include employees and the local community. Once established, the operational area of the proposal would be more than 100m from areas of the adjacent property mapped as comprising bushfire prone land and will be devoid of vegetation and will have a safe evacuation route to the local road network. Furthermore, the proposal would not require construction of infrastructure that would require protection from bushfire attack.

With the implementation of the proposed safeguards and controls, it is considered that the bush fire hazard associated with the proposal would be acceptable and would not significantly increase the risk of bush fires impacting the community, property or environmental assets.

Unauthorised Access
In relation to public safety risks associated with unauthorised access to the site, the site is fenced, gates would be locked when not in use and appropriate signage alerting the public to the quarry would be placed at the entrance to the access to the proposal. In addition, the landowners residence is located within the site and there has been no history of unauthorised access to the site. As a result, public safety risks associated with unauthorised access to the site are considered negligible.

Waste

Overburden material is minimal and will not result in overburden 'waste' areas, rather it will be blended with quarry materials to produce other products for sale or retained for use in the rehabilitation of the site. General waste generated by the proposal is likely to be minimal and can be managed appropriately and assuming adherence to industry standard waste management measures via a licenced waste management contractor. Based on the adoption of these mitigation measures the site can minimise waste management impacts to an acceptable level. In relation to risks associated with hydrocarbons, based on the proposed management and mitigation measures, the risk of hydrocarbon contamination to land is considered to be negligible.

5.10. Social and Economic

5.10.1. Introduction

The SEARs for the EIS required 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. An assessment of potential social impacts of the proposed development has been undertaken with regards to scoping methodology outlined in the Social Impact Assessment Guideline (2017) (SIA Guideline), published by the Department of Planning and Environment. The significance of the resource is addressed in Section 2.4 of the EIS.

5.10.2. The Existing Social and Economic Setting

The site and surrounding land is zoned RU1 Primary Production. The site will continue to be used for agricultural purposes concurrently with the operation of the proposal. The EIS has considered land use compatibility and recommended that the site is considered suitable for the proposal with respect to land use zoning and the intended purpose of the land and surrounding land. Table 14 provides the population statistics for the Gwydir Shire Council LGA and NSW taken from the 2016 Census data available from the ABS (2016). The median age of people in Gwydir (A) (Local Government Areas) was 48 years. Children aged 0 - 14 years made up 18.5% of the population and people aged 65 years and over made up 26.1% of the population.

Table 14 – Population Statistics (ABS 2016)

Age	Gwydir (A)	%	New South Wales	%	Australia	%
Median age	48	--	38	--	38	--
0-4 years	330	6.3	465,135	6.2	1,464,779	6.3
5-9 years	338	6.4	478,184	6.4	1,502,646	6.4
10-14 years	303	5.8	443,009	5.9	1,397,183	6.0
15-19 years	248	4.7	448,425	6.0	1,421,595	6.1
20-24 years	229	4.4	489,673	6.5	1,566,793	6.7
25-29 years	202	3.8	527,161	7.0	1,664,602	7.1
30-34 years	235	4.5	540,360	7.2	1,703,847	7.3
35-39 years	235	4.5	499,724	6.7	1,561,679	6.7
40-44 years	287	5.5	503,169	6.7	1,583,257	6.8
45-49 years	353	6.7	492,440	6.6	1,581,455	6.8
50-54 years	381	7.3	485,546	6.5	1,523,551	6.5
55-59 years	384	7.3	469,726	6.3	1,454,332	6.2
60-64 years	356	6.8	420,044	5.6	1,299,397	5.6
65-69 years	421	8.0	384,470	5.1	1,188,999	5.1
70-74 years	353	6.7	292,556	3.9	887,716	3.8
75-79 years	278	5.3	217,308	2.9	652,657	2.8
80-84 years	164	3.1	155,806	2.1	460,549	2.0
85 years and over	155	3.0	167,506	2.2	486,842	2.1

Table 15 presents employment statistics from the ABS 2016 Census for the Gwydir LGA and NSW. There were 2,188 people who reported being in the labour force in the week before Census night in Gwydir (A) (Local Government Areas). Of these 60.6% were employed full time, 28.2% were employed part-time and 4.8% were unemployed.

Table 15 – Employment

Employment *People who reported being in the labour force, aged 15 years and over*	Gwydir (A)	%	New South Wales	%	Australia	%
Worked full-time	1,327	60.6	2,134,521	59.2	6,623,065	57.7
Worked part-time	618	28.2	1,071,151	29.7	3,491,503	30.4
Away from work	137	6.3	174,654	4.8	569,276	5.0
Unemployed	106	4.8	225,546	6.3	787,452	6.9

Of the employed people in Gwydir (A) (Local Government Areas), 16.2% worked in Beef Cattle Farming (Specialised). Other major industries of employment included Local Government Administration 6.3%, Other Grain Growing 5.8%, Grain-Sheep or Grain-Beef Cattle Farming 4.7% and Hospitals (except Psychiatric Hospitals) 3.3%.

5.10.3. Management and Mitigation Measures

Management and mitigation measures for each of the elements comprising a potential social impact (eg. noise, traffic, visual amenity and air quality) have been addressed in their relevant sections of the EIS. Furthermore, the proposal would implement the following management and mitigation measures to ensure that the proposal-related benefits for the community surrounding the site are maximised and adverse impacts are minimised:

- Maintain a complaints telephone line and ensure that the existence of the number is advertised at the site entrance.
- Give preference when engaging new employees, where practicable, to candidates from the surrounding communities over candidates with equivalent experience and qualifications from elsewhere.
- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the surrounding communities.
- Support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance.

5.10.4. Impact Assessment

Adverse Impacts

The proposed development has the potential result in adverse social impacts (e.g. adverse amenity or sense of community) in the absence of the implementation of any mitigation measures. Table 16 below provides an assessment of the proposed development against the identified social impact assessment checklist matters.

Considering the previously addressed impacts on local noise, traffic, heritage, visual amenity and air quality, the proposal would be unlikely to have an unacceptable impact on residents or the environment within or surrounding the site. As a result, adverse socio-economic impacts are likely to be negligible.

Table 16 – Checklist of Matters Assessment

Matters		Key Links to Social Impacts	Risk of Impact Without Mitigation	Nature of Impact	Explanation
Amenity	Acoustic	Way of life;	Unlikely	Negative	Noise emissions are unlikely to impact on nearby sensitive receptors.
	Visual	Surroundings	Unlikely	Negative	The proposal has been designed to avoid visual amenity impacts to the greatest numbers of nearby sensitive receptors as possible.
	Odour	Surroundings	Unlikely	Negative	The proposal will not produce a strong odour.
	Microclimate	Surroundings	N/A	Nil	The proposal will not significantly impact microclimate.
Access	Access to property	Way of life;	N/A	Nil	The proposal will not impact on access to neighbouring properties.
	Utilities and public transport	Access to infrastructure, services and facilities;	Unlikely	Negative	The proposal will utilise public roads for transportation. This will not result in the reduction of access to public transport services.
	Road and rail	Personal and property rights.	Unlikely	Negative	The proposal will utilise public roads and rail sidings for delivery of products. However, this will not preclude public access to these areas.
Built Environment	Public domain	Community;	N/A	Nil	The proposal will not impact the public domain as it will be located on private land.
	Public infrastructure	Access to infrastructure, services and facilities;	N/A	Nil	The proposal will not preclude public access to public infrastructure.
	Other built assets	Surroundings; Personal and property rights.	N/A	Nil	As above.
Heritage	Natural	Way of life;	N/A	Nil	The site is not mapped as comprising any natural heritage values.
	Cultural	Community;	Likely	Negative	The proposal will not impact on cultural values in the public domain.
	Aboriginal culture	Culture;	Likely	Negative	The proposal will implement the unexpected finds procedure.
	Built	Surroundings.	Unlikely	Negative	There are no built heritage items registered on the site
Community	Health	Health and wellbeing;	Likely	Negative	Dust and noise emissions are expected to be below NSW guidelines at the nearby sensitive receptors therefore minimising the possibility of any health impacts to the community.
	Safety	Surroundings;	Likely	Negative	The proposal has been assessed as not increasing a known safety risk.
	Services and facilities	Way of life; Access to infrastructure, services and facilities;	N/A	Nil	The proposal does not impact access to public services or facilities.

Matters		Key Links to Social Impacts	Risk of Impact Without Mitigation	Nature of Impact	Explanation
	Cohesion, capital and resilience	Way of life; Community; Culture;	Likely	Positive	The proposal will provide employment opportunities to the local community and contribute to the community through various community benefit programs.
	Housing	Way of life; Personal and property rights.	N/A	Nil	As per above.
Economic	Natural resource area	Way of life;	Likely	Positive	The proposal will utilise available natural resources in a sustainable manner. The natural resources consumed will be supplied to support the construction of the Inland Rail Project and associated road projects which have significant benefit to the region.
	Livelihood	Surroundings;	Likely	Positive	The proposal will provide employment and training opportunities for the area. The economic activity generated by the quarry will also relate to the longer-term benefit to the region through the construction of the Inland Rail Project and associated road projects.
	Opportunity cost	Personal and property rights	N/A	Nil	The net benefit to the community and region outweighs the utilisation of geological resources. The opportunity cost would favour the use of the land as a quarry over agricultural uses. The site can be rehabilitated for longer term outcomes.
Air	Air emissions.	Surroundings	Likely	Negative	The proposal will not exceed the NSW EPA air quality criteria. Air quality mitigation measures will be implemented during the operation and monitoring will be carried out to ensure ongoing compliance.
Biodiversity	Native vegetation and fauna	Surroundings	Likely	Negative	Vegetation clearing is proposed on site however the net loss of biodiversity impacts are to be offset by the provision of biodiversity credits under the NSW Biodiversity Offset Scheme. The sites most sensitive areas have been avoided.
Land	Stability/structure, land capability, topography	Surroundings	Likely	Negative	While the proposal will result in land disturbance, controls will be in place to overcome these impacts and the land will be rehabilitated following the cessation of the extractive activities.
Water	Quality, availability, hydrological flows	Surroundings	Unlikely	Negative	Soil and water management measures will be implemented to ensure the proposed development has minimal impact to surrounding water bodies and hydrological flows.

Positive Impacts

The proposal would provide a range of specialist, high quality products for the local market in the long term and the Inland Rail Project and associated road projects in the short term.

The proposal would provide direct full-employment for between 5 to 10 staff. Several contract truck drivers would also be required for product delivery. This would have a positive impact on economic activities within the Gwydir LGA.

As a result, assessment of the potential socio-economic impacts demonstrates the beneficial impacts of the proposal outweigh the adverse impacts associated with the operations.

6. Evaluation and Justification of the Proposal

6.1. Introduction

This section presents the evaluation and justification of the proposal, revisits the predicted residual impacts on the biophysical environment, considers the Objects of the EP&A Act 1979 and assesses the consequences of not proceeding with the proposal.

The evaluation of the proposal is undertaken by firstly assessing the identified environmental risks posed to the local environment by the proposed activities and then considering the implementation of the commitments for controls, safeguards or mitigation measures outlined in the EIS. The proposal has also been evaluated against the principles of Ecologically Sustainable Development (ESD) in order to provide further guidance as to the acceptability of the proposal, as presented in the EIS.

6.2. Ecological Sustainable Development

Ecologically sustainable development (ESD) is defined as, *"Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased" (DMP 1990).*

The proposal has endeavoured to address each of the following ESD principles, where applicable.

- The precautionary principle.
- The principle of social equity.
- The principle of the conservation of biodiversity and ecological integrity.
- The principle for the improved valuation and pricing of environmental resources.

The precautionary principle

The EIS has been prepared in accordance with relevant environmental data. From this the project has been evaluated against relevant criteria to ensure that environmental outcomes are quantified with a high-level certainty. The scope of the assessment addresses the SEARs and items raised through consultation. Where residual environmental impacts occur mitigation, measures have been adopted to ensure that the best outcomes are being reached for the surrounding community. In terms of biodiversity, relevant surveys have taken place and the proposed footprint was modified to avoid the highest values and any residual impacts which can not be avoided will be offset.

Social equity

Social equity provides a notion of preservation of environmental aspects that cannot be replace for the enjoyment of future generations. Generally, such aspects of quarry development relate to biodiversity, cultural heritage, land use and the transformation of the locality as a result of the development. The EIS has considered these aspects and the assessment has concluded that impacts in such areas will be minimal. By avoiding areas of significant vegetation and adopting cultural heritage management practises across the operation intergeneration equity can be maintained. The site will be rehabilitated following the cessation of the works to ensure that landform can support ongoing rural activities.

Conservation of biological and ecological integrity

The biological integrity of the site has been considered through the planning of the proposal. Areas containing significant vegetation areas have been avoided to ensure that the ecological integrity of existing habitat can be maintained.

Improved valuation, pricing and incentive mechanisms

Where the proposed development has an impact on common public areas the appropriate pricing mechanism are used to reflect the polluter pays approach to environmental management. This is recognised in the developer contributions payable under the Council provisions for the use of public roads used for the heavy haulage from the site. The proposal is designed in a manner that minimises disturbance and impacts on the environment and surrounding residents.

6.3. Consequences of not proceeding with the proposal

The consequences of not proceeding with the proposal include:

- The hard rock resource would not be extracted.
- Haulage distance to the Inland Rail Project would increase, having a direct impact on the cost of that project.
- The opportunity to generate 5 to 10 full-time-equivalent positions would be foregone.
- Minor impacts on the local biophysical environment would not eventuate.
- A hard rock quarry would not be established to supply the general market over the long term.

6.4. Cumulative Impacts

The potential environmental impacts (eg traffic) of the proposal have been detailed in the relevant sections of the EIS.

The site is located in an area where agriculture is the dominant land use. The proposal is located on a previously modified landscape as a result of historical agricultural development. As such the establishment of the site does not result in a net impact to biodiversity. Indirect impacts to surrounding landholders have been assessed and are considered similar to existing rural activities. Therefore, the proposal does not contribute significantly to cumulative environmental impact within the locality.

Overall, the proposal does include positive contributions which counter balance the potential negative impacts. As such the proposal is considered compatible with the site and its surrounds and does not contribute to having a significant cumulative impact.

6.5. Object of the EP&A Act

Development Consent is being sought under Section 4.15 of the EP&A Act and must therefore satisfy the objectives of the EP&A Act. The objectives of the EP&A Act are considered below. It is recommended that each has been satisfied by the proposal and this EIS.

The objects of this Act are as follows—

a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,
b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,
c) to promote the orderly and economic use and development of land,
d) to promote the delivery and maintenance of affordable housing,
e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,
f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),
g) to promote good design and amenity of the built environment,
h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,
i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,
j) to provide increased opportunity for community participation in environmental planning and assessment.

The proposal would provide for a new hard rock quarry to be established to support the Inland Rail Project in the short term and the general market in the long term. The proposal would contribute to a better environment by providing a source of construction materials for the project adjacent to the planned alignment of the Inland Rail Project. This will minimise environmental impacts, traffic impacts and other associated socio-economic impacts, whilst avoiding any significant biodiversity and aboriginal cultural heritage values. On this basis and considering that the proposal would offset any residual biodiversity impacts it is considered that the proposal conforms to the principles of ecological sustainable development.

The proposal would result in a beneficial use of the land for extractive industry without constraining the ongoing rural activities occurring on adjacent and surrounding land. The proposal would not contribute to impact on the delivery and maintenance

of affordable housing. The proposal avoids significant impacts to biodiversity values and where impact can not be avoided any residual impacts will be offset. The proposal exhibits good design and consideration of the amenity of the area by minimising visual amenity impacts to the greatest extent possible. The proposal has no impact on the proper construction and maintenance of buildings as any buildings will be temporary demountable buildings. The proposal has carefully considered the relevant environmental planning legislation. The applicant is of the view that the proposal meets all relevant requirements.

The applicant anticipates that the community will have opportunity to participate in the environmental planning and assessment process through the public notice period arranged by the Council.

6.6. Conclusion

This EIS has been prepared by Groundwork Plus Pty Ltd on behalf of Regional Quarries Australia (the applicant). This document has been prepared to accompany a development application for the establishment of the North Star Quarry.

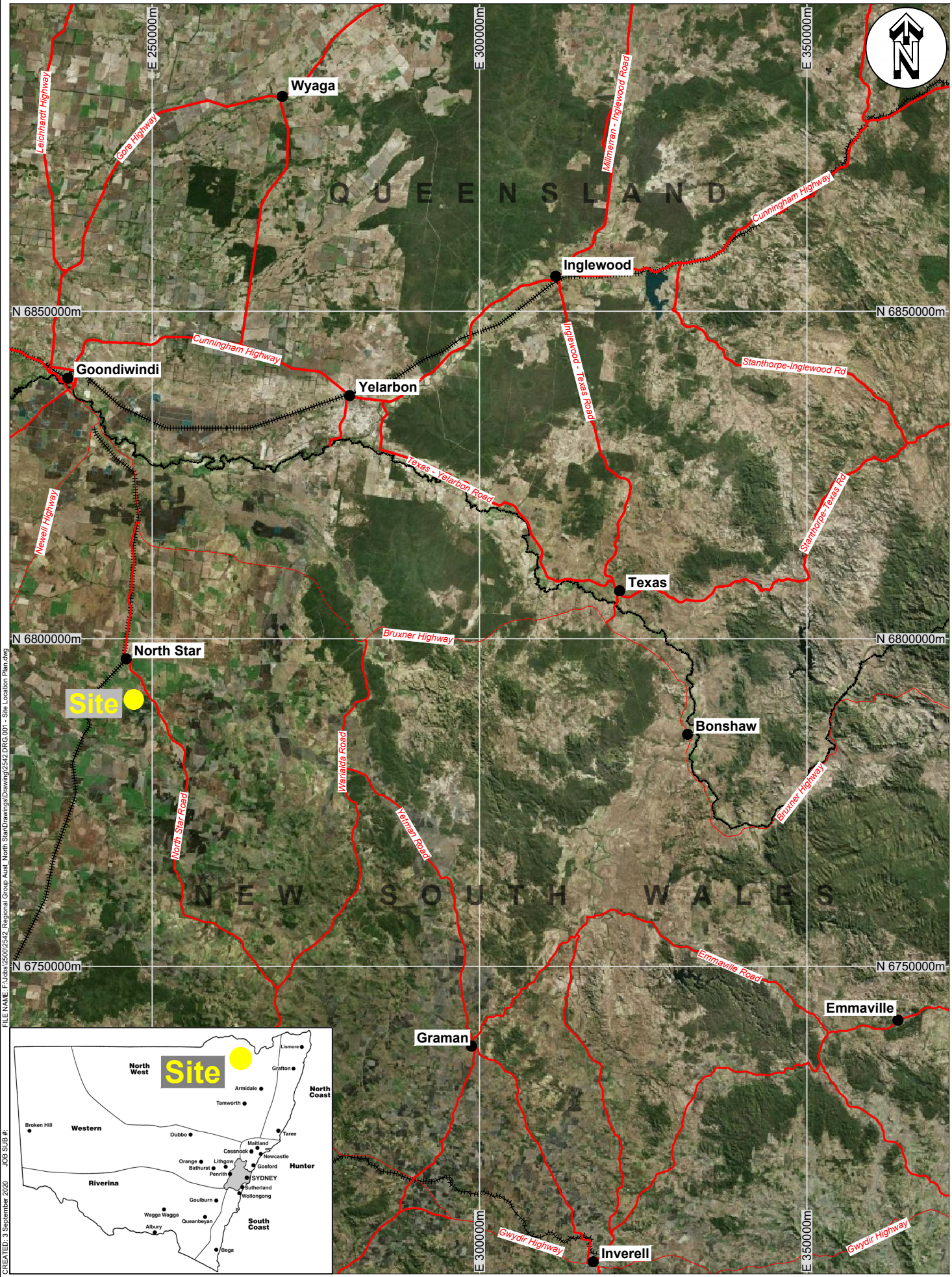
It is noted that Australian Rail Track Corporation (ARTC) have been consulting with impacted local government authorities during the planning of the Inland Rail Project (IRP) it is understood that Council would have been informed by the ARTC that ARTC will take on the burden of maintaining the local road network during delivery of the IRP.

While alternative sites may be available in due course to provide the required construction materials for the Inland Rail and associated road upgrade works the site is close to the proposed alignment and would minimise potential environmental impacts compared to sourcing the material from alternative sites further from the alignment.

A thorough and comprehensive assessment of existing environmental values and potential environmental impacts have been undertaken. The proposal has been designed to avoid impacts to areas of environmental significance on the site and minimise any remaining potential impacts through appropriate design and management measures.

The proposal would provide economic benefits to the local community through additional employment whilst also providing improved material delivery efficiencies to the Inland Rail Project which will benefit the wider region. Accordingly, it is considered that the proposal is justified and its impacts acceptable subject to the implementation of the management and mitigation measures identified by this EIS and supporting specialist assessments.

drawings



FILE NAME: F:\Jobs\2500\2542_Regional Group Aust_North Star\Drawings\Drawing\2542.DRG.001 - Site Location Plan.dwg

CREATED: 3 September 2020 JOB SUB #:

Legend:

- Project Site
- Population Centre
- Existing Railway
- Major Roads
- State Border

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Site Location Plan

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:750,000 When Printed On A4 — 0 — 15kms

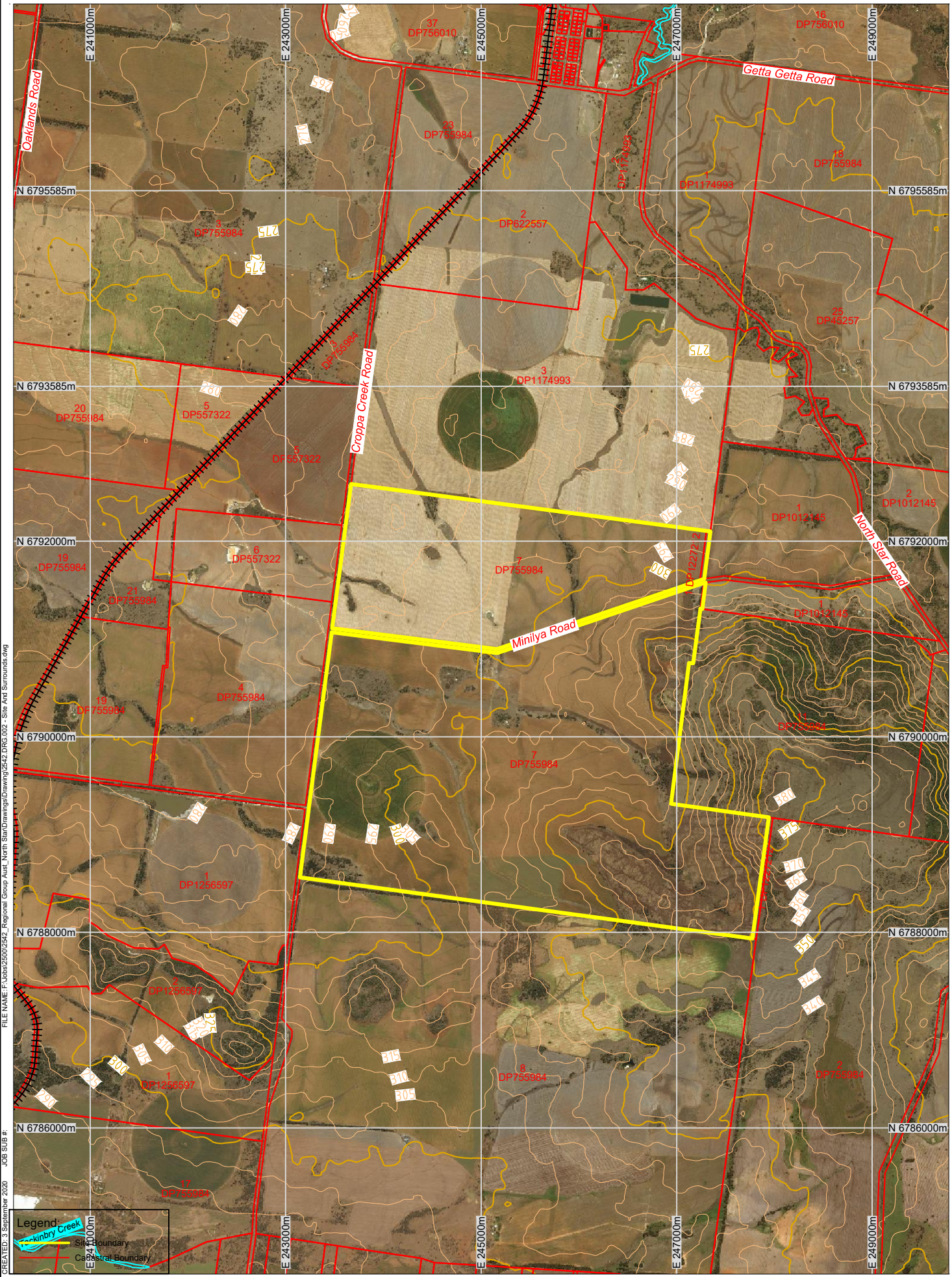
DRAWING NUMBER: 2542.DRG.001

REVISION:

DATE: 3 September 2020 DRAWN: MRescar

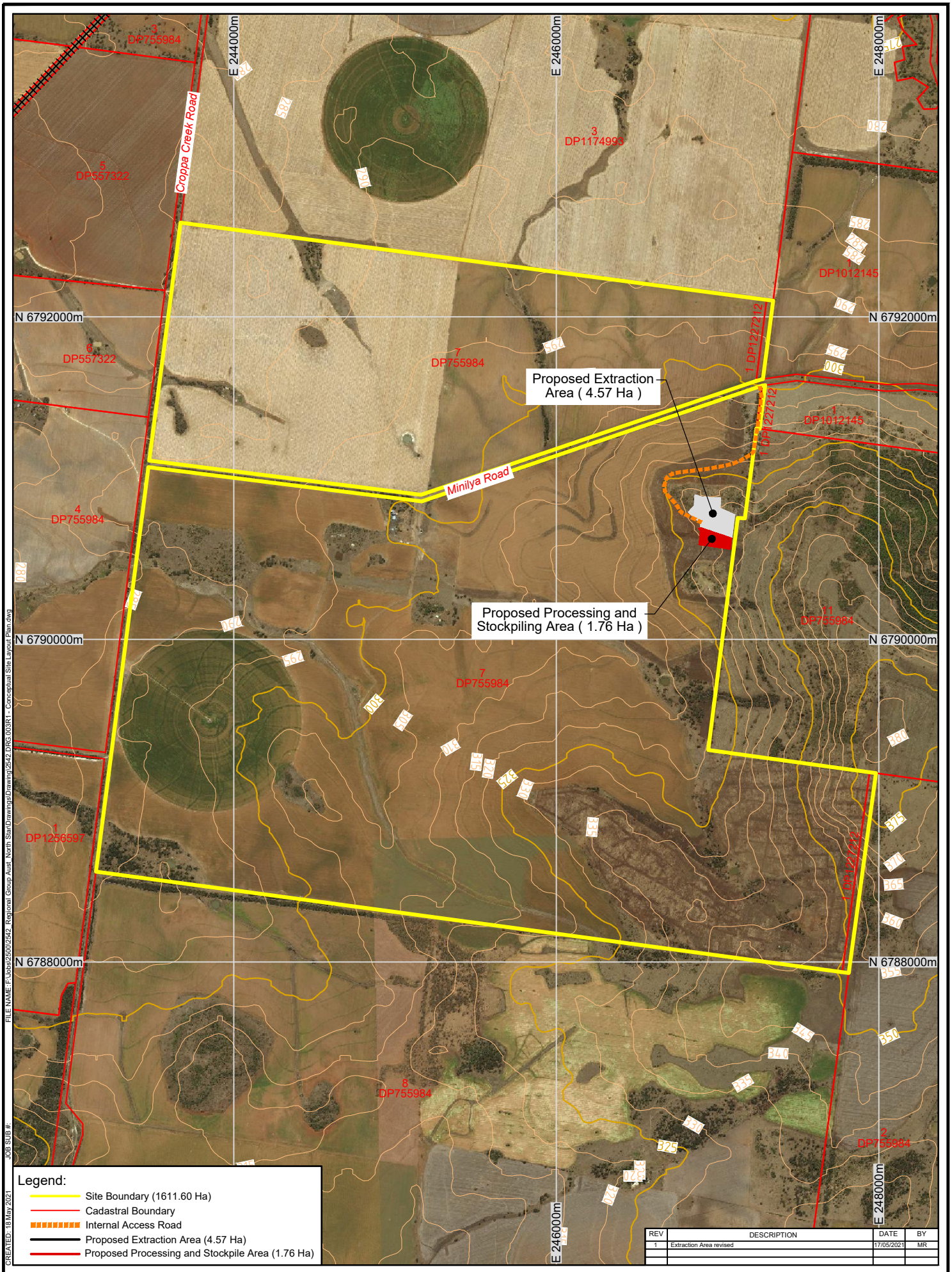
PRINTED: 3 September 2020 CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE MGA / / 56



FILE NAME: F:\Jobs\2500\2542_Regional Group Aust_North Star\Drawings\Drawing\2542.DRG.002 - Site And Surrounds.dwg
CREATED: 3 September 2020 JOB SUB #:

PROJECT: North Star Quarry	TITLE: Site and Surrounds				
CLIENT: Regional Group Australia	GROUNDWORK plus PH: +61 7 3871 0411 WWW.GROUNDWORK.COM.AU	SCALE: 1:50,000 When Printed On A4 (0 – 1km)	DRAWING NUMBER: 2542.DRG.002	REVISION:	
		DATE: 3 September 2020	DRAWN: MRescar	DATUM: HORIZONTAL / VERTICAL / ZONE	
		PRINTED: 3 September 2020	CHECKED: JLawler	MGA / / 56	



REV	DESCRIPTION	DATE	BY
1	Extraction Area revised	17/05/2021	MR

FILE NAME: P:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.003R1 - Conceptual Site Layout Plan.dwg

JOB SUB #:

CREATED: 18 May 2021

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Conceptual Site Layout Plan

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:30,000 When Printed On A4 — 0 — 600m

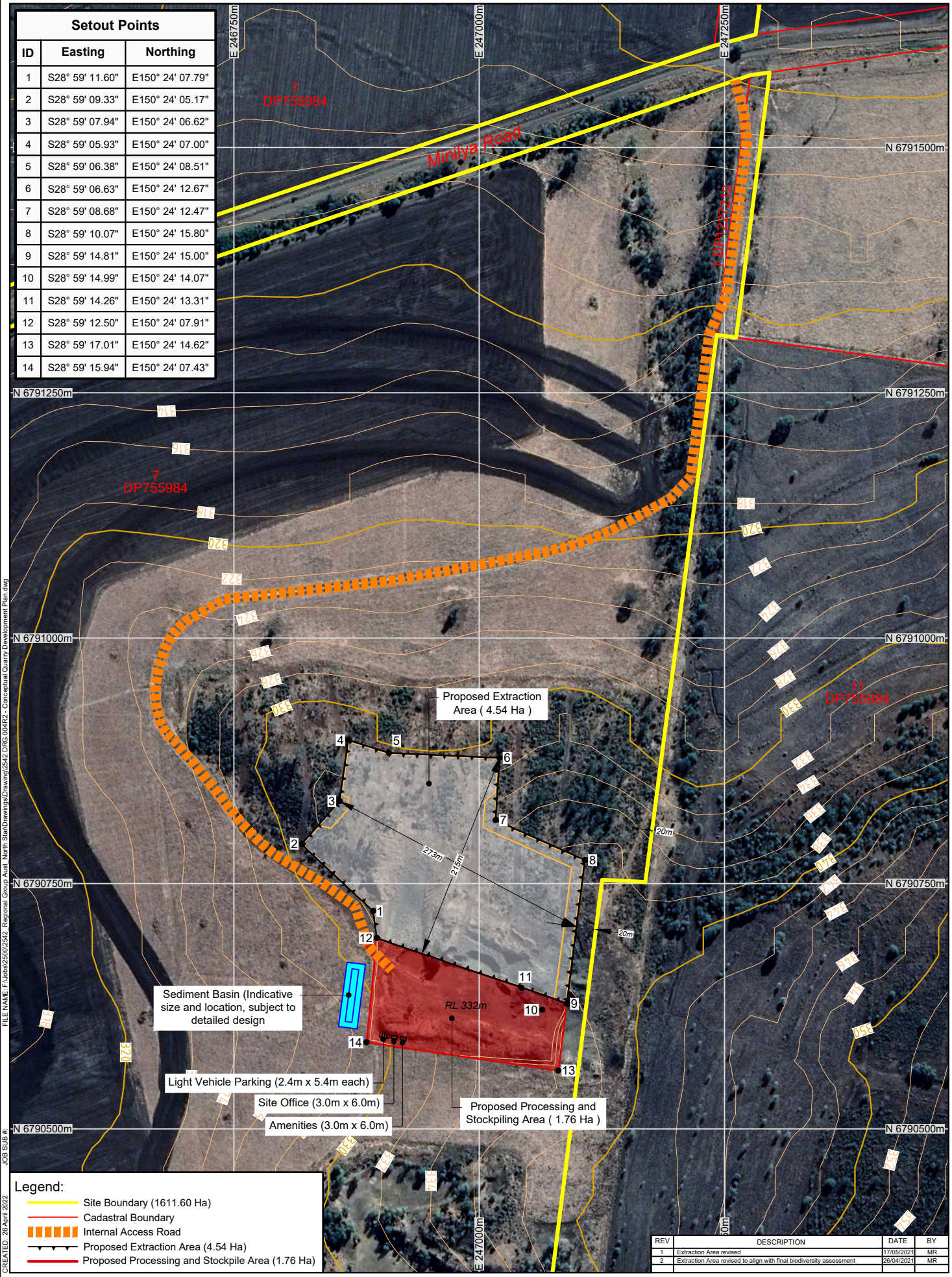
DRAWING NUMBER: 2542.DRG.003

REVISION: 1

DATE: 18 May 2021 | DRAWN: MRescar

PRINTED: 18 May 2021 | CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE MGA / / 56



PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Conceptual Quarry Development Plan

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:5,000 When Printed On A4 — 0 — 100m

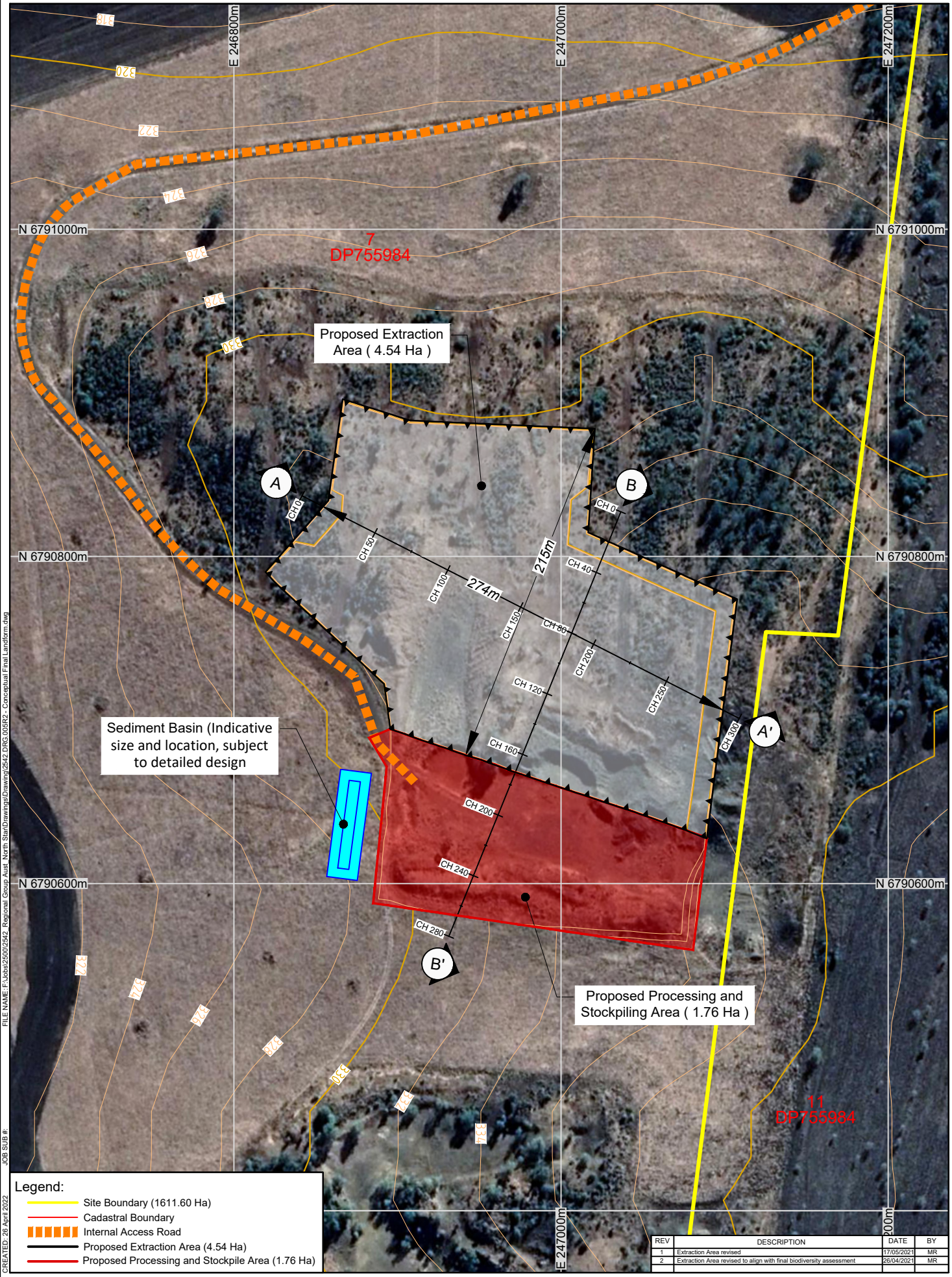
DRAWING NUMBER: 2542.DRG.004

REVISION: 2

DATE: 26 April 2022 | DRAWN: MRescar

PRINTED: 26 April 2022 | CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE MGA / / 56



REV	DESCRIPTION	DATE	BY
1	Extraction Area revised	17/05/2021	MR
2	Extraction Area revised to align with final biodiversity assessment	26/04/2021	MR

FILE NAME: F:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.005R2 - Conceptual Final Landform.dwg

CREATED: 26 April 2022

JOB SUB #:

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Conceptual Final Landform

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:3,000 When Printed On A4 — 0 — 60m

DRAWING NUMBER: 2542.DRG.005

REVISION: 2

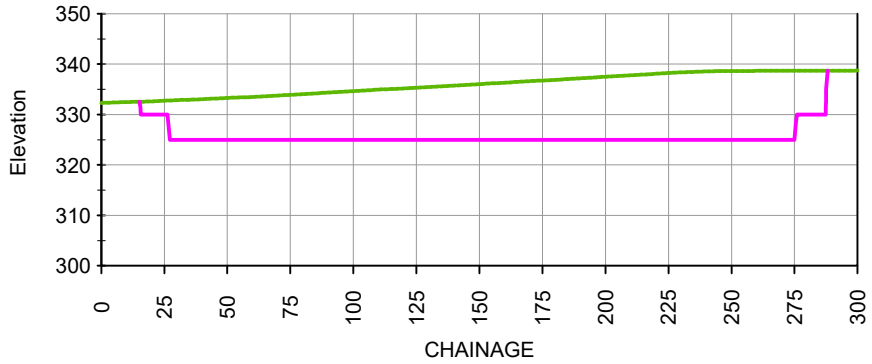
DATE: 26 April 2022 | DRAWN: MRescar

PRINTED: 26 April 2022 | CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE MGA / / 56

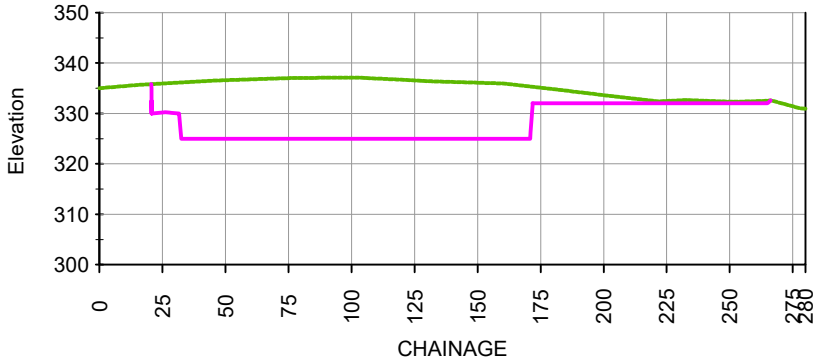
Cross Section A-A'

SCALES: HORIZONAL 1:3000 VERTICAL 1:1500



Cross Section B-B'

SCALES: HORIZONAL 1:3000 VERTICAL 1:1500



FILE NAME: F:\Jobs\25000\2542_Regional Group Aust_North Star\Drawings\Drawing\2542.DRG.005R2 - Conceptual Final Landform.dwg

JOB SUB #:

CREATED: 26 April 2022

REV	DESCRIPTION	DATE	BY
1	Extraction Area revised	17/05/2021	MR
2	Extraction Area revised to align with final biodiversity assessment	26/04/2021	MR

Data Sources:
Photography:
Topography:
Cadastre:
Ecosystem:
Other:

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Legend:

- Existing Ground
- Design Surface

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Conceptual Final Land Form (Cross Sections)

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:3000 When Printed On A4 — 0 — 60m

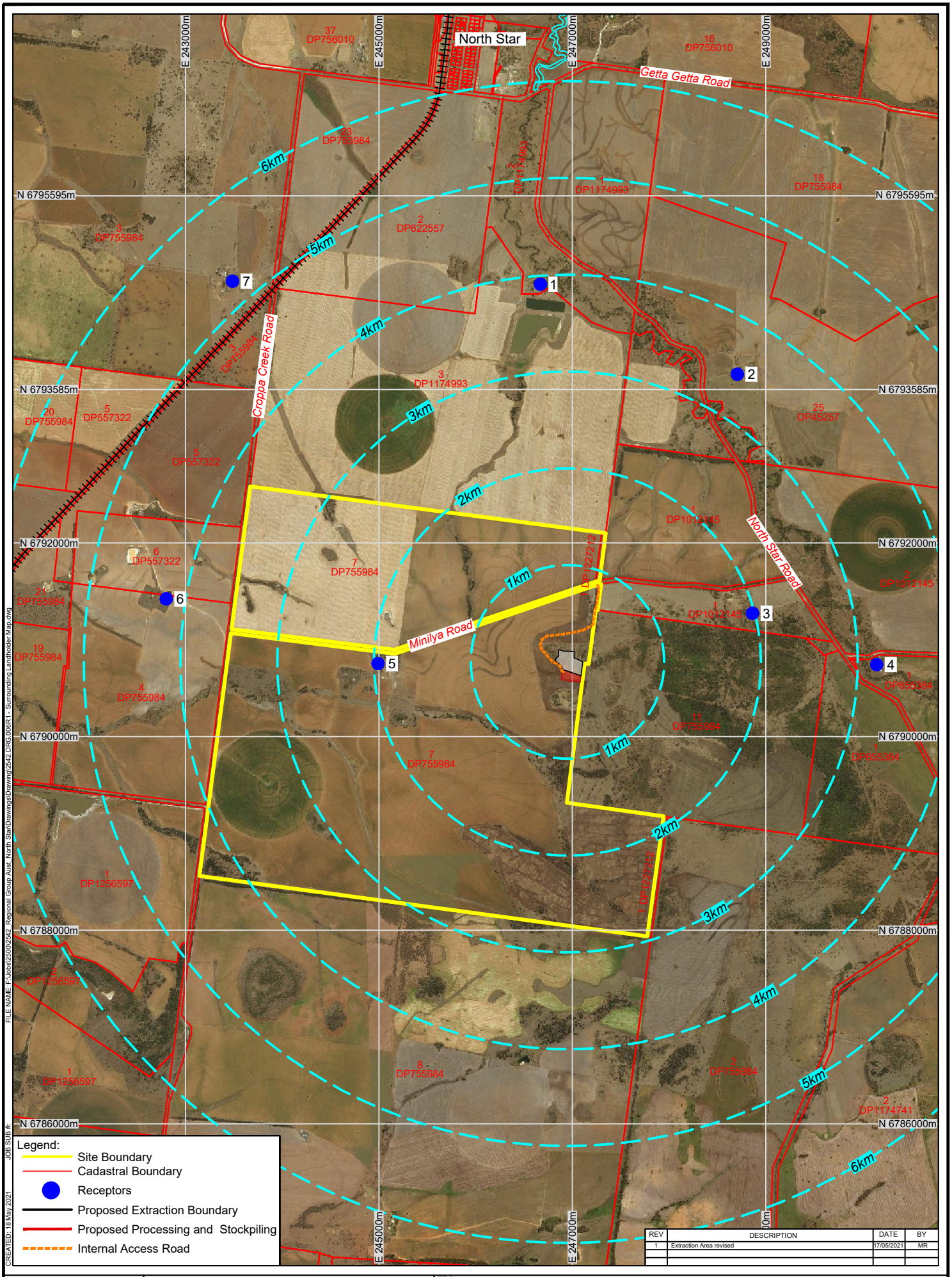
DRAWING NUMBER: 2542.DRG.005A

REVISION: 2

DATE: 26 April 2022 | DRAWN: MRescar

PRINTED: 26 April 2022 | CHECKED: Jlawler

DATUM: HORIZONTAL / VERTICAL / ZONE
MGA / AHD / 56



REV	DESCRIPTION	DATE	BY
1	Extraction Area revised	17/05/2021	MR

FILE NAME: P:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.006R1 - Surrounding Landholder Map.dwg

JOB SUB #:

CREATED: 18 May 2021

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Surrounding Landholder Map

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:5,000 When Printed On A4 — 0 — 100m

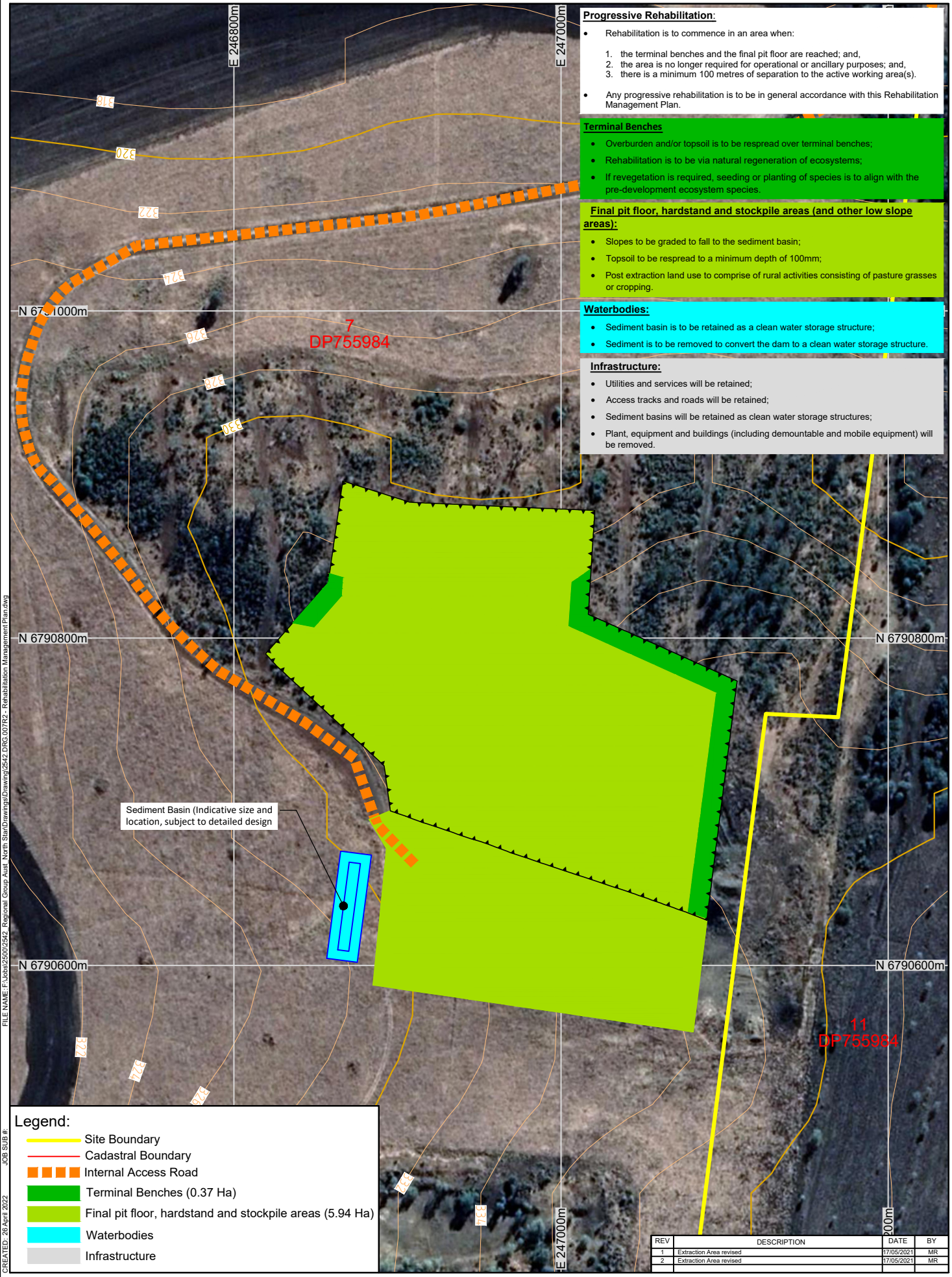
DRAWING NUMBER: 2542.DRG.006

REVISION: 1

DATE: 18 May 2021 | DRAWN: MRescar

PRINTED: 18 May 2021 | CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE MGA / / 56



Progressive Rehabilitation:

- Rehabilitation is to commence in an area when:
  1. the terminal benches and the final pit floor are reached; and,
  2. the area is no longer required for operational or ancillary purposes; and,
  3. there is a minimum 100 metres of separation to the active working area(s).
- Any progressive rehabilitation is to be in general accordance with this Rehabilitation Management Plan.

Terminal Benches

- Overburden and/or topsoil is to be respread over terminal benches;
- Rehabilitation is to be via natural regeneration of ecosystems;
- If revegetation is required, seeding or planting of species is to align with the pre-development ecosystem species.

Final pit floor, hardstand and stockpile areas (and other low slope areas):

- Slopes to be graded to fall to the sediment basin;
- Topsoil to be respread to a minimum depth of 100mm;
- Post extraction land use to comprise of rural activities consisting of pasture grasses or cropping.

Waterbodies:

- Sediment basin is to be retained as a clean water storage structure;
- Sediment is to be removed to convert the dam to a clean water storage structure.

Infrastructure:

- Utilities and services will be retained;
- Access tracks and roads will be retained;
- Sediment basins will be retained as clean water storage structures;
- Plant, equipment and buildings (including demountable and mobile equipment) will be removed.

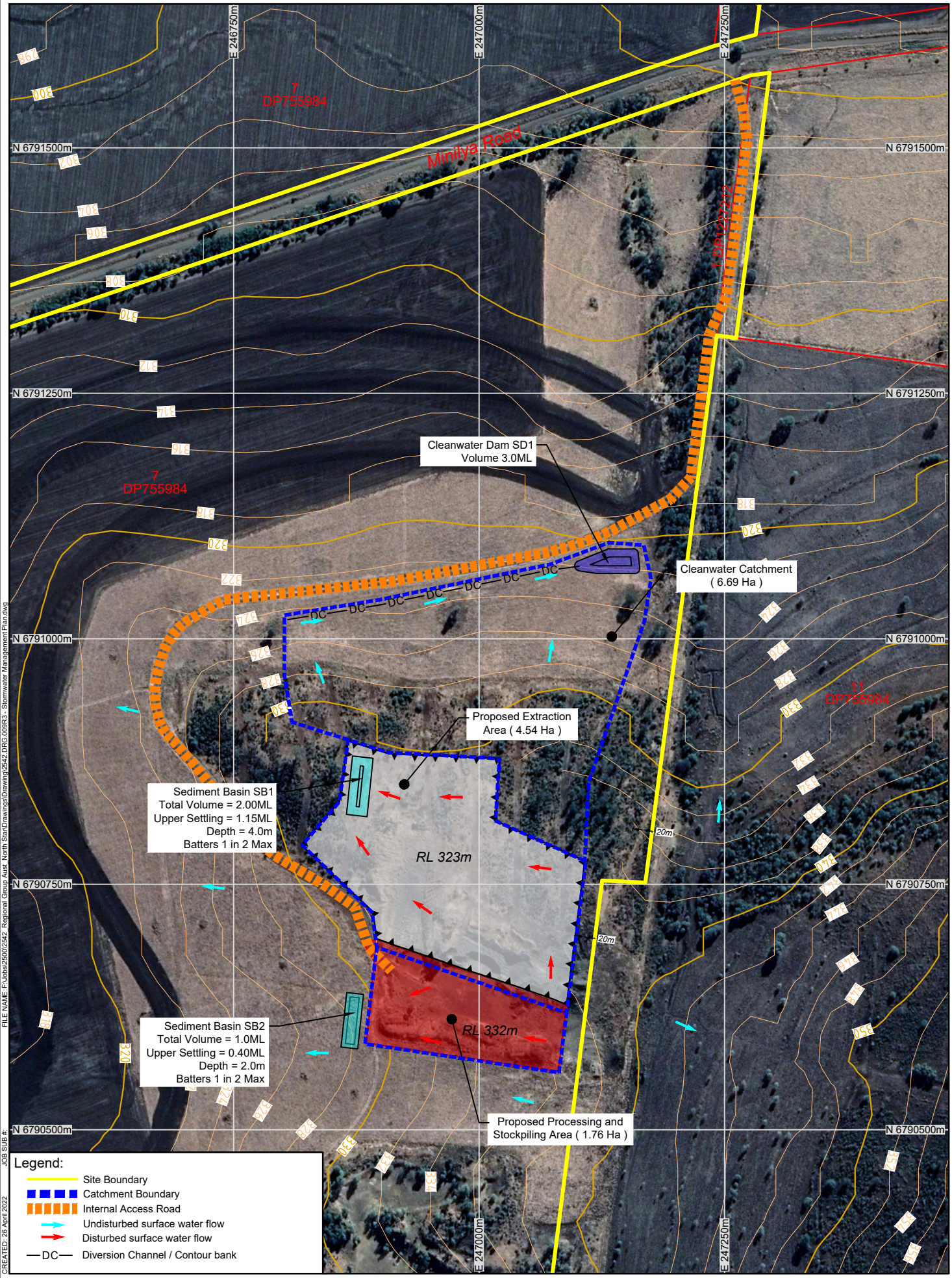
REV	DESCRIPTION	DATE	BY
1	Extraction Area revised	17/05/2021	MR
2	Extraction Area revised	17/05/2021	MR

FILE NAME: F:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.007R2 - Rehabilitation Management Plan.dwg
JOB SUB #:
CREATED: 26 April 2022

PROJECT: North Star Quarry
CLIENT: Regional Group Australia
TITLE: Rehabilitation Management Plan

GROUNDWORK plus
PH: +61 7 3871 0411
WWW.GROUNDWORK.COM.AU

SCALE: 1:3,000 When Printed On A4	0 60m	DRAWING NUMBER: 2542.DRG.007	REVISION: 2
DATE: 26 April 2022	DRAWN: MRescar	DATUM: HORIZONTAL / VERTICAL / ZONE	
PRINTED: 26 April 2022	CHECKED: JLawler	MGA / / 56	



FILE NAME: F:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.009R3 - Stormwater Management Plan.dwg
JOB SUB #:
CREATED: 26 April 2022

PROJECT: North Star Quarry

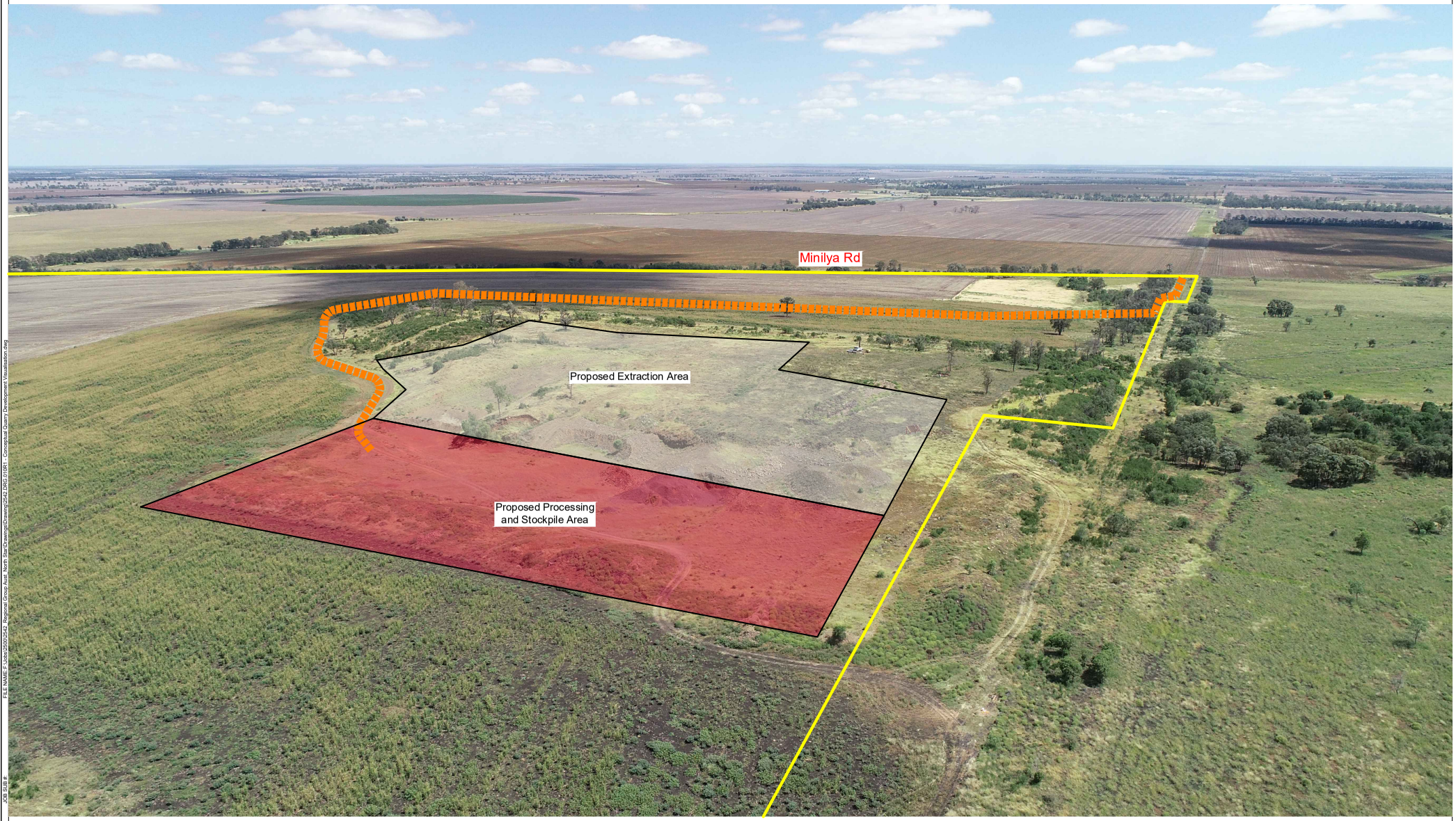
CLIENT: Regional Group Australia

TITLE: Figure 1 - Surface Water Management Plan

GROUNDWORK plus
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SCALE: 1:5,000 When Printed On A4	0 100m	DRAWING NUMBER: 2542.DRG.009	REVISION: 3
DATE: 26 April 2022	DRAWN: MFolker	DATUM: HORIZONTAL / VERTICAL / ZONE	
PRINTED: 26 April 2022	CHECKED: JLawler	MGA / / 56	

NOTE:
This drawing is conceptual in nature for visualisation purposes only and should not be used to confirm boundaries of extraction or disturbance



FILE NAME: P:\Jobs\2500\2542_Regional Group Aust_North Star\Drawings\Drawing\2542.DRG.010R1 - Conceptual Quarry Development Visualisation.dwg
JOB SUB #:
CREATED: 18 May 2021

REV	DESCRIPTION	DATE	BY
1	Revised Extraction Area	18-05-2021	JHV

Data Sources:
Photography:
Topography:
Cadastre:
Ecosystem:
Other:

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Legend:
- Site Boundary
- Internal Access Road
- Proposed Extraction Area
- Proposed Processing and Stockpile Area

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Conceptual Quarry Development Visualisation

GROUNDWORK plus
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WWW.GROUNDWORK.COM.AU

DRAWING NUMBER: 2542.DRG.010
REVISION: 1
DATE: 18 May 2021
DRAWN:
PRINTED: 18 May 2021
CHECKED:
DATUM: HORIZONTAL / VERTICAL / ZONE
GDA94 / MGA / AHD / 56

appendices

Appendix 1

Application for Development Consent

GWYDIR SHIRE COUNCIL
ABN 11 636 419 850
Locked Bag 5, Bingara NSW 2404
Email: mail@gwydir.nsw.gov.au – ***Website:*** www.gwydirshire.com

Bingara Office: 33 Maitland St, Bingara NSW 2404 Telephone: 02 6724 2000 Facsimile: 02 6724 1771
Warialda Office: 52 Hope Street, Warialda NSW 2402 Telephone: 02 6729 3000 Facsimile: 02 6729 1400

DEVELOPMENT APPLICATION

Date received:_____/_____/_____ **DA No:** _____

Use this form to apply for **consent to carry out development**. The **DA Supplement** that accompanies this form will help you complete the application. To complete this form, please place a cross in the boxes ☐ and fill out the white sections as appropriate. To minimise delay in receiving a decision about your application, please ensure you submit all relevant information. You need to apply to the relevant consent authority (usually the council). Once the consent authority has assessed your application, you will receive a notice of determination.

Applicant's Details

First name: Regional Quarries Australia c/o Groundwork Plus

Family name:

Flat/street no.: 6

Street name: Mayneview Street, Milton

Suburb or town: Brisbane

State: QLD

Postcode: 4064

Daytime telephone: 07 3871 0411

Fax:

Mobile:

Email Address: planning@groundwork.com.au

Please ✓ **if you do not** wish to be added to Councils Mailing List, to be sent information about Council & Community Activities from time to time. ❑

Identify the land you propose to develop

Flat/street no. Street name: 5535 North Start Road, North Star, NSW 2408

Suburb or town:

Postcode:

Lot no. DP/MPS no.: Lot 7 DP755984 and Lot 1 DP1227212

Parish:

You can find the lot no., section, DP/MPS no. details on a map of the land or on the title documents for the land. If you need additional room, please attach a schedule and/or a map with these details.

The Development will involve:

☐ erecting, altering or adding to a building or structure
- ➢ Is it a temporary building or structure ? Yes ☐ No ☐

☐ subdividing land

☐ subdividing a building into strata units

☐ demolition

☒ changing the use of land or a building or the classification of a building under the Building Code of Australia (without building, subdividing or demolishing)

☐ other work (without building, subdividing or demolishing)?

Describe what you propose to do

The proposal is to establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects and then a maximum of 150,000t/yr for a period of ten (10) years to service the general market in the local area.

Existing Development on Site **(Describe any existing building or structures on the site & their uses):**

Agriculture and rural uses

Estimated Cost of the Development

Estimated Cost of the Development (including all construction & labour costs) $ 26,320 ex GST

For building work, what is the class/s of the building under the Building Code of Australia? NA

Building Details

Tick whether builder is? Licenced ☐ (please complete details) or Owner ☐

Builder's Name: Not applicable

Licence Number:

Builder's Address:

Phone:

Fax:

Mobile:

Staged development

You can apply for development consent for only part of your proposal now, and for the remaining part(s) at a later stage.

Are you applying for development consent in stages?

No ☒

Yes ☐➢ Please attach:

- information which describes the stages of your development
- a copy of any consents you already have for part of your development.

Plans of the land and development

Refer attached EIS

You need to provide a number of plans that show what you intend to do. Section 2 of the **DA Supplement** sets out which plans to provide and the details to include.

Please attach:

- a site plan of the land, drawn to scale (3 copies)
- plans or drawings of the proposal, drawn to scale (3 copies)

and, where relevant:

- an A4 size plan of the proposed building and other structures on the site
- a plan of the existing building, drawn to scale.

BASIX Certificate

Not applicable

You need to provide a Basix Certificate detailing your commitments to water, energy and thermal comfort as detailed in the BASIX Certificate relating to the proposed development must be incorporated into the plans and/or specifications to accompany the Development Application, Complying Development Certificate or Construction Certificate as required by the BASIX Certificate, and submitted to Council.

Note: The commitments required to be shown on the plans and specifications can be found detailed on your BASIX Certificate under the column "Show on CC/CDC Plans & Specs", and marked with a tick (√). Section 2 of the **DA Supplement** sets out which plans to provide and the details to include.

Environmental effects of your development

To assess your proposal, the consent authority needs to understand the impacts it will have. Depending upon the nature and scale of your proposal, you need to provide one or more of the statements listed below to explain the environmental effects of your proposal. See section 3 of the **DA Supplement**.

Is your proposal **designated development**? Refer attached EIS

Yes ☒ ➢ Please attach an environmental impact statement.

No ☐ ➢ Please attach a statement of environmental effects.

Is your proposal likely to significantly impact on **threatened species,** populations, ecological communities or their habitats?

Yes ☒ ➢ Please attach a species impact statement.

No ☐

Concurrence from State Agencies

Do you need the concurrence of a state agency to carry out the development? See section 5 of the **DA Supplement**.

No ☒

Yes ☐ ➢ Please list any agencies whose concurrence you need.

Please attach sufficient information for the agency(s) to assess your application.

Approvals from state agencies

If you need a development consent and one or more of the approvals listed in **Attachment A** of the **DA Supplement**, your development is known as integrated development. The relevant state agency will be involved in the assessment of your proposal. See section 6 of the **DA Supplement**.

Is your application for integrated development?

No ☐

Yes ☒ ➢ Please submit **Attachment A** of the **DA Supplement** with your application and attach:

- sufficient information for the approval body(s) to assess your application
- additional copies of your application for each agency. *The consent authority can tell you the number that will be needed.*

Supporting information

You can support your application with additional material, such as photographs, including aerial photographs, slides and models to illustrate your proposal. Please list what you have attached:

Refer attached EIS

Application fee

For development that involves a building or other work, the fee for your application is based upon the estimated cost of the development. If your application is for integrated development, you need to include $250 for each agency that will look at your proposal. If your development needs to be advertised to the public you may also need to include an advertising fee. The consent authority will help you calculate the fee for your application. (Advertising fees attract GST, all other fees do not).

Signatures

The owner(s) of the land to be developed must sign the application.
If you are not the owner of the land, you must have all the owners sign the application. If the land is Crown land, an authorised officer of the Department of Land and Water Conservation must sign the application.

As the owner(s) of the above property, I/we consent to this application:

Signature

Name: SIMON VICTOR DODLIN

Date: 9/8/21

Signature

Name

Date

The applicant, or the applicant's agent, must sign the application.

Signature

Name if you are not the applicant: James John Lawler

In what capacity are you signing if you are not the applicant: Consultant

Date: 13. 8. 2021

Privacy policy

The information you provide in this application will enable your application to be assessed by the consent authority and any relevant state agency. If the information is not provided, your application may not be accepted. Your application will be advertised to the public for comment if the development is designated development, advertised development or is required to be advertised by a development control plan. The application will also be kept in a register by the council that can be viewed by the public at any time. Please contact the council if the information you have provided in your application is incorrect or changes.

Owner's Appointment of Principal Certifying Authority (PCA)

Once you have the necessary approvals the property owner MUST appoint a PCA prior to work starting

☐ I/We appoint Council as the PCA (for inspections/construction certificates including the issue of the compliance/occupation/subdivision certificates).

☐ I/We nominate a Private Certifier other than Council (please indicate details below)

Not applicable

The owner/s must sign the application.

Signature

Name: SIMON VICTOR DODLIN

Date: 9/8/21

Signature

Name

Date

Private Certifier Details

Name:	
Postal Address:	
Business Phone:	Mobile No:
Email:	Accreditation No.

Lodgement

Before submitting your application, please ensure you have attached all the information the consent authority needs to assess your proposal. You can use the following checklist. Please place a cross in the box ☐ next to any items you have attached:

Land details

- ☒ A map that sets out the lot, DP/MPS and volume/folio numbers
- ☒ A schedule that sets out the lot, DP/MPS and volume/folio numbers

Staged development

- ☐ Information which describes the stages of the development
- ☐ A copy of any consents already granted for part of the development

Plans

- ☒ A site plan of the land (3 copies) — **required for all applications**
- ☒ Plans or drawings of the proposal (3 copies) — **required for all applications**
- ☒ An A4 size plan of the proposed building and other structures on the site
- ☐ A plan, drawn to scale, of the existing building

Environmental effects

- ☒ An environmental impact statement for a designated development proposal
- ☐ A statement of environmental effects — **required for all applications** that are not designated development
- ☐ A species impact statement
- ☐ SEPP 55 – Remediation of Land – **required for all applications**

State agency concurrences and approvals

- ☐ Additional information required by the agencies from which you need concurrence
- ☐ Attachment A of the DA Supplement
- ☐ Additional information required by the agencies you have identified in Attachment A of the DA Supplement
- ☐ Additional copies of your application for each of those agencies

Supporting information

- ☒ Other material to support your application, such as photos, slides and models.

Application fee

- ☐ Your application fee — **required for all applications.**

State Environmental Planning Policy (SEPP) No. 55 – Remediation of Land

Preliminary Investigation of Site Contamination

Under the provisions of the *Environmental Planning and Assessment (Amendment) Act 1979*

(to be submitted with Development Application)

The purpose of this form is to determine whether the issue of land contamination is relevant to the subject site, and whether further investigation s of land contamination are required.

LAND IDENTIFICATION

Lo Lot 7 DP755984 and Lot 1 DP1227212

County: _____ Parish: _____ Street: _____ District, Town or Village:_____

- Have any contamination investigations been carried out on the subject site? Yes ☐ No ☒
  NB: If yes, please attach results (including any previous initial evaluations).

- Have any of the following activities ever been carried out on the subject site? (please tick)

acid/alkali plant and formulation	☐	metal treatment	☐
agricultural/horticultural activities	☒	mining and extractive industries	☐
airport	☐	oil production and storage	☐
asbestos production and disposal	☐	paint formulation and manufacturing	☐
chemicals manufacture and formulation	☐	pesticide manufacture and formulation	☐
defence works	☐	power station	☐
drum re-conditioning works	☐	railway yards	☐
dry cleaning establishments	☐	scrap yards	☐
electrical manufacturing (transformers)	☐	service stations	☐
electroplating and heat treatment premises	☐	sheep and cattle dips	☐
engine works	☐	smelting and refining	☐
explosive industry	☐	tanning and associated trades	☐
gas works	☐	waste storage and treatment	☐
iron and steel works	☐	wood preservation	☐
landfill sites	☐		

- Are there any contamination impacts on land immediately adjacent to the subject site which may affect the subject land? Yes ☐ No ☒
  NB: If yes, please attach details of contamination impacts

DECLARATION

☒ I declare that to the best of my knowledge, the issue of land contamination is not relevant to the subject site.

Signed: _____

Date: 13/8/21

☐ I declare that the subject site may be affected by land contamination and that further contamination investigation is warranted.

Signed: _____

Date: _____

DA Supplement

Guide to the information you need to include with your development application

1. How to use this guide

This guide provides information to help you to complete your development application. Each section relates to a question in the form where you may need to attach additional information.

If you need further assistance to complete the application, please contact the consent authority (usually the council).

2. Plans of the land and development

You need to include a site plan of the land and the plans or drawings of the proposal to show what you intend to do.

The site plan is to be drawn to scale and show:

- the location of the land, the measurements of the boundaries of the land, the size of the land and which direction is north
- existing vegetation and trees on the land
- the location and uses of buildings that are already on the land
- the existing levels of the land in relation to buildings and roads
- the location and uses of buildings on sites adjoining properties.

The plans or drawings are be to drawn to scale and show, where relevant:

- the location of any buildings or structures on the land, any proposed extensions or additions, the boundaries of the land and any development on adjoining land
- the floor plans of the proposed buildings
- how high the proposed development will be in relation to the land
- each elevation of the proposed building(s)
- any changes that will be made to the level of the land by excavation, filling or otherwise
- the level of the lowest floor, the level of any yard or unbuilt area and the level of the ground
- the arrangements you have made for parking, where vehicles will enter and leave the site, and how vehicles will move about the site
- how the land will be landscaped or otherwise treated and what types of vegetation will be used (including their height and maturity)
- how you intend to drain the land.

You need to attach other plans in the following circumstances:

- an A4 size plan of the proposed building and other structures on the site if you propose to erect, alter or add to a building, and your development does not need to be advertised to the public. The consent authority can tell you if your development must be advertised.
- The plan is to indicate the height and external shape of the proposed building as it will be erected on the site and include details of other buildings or structures on the site.
- a plan of an existing building, drawn to scale, if your application involves building work to alter, expand or rebuild the building.

The plan will allow the consent authority to assess whether any existing buildings must be upgraded for safety reasons.

Other attachments

- **BASIX Certificate**

  The Building Sustainability Index (BASIX) is a web-based planning tool designed to assess the potential performance of residential buildings against a range of sustainability indices.

  A BASIX Certificate identifies the sustainability features required to be incorporated in the building design. These features may include sustainable design elements such as recycled water, rainwater tanks, AAA-rated showerheads and taps, native landscaping, heat pump or solar water heaters, gas space heaters, roof eaves/awnings and wall/ceiling insulation.

  You need a BASIX Certificate in Gwydir Shire when BASIX applies to the type of development for which you require approval. Commencement dates and details of types of development are at www.basix.nsw.gov.au.

  The applicant is required to submit the BASIX Certificate with the Development Application or Complying Development Certificate application. The plans and specifications must also identify the BASIX commitments which will be checked by a professional building certifier during construction. Where submitted plans or specifications are inconsistent with the relevant BASIX Certificate, Council should require applicants to submit consistent applications before progressing the assessment process, either by amending plans / specifications or by submitting a new BASIX Certificate with commitments that match the rest of the application.

2. continued

Applicants can generate the BASIX Certificate only on the NSW Department of Planning' BASIX website: www.basix.nsw.gov.au. For more information, phone the BASIX Help Line on 1300 650 908.

3. Assessing the environmental impacts of your proposal

The consent authority needs to assess the impacts your proposal will have. You need to attach one or more environmental reports to your application so this assessment can be made. The types of reports will depend upon whether your proposal is designated development or will impact upon threatened species.

Designated development

If your proposal will have a high potential risk to the environment and is listed in Schedule 3 of the Environmental Planning and Assessment Regulation 2000 or in a planning instrument made under the *Environmental Planning and Assessment Act 1979*, it is known as designated development. The consent authority can help you determine if your proposal is designated development.

If your development is designated development, please attach an environmental impact statement (EIS) to your application.

The Director-General of the Department of Urban Affairs and Planning has a number of requirements for what must be included in an EIS. The requirements depend upon the nature of the proposed development. Contact the Department's Development and Infrastructure Assessment Branch on (02) 9391 2056 to find out what you need to include in your EIS.

All other types of development

If your development is not designated development, please attach a statement of environmental effects (SEE). Table 1 sets out the information you need to include in your SEE.

Table 1 What to include in a statement of environmental effects

A statement of environmental effects of a proposal is to include information on the following:

- what you consider to be the environmental impacts of the development
- how you have identified the environmental impacts of the development
- the steps you will take to protect the environment or to lessen the expected harm to the environment
- any matters that must be included by any guidelines issued by the Director-General of the Department of Urban Affairs and Planning
- how you have addressed any other matters identified by the relevant planning instruments

Where relevant, your statement of environmental effects may also need to include additional information:

For shops, offices, commercial or industrial development:

- the hours of operation
- the plant and machinery to be installed
- the type, size and quantity of goods to be made, stored or transported
- the loading and unloading facilities that will be available

To change the use of a building (where you are not doing any building work):

You do not need to include these lists if the building will now be used as a single dwelling or a non-habitable building or structure (such as a private garage, carport, shed, fence, antenna or swimming pool).

- a list of Category One Fire Safety Provisions relating to the proposed change
- a list of Category One Fire Safety Provisions used in the existing building or on the land
- a list of fire safety measures currently used in the building

Each list is to describe the extent, capability and the basis of design of each of the provisions/measures.

For a subdivision:

- the details of the existing and proposed subdivision pattern (including the number of lots and the location of roads)
- the consultation you have carried out with the public authorities who provide, or will increase, the services you will need (eg water, road, electricity, sewerage)
- preliminary engineering drawings which show proposed roads, water, sewer, and earthworks
- both the existing and the proposed ground levels when the subdivision is completed

3. continued

For demolition:

- the age and condition of the building or structure you will demolish
- whether the building or structure has heritage value

For advertisements:

- the size, type, colour, materials and position of the sign board or structure on which the advertisement will be displayed

For development relating to an existing use:

- the details of the existing use
- a justification for the proposal having regard to the objectives of the zone

For development in a wilderness area:

- a copy of a consent from the Minister for the Environment if the area is subject to a wilderness protection agreement or a conservation agreement. (You can contact the National Parks and Wildlife Service on (02) 9251 4466 to determine if there is an agreement in place)

For building or demolition:

- the methods that will be used to protect the site during construction or demolition

Threatened species

Please use the test set out in Table 2 to work out whether your proposal is likely to significantly impact on threatened species, populations, ecological communities or their habitats. If you need help to do the test, please contact the consent authority, the National Parks and Wildlife Service (phone: (02) 9251 4466) or NSW Fisheries (phone: (02) 9566 7800).

If your development will impact on threatened species, populations, ecological communities or their habitats, please attach a species impact statement (SIS) to your application. If you are also required to attach an EIS to your application, you can address the requirements of the SIS in your EIS. Contact the National Parks and Wildlife Service and/or NSW Fisheries about what you need to include in your SIS.

Table 2 Will your proposal impact on threatened species?

The following factors are to be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

- in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction
- in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised
- in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed
- whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community
- whether critical habitat will be affected
- whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region
- whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process
- whether any threatened species, population or ecological community is at the limit of its known distribution.

Source: section 5A *Environmental Planning and Assessment Act 1979.*

4. Concurrences from state agencies

You may need the agreement of a state agency to carry out your development. The consent authority will refer a copy of your application to the relevant agencies to seek their agreement. The consent authority can tell you whether the application needs to be referred.

Please include sufficient information with your application for the agency(s) to assess your proposal.

5. Approvals from state agencies

If you need a development consent and one or more of the approvals listed in Attachment A of this Guide, your development is known as integrated development. Please complete Attachment A to identify the approvals you need and the agency(s) from which you need the approvals. The consent authority can help you fill out the attachment. The contact details for each agency can also be found at the end of Attachment A.

If your proposal is integrated development, the assessment of your proposal will be integrated. The consent authority will refer your application to the agency(s) you identify. The agency(s) will tell the consent authority whether or not it will approve your application and, if so, what the general terms of the approval will be. If your application is approved, the conditions of the consent will include those general terms.

Please include Attachment A with your application if you have identified that you need one or more approvals.

Attachment A Integrated development – approvals from state agencies

Some proposals, because of their nature, need other kinds of approvals (eg licences, permits). Your proposal is known as integrated development if you need development consent and one or more of the approvals that have been set out in this attachment. Follow through each group of questions to decide whether you need any of these approvals. If you have identified you need one or more approvals, please include this attachment with your application. (Section 65)

Aquaculture

Does your proposal involve the cultivation of fish, shellfish, crustaceans, seaweeds, or other aquatic organisms for commercial purposes (but not including a pet shop or aquarium)?

No ☒

Yes ☐➢ You need a permit under section 144 of the *Fisheries Management Act 1994* from NSW Department of Primary Industries.

Dredging or reclamation

Do you want to carry out dredging or reclamation work in a waterway (a stream, river, lake, lagoon, estuary or marine waters)?

No ☒

Yes ☐➢ You need a permit under section 201 of the *Fisheries Management Act 1994* from NSW Department of Primary Industries.

Excavation or filling of a waterway

Does your proposal involve any excavation or filing of the bed of a natural or semi-natural waterway whether permanently or intermittently inundated or flowing (including a bay, estuary, lake, river, creek, lagoon or wetland), with any earth, soil, rock, rubble, concrete, timber or bricks etc? This does not include works within farm dams, urban ponds, irrigation channels, stormwater ponds, sewerage treatment ponds etc.

No ☒

Yes ☐➢ You need a permit under section 201 of the *Fisheries Management Act 1994* from NSW Department of Primary Industries.

Harm to marine vegetation

Does your proposal involve any disturbance, damage or harm to marine vegetation (including seagrasses, mangroves and seaweeds) on public water land or private land which is adjacent to public water land, including by shading them with an overhead structure (eg jetty or pontoon)?

No ☒

Yes ☐➢ You need a permit under section 205 of the *Fisheries Management Act 1994* from NSW Department of Primary Industries.

Obstruct Fish Passage

Does your proposal involve the construction of any structure such as a weir, dam, floodgate, culvert or causeway across any natural or semi-natural waterway whether permanently or intermittently inundated or flowing (including a bay, estuary, lake, river, creek, lagoon or wetland)?

No ☒

Yes ☐➢ You need a permit under section 201 and 219 of the *Fisheries Management Act 1994* from NSW Department of Primary Industries.

Heritage

Does your development involve a building, a place or land that has a permanent conservation order, an interim conservation order or an interim heritage order protecting it, or which is listed on the State Heritage Register?

No ☒

Yes ☐➢ You need an approval under section 57 of the Heritage Act 1977 from the NSW Office of Environment & Heritage.
If the council can give this consent, however, the development is not integrated development.

Attachment A Continued

Mine subsidence

Do you want to build, subdivide, make roads, paths or driveways, or put in any pipelines, water, sewage, telephones, gas or other service mains in a mine subsidence district, or alter any of these types of development in a mine subsidence district?

No ☒

Yes ☐➢ You need an approval under section 15 of the *Mine Subsidence Compensation Act 1961* from the Subsidence Advisory Board.

Aboriginal relics and places

Do you want to destroy, damage or otherwise harm an Aboriginal relic that is known to exist on the land you want to develop?

No ☒

Yes ☐➢ Are you going to do so in accordance with Aboriginal tradition?

Yes ☐

No ☐➢ You need an approval under section 90 of the *National Parks and Wildlife Act 1974* from the Office of Environment & Heritage.

Do you want to destroy, damage or otherwise harm land that has been declared to be an Aboriginal place?

No ☒

Yes ☐➢ You need an approval under section 90 of the *National Parks and Wildlife Act 1974* from the Office of Environment & Heritage.

Pollution

Is your development designated development?

No ☐➢ Will the development cause the pollution of water?

No ☐

Yes ☐➢ You can apply for a licence under section 43(d) of the *Protection of the Environment Operations Act 1997* from the Environment Protection Authority so that you cannot be convicted of an offence of polluting water.

Yes ☒➢ You are likely to need a licence from the Environment Protection Authority. Is your land already designed to carry out the activity?

No ☒➢ You need a licence under section 47 of *the Protection of the Environment Operations Act 1997* from the Environment Protection Authority.

Yes ☐➢ You need a licence under section 48 of the *Protection of the Environment Operations Act 1997* from the Environment Protection Authority.

Rivers and lakes

Is your development within 40 metres of a stream, river, lake or lagoon?

No ☒

Yes ☐➢ Are you going to excavate the land, remove material from the land or do anything which will obstruct or detrimentally affect the water flowing in a stream, river, lake or lagoon?

No ☐

Yes ☐➢ You need a permit under Part 3, Chapter 3 of the *Water Management Act 2000* from the NSW Office of Water.

Attachment A continued

Roads

Will your development affect a public road, a Crown road, a highway, a main road, a freeway or a tollway?

No ☐

Yes ☒ ➢ You need a consent under section 138 of the *Roads Act 1993* from Roads and Maritime Services, the Department of Primary Industries or the council.
If the council can give this consent, however, the development is not integrated development.

Using water

NB: The following approvals are taken from the Water Management Act 2000.

➢ *Licences and permits for occupiers of land*

Is your development going to be used for conserving water, irrigation, water supply, drainage or changing the course of a river?

No ☒

Yes ☐ ➢ Will your development affect the quantity or use of water in a river, lake or swamp, or water flowing into or from a river, lake or swamp?

No ☐

Yes ☐ ➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

➢ *Licence for non-occupiers of land*

1. Do you propose to build pumps (or the like) to obtain water, or build pipes (or the like) to carry water?

   No ☒

   Yes ☐ ➢ Is your development going to be used for conserving water, irrigation, water supply, drainage, changing the course of a river, or preventing the course of a river from changing?

   No ☐

   Yes ☐ ➢ Go on to question 2

2. Will your development affect the quantity or use of water in a river, lake or swamp, or water flowing into or from a river, lake or swamp?

   No ☒

   Yes ☐ ➢ Do you propose to use the water for household use, stock use or irrigation?

   No ☐

   Yes ☐ ➢ Go on to question 3

3. Do you occupy the land on which you propose to build the pumps (or the like)?

   Yes ☐ ➢ Go on to question 4 Not applicable

   No ☐ ➢ Can you obtain occupation of the land?

   No ☐ ➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

   Yes ☐ ➢ Go on to question 4

4. Do you occupy all the land on which you propose to build pipes (or the like) to carry the water from the pumps to the land where you will use the water?

   Yes ☐ Not applicable

   No ☐ ➢ Can you obtain occupation of the land?

   Yes ☐

   No ☐ ➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

Attachment A continued

➢ *Joint water supply scheme*

1. Is your development going to be used for conserving water, irrigation, water supply, drainage, changing the course of a river or preventing the course of a river from changing?

   No ☒

   Yes ☐➢ Will your development affect the quantity or use of water in a river, lake or swamp, or water flowing into or from a river, lake or swamp?

   No ☐

   Yes ☐➢ Go on to question 2

2. Is the development going to be used by two or more occupiers of land to supply water to their lands?

   No ☒

   Yes ☐➢ Go on to question 3

   Is the development going to supply water to irrigate land(s) other than the land on which the development is built?

   No ☒

   Yes ☐➢ Go on to question 3

   Will the development involve pipes (or the like) to carry water to irrigate your land and the land of other occupiers?

   No ☒

   Yes ☐➢ Go on to question 3

3. Will the development be built on land that is occupied by those who will use the water?

   Yes ☐➢ Go on to question 4 Not applicable

   No ☐➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

4. Do the occupiers of land who will use the water want to build and use the development to supply water for household use, stock water use or irrigation?

   No ☐ Not applicable

   Yes ☐➢ Do they occupy all of the land on which the development will be built, and the land on which the pipes ((or the like)) will be built?

   Yes ☐

   No ☐➢ Can they obtain occupation of the land?

   Yes ☐

   No ☐➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

➢ *Group licences*

Are you a Board of Management elected under the *Private Irrigation Districts Act 1973*?

No ☒

Yes ☐➢ Do you want to build and use the development to take water from a river or lake for occupiers of land in a private district to use?

No ☐

Yes ☐➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

➢ *Bores*

Do you want to sink a bore or enlarge, deepen or alter a bore?

No ☒

Yes ☐➢ Is the work to be carried out by the Crown?

Yes ☐

No ☐➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

Attachment A continued

➢ *River banks and floodplains*

1. Do you want to build an earthwork, embankment or levee, or a road, railway or bridge?
   - No ☒
   - Yes ☐➢ Go on to question 2
2. Will the development be on land that is the bank of a river or lake, forms part of a bank of a river or lake or is within a floodplain?
   - No ☒➢ Go on to question 3
   - Yes ☐➢ Do you have a licence, authority, permit or consent under the *Water Management Act 2000*?
     - Yes ☐
     - No ☐➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.
3. Will the development affect the flow of water to or from a river or lake and prevent land being flooded by water?
   - No ☒
   - Yes ☐➢ Do you have a licence, authority, permit or consent under the *Water Act* 1912?
     - Yes ☐
     - No ☐➢ You will need approval under *Water Management Act 2000* from the NSW Office of Water.

Contact details for state agencies

NSW Department of Primary Industries
Internet: www.dpi.nsw.gov.au
Phone: (02) 6391 3100
Email: Fishery
information-advisory@dpi.nsw.gov.au
Biosecurity
biosecurity@dpi.nsw.gov.au
Agriculture
Nsw.agriculture@dpi.nsw.gov.au
Food Authority
contact@foodauthority.nsw.gov.au
Crown Lands
enquiries@crownlands.nsw.gov.au

NSW Office of Environment & Heritage
Internet: www.environment.nsw.gov.au
Phone: (02) 9995 500
Email: info@envrionment.nsw.gov.au

Subsidence Advisory Board
Internet: www.subsidenceadvisory.nsw.gov.au
Phone: (02) 4908 4300
Email: sa-mail@finance.nsw.gov.au

National Parks and Wildlife Service
Internet: www.nationalparks.nsw.gov.au
Phone: 13000 72757
Email: info@environment.nsw.gov.au

Environment Protection Authority
Internet: www.epa.nsw.gov.au
Phone: 131 555
Email: info@epa.nsw.gov.au

NSW Office of Water
Internet: www.water.nsw.gov.au
Phone: 1800 353 104
Email: water.enquiries@dpi.nsw.gov.au

Roads and Maritime Services
Internet: www.rms.nsw.gov.au

Appendix 2

Secretary's Environmental Assessment Requirements and Requirements of the Consulted Government Agencies

Planning and Assessments
Energy, Industry and Compliance
Contact: Joel Herbert
Phone: 8289 6614
Email: Joel.herbert@planning.nsw.gov.au

Mr Jim Lawler
Groundwork Plus Pty Ltd
PO Box 1779
Milton QLD 4064
Via email: jlawler@groundwork.com.au

15 January 2021

Dear Mr Lawler

Planning Secretary's Environmental Assessment Requirements
North Star Quarry (EAR 1494)

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 proposed 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 as it requires additional statutory authorisations. 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 also require separate 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 and Energy 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,



Lauren Evans
A/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 1494
Proposal	Extraction and processing of up to 490,000 tonnes of hard rock per annum over a 15 year period
Location	5535 North Star Road, North Star, NSW 2408 (Lot 7 DP755984, Lot 1 DP1227212)
Applicant	Regional Quarries Australia Pty Ltd
Date of Issue	15 January 2021
Date of Expiry	15 January 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 suitable monitoring and reporting procedure to ensure that the total resource extracted by the development does not exceed 5 million tonnes; • 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 *Gwydir Local Environmental Plan 2013* and any relevant development control plans/strategies, including the New England North West Regional Plan 2036.

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
	Gwydir Local Environmental Plan 2013
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)
	Guidelines for Controlled Activities on Waterfront Land 2018 (NRAR) (Waterfront land only)
Flooding	Floodplain Development Manual (OEH)
	Floodplain Risk Management Guideline (OEH)
Biodiversity	

	Biodiversity Assessment Method (DPIE 2020)
	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 & Blasting	
	NSW Noise Policy for Industry (EPA)
	Interim Construction Noise Guideline (EPA)
	NSW Road Noise Policy (EPA)
	Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC)
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 2006 (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

Our ref: DOC20/753875-2
Senders ref: EAR no.1494

Mr Joel Herbert
Environmental Assessment Officer
Energy and Resource Assessments
Planning and Assessment Group

Joel.Herbert@planning.nsw.gov.au

Dear Joel,

Subject: Environmental Assessment Requirements (EAR)1494 North Star Hard Rock Quarry

I refer to your email dated 9 September 2020 seeking input from the Biodiversity and Conservation Division (BCD) into the Department of Planning, Industry and Environment's Environmental Assessment Requirements (EARs) for the preparation of an Environmental Impact Assessment (EIS) for North Star Hard Rock Quarry project.

BCD understands that the proposal is to establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five years to service the Inland Rail Project, associated road upgrade projects, and then 150,000 t/yr for a period of 10 years to service the market in the local area. A maximum of 2,450,000 t would be extracted over the 15-year life of the quarry.

BCD has considered your request and provides standard EARs for the proposed development in **Attachments A** and **B**.

BCD recommends the EIS needs to appropriately address the following:

1. Biodiversity and offsetting
2. Water and soils
3. Flooding

Please note that as of 1 July 2020 Aboriginal cultural heritage responsibilities previously performed by BCD have been transferred to the Heritage Division of the Department of Premier and Cabinet. Any questions or requests for formal Aboriginal cultural heritage assessment requirements should be directed to heritagemailbox@environment.nsw.gov.au , phone 02 9873 8500 or mail Heritage NSW, Department of Premier and Cabinet, Locked Bag 5020 Parramatta NSW 2124.

If you have any questions about this advice, please do not hesitate to contact Helen Knight, Conservation Assessment Data Officer, via helen.knight@environment.nsw.gov.au or (02) 6883 5327

Yours sincerely,



Samantha Wynn
Senior Team Leader Planning North West
Biodiversity and Conservation Division

17 September 2020

Attachment A - Environmental Assessment Requirements

Attachment B - Guidance Material

BCD's Recommended Environmental Assessment Requirements (EARs) for North Star Hard Rock Quarry

OEH	Office of Environment and Heritage (now Biodiversity and Conservation Division)
BCD	Biodiversity and Conservation Division of the NSW Department of Planning, Industry and Environment, formerly OEH
The Department	NSW Department of Planning, Industry and Environment
NPWS	National Parks and Wildlife Service

1. The Proposal

All components of the proposed development must be clearly described, including:

- the location of the proposed development and its context in the locality
- the rationale for the project
- the size, scale and type of the proposed development
- the pre-construction, construction, operational, and, where relevant, decommissioning phases of the proposed development, and the methods proposed to implement these phases
- plans and maps of the proposed development showing the locations of relevant phases and infrastructure
- the staging and timing of the proposed development
- the proposed development's relationship to any other proposals and developments

2. Environmental Impacts of the Proposal

The proponent must consider, assess, quantify and report on the likely environmental impacts of the proposal if applicable, particularly:

- Biodiversity
- National Park estate: land reserved or acquired under the *National Parks and Wildlife Act 1974*
- Flooding, floodplain issues and coastal erosion
- Cumulative impacts

The Secretary's Environmental Assessment Requirements 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 and reference material is presented in **Attachment 2**. Appropriate justification should be provided in instances where the matters below are not addressed.

3. Biodiversity

Biodiversity Assessment Methodology for the Biodiversity Offsets Scheme (BOS)

The EIS should include an assessment of the following:

a. The EIS must assess the impact 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 and document how the proposed development exceeds, or does not exceed, the biodiversity offsets scheme threshold as set out in Section 7.4 of the BC Act 2016 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 exceeds the thresholds** listed under Clause 7.23 of the BC Regulation, **or**

      ii. The clearing of native vegetation, or other action, **on land included on the Biodiversity Values Map** published under Clause 7.23 of the BC Regulation (this map includes areas of outstanding biodiversity value, as declared under Section 3.1 of the BC Act).

   b. If the proposal does not trigger any of the criteria in (a) above, then the EIS must determine whether the proposed development is likely to have a significant impact based on '*the test for determining whether proposed development likely to significant affect threatened species or ecological communities'* in Section 7.3 of the BC Act.

   c. Where there is reasonable doubt regarding potential impacts, or where information is not available, then a significant impact upon biodiversity should be considered likely when applying the test in Section 7.3 of the BC Act. Where it is concluded that there is no significant impact, the EIS must justify how the conclusion has been reached.

   d. If the development exceeds the thresholds in (a) or (b), then the EIS must be accompanied by a biodiversity development assessment report (BDAR) prepared in accordance with Part 6 of the BC Act. That is, the Biodiversity Assessment Methodology applies.

Required Information

Where development is considered "likely to significantly impact on threatened species" and a Biodiversity Development Assessment Report is required, the following requirements apply:

- Biodiversity impacts related to the proposal are to be assessed in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method.
- The BDAR must document the application of the avoid, minimise and offset hierarchy including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.
- The BDAR must include details of the measures proposed to address the offset obligation as follows:
  - The total number and classes of biodiversity credits required to be retired for the proposal.
  - The number and classes of like-for-like biodiversity credits proposed to be retired.
  - The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.
  - Any proposal to fund a biodiversity conservation action.
  - Any proposal to make a payment to the Biodiversity Conservation Fund.

- If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.

The BDAR must be prepared by a person accredited to apply the Biodiversity Assessment Method under s6.10 of the *Biodiversity Conservation Act 2016*.

Where a BDAR is not required and a threatened species assessment is prepared to support a conclusion of "no significant impact", the EIS must include a field survey of the site, conducted and documented in accordance with the relevant guidelines including the Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW, 2009), Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004) and Guidelines for Threatened Species Assessment (Dept Planning, July 2005). The approach should also reference the field survey methods and assessment information on the Department of Planning, Industry and Environment website including the Bionet Atlas, Threatened Species Profile and Bionet Vegetation Classification (see Attachment 2).

4. NPWS Managed Estate

Land reserved or acquired under the *National Parks and Wildlife Act 1974* (NPW Act)

If the proposed development is within, adjacent to, or in close proximity to, NPWS managed conservation estate (e.g. a national park, nature reserve, state conservation area, land which is declared wilderness under the *Wilderness Act 1987*), or is within, adjacent to, or in close proximity to, a watercourse that flows directly into NPWS managed conservation estate, then the EIS must address impacts upon such area/s.

Where NPWS managed estate is likely to be impacted, the EIS should include:

- The following (as appropriate):
    - Evidence that the proponent has consulted with BCD on the legal permissibility of the proposal under the NPW Act.
    - In the case of proposals on land declared as wilderness under the *Wilderness Act 1987*, evidence that the proponent has consulted with BCD on the appropriateness of the proposal. That is, whether it is consistent with the objects of the *Wilderness Act 1987* (section 3) and the management principles for wilderness areas (section 9).
    - Alternative options that have been explored to avoid impacts on the NPWS managed estate (on-park) and a clear justification of any on-park components of the proposal.
    - If on-park impacts are considered unavoidable, consideration of the issues, including details of any compensation proposal, consistent with the Department's *Revocation, Recategorisation and Road Adjustment Policy* (2012) for proposals that are located wholly or partly in a National Park or other land acquired or reserved under the *National Parks and Wildlife Act 1974*.
- Consideration of the matters identified in the *Guidelines for developments adjoining land managed by the Office of Environment & Heritage* (OEH 2013) where a proposal adjoins or is immediate vicinity of NPWS managed estate, or is upstream of NPWS managed estate, which include:
    - The nature of the impacts, including direct and indirect impacts
    - The extent of the direct and indirect impacts
    - The duration of the direct and indirect impacts
    - The objectives of the reservation of the land
- A description of the mitigation and management options that will be used to prevent, control, abate or minimise identified direct and indirect impacts associated with the proposal. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

5. Water

- The EIS must map features relevant to water, including:
  - Rivers, streams, estuaries (as described in s4.2 of the Biodiversity Assessment Method)
  - Wetlands (as described in s4.2 of the Biodiversity Assessment Method)
  - Groundwater
  - Groundwater dependent ecosystems
- The EIS must describe background conditions for any water resource likely to be affected by the proposal, including:
  - Existing surface and groundwater
  - Hydrology
  - Water Quality Objectives (as endorsed by the NSW Government) including groundwater as appropriate that represent the community's uses and values for the receiving waters. Indicators and trigger values/criteria for the identified environmental values in accordance with the ANZECC (2000) *Guidelines for Fresh and Marine Water Quality* and / or local objectives, criteria or targets endorsed by the NSW Government
  - *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (OEH/EPA, 2017)
- The EIS must assess the impacts of the proposal on water quality, including:
  - The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the proposal protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.
  - Identification of proposed monitoring of water quality.
- The EIS must assess the impact of the proposal on hydrology, including:
  - Water balance including quantity, quality and source.
  - Effects upon rivers, wetlands, estuaries, marine waters and floodplain areas.
  - Effects upon water-dependent fauna and flora including groundwater dependent ecosystems.
  - Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).
  - Changes to environmental water availability, both regulated / licensed and unregulated / rules-based sources of such water.

6. Flooding

- The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:
  - Flood prone land (ie land susceptible to the probable maximum flood event).
  - Flood planning area, the area below the flood planning level.
  - Hydraulic categorisation (floodway and flood storage areas).
  - Flood hazard.
- The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 10% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.

- The EIS must model the effect of the proposal (including fill) on the current flood behaviour for a range of design events as identified above, and the 0.5% AEP and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.
- All site drainage, stormwater quality devices and erosion / sedimentation control measures should be identified in the EIS and the onsite treatment of stormwater and effluent runoff and predicted stormwater discharge quality from the proposal should be detailed.
- Modelling in the EIS must consider and document:
    - Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.
    - The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood (PMF), or an equivalent extreme flood.
    - Impacts of the proposal on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.
    - Impacts of earthworks and stockpiles within the flood prone land up to the PMF level. The assessment should be based on understanding of cumulative flood impacts of construction and operational phases.
    - Relevant provisions of the NSW Floodplain Development Manual 2005.
- The EIS must assess the impacts on the proposal on flood behaviour, including:
    - Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
    - Consistency with Council floodplain risk management plans.
    - Consistency with any Rural Floodplain Management Plans.
    - Compatibility with the flood hazard of the land.
    - Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
    - Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
    - Whether there will be a direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
    - Appropriate mitigation measures to offset potential flood risk arising from the proposal. Any proposed mitigation work should be modelled and assessed on the overall catchment basis in order to ensure it fits its purpose and meets the criteria of the Council where it is located, and to ensure it has no adverse impact to surrounding areas.
    - Any impacts the proposal may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.
    - Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.
    - Emergency management, evacuation and access, and contingency measures for the proposal during both construction and operational phases considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.
    - Any impacts the proposal may have on the social and economic costs to the community as a consequence of flooding.

ATTACHMENT B

Guidance Material

Title	Web address
Relevant Legislation	
Biodiversity Conservation Act 2016	https://www.legislation.nsw.gov.au/#/view/act/2016/63/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
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 Values Map	https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap
Biodiversity Assessment Method (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf
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
Ancillary rules: Biodiversity conservation actions	http://www.environment.nsw.gov.au/resources/bcact/ancillary-rules-biodiversity-actions-170496.pdf
Ancillary rules: Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying the variation rules	http://www.environment.nsw.gov.au/resources/bcact/ancillary-rules-reasonable-steps-170498.pdf
Ancillary rules: Impacts on threatened species excluded from application of the variation rules	http://www.environment.nsw.gov.au/resources/bcact/ancillary-rules-impacts-on-threatened-entities-excluded-from-variation-170497.pdf
The Departments Threatened Species Profiles	http://www.environment.nsw.gov.au/threatenedspeciesapp/
BioNet Atlas	http://www.environment.nsw.gov.au/wildlifeatlas/about.htm
BioNet Vegetation Classification	http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx

Title	Web address
NSW Guide to Surveying Threatened Plants (OEH, 2016)	http://www.environment.nsw.gov.au/research-and-publications/publications-search/nsw-guide-to-surveying-threatened-plants
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians (DECC, 2009)	www.environment.nsw.gov.au/resources/Threatenedspecies/09213amphibians.pdf
Threatened Species Assessment Guideline - The Assessment of Significance (DECC 2007)	www.environment.nsw.gov.au/resources/Threatenedspecies/tsaguide07393.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Fisheries NSW policies and guidelines	http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation
National Park Estate	
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm
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
List of aquatic reserves	www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/mpa
List of marine parks	www.mpa.nsw.gov.au/contact.html
Water	
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
Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions	http://www.environment.nsw.gov.au/research-and-publications/publications-search/risk-based-framework-for-considering-waterway-health-outcomes-in-strategic-land-use-planning
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 Pollutants in New South Wales (DEC 2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Title	Web address
Flooding	
Floodplain Development Manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Floodplain Risk Management Guidelines	http://www.environment.nsw.gov.au/topics/water/coasts-and-floodplains/floodplains/floodplain-guidelines
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

Joel Herbert

From: Lands Ministerials Mailbox
Sent: Monday, 14 September 2020 8:20 AM
To: Joel Herbert
Subject: Re: Request for Requirements - EAR 1494 - North Star Quarry

Hi Joel

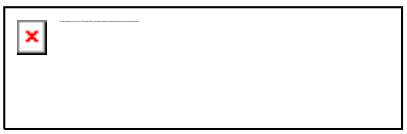
Crown Lands has no comments for this proposal as no Crown ladn is affected.

Thanks
Kirstyn

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, 437 Hunter Street Newcastle NSW 2295
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: Wednesday, 9 September 2020 10:56 AM
To: DPE PSVC Western Region Mailbox <westernregion@planning.nsw.gov.au>; 'records@rfs.nsw.gov.au' <records@rfs.nsw.gov.au>; OLG - Gwydir Shire Council <mail@gwydir.nsw.gov.au>; DPI Landuse Ag Mailbox <landuse.ag@dpi.nsw.gov.au>; Resources Regulator <nswresourcesregulator@service-now.com>; OEH HD Heritage Mailbox <HERITAGEMailbox@environment.nsw.gov.au>; EPA Planning Matters Mailbox <planning.matters@epa.nsw.gov.au>; DPI AHP Central Mailbox <ahp.central@dpi.nsw.gov.au>; Lands Ministerials <lands.ministerials@industry.nsw.gov.au>; DRG RO Assessment Coordination Mailbox <assessment.coordination@planning.nsw.gov.au>; Planning Matters Mailbox <planning.matters@environment.nsw.gov.au>; Development Northern <development.northern@rms.nsw.gov.au>; DPI Cabinet Mailbox <dpi.cabinet@dpi.nsw.gov.au>; DPI Landuse Enquiries Mailbox <landuse.enquiries@dpi.nsw.gov.au>
Subject: Request for Requirements - EAR 1494 - North Star Quarry

Good morning,

Proposal – North Star Hard Rock Quarry
EAR ID No. 1494

Groundwork Plus Pty Ltd on behalf of Regional Quarries Australia 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 Gwydir local government area.

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 **Wednesday 23 September 2020.**

Please note that the proposal seeks to extract Hard Rock from a total resource of 2,450,000 million tonnes at a maximum rate of 490,000 tonnes per annum for up to 15 years.

If you have any queries, please contact me on the details below.

Joel Herbert
Environmental Assessment Officer
Energy and Resource Assessments
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

OUT20/11488

23/09/2020

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

Dear Joel,

SEAR's Request – North Star Quarry - Gwydir Shire EAR ID No. 1494

Thank you for the opportunity to provide Environmental Assessment Requirements (EAR) for the above proposal as per your correspondence dated 9 September 2020.

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 post extraction.

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

Should you require clarification on any of the information contained in this response, please contact myself by e-mail andrew.scott@dpi.nsw.gov.au .

Yours sincerely

Andrew Scott
Agricultural Land Use Planning

Attachment 1: SEARs Recommendations

Issue and desired outcome	Detail / Requirement
Site Suitable for development	• Include a map to scale showing the above operational and infrastructure details including separation distances from sensitive receptors.
Consideration for impacts to agricultural resources and land	• Describe the current and potential Strategic and/or *Important Agriculture Land* on the proposed development site and surrounding locality including the land capability and agricultural productivity. • Demonstrate that all significant impacts on current and potential agricultural developments and resources can be reasonably avoided or adequately mitigated. • Consider cumulative effects of Quarries in the area on agricultural enterprises and landholders. • Detail the expected life span of the proposed development
Suitable and secure water supply	• Estimated water demand and water availability should be clearly outlined in the proposal. • Outline any impacts to water use for agriculture and mitigation measures if required.
Biosecurity Standards met	• Biosecurity risks and management measures relating to the potential for spread of pests, diseases or weeds in the project area, in accordance with the 'general biosecurity duty' under the Biosecurity Act 2015. • Develop a management plan for weeds Including monitoring and mitigation measures (particularly for any soil stockpiles to be used for future rehabilitation) and adjacent roadsides (to avoid spreading weeds off site).
Visual amenity achieved	• Amenity impacts are assessed and any necessary response to mitigate visual impacts is described and illustrated.
Land stewardship met	• Develop Rehabilitation and Decommissioning/Closure Plans that describes the design criteria of the final land use and landform along with the expected timeline for the rehabilitation program. • Outline monitoring and mitigation measures to be adopted for rehabilitation remedial actions.
Adequate Consultation with surrounding rural community to prevent future land use conflict	• Consult with the owners / managers of affected and adjoining neighbours and agricultural operations in a timely and appropriate manner about; the proposal, the likely impacts and suitable mitigation measures. • Consultation program needs to consider and avoid key periods for Agricultural activities such as Harvest, Sowing, Sales and Holiday periods. • Establish a complaints register that includes reporting and investigating procedures and timelines, and liaison with Council in relation to complaint issues.

Attachment 2: Guidelines to assist development of plans and their assessment

Title	Location
Agricultural Issues for Extractive industry Development	https://www.dpi.nsw.gov.au/agriculture/lup/development-assessment2/extractive-industries
Infrastructure proposals on rural land	https://www.dpi.nsw.gov.au/agriculture/lup/development-assessment2/infrastructure-proposals

Joel Herbert

From: David Ward
Sent: Wednesday, 9 September 2020 12:33 PM
To: Joel Herbert
Subject: FW: Request for Requirements - EAR 1494 - North Star Quarry
Attachments: North Star Quarry_SEARs Request.pdf

Hi Joel,

Thank you for your request for EARs. This site is located several kilometres from Key Fish Habitat. Fisheries don't have any environmental assessment requirements.

Cheers
David

David Ward | Fisheries Manager
DPI Fisheries - Aquatic Environment
Department of Primary Industries
4 Marsden Park Road | Calala NSW 2340
T: +61 2 6763 1255 | M: +61 (0) 0429 908 856
E: david.ward@dpi.nsw.gov.au
W: www.dpi.nsw.gov.au

From: DPI AHP Central Mailbox <ahp.central@dpi.nsw.gov.au>
Sent: Wednesday, 9 September 2020 11:16 AM
To: David Ward <david.ward@dpi.nsw.gov.au>
Subject: FW: Request for Requirements - EAR 1494 - North Star Quarry

Jane Gordois | Administrative Assistant
Solitary Islands Marine Park | Fisheries Compliance
NSW Department of Primary Industries | Fisheries
36 Marina Drive | Coffs Harbour | NSW 2450
T: +61 2 6691 0600 | M: 0429 135 230 | E: jane.gordois@dpi.nsw.gov.au



From: Joel Herbert <Joel.Herbert@planning.nsw.gov.au>
Sent: Wednesday, 9 September 2020 10:56 AM
To: DPE PSVC Western Region Mailbox <westernregion@planning.nsw.gov.au>; 'records@rfs.nsw.gov.au' <records@rfs.nsw.gov.au>; OLG - Gwydir Shire Council <mail@gwydir.nsw.gov.au>; DPI Landuse Ag Mailbox <landuse.ag@dpi.nsw.gov.au>; Resources Regulator <nswresourcesregulator@service-now.com>; OEH HD Heritage

Mailbox <HERITAGEMailbox@environment.nsw.gov.au>; EPA Planning Matters Mailbox <planning.matters@epa.nsw.gov.au>; DPI AHP Central Mailbox <ahp.central@dpi.nsw.gov.au>; Lands Ministerials <lands.ministerials@industry.nsw.gov.au>; DRG RO Assessment Coordination Mailbox <assessment.coordination@planning.nsw.gov.au>; Planning Matters Mailbox <planning.matters@environment.nsw.gov.au>; Development Northern <development.northern@rms.nsw.gov.au>; DPI Cabinet Mailbox <dpi.cabinet@dpi.nsw.gov.au>; DPI Landuse Enquiries Mailbox <landuse.enquiries@dpi.nsw.gov.au>
Subject: Request for Requirements - EAR 1494 - North Star Quarry

Good morning,

Proposal – North Star Hard Rock Quarry
EAR ID No. 1494

Groundwork Plus Pty Ltd on behalf of Regional Quarries Australia 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 Gwydir local government area.

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 **Wednesday 23 September 2020.**

Please note that the proposal seeks to extract Hard Rock from a total resource of 2,450,000 million tonnes at a maximum rate of 490,000 tonnes per annum for up to 15 years.

If you have any queries, please contact me on the details below.

Joel Herbert
Environmental Assessment Officer
Energy and Resource Assessments
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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Our reference: : SF20/85953; DOC20/742495-1
Contact: : Rebecca Scrivener – 02 6773 7000 – armidale@epa.nsw.gov.au
Date : 21 September 2020

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

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

Attention: Joel Herbert **BY EMAIL**

Dear Mr Herbert,

RE: North Star Quarry (EAR 1494) – Request for Input into Secretary's Environmental Assessment Requirements (SEARs)

I refer to your request for the Environment Protection Authority's (EPA) requirements for the environmental assessment (EA) regarding the above proposal received by EPA on Wednesday 9 September 2020.

The EPA has considered the details of the proposal as provided by the Department of Planning, Industry and Environment (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. **Noise and Vibration -** Proximity to sensitive receptors and impacts of any sources associated with the project, including operational noise and blasting;

2. **Air -** Dust generation and management of potential impacts on adjacent landscape and/or communities;

3. **Water and Soils -** Water balance, water management systems and the implementation of adequate erosion and sediment controls to control runoff from the quarry.

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

Based on the information provided to the EPA, the proponent will require an Environment Protection Licence to construct and operate the proposed quarry if approval is granted. The proponent will need to make a separate application to the EPA at the completion of the assessment process. General information on licence requirements can be obtained from the EPA's Environment Line by calling 131 555 or on the EPA's website at www.epa.nsw.gov.au/licensing/licencePOEO.htm.

To assist the EPA in assessing the EA it is requested that the EA document follow the format of DPIE's EIS guidelines and addresses the EPA's specific requirements outlined in the following attachments.

If the necessary information is not adequately addressed in the EA then delays in the development assessment process may occur.

The Proponent should be made aware that any commitments made in the Environmental Assessment (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.

The EPA requests that the proponent provide one (1) electronic copy of the EA when lodging it application with the EPA. These documents should be sent to the EPA's Armidale office by email to: armidale@epa.nsw.gov.au.

Please contact myself on (02) 6773 7000 or by email to armidale@epa.nsw.gov.au if you wish to discuss this matter further.

Yours sincerely,



REBECCA SCRIVENER
Head Regional Operations Unit - Regulatory Operations

ATTACHMENT A: Environmental Assessment Requirements – EAR 1494

1. Environmental impacts of the project

1.1. The EA must address the requirements of Section 45 of the Protection of the Environment Operations Act 1997 (POEO Act) by determining the extent of each impact and providing sufficient information to enable the EPA to determine appropriate conditions, limits and monitoring requirements for an Environment Protection Licence (EPL).

1.2. Impacts related to the following environmental issues need to be assessed, quantified and reported on:

- **Air Issues**: air quality including dust generation from the operation on the surrounding landscape and/or community;
- **Noise and vibration impacts** associated with blasting, and operational noise particularly machinery and plant movements;
- **Waste** including hazardous materials and radiation. Consideration needs to be given to disposal options for general waste, sanitary waste as well as hazardous materials and radiation, where relevant.
- **Water and Soils** including site water balance and sediment and erosion controls during construction and operation phases.

The Environmental Assessment (EA) should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned.

2. Licensing requirements

2.1. The development is a scheduled activity under the *Protection of the Environment Operations Act 1997* (POEO Act) and will therefore require an Environment Protection Licence (EPL) if approval is granted.

2.2. Should project approval be granted, the proponent will need to make an application to the EPA for its EPL for the proposed facility prior to undertaking any on site works. Additional information is available through the *EPA Guide to Licensing* document (www.epa.nsw.gov.au/licensing/licenceguide.htm).

SPECIFIC ISSUES

3 Air issues

3.1. The EA must demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations (POEO) Act (1997)* and the *POEO (Clean Air) Regulation (2002)*. Particular consideration should be given to section 129 of the POEO Act concerning control of "offensive odour".

3.2. The EA must include an air quality impact assessment (AQIA).

3.3. The AQIA must be carried out in accordance with the document, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005) http://www.epa.nsw.gov.au/resources/air/ammodelling05361.pdf.

3.4. The EA must detail emission control techniques/practices that will be employed at the site and identify how the proposed control techniques/practices will meet the requirements of the POEO Act, *POEO (Clean Air) Regulation* and associated air quality limits or guideline criteria.

4. Noise and Vibration

The EA must assess the following noise and vibration aspects of the proposed development

4.1. Construction noise associated with the proposed development should be assessed using the *Interim Construction Noise Guideline (*DECC, 2009). These are available at:https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/interim-construction-noise-guideline

4.2. Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in the *Assessing Vibration: a technical guideline* (DEC, 2006). These are available at: https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/assessing-vibration

4.3. If blasting is required for any reasons during the construction or operational stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in *Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990).These are available at: https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/interim-construction-noise-guideline

4.4. Operational noise from all industrial activities (including private haul roads and private railway lines) to be undertaken on the premises should be assessed using the guidelines contained in the *NSW Noise Policy for Industry* (EPA, 2017). https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-(2017)

4.5. Noise on public roads from increased road traffic generated by land use developments should be assessed using the guidelines contained in the *NSW Road Noise Policy* and associated application notes (EPA, 2011).https://www.epa.nsw.gov.au/your-environment/noise/transport-noise

5. Waste, chemicals and hazardous materials and radiation

5.1. The EA must assess all aspects of waste generation, management and disposal associated with the proposed development.

5.2. The EA must demonstrate compliance with all regulatory requirements outlined in the POEO Act and associated waste regulations.

5.3. The EA must identify, characterise and classify the following in accordance with the EPA's *Waste Classification Guidelines (2014)* and associated addendums:

(i) all waste that will be generated onsite through excavation, demolition or construction activities, including proposed quantities of the waste;

(ii) all waste that is proposed to be disposed of to an offsite location, including proposed quantities of the waste and the disposal locations for the waste. This includes waste that is intended for re-use or recycling.

Note: The EPA's W*aste Classification Guidelines (2014)* and associated addendums are available at: https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste

5.4. The EA must outline contingency plans for any event that may result in environmental harm, such as excessive stockpiling of material, or dirty water volumes exceeding the storage capacity available on-site.

5.5. The EA must demonstrate that appropriate spill containment will be provided for storage, filling and loading of all fuels and other chemicals to be used on site, in accordance with the relevant Australian Standard.

6. Water

6.1. The EA must demonstrate how the proposed development will meet the requirements of section 120 of the POEO Act.

6.2. The EA must include a water balance for the development including 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.

6.3. If the proposed development intends to discharge waters to the environment, the EA must demonstrate how the discharge(s) will be managed in terms of water quantity, quality and frequency of discharge and include an impact assessment of the discharge on the receiving environment. This should include:

- Description of the proposal including position of any intakes and discharges, volumes, water quality and frequency of all water discharges.

- Description of the receiving waters including upstream and downstream water quality as well as any other water users.

- Demonstration that all practical options to avoid discharge have been implemented and environmental impact minimised where discharge is necessary.

6.4. The EA must refer to Water Quality Objectives for the receiving waters and indicators and associated trigger values or criteria for the identified environmental values of the receiving environment. This information should be sourced from the ANZECC (2000) Guidelines for Fresh and Marine Water Quality (http://www.environment.gov.au/water/policy-programs/nwqms/).

6.5. The EA must describe how stormwater will be managed in all phases of the project, including details of how stormwater and runoff will be managed to minimise pollution. Information should include measures to be implemented to minimise erosion, leachate and sediment mobilisation at the site. The EA should consider the guidelines *Managing urban stormwater: soils and construction,* vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC, 2008).

6.6. The EA must describe any water quality monitoring programs to be carried out at the project site. Water quality monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutant in NSW* (2004) which is available at: http://www.epa.nsw.gov.au/resources/legislation/approvedmethods-water.pdf.

Our reference: DOC20/745656
Date: 24 September 2020

HERITAGE NSW – Aboriginal Cultural Heritage - SEARs

Project Name: North Star Hard Rock Quarry
EAR ID #: 1494

1. The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigation in NSW (OEH 2010), and be guided by the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales (DECCW 2011).
2. Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.
3. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to Heritage NSW.
4. The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the ACHAR.
5. The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts.
6. The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.

NOTE: The process described in the *Due Diligence Code of Practice for the protection of Aboriginal objects in NSW* (DECCW 2010) is not sufficient to assess the impacts on Aboriginal cultural heritage of Designated Development.

Level 6, 10 Valentine Ave Parramatta NSW 2150 ■ Locked Bag 5020 Parramatta NSW 2124
P: 02 9873 8500 ■ E: heritagemailbox@environment.nsw.gov.au

Our ref: DOC20/761338

Joel Herbert
Department of Planning, Industry and Environment
320 Pitt Street
SYDNEY NSW 2000

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

Dear Mr Herbert

Request for Secretary's Environmental Assessment Requirements (SEARS) for North Star Hard Rock Quarry (EAR 1494)

Thank you for your referral dated 9 September 2020 inviting SEARS input from the Heritage Council of NSW on the above 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 deposits. Therefore, no referral to the Heritage Council of NSW is required. The Department does not need to refer subsequent stages of this proposal to the Heritage Council of NSW.

Comments relating to Aboriginal cultural heritage (ACH) will be provided separately by our colleagues in the ACH regulation teams, Heritage NSW.

If you have any questions regarding the above advice, please contact Gary Hinder, A/Senior Heritage Assessment 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
24 September 2020

Regional NSW

Joel Herbert
Environmental Assessment Officer
Energy and Resource Assessments
Dept of Planning, Industry and Environment
4 Parramatta Square
Parramatta NSW 2124

Our ref: DOC20/756891
Your ref: EAR ID No.1494

Emailed: via planning portal

23 September 2020

Dear Mr Herbert

Subject: Proposal – North Star Hard Rock Quarry - EAR ID No.1494.

Thank you for the opportunity to provide advice on the above matter. This is a response from the NSW Department of Regional NSW – Mining, Exploration & Geoscience (MEG) – Geological Survey of NSW (GSNSW).

Hard rock (Basalt) aggregate is not a prescribed mineral under the Mining Act 1992. Therefore, MEG has no statutory role in authorising or regulating the extraction of this commodity. However, MEG is the principal government authority responsible for assessing the State's resources of construction materials and for advising state and local government on their planning and management.

MEG has reviewed the scoping report for the project (dated 8/9/2020) and notes that the size, scale and nature of the proposal has been outlined. MEG requests that the extent and quality of the resource is outlined within the EIS so that the resource assessment should:

- Document the size and quality of the resource and demonstrate that both have been adequately assessed; and
- Document the methods used to assess the resource and its suitability for the intended applications.

If deemed commercial-in-confidence, the resource assessment summary included in the EIS should commit to providing MEG with full resource assessment documentation separately.

MEG collects data on the quantity of construction materials produced annually throughout the state. Forms are sent to all operating quarries at the end of each financial year for this purpose. The statistical data collected is of great value to Government and industry in planning and resource management, particularly as a basis for analysing trends in production and for estimating future demand for particular commodities or in particular regions. Production data may be published in aggregated form, however production data for individual operations is kept strictly confidential.
In order to assist in the collection of construction material production data, the proponent should be required to provide annual production data for the subject site to MEG as a condition of any new or amended development consent.

MEG would appreciate the opportunity for early consultation in relation to the proposed location of any biodiversity offset areas (both on and off site) or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.

Queries regarding the above information should be directed to the GSNSW - Land Use team at landuse.minerals@geoscience.nsw.gov.au.

Yours sincerely,



Steven Palmer

Manager, Land Use Assessment

Geological Survey of NSW – Mining, Exploration & Geoscience.

Joel Herbert

From: Alan Bawden <Alan.Bawden@rfs.nsw.gov.au>
Sent: Thursday, 29 October 2020 11:51 AM
To: Joel Herbert
Subject: FW: Request for Requirements - EAR 1494 - North Star Quarry
Attachments: North Star Quarry_SEARs Request.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Good morning Joel

The NSW RFS has received and reviewed the attached document and your request below.

The NSW RFS previously provided EARs for this project in 2018, as follows.

> The quarry site is mapped bush fire prone land by Gwydir Shire Council. NSW RFS is also the primary response agency for structural fires.
>
> The NSW RFS considers that the environmental assessment for the development of a 'hard rock quarry' should address the following bush fire criteria:

- *the aim and objectives of 'Planning for Bush Fire Protection 2006';*
- *identification of potential ignition sources during construction and operation of the development;*
- *storage of fuels and other hazardous materials (e.g., explosives for blasting);*
- *proposed bush fire protection measures for the development, including vegetation management and fire suppression capabilities;*
- *operational access for fire fighting appliances to the site; and*
- *emergency and evacuation planning.*

The NSW RFS has no changes to that recommendation.

Regards

Alan Bawden
Team Leader - Development Assessment and Planning
Planning and Environment Services (North)
NSW RURAL FIRE SERVICE
51 Moonee Street Coffs Harbour
Locked Bag 17 GRANVILLE NSW 2142
p 02 66910400 e pes@rfs.nsw.gov.au
www.rfs.nsw.gov.au **www.facebook.com/nswrfs** **www.twitter.com/nswrfs**
PREPARE.ACT.SURVIVE

From: Joel Herbert <Joel.Herbert@planning.nsw.gov.au>
Sent: Wednesday, 9 September 2020 10:56 AM
To: DPE PSVC Western Region Mailbox <westernregion@planning.nsw.gov.au>; Records <Records@rfs.nsw.gov.au>; OLG - Gwydir Shire Council <mail@gwydir.nsw.gov.au>; DPI Landuse Ag Mailbox <landuse.ag@dpi.nsw.gov.au>; Resources Regulator <nswresourcesregulator@service-now.com>; OEH HD Heritage Mailbox <HERITAGEMailbox@environment.nsw.gov.au>; EPA Planning Matters Mailbox <planning.matters@epa.nsw.gov.au>; DPI AHP Central Mailbox <ahp.central@dpi.nsw.gov.au>; Lands Ministerials <lands.ministerials@industry.nsw.gov.au>; DRG RO Assessment Coordination Mailbox <assessment.coordination@planning.nsw.gov.au>; Planning Matters Mailbox

<planning.matters@environment.nsw.gov.au>; Development Northern <development.northern@rms.nsw.gov.au>; DPI Cabinet Mailbox <dpi.cabinet@dpi.nsw.gov.au>; DPI Landuse Enquiries Mailbox <landuse.enquiries@dpi.nsw.gov.au>
Subject: Request for Requirements - EAR 1494 - North Star Quarry

Good morning,

Proposal – North Star Hard Rock Quarry
EAR ID No. 1494

Groundwork Plus Pty Ltd on behalf of Regional Quarries Australia 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 Gwydir local government area.

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 **Wednesday 23 September 2020.**

Please note that the proposal seeks to extract Hard Rock from a total resource of 2,450,000 million tonnes at a maximum rate of 490,000 tonnes per annum for up to 15 years.

If you have any queries, please contact me on the details below.

Joel Herbert
Environmental Assessment Officer
Energy and Resource Assessments
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

NSW GOVERNMENT | Planning, Industry & Environment

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23 September 2020

File No: NTH18/00123/02
Your Ref: EAR 1494

Department Planning Industry & Environment
Energy and Resource Assessment
Locked Bag 5022
PARRAMATTA NSW 2134

Attention: Joel Herbert – Environmental Assessment Officer

Dear Sir / Madam,

RE: Secretary's Environmental Assessment Requirements (EAR 1494). North Star Quarry. Lot 7 DP 755984 & Lot 1 DP 1227212 - 5535 North Star Road, North Star.

I refer to your email of 9 September 2020 requesting input from Transport for NSW to the Secretary's Environmental Assessment Requirements (SEARs) for the abovementioned development proposal.

Roles and Responsibilities

From 1 December 2019, all functions and responsibilities of Roads and Maritime Services will now be vested in an integrated Transport for NSW (TfNSW). Our key interests are for the safety and efficiency of the transport network, the integrity of State infrastructure and the integration of land use and transport in accordance with *Future Transport Strategy 2056.*

North Star Road (RR7705) is an unclassified (Regional) road. Minilya Road and Croppa Creek Road are local roads. In accordance with Section 7 of the *Roads Act 1993* (the Act) Gwydir Shire Council is the Roads Authority for these roads. Council is responsible for setting standards, determining priorities and carrying out works.

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.

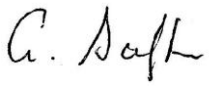
Transport for NSW Response

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**.

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 Greg Sciffer, Development Assessment Officer or the undersigned on (02) 6640 1362 or via email at: development.northern@rms.nsw.gov.au

Yours faithfully,



for Matt Adams
Manager Land Use Assessment Northern
Regional NSW and 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 23 September 2020.

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 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 proposed transport route/s identifying all public roads proposed to obtain access from the classified (State) road/s to the development, site access, intersections and transport related facilities.
- 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 proposed trips to be generated by the construction and operational 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 intersections along the proposed haulage routes and any constraint 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.

- 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.
- 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.
- Site plan demonstrating site access, internal manoeuvring, servicing and parking areas consistent with the relevant parts of AS2890 and Council requirements.
- Details of measures to address impacts and/or provide connections for 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 and dust generated along the proposed transport route/s.
- Details of any Traffic Management Plan (TMP) proposed to address the construction and operation phases of the proposed development. The TMP may include temporary measures such a Traffic Control Plan (TCP) 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 haulage 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.

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 (Regional) road/s is to be designed and constructed in accordance with the current Austroads Guidelines, Australian Standards and TfNSW Supplements.

Appendix 3

Coverage of Secretary's Environmental Assessment Requirements and Requirements of Consulted Government Agencies

Secretary's Environmental Assessment Requirements 1494 North Star Quarry

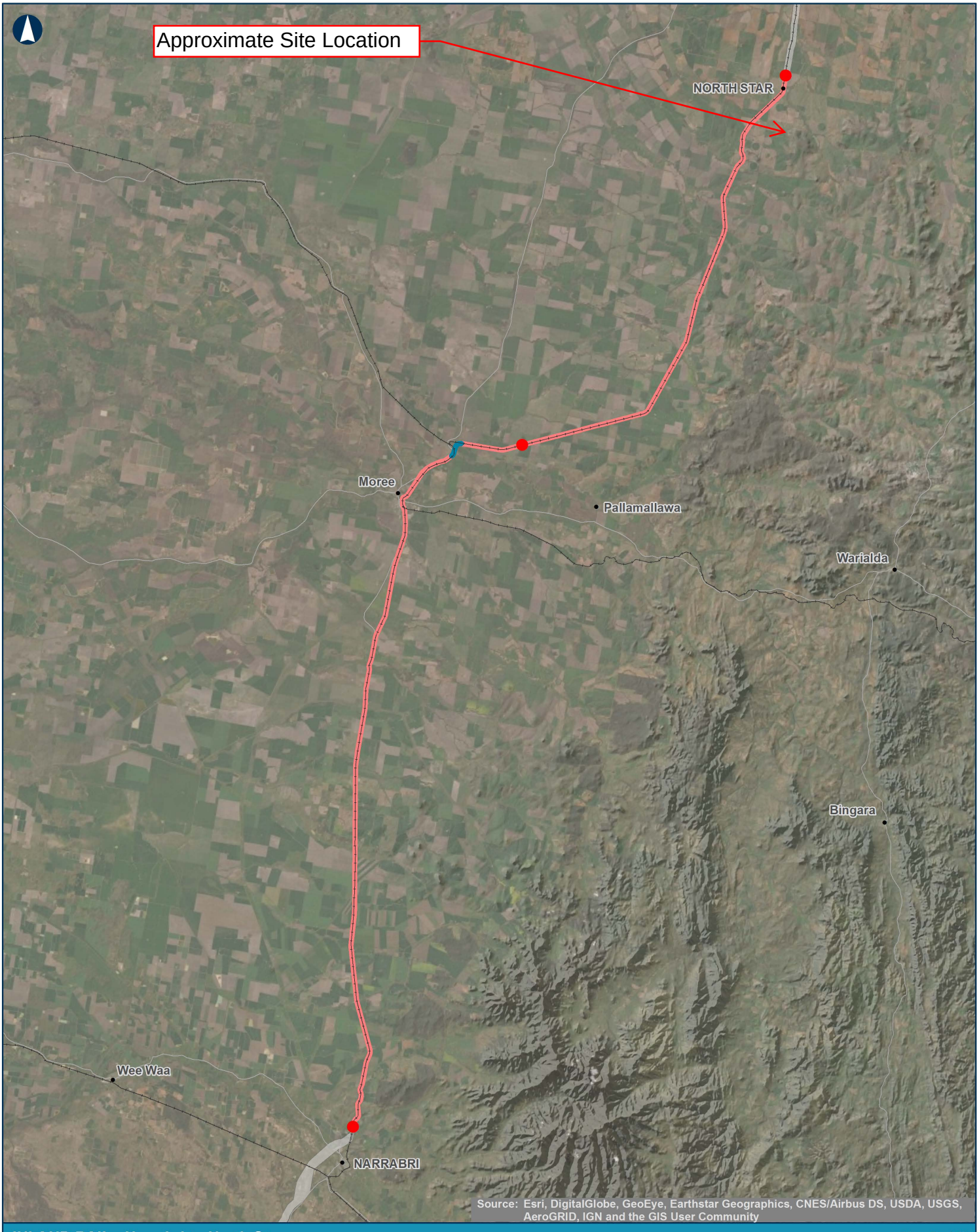
General Requirements	EIS Section
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. In particular, the EIS must include the following.	
an executive summary	Executive 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; • 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;	1 & 2 & 3 2.4 2.3 3 & 5 & 6 2.13 5 3.3 3.5 1.10
a suitable monitoring and reporting procedure to ensure that the total resource extracted by the development does not exceed 5 million tonnes	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	6
a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	Page ii
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.	1.9
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;	5.4

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;	5.4
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;	5.3
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;	5.5
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.	5.2
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;	5.6

Traffic & Access – 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;	5.1
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;	5.7
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;	5.9
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;	5.9
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;	5.8
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	5.10
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.	2.13
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 Gwydir Local Environmental Plan (LEP) 2013 including the New England North West Regional Plan 2036.	3

Appendix 4

ARTC Inland Rail Project Map



INLAND RAIL - Narrabri to North Star

Map 7 of 13

0 15 30 Km

Coordinate System: GDA 1994 MGA Zone 55

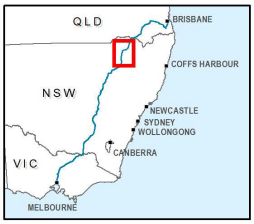
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Date: 12/12/2019
Author: IR GIS

Paper: A3
Scale: 1:500,000

Data Sources: Geoscience Australia

- Project boundaries
- New corridor
- Upgrade track within existing corridor
- Study area
- Other railway
- Road



INLAND RAIL

ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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FIGURE 1: OVERVIEW OF THE PROPOSAL

Appendix 5

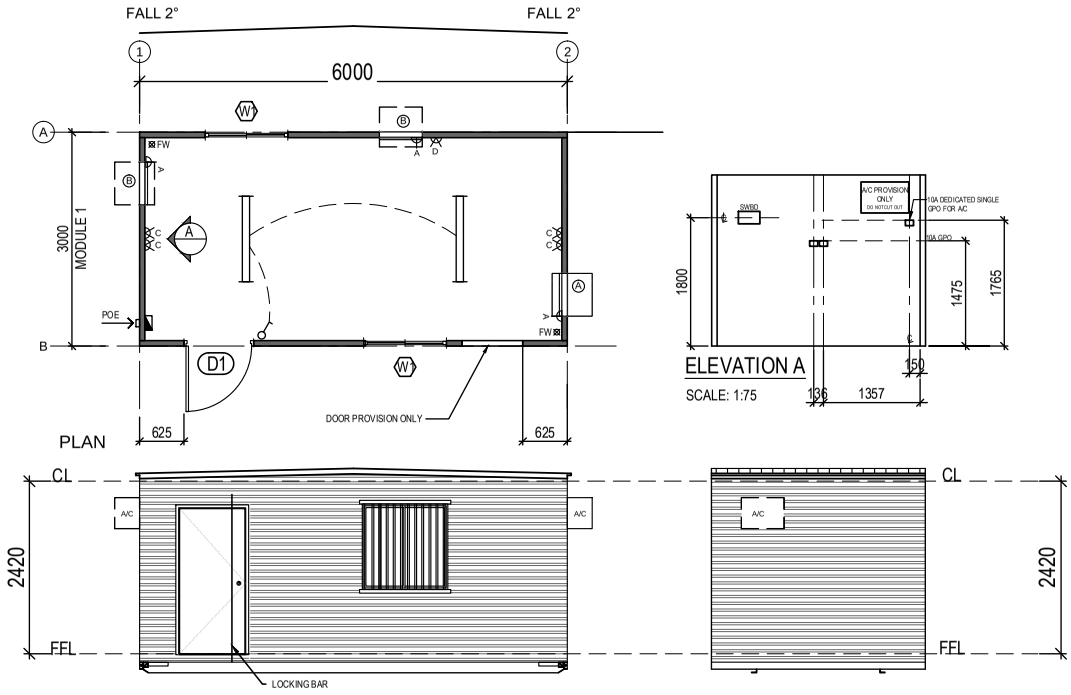
Site Office and Toilet

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



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

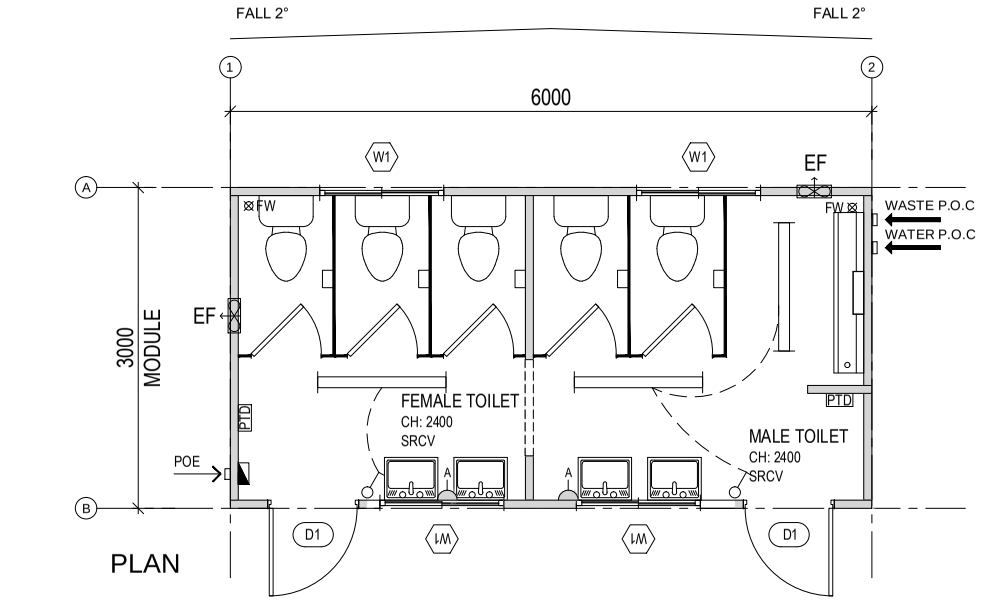
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DATE : 15.01.2018	TITLE : PLAN- GENERAL ARRANGEMENT	
DRAWN BY : TW		
CHECKED BY : DT	DRAWING NUMBER : MS-200108-101	BUILDING NUMBER : #0000
SCALE : SHOWN	QUOTATION NUMBER : 200108	REV : [1]

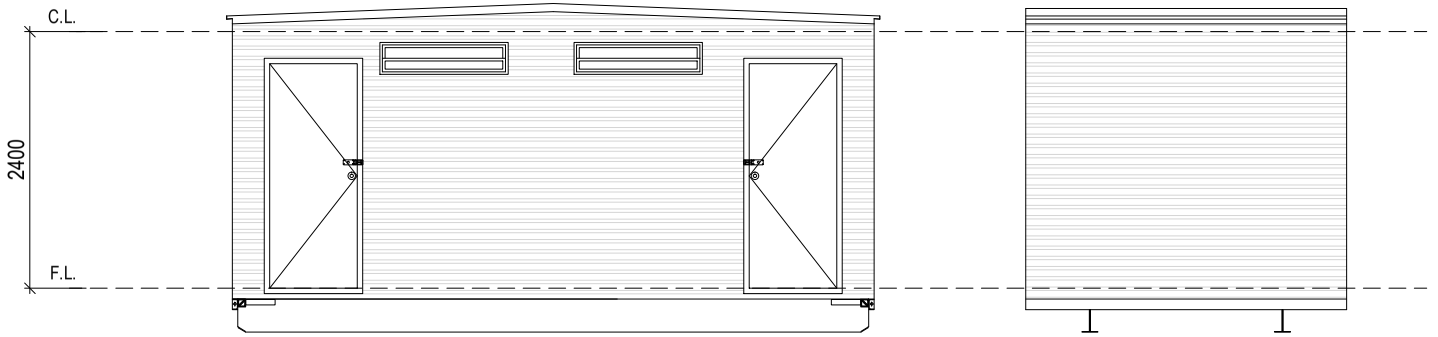
ISSUE	AMENDMENT	BY	DATE
1	FOR CONSTRUCTION	TW	15.01.2018

coateshire

DESIGN SPECIFICATION	
BASEFRAME / REFER BASEFRAME LAYOUTS FOR DETAILS	
BEARER	310 UB
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	10mm PLATE / Ø30mm HOLE
STEELWORK TREATMENT	PRIMED WITH RED OXIDE / FINISHED WITH BLACK ENAMEL
FLOOR FRAME / REFER BASEFRAME LAYOUTS FOR DETAILS	
JOISTS	C10015 @ 480 CENTRES
CAPPER	C10415
END JOIST	100 x 100 x 4mm SHS
FLOORING	
FLOOR SHEET	15mm TONGUE AND GROOVE PLYWOOD F11
FLOOR COVERING	2.0mm NON-SLIP VINYL - POLYSAFE HYDRO EVOLVE TIGRIS #4257
SKIRTING	100mm COVED VINYL
COMPLEXING	-
WATERPROOFING	NO
OTHER	DRY FLOOR WASTES
WALLS	
INTERNAL HEIGHT	2400mm
INTERNAL LINING	4mm POLYPLY PRE-FINISHED EMBOSSED PLYWOOD - GREY
INTERNAL TRIM	PVC D MOULD - WHITE (3 ROWS OF GREY SCREWS)
WALL INSULATION	-
EXTERNAL CLADDING	COLORBOND PANELRIB, LAID HORIZONTALLY - SURFMIST
EXTERNAL CORNER	HD 40x40x2.5mm D'GAL ANGLE
WALL FRAMES	
FRAMING	75 x 41 x 0.75mm G550 STEEL STUDS
STUD SPACING	400mm CTS
ROOF / CEILING	
CEILING TYPE	FLAT
CEILING LINING	4mm PRE-FINISHED PLYWOOD - MIRAGE PEARL
CEILING INSULATION	R 1.8 (75mm)
ROOF PITCH	2° CENTRE PITCH
ROOF CLADDING	TRIMDECK 0.42 BMT - ZINCALUME
ROOF INSULATION	-
UNDER BARGE FLASHING	ZINC
BARGE	WOODLAND GREY
GUTTER	-
DOWNPIPE	-
STEPDOWN FLASHING	30 x 60 STEP DOWN - WOODLAND GREY
ROOF / CEILING FRAMES	
FRAMING	75 x 41 x 0.75mm G550 STEEL STUDS
STUD SPACING	400mm CTS
ELECTRICS	
SPECIFICATION	TO AS3000, 3001, 3012(TO COATES HIRE PURCHASE SPECIFICATIONS)
S/W BOARD	P.O.E. LOCATED BEHIND SWITCHBOARD, POLY PLASTIC INTERNALLY MOUNTED SWITCHBOARD, 1800mm AFFL(TO CTR)



PLAN



TYPICAL FRONT ELEVATION

TYPICAL END ELEVATION

GENERAL ARRANGEMENT

SCALE: 1:50

ELECTRICAL LEGEND			
ITEM	DESCRIPTION	HEIGHT	QTY
EDB	ELECTRICAL DISTRIBUTION BOARD	-	1
POE	ELECTRICAL SUPPLY POINT OF ENTRY	1800 AFFL	1
	2x28W FLURO LIGHT DIFFUSED - SURFACE MOUNT	C/MNTD	3
	SINGLE LIGHT SWITCH	1300 AFFL	2
	SINGLE GPO - 10 AMP	1550 AFFL	2
EF	EXHAUST FAN	-	2

ITEMS & EQUIPMENT SCHEDULE		
TAG	QTY	DESCRIPTION
A	5	TOILET SUITE , DUAL FLUSH w/HASP & STAPLE
B	4	S/S HAND BASIN (H&C) PUSHBUTTON TYPE w/ MIRROR OVER
C	2	PAPER TOWEL DISPENSER (ROLL TYPE)
-	-	-
E	1	S/S URINAL - 1500
		NOTES:
		COATES SIGNS - 4 PER BUILDING @ TOP RIGHT CORNERS
		COATES ASSET TAGS - FIT BESIDE ENTRY DOOR @ LOCK
		WASTE OUTLET TO BE MIN. 70mm HIGHER THAN BOTTOM OF SKID
	5	TOILET CUBICLES IN WHITE

DOOR SCHEDULE												
TAG	SIZE	QTY	LOCATION	COLOUR	FURNITURE	LOCKING	KEYING	ARCHITRAVE	GLASS	CLOSER	STOP	NOTES
D1	2040 x 920mm	2	EXTERNAL	WHITE	KNOB	PASSAGE	-	PVC	-	STD	YES	REBATED EDGE; SECURITY - ZINC PLATED HASP & STAPLE, CABIN HOOK

WINDOW SCHEDULE											
TAG	SIZE H x W	QTY	LOCATION	HEIGHT	OPENING	COLOUR	KEYING	ARCHITRAVE	GLASS	BLINDS	NOTES
W1	280 x 1175mm	4	EXTERNAL	2020 AFFL	290 x 1190mm CUT-OUT	PEARL WHITE	-	PVC	OBS& PERMANENT VENT	-	TAPE & SILICON SEAL TOP SIDES.

PRELIMINARY ISSUE

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CLIENT APPROVAL

SIGNATURE:
NAME: .....
DATE: .....

PROJECT:
COATES - CAPEX
3.0 x 6.0m M/F TOILET

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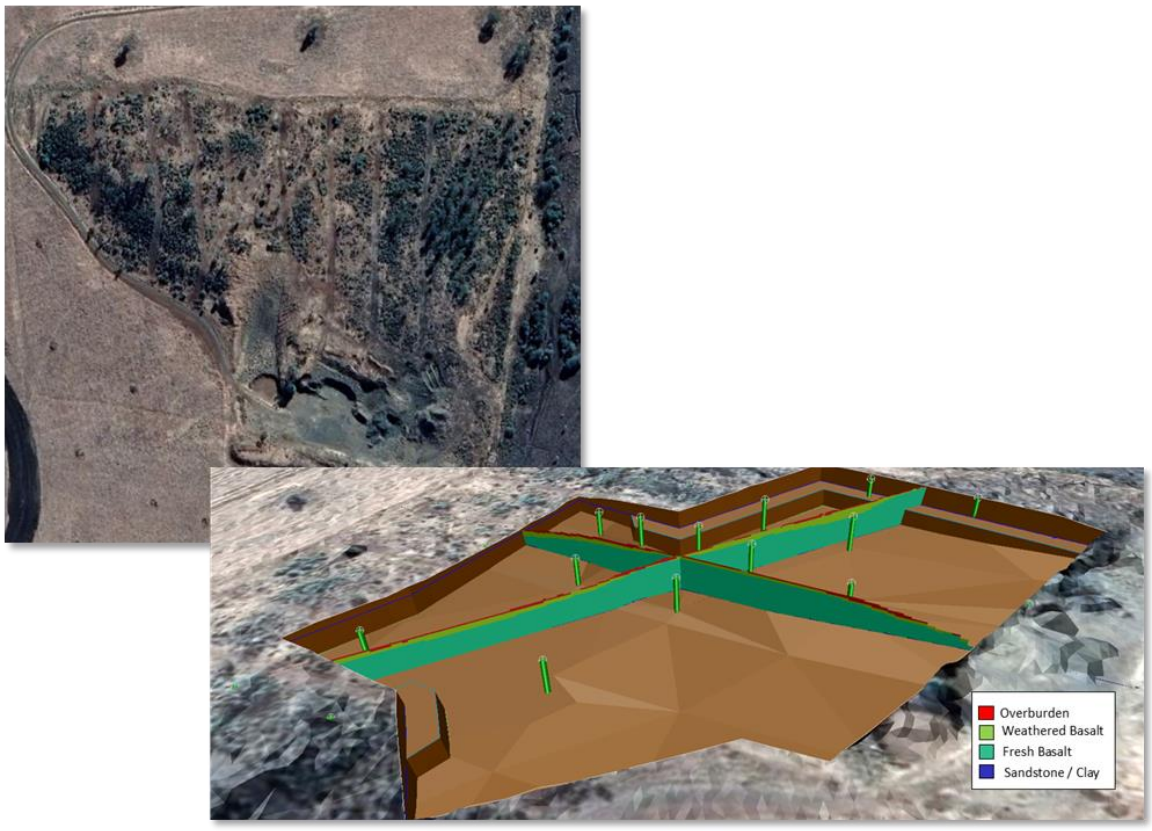
DATE: 09.10.2015	TITLE: PLAN- GENERAL ARRANGEMENT		
DRAWN BY: ML			
CHECKED BY: DT	DRAWING NUMBER: MS-200305-B20-101	BUILDING NUMBER: #0000	
SCALE: SHOWN	QUOTATION NUMBER: 200305	REV: E	SHEET A3

c:\users\marija\desktop\projects\ms-catalogue-101(e).dwg

ISSUE	AMENDMENT	BY	DATE
E	AS CLOUDED	ML	04.05.18
D	AS CLOUDED	ML	06.02.18
C	REVISED SPECIFICATIONS	TW	18.08.17
B	PRELIMINARY ISSUE	SN	27.07.16
A	PRELIMINARY ISSUE	ML	09.10.15

Appendix 6

Resource Investigation



NORTH STAR QUARRY

RESOURCE ASSESSMENT

Prepared for:
Regional Quarries Australia Pty Ltd

Date:
December 2020

File Ref:
2542.200.001

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Document Control

Project/ Report Details

Document Title:	North Star Quarry – Resource Assessment
Principal Author:	Troy Lowien
Client:	Regional Quarries Pty Ltd
Ref. No.	2542.200.001

Document Status

Issue	Description	Date	Author	Reviewer
R0	First Draft	December 2020	T. Lowien	R. Huntley
R1	Change to Pit Outline	June 2021	T. Lowien	

Distribution Record

Recipient	Transmission Method
Regional Quarries Pty Ltd	Electronic

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Table of Contents

Important Note regarding this Report **3**

1. Introduction **4**

2. Key Site Details **4**

3. Regional Geology **5**

4. Local Geology **6**

5. Investigative Drilling Program **7**

6. Drilling Results **8**

7. Resource Quantities **11**

Pit Design 11

Important Information **13**

ATTACHMENTS

Attachment 1 Understanding Your Geological Report

Important Note regarding this Report

The geological information in this report was logged and compiled by Troy Lowien, Principal Geologist of Groundwork Plus.

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Experience: 23 years Mine Geology, Resource Geology, and Operations

Professional Qualifications: B.App.Sc Hons (Geology), Grad. Cert. Geostatistics.

Signature: 

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Groundwork Plus waives all responsibility for loss or damage where the accuracy and effectiveness of information provided by the Client or other third parties was inaccurate and was relied upon, wholly or in part in reporting. For further information on understanding this report, refer to **ATTACHMENT 1 - Understanding Your Geological Report**.

1. Introduction

Groundwork Plus was commissioned by Regional Quarries Pty Ltd (part of the Regional Group Australia) to conduct a resource assessment of the quantity and quality of hard rock resources present at the site of the proposed North Star Quarry, NSW.

The site has been subject to minor quarrying activities over the last 15 years.

The resource assessment is based on results from a drilling program undertaken on the site in 2018.

2. Key Site Details

Location:	'Minilya' Property Situated at 5535 North Star Road, North Star, approximately 6km south of North Star township, NSW, *Latitude: -28.985°* *Longitude: 150.403°*
Access:	Access to the site is via North Star Road or Croppa Creek Road then Minilya Road (**Figure *1***).
Real Property Description:	Lot 7 DP755984.
Land Use:	The property is currently used for agricultural activities.
Landform:	The site consists of sloping paddocks and low ridges.
Site Geology:	Geology of the site is dominated by remnant basalt flows overlying sedimentary rocks (sandstones, siltstones etc.).
Vegetation:	Grassland and cultivation with remnant vegetation.



Figure 1– Site Location

3. Regional Geology

The site is located on the western edge of the New England Orogen and just inside the boundary of the Surat Basin. Sedimentary rocks of the Surat Basin were deposited in fluviolacustrine environments during the onset of a period of subsidence of much of eastern Australia between the Early Jurassic and Early Cretaceous Periods. The rocks of Surat Basin this area were overlain by basaltic flows during the Tertiary Period. These flows are typically thin and composed of quartz-bearing tholeiitic basalt and dolerite with minor volcanoclastic deposits.

4. Local Geology

The site of the proposed quarry is situated on a remnant basalt flow of the Mount Russell Volcanics, which overlies fluviatile sedimentary rocks (sandstone, siltstone) which belong to the Keelindi Beds (**Figure *2***). The basalt occupies a low hill on the eastern side of the property which rises above the surrounding cropping areas dominated by sandstones Basalt has been exposed as a result of previous quarrying activities on the southern side of the hill (**Figure *3***), with basalt outcrop and cobble float observed across the crest of the hill.

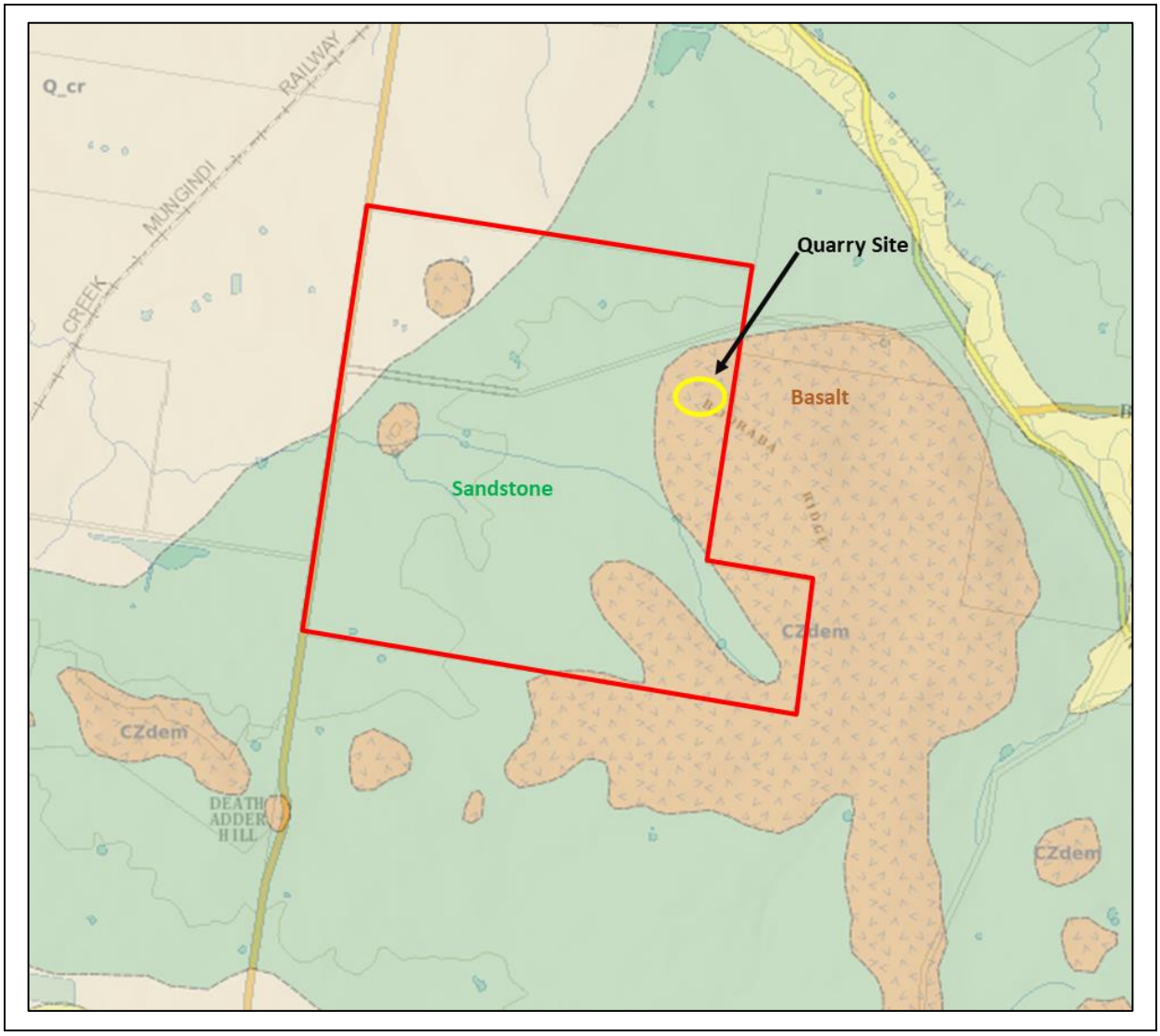


Figure 2– Local Geology (source NSW Geological Survey)



Figure 3–Extraction area on southern side of hill.

5. Investigative Drilling Program

A series of holes were drilled across the main hill during August 2018 using a blast hole rig to determine the basalt thickness and quality. There were 23 holes drilled for a total of 366m, with an average drill hole depth of 16m (**Figure *4***). Material was retrieved at one (1) metre intervals and stored in chip trays for logging. The material was geologically logged, recording lithology, degree of weathering, colour and hardness.

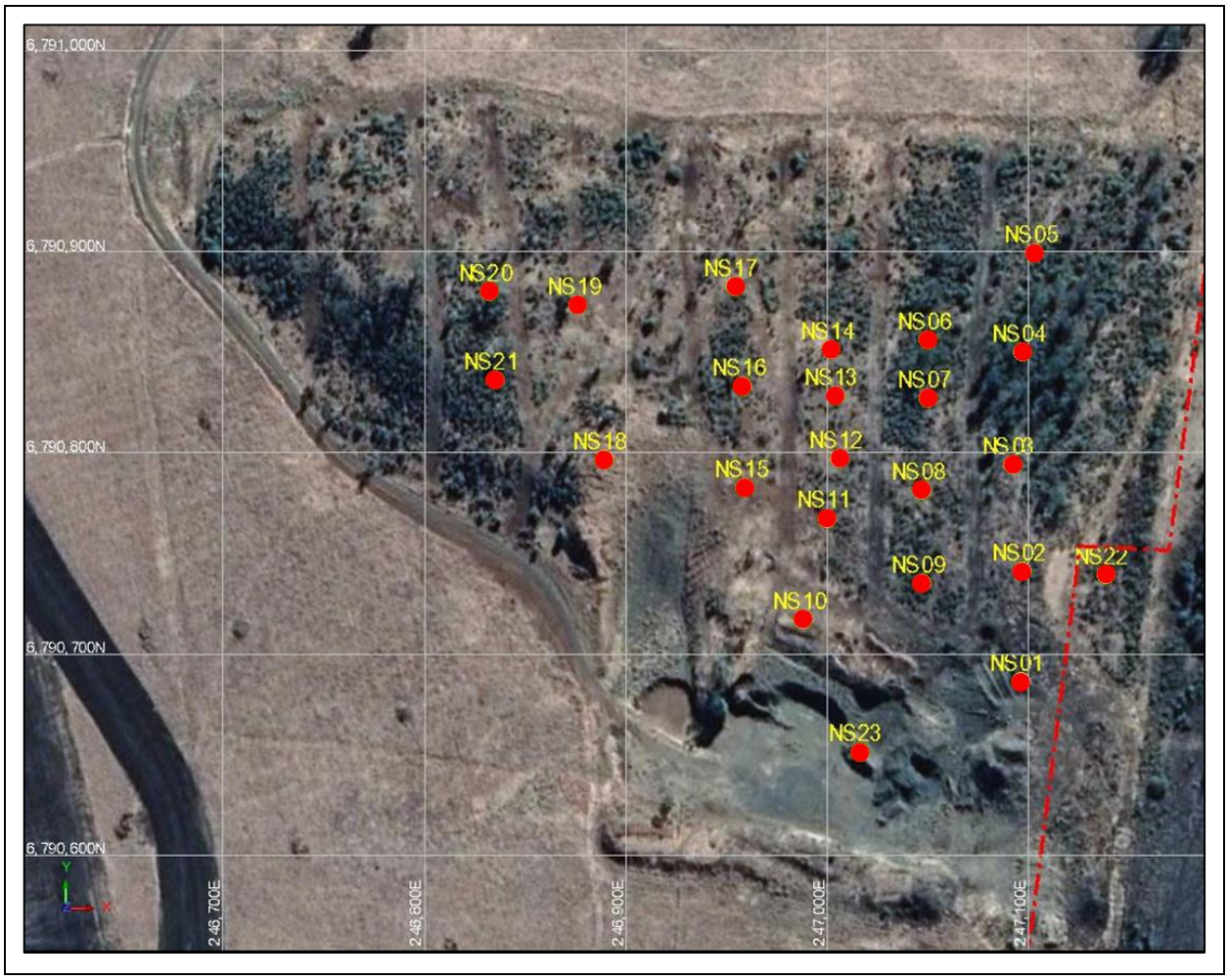


Figure 4– Drill Hole Location Plan

6. Drilling Results

Drilling intersected on average 1m of overburden and up to 7m of highly to moderately weathered basalt across the hill. The thickness of weathered basalt is at a minimum in the south east of the area, increasing top the north and west, with localised zones of deeper weathering (**Figure *5***).

The majority of drill holes intersected the base of the basalt, encountering sandstone and/or clay. Cross sections through the drill holes and interpreted geology are shown in (**Figure *6*** and **Figure *7***). Fresh basalt has a maximum thickness of around 20m in the east and gradually thins out towards the west (**Figure *8***).

Samples of drill chips were collected from holes NS8, NS12 and NS22 and submitted for testing to determine Degradation Factor. Results were in the range 81 to 82, indicating the rock is durable and potentially suitable for use as pavement material as well as cover and asphalt aggregates.

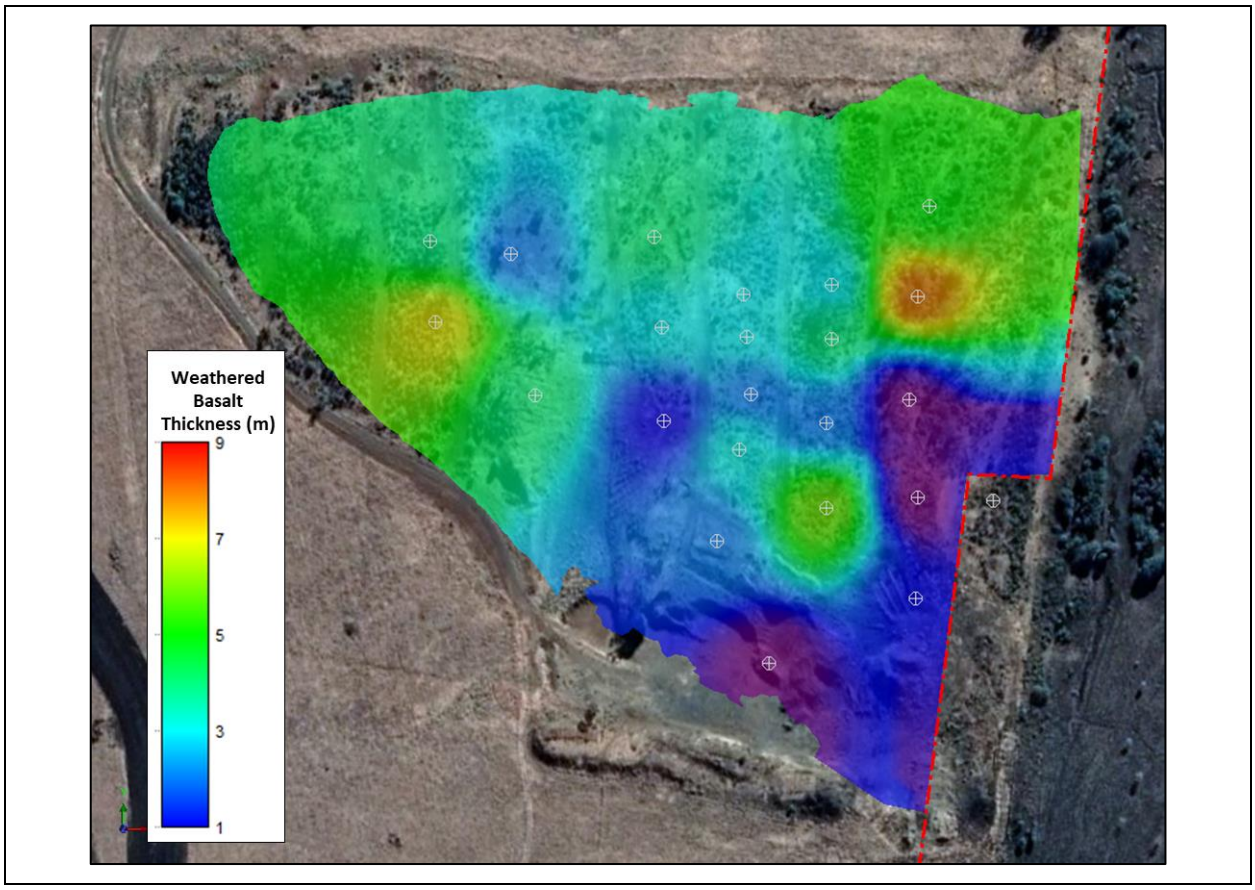


Figure 5– Weathered Basalt Thickness

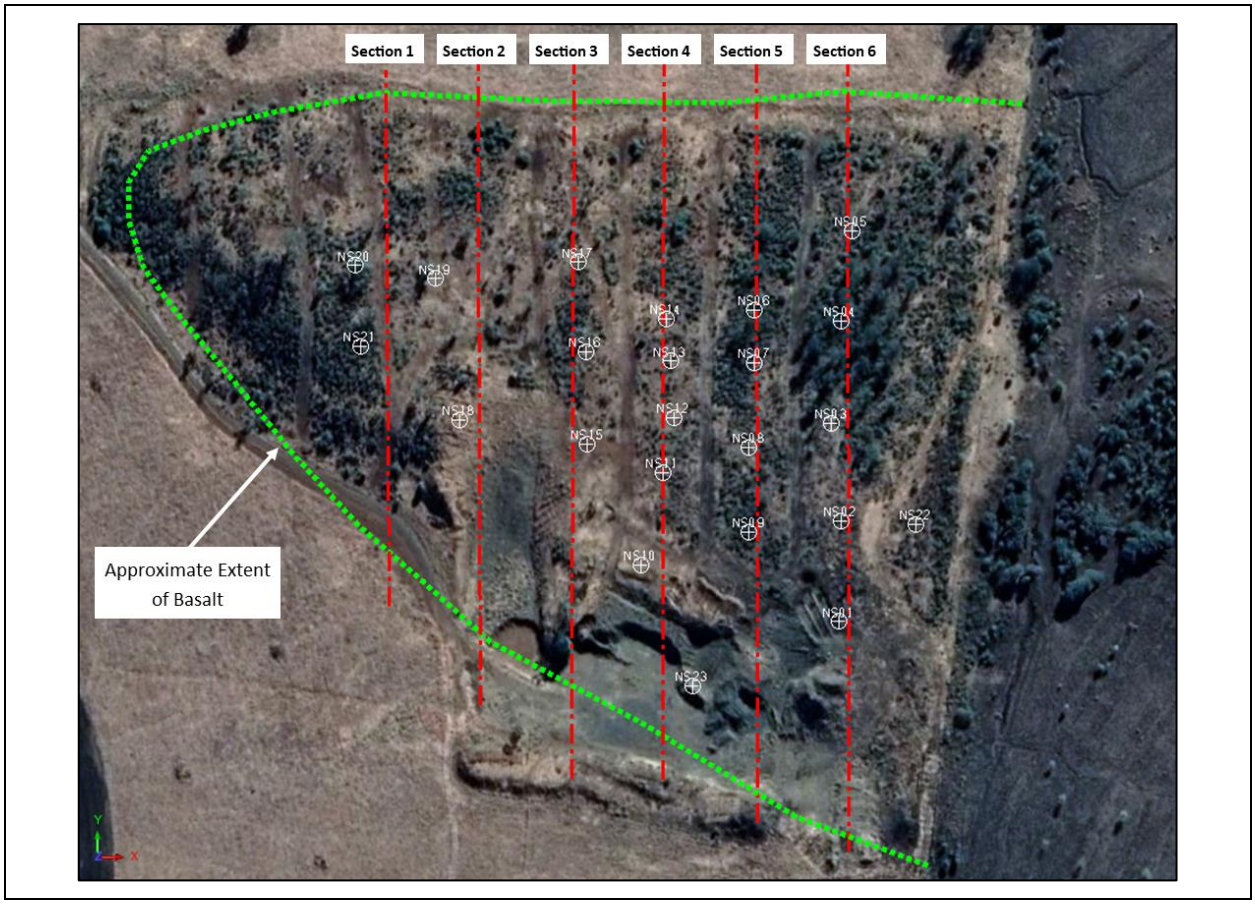


Figure 6– Cross Section Locations

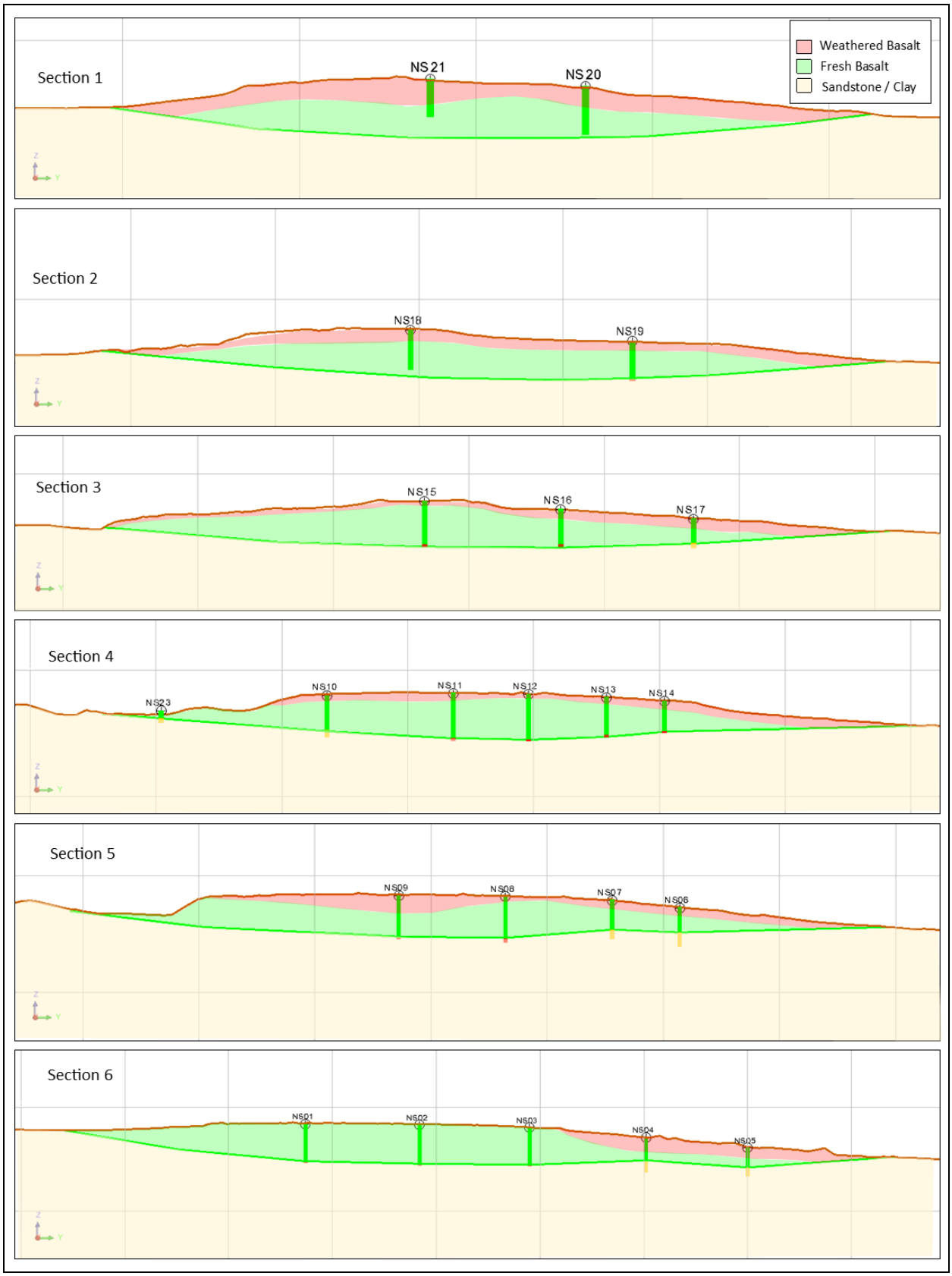


Figure 7– Cross Sections

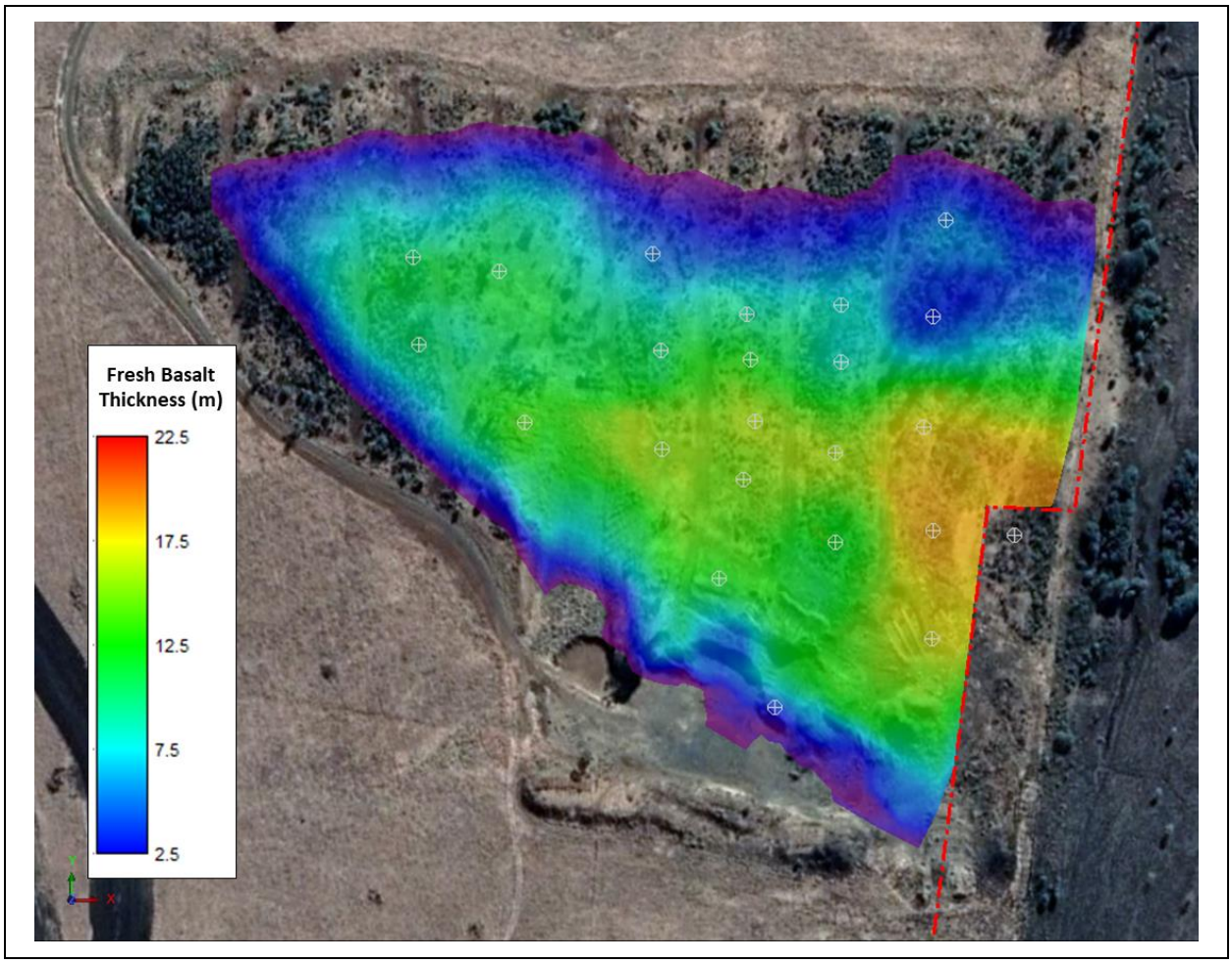


Figure 8– Fresh Basalt Thickness

7. Resource Quantities

Pit Design

A conceptual long term pit design was constructed using the Surpac mining software package and was designed using a terminal batter angle of 80° and terminal bench width and heights of 10 metres. The pit floor was terminated at, or just below the base of the basalt. A buffer of at least 20 metres to the eastern property boundary was included in the design, as well as avoidance of mapped ecologically significant areas. As the basalt slopes away from the current extraction area, there is no need to include an internal ramp in the design. Examples of the pit design are shown in **Figure *9*** and **Figure *10***.



Figure 9– Pit Design Plan View

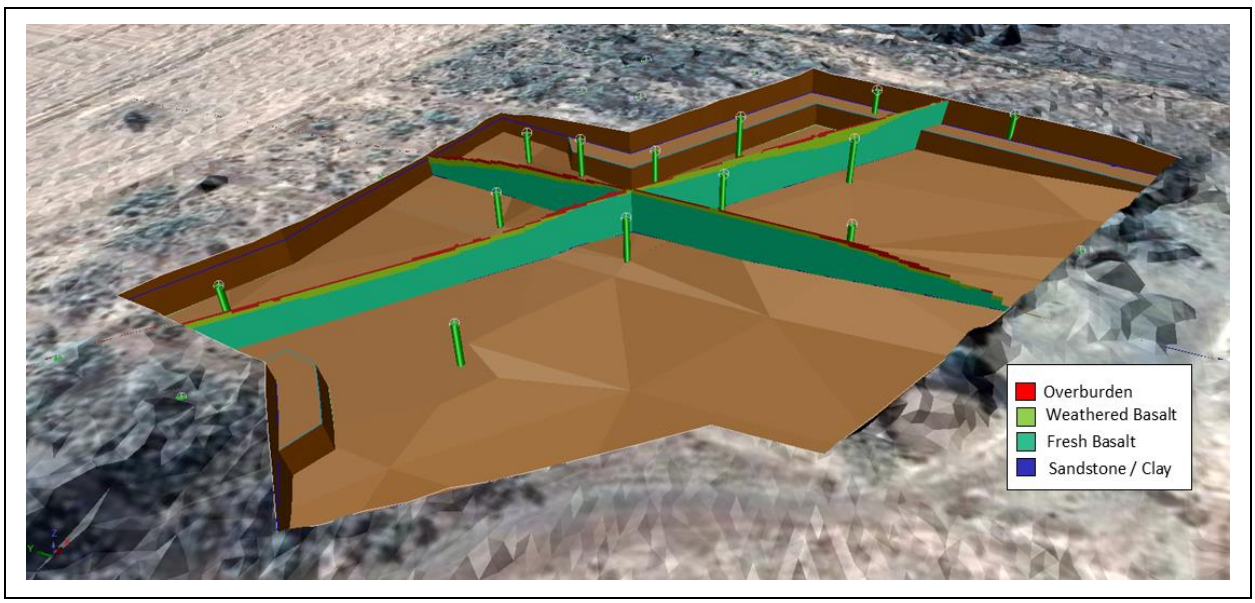


Figure 10– Pit Design Oblique View

A three-dimensional sub-celled block model was constructed using Surpac mining software for the purpose of providing appropriate definition of the topographic surface and geological boundaries when estimating

volumes. An estimate of the amount of resources contained within the pit design, subdivided by material type and degree of weathering, is shown in **Table *1*.**

Table 1: Resource Quantities

Material Type	Weathering	Volume (m^3)	Tonnes*
Overburden	-	37,000	44,400
Basalt	Highly Weathered	81,000	202,800
	Fresh	469,000	1,313,400
Sandstone	Highly Weathered	1,000	2,300
Total		**588,000**	**1,562,900**

*Tonnes calculated based on dry bulk densities of 1.2 t/m^3 for overburden, 2.3 for weathered sandstone, 2.5 t/m^3 for highly weathered basalt and 2.8 t/m^3 for fresh basalt.

The resource estimate is based on in-situ volumes. The actual product yield would depend on a number of factors including, (but not limited to), final pit design, geotechnical conditions, unsaleable product and losses due to mining, sales mix, plant configuration, haul road location, degree off deleterious alteration and other diluting factors.

The fresh basalt could possibly be well suited to the production of quality aggregate for asphalt and spray sealed pavements. The highly weathered basalt would be suited to the production of unbound pavement material of all types.

Important Information

Your attention is drawn to the document – 'Important Information about your Geological Report'. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be and to present you with recommendations on how to minimise the risks associated with the geotechnical criteria for this project. The document is not intended to reduce the level of responsibility accepted by Groundwork Plus, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing. We would be pleased to answer any questions about this important information from the reader of this report. Further information on **Understanding Your Geological Report** is presented in **ATTACHMENT 1**.

Attachments

Attachment 1

Understanding your Geological Report

IMPORTANT INFORMATION ABOUT YOUR GEOLOGICAL REPORT

These notes have been collated by Groundwork Plus. They are designed to help you in the interpretation of your Report.

Geological studies are commissioned to gain information about environmental conditions on and beneath the surface of a site. The more comprehensive the study, the more reliable the assessment is likely to be, but remember, any such assessment is to a greater or lesser extent based on professional opinions about conditions that cannot be seen or tested. Accordingly, no matter how much data is accumulated, risks created by unanticipated conditions will always remain. Work with your geological consultant to manage known and unknown risks. Part of that process should already have been accomplished, through the risk allocation provisions you and your geological professional discussed and included in your contract's general terms and conditions. This document is intended to explain some of the concepts that may be included in your agreement and to pass along information and suggestions to help you manage your risk.

Beware of Change; Keep Your Geological Professional Advised

The design of a geological study considers a variety of factors that are subject to change. Changes can undermine the applicability of a reports findings, conclusions, and recommendations. Advise your geological professional about any changes as you become aware of them. Geological professionals cannot accept responsibility or liability for problems that occur because a report fails to consider conditions that did not exist when the study was designed. Ask your geological professional about the types of changes you should be particularly alert to. Some of the most common include:

- modification of the proposed development or ownership group;
- sale or other property transfer;
- replacement of or additions to the financing entity;
- amendment of existing regulations or introduction of new ones; or
- changes in the use or condition of adjacent property.

Should you become aware of any change, do not rely on an existing geological report. Advise your geological professional immediately; follow the professional's advice.

Prepare to Deal with Unanticipated Conditions

The findings, recommendations, and conclusions of a report typically are based on a review of historical information, interviews, a site 'walkover' and other forms of non-invasive research. When site subsurface conditions are not sampled in any way, the risk of unanticipated conditions is higher than it would otherwise be.

While borings, installation of monitoring wells, and similar invasive test methods can help reduce the risk of unanticipated conditions, do not overvalue the effectiveness of testing. Testing provides information about actual conditions only at the precise locations where samples are taken and only when they are taken. Your geological professional has applied that specific information to develop a general opinion about environmental conditions. Actual conditions in areas not sampled may differ (sometimes sharply) from those predicted in a report. For example, a site may contain an unregistered underground storage tank that shows no surface trace of its existence. Even conditions in areas that were tested can change, sometimes suddenly, due to any number of events, not the least of which include

occurrences at adjacent sites. Recognize too, that even some conditions in tested areas may go undiscovered, because the tests or analytical methods used were designed to detect only those conditions assumed to exist.

Manage your risks by retaining your geological professional to work with you as the project proceeds. Establish a contingency fund or other means to enable your geological professional to respond rapidly, in order to limit the impact of unforeseen conditions. To help prevent any misunderstanding, identify those empowered to authorize changes and the administrative procedures that should be followed.

Do Not Permit Any Other Party to Rely on The Report

Geological professionals design their studies and prepare their reports to meet the specific needs of the clients who retain them, in light of the risk management methods that the client and geological professionals agree to, and the statutory, regulatory, or other requirements that apply. The study designed for a developer may differ sharply from one designed for a lender, insurer, public agency or even another developer. Unless the report specifically states otherwise, it was developed for you and only you. Do not unilaterally permit any other party to rely on it. The report and the study underlying it may not be adequate for another party's needs and you could be held liable, for shortcomings your geological professional was powerless to prevent or anticipate. Inform your geological professional when you know or expect that someone else - a third-party will want to use or rely on the report. Do not permit third-party use or reliance until you first confer with the Geological professional who prepared the report. Additional testing, analysis, or study may be required and in any event, appropriate terms and conditions should be agreed to so both you and your geological professional are protected from third-party risks. Any party who relies on a geological report without the express written permission of the professional who prepared it and the client for whom it was prepared may be solely liable for any problems that arise.

Avoid Misinterpretation of the Report

Design professionals and other parties may want to rely on the report in developing plans and specifications. They need to be advised, in writing, that their needs may not have been considered when the study's scope was developed and even if their needs were considered, they might misinterpret geological findings, conclusions, and recommendations. Commission your geological professional to explain pertinent elements of the report to others who are permitted to rely on it and to review any plans, specifications or other instruments of professional service that incorporate any of the report's findings, conclusions, or recommendations. Your geological professional has the best understanding of the issues involved, including the fundamental assumptions that determined the study's scope.

Give Contractors Access to the Report

Reduce the risk of delays, claims, and disputes by giving contractors access to the full report, providing that it is accompanied by a letter of transmittal that can protect you by making it unquestionably clear that: I) the study was not conducted and the report was not prepared for purposes of bid development and 2) the findings, conclusions and recommendations included in the report are based on a variety of opinions, inferences, and assumptions and are subject to interpretation. Use the letter to also advise contractors to consult with your geological professional to obtain clarifications, interpretations, and guidance (a fee may be required for this service) and that-in any event, they should conduct additional studies to obtain the specific type and extent of information each prefers for preparing a bid or cost estimate. Providing access to the full report, with the appropriate caveats, helps prevent formation of adversarial attitudes and claims of concealed or differing conditions. If a contractor elects to ignore the warnings and advice in the letter of transmittal, it would do so at its own risk. Your geological professional should be able to help you prepare an effective letter.

Do Not Separate Documentation from the Report

Geological reports often include supplementary documentation, such as maps and copies of regulatory files, permits, registrations, citations, and correspondence with regulatory agencies. If subsurface explorations were performed, the report may contain final boring logs and copies of laboratory data. If remediation activities occurred on site, the report may include; copies of daily field reports, waste manifests and information about the disturbance of subsurface materials, the type and thickness of any fill placed on site and fill placement practices, among other types of documentation. Do not separate supplementary documentation from the report. Do not permit any other party to redraw or modify any of the supplementary documentation for incorporation into other professionals' instruments of service.

Realize That Recommendations May Not Be Final

The technical recommendations included in a geological report are based on assumptions about actual conditions and so are preliminary or tentative. Final recommendations can be prepared only by observing actual conditions as they

are exposed. For that reason, you should retain your geological professional to observe construction and/or remediation activities on site, to permit rapid response to unanticipated conditions. The geological professional who prepared the report cannot assume responsibility or liability for the report's recommendations if that professional is not retained to observe relevant site operations.

Understand That Geotechnical Issues Have Not Been Addressed

Unless geotechnical engineering was specifically included in the scope of professional service, a report is not likely to relate any findings, conclusions, or recommendations about the suitability of subsurface materials for construction purposes, especially when site remediation has been accomplished through the removal, replacement, encapsulation, or chemical treatment of on- site soils. The equipment, techniques, and testing used by geotechnical engineers differ markedly from those used by Geological professionals; their education, training, and experience are also significantly different. If you plan to build on the subject site, but have not yet had a geotechnical engineering study conducted, your Geological professional should be able to provide guidance about the next steps you should take. The same firm may provide the services you need.

Read Responsibility Provisions Closely

Geological studies cannot be exact; they are based on professional judgement and opinion. Nonetheless, some clients, contractors, and others assume geological reports are, or certainly should be, unerringly precise. Such assumptions have created unrealistic expectations that have led to wholly unwarranted claims and disputes. To help prevent such problems, geological professionals have developed a number of report provisions and contract terms that explain who is responsible for what and how risks are to be allocated. Some people mistake these for 'exculpatory clauses', that is, provisions whose purpose is to transfer one party's rightful responsibilities and liabilities to someone else. Read the responsibility provisions included in a report and in the contract you and your Geological professional agreed to.

Appendix 7

Traffic Impact Assessment

SMK

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surveying – irrigation – environmental – planning

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North Star Quarry

Traffic Impact Assessment

Regional Quarries Australia

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January 2021

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ABN 63 061 919 003

DOCUMENT CONTROL

Project Name	Traffic Impact Assessment
Proponent	Regional Quarries Australia Pty Ltd
Project Reference	21-23
Report Number	21-23 Traffic Impact Assessment
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Revision History			
Version Number	Date	Authority	Details
0	January 2021	Peter Taylor	Initial Issue
1	April 2021	Peter Taylor	For submission with DA

TABLE OF CONTENTS

1 Introduction 6
1.1 Purpose 6
1.2 Scope of Works 6
2 Existing Conditions 7
2.1 Development Site 7
2.1.1 Site Layout and Access 9
2.1.2 Parking Supply 11
2.1.3 Operating Hours 11
2.1.4 Truck Types and Operations 12
2.2 Haulage Routes 12
2.2.1 Designated Haulage Route – Inland Railway Project 13
2.2.2 Designated Haulage Routes – Newell Highway Projects 13
2.3 Existing Road Network 16
2.3.1 Road Condition Assessment 16
2.4 Current and proposed roadworks and traffic management Works 22
2.5 Traffic Volumes 23
2.6 Traffic Safety 25
2.7 Proposed Developments in the Vicinity 26
3 Traffic Generation and Distribution 27
3.1 Light Vehicle Movements 27
3.2 Heavy Vehicle Movements 27
3.2.1 Inland Rail Project 28
3.2.2 Newell Highway Projects 30
4 Traffic Management 30
4.1 Public Transport and Pedestrians 31
4.1.1 School Bus Routes and Bus Stop Locations 31
4.1.2 Public Transport 31
4.1.3 Pedestrians and Cyclists 31
5 Impact on Road Network 32
5.1 Impact on Traffic Volumes 32
5.2 Impacts on Road Condition 34
5.3 Impact on Traffic Safety 36
5.4 Impact on Traffic Noise and Dust Production 37
5.5 Cumulative Impacts with Neighbouring Developments 40

5.6 Calculation of Expected Development Contribution Rate....41
5.6.1 Gwydir Shire Council Contributions....41
5.6.2 Moree Plains Shire Council Contributions....42
6 Conclusion and Recommendations....44
7 Limitations....46
Appendix 1 – Road Condition Assessment: Haulage Route Photos....47

1 Introduction

SMK Consultants have been engaged by Regional Quarries Australia to provide a Traffic Impact Assessment (TIA). The assessment has been prepared in accordance with requirements under the *Environmental Planning and Assessment Act 1979* to consider the environmental impact of a development proposal. In this instance, the environment considered is the road network servicing the proposed development.

1.1 Purpose

Regional Quarries Australia intend to develop a hard rock quarry on the property of "Minilya" in the North Star region. The proposal involves establishing an extractive industry producing a maximum of 490,000 tonnes per year for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects and then 150,000 tonnes per year for a period of 10-years to service the general market in the local area. A maximum of 2,450,000 tonnes would be extracted over the 15-year life of the quarry.

1.2 Scope of Works

The scope of works for this Traffic Impact Assessment (TIA) includes the following:

- Predict the road traffic generated by the construction and operation of the quarry including a description of the types of vehicle likely to be used for transportation of quarry products;
- Assess 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 volume and potential impacts on local and regional roads;
- Describe 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 quarry;
- Provide evidence of consultation with relevant road authorities, regarding establishment of agreed contribution toward road upgrades or maintenance;
- Describe access roads specifically Crown roads and tracks;
- Consider any school zones, school bus routes, residential areas or potential risk locations;
- Assessment of the surrounding environment, existing conditions and road safety;
- Assessment of existing private property driveways and farm access points;
- Liaison with Gwydir Shire Council in relation to existing road traffic numbers;
- Identify any required mitigation measures required to minimise road impacts, e.g., dust and noise suppression;
- Calculation of expected contribution rate.

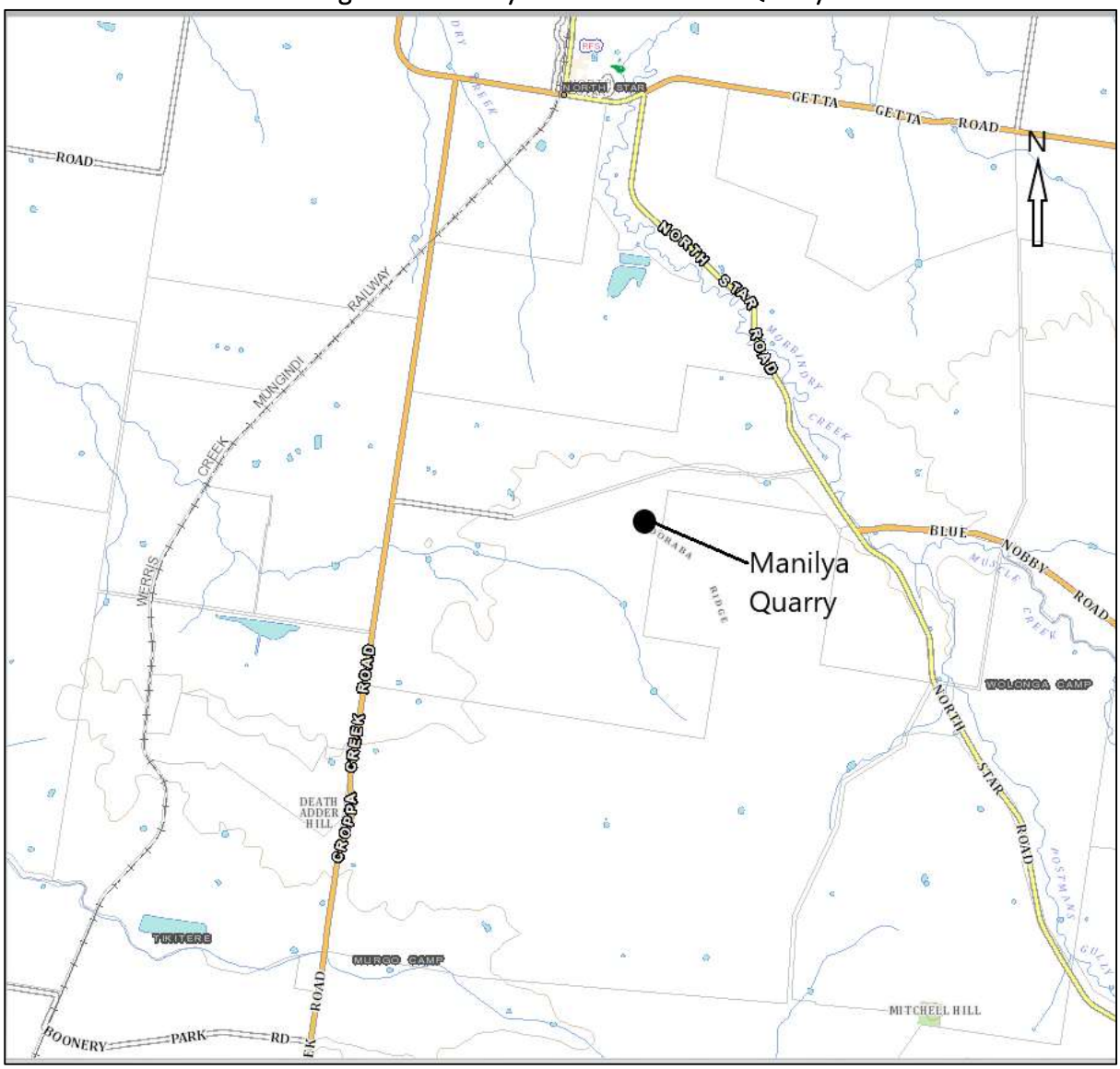
2 Existing Conditions

2.1 Development Site

The development site is located at 5,535 North Star Road, North Star. The land to be subject to the development includes Lot 7/755984 and Lot 1/1227212. The property is called "Minilya".

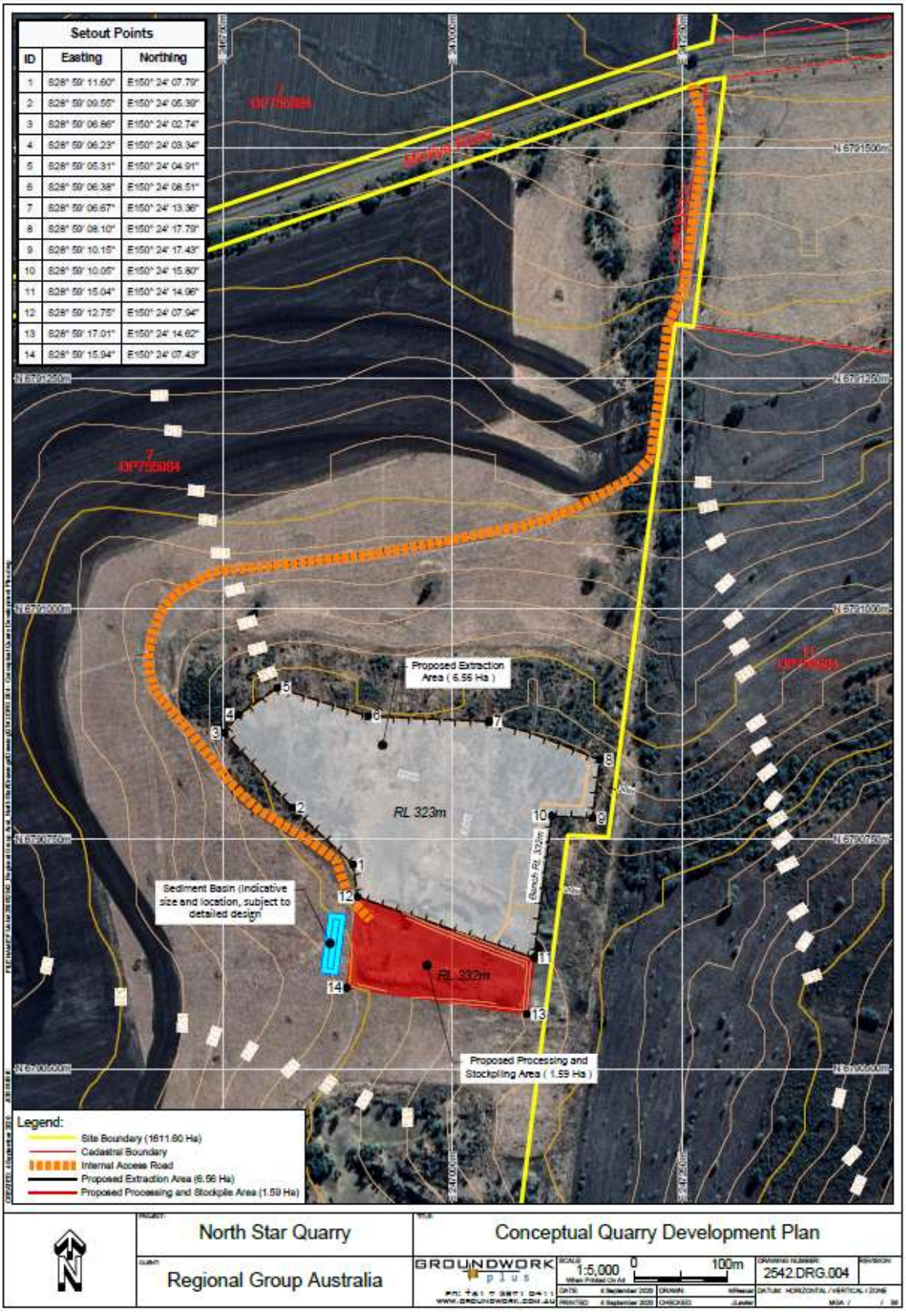
The following provides a locality plan of the quarry site.

Figure 1: Locality Plan of North Star Quarry



The following plan presents a general layout of the quarry site showing the entrance road from Minilya Road. The intention is to utilise an existing internal farm access road between Minilya Road and the quarry site. This internal road will be upgraded to provide access for trucks.

Figure 2: Quarry Site Locality Plan



2.1.1 Site Layout and Access

The site has operated as a farm quarry for an extended period. No construction work is required to commence operations on the site other than delivery of a dozer to win the gravel, an excavator to assist with stockpiling and loading, and a front-end loader. A site office and amenity building would also be established on-site. These would be portable buildings. Construction would involve possibly 5-low loader movements to the site.

The internal access will utilise an existing farm road. This will be reconstructed as a two-lane road between the quarry and Minilya Road. Trucks will enter the stockpile area to be loaded and then despatched. The internal layout within the stockpile area will vary according to stockpile size, the range of processed material to be delivered and delay time within the quarry to load trucks. The intent will be to load trucks as they arrive and despatch immediately. Holding areas for trucks will be available within the stockpile area. Internal traffic routes will be marked and operate as a single one-way lane between the entrance road and within the stockpile area. The internal road layout can be varied according to stockpile arrangements.

Once loaded, trucks will exit the site onto Minilya Road and travel west to the Croppa Creek-North Star road. Trucks will then move either north or south along Croppa Creek-North Star road to deliver the aggregate to the respective project. At present, the prediction is that movements will be evenly distributed between north and south.

Minilya Road is a Council road that has some gravel but sections of minimal gravel depth. Some of the gravel has been applied by the property owner of Minilya to improve truck access to a grain storage facility on the property. Minilya Road has a limited pavement width which is insufficient for two trucks to pass without one truck moving onto the road shoulder. The road is not considered as all-weather and therefore work would be required to increase the depth of pavement and provide suitable options for two-trucks to pass safely, in addition to upgrading the intersection into the gravel pit road to cater for 26m long vehicles as a minimum. The road can be utilised by road trains, subject to Council approval.

In relation to options for two-trucks to pass on Minilya Road, the proponent considers that two options are available. Option 1 involves installation of “whale berms” to allow an empty truck to park while a loaded truck is travelling west. This is a viable option if the speed limit is reduced to 50 km/h. However, this may not be suitable unless North Star Quarry can impose (via Council approval), a Traffic Control Plan (TCP) on this road to ensure that other road users are aware of the procedure along this section of road during quarry hours. The alternative would involve establishing a two-lane gravel road with no TCP other than warning signs for trucks entering or turning during operational hours. The objectives of providing these two options relates to the current clear width of the road at present, as per figure 3. Construction of a two-lane road may require removal of some vegetation. This could be

avoided if “whale berms” are installed. The woodland along the southern side of the road provides an important vegetation corridor and therefore options for preservation of this corridor should be considered when considering any short-term upgrades for this road.

Minilya Road carries no non-local traffic. This road is mainly used for inter-property access and as a link between the Croppa Creek Road and the North Star-Warialda Road. The road is utilised for grain haulage in harvest periods between November and December.



Figure 3: Selective photo of Minilya Road



Figure 4: Sight Distance facing north along Croppa Creek Road. Sight distance >600metres.



Figure 5: Sight Distance facing south along Croppa Creek Road. Sight distance >300metres.

The Croppa Creek-North Star Road is a two-way bitumen sealed road that services the local cattle and grain industries. The road has been subject to various upgrades and improvements to cater for heavy traffic. Road trains can be used on this road, subject to permit approval.

2.1.2 Parking Supply

The development site is located within a rural property which does not have access to public transport, and therefore is only accessible via private vehicle. For industries it is recommended that parking spaces be provided in accordance with the following rate:

- 1 parking space per 2 staff employed.

Ample parking is available on site to accommodate staff vehicles, in addition to visitors to the site. Parking for smaller vehicles will be available adjacent to the temporary site office. At peak operation, the site will have in excess of 10-parking spaces for the 5 to 10 staff required to operate the site. Trucks will be encouraged to remain within the internal loading roads, but not remain onsite overnight.

2.1.3 Operating Hours

The intended operating hours are included in Table 1. The loading of trucks to haul product can occur within these hours, as long as the trucks do not leave the site outside of these hours. Some trucks may enter the site prior to start of each morning, but the final load must leave by the closing hour.

No haulage or quarry work other than low noise impact repair of equipment within the quarry will occur outside of these hours.

Table 1: Hours of Operation

Activity	Monday to Saturday	Saturday	Sunday	Public Holidays
Loading of trucks to haul product.	6am to 6pm	7am to 1pm	Nil	Nil
Light vehicle traffic associated with employees, or light service vehicles entering or leaving the site.	24/7			

2.1.4 Truck Types and Operations

The Proponent will need to utilise a mixture of truck combinations. The combination to be used for the varying contracts will depend on several factors including access to the unloading site, permit approval from local road authorities and truck availability.

The Proponent has indicated that trucks will range between rigid truck and trailer (truck and dog), B-doubles and if permitted, Type 1 A-double road trains. Average haul load is considered to be 38-tonnes of gravel.

The rate of truck turn-around time within the site has been planned by the Proponent to be 15-minutes per load. On this basis, trucks will exit the site at a rate of 4-trucks per hour. Allowing for some start-up and shut-down operations on a daily basis, the Proponent aims to despatch an average of 46-trucks per day.

2.2 Haulage Routes

The Quarry is expected to supply material to two significant infrastructure projects, mainly:

- Inland Railway Project (Northern Section): Scheduled to commence in 2021 and continue for approximately 18-months to 3 years.
- Newell Highway Project: Commenced in 2019 and to continue as a range of new projects over the next 5-years or more.

The two projects may overlap for a period. Other smaller projects will also be serviced. This may include local roadworks undertaken by Council and private landowners.

The following sections address the designated haulage routes and heavy vehicle movements associated with the two projects.

2.2.1 Designated Haulage Route – Inland Railway Project

The proposed haulage route from the development site will utilise internal roads before entering Minilya Road onto the Croppa Creek-North Star Road and then proceeding either north or south as required to provide material to stockpile sites to be established by Inland Rail.

The haul routes will be variable and subject to agreements between the Quarry Operator, Inland Rail and Councils. Agreements currently being discussed include additional funding for Council/s to upgrade sections of key haul routes that will be used for construction of the Inland Rail line. The following provides a list of Primary and Secondary haul routes.

Primary Roads

- Croppa Creek – North Star Road
- North Star - Boggabilla Road
- County Boundary Road

Secondary Roads

- IB Bore Road
- Boonery Park Road
- Tumba Road
- Buckie Road
- Crooble Road (Gil Gil Creek Road)
- Alma Lane
- Calimpa Road

It is noted that the Rail corridor will be developed for access along the rail. This will be managed by the rail contractor and may supply key access along the rail route where the local road network is unsuitable to carry trucks and rail associated traffic.

2.2.2 Designated Haulage Routes – Newell Highway Projects

The proposed haulage route from the development site will utilise internal roads before entering Croppa Creek Road and proceeding north to the Croppa Creek Road/I B Bore Road T-intersection. Traffic would then proceed west along I B Bore Road to the Newell Highway. Use of the IB Bore Road would be subject to Council agreement due to the varied condition of this road. It is noted that Council has recently obtained a grant to seal this road and create a 2-lane road.

An alternative route for northern traffic to the Newell Highway would include the North Star – Boggabilla Road. This a bitumen sealed road leading to the Bruxner Highway. Trucks would travel via Boggabilla to access the Newell Highway if this route is used.

Buckie Road to the west of Croppa Creek village presents an alternative road to access the Newell Highway. Buckie Road provides access to the highway approximately 56 km north of Moree. This road is in variable condition including sections of low-quality pavement and therefore use of this road would be subject to approval from both Moree Plains and Gwydir Councils. This would be a dry weather road only.

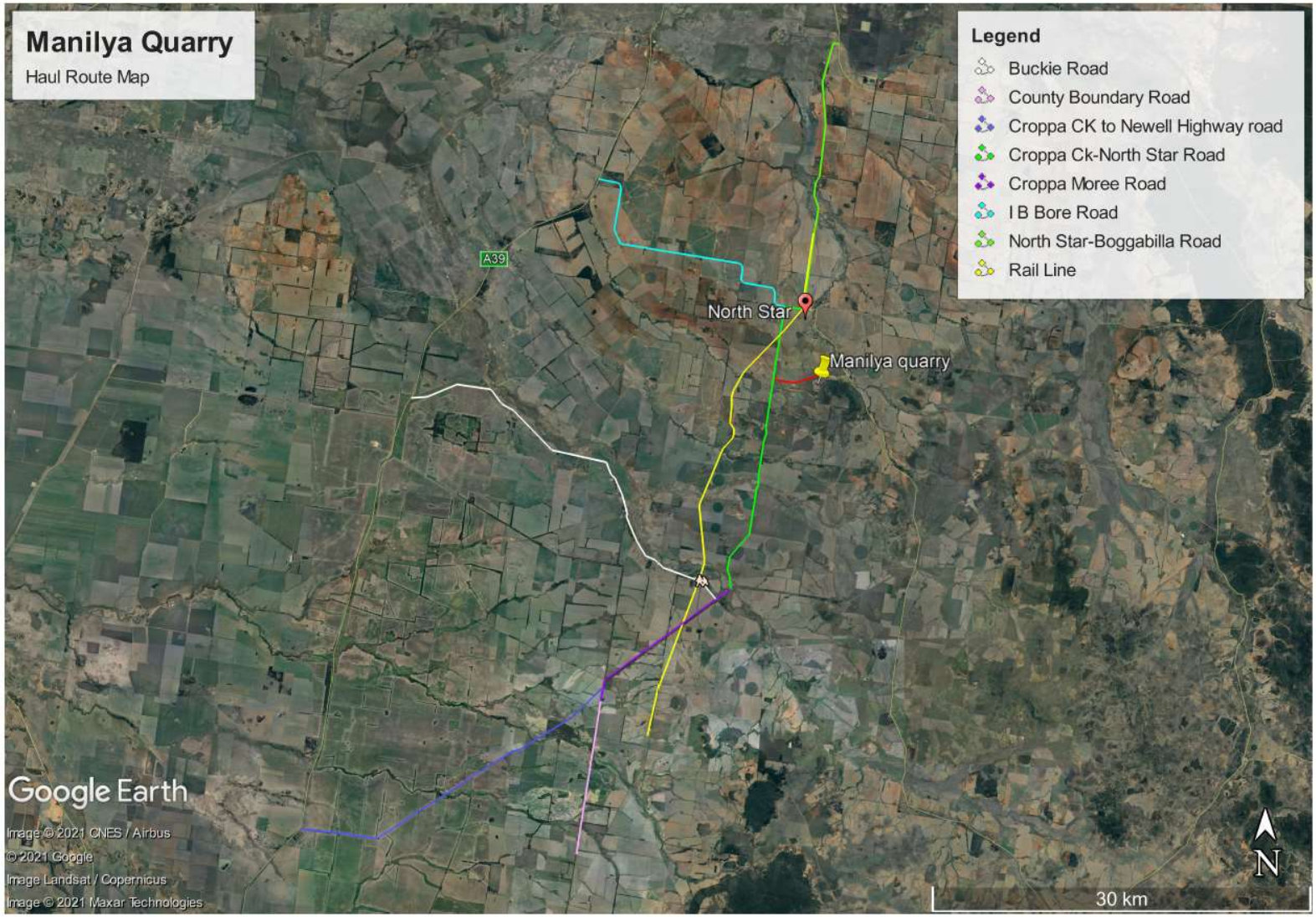
More southern Newell Highway projects may utilise the Croppa Creek – Moree Road to enter the Newell Highway. This is a fully bitumen sealed road providing the main haul route for trucks from the Croppa Creek – North Star area to access Moree.

Once trucks reach the Newell Highway, they would enter the Newell Highway and travel either north or south, as required, to provide material to a range of Newell Highway Projects.

These haul routes are mapped and presented in the follow aerial image.

More southern access roads may include the Back Pally Road which leads to the Boolooroo Bridge area of the Newell Highway.

Figure 6: Inland Railway Haulage Route



Access to the rail from these Gwydir Council roads would occur via selected minor roads. Many of these minor roads consist of narrow paved and unpaved roads used by farmers to haul grain crops from their properties. These roads will be used by Inland Rail contractors to access the rail line once the project commences. Any access would be subject to agreement with Council, and it is expected that any such agreement would include maintenance and restoration of any roads used to access the rail line as many of these roads are dry weather roads only.

At present, the author is aware of a grant to upgrade the County Boundary Road. No information is available at present in relation to any other potential agreements or funding proposals to enable construction of the Inland Rail line between Milguy and North Star and then to the Qld Border.

2.3 Existing Road Network

2.3.1 Road Condition Assessment

SMK Consultants conducted a visual pavement inspection of the proposed haulage routes. The inspection was completed over a number of days in variable weather conditions. The roads were driven in both directions. No geotechnical investigation of the existing pavement has been undertaken as part of this investigation. Pavement depths and road condition have been visually determined.

The photos included as Appendix 1 are taken at key points along proposed haulage routes.

North Star Road – North of Minilya Road

North Star Road is a bitumen sealed two-way road maintained by GSC. The road services the farming community and several other smaller arterial roads. The road is trafficable in all weather conditions apart from times of extreme flood events. The section impacted by the quarry involves 24.6 kilometres in length. The following notes have been made on this road:

- The average road width is 6.0 metres with a minimum of 4.8 metres of sealed pavement.
- Culvert width is generally >8.6 metres, with the narrowest culvert width of 8.1 metres.
- There is no line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- North Star Road is part of a school bus route.
- ADT Data is available on this road which is summarised in Table 2.
- Road pavement has been upgraded in sections.

The southern end of this road includes a 2.5 km long section which has historically been subject to pavement deformation. This section of road has been reconstructed on several occasions over the past 30-years. The subgrade materials appear to have moisture issues due to either a local spring or weathered rock material. The deformation leads to some pot-holing

of the bitumen. Most vehicles travel this section of road at slower speeds due to the rough surface.

The remainder of the road between Croppa Creek and North Star is considered in good condition with only light patching of potholes. Road alignment is relatively straight and therefore no sight distance issues were identified at bends, corners or crest areas along this road. This section of road is subject to other quarry traffic from two quarry sites located on the property of Tikitere in addition to traffic from the Myola and Tullin Tulla feedlots. The Tikitere quarry entrance is located approximately 3.5 km south of the Minilya Road. The feedlots are located along the southern section of the North Star road.

The road shoulders along this section of road remain in good condition. This reflects road width and smoothness of the road. Trucks passing each other generally do not need to place wheels off the edge of the bitumen which would cause pavement failure along the edge of the seal. Sections of this road require some limitations on truck speed due to undulations in the subgrade areas causing small depressions but not potholing or loss of bitumen pavement.

Sections of this road are subject to spider cracking of the seal. This may lead to potholing and some deformation if moisture enters the subgrade material. Some intersections and stop points (rail crossing in North Star) have existing conditions where vehicle pressure or scraping of tyres is damaging the pavement. This is possibly a hot weather issue during summer. An increase in heavy vehicle numbers may lead to an exacerbation of this road damage.

Croppa Moree Road

Croppa Moree Road is a bitumen sealed two-way road maintained by both the Gwydir Shire Council (GSC) and Moree Plains Shire Council (MPSC). For general purposes, this road commences at the southern end of the Croppa Creek-North Star Road and continues to the Newell Highway.

This road provides a sealed connection between Croppa Creek and the Newell Highway. The road services the farming community and several other smaller arterial roads. The road is trafficable in all weather conditions apart from times of extreme flood events.

The section impacted by the quarry includes sections within both local Shires.

- The average road width is 6.7 metres with a minimum of 6.5 metres of sealed pavement.
- Culvert width is generally >12 metres, with the narrowest culvert width (11.5 metres) located approximately 600 metres south of the T-intersection with Buckie Road.
- Line marking varies but is limited to short sections.
- The road is generally raised above surrounding natural surface.

- Croppa Moree Road is a B-double and Road Train (with conditions[1]) approved route.
- Croppa Moree Road is part of a school bus route.
- ADT Data is available on this road and summarised in Table 2.

The Croppa Creek – Moree Road consists of approximately 27 km of bitumen road administered by the Moree Plains Council with the remaining 14 km managed by Gwydir Shire. Sections of the road have been recently upgraded, including causeways and some re-sheeting. Sections of the pavement include areas of deformation due to movement in the black soil sub-grade. The road is generally in good condition for the volume of traffic utilising the road. Some shoulder deformation is present due to mainly trucks moving off the edge of the road in narrower or rougher sections. This is more prevalent in the section of road between Croppa Creek and the County Boundary Road.

Sections of the road to the east of the Crooble Road intersection are subject to shallow ponding or drainage water after rainfall events. Under such conditions, Council generally establish warning signs and vehicle speed is reduced. The ongoing use of this section of road under such conditions has not to date resulted in any significant deformation or break-down of the pavement and bitumen seal.

Croppa Creek – Moree road crosses the County Boundary road at the Shire boundary. The road crossing consists of an "S" bend over approximately 630m with the give-way signs located on Croppa Creek – Moree Road. This can be considered as un-conventional as the Croppa Creek – Moree intersections are not perpendicular to the County Boundary Road. The main flow of traffic is along the Croppa Creek – Moree Road. Sight distances are extensive. The configuration of this cross-over of the two roads is considered to create a minor safety issue. This intersection would need to be identified in a driver induction if this road is used as a haul route for gravel trucks.

The section of road between County boundary road and the Croppa Creek turn-off includes four dips (causeways) and some narrow sections of road. The dips are considered severe and require slowing of all vehicles. This section of road is not smooth due to the black soil sub-grade. The deformation results in reduced speeds. The bitumen seal remains in good condition with only minor patching.

The intersections at Buckie Road and the North Star Road are perpendicular and both have give-way signs. Sight distance is sufficient at both intersections and is considered safe.

[1] The operator of a Type 1 A-double road train must hold National Heavy Vehicle Accreditation Scheme (NHVAS) maintenance management accreditation for the vehicle. The vehicle must have a tri-axle dolly and the tri-axle dolly must be fitted with certified Road Friendly Suspension (RFS). The minimum extreme axle spacing must be at least 26.5m.

The intersection of this road onto the Newell Highway has been upgraded to cater for road trains. A right-hand turn lane is present from the Newell Highway and road width is sufficient for a left-hand turn lane from the Highway. Visibility at this intersection exceeds 300m in all directions and therefore no safety issues are considered to exist at this major intersection.

I B Bore Road (SR9)

I B Bore Road is a gravelled two-way road maintained by both the GSC and MPSC. The section impacted by the quarry involves 22.1 kilometres in length (3.1 kilometres within the MPSC and 19 kilometres within the GSC) with the following characteristics:

- The average road width is 6.0 metres of formed gravel road.
- Culvert width is generally >8.6 metres, with the narrowest culvert width (8.1 metres) located at a drainage line approximately 1.7 kilometres west of the T-intersection with the North Star road.
- The road is relatively flat with several significant bends.
- There is no line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- I B Bore Road is a B-double and Road Train (with conditions) approved route.
- I B Bore Road is part of a school bus route.
- ADT Data is available on this road which is summarised in Table 2.

The condition of IB Bore road is variable. Some sections have 150mm to 300mm depth of gravel pavement. Other sections have exposed black soil subgrade. This is not an all-weather road due to a lack of gravel on sections. A large part of this road has a white rock gravel base. The white rock is soft and subject to weathering and then wind-borne losses of gravel dust.

This road is utilised for haulage of grain from local farms onto the Newell Highway. The road has also been utilised as a key haulage route for delivery of gravel from North Star quarries to Newell Highway projects. For truck operations, this road should be considered as a dry weather road only.

It is noted that Gwydir Shire has received grant funding to upgrade this road into a 2-lane bitumen sealed road. It is assumed that this will then be approved for road train access into the North Star area from the Newell Highway.

Buckie Road

Buckie Road is maintained by both the GSC and MPSC. The road connects Croppa Creek directly with the Newell Highway. The western 14.5 km of this road has a bitumen seal. The remainder is gravel pavement until it enters Croppa Creek. The section between Croppa Creek and the Croppa Creel-Moree Road is bitumen sealed.

For deliveries of Inland Rail gravel, the eastern section between Croppa Creek Road and Croppa Creek village would be utilised to access the rail line through Croppa Creek. For Newell Highway works, the whole road may be utilised to access sections of the Newell Highway. The haulage route therefore may extend across both Shires.

Details of the road are as follows:

- The average road width is 6.8 metres with a minimum of 5.4 metres of sealed pavement between Croppa Creek Road and Croppa Creek village.
- Culvert width is generally >14 metres, with the narrowest culvert width (12.2 metres) located to the west of the Railway Crossing.
- The road is relatively flat and straight.
- There is no line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- Buckie Road contains a school zone within Croppa Creek and is part of a school bus route.
- Buckie Road is a B-double and Road Train (with conditions) approved route.
- There were no available traffic counts for this road.
- Gravelled sections have varying quality and depth of pavement.
- Bitumen sealed sections show minimal deformation or pot-holing.
- The central gravelled sections include sections of minimal gravel which have exposed black soil subgrade.
- The western sealed section is 7m or more in width and relatively new bitumen seal pavement.

The limitation on this road is the gravelled section. Gravel depth is limited to 150mm to 200mm with some minor sections where little or no gravel is present. Road width through the gravelled sections reflects the road condition with vehicles occasionally using the road shoulder to drive around problematic sections. In general terms, this road should be considered as a dry weather road only for trucks.

The intersections onto the Croppa Creek Road and Newell Highway are considered as standard rural intersections with no right or left-hand turning lanes. This reflects the normal traffic volumes on these roads. Sight distance at both intersections is extensive (>300m) and therefore considered to conform to safe traffic flows.

Bruxner Highway

Bruxner Way is a bitumen sealed two-way road maintained by Council with State funding. This section of road provides the connection between the northern end of the North Star Road into Boggabilla. The road is trafficable in all weather conditions apart from times of extreme flood events. This road may be used on occasions to haul gravel to the Inland Rail section north of North Star and to either the Newell or Bruxner highways for roadwork.

The section that may be utilised by North Star Quarry has the following characteristics:

- The average road width is 7.8 metres with a minimum of 7.1 metres of sealed pavement.
- Culvert width is generally >11.8 metres.
- The road is relatively flat and straight.
- There is limited line marking.
- There are table drains either side.
- The road is generally raised above surrounding natural surface.
- Bruxner Way is a B-double and Road Train (with conditions) approved route.
- ADT Data is available on this road between Boggabilla and Tucka Tucka Road which recorded 190.57 ADT in 2013 with 12.3% heavy vehicles.
- These volumes are within the capacity of the existing >7 metres sealed pavement width generally provided along Bruxner Way.

Bruxner Way is currently in moderate condition with some light patching and sections recently replaced and upgraded in gravel foundation and width.

County Boundary Road

The County Boundary Road is a major local road managed by both Moree Plains and Gwydir Shires. The road provides the primary north-south access between the Gwydir Highway at the southern end and onto the Croppa Creek Road.

Road width is variable. The southern section has a bitumen seal width of between 6.5m and 7m with some sections showing edge/shoulder damage because of wheel damage along the edge of the road. The northern 12km is not sealed. The gravel formation has been upgraded to ensure the road remains trafficable in wet conditions.

It is noted that grant funding has been provided to upgrade this road but details of specific sections to be upgraded have not been clearly identified to date.

Local Roads for Inland Rail Access

Quarry operations aim to provide a range of gravel materials to the various sections of the proposed N2NS Inland Rail project via the above more major roads. The primary section for

which the applicant will seek contracts includes the section of rail between Milguy and North Star. Roads that provide access from more major local roads along this section include:

- Alma Lane
- Gil Gil Creek Road
- Crooble Road
- Plevna Road
- Tumba Road
- Boonery Park Road

These are local road administered by the Gwydir Shire. The roads vary in quality from lightly gravelled to black soil tracks.

Alma Lane (Makims Road) provides access to several adjoining properties. Road width is sufficient to allow two trucks to pass, but road construction is limited to servicing this local traffic. Pavement depth is minimal, and trucks may need to pull-over onto the road shoulder to allow another truck to pass in sections. This would be considered a dry weather road.

Gil Gil Creek Road has a gravel pavement with a section of bitumen seal across the Gil Gil Creek floodplain. The road carries only minor local farm related traffic. The road supports heavy grain traffic in dry conditions. In wet conditions, traffic is generally minimised to light vehicles only due to issues of gravel pavement depth and reduced farm access.

Crooble Road is a dry weather road only. The road services local farms and the village of Crooble. The road can be classified as a black soil road and therefore wet weather access is limited to 4WD only. The road runs parallel to approximately 6km of rail line and would therefore provide access to a rail section between Crooble and Croppa Creek road at the northern end.

Plevna Road has a gated entrance to the properties it services and the local landowner appears to provide access by permission only. This suggests that use of this road would be subject to agreement with the landowner. The road consists of a single lane lightly gravel road with black soil at the western end.

Tumba Road is a narrow black soil road between the North Star Road and the rail line to the west. This road is a dry weather road only. Road width is approximately 3m and therefore would limit two-way truck access unless one truck parks on the road shoulder.

Boonery Park Road is a minor Gwydir Shire road providing access to several properties from the North Star Road. The road has some gravel but is not considered as an all-weather road for truck access. The road is single lane with a black soil side-track.

All local roads have relatively narrow intersections onto the adjoining main road. None of these intersections have been constructed in accordance with Austroad standards involving the minimum curve radius into the local road to allow truck access without the truck needing to use the whole width of the adjoining road during the turning process to enter the local road.

2.4 Current and proposed roadworks and traffic management Works

There are no current roadworks or traffic management works, apart from routine maintenance, which will be affected by the development.

It is noted that funding is available to undertake upgrades of some of the potential haul routes. The dates for this work have not been published by road authorities.

2.5 Traffic Volumes

Available traffic data for identified haulage roads are presented in Table 2. Data was provided by the Gwydir Shire Council, Moree Plains Shire Council and Transport NSW (RMS).

Table 2: Available Traffic Data for Key Haulage Roads

Road	Date of Observation	Average Daily Traffic (ADT)	Heavy Vehicles
Croppa Creek Road	March 2011	143	29.5 (20%)
	Dec/Jan 2017	138.0	28.00 (20.3%)
I B Bore Road	October 2014	32	6.39 (19.9%)
	March 2017	18	2.43 (13.5%)
North Star Road	September 2011	330	51.45 (15.6%)
	June/July 2013	788.43	644.54 (82%)
	March 2014	240	49.3 (20.5%)
	March 2017	297	55.69 (18.8%)
Bruxner Way	June/July 2013	190.57	23.49 (12%)
Croppa Moree Road	September 2014	153	23.9 (15.6%)
	March/April 2015	142.86	37.14 (26%)
	March/April 2017	106	21.10 (19.9%)
Newell Highway	2015	3,911	1,329.74 (34%)
	2016	3,858	1,234.56 (32%)
	2017	4,051	1,336.83 (33%)
	2018	3,822	1,299.48 (34%)

Note: Heavy Vehicles = Class 4 and above.

No data was available for Crooble Road, Buckie Road, or Boonery Park Road.

Annual Average Daily Traffic (AADT) is available for the Newell Highway (Site: T0146). The counter recorded 3,911 AADT (34% heavy vehicles) in 2015, 3,858 AADT (32% heavy vehicles) in 2016, 4,051 AADT (33% heavy vehicles) and 3,822 AADT (34% heavy vehicles) to date in 2018. This information is presented in Figure 7.

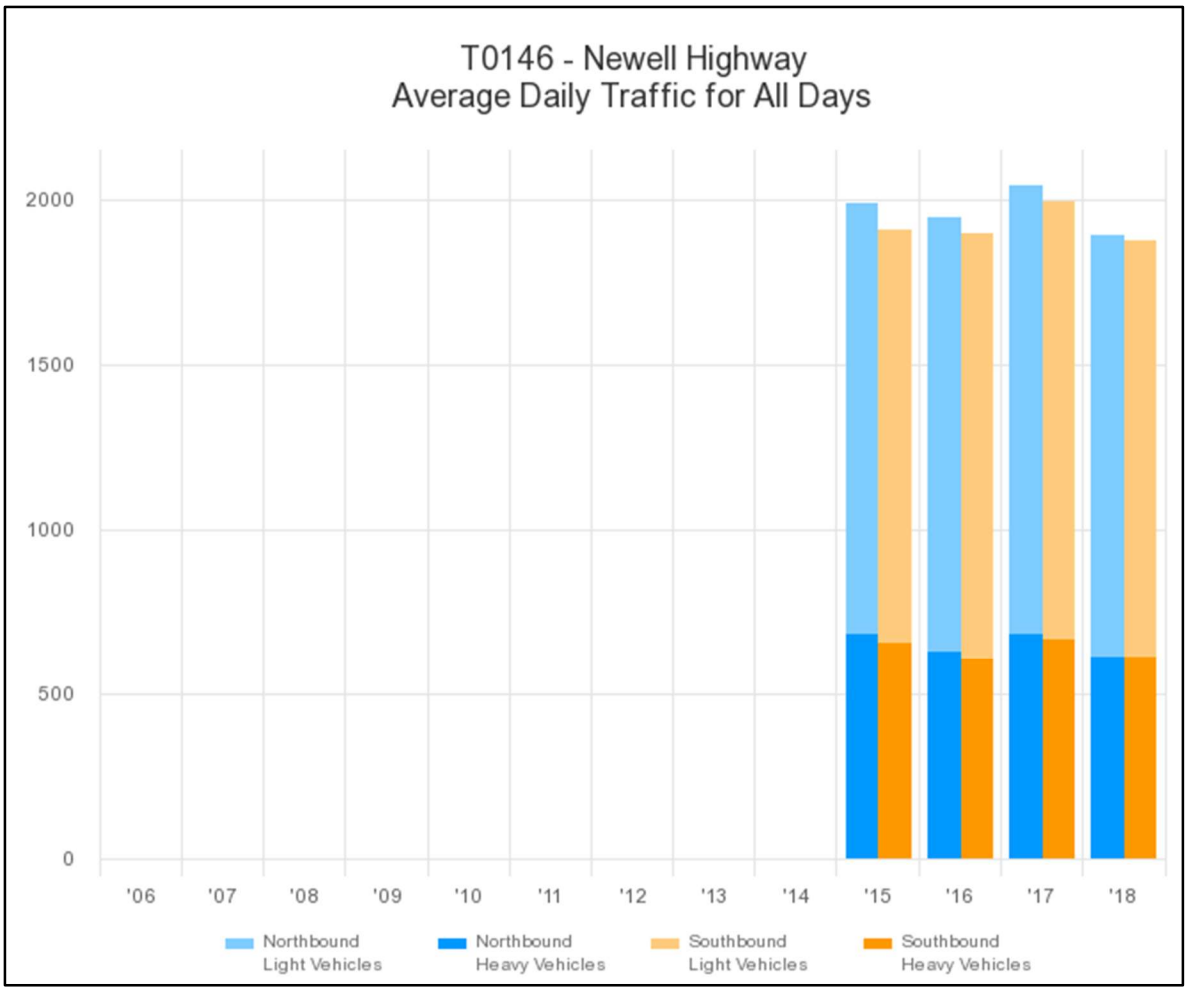


Figure 7: Annual Average Daily Traffic Distribution of the Newell Highway, Boggabilla. Source: RMS Traffic Volume Viewer (Site: T0146).

Hourly traffic flow data is also available for the Newell Highway (Site: T0146) as shown in Figure 8. The data shows that the traffic distribution is reasonably even from 8am to 5pm. Minimal traffic occurs between 1am and 5am.

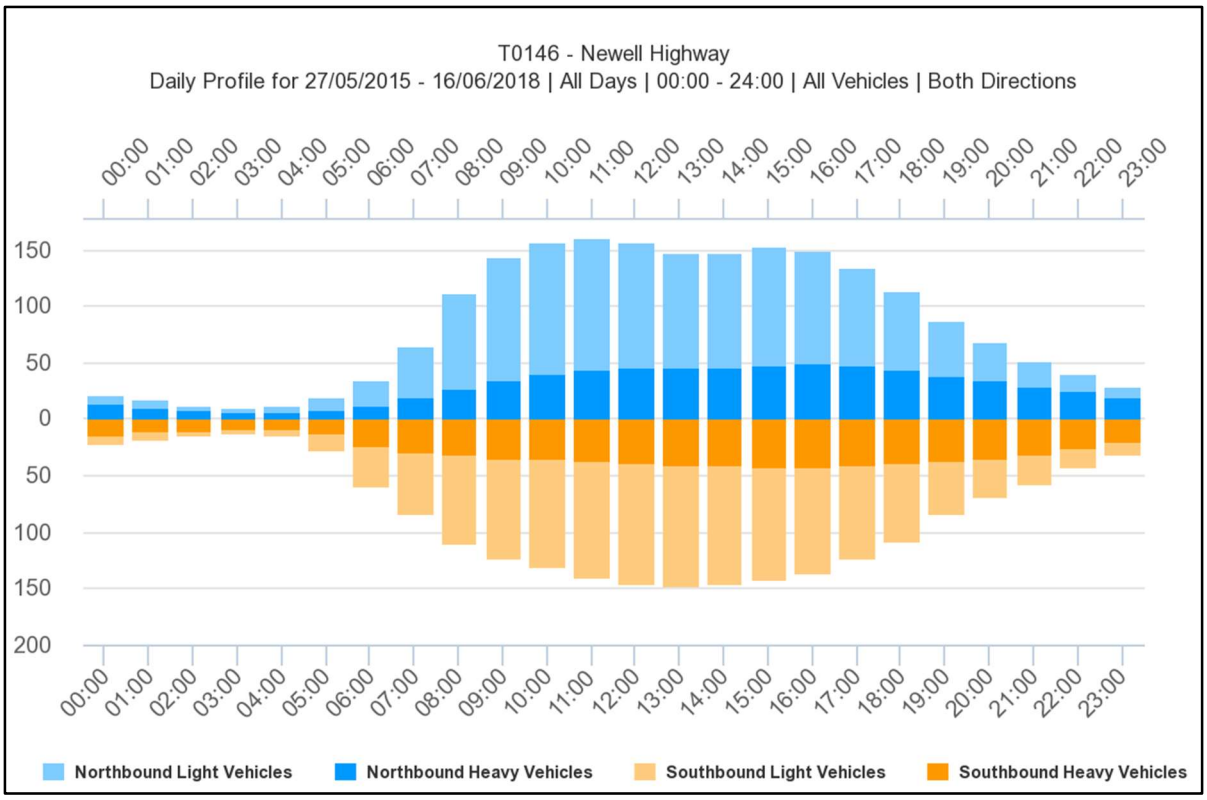


Figure 8: Hourly Average Traffic Distribution of the Newell Highway, Boggabilla. Source: RMS Traffic Volume Viewer.

2.6 Traffic Safety

The NSW Centre for Road Safety provides crash statistics for all reportable accidents to occur within both the Gwydir Shire and Moree Plains Shire areas from 2015-2019. Mapping of reportable accidents is presented in Figure 7. Mapping indicates that a low number of traffic incidents occur on rural roads in the vicinity of the development site. This is likely to be a result of low traffic density of these roads. By contrast, roads with higher traffic densities (such as the Newell Highway) experienced a greater number of collisions during this time period.

From 2015 to 2019, one (1) minor reportable incident occurred on the Backspear Road near the boundary of the Gwydir Shire and the Moree Plains Shire. No other reportable incidents occurred on any rural roads in close proximity to the development site. Given the lack of traffic incidents within the region, it is unlikely that any particular section of roads in the vicinity of the North Star Quarry presents a traffic hazard.

The Newell Highway may be utilised as a transport route for the proposed Quarry if materials were supplied to the Newell Highway Project. A number of incidents occurred on this section of the Newell Highway from 2015 to 2019, yet as these incidents occurred at different locations along the highway, it appears that no particular locations along the highway present a hazard to road safety.



Figure 9: Reportable Crash Statistics, 2015-2019

2.7 Proposed Developments in the Vicinity

The GSC and MPSC were contacted to discuss any proposed traffic generating developments within the vicinity of North Star Quarry.

Council has clearly advised that the Inland Rail development is considered as a traffic generating development as a result of vehicles associated with its construction in addition to trucks delivering gravel to the works. The scheduling of works for rail construction is unknown at present.

Seasonal activities in the region include crop harvest periods. These are considered as a traffic generating activity. For example, during grain harvest periods between October and December, most farms will generate multiple truck movements for delivery of grain to local grain storage facilities. A significant quantity of on-farm grain storage has been built in the past 10-years. This has resulted in a reduction of peak traffic numbers during grain harvest. This peak has been replaced with daily haulage operations from the farms over an extended period.

Other local developments include adjoining quarries which have been expanded or obtained approval for supply of gravel and other products to Inland Rail, Newell Highway projects or local road projects. These adjoining quarries have a similar capacity to the proposed North Star Quarry operation. However, these adjoining quarries will be competing for the same contracts as North Star Quarry and therefore the overall quantity of gravel produced from all local quarries will be shared between the quarries. The result will involve a similar or the same

number of trucks in total as described for one of the quarries at peak production. On occasions, all quarries may operate simultaneously to supply a peak short-term demand at a construction site.

3 Traffic Generation and Distribution

The proposal involves the development of a hard rock quarry with a peak production capacity of 490,000 tonnes per year. Once the Inland Rail project is completed, the intent is to reduce annual extraction limits to 150,000 tonnes per year for a period of 10-years to service the general market in the local area. A maximum of 2,450,000 tonnes would be extracted over the 15-year life of the quarry.

To establish the impact of the development on the adjacent road network and assess the need for improvements to accommodate traffic generated based on the proposed North Star Quarry, traffic generation and trip distribution to the proposed developments have been estimated by the proponent. This is based on extraction and haulage of the whole 490,000 tonnes of quarry material during peak operations.

The components of traffic generation for the proposed development are:

- Staff trips
- Visitor trips
- Haulage of equipment
- Haulage of quarry materials

3.1 Light Vehicle Movements

The site will have 10 full time equivalent (FTE) staff and will therefore utilise 5 light vehicles per day. The employees will be based in either North Star or Croppa Creek, dependent on accommodation. They will need to utilise the North Star Road to access the site via Minilya Road.

Additional light traffic will occur from other company staff including project managers and planners. Light traffic will also be generated by service and repair vehicles in addition to several fuel trucks each week of operations.

3.2 Heavy Vehicle Movements

The aim of the applicant is to supply a range of markets. The major initial works will involve supplying a range of gravel material for construction of the Inland Rail upgrade between mainly Milguy and North Star. This may extend to the Qld border as a second phase on the N2NS rail project. Other projects will include upgrades to the Newell Highway undertaken by the NSW Government. A range of projects have been presented by government, but no fixed dates or contracts have been developed.

The initial period of extraction may generate an average of 46-truck movements per day from the quarry at a rate of 4-trucks per hour. This will generate one truck leaving the site every 15-minutes and one truck returning to the site every 15-minutes. The proponent has predicted that on a "busy day", truck numbers may consist of up to 24-truck trips per hour for one or two days.

Once the Inland Rail proposal is completed, the quarry aims to provide local projects with a range of road base and foundation type gravel materials. These projects will include Council and private on-farm developments. The quarry aims to maintain a long-term annual extraction limit of 150,000 tonnes. Average truck movements would decline to an estimated 14-trucks leaving the site per day at a rate of approximately 1-truck per hour. Such operation may involve only two or three trucks operating from the site for normal supply conditions.

3.2.1 Inland Rail Project

The Inland Rail project is expected to extend over a period of 3-years. The traffic generated by the development will include heavy-vehicle traffic carrying materials, and light vehicles transporting employees, visitors and service personnel.

Supplying the Inland Rail project with quarry material will involve stockpiling quarry materials at selected locations along the rail route. Stockpiled material would then be moved by rail contractors along the rail corridor. Haulage from the quarry will therefore result in selected haul routes along agreed side roads from the more major local roads.

Road traffic from North Star quarry would be distributed evenly north and south from the Minilya Road access on Croppa Creek Road. It is expected that quarry material from this site will mostly be utilised in the rail section between Milguy and North Star.

The current projected start date for construction of the Narrabri to North Star section of the Inland Railway is April 2021 for the Stage 2 section from Penny's Lane to Moree. No specific date has been set for the Moree to North Star section.

Normal Heavy Vehicle Movements

Projected haulage distribution has been provided by Regional Quarries Australia. The following assumptions have therefore been made with regards to traffic calculations:

- Haulage vehicles will typically be truck & dog configurations.
- The General Mass Limit (GML) is 55.95 tonnes for truck & dog configurations.
- A 38-tonne haulage capacity per trip has been assumed.
- Hours of operation for loading of trucks to haul material are 6am to 6pm Monday to Friday and 7am to 1pm Saturday. Allowing for loading times it is assumed that trucks will only be operational for 11 hours a day.

- There will be 50 working weeks/year.
- There will be 6 working day/week.
- Movement calculations are based on one-way (i.e. a truck entering and leaving is considered two movements).

Table 3 outlines the anticipated numbers of truck movements that are predicted to be generated by the proposed development.

Table 3: Inland Railway/Newell Highway - Heavy Vehicle Movements (Predicted)

Traffic Calculations	
Tonnes Processed	490,000 tonnes/year
	9,800 tonnes/week
	1,633 tonnes/day (6 days)
Trucks (38-tonne loads)	12,895 trucks/year
	258 trucks/week
	46 trucks/day

Note: These figures have been rounded up to the nearest whole number. These calculations do not include the use of Double Road Trains – Prime Mover Hauling Unit's. These vehicles may be used on occasion and would reduce the number of truck movements calculated above.

Peak Heavy Vehicle Movements

The haulage of gravel will be subject to contractual issues of supply. Table 3 provides an average of 1,633 tonnes per day of gravel to be hauled from the site. On occasion, the Proponent may be required to supply additional gravel due to project deadlines and schedules in addition to issues such as weather delays. Inland Rail has the option to work 24-hours subject to approvals.

The quarry may therefore haul 5,000 tonnes per day for short periods or single day operations. This would generate up to 132 two-way truck movements under such conditions. The limitation on this would be the ability to load and process the trucks at the quarry site. This would involve a 15-minute turn-around within the quarry. Based on this time, each loading unit would be capable of loading up to 44-trucks per day, thus requiring multiple loading units and potentially two weighbridges on this site. Peak operating days would be offset by periods of lower activity.

Once the Inland Rail project is completed, the proponent has indicated that quarry activity will reduce to 14-laden trucks per day on average for local deliveries.

3.2.2 Newell Highway Projects

Regional Quarries Australia has been approached to supply material for the Newell Highway Corridor Strategy project which involves key upgrades between Moree and Goondiwindi with the aim of increasing productivity for freight operators and improving safety for all road users. The Australian Government is investing $9.3 billion for the delivery of the Inland Rail project and the Newell Highway Corridor Strategy will investigate opportunities to better integrate the Newell Highway with rail operations.

No specific detail is available to determine potential locations for Newell Highway projects.

4 Traffic Management

Regional Quarries Australia recognises the need for safe, responsible and efficient transport of quarry materials in the interest of public benefit and safety. To ensure the quarry is managed in accordance with best practices, all staff and drivers must adhere to a Traffic Management Plan and a Drivers Code of Conduct. The Proponent has advised that all truck drivers must undertake a full induction to the traffic management plan and drivers code of conduct prior to be approved for work on the site. The traffic management plan will include daily induction/site inductions to update drivers on site conditions, haul route matters and operational procedures.

The key components in the Drivers Code of Conduct and Induction procedures will include the following:

- Speed limits – speed limits are to be adhered to. The limits of speed through village areas, along gravel roads, adjacent to homesteads within 100m of the gravel road, and importantly school bus hour operations;
- Approved haulage routes – use only approved haulage routes;
- Abide by Drug and Alcohol Policy under North Star Quarry HSE Policy;
- Adhere to site operation conditions for traffic management of noise and dust emissions;
- Adhere to approved operating hours;
- Report all incidents and complaints to Quarry management;
- Ensure there is no loading over registered mass;
- Appropriately cover and secure loads before leaving the quarry and check for loose material on trailers before leaving delivery site;
- Always drive in a manner that is in accordance with road conditions;
- Reduce engine brake noise to respect community;
- In the event of an environmental incident, make sure every endeavour is taken to contain and minimise environmental harm;

- Adhere to professional and appropriate use of two-ways and maintain communication with other road users via two-way when required;
- Acknowledge courteous acts by others.

North Star Quarry management has indicated that truck drivers not adhering to induction policy will have a show-cause meeting if the code is not adhered to.

4.1 Public Transport and Pedestrians

4.1.1 School Bus Routes and Bus Stop Locations

School Bus routes from Croppa Creek Public School (CCPS) and North Star Public School (NSPS) travel along Croppa Creek Road, Croppa Moree Road, North Star Road and I B Bore Road. Under the current bus routes, the CCPS bus travels as far north as the intersection between Croppa Creek Road and Baroma Downs Road, and as far south as the intersection between Croppa Moree Road and the County Boundary Road. The NSPS route currently reaches as far south as Bonny Ridge, as far north as Scotts Road off the North Star Road and as far west as Nullin Nulla along I B Bore Road. These bus routes may vary from year to year as a result of changes in on-farm staff for local properties and whether they have children that go to school locally.

School buses are on the road shortly before and after school hours, Monday to Friday during the school term. The designated routes and operating times will form part of all operator inductions when engaged by the quarry. Any change to school bus routes will be presented at the morning induction procedure. Such changes may occur after a rainfall event or during school holidays.

4.1.2 Public Transport

There is no public transport within the supply area of North Star Quarry.

4.1.3 Pedestrians and Cyclists

It is exceedingly rare to have pedestrian traffic or cyclists along the main local shire roads. Pedestrians may be present within local villages including North Star and Croppa Creek. Both villages have speed limits of 50 km/h in addition to school zones of 40 km/h to control traffic speed. Such speed limitations are considered appropriate to manage vehicle interactions where the presence of pedestrians or cyclists may occur.

5 Impact on Road Network

5.1 Impact on Traffic Volumes

North Star Quarry is located in a rural region, in which high traffic volumes and traffic congestion are not significant issues throughout the majority of the year. Peak traffic volumes on the road network are typically experienced in association with periods of crop harvest.

Traffic volume data was only available for the following roads:

- Croppa Creek Road
- I B Bore Road
- North Star Road
- Bruxner Way
- Croppa Moree Road
- Newell Highway

The following tables calculate the total heavy vehicle movements predicted to occur per day along the haulage routes for both the Inland Railway and Newell Highway projects. This includes the predicted percentage increase in movements. It should be noted that these calculations assume trucks utilise the entire haulage route and as such should be viewed as extremely conservative.

Table 4 assumes normal operations involving 100% of materials being delivered to the railway or the Newell Highway via the road network. The traffic data used in these calculations indicates relatively low daily heavy vehicle movements based on the available ADT data. This is expected for a rural area where trucks are only generated from local farms. The trucks are generally required to haul grain during harvest periods only. This is reflected in the data. For example, the IB Bore Road carries as few as 2-trucks per day during non-harvest periods. This can be compared to the more major North Star Road which is used as a regional haul route to and from Qld. Daily truck movements range from 49 to 56 truck movements per day. This is associated with cattle and grain movements to and from farms and local feedlot operations.

The exception to this is the Newell Highway which is the main freight route between Qld, NSW, Vic and SA in addition to WA. Daily truck movements on this road are in excess of 1,200 movements.

The addition of up to 92-two-way truck movements per day from the quarry is therefore significant in relation to the current level of local traffic. It is noted that these daily traffic figures do not include any period since other local quarries were approved after 2018. Other local quarries are known to generate a similar level of traffic that is predicted for North Star Quarry. However, it is noted that the quarries will share quarry material contracts and therefore the 92-truck movements will vary according to each quarry winning contracts.

Table 4: Inland Railway - Average Daily Heavy Vehicle Movements (Peak)

Road	Date of Observation	Current Heavy Vehicle Movements/Day	Proposed Heavy Vehicle Movements/Day from Quarry	Total Heavy Vehicle Movements/Day	% Increase in Heavy Vehicle Movements
Croppa Creek Road	Mar-11	30	94	124	319
	Dec/Jan 2017	28	94	122	336
North Star Road	Sep-11	51	94	146	183
	Mar-14	49	94	143	191
	Mar-17	56	94	150	169
Bruxner Way	June/July 2013	23	94	117	400
Croppa Moree Road	Sep-14	24	94	118	393
	March/April 2015	37	94	131	253
	March/April 2017	21	94	115	445
Croppa Creek Road	Mar-11	30	94	124	319
	Dec/Jan 2017	28	94	122	336
I B Bore Road	Oct-14	6	94	100	1471
	Mar-17	2	94	96	3868
Newell Highway	2015	1,330	94	1,424	7
	2016	1,235	94	1,329	8
	2017	1,337	94	1,431	7
	2018	1,299	94	1,393	7

5.2 Impacts on Road Condition

The proposed haulage routes include both sealed and unsealed roads. The sealed roads include the route between Boggabilla-North Star-Croppa Creek and the Croppa Creek-Moree Road to the Newell Highway. The remaining haul roads have minor sections of bitumen seal, but mostly consist of gravel pavement in varying condition.

The bitumen sealed roads are considered in good condition as a result of regular patching and replacement of sections by both Gwydir and Moree Plains Shires. The important components relating to bitumen sealed roads includes gravel depth, drainage and bitumen seal width. This assessment has determined that the majority of the bitumen sealed haul routes have sufficient gravel sub-grade to support the current truck traffic impacts during peak periods of grain harvest. This is evident in the more recent 2020 grain harvest which was a large grain harvest for the region. Bitumen sealed roads supported these trucks with minimal road damage or pavement failure.

Drainage is an issue during wet periods or after storm events where ponding of water on roads can result is soakage into subgrades, leading to failure of the sealed surface. Councils appear to be fully aware of this and maintain programs to minimise sections of road where water cannot drain away from the road shoulder.

Road width is a significant factor in whether bitumen sealed roads survive minor or major heavy vehicle use. The issue relates to shoulder damage where passing trucks need to place their passenger wheels onto the road shoulder to ensure safe passing. For the haul roads assessed for North Star Quarry, road width throughout the majority of bitumen sealed haul roads is sufficient to allow two trucks to pass without the need to place wheels over the edge of the bitumen. Small sections of bitumen seal where the black soil subgrade has made the road uneven show some signs of shoulder damage. These sections result in truck and trailer combinations being slightly unsteady and therefore drivers allow additional width between vehicles when passing. On occasions, the passenger side wheels travel on the road edge, resulting in some edge damage to the bitumen seal. Such sections are restricted to the 10km section of Croppa Creek Road to the south of Croppa Creek and approximately 3km of the northern end of the North Star-Croppa Creek Road.

The southern end of the North Star Croppa Creek Road is currently considered in a rough surface condition. The bitumen seal in this southern section between the causeway located approximately 750m north of the Croppa-Moree Road intersection and the top of the hill adjacent to Plevna Road (Murgo Access Road), has historically been an issue of possibly poor subgrade or soil issues at depth. The bitumen becomes rough and therefore some pavement failure occurs on a regular basis. Heavy vehicles would exacerbate potential development of pot holes and pavement failure. Heavy vehicles generally reduce speed in this section as a

result of the rough surface. Road width is satisfactory and therefore shoulder damage is generally not an issue.

Most of the unsealed roads included in potential haul roads are in variable condition. Most of the roads include sections where clay subgrade material is exposed as a result of loss of gravel pavements. This renders the road to dry weather conditions only for trucks. It should be noted that the gravel carting operations would generally be limited to dry weather conditions only as a result of limitations of access on unpaved roads at the stockpiling sites. This would result in a limited need for North Star Quarry haulage trucks to use local minor roads during wet weather. The critical period for such roads is during a rainfall event when trucks are en route during haulage operations. It would be recommended that alternative access routes (sealed) be adopted once a rainfall event occurs on local gravelled roads to avoid damage in sections with limited pavement depth. After a rainfall event, quarry management would need to inspect the haul routes on such roads before providing permission for trucks to travel such routes. The outcome of either scenario is that the heavy vehicles would bog through the surface and complete pavement failure would occur, making sections of the roads unusable. This would require maintenance to be provided by Councils, being the local road authorities.

On this basis, it is recommended that the quarry operator instigates a wet weather protocol within the overall project management plan to ensure that when gravel roads are used for haulage to sites, damage from truck use in wet or rainy weather can be avoided.

The development is subject to both the Gwydir Shire Council “Section 94 Development Contribution Plan No.1 – Traffic Generating Development” (April 2011) (DCP) and the Moree Plains Shire Council “Section 94 Development Contribution Plan – Traffic Generating Development” (April 2016). The contribution plans allow the Councils to levy contributions from traffic generating developments under Section 7.11 (previously Section 94) of the Environmental Planning and Assessment Act 1979. These contributions are typically utilised to cover the costs of maintenance, repair and reconstruction of roads as a result of damage caused by heavy vehicles generated by the development.

The payment of contribution fees is therefore considered essential to compensate the Councils for any impacts on existing road condition as a result of the proposed development. Council does not collect such contributions from local road users such as farming operations where no development consent is present, being the planning instrument, which triggers the opportunity for Council to secure contributions for specific operations. Landholders pay rates to Council in lieu of road contributions.

5.3 Impact on Traffic Safety

A review of traffic safety has been undertaken. This has mainly included inspections of intersections to be used by trucks from the quarry and general road geometry, including speed and any sharp corners on the local road network.

Minilya Road is currently a relatively narrow property road. This will require an upgrade to form a two-lane gravel pavement or installation of "whale berms" under a TCP to ensure the safe movement of trucks and other local vehicles during haulage campaigns. The property intersection will require appropriate treatment in the form of a standard property access with two lanes. A requirement to bitumen seal the Minilya property intersection will depend on the quarry management adopting an appropriate standard of road watering. This intersection will become dusty as a result of extensive road fines and powdered dirt. Such an issue would result in a dust cloud being generated as a truck leaves or enters the site. Such a cloud would impact visibility. Adequate selection of course gravel in addition to road watering or dust sealant application would avoid or minimise this safety risk. The alternative would involve bitumen sealing up to 50m at the road entrance on both the internal access road and part of Minilya Road.

The proposed site access onto the North Star Croppa Creek Road has appropriate sight distances. At present, the intersection has a short section of poor-quality bitumen approach on Minilya Road. This will need to be lengthened to approximately 30m to ensure dust and dirt does not create a safety issue at the intersection. The entry into this road from North Star is impacted by a power pole and associated stay wire on the northern side. The stay wire extends into the intersection and therefore has created a minor alignment issue. This is considered a minor issue, but any reconstruction of this intersection will need to align the road accordingly to avoid this stay wire if it cannot be removed. Alignment would require perpendicular entry into the intersection. It is expected that a Rural Basic Left Turn (Figure 8.2 Guide to Road Design Part 4A) will satisfy the requirement for this intersection. The speed control along the North Star Road is 100 km/h. Safe intersection sight distance is calculated to be a maximum of 318m. This sight distance is available in both directions.

A review of all other roads that may be utilised by North Star Quarry traffic did not identify any specific safety issues that may result from either intersection sight distances or road geometry in corners/bends in the roads. Sight distance is considered greater than the minimum requirement at all intersections to be used by haulage trucks. The only minor exception to this is the sight distance toward Baroma Road-Myall Downs Road from the southern end of the Croppa Creek-North Star Road. The issue with this intersection is that Myall Downs Road has a sweeping bend commencing at a distance of approximately 220m from the Croppa Creek-North Star Road and the road side vegetation can on occasion limit sight distance to this distance. The geometry of Myall Downs Road would ensure vehicles are

travelling slower than the 100 km/h limit and therefore this issue is considered relatively minor.

The road geometry at the intersections of the Moree-Croppa Creek Road across the County Boundary Road has been discussed above. To date, this intersection has not resulted in any severe road safety issue. The introduction of non-local truck drivers for hauling of quarry product may require the quarry management to include a precaution in driver induction protocols if this road is to be used as a haul road. This would be exacerbated during construction of the Inland Rail where a significant increase in traffic is anticipated. The major increase in traffic may occur from the southern section of County Boundary Road as it runs parallel with the rail line. Give way signs are present but due to the angles of approach onto the County Boundary road, some issues remain for vehicles travelling either east or west along the Croppa Creek-Moree Road.

5.4 Impact on Traffic Noise and Dust Production

The proposed development will result in a net increase in traffic volumes on the public road network. Therefore, the development will increase traffic noise and dust production throughout the local road network.

The closest residences to the haulage route have been identified in Table 5, as well as the potential amenity impacts.

Table 5: Residents located along the designated haulage route.

Address	Distance to road	Sealed / Unsealed	Potential issue
578 IB Bore Road North Star	>400m	Sealed	Minimal issue.
751 IB Bore Road North Star	>400m	Unsealed	Minor dust issue but 400m buffer is appropriate
1069 IB Bore Road North Star	>400m	Unsealed	Minor dust issue but 400m buffer is appropriate
1863 IB Bore Road North Star	>400m	Sealed	Minimal issue.
2279 IB Bore Road North Star	<400m	Sealed	Minimal issue.
2107 Croppa Creek Road North Star	>400m	Sealed	Minimal issues.
1835 Croppa Creek Road North Star	>400m from Croppa Creek,	Sealed	Minimal issues.
	<100m to the private portion of Bushes Access Road	Unsealed	Dust issue if private road used. Otherwise, no concerns.

Address	Distance to road	Sealed / Unsealed	Potential issue
1176 Oaklands Road North Star	>400m from Bruxner Way	Unsealed	Minimal issues.
141 Boonery Park Road North Star	<100m to Boonery Park Road	Unsealed	Dust if Boonery Park Road used. Otherwise, no concerns.
	>400m from Croppa Creek Road	Sealed	Minimal issues.
781 Croppa Creek Road North Star	<400m from Croppa Creek Road	Sealed	Minimal issues.
Feedlot on Croppa Creek Road	>400m from Croppa Creek Road	Sealed	Minimal issues.
Tumba Road	No residents	Unsealed	Minimal issues.
367 Croppa Creek Road North Star	>400m from Croppa Creek Road	Sealed	Minimal issues.
195 Croppa Creek Road North Star	>400m from Croppa Creek Road	Sealed	Minimal issues.
	>400m from Plevna Road	Unsealed	Road has been gated by property owner.
4011 Croppa Moree Road Croppa Creek	<100m from Croppa Moree Road	Sealed	Road noise if road haulage goes south to Croppa Creek.
Buckie Road Croppa Creek (1 house with silos north of the road)	<400m from Buckie Road	Sealed	Minimal issues.
Residents and businesses in North Star town		Sealed	Speed limit in place to reduce issues.
7056 North Star Road North Star	<400m from North Star Road	Sealed	Minimal issues.
7114 North Star Road North Star	<100m from North Star Road	Sealed	Noise if road haulage goes north to Bruxner Highway.

Address	Distance to road	Sealed / Unsealed	Potential issue
7409 North Star Road North Star	<400m from North Star Road	Sealed	Minimal issues.
21930 Bruxner Way Boggabilla	<400m from highway	Sealed	Minimal issues.

Assumptions:
House >400m from sealed road are not a concern for noise and dust.
House <400m from unsealed road may have a concern about dust.
House <100m from sealed road may have a concern about noise.
House <100m from unsealed road may have concern about noise and dust.

Regional Quarries Australia aims to contact the residences located between 100m and 400m of a haul route prior to operation to discuss acceptable mitigation measures and resolve concerns related to noise and dust impacts. Regional Quarries Australia will also implement dust and noise mitigation measures in accordance with the Environmental Management Plan.

Dust management measures in all trafficable areas on site will include:

- Enforce a maximum speed of 40 km/hr on internal roads.
- Keep trafficable areas as clean as possible.
- Maintain road surfaces in good condition.
- Use water sprays on trafficable areas (approx. rate 2L/m^2/hr).

When transporting materials, the following dust management measures will be implemented:

- Ensure loads are appropriately contained and covered prior to leaving the site.
- Remove spillages from side rails, tailgates and draw bars of trucks (following loading and tipping).
- Securely fix tailgates of all material transport vehicles prior to loading to prevent material.

Dust is not considered to be an issue on the bitumen sealed roads. Gravel and dirt roads are expected to generate dust for a brief period after each heavy vehicle. Busy intersections on gravel pavement haul roads present a risk which needs to be addressed in relation to truck frequency. The alternative dust management strategy would involve road watering or the use of dust stabilisation fluids.

When transporting materials, the following noise management measures will be implemented:

- Heavy vehicle traffic being limited to the hours of operation in accordance with the conditions of consent.
- Enforce a maximum speed of 40 km/hr on internal roads.

- Operate well-maintained plant, vehicles and equipment, and ensure all plant, vehicles and equipment are serviced in accordance with, or more frequently than, manufacturers' specifications.
- Avoid unnecessary revving of engines.
- Ensure that any extraneous noises are rectified.
- Avoid the use of compression braking on product delivery trucks in residential areas.
- Selective approach to trailer bodies to limit noise generation from empty trailers on all pavements.

Provided the Operator manages dust and noise effectively and addresses the concerns of sensitive rural receptors the potential for heavy vehicle traffic to adversely impact the amenity of rural areas within the vicinity of the freight routes to be utilised by North Star Quarry is considered minimal.

5.5 Cumulative Impacts with Neighbouring Developments

It is noted that the North Star Quarry is one of three quarries seeking or have obtained approval in the North Star area for supply of quarry material to both Inland Rail and Newell Highway projects. Each site aims to obtain an approval for up to 490,000 to 500,000 tonnes of gravel per annum during construction of the Inland Rail project. Additional smaller quarries of up to 30,000 tonne per annum have approvals in the local area.

Data published by Trans4m Rail suggests a total requirement for approximately 700,000 tonnes of quarry material for construction of the Inland Rail between Moree and North Star. Some of this quarry material will be obtained from these northern quarries but not all. The issue identified in this assessment is the cumulative impact if all three local quarries generate up to 92 or more trucks per day. Each site may have an average of 92-one way truck movements each day when averaging total permissible extractions over a 50-week period each year. This would potentially create significant traffic issues relating to road safety and pavement wear and tear.

The three quarries operating at once would add to the existing local businesses such as the feedlots and farming operations. During a major grain harvest period, the cumulative impact of all operations needing to use local roads, may require development of a traffic management plan to cater for the significant increase in local traffic. Such a plan would require cooperation of all local quarries to ensure efficiencies can be maintained for haulage operations. Councils would need input in such a plan as they will be responsible for road maintenance. It is envisaged that this plan will need to include speed control and traffic management protocols to ensure all vehicles comply with their individual traffic management plans to minimise congestion at intersections and stockpiling points. Such a plan/s is beyond the scope of this assessment as the specific haul routes and daily concentration of delivery points is not available. The outcome of such a plan will need to include specific TCPs for

management and signage to be deployed for delivery points for larger haulage or stockpile sites. It is noted that road work along the Newell Highway deploys extensive TCPs, including variable speed controls. Inland Rail is yet to commence operations; however, they will be subject to similar responsibilities and therefore require specific TCPs for entry points to stockpile sites along the local road network.

Other existing quarries in the local area will require a traffic management plan as part of their approvals. The Plans are designed as an adaptive tool for operation of the quarry. On this basis, these plans, including the plan that will be prepared for North Star Quarry are considered as an appropriate tool to manage the impacts of cumulative traffic impacts on the local road network.

5.6 Calculation of Expected Development Contribution Rate

The method of calculating contribution rates is based on the reconstruction costs, average road maintenance costs and the length of road likely to be used by vehicles associated with the development. The impact is calculated on the Equivalent Standard Axle (ESA) loading on the road per vehicle as a proportion of the total loadings on the road. This is then converted to a total cost per tonne (1,000 kilograms) per kilometre. The designated haulage route will form the length of road upon which the contribution will be levied. Where the designated haulage route involves the use of more than one road then each road will be treated separately in terms of the road maintenance contribution. Therefore, the total contribution payable for the development will be the sum of all the calculated contribution rates for all the individual roads on the designated haulage route/s.

5.6.1 Gwydir Shire Council Contributions

The Gwydir Shire development contribution rates are as follows:

- Unsealed Roads: 0.19c/tonne/kilometre
- Sealed Local Road: 1.29c/tonne/kilometre.

Newell Highway Project

The total length of unsealed roads within the designated haulage route for the current Newell Highway Project is 19 kilometres. This includes I B Bore Road. Using the base rates provide by Council, the estimated contribution rate for unsealed roads in the Gwydir Shire is therefore:

0.19c x 350,000 t x 19km = 1,263,500c
In dollars: 1,263,500c /100c = $12,635

The total length of local sealed roads within the designated haulage route for the Newell Highway Project is 9.4 kilometres. This includes Croppa Creek Road. Using the base rates provide by Council, the estimated contribution rate for local sealed roads in the Gwydir Shire is therefore:

1.29c x 350,000 t x 9.4km = 4,244,100c
In dollars: 4,244,100c /100c = $42,441

The above figures provide an estimated contribution rate. The final rates will need to be negotiated with Council during final discussions to determine approved haulage routes and road conditions at the time that this occurs.

Inland Railway Project

The total length of unsealed roads within the designated haulage route for the Inland Railway Project is currently unknown as Trans4m Rail has not identified the specific location of stockpile points and gravel contracts have not been issued.

The entire haulage route will not be utilised for every trip. It is therefore assumed that the average haulage trip would involve 30 kilometres of roads in either a north or south direction from the proposed Minilya driveway within the Gwydir Shire Council.

For the ease of administration for both the Operator and Council, a standard contribution rate could be adopted within a planning agreement. Previous calculations undertaken by SMK Consultants for adjoining quarries has identified a standard contribution rate of **38.7c/tonne** for unsealed roads. This may need to be altered once full detail of the Inland Rail project is released by Trans4m Rail.

This figure of 38.7 c/tonne was calculated using the higher local sealed road rate across both sealed and unsealed roads, as follows:

1.29c x 490,000 t x 30km = 18,963,000 cents
In dollars = $189,630/year
Estimated cost = $0.387/tonne (38.7c)

This contribution rate would be payable on every tonne out the gate regardless of the trip length or road type. The measurement of tonnes moved would be the responsibility of the operator via weighbridge dockets or receival receipts.

The above figure provides an estimated contribution rate. The final rate will need to be negotiated with Council during final discussions to determine approved haulage routes and road conditions at the time that this occurs.

5.6.2 Moree Plains Shire Council Contributions

The total length of unsealed roads included within the designated haulage route in the Moree Plains Shire area is 3.1 kilometres (I B Bore Road). The total length of sealed roads is 18

kilometres, including North Star Road and Bruxner Way. Other roads may also be used. The entire haulage route will not be utilised for every trip. It is therefore assumed that the average haulage trip would involve 10 kilometres of roads within the Moree Plains Shire Council.

A potential contribution rate has been calculated for other local quarries delivering material through Moree Plains roads. This was calculated using the higher local sealed road rate across both sealed and unsealed roads, as follows:

1.29c x 490,000 x 10km= 6,321,000 cents
In dollars = $63,210/year
Estimate = $0.129/tonne (12.9c)

The final rate will need to be calculated during discussions with Council in relation to approved haulage routes and roads conditions.

It should be noted that all local haul roads subject to use by Inland Rail will also be the responsibility of the Inland Rail Contractor. This obligation is presented in the approval for this project. Such obligations will include road dilapidation studies prior to commencement of the project in addition to repair and maintenance of haul or access roads during and after the project. The potential is that quarries supplying gravel to the Inland Rail project will be contributing to road maintenance and this will be duplicated through the Inland Rail Project. This should be to the benefit of Council in that the roads will receive active maintenance during the Inland Rail Project. This is not applicable to the Newell Highway upgrade projects. Once the Inland Rail project is completed, this duplication will cease and therefore this contribution will be paid by the quarry operators and passed on to their customers.

6 Conclusion and Recommendations

SMK Consultants were commissioned by Regional Quarries Australia to prepare a Traffic Impact Assessment to be lodged as part of an EIS to obtain consent for development and operation of the North Star Quarry. This Traffic Impact Assessment has considered the potential impacts of the proposed North Star Quarry upon traffic on site and within the wider region.

The proposed site access and internal roads within Minilya will require upgrades to be suitable for the potential peak traffic movements of up to 92-truck movements per day. This will include construction of an appropriate intersection into Minilya and widening of Minilya Road to either a 2-lane haul road or installation of "Whale berms" to allow empty trucks to wait on the side of the road for loaded trucks to pass with a TCP in place.

Roads to be constructed or modified in association with the proposed development should be constructed in accordance with relevant standards to ensure that the site will be operated and maintained at a high standard.

The Minilya Road-North Star Road intersection will require upgrading to provide a safe entry-exit intersection for trucks. Work will include extending the bitumen seal on Minilya Road to approximately 30m in length and re-alignment of the intersection to meet Austroad standards for the trucks to use this road safely. A standard rural intersection is considered a minimum to provide safe entry and exit for up to 8-trucks per hour either leaving or entering this road.

The increase in traffic along the local road network is considered significant. Road condition of sealed roads is generally suitable for this increase in truck movements, but specific sections have been identified to have minor issues in relation to road foundations and roughness of the roads. The result of such poorer quality sections will include a reduction in truck speed, rather than a traffic safety issue. Road shoulder damage is predicted to increase in these rougher sections. Some intersection points at present, show dilapidation at stop points.

The use of local gravel paved roads will require close management due to the presence of relatively poor sections of gravel pavement. Some sections of these local roads would be considered as dry weather roads only due to the lack of gravel pavement depth. It is recommended that the quarry operator adopt a wet weather protocol to ensure the integrity of these gravel roads is maintained. This will include variation to haul routes during and for several days after a rainfall event. A figure of 10mm of rain may be required as a formal trigger for stopping the use of certain roads. Quarry management will need to continue an active program to avoid road damage in wet weather. The alternative is that Council closes unsealed roads to quarry trucks to prevent use of these roads to ensure access is retained for local landholders.

Both Moree Plains and Gwydir Shires have a road contribution policy. This will enable Councils to impose an appropriate contribution rate for road maintenance and potentially road upgrades once North Star Quarry operations reduce to 150,000 tonnes per annum when the Inland Rail project is completed.

Regional Quarries Australia would commit to:

- Paying all heavy haulage contribution fees within 30 days from the end of the month.
- Continued liaison with the community along the haulage route.
- The construction of a new Intersection from Minilya Road and upgrading of Minilya Road to accommodate heavy vehicles in accordance with the Austroads specifications and bitumen sealed for a minimum of 35m metres from the North Star Road.
- Comply with all the conditions of approval as issued by Gwydir Shire Council.

The issue of cumulative traffic increases has been identified during this investigation. Three or more other quarries in the local area will be vying for gravel contracts to supply either Inland Rail or Newell Highway projects. If all three quarries become operational at the same time, truck traffic frequency on the local road network would be significant. It is recommended that if this occurs, a traffic management plan is developed for all three quarries to work together to ensure road safety can be maintained, road maintenance can be managed by Councils and other users can safely use their local road network. This is identified to be a significant issue that will need cooperation during grain harvest periods when additional local trucks are hauling grain around the district.

Based on this assessment, use of the local road network will result in some damage. Appropriate contributions need to be paid to Councils to cover the cost of repairs which may include an increased presence of road repair gangs for pot hole repairs on a weekly basis. As a whole, no specific road safety issues were identified that need immediate action prior to North Star Quarry operations commencing other than the Minilya Road.

7 Limitations

This Traffic Impact Assessment ("report"):

- Has been prepared by SMK Consultants Pty Ltd ("SMK Consultants") for Regional Quarries Australia Pty Ltd ("Regional Quarries Australia");
- Should be read in full, and no summary, conclusion or other section of the report may be used or relied on in isolation or taken as representative of the report as a whole;
- May be provided to other third parties but such third parties' use of or reliance on the report is at their sole risk; and
- May only be used for the purpose as stated in Section 1.1 of the report (and must not be used for any other purpose).

SMK Consultants and its employees otherwise expressly disclaim responsibility to any person other than Regional Quarries Australia arising from or in connection with this report.

No representation or warranty, express or implied is made as to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning its application to and where necessary seek expert advice in respect of their situation.

The services undertaken by SMK Consultants in conjunction with preparing this report:

- Were limited to those specifically detailed in Section 1.3 of this report; and
- Were undertaken in accordance with current professional practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this report.

The opinions, conclusions and any recommendations included in this report are based on assumptions made by SMK Consultants when undertaking the services mentioned above and preparing the report as specified throughout this report. SMK Consultants expressly disclaims responsibility for any error in, or omission from, the report arising from or in connection with any of the assumptions being incorrect.

Subject to the paragraphs in this section of the report, the opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the time of preparation of this report and are relevant until such as the site conditions or relevant legislation changes, at which time, SMK Consultants expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with those opinions, conclusions and recommendations.

SMK Consultants has prepared this report on the basis of information provided by Regional Quarries Australia, Gwydir Shire Council, Moree Plains Shire Council and Transport NSW among others, which SMK Consultants has not independently verified or checked ("unverified information") beyond the agreed scope of work. SMK Consultants expressly disclaims responsibility in connection with the unverified information, including (but not limited to) errors in, or omissions from, the report, which were caused or contributed to by errors in, or omissions from, the unverified information.

Inspections undertaken in respect of this report are limited to visual inspections only and are constrained by the particular site conditions, such as site access or vegetation. The results of the road condition assessment are limited to the date of the site inspection. The suitability of the roads for purpose should be determined by Regional Quarries Australia prior to each trip.

Appendix 1 – Road Condition Assessment: Haulage Route Photos

Figure 10: Minilya Road with entrance to quarry on right.



Figure 11: Intersection of Minilya and North Star Road



Figure 12: Sight distance north from Minilya Road entry



Figure 13: Sight distance south from Minilya Road



Figure 14: North Star-Croppa Creek Road



Figure 15: North Star – IB Bore Road Intersection



Figure 16: North Star to Bruxner Highway – minor shoulder patching



Figure 17: North Star Road at "Warendi" showing some deterioration in bitumen surface.



Croppa Moree Road

Figure 18: Intersection of Buckie Road and Croppa Creek-Moree Road



Figure 19 – Croppa Moree Road Railway Crossing (To be replaced by Trans4m Rail)



Figure 20- Croppa Creek - Moree Road



Figure 21 – Croppa Creek - Moree Road showing subgrade deformation and uneven pavement surface requiring vehicles to slow down.



Figure 22: Concrete causeway along Croppa Creek-Moree Road



Figure 23: 'S" bend alignment of Croppa Creek-Moree Road as it crosses County Boundary Road



Figure 24: Belmont Bridge over Croppa Creek (north of Croppa Creek) – 6.6m deck width



Figure 25: Croppa Creek – North Star intersection at the start of Baroma Downs (Myall Downs) Road with wheel marks from B-doubles



Figure 26: IB Bore Road – section of shallow gravel pavement showing wet weather damage.



Figure 27: Rail Crossing in North Star – some pavement failure (spider cracking)



Figure 28: Edward Street within North Star after rain



Figure 29: North Star to Boggabilla Road on northern edge of North Star.



Figure 30: Bruxner Way showing road damage on and near a piped culvert.



Figure 31: Buckie Road west of Croppa Creek with blue metal pavement



Figure 32: Buckie Road west of Croppa Creek with thin gravel pavement showing signs of wet weather damage.



Appendix 8

Biodiversity Development Assessment Report



Biodiversity Development Assessment Report

North Star Quarry

North Star, NSW

Gwydir Local Government Area

April 2021

Report prepared by

OzArk Environment & Heritage

for Groundwork Plus

on behalf of

Regional Quarries Pty Ltd

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DOCUMENT CONTROLS

Proponent	Regional Quarries Australia Pty Ltd		
Client	Groundwork Plus		
Document description	Biodiversity Development Assessment Report (BDAR)		
	Name	Signed	Date
Clients reviewing officer			
Clients representative managing this document		OzArk representative managing this document	
Jim Lawler		Dr Crystal Graham (CG)	
File Location		OzArk job number	
S:\OzArk EHM Data\Clients\Groundworks Plus\North Star Quarry_Nov 2020\Ecology		2900	
Document status: **V3.0 FINAL**		Version	Date	Action
Internal Draft series V1.X		V1.0 V1.1 V1.2 V1.3 V1.4	2/7/2021 2/7/2021 15/7/2021 16/7/2021 19/7/2021	KH to CG CG to KH KH to CG CG to KH KH to CG
First Draft for Client Review		V2.0	20/7/2021	CG to JL
Final		V3.0	11/8/2021	CG to JL
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Enquiries would be addressed to OzArk Environmental & Heritage Management Pty Ltd.

CERTIFICATION

I certify that I have prepared the contents of this BDAR and, to the best of my knowledge, it is in accordance with the *NSW Biodiversity Conservation Act 2016* and the Biodiversity Assessment Method (BAM). The information it contains is neither false nor misleading. It addresses, to the fullest extent possible, all matters affecting or likely to affect biodiversity as a result of the proposed activity. This BDAR has been prepared by a BAM Accredited Assessor.

BDAR prepared by	**Dr Kate Hammill**
Signed	
Date	11/8/2021
Organisation	KHS Ecology & Bushfire with OzArk Environment and Heritage
Position	Senior Ecologist / Botanist
Qualification	Doctor of Philosophy (Ecology)
Accreditation number	BAAS18022

BDAR revised by	**Dr David Orchard**
Signed	
Date	20/04/2022
Organisation	OzArk Environment and Heritage
Position	Ecologist
Qualification	Doctor of Philosophy (Science)
Accreditation number	BAAS21028

EXECUTIVE SUMMARY

OzArk Environment & Heritage (OzArk) has been engaged by Groundworks Plus, on behalf of Regional Quarries Australia Pty Ltd (the proponent) to complete a Biodiversity Assessment Report (BDAR) for the proposed hard rock quarry at 5535 North Star Road, North Star (the proposal). The proposal is within the Gwydir Shire Council Local Government Area (LGA).

The assessment seeks to address the requirements of the *Biodiversity Conservation Act 2016* in relation to biodiversity assessment and the NSW Biodiversity Offset Scheme. This report applies the *Biodiversity Assessment Method* (BAM) (OEH 2020) to calculate the number of ecosystem and species credits generated by the proposal requiring offset.

The native vegetation to be cleared has been identified as 2.00 ha of one Plant Community Type (PCT):

- PCT 445 *Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion.*

The vegetation within the modified quarry footprint as of March 2022 includes partially cleared, degraded, and wholly cleared areas. The wholly cleared areas belong to the quarry, which is subject to an existing development approval. These areas were excluded from impact calculations. The vegetation on the site is not of sufficient condition to be part of any of the TECs associated with the Brigalow vegetation in the surrounding woodland areas.

In total 16 potential ecosystem credit species were predicted for the PCT and condition as a derived grassland. Woodland areas around the quarry site were excluded from the development footprint after the design was modified, as part of avoidance measures. Due to the low VI scores for each zone, no ecosystem credits either for the PCT or for the 16 predicted species are required to be offset.

Ten candidate species credit species were determined from the BAM calculations. The following species have been excluded and are considered not impacted due to habitat requirements not being present in the subject land (suitable habitat trees, flora species, and intact native vegetation not present) or due to targeted surveys having been conducted to determine presence or absence.

- Absent: Pale Imperial Hairstreak (*Jalmenus eubulus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Koala (*Phascolarctos cinereus*), Masked Owl (*Tyto novaehollandiae*), Ooline (*Cadellia pentastylis*), Belson's Panic (*Homopholis belsonii)*.

The following species have been assessed as ‘assumed present’, due to there being no justifiable reason for excluding them from the site. Targeted surveys were not conducted for these species.

- Present: Large-eared Pied Bat (*Chalinolobus dwyeri*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Barking Owl (*Ninox connivens*), Eastern Cave Bat (*Vespadelus troughtoni*).

The proponent is obligated to offset the impacts of the development on potential threatened species (species credit species) by purchasing and retiring species credits on the open market or by making a payment to the Biodiversity Conservation Fund.

The following threatened species present or assumed present on the subject land have been assessed in relation to potential SAII on the species, as per section 9.1.2 of the BAM manual.

- Large-eared Pied Bat (*Chalinolobus dwyeri*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Eastern Cave Bat (*Vespadelus troughtoni*).

The significance of the proposed impact to EPBC Listed threatened, migratory, wetland and marine species predicted to occur within a 10 km search area was assessed. No significant impact to a threatened, migratory, wetland or marine species likely to result in the extinction of a local population was identified. The residual ecological impacts of the project would be adequately mitigated using the management actions recommended. Therefore, a referral of the project to the Federal Department of Agriculture, Water and the Environment for these matters is not required.

This assessment covers the current form of the project as shown in **Figure 1-2** at the start of this report. Any change to the development layout or scope of work may require re-assessment.

Table of Contents

Document Controls ..... **i**

Certification ..... **ii**

Executive Summary ..... **iii**

Table of Contents ..... **v**

List of Tables ..... **vii**

Table of Figures ..... **vii**

1 Introduction **1**

1.1 Description of the proposal 1

1.2 Subject Land and Study area 1

1.3 Aims 2

1.4 Personnel 5

1.5 Information sources 5

1.6 Native vegetation regulatory assessment 6

1.7 Methods overview 6

1.8 Field survey effort 7

1.9 Targeted surveys 8

1.10 Survey conditions 10

1.11 Limitations and assumptions 11

2 Landscape context **12**

2.1 Bioregion and NSW (Mitchell) landscape 12

2.2 Native vegetation cover and connectivity 14

2.3 Rivers, streams and wetlands 14

2.4 Karst, caves, crevices, cliffs and areas of geological significance 15

2.5 Areas of Outstanding Biodiversity Value (OBV) 15

2.6 SEPP (Koala habitat protection) 2020 and 2021 15

3 Native vegetation **17**

3.1 Plant species 17

3.2 Fauna species 17

3.3 Vegetation communities 17

3.4 Vegetation zones and patch size 20

3.5 Threatened ecological communities 20

3.6 Weeds 23
4 Threatened species 24
4.1 Wildlife Atlas records 24
4.2 Habitat Features Present 24
4.3 Habitat suitability assessment 25
4.3.1 Ecosystem credit species 25
4.3.2 Species credit species 26
4.3.3 Species credit species targeted surveys 29
5 Assessment of impacts 33
5.1 Avoid and minimise measures 33
5.2 Environmental safeguards 33
5.3 Offset scheme thresholds 36
5.4 Impacts to wetlands, watercourses and aquatic habitat 36
5.5 Impacts to native vegetation 36
5.6 Serious and Irreversible Impacts (SAII) 37
5.7 Prescribed impacts 42
5.8 Indirect impacts 44
5.9 Matters of National Environmental Significance 44
6 Biodiversity Credit and Offset Report 46
6.1 Management zones 46
6.2 Vegetation Integrity assessment 46
6.3 Ecosystem Credit summary 46
6.4 Species Credit summary 47
6.5 Offset requirement 48
7 Summary and conclusions 49
8 References 51
Appendix A: Database search results 54
Appendix B: Vegetation plot locations and photographs 59
Appendix C: Flora species list and plot data summary 73
Appendix D: BAM calculator reports 79
Appendix E: Threatened species assessment 82
Appendix F: MNES assessment 91
Appendix G: EPBC Act Test of significance 113

Appendix H: Terms and abbreviations 122

Appendix I: State Vegetation Type Map: Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping 127

Appendix J: EPBC Act referral guidelines for Koala 128

LIST OF TABLES

Table 1-1. Summary of OzArk personnel qualifications. 5

Table 1-2. Minimum number of plots and transects required per zone area (OEH, 2020). 7

Table 1-3. Summary of targeted survey methods and effort undertaken. 8

Table 2-1: Description of the subregion. 12

Table 3-1: Identification of PCTs on the subject land 19

Table 3-2. Vegetation zones, patch size, area of impact and vegetation integrity score. 20

Table 3-3. Assessment of potential TECs on the subject land. 21

Table 4-1. Ecosystem credit species predicted to occur on the subject land. 25

Table 4-2. Species credit species predicted to occur on the subject land. 26

Table 4-3. Threatened Species Targeted Survey Methodology and Results. 29

Table 5-1. Recommended environmental safeguards. 33

Table 5-2. Area clearing thresholds for entry into the Biodiversity Offset Scheme. 36

Table 5-3. Vegetation zones, area of impact and VI score. 36

Table 5-4. Prescribed impacts of the project. 42

Table 5-5. Impacts to matters of national environmental significance. 44

Table 6-1. Vegetation Integrity (VI) assessment. 46

Table 6-2. Ecosystem credits produced for vegetation and threatened species habitat cleared. 47

Table 6-3. Species credits produced for the habitat cleared. 47

Table 6-4. Retirement options for credits, including like-for-like and IBRA region options. 48

TABLE OF FIGURES

Figure 1-1. The location of the proposed quarry, south of North Star. 1

Figure 1-2. Proposed quarry layout (proponent's Surface Water Management Plan, 24 May 2021). 1

Figure 1-3. Site map showing the subject land and proposed disturbance footprint. 3

Figure 1-4. Location map, showing the study area (1500 m buffer) around the development. 4

Figure 1-5. Initial vegetation mapping, plot locations and ecologist's survey track. 9

Figure 1-6. Rainfall records at Tulloona (28.7km from North Star) for 2020. 10

Figure 1-7. Rainfall records at Tulloona (28.7km from North Star) for early 2021. 10

Figure 2-1. Site Map showing the Subject Land, Study Area, Lot Boundaries, IBRA Subregions and Mitchell (NSW) Landscapes. 13

Figure 2-2. Extent of native vegetation cover (green shading) in the 1500m buffer area. 14

Figure 4-1. Species credit species polygon for threatened fauna assumed present. 28

Figure 4-2. Flora transects for Ooline (*Cadellia pentastylis*) and Belson's Panic (*Homopholis belsonii*). 32

Figure 5-1. Amended site layout to avoid impacts to remnant woodland. 35

Figure 5-2. Large-eared Pied Bat (*Chalinolobus dwyeri*) records surrounding the subject land. Source: Saving our Species 38

Figure 5-3. Large Bent-winged Bat (*Miniopterus orianae oceanensis*) records surrounding the subject land. Blue shaded areas show priority management sites. Source: Saving our Species 39

Figure 5-4. Eastern Cave Bat (*Vespadelus troughtoni*) records surrounding the subject land. Blue shaded areas show priority management sites. Source: Saving our Species 39

1 Introduction

1.1 Description of the proposal

OzArk Environment & Heritage (OzArk) has been engaged by Groundworks Plus, on behalf of Regional Quarries Australia Pty Ltd (the proponent) to complete a Biodiversity Assessment Report (BDAR) for the proposed hard rock quarry at 5535 North Star Road (the proposal), approximately 6 km southeast of North Star, NSW (**Figure 1-1**). This assessment assumes no native vegetation clearing will occur on the access track between the public road (Minilya Rd) north of the quarry, to the quarry site. The proposal is located on Lot 7 DP755984 and Lot 1 DP1227212 within the Gwydir Shire Council Local Government Area (LGA) and will be accessed via Minilya Rd.

The proposal is to establish a quarry producing a maximum of 490,000 tonnes per year (t/yr) for a period of five years to service the Inland Rail Project and associated road upgrade projects. The proposal is to produce a further 150,000 t/yr for a period of ten additional years to service the general market in the local area.

The plans used to determine the impact footprint for this assessment were provided by the proponent and dated 24 May 2021. These are the updated plans that consider avoidance and minimisation of impacts outlined in **Section 5.1** of this report. The impact area was further revised in April 2022 following the resumption of quarrying in areas subject to an existing development approval. These areas were excluded from the subject land. The final impact area (subject land) is approximately 2.03 ha in size and includes unquarried land north of the existing quarry, a processing and stockpile area, and a sediment basin and cleanwater dam, but excludes the existing quarry and the surrounding disturbance area. This disturbance area contains piled quarried materials and lacks native vegetation. The development will be accessed via a 1.3-kilometre (km) existing access road through the property (**Figure 1-2**), which connects to Minilya Rd. As the access road is already used by heavy vehicles, it is assumed that no further clearing will be required.

Figure 1-1. The location of the proposed quarry, south of North Star.

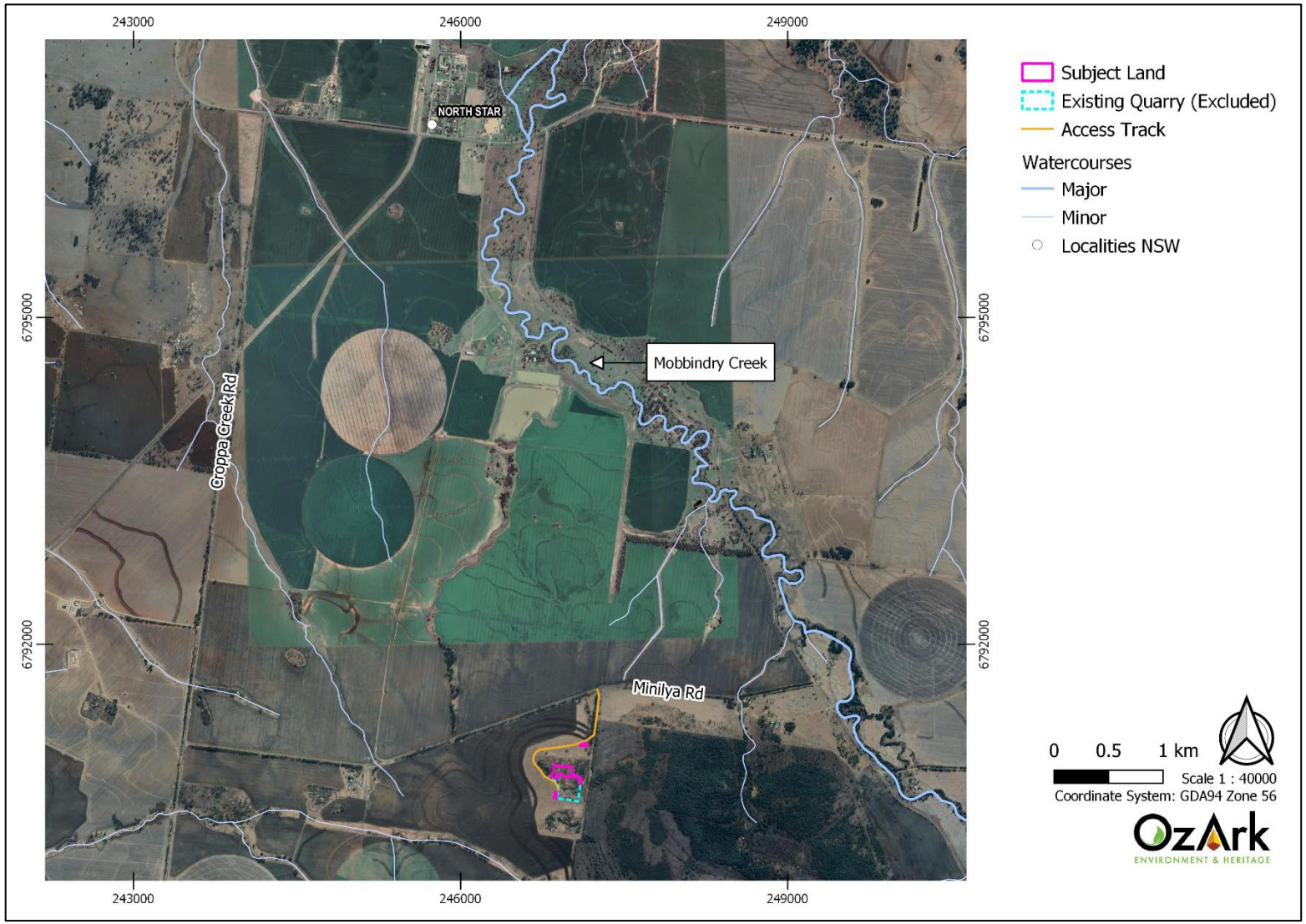
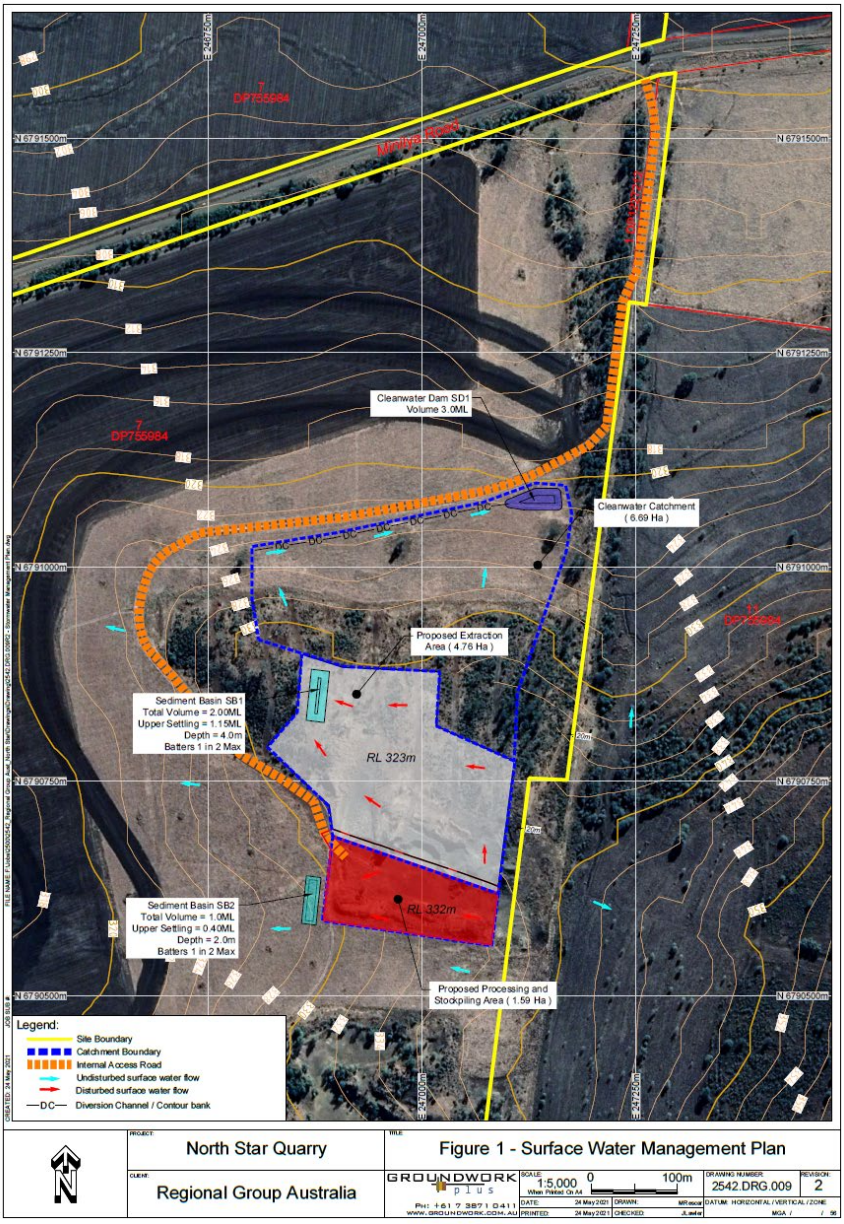


Figure 1-2. Proposed quarry layout (proponent's Surface Water Management Plan, 24 May 2021).



1.2 Subject Land and Study area

The following terms are used to define the subject land and study area for this assessment.

Subject land – The subject land includes the area directly affected by the project. The subject land has been amended from the land identified in the project plans from May 2021, which were themselves amended to exclude areas of remnant woodland and semi-cleared woodland from the development. The subject land now excludes existing quarried areas (see **Figure 1-2, Figure 1-3,** and **Figure 5-1**.)

1500 m buffer (Study area) – A 1500 m buffer has been applied to the subject land. The BAM defines this buffer for the landscape assessment and vegetation cover mapping used in the credit calculations. (Refer to **Figure 1-4**.)

10 km search area – The area within 10 km of the subject land. The 10 km search area has been used to search for known records of threatened species near the study area and to inform the threatened species review in this assessment.

1.3 Aims

The aim of the Biodiversity Development Assessment Report (BDAR) is to determine the biodiversity assets, of the subject land including flora, fauna, threatened species, threatened communities and habitat values.

The assessment seeks to address the requirements of the *Biodiversity Conservation Act 2016* in relation to biodiversity assessment and the NSW Biodiversity Offset Scheme. This report applies the *Biodiversity Assessment Method* (BAM) (OEH 2020) to calculate the number of ecosystem and species credits generated by the proposal requiring offset.

Figure 1-3. Site map showing the subject land and proposed disturbance footprint.

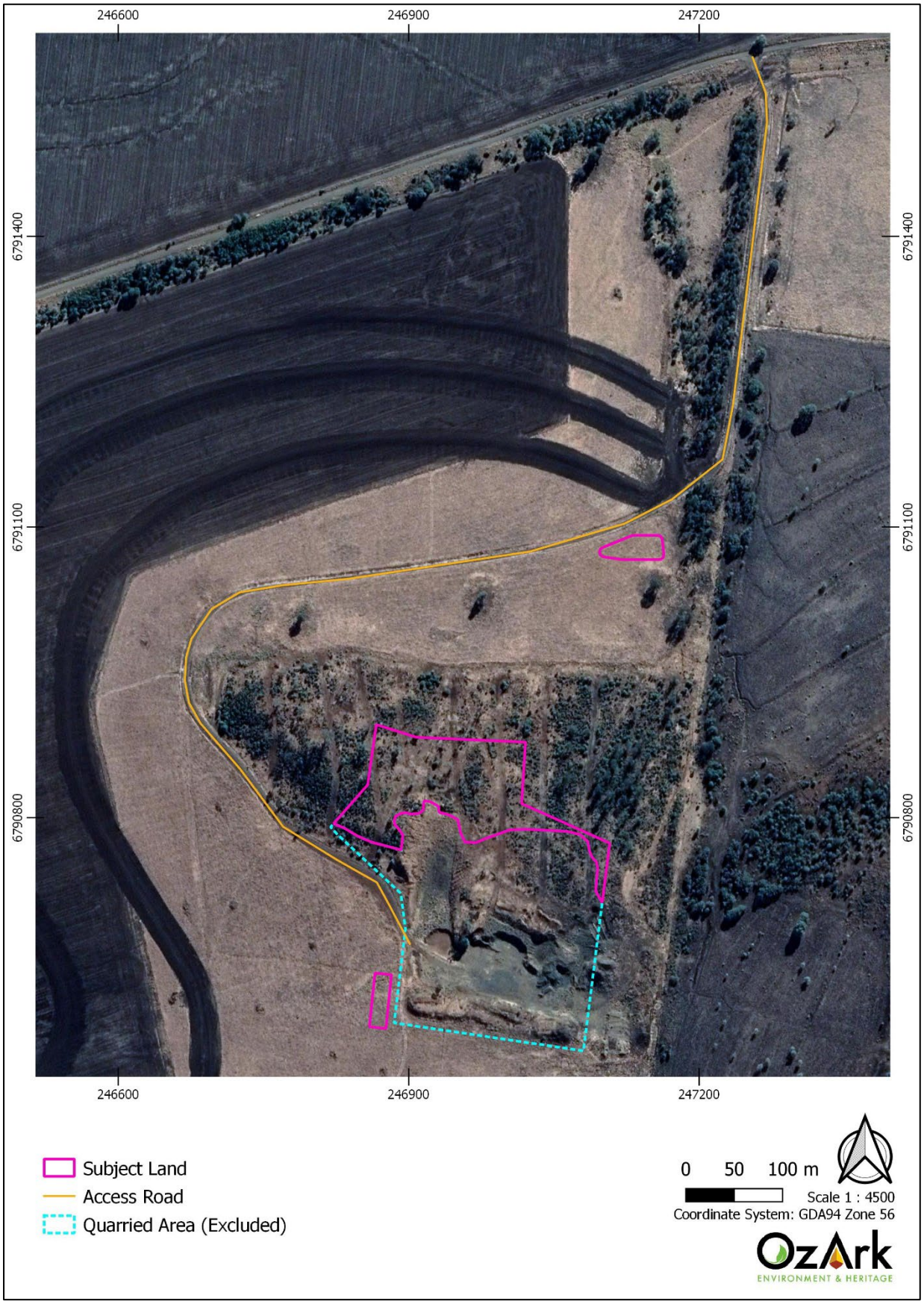


Figure 1-4. Location map, showing the study area (1500 m buffer) around the development.



Note that the above figure shows the entirety of the proposed quarry footprint, including areas already subject to clearing and quarrying.

1.4 Personnel

OzArk Environment & Heritage Pty Ltd (OzArk) operates under NSW Scientific Research License 101908, and NSW Department of Primary Industries (DPI) Accreditation of a corporation as an animal research establishment Ref No. AW2017/012. The role and details of personnel involved in the assessment are provided in **Table 1-1**.

Table 1-1. Summary of OzArk personnel qualifications.

Name	Position	Role	CV Details
Dr David Orchard	BAM Accredited Assessor BAAS21028	Targeted surveys, additional BAM calculations, revision of BDAR	Doctor of Philosophy – Charles Sturt University Graduate Diploma in Science (Botany) – University of New England Bachelor of Arts – Australian National University First aid training WH&S Induction Training for Construction Work
Dr Kate Hammill	BAM Accredited Assessor BAAS18022	Field survey of vegetation, GIS analysis, BAM calculations and preparation of the BDAR. KHS Ecology & Bushfire sub-contractor.	PhD land restoration and revegetation, Bachelor of Science, University of Sydney Ecological Consultants Association (ECA), Practicing Member 2021 4WD and First Aid training 20 years' experience in ecological research and consulting Scientific Licence # 102300
Dr Crystal Graham	Senior Ecologist	Project management, technical review of BDAR, client liaison	Postdoctoral Fellow – Smithsonian Tropical Research Institute Doctor of Philosophy (Biology) – University of Sydney Honours in Biology – University of Sydney Bachelor of Advanced Science – University of Sydney 4WD Training First Aid Training WH&S Induction Training for Construction Work Scientific License 101908

1.5 Information sources

Existing information sources were reviewed to contextualise the study area, identify entities for targeted surveys, predict possible constraints, refine field survey methodology and assist with assessing and minimising the impacts of the project.

- Aerial imagery interpretation of the landscape.
- Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping SVT map, published by NSW Office of Environment & Heritage, 2015.
- NSW BioNet Wildlife Atlas Vegetation classification (https://www.environment.nsw.gov.au/research/Visclassification.htm)
- NSW BioNet Threatened Biodiversity Data Collection (www.bionet.nsw.gov.au/)
- NSW BioNet Atlas (www.bionet.nsw.gov.au/)

- Literature reviews to determine vegetation and species habitat(s) within the proposed study area
- EPBC Protected Matters Search Tool (https://www.environment.gov.au/epbc/protected-matters-search-tool)
- Register of Declared Areas of Outstanding Biodiversity Value (www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/critical-habitats)
- PlantNET, NSW Flora Online (https://plantnet.rbgsyd.nsw.gov.au)
- Department of Environment and Planning *Biodiversity Values Map* (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap)
- Mapping of vulnerable lands – steep and highly erodible (NSW Office of Environment and Heritage, 2011)
- Acid Sulphate Soils Risk mapping (NSW Office of Environment and Heritage, 1998)
- Directory of Important Wetlands of Australia (DIWA) (https://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands)
- NSW wetlands mapping (NSW Office of Environment and Heritage, 2011a)
- Important area mapping for Regent Honeyeater and draft important area mapping for Swift Parrot (available on request from NSW Office of Environment and Heritage).

All databases were searched in January to May 2021 and results of the database searches are provided in **Appendix A**.

1.6 Native vegetation regulatory assessment

In accordance with section 6.8 of the BC Act, The BAM is to exclude the assessment of impacts of any clearing of native vegetation and loss of habitat on Category 1-exempt land (within the meaning of Part 5A of the *Local Land Services Act 2013*), other than any impacts prescribed by the regulations under section 6.3.

The Native Vegetation Regulatory Assessment of Category 1 land has not been applied in this case, instead the credits have been assessed for the vegetation condition as surveyed in the field. No credits are incurred for land that has been farmed and cropped in the past due to the vegetation integrity being under the threshold that produces credits.

1.7 Methods overview

This BDAR has been prepared in accordance with the NSW Biodiversity Assessment Method (BAM) (NSW Government 2020). The assessment uses a site-based approach using a buffer of 1500 m around the development footprint to define the study area and landscape context.

The assessment was carried out in three stages:

1. Desktop searches and review of ecological databases and information to identify threatened species, populations or ecological communities listed in the BC Act or the

EPBC Act that have the potential to occur in the study area.

2. Field survey of the subject land to collate species lists for the purposes of identifying the vegetation communities present and habitat for predicted threatened species and ecological communities. Where a threatened species or community or habitat feature is identified, document the nature and extent of the protected matter and describe its 'viable local population' or occurrence.
3. Preparation of a BDAR that describes the impacts of the proposed activity on native vegetation and threatened species, populations and ecological communities, including measures to avoid and minimise impacts. Residual (unavoidable) impacts are mitigated by the ecosystem credits and species credits required to be offset by the development, which are detailed in this report.

1.8 Field survey effort

The initial field survey was carried out by one ecologist over two days on 18-19 March 2021, entailing a site assessment, recording f habitat observations and collection of Vegetation Integrity data. The location of the Vegetation Integrity plots and the ecologist's GPS survey tracks are mapped in **Figure 1-5**.

Vegetation Integrity surveyed was completed according to the BAM as follows:

- A total of seven (7) plots of size 20m x 50m were located randomly within vegetation zones across the subject land and replicated for the zone size. The details of the vegetation zones and plot locations are provided in **Section 3.2** of this report (refer also to **Figure 1-5** below).
- Species composition and structure was surveyed within each nested 20m x 20m plot, and Vegetation function (size and number of trees, presence of hollow-bearing trees and woody debris) was surveyed within each 20m x 50m plot.
- Percent litter cover was recorded within five 1m x 1m squares positioned at 5m, 15m, 25m, 35m and 45m along the 50m midline of the plot.
- The plots were positioned with random locations and orientation of the midline within the vegetation zones mapped for the subject land and their locations were recorded by handheld GPS (GDA 94 / MGA Zone 56). Data were collected on paper field sheets and entered into excel after the field survey was completed, for upload into the BAM calculator.

The plot locations were randomly selected within vegetation zones to provide the required number of plots for the zone area, as per the BAM, as shown in **Table 1-2**. The impact footprint of the subject land has been modified by the client to avoid areas of high-quality woodland, and the biodiversity credits have been calculated for the layout provided 9 May 2021. All vegetation plot data has been reported in this BDAR to provide site context and demonstrate the avoid and minimise approach.

Table 1-2. Minimum number of plots and transects required per zone area (OEH, 2020).

Vegetation zone area (ha)	Minimum number of plots/transects
<2	1 plot/transect

Vegetation zone area (ha)	Minimum number of plots/transects
>2 – 5	2 plots/transects
>5 – 20	3 plots/transects
>20 – 50	4 plots/transects
>50 – 100	5 plots/transects
>100 – 250	6 plots/transects
>250 – 1000	7 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone
>1000	8 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone

Targeted flora surveys were conducted for Ooline (*Cadellia pentastylis*) and Belson's Panic (*Homopholis belsonii*) during a second site visit on 29-30 March 2022. No targeted threatened fauna species surveys were carried out for this assessment. The assessment includes observations of the presence/absence of suitable habitat for threatened species on the subject land based on the observations and data collected during the traverses across the site by the ecologist. In the absence of targeted threatened species surveys, species that have no suitable habitat on the subject land have been excluded from the credit calculations; while species with potential suitable habitat have been retained in the calculations as 'Assumed present, not surveyed'.

1.9 Targeted surveys

Targeted surveys were carried out to confirm the presence/absence of two candidate species credit species identified by the BAM-C, namely Ooline (*Cadellia pentastylis*) and Belson's Panic (*Homopholis belsonii*). A summary of OzArk's field survey methods is provided in **Table 1-3** and described in further detail in **Section 4** of this report.

Table 1-3. Summary of targeted survey methods and effort undertaken.

Survey date	Method	Effort
29 March 2021 to 30 March 2021	• Transects (5 - 10 m separation) for Belson's Panic (*Homopholis belsonii*). • Transects (20 m separation) for Ooline (*Cadellia pentastylis*).	c. 6.67 km plant transects – 5 to 10 m spacing across all suitable habitat

Figure 1-5. Initial vegetation mapping, plot locations and ecologist's survey track.



1.10 Survey conditions

The survey was conducted in early Autumn (March) 2021, during mild to warm fine weather. The surveys followed a wetter than average period in 2020 and early 2021. The weather records for Tulloona weather station 28.7km from North Star (Bureau of Meteorology station 053041; (Bureau of Meteorology, 2021)) show there was above average rainfall in February, October and December 2020 (**Figure 1-6**), and also in January and March 2021 (**Figure 1-7**) leading into the survey period in March 2021.

Figure 1-6. Rainfall records at Tulloona (28.7km from North Star) for 2020.

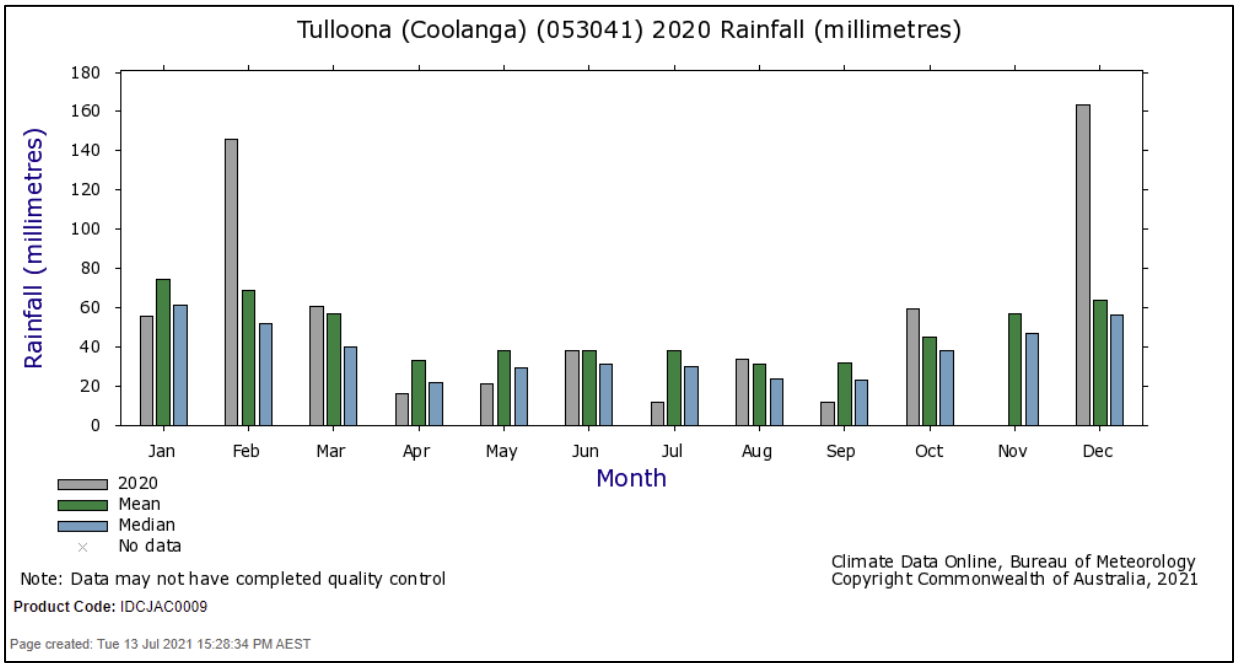
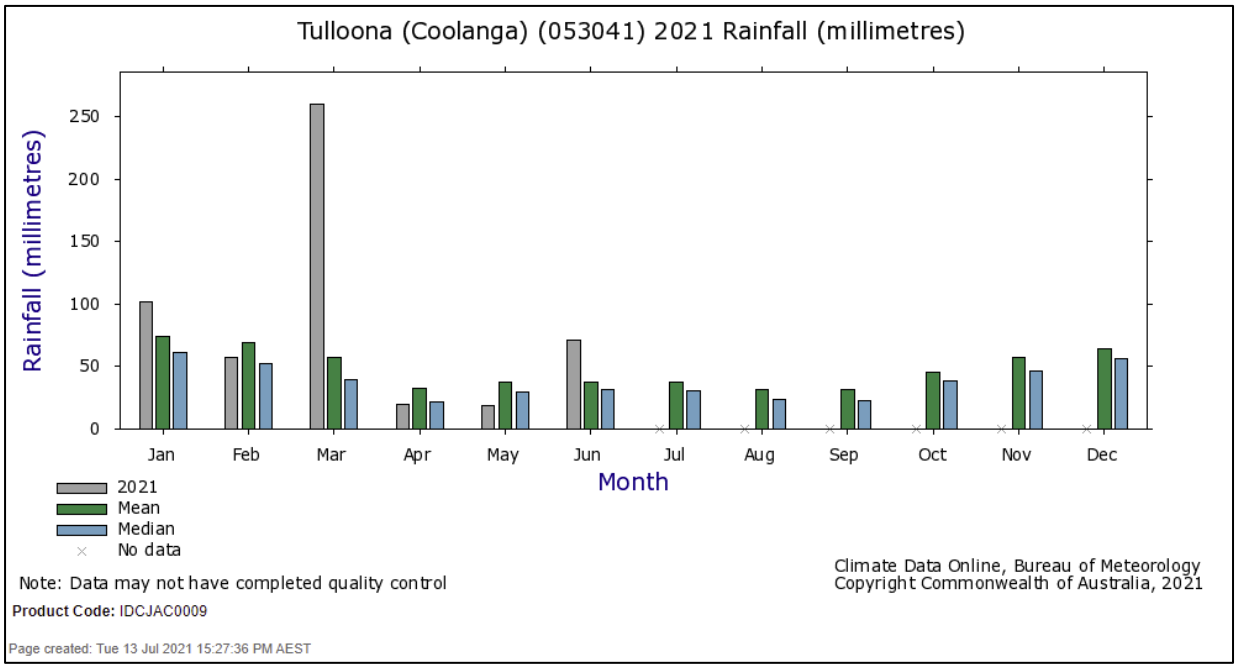


Figure 1-7. Rainfall records at Tulloona (28.7km from North Star) for early 2021.



1.11 Limitations and assumptions

This study is based upon the species data available at the time of the field investigation, and the environmental conditions, season, and time constraints imposed by the project for the field survey.

Specific limitations on this study include the following.

- The initial BAM vegetation field survey was completed over two days in March 2021. Certain flora species which are undetectable at the time due to not being in flower or fruit (which can be essential for identification of some species) may not have been observed during the field survey.
- A ‘precautionary approach’ for species presence has been adopted, whereby a species is assumed present if suitable habitat for the species is present on the site and the conditions for targeted survey were not suitable or able to be met (e.g. due to conditions or timing of targeted surveys).
- The above-mentioned constraints were also considered when preparing the recommendations of avoiding, minimising and mitigating potential impacts.

2 Landscape context

2.1 Bioregion and NSW (Mitchell) landscape

The study area is in the Northern Basalts subregion of the Brigalow Belt South bioregion, according to the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway & Cresswell, 1995). The Darling Depression sub-region is characterised by aspects of geology, landforms, soil types and vegetation, as described in **Table 2-1**.

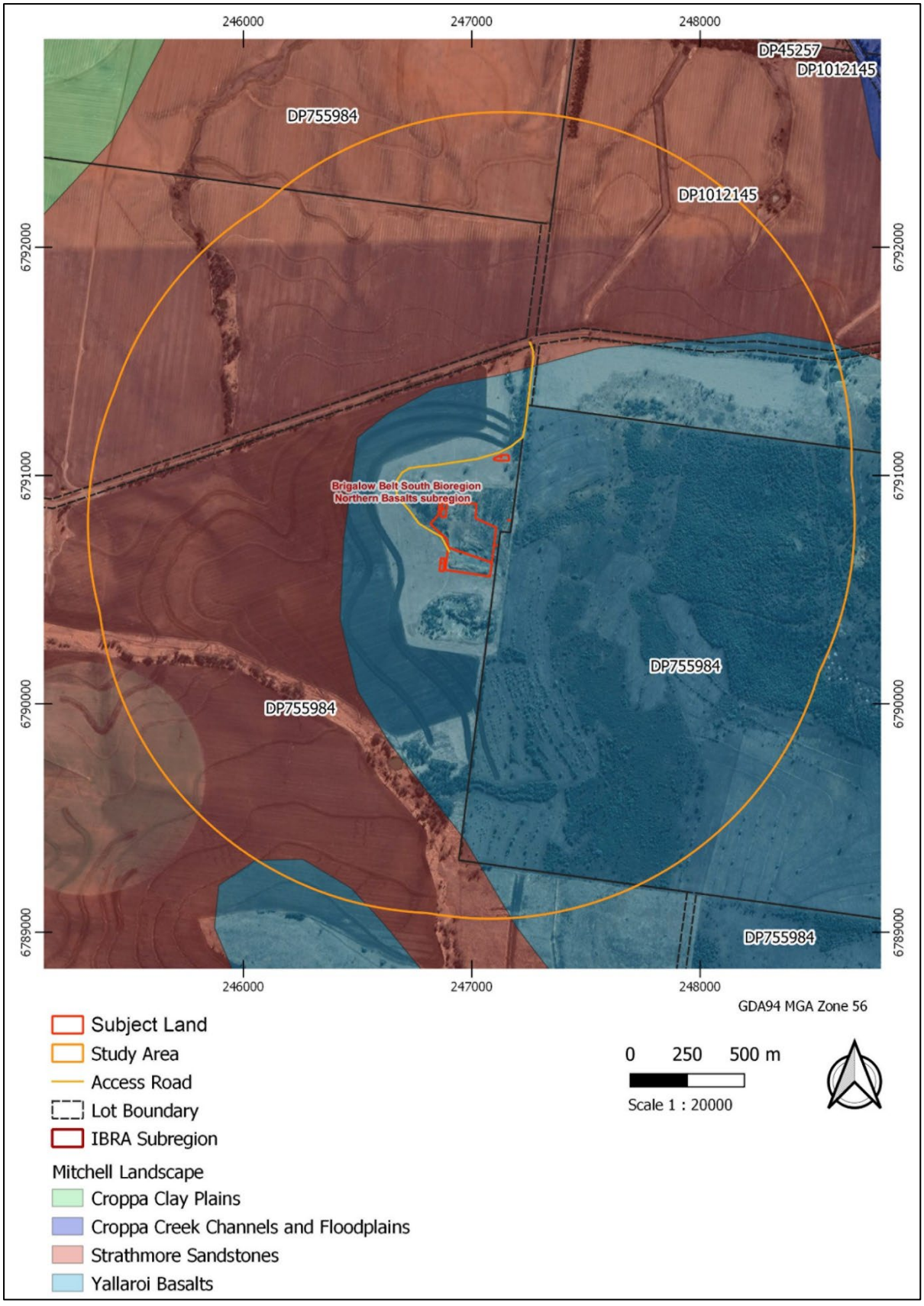
Table 2-1: Description of the subregion.

Brigalow Belt South Bioregion				
Subregion	Geology	Landform	Soils	Vegetation
Northern Basalts	Tertiary basalts over Jurassic quartz sandstones and alluvial sediments derived from these.	Undulating low stony hills, long slopes with sandy wash and heavy clays in the valley floors.	Black loams on basalt ridges, deep sands on sandstones and texture sediments contrast soils on slopes. Heavy grey clay on alluvial flats.	Vegetation on the northern basalts includes brigalow, belah, whitewood, wilga, budda and poplar box on the hills, with river red gum, belah, myall (*Acacia pendula*) and poplar box on the flats. White box with silver-leaved ironbark, white wood, bull oak and brigalow are present on alluvial clays. River red gum occurs on all streams

The study area is located within the NSW (Mitchell) Landscape Yallaroi Basalts (Mitchell, 2002). The landscape is described as:

Rolling hills and flat top ridges on Tertiary basalt flows over Jurassic quartz and lithic sandstone. General elevation 300 to 530m, local relief 100m. Shallow stony, red or brown, well-structured clays with high nutrient values. Similar but thicker soils on the slopes and the valley floors. Woodland and open forest of; white box (*Eucalyptus albens*), with silver-leaved ironbark (*Eucalyptus melanophloia*), white wood (*Atalaya hemiglauca*), bull oak (*Allocasuarina luehmannii*), ironbarks (*Eucalyptus* sp.), brown bloodwood (*Corymbia trachyphloia*) and brigalow (*Acacia harpophylla*) on alluvial clays. River red gum (*Eucalyptus camaldulensis*) on all streams (Mitchell, 2002).

Figure 2-1. Site Map showing the Subject Land, Study Area, Lot Boundaries, IBRA Subregions and Mitchell (NSW) Landscapes.



2.2 Native vegetation cover and connectivity

The subject land is surrounded by highly disturbed landscape within a predominantly agricultural landscape. However native vegetation remains along roadsides and the nearby hill to the east of the subject site connecting the site to a larger area of remnant native vegetation. The extent of native vegetation within the study area (i.e. within the 1500m buffer) is mapped in **Figure 2-2**. Some of the subject land has been cleared in the past for agricultural and mining purposes. A summary of the vegetation cover assessment is provided below:

- Area of the 1500 m assessment circle: 979 ha
- Area of woodland/forest in assessment circle: 225 ha
- Percent vegetation cover: 22.98%

For the purposes of the BAM, the native vegetation cover class has been determined as >10-30% native vegetation cover.

Figure 2-2. Extent of native vegetation cover (green shading) in the 1500m buffer area.



2.3 Rivers, streams and wetlands

The Strahler stream order and associated riparian buffer distance of each watercourse that occurs within the study area was determined using Appendix 3 of the BAM Manual (OEH, 2020) (refer also to **Figure 2-2** above).

There are no major watercourses or wetlands within the subject land. A number of first order streams occur at the outer edges of the 1500m buffer area, and one second order stream traverses the southwestern part of the study area, approximately 800 m from the subject land.

2.4 Karst, caves, crevices, cliffs and areas of geological significance

There are no areas of geological significance in the study area or on the subject land. There are no cliffs or previously mapped karst or cave systems in the study area.

Due to past mining / quarrying activity on the site, there are some areas of rock cutting and outcropping with crevices that might represent potential habitat for threatened fauna. This has been considered in relation to the assumption of presence of threatened microbats in the credit calculations.

2.5 Areas of Outstanding Biodiversity Value (OBV)

There are no areas of outstanding biodiversity value listed under the BC Act in the subject land, or study area.

2.6 SEPP (Koala habitat protection) 2020 and 2021

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP) consolidates, transfers and repeals provisions of 11 SEPPs, the following of which are relevant to the current assessment:

- *SEPP (Koala Habitat Protection) 2020*
- *SEPP (Koala Habitat Protection) 2021*

The *SEPP (Koala Habitat Protection)* aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline'. Currently two versions of the Koala SEPP apply in NSW as follows:

- Koala SEPP 2021 applies to all zones in nine LGAs: Metropolitan Sydney (Blue Mountains, Campbelltown, Hawkesbury, Ku-Ring-Gai, Liverpool, Northern Beaches, Hornsby, Wollondilly) and the Central Coast LGA.
- Koala SEPP 2020 applies to all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast. This is an interim measure while new land management and private native forestry codes are developed in line with the NSW Government's announcement on 8 March 2021.

The subject land is on RU1 zoned land within Gwydir Shire LGA. The land is within the Northwest Slopes Koala Management area. Gwydir Shire LGA is included in the Schedule 1 of Koala SEPP 2020 and the land therefore is required to be assessed as to whether it is potential Koala habitat.

Under the Koala SEPP 2020, 'potential koala habitat' means areas of native vegetation where trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

'Core koala habitat', is defined under Koala SEPP 2020 as:

a) An area of land where Koalas are present, or
b) An area of land

i. Which has been assessed by a suitably qualified and experienced person in accordance with the guidelines as being highly suitable Koala habitat, and
ii. Where Koalas have been recorded as being present in the previous 18 years.

The preference of the Koala is to inhabit woodland and forest areas including riparian corridors with suitable feed trees. The subject land is not considered to be core koala habitat because it is largely cleared with few feed trees. None of the feed tree species listed in Schedule 2 of the Koala SEPP 2020 are present on site. Specifically, feed tree species listed in Schedule 2 of the Koala SEPP 2020 are: *Eucalyptus tereticornis, Eucalyptus microcorys, Eucalyptus punctata, Eucalyptus viminalis, Eucalyptus camaldulensis, Eucalyptus haemastoma, Eucalyptus signata, Eucalyptus albens, Eucalyptus populnea, Eucalyptus robusta*.

There are five records for Koala within 10 km of the subject land, from 2006 to 2019. All of the records have minimal location and sighting notes, so it is not possible to determine exactly where the records were made. The location descriptions for the records are provided as ‘Suburb only, North Star’.

3 Native vegetation

3.1 Plant species

The vegetation survey recorded a total of 74 plant species across all Vegetation Integrity plots, comprising 50 native species and 24 non-native species (**Appendix C**). Plant identification followed nomenclature in the Royal Botanic Gardens PlantNet online database (Royal Botanic Gardens and Domain Trust, 2021). Growth form types are defined in the accompanying data with the NSW Government's BAM resources.

Of the native species recorded per growth form type, there were 4 native tree species, 12 native shrub species, 18 native forbs species, 12 grass and grass-like species, no ferns and 4 other growth form species (**Appendix C**).

The trees comprised *Alstonia constricta* (Quinine Bush), *Casuarina cristata* (Belah), *Eucalyptus melanophloia* (Silver-leaved Ironbark), and *Notelaea microcarpa* (Native Olive). Other trees near the subject land (not within the subject land and therefore not within any plots) include *Acacia harpophylla* (Brigalow) and *Eucalyptus populnea* (Poplar Box).

In the understorey, common shrubs included *Abutilon oxycarpum* (Straggly Lantern-bush), *Beyeria viscosa* (Sticky Wallaby Bush), *Croton phebalioides*, *Geijera parviflora* (Wilga), *Rhagodia spinescens* (Thorny Saltbush), *Salsola australis*, *Sclerolaena muricata* (Black Rolypoly). Grasses and forbs included species such as: *Atriplex muelleri*, *Bergia trimera*, *Calotis lappulacea*, *Chloris divaricata*, *Dactyloctenium radulans*, *Dysphania pumilio*, *Einadia nutans*, *Enteropogon acicularis*, *Eriochloa pseudoacrotricha*, *Portulaca oleracea*, *Tetragonia tetragonioides*, *Tribulus micrococcus*, *Vittadinia cuneata*.

3.2 Fauna species

No fauna species were recorded during the field survey.

3.3 Vegetation communities

Vegetation communities have been identified in accordance with the current NSW vegetation classification system for Plant Community Types (PCTs) published on BioNet. This classification system is used for ecological and development assessments in NSW and describes over 1,500 PCTs across the state, also classified to vegetation Class and Formation as per Keith (2004).

The following inputs were used to identify PCTs on the subject land.

- Regional Scale State Vegetation Map*:* Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping, which provides predictive mapping of PCTs in and around the subject land. This mapping is indicative (modelled / predicted) and not necessarily accurate at a fine scale for the purposes of the current study.

- Field survey results to confirm the flora species present, vegetation structure, landscape position and soil type at the subject site and the extent and condition of native vegetation.
- The BioNet Vegetation Classification database and PCT descriptions, which were used to identify a shortlist of candidate PCTs likely to be present based on the site conditions (flora species present, vegetation structure, bioregion, and landscape position and soil type).

One PCT (in four condition states) was identified within the subject land namely:

- PCT 445 *Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion*.

PCT 445 occurs on basalt on hills and low hills in the Moree Plains, Gwydir and Inverell LGAs, within the Northern Basalts; Northern Outwash; Kaputar; Peel IBRA subregions. The community is described as a very tall mid-dense to dense open forest or very tall shrubland dominated by Brigalow (*Acacia harpophylla*) with other trees including Belah (*Casuarina cristata*), *Eucalyptus melanophloia* or *Eucalyptus populnea* subsp. *bimbil* with a shrub layer of semi-evergreen vine thicket species such as *Notelaea microcarpa* var. *microcarpa*, *Carissa ovata*, *Spartothamnella juncea*, *Jasminum lineare*, *Breynia cernu*a, *Psydrax odorata*, *Santalum acuminatum* and *Croton phebalioides*.

A description of the identified PCT and justification for identifying the PCT on the subject land is provided in **Table 3-1**.

Existing vegetation mapping of the Border Rivers Gwydir / Namoi Regional Native Vegetation mapping of the study area is shown in **Appendix J**.

Table 3-1: Identification of PCTs on the subject land.

PCT ID and name	**445, Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion**
Formation / Class	Rainforests / Western Vine Thickets
Associated TEC	EPBC Act, Endangered: Brigalow-Gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions (Part); BC Act, Endangered: Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Part); EPBC Act, Endangered: Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Part).
Published description	Very tall mid-dense to dense open forest or very tall shrubland dominated by Brigalow (*Acacia harpophylla*) with other trees including Belah (*Casuarina cristata*), *Eucalyptus melanophloia* or *Eucalyptus populnea* subsp. *bimbil*. The shrub layer may be mid-dense to sparse and contains semi-evergreen vine thicket shrub species such as *Notelaea microcarpa* var. *microcarpa*, *Carissa ovata*, *Spartothamnella juncea*, *Jasminum lineare*, *Breynia cernu*a, *Psydrax odorata*, *Santalum acuminatum* and *Croton phebalioides*. Other common shrubs include *Pimelea neo-anglica, Myoporum montanum, Dodonaea sinuolata* subsp. *sinuolata, Rhagodia spinescens, Enchylaena tomentosa* and *Capparis mitchellii*. Vines include *Parsonsia eucalyptophylla*, *Clematis microphylla var. leptophylla* and *Marsdenia viridiflora*. The ground cover is usually sparse or very sparse with substantial areas of bare earth. Grass species include *Austrostipa scabra, Austrostipa verticillata, Austodanthonia bipartita* and *Aristida personata*. Forb species include *Einadia nutans subsp. linifolia, Eianada hastata, Brunoniella australis, Eremophila debilis, Chenopodium pumilio, Einadia polygonoides, Sida corrugata, Oxalis perennans* and *Goodenia hederacea*. Sedges include *Cyperus gracilis* and *Gahnia aspera*. Occurs on red to brown loam to light clay soils on plains or footslopes in low hills and hills landsform patterns in the Terry Hie Hie, Bingara and North Star regions of the Brigalow Belt South Bioregion. Grades into dry scrub or semi-evergreen vine thicket on hills. Grades into the more widespread ID35 Brigalow open forest on heavy clay soils on alluvial plains to the west. Mostly cleared and highly threatened. Part of the NSW TSC Act Brigalow EEC
Justification for identification on site	Location being with the Northern Basalts subregion and Gwydir LGA. The landform being low hills with red to black basalt. Tree species observed on the subject land being *Casuarina cristata* (Belah), *Eucalyptus melanophloia* (Silver-leaved Ironbark), and nearby trees being *Eucalyptus populnea* and *Acacia harpophylla*. Characteristic shrubs on and near the subject land include *Notelaea microcarpa* var. *microcarpa*, *Carissa ovata*, *Rhagodia spinescens, Enchylaena tomentosa* and *Capparis mitchellii,* with a grassy herbaceous groundcover where native species were present (amongst significant weed cover).
Current NSW Extent (ha)	200 hectares
% Cleared	90%

3.4 Vegetation zones and patch size

Native vegetation PCTs and broad condition states were mapped across the subject land and have been assigned to vegetation zones according to the BAM. This was done using a combination of review of the existing PCT mapping (Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping SVT map), interpretation of aerial imagery over the study area and field observations during the site survey. Broad condition states were determined by the presence or absence of the key structural elements of the respective PCT and evidence of disturbance and weeds.

The patch size for each vegetation zone was identified as connected areas of native woody and non-woody vegetation extending beyond the subject land. Individual patches are defined under the BAM as areas of native vegetation separated by less than 100 m for woody vegetation or 30 m for non-woody vegetation.

The mapping analysis of vegetation zones and patch size was completed in GIS using QGIS software (https://www.qgis.org/en/site/).

A summary of the vegetation zones and plots surveyed in this assessment is provided in **Table 3-2**. The vegetation zones and location of Vegetation Integrity plots have been presented in **Figure 1-5.**

Table 3-2. Vegetation zones, patch size, area of impact and vegetation integrity score.

Vegetation zone	Description	Patch size	Area of impact	BAM plots	Minimum plots required
PCT 445 Cropped	Cropped areas near the base of the hill proposed for sediment basin and the clean water dam.	170 ha, connecting to surrounding cropped paddocks	0.24	BAM 2	1
PCT 445 Derived	Cleared areas with mixed native and exotic shrubby grassland, generally lacking trees	5 ha	1.76 ha	BAM 1, 4, 6, 7	1
PCT 445 Woodland	Areas of remnant viney open-woodland in the north-western corner of the subject land. Most of this zone has been removed from the footprint.	>100 ha connecting to the hilltop area to the east	0.03 ha	BAM 3, 5	1

3.5 Threatened ecological communities

TECs that are known to occur in the Northern Basalt subregion have been assessed for potential presence at the subject site. The presence of a TEC was assessed by referring to the relevant Scientific Committee listing criteria and identification guides in relation to the site observations and vegetation identified.

TECs associated with PCT 445 are:

- EPBC Act, Endangered: *Brigalow-Gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions*;
- BC Act, Endangered: *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregion*s;
- EPBC Act, Endangered: *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions*.

The assessment of whether the native vegetation on the subject land is part of a TEC is provided in **Table 3-3**. The assessment considers only the land that is proposed to be developed within the modified quarry plans of May 2021, as per **Figure 1-2**. It is assumed that there will be no vegetation clearing along the existing access track to the quarry site, as this area is likely to contain a remnant of TEC vegetation. Other areas of semi-cleared and remnant woodland nearby, not on the immediate subject land, are likely to be part of a TEC.

It is concluded that parts of the site have characteristics of the following two TECs:

- *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions* – on the lower slopes of the hill including along the edges of the access track where *Acacia harpophylla* and *Casuarina cristata* are present.
- *Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions* – on the basalt rock hilltop where the quarry is proposed, with scattered trees of E*ucalyptus melanophloia* (Silver-leaved Ironbark) over a mesic tall shrub/small tree layer.

However, when the vegetation within the subject site is assessed against the identification criteria for each of these TECs, it is concluded that the vegetation on the immediate subject land is not consistent with either TEC due to the degraded nature of these sites. The proposed development has been reduced in area to avoid the remnant woodland and scrubby vegetation that is likely part of these TECs (refer to **Section 5.1** for an overview of the avoidances measures and adjustments made to the quarry footprint).

Table 3-3. Assessment of potential TECs on the subject land.

TEC	NSW Status	Comm. status	Site assessment
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions	E	E	Trees surrounding the site include *Casuarina cristata* (Belah), *Eucalyptus melanophloia* (Silver-leaved Ironbark), *Notelaea microcarpa* (Native Olive), *Acacia harpophylla* (Brigalow) and *Eucalyptus populnea* (Poplar Box). These species and the heavy dark brown clay soils indicate this TEC is present near the site and may have been present on the subject land in the past before clearing of the land for agricultural and previous mining activity. The TEC is present along the access road where *Acacia harpophylla* and *Casuarina cristata* are present. However, the subject land is already cleared and does not have a tree stratum with Brigalow. Some native species of the TEC are still present, but the diagnostic Brigalow are not

TEC	NSW Status	Comm. status	Site assessment
			present. Due to the degraded nature of the site and the lack of Brigalow trees on the subject land (although they do occur downslope nearby) this community is deemed not to be present on the development site.
*Cadellia pentastylis (*Ooline*) community in the Nandewar and Brigalow Belt South Bioregions*	E		The diagnostic tree *Cadellia pentastylis* is not present. The community does not occur on the subject site.
Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions	E		The site is not on siliceous sands, earthy sands and clayey sands on the riverine plains of the Meehi, Gwydir, MacIntyre and Barwon Rivers. The distinctive plants such as *Corymbia tessellaris* (Carbeen) are not present. The community does not occur on the subject site.
Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregions	E	E	Diagnostic trees *Eucalyptus coolabah* and *Eucalyptus largiflorens* not present and the site is not on a floodplain. The community does not occur on the subject site.
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	E		*Eucalyptus conica* is not present and the site is not on alluvial plains. The community does not occur on the subject site.
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E	E	*Eucalyptus microcarpa* is not present and the site is not on typical slopes and plains. The community does not occur on the subject site.
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	E3	E	*Acacia pendula* is not present. The community does not occur on the subject site.
Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions	E3	E	This community often occurs on rocky hills, in deep, loamy, high- nutrient soils derived from basalt or other volcanic rocks, in areas which are sheltered from frequent fire. It is a low, dense form of dry rainforest generally less than 10 m high, made up of vines and rainforest trees as well as some shrubs. The basalt soil type and hilltop location are characteristic of this TEC. It is likely that this TEC previously occurred within the subject land, however, the vegetation is now highly degraded and no longer constitutes a dry rainforest or scrub. Instead it forms a sparse shrubland or weedy derived grassland, lacking signature elements of this TEC, including vine thickets. Areas likely to meet the criteria have been excluded.
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and	E4B	CE	No Yellow Box, White Box or Red Gum are present. The community does not occur on the subject site.

3.6 Weeds

Five BAM listed 'High Threat Exotics' (HTE) weeds were recorded on the subject land. Some of these weeds are also listed under the *NSW Biosecurity Act 2015* and have a biosecurity duty for control.

- *Alternanthera pungens* (Khaki Weed), a common environmental weed, that alters native vegetation by smothering groundcover. Carries a General Biosecurity Duty under the *NSW Biosecurity Act 2015* for all of NSW.
- *Cenchrus ciliaris* (Buffel Grass), likely introduced as pasture for grazing. An environmental weed but not listed under the *NSW Biosecurity Act 2015* due to its use as a pasture species.
- *Lycium ferocissimum* (African Boxthorn), present mainly under trees. The Biosecurity Duty under the NSW Biosecurity Act 2015 for this weed in Northwest NSW is 'Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. Land managers reduce impacts from the plant on priority assets.'
- *Xanthium occidentale* (Noogoora Burr), competes with summer crops and pasture. Carries a General Biosecurity Duty under the *NSW Biosecurity Act 2015* for all of NSW.
- *Xanthium spinosum* (Bathurst Burr), one of the most common and economically serious weeds in Australian agriculture affecting livestock and crops. Carries a General Biosecurity Duty under the *NSW Biosecurity Act 2015* for all of NSW.

4 Threatened species

4.1 Wildlife Atlas records

A search of the BioNet Wildlife Atlas database on 14/07/2021 returned a total of 15 records of six threatened species within 10km of the subject land. These records are included in **Appendix A** and a summary is provided below.

- Speckled Warbler (*Chthonicola sagittata*). One record for this species in 1979, described as being from the Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940.
- Varied Sittella (*Daphoenositta chrysoptera*). Two records for this species in 1979, described as being from the Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940.
- Little Eagle (*Hieraaetus morphnoides*). Two records for this species in 1979, described as being from the Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940.
- Belson's Panic (*Homopholis belsonii*). Two records for this species in 1988, described as 'Warivan', 7.4 km from North Star on Warialda Road. Sighting notes include: 'Basalt hills. *Acacia harpophylla - Allocasuarina cristata* closed forest. Very rocky red brown friable loam.' and 'Tall caespitose grass located on basalt hills with very rocky red brown friable loam in *Acacia harpophylla/Allocasuarina cristata* closed forest.'
- Koala (*Phascolarctos cinereus*). Five records for Koala from 2004 to 2019. Suburb only provided with the records as being North Star, NSW. No further location notes or sighting descriptions provided with the records.
- Grey-crowned Babbler (eastern subspecies; *Pomatostomus temporalis temporalis*). Three records for this species from 2019 and 2020. Described as being at Croppa Creek Rd, North Star and Wolonga Camp TSR North Star, recorded during the LLS NW Goondiwindi survey 2020.

4.2 Habitat Features Present

The subject land was assessed for its potential to provide habitat for threatened flora and fauna known or predicted to occur in the study area. Habitat features including but not limited to rock outcrops, caves and overhangs, hollow-bearing trees, wetlands (including dams), and watercourses were recorded, if present.

The subject land was found to contain piles of quarried material and loose rock, which may provide habitat for certain fauna species, as well as small numbers of larger embedded rocks (**Figure 5-2**). One hollow-bearing live tree and one hollow-bearing stag (Plot 6) were recorded within the derived grassland vegetation zone. Both large (>20cm diameter) and small (<20 cm diameter) hollows were recorded. Areas of fallen timber, including hollow logs, were also recorded. No waterways, natural water bodies, wetlands or dams were present within the subject land.

4.3 Habitat suitability assessment

The candidate ecosystem and species credit species generated by the BAM calculator were reviewed in the context of information collected by the assessor about the site context and presence / absence of habitat attributes (**Appendix E**).

The likelihood of occurrence of ecosystem and species credit species was categorised as follows:

- 'Present' – the species was observed or has been previously recorded on the subject land.
- 'Assumed present' – the species was predicted to occur by the BAM calculator and suitable habitat features occurred within the subject land for that species.
- 'Absent' – habitat on-site and in the vicinity is unsuitable for the species or targeted survey during the species required survey timeframe confirmed the species absence.
- EPBC listed fauna that were predicted to occur within 10 km of the subject land were also assessed for their presence or absence within the subject land (**Appendix F**). Those species that were assessed as having a Moderate potential to occur on site were assessed using the EPBC Test of Significance (**Appendix G**).

4.3.1 Ecosystem credit species

In total, 16 ecosystem credit species were predicted to occur on the subject land based on the PCT 445 *Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion* and other site features. These species are listed in **Table 4-1** and the habitat assessment is provided in **Appendix E.** Of these 16 species, 13 were assumed present and three were assumed absent based on habitat constraints (**Appendix E**).

Table 4-1. Ecosystem credit species predicted to occur on the subject land.

Scientific Name	Common Name	Species presence
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Assumed present
Chalinolobus picatus	Little Pied Bat	Assumed present
Chthonicola sagittata	Speckled Warbler	Assumed present
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Assumed present
Daphoenositta chrysoptera	Varied Sittella	Assumed present
Dasyurus maculatus	Spotted-tailed Quoll	Assumed present
Grantiella picta	Painted Honeyeater	Assumed absent – no mistletoe or habitat trees present
Hirundapus caudacutus	White-throated Needletail	Assumed present
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Assumed present
Miniopterus orianae oceanensis	Large Bent-winged Bat	Assumed present
Ninox connivens	Barking Owl	Assumed present

Scientific Name	Common Name	Species presence
Phascolarctos cinereus	Koala	Assumed absent – no feed or shelter tree species present
Pteropus poliocephalus	Grey-headed Flying-fox	Assumed absent – no feed trees or camps present
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Assumed present
Stagonopleura guttata	Diamond Firetail	Assumed present
Tyto novaehollandiae	Masked Owl	Assumed present

4.3.2 Species credit species

In total, 10 species credit species were generated by the BAM-C. Two species – Ooline (*Cadellia pentastylis*) and Belson's Panic (*Homopholis belsonii*) – were the subject of targeted surveys. Assessment for each of the remaining species is based on determining whether suitable habitat is present based on observations made during the field assessment, in relation to the habitat constraints and requirements for each the species. No targeted species searches were undertaken for the remaining species and hence these species are assumed present, where they cannot be reasonably excluded due to lack of habitat. The species credit species requiring assessment are listed in **Table 4-2** and the habitat assessment for each species is provided in **Appendix E**.

In summary, the following species have been assessed as 'present' and impacted, due to their being no justifiable reason for excluding them from occurring the site, i.e. potential habitat is present.

- Present: Large-eared Pied Bat (*Chalinolobus dwyeri*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*), Eastern Cave Bat (*Vespadelus troughtoni*).

Species polygons for the species credit fauna assumed present are shown in **Figure 4-1**. In all cases, the species polygon includes a 100 m buffer around suitable habitat, thereby incorporating the entire impact footprint.

The following species have been excluded and are considered not impacted due to habitat requirements not being present in the subject land (suitable habitat trees and intact native vegetation not present) or due to the use of targeted surveys to rule the species out.

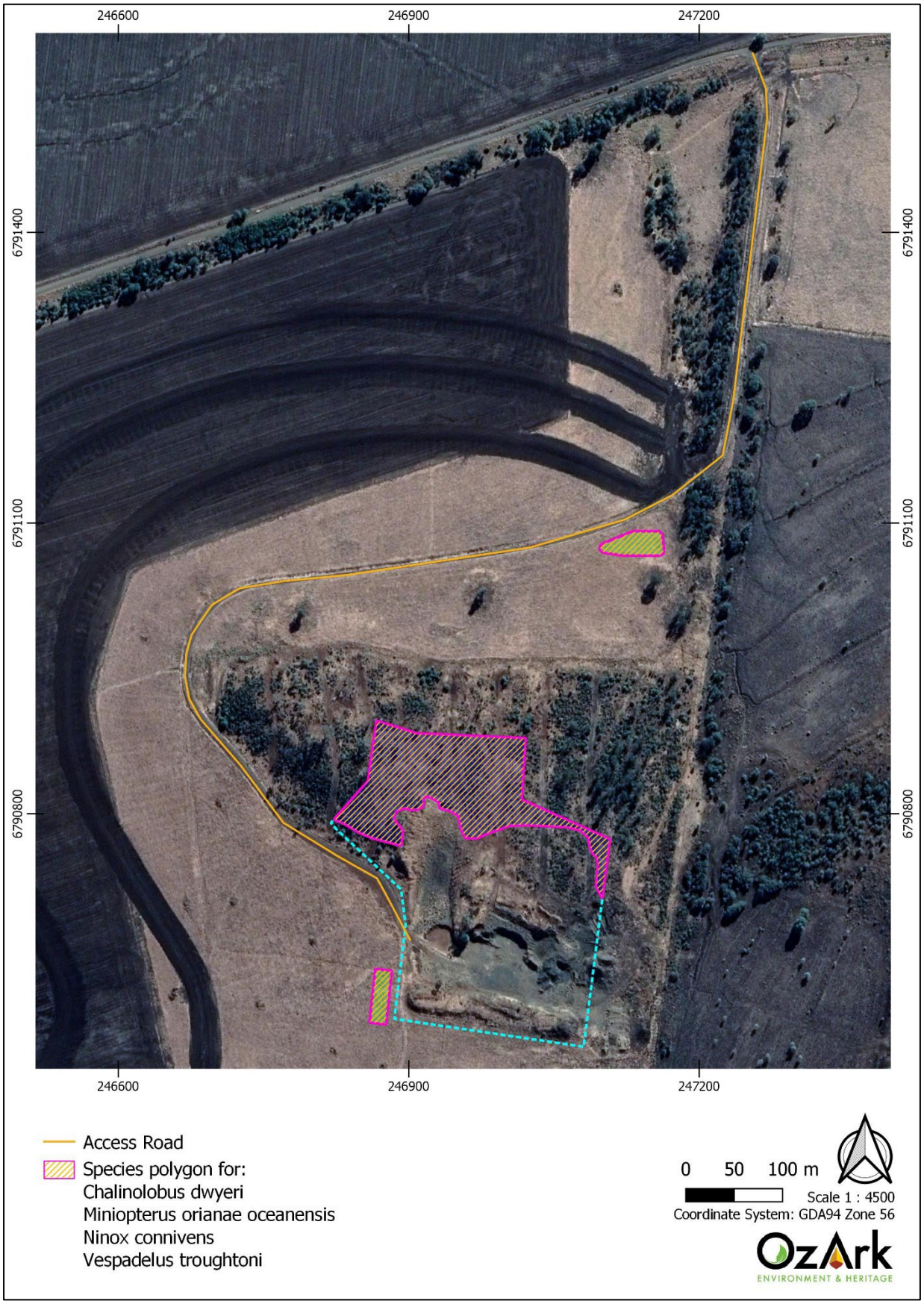
- Absent: Ooline (*Cadellia pentastylis*), Belson's Panic (*Homopholis belsonii*), Pale Imperial Hairstreak (*Jalmenus eubulus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Koala (*Phascolarctos cinereus*).

Table 4-2. Species credit species predicted to occur on the subject land.

Scientific Name	Common Name	Assumed present / or not present if suitable habitat is absent
Cadellia pentastylis	Ooline	Absent. Targeted survey undertaken in March 2022.
Chalinolobus dwyeri	Large-eared Pied Bat	Assumed present
Homopholis belsonii	Belson's Panic	Absent. Targeted survey undertaken in March 2022.

Scientific Name	Common Name	Assumed present / or not present if suitable habitat is absent
Jalmenus eubulus	Pale Imperial Hairstreak	Not present, habitat degraded, no suitable habitat trees present or impacted, no *Acacia harpophylla* within subject land
Miniopterus orianae oceanensis	Large Bent-winged Bat	Assumed present
Ninox connivens	Barking Owl	Assumed present
Vespadelus troughtoni	Eastern Cave Bat	Assumed present
Pteropus poliocephalus	Grey-headed Flying-fox	Not present, habitat degraded, no suitable habitat trees present or impacted
Phascolarctos cinereus	Koala	Not present, habitat degraded, no suitable habitat trees present or impacted
Tyto novaehollandiae	Masked Owl	Assumed present

Figure 4-1. Species credit species polygon for threatened fauna assumed present.



4.3.3 Species credit species targeted surveys

Targeted species surveys were conducted according to the methodologies outlined in **Table 4-3**, which were based on the BAM and its associated guidelines and documents. These surveys determined that the relevant threatened species do not occur on site.

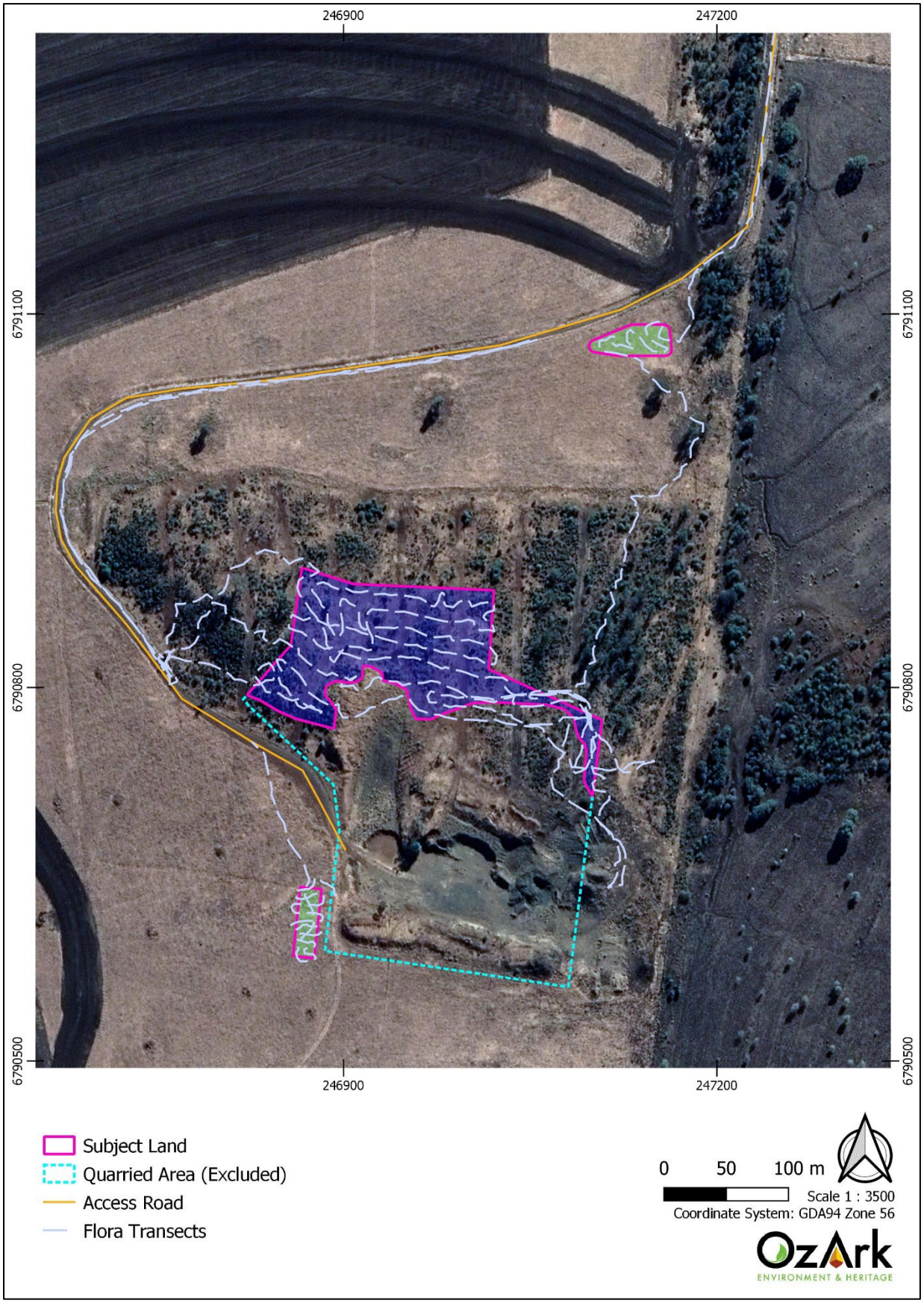
Table 4-3. Threatened Species Targeted Survey Methodology and Results.

Species	Survey requirements (TBDC)	Primary reference material	Survey timetable (BAM-C)	Survey Period (see also Table 2-3)	Results of survey
Ooline (*Cadellia pentastylis*)	1. Where a PCT associated with the target species is recorded **OR** the surveyor determines that habitat present on the subject land is likely to support the target species then a targeted survey must be conducted using the methodology detailed below such that the following conditions can be met. 2. (a) The survey must take place within the appropriate survey window and (b) within abiotic conditions under which the target species is likely to be detected if present. (c) Appropriate habitat must be identified on the subject land.	**OEH, 2016**	**All year**	Surveys were conducted on **29 to 30 March 2022.**	1. The target species is associated PCT 445. 2. (a) The targeted survey took place in March. The survey period allows for surveys to be conducted at any time of the year. (b) The survey followed three months of average to above average rainfall. (c) All vegetation zones in PCT 445 were searched. 3. (a) Targeted surveys were undertaken using 20 m transects, meeting the requirement for 20-40 m transects for tree species. (b) The vegetation was largely open throughout, with small areas of locally dense shrubland. (c) A suitable walking speed of 4 km/h was maintained. (d) All associated habitat was searched (e) Tracks were recorded using handheld GPS devices (**Figure 4-2**). This survey did not detect Ooline, nor any species

Species	Survey requirements (TBDC)	Primary reference material	Survey timetable (BAM-C)	Survey Period (see also Table 2-3)	Results of survey
	3. (a) Parallel transects must be conducted at a prescribed distance based on the growth form of the target species and (b) the density of the surrounding vegetation. (c) Transects must be walked at a reasonable speed based on the density of the surrounding vegetation to maximise the potential of detection by the surveyor. (d) All potential habitat on the subject land must be searched for the species and (e) tracks of the walked transects should be recorded using a suitable GPS device.				which may be mistaken for Ooline. **Result: Absent (Surveyed)**
Belson's Panic (*Homopholis belsonii*)	1. Where a PCT associated with the target species is recorded **OR** the surveyor determines that habitat present on the subject land is likely to support the target species then a targeted survey must be conducted using the methodology detailed below such that the following conditions can be met.	**OEH, 2016**	**Dec-Apr**	Surveys were conducted on **29 to 30 March 2022.**	1. The target species is associated PCT 445. 2. (a) The targeted survey took place in March, within the survey period for this species. (b) The survey followed three months of average to above average rainfall. (c) All vegetation zones in both PCT 267 and PCT 282 were searched. 3. (a) Targeted surveys were undertaken using 20 m transects, meeting the requirement for 20-40 m transects for tree species. (b) The vegetation was largely open throughout, with small areas of

Species	Survey requirements (TBDC)	Primary reference material	Survey timetable (BAM-C)	Survey Period (see also Table 2-3)	Results of survey
	2. (a) The survey must take place within the appropriate survey window and (b) within abiotic conditions under which the target species is likely to be detected if present. (c) Appropriate habitat must be identified on the subject land. 1. (a) Parallel transects must be conducted at a prescribed distance based on the growth form of the target species and (b) the density of the surrounding vegetation. (c) Transects must be walked at a reasonable speed based on the density of the surrounding vegetation to maximise the potential of detection by the surveyor. (d) All potential habitat on the subject land must be searched for the species and (e) tracks of the walked transects should be recorded using a suitable GPS device.				locally dense shrubland. (c) A suitable walking speed of 4 km/h was maintained. (d) All associated habitat was searched (e) Tracks were recorded using handheld GPS devices (**Figure 4-2**). This survey did not identify Belson's Panic. Several panicle-forming grasses were recorded from the site, including *Panicum decompositum*, *Panicum buncei*, and *Panicum coloratum*, but these could be clearly differentiated from the target species. **Result: Absent (Surveyed)**

Figure 4-2. Flora transects for Ooline (*Cadellia pentastylis*) and Belson's Panic (*Homopholis belsonii*).



5 Assessment of impacts

5.1 Avoid and minimise measures

The impact footprint of the subject land has been modified by the client to avoid areas of high-quality woodland. Biodiversity credits were initially calculated for the layout provided on 9 May 2021; however, following the resumption of quarrying in areas of the impact footprint subject to an existing development approval, the subject land was further reduced and credit calculations were performed on this smaller footprint. All vegetation plot data has been reported in this BDAR to provide site context and demonstrate the avoid and minimise approach.

The following avoidance measures have been integrated into the design of the project:

- The proposed impact footprint has been reduced in the planning phase to minimise impact on biodiversity. The original footprint, which has subsequently been revised, is shown in **Figure 5-1**. The amended plan has resulted in a reduction in clearing and associated habitat loss of approximately 0.84 ha on the western side and 1.03 ha on the northeastern side.
- Implementation of additional recommended environmental safeguards outlined in **Section 5.2** below.

5.2 Environmental safeguards

In addition to the avoidance measures implemented through the amended quarry layout, the following minimisation measures and environmental safeguards are recommended to be implemented.

- Before starting work, erect a physical vegetation clearing boundary with a suitable material such as temporary fencing, flagging tape, or similar.
- Vegetation will be removed in a manner that avoids damage to surrounding vegetation, ensuring disturbance to vegetation and soil is kept to a minimum.
- Implement the recommended environmental safeguards to reduce impacts on vegetation, soil and biodiversity outlined in **Table 5-1**.

Table 5-1. Recommended environmental safeguards.

Impact	Environmental Safeguard	Timing
Clearing and prevention of over-clearing	All personnel are to be inducted to be aware that disturbance of any stand of native vegetation outside the development footprint, or otherwise unauthorised disturbance, could have legislative consequences if done without approval. Evidence of all personnel receiving an induction would be kept on file (signed induction sheets). Before start of work, clearly identify the extent of permitted vegetation clearing and areas to be retained as native vegetation. A pre-clearing process and unexpected threatened species finds procedure is recommended. Any fauna found during the disturbance are to be allowed (or assisted) to relocate into adjoining habitat. Vegetation will be removed in such a way to avoid	Pre-construction

Impact	Environmental Safeguard	Timing
	unnecessary damage to surrounding vegetation. Where possible, vegetation to be removed will be mulched on-site and re-used to stabilise disturbed areas. Natural regeneration of any bare soil or cleared areas will be encouraged through retention of native vegetation material on site and brush-matting.	
Bushfire protection	Ensure vegetation management for bushfire protection is consistent, as far as practicable, with biodiversity protection and remove only the necessary vegetation to achieve fuel reduction.	
Soil management	An erosion and sediment control plan will be developed to comply with Council requirements and/or Landcom's Managing Urban Stormwater, Soils & Construction Guidelines 'The Blue Book' (Landcom 2004)	Pre-construction
Damage to native vegetation outside of impact zone	Stockpile and compound sites are to be located within the assessed subject site and preferentially according to the following criteria: At least 40 m away from the nearest waterway. In areas of low ecological conservation significance (i.e. previously disturbed land). On relatively level ground. Stockpiling of materials and equipment, and parking of vehicles, is to be avoided within the dripline (extent of foliage cover) of any tree.	Construction
Introduction and spread of significant weeds and pathogens	Inspection and control of environmental weeds in accordance with a site vegetation management plan and subject to requirements of Council. Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be clean, and soil- and weed-free, before entry to the work site. Weed-free fill only to be used for on-site earthwork. Any herbicide use is to be in accordance with the requirements on the label. Any person carrying out herbicide application would be appropriately trained and competent in its use.	Construction
Disturbance to fallen timber, dead wood and bush rock	All bush rock encountered on site is to be relocated to the edge of the disturbance area to enhance habitat and regeneration. If threatened bats are detected, stop work immediately and either leave the area undisturbed until the individuals have dispersed or engage suitably qualified personnel to attempt their removal.	Pre-construction Construction
Threatened species	No new tracks to be cleared without further assessment, as threatened flora species may occur in any unassessed impact area. If the impact footprint changes from the current extent assessed in the study, re-assessment of the potential impact of the activity would be needed to ensure impacts to threatened species are not inadvertently caused, given that suitable habitat for threatened species occurs elsewhere on the property. Construction work to occur only during daylight hours to avoid indirect impacts on threatened fauna such as vehicle strikes. Enforce 40 km/h speed limits on access roads to reduce the risk of vehicle strikes.	Construction

Figure 5-1. Amended site layout to avoid impacts to remnant woodland.



5.3 Offset scheme thresholds

The project will not impact on land mapped on the Biodiversity Values Map (refer to **Appendix A**).

The project has been assessed against the relevant vegetation clearing thresholds under the BOS. The thresholds applicable to different lot size categories for the land zoning are provided in **Table 5-2** (NSW Office of Environment & Heritage, 2020).

The subject land is currently zoned RU1 (primary production), with a minimum lot size of 200 ha. Clearing of 1 ha or more of native vegetation will require entry into the BOS. The project will clear up to 2.00 ha of native vegetation; thus, entry into the BOS is required.

Due to the area of clearing being exceeded and triggering the BOS in this case, the Test of significance (5-part tests) for threatened species are not required.

Table 5-2. Area clearing thresholds for entry into the Biodiversity Offset Scheme.

LEP Minimum Lot Size	Threshold Area of Clearing
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

5.4 Impacts to wetlands, watercourses and aquatic habitat

There are no wetlands on the subject land or within the study area. Any potential for indirect impact to nearby watercourses from erosion and sedimentation related to construction activities will be avoided and minimised by developing and implementing an erosion and sediment control plan.

5.5 Impacts to native vegetation

This assessment has mapped one vegetation type, PCT 445 *Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion*, within the subject land occurring in three condition classes. The area of clearing is set out in **Table 5-3**.

Table 5-3. Vegetation zones, area of impact and VI score.

Vegetation zone	Description	Area of impact	VI Score
PCT 445 Cropped	Cropped areas near the base of the hill proposed for sediment basin and the clean water dam.	0.24 ha	0.8
PCT 445 Derived	Cleared areas with mixed native and exotic shrubby grassland, generally lacking trees	1.76 ha	5.5
PCT 445 Woodland	Areas of remnant viney open-woodland in the north-western corner of the subject land. This zone has been removed from the footprint.	N/A	30.8

5.6 Serious and Irreversible Impacts (SAII)

The *Guidance to assist a decision-maker to determine a serious and irreversible impact* (NSW Office of Environment and Heritage, 2017) and the NSW threatened species data collection has been used to inform the following further assessment for species at risk of Serious And Irreversible Impacts (SAII).

Based on the assessment described in this report, the following threatened species require assessment in relation to potential SAII, as per section 9.1.2 '*Additional impact assessment provisions for threatened species at risk of an SAII'* of the BAM 2020 manual: These are the species at risk of an SAII that are assumed present on the subject land.

- Large-eared Pied Bat (*Chalinolobus dwyeri*),
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*),
- Eastern Cave Bat (*Vespadelus troughtoni*).

Section 9.1.2 of the BAM 2020 manual is addressed below for these three bat species.

1. **In relation to actions and measures taken to avoid the direct and indirect impacts on the species at risk of SAII.**

The development layout has been significantly amended to avoid impacting and clearing the areas of remnant woodland on the western and northern edges of the proposed quarry site. The amended design of May 2021 will avoid clearing of vegetation and associated habitat loss of approximately 0.84 ha of woodland (western side) and 1.03 ha of semi-cleared woodland on the northeastern side (refer to **Figure 5-1**). These areas include remnant woodland of *Acacia harpophylla* (Brigalow), *Eucalyptus melanophloia* (Silver-leaved Ironbark) and *Casuarina cristata* (Belah) trees, with a native sub-tropical shrub and vine understorey and native groundcover. These trees and remnant vegetation represent potential habitat for a number of native species including the Large-eared Pied Bat, Large Bent-winged Bat and Eastern Cave Bat that may occur locally and forage in the woodland.

The areas of woodland avoided have been partially cleared in the past but still contain a good diversity of native species and large trees amongst some non-native groundcover. These woodland areas have not been included in the credit calculations in this BDAR. There will need to be environmental protection measures in place to ensure those areas are retained and not impacted by the quarry works. Any change to the site layout or additional footprint would be subject to additional impact assessment, other than what is provided in this BDAR.

2. **In relation to the current population of the species across NSW, its decline, size, geographic range, and potential response to management.**

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. This species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-

shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.

The Large Bent-winged Bat (*Miniopterus orianae oceanensis*) occurs along the entire eastern coastline of Australia. Caves (limestone and sandstone) are the primary roosting habitat, but they also use derelict mines, concrete bunkers, storm-water tunnels, buildings and other man-made structures. They form discrete populations centred on maternity caves that are used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. This species hunts in forested areas, catching moths and other flying insects above the tree tops.

The Eastern Cave Bat (*Vespadelus troughtoni*) is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Very little is known about the biology of this uncommon species. It is a cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.

Relevant to the subject land, for all three species there are records in Arakoola National Park to the east, Warialda to the south and Bullala National Park to the southwest. Maps of the records are shown below (**Figure 5-2** to **Figure 5-4**), for each species.

Figure 5-2. Large-eared Pied Bat (*Chalinolobus dwyeri*) records surrounding the subject land. Source: Saving our Species

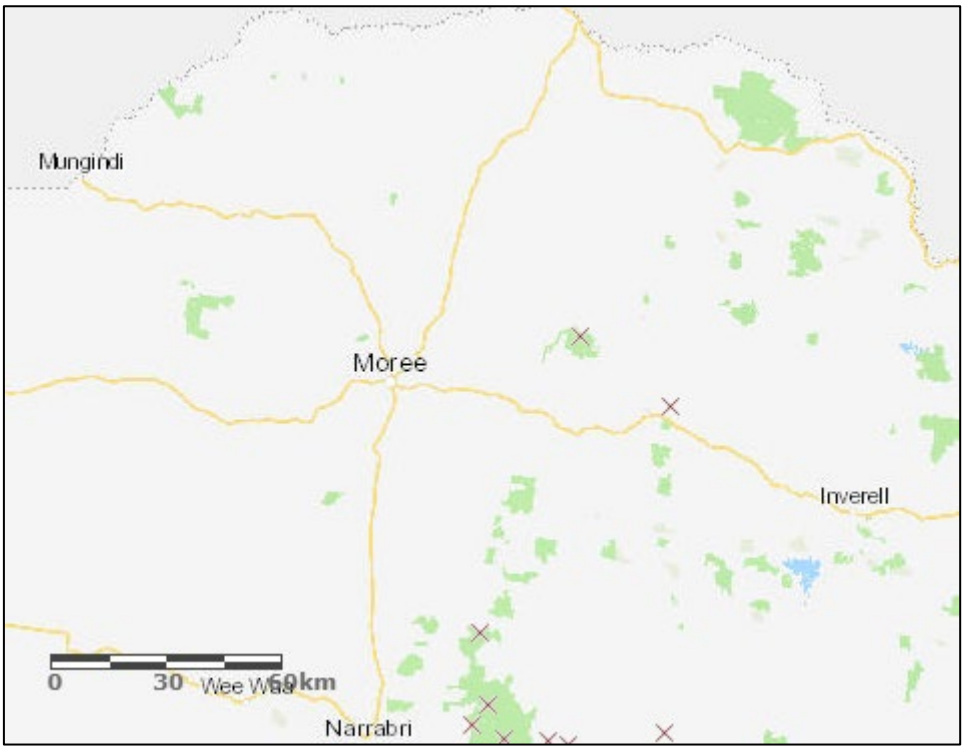


Figure 5-3. Large Bent-winged Bat (*Miniopterus orianae oceanensis*) records surrounding the subject land. Blue shaded areas show priority management sites. Source: Saving our Species

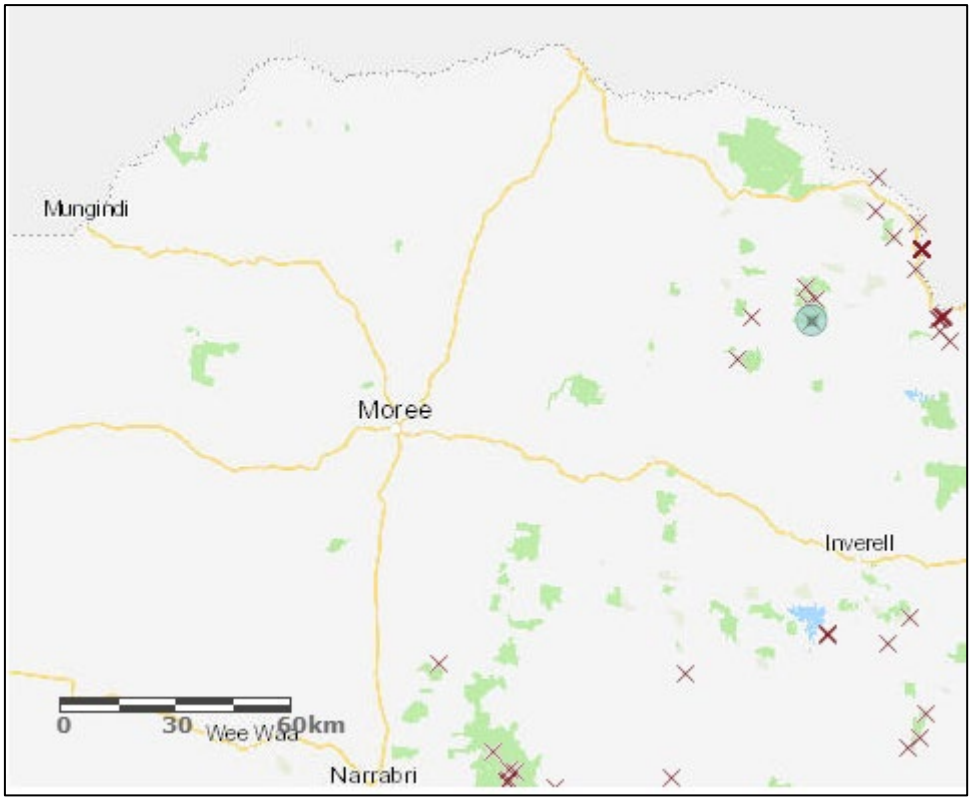
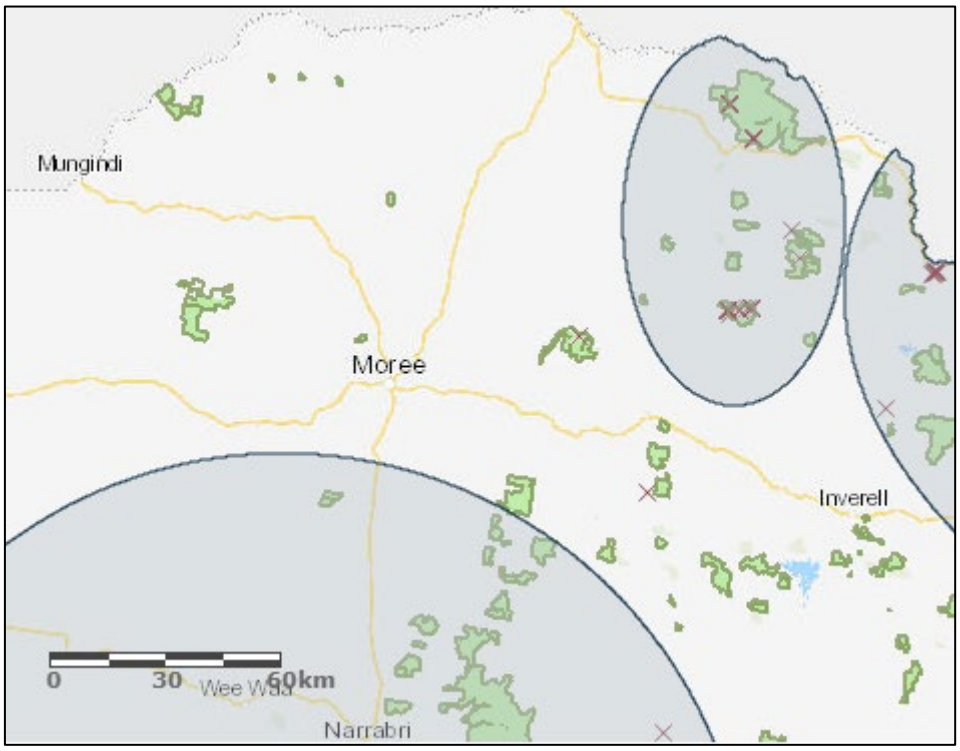


Figure 5-4. Eastern Cave Bat (*Vespadelus troughtoni*) records surrounding the subject land. Blue shaded areas show priority management sites. Source: Saving our Species



3. **In relation to whether the species is 'unknown' or a 'data deficient' species.**
    - **Large-eared Pied Bat (*Chalinolobus dwyeri*):** this species is assigned to the data-deficient management stream.
    - **Large Bent-winged Bat (*Miniopterus orianae oceanensis*):** this species has been assigned to the Site-managed species management stream.
    - **Eastern Cave Bat (*Vespadelus troughtoni*):** this species has been assigned to the Landscape species management stream.
4. **In relation to the impacts of the proposal of the species at risk of an SAII, on its population and geographic range.**

For all three species, the proposal will impact a small area of low-quality habitat that has been cleared and modified in the past, and that is also to the west of the main areas of known occurrence. The area of modified potential habitat that will be cleared for the proposed quarry is approximately 2.00 ha. The removal of this small extent of low-qualify habitat is not expected to threaten the survival of any local populations of any of these species. The project intends to retain the adjoining woodland areas, which were originally proposed to be part of the quarry and which have been excised from the development footprint to avoid impact to the woodland.

5. **Any new information that may be used to demonstrate that the principle identifying the species as at risk of an SAII is inaccurate.**

No new information has been generated by this project since there were no targeted surveys for any of these species. The proponent has elected to use the option to assume the species are present, and pay for the credits in this case.

For the SAII species, Principle 4, clause 6.7(2) (d) Biodiversity Conservation Regulation 2017, is required to be addressed. Specifically, in this instance, an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of one or more of the above threatened species becoming extinct because the species "is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable". The aforementioned Principle 4 is explored below for these three bat species.

i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

    - **Large-eared Pied Bat (*Chalinolobus dwyeri*):** this species occurs in eastern Australia (Qld, NSW) and utilises dry sclerophyll forests and woodlands, cypress pine woodland, rainforest edges, tall open forest, subalpine woodland (Van Dyck et al. 2012). This species roosts in rock overhangs, caves, mines, and Fairy Martin nests (Van Dyck et al. 2012). This species has one to two young per year and nursery colonies have been reported in caves and mines (Dwyer 1966, Hoye and Dwyer 1995). Considering its generally broad habitat use, its ability to occupy new habitat (e.g., on a Biodiversity Stewardship site) is likely not a limiting factor.

- **Large Bent-winged Bat (*Miniopterus orianae oceanensis*):** this species occurs in eastern Australia (Qld, NSW, Vic) and utilises rainforest, sclerophyll forest, monsoon forest, open woodland and grassland, and *Melaleuca* forest (Van Dyck et al. 2012). Considering its fairly broad habitat use for foraging purposes, its ability to occupy new foraging habitat (e.g., on a Biodiversity Stewardship site) is likely not a limiting factor. This species roosts in caves, mines, concrete bunkers and lava tubes (Van Dyck et al. 2012). Reproduction for this species is centred on maternity caves that are used repeatedly (Mills 2021), therefore, this is a limiting abiotic factor. The subject land does not contain caves.
- **Eastern Cave Bat (*Vespadelus troughtoni*):** this species occurs in eastern Australia (Qld, NSW) and utilises rainforest edges, tropical and temperate forests, woodlands, and semiarid areas. This species roosts in rock overhangs, caves, mines, culverts, buildings, Fairy Martin nests, and lava tubes (Law et al. 2005, Law and Chidel 2007, Van Dyck et al. 2012). Considering its generally broad habitat use, its ability to occupy new habitat (e.g., on a Biodiversity Stewardship site) is likely not a limiting factor.

ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site

- **Large-eared Pied Bat (*Chalinolobus dwyeri*):** this species is associated with sandstone cliffs and caves (neither of which are present on the subject land), but also occurs in manmade abiotic habitats such as mine shafts and culverts (Dwyer 1966). Considering its opportunistic use of manmade abiotic habitat, it is not considered reliant on abiotic habitat which cannot be restored or replaced.
- **Large Bent-winged Bat (*Miniopterus orianae oceanensis*)**: this species is reliant on maternity caves for breeding (Mills 2021) and cold caves for hibernation. Suitable caves may not be able to be restored or replaced. No caves are present on the subject land, therefore no caves will be impacted by the development.
- **Eastern Cave Bat (*Vespadelus troughtoni*):** this species utilises both natural and manmade habitat for breeding, therefore it is not considered reliant on abiotic habitat which cannot be restored or replaced. No lava tubes or caves will be impacted by the development.

iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).

- **Large-eared Pied Bat (*Chalinolobus dwyeri*):** this species is not well studied and is considered “data-deficient”. However, life history trait data and basic ecological information is available (Dwyer 1966, Hoye and Dwyer 1995, Pennay 2008, Van Dyck et al. 2012). Key threatening processes specific to this species have not been elucidated.

- **Large Bent-winged Bat (*Miniopterus orianae oceanensis*):** this species is reasonably well studied (e.g., Gonsalves and Law 2017, Holz et al. 2020, Mills 2021) and life history trait data and ecological information is available (Mills 2021 Dwyer 1966, Hoye and Dwyer 1995, Van Dyck et al. 2012). Key threatening processes specific to this species have not been elucidated.
- **Eastern Cave Bat (*Vespadelus troughtoni*):** this species is relatively understudied but basic life history trait data and ecological information is available (e.g., Law and Chidel 2005, Law and Chidel 2007, Van Dyck et al. 2012). Key threatening processes specific to this species have not been elucidated.

In summary, based on the above summary and considering the small area of proposed impact in low-quality disturbed vegetation (that does not contain caves) and that the amended site layout avoids impacting the patches of woodland at the site, it is unlikely that the development will cause any substantial loss of habitat or lead to a SAII for any of these three species. The assessment of potential SAII is however subject to the consent authority and reviewing authority to make a decision in this case.

5.7 Prescribed impacts

The Biodiversity Regulation 2017 lists nine impacts as prescribed impacts that must be avoided, minimised and mitigated. These prescribed impacts and their relevance to the proposed development are described in **Table 5-4.**

Table 5-4. Prescribed impacts of the project.

Prescribed Impacts	Site Assessment	Mitigation Measure
Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance.	No karsts, caves, crevices, cliffs or other features of geological significance are present on the subject land or known within the study area.	None required.
Impacts of development on the habitat of threatened species or ecological communities associated with rocks.	Previous quarry/mine workings may provide rock crevices that could be inhabited by threatened bats. These are not considered features of geological significance, however. Species credits have been incurred for the predicted threatened bats which are assumed present in the absence of targeted survey.	Biodiversity credits incurred for potential presence of threatened bats in old mine workings.
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures.	No human made structures occur within the subject land. Potential impacts of the proposal on the old mine workings have been address in the line above.	None required.

Prescribed Impacts	Site Assessment	Mitigation Measure
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	Areas of non-native dominated vegetation have been cropped and are highly degraded and contained no or very few native species. It is not likely that any species relies on the non-native areas of cropped land due to its lack of structure and habitat resources. The predicted species would, at best, fly over or pass through the areas of non-native vegetation, rather than inhabit or rely upon it for survive or breeding.	None required.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	The proposed quarry is at the western end of a short section of low hills in the landscape that is otherwise highly modified and cleared for agriculture. The proposed quarry site will impact an existing disturbed portion of these low hills, on the west end of the hills, at a site that has already been cleared and fragmented by past mining and agricultural activity. There is an adjoining larger area of native vegetation to the east on these hills. The proposed will reduce connectivity by a minimal amount, between a small fragment of native woodland on the western side of the proposed quarry site and the larger areas of native vegetation to the east. However, the subject land in its current state is already cleared and modified. Overall, there will be minimal new fragmentation caused with no new areas of fragmentation been created. The road vegetation corridor will still be a viable passage for fauna which may use it to access adjoining native vegetation. Wooded vegetation within the subject land is no less than 70 m from connecting wooded corridors, therefore contributing minimal value to connectivity.	Refer to environmental protection measures in **Table 5-1.**
Impacts of the development on movement of threatened species that maintains their life cycle.	The subject land potentially contains foraging habitat for a number of threatened bird species, and bats, however the project will not significantly alter connectivity of native woodland within the landscape due to the site being on an existing disturbed area that has been previously mined/quarried.	Refer to environmental protection measures in **Table 5-1.**
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.	The project will not impact any watercourses, there are no watercourses within the subject land A second order stream is situated 800 m to the southwest of the subject land, but will not be impacted by the proposal. The proposed includes a stormwater management plan for sediment retention and clear water dam, which should retain all surface flows from the site – refer to **Figure 1-2** . No wetlands occur within the subject site.	Refer to the project Stormwater plan shown in **Figure 1-2**.

Prescribed Impacts	Site Assessment	Mitigation Measure
Impacts of wind turbine strikes on protected animals.	None associated with the project.	None required.
Impact of vehicle strikes on threatened species of animals or on animals that are part of a TEC.	The risk of vehicle strikes on native animals is minimal, but is possible both during the construction and operational phases of the project. The main areas of operational risk would be along the access road to the quarry site which goes through a corridor of remnant native vegetation (refer to **Figure 1-3**)	Refer to **Table 5-1**. Enforce 40 km/h speed limits on access roads to reduce the risk of vehicle strikes.

5.8 Indirect impacts

The main impacts of the project are expected to be contained within the subject land, provided there is adequate demarcation between the construction and non-construction areas. Disturbance from machinery and construction activities will occur, such as noise and dust. However, these impacts will be minimised by following the environmental safeguards proposed in **Table 5-1**. Additionally, the continued operation of the quarry has and will produce noise and dust. There is also the risk of biosecurity associated with vehicle movements through farmland and waste management, however the operations should comply with the *Protection of the Environment Operations Act 1997, Environmental Planning & Assessment Act, Environmental Planning & Regulation 2000, Gwydir Local Environmental Plan 2013* and *Contaminated Land Management Act 1997* to ensure these impacts are controlled appropriately.

5.9 Matters of National Environmental Significance

Under the environmental assessment provisions of the EPBC Act, Matters of National Environmental Significance (MNES) and impacts on Commonwealth land are required to be considered to assist in determining whether the project should be referred to the Commonwealth Government Department of Agriculture, Water and the Environment.

The results of the EPBC Act protected matters search is provided in **Appendix A**. This search has identified, three Wetlands of International Importance, six TECs, 22 threatened species and 9 migratory relevant to the 10 km search area. Of the former items, one migratory and six threatened species were assessed as having a Moderate likelihood of occurrence on the subject land (**Appendix F**). Tests of significance in accordance with the EPBC Act have been carried out and are presented in **Appendix G**.

A summary of these matters and whether the project is likely to impact them is provided in **Table 5-5**. It is concluded that no MNES will be significantly impacted by the project.

Table 5-5. Impacts to matters of national environmental significance.

Factor	Potential impact
Any impact on a World Heritage property?	NIL
Any impact on a National Heritage place?	NIL
Any impact on a wetland of international importance?	NIL
Any impact on a listed threatened species or communities?	Unlikely, see **Appendix G**

Factor	Potential impact
Any impacts on listed migratory species?	Unlikely, see Appendix G
Any impact on a Commonwealth marine area?	NIL
Does the project involve a nuclear action (including uranium mining)?	NIL
Additionally, any impact (direct or indirect) on Commonwealth land?	NIL
Any impact on a water resource, in relation to coal seam gas development and large coal mining development?	NIL

6 Biodiversity Credit and Offset Report

6.1 Management zones

The BAM considers future vegetation condition of different areas of the development footprint when calculating biodiversity credits and offsets. It has been assumed that all vegetation within the development footprint will be cleared and, therefore, the offset calculations have assumed one future management zone, where there will be complete loss of native vegetation.

6.2 Vegetation Integrity assessment

Vegetation integrity (VI) scores have been calculated for each vegetation zone based on patch size, area to be impacted, vegetation composition, structure and function, as defined below.

Patch size – Area in hectares of total vegetation zone patch (i.e. the connected woody and non-woody vegetation).

Area – Area within the property that will be subject to clearing, modification or other treatment by the Project. There is only one management zone as described above.

Composition – Score calculated based on species richness, i.e. the number of native species present.

Structure – Score calculated based on the cover (%) of each native species growth form.

Function – Score calculated based on habitat features, i.e. presence of tree sizes, hollow trees, coarse woody debris, litter cover (%) and high threat weed cover (%).

Benchmark data for the PCTs is also used in this calculation.

Data required for the VI calculations were collected in the field using the BAM, as described above. The VI assessment for each vegetation zone including the loss of VI due to the development is shown in **Table 6-1**.

Table 6-1. Vegetation Integrity (VI) assessment.

Vegetation zone	Zone name	Area of impact (ha)	Assessed VI score	Future VI score	Change in VI score
1	445_cropped	0.24	0.8	0	0.8
2	445_cleared	1.76	5.5	0	5.5

6.3 Ecosystem Credit summary

Ecosystem credits requiring offset by the project have been calculated using field data entered into the BAM calculator. A summary of the ecosystem credits generated is provided in **Table 6-2**. Note that due to the low VI Score no ecosystem credits are generated for this site.

The Biodiversity Credit Report generated by the BAM calculator is included in **Appendix D**.

Table 6-2. Ecosystem credits produced for vegetation and threatened species habitat cleared.

Zone	Vegetation zone name	Vegetation integrity loss/gain	Area (ha)	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Ecosystem credits
1	445_cropped	0.8	0.24	Low sensitivity to potential gain	2.00	0
2	445_cleared	5.5	1.76	High sensitivity to potential gain	2.50	0
					Total	**0**

6.4 Species Credit summary

The species credit species output by the BAM calculator have been described in **Section 4.2** of this report. Some of the species credit species have been excluded from the calculations on the basis that no suitable habitat is present on the subject land. Others that were not able to be excluded on the basis of habitat and that were not assessed by targeted survey have been retained in the credit calculations as 'Assumed Present, not surveyed'.

The following species have been excluded and are considered not impacted due to habitat requirements not being present in the development footprint (suitable habitat trees and intact native vegetation not present) or due to targeted surveys determining that the species is not present.

- Absent: Pale Imperial Hairstreak (*Jalmenus eubulus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Koala (*Phascolarctos cinereus*), Ooline (*Cadellia pentastylis*), Belson's Panic (*Homopholis belsonii*).

The following species have been assessed as 'present', due to there being no justifiable reason for excluding them from the site, and also not being assessed by targeted survey.

- Present: Large-eared Pied Bat (*Chalinolobus dwyeri*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*), Eastern Cave Bat (*Vespadelus troughtoni*)

The credits generated for the retained species credit species are summarised in **Table 6-3** below.

Table 6-3. Species credits produced for the habitat cleared.

Species	Vegetation zone	Vegetation integrity (Habitat condition)	Area (ha)	Biodiversity risk weighting	Potential SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)	445_Derived 445_Cropped	5.5 0.8	1.8 0.24	3	Yes	7 1
Miniopterus orianae oceanensis / Large Bent-winged Bat (Fauna)	445_Derived 445_Cropped	5.5 0.8	1.8 0.24	3	Yes	7 1
Ninox connivens / Barking Owl (Fauna)	445_Derived 445_Cropped	5.5 0.8	1.8 0.24	2	No	5 1

Species	Vegetation zone	Vegetation integrity (Habitat condition)	Area (ha)	Biodiversity risk weighting	Potential SAII	Species credits
Tyto novaehollandiae / Masked Owl	445_Derived 445_Cropped	5.5 0.8	1.8 0.24	2	No	5 1
Vespadelus troughtoni / Eastern Cave Bat (Fauna)	445_Derived 445_Cropped	5.5 0.8	1.8 0.24	3	Yes	7 1

6.5 Offset requirement

Like for like credit retirement options and the variation rules according to the Biodiversity Conservation Regulation 2017 are summarised in **Table 6-4** (for only the species credits produced, in this case).

Table 6-4. Retirement options for credits, including like-for-like and IBRA region options.

Species	Like-for-like credit retirement options	IBRA Subregion
Chalinolobus dwyeri Large-eared Pied Bat	Spp *Chalinolobus dwyeri* Large-eared Pied Bat	Any in NSW
Miniopterus orianae oceanensis Large Bent-winged Bat	Spp *Miniopterus orianae oceanensis* Large Bent-winged Ba	Any in NSW
Ninox connivens Barking Owl	Spp *Ninox connivens* Barking Owl	Any in NSW
Tyto novaehollandiae Masked Owl	Spp *Tyto novaehollandiae* Masked Owl	Any in NSW
Vespadelus troughtoni Eastern Cave Bat	Spp *Vespadelus troughtoni* Eastern Cave Bat	Any in NSW

7 Summary and conclusions

The native vegetation consists of one Plant Community Type:

- PCT 445 *Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion.*

PCT 445 is associated with the following threatened ecological communities (TECs):

- EPBC Act, Endangered: *Brigalow-Gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions*;
- BC Act, Endangered: *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregion*s;
- EPBC Act, Endangered: *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions*.

However, based on the cleared and degraded nature of the subject land, this assessment finds that the vegetation on the site is not of sufficient condition to be part of any of the above TECs.

In total 16 potential ecosystem credit species were predicted for the PCT and condition as a derived grassland. Woodland areas around the quarry site were excluded from the development footprint after the design was modified, as part of avoidance measures. Due to the low VI scores for each zone, no ecosystem credits either for the PCT or for the 16 predicted species are required to be offset.

Ten candidate species credit species were determined from the BAM calculations. The following species have been excluded and are considered not impacted due to habitat requirements not being present in the development footprint (suitable habitat trees and intact native vegetation not present) or due to targeted surveys failing to locate the species within the subject land.

- Absent: Pale Imperial Hairstreak (*Jalmenus eubulus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Koala (*Phascolarctos cinereus*), Ooline (*Cadellia pentastylis*), Belson's Panic (*Homopholis belsonii*).

The following species have been assessed as ‘assumed present’, due to there being no justifiable reason for excluding them from the site. The species credits have been calculated for these species and summarised in **Table 6-3** above.

- Present: Large-eared Pied Bat (*Chalinolobus dwyeri*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*), Eastern Cave Bat (*Vespadelus troughtoni*).

The proponent is obligated to offset the impacts of the development on potential threatened species (species credit species) by purchasing or retiring species credits on the open market or by making a payment to BCT.

The following threatened species assumed present on the subject land have been assessed in relation to potential SAII on the species, as per section 9.1.2 of the BAM (2020).

- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*),
- Eastern Cave Bat (*Vespadelus troughtoni*).

The likelihood of a SAII occurring for any of these bat species will be determined by the consent authority.

The significance of the proposed impact to EPBC Listed threatened, migratory, wetland and marine species predicted to occur within a 10 km search area was assessed. No significant impact to a threatened, migratory, wetland or marine species likely to result in the extinction of a local population was identified. The residual ecological impacts of the project would be adequately mitigated using the management actions recommended. Therefore, a referral of the project to the Federal Department of Agriculture, Water and the Environment for these matters is not required.

This assessment covers the current form of the project as shown in **Figure 1-2** at the start of this report. Any change to the development layout or scope of work will require re-assessment.

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Appendix A: Database search results

BioNET Atlas search of records with 10km of the development site.

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: Public 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: -28.93 West: 150.36 East: 150.46 South: -29.03] returned a total of 15 records of 6 species. Database search on 14/07/2021.

Class	Scientific Name	Common Name	NSW Status	Comm Status	Date	No. Individs.	Description	Latitude GDA94	Longitude GDA94	Accuracy	Sighting Notes
Aves	*Chthonicola sagittata*	Speckled Warbler	V,P		1/03/1979	0	Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940	-28.9917	150.4196	1000	
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V,P		1/03/1979	0	Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940	-28.9917	150.4196	1000	
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V,P		1/03/1979	0	NW Slopes - W3	-28.9984	150.4178	100	
Aves	*Hieraaetus morphnoides*	Little Eagle	V,P		1/03/1979	0	Far North Western Slopes Remnant Veg and Bird Survey Site W3 Specified Map No: 8940	-28.9917	150.4196	1000	
Aves	*Hieraaetus morphnoides*	Little Eagle	V,P		1/03/1979	0	NW Slopes - W3	-28.9984	150.4178	100	
Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V,P		17/01/2020	5	Wolonga Camp TSR North Star	-29.0089	150.4432	500	LLS NW Goondiwindi survey 2020
Aves	*Pomatostomus temporalis*	Grey-crowned	V,P		31/03/2020	8	Wolonga Camp TSR North Star	-29.0089	150.4432	500	LLS NW Goondiwindi survey 2020

Class	Scientific Name	Common Name	NSW Status	Comm Status	Date	No. Individs.	Description	Latitude GDA94	Longitude GDA94	Accuracy	Sighting Notes
	temporalis	Babbler (eastern subspecies)									
Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V,P		28/03/2019	0	Croppa Creek Rd, North Star, NSW	-28.9851	150.4034	20	
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	13/03/2019	0	Suburb only provided: North Star, 2408	-28.942	150.4173	16970	Encounter broad: Unknown; Encounter narrow: Unknown
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	1/07/2004	1		-28.9595	150.3919	10000	Data Entry: Aimery Thomas.
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	11/10/2015	0	Suburb only provided: North Star, NSW, 2408	-28.942	150.4173	16970	Encounter broad: Unknown; Encounter narrow: Unknown
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	13/03/2019	0	Suburb only provided: North Star, 2408	-28.942	150.4173	16970	Encounter broad: Unknown; Encounter narrow: Unknown
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	13/03/2019	0	Suburb only provided: North Star, 2408	-28.942	150.4173	16970	Encounter broad: Unknown; Encounter narrow: Unknown
Flora	*Homopholis belsonii*	Belson's Panic	E1	V	22/09/1988	0	`Warivan', 7.4 km from North Star on Warialda road.	-28.9818	150.4178	1000	Determination status: conf. Determiner: K.E. Wills Date Determined: 1 Jul 2001 Habit / Notes: Rare. Tall caespitose grass. Noted NPWS Rare Plant Data Base 1991.
Flora	*Homopholis belsonii*	Belson's Panic	E1	V	22/09/1988	0	Warivan 7.4km from Nth Star on Warialda Rd	-29.0204	150.4145	1000	Tall caespitose grass located on basalt hills

Class	Scientific Name	Common Name	NSW Status	Comm Status	Date	No. Individs.	Description	Latitude GDA94	Longitude GDA94	Accuracy	Sighting Notes
							Specified Map No: 8939				with very rocky red brown friable loam in *Acacia harpophylla/Allocasuraina cristata* closed forest. Collected in flower.

Biodiversity Values Map

NSW Government's BV map online layer accessed 17/03/2021. Areas marked as purple are areas mapped on the BV map biodiversity value. The red outline indicates the subject land.





Appendix B: Vegetation plot locations and photographs

Plot	Plot photographs (from 0m, along centreline)
BAM 1 Bearing: 270° 247065E, 6790591N (zone 56) PCT 445 Derived grassland zone	

Plot	Plot photographs (from 0m, along centreline)
	

Plot	Plot photographs (from 0m, along centreline)
BAM 2 Bearing: 80° 247111E, 6791082N (zone 56) PCT 445 Cropped zone	

Plot	Plot photographs (from 0m, along centreline)
	

Plot	Plot photographs (from 0m, along centreline)
BAM 3 Bearing: 20° 247133E, 6790825N (zone 56) PCT 445 Woodland zone – not in proposed impact footprint	

Plot	Plot photographs (from 0m, along centreline)
	

Plot	Plot photographs (from 0m, along centreline)
BAM 4 Bearing: 250° 247009E, 6790812N (zone 56) PCT 445 Derived grassland zone	

Plot	Plot photographs (from 0m, along centreline)
	

Plot	Plot photographs (from 0m, along centreline)
BAM 5 Bearing: 20° 246865E, 6790837N (zone 56) PCT 445 Woodland zone – not in proposed impact footprint	

Plot	Plot photographs (from 0m, along centreline)
	

Plot	Plot photographs (from 0m, along centreline)
BAM 6 Bearing: 200° 246993E, 6790769N (zone 56) PCT 445 Derived grassland zone	

Plot	Plot photographs (from 0m, along centreline)
	

Plot	Plot photographs (from 0m, along centreline)
BAM 7 Bearing: 250° 247090E, 6790699N (zone 56) PCT 445 Derived grassland zone	

Plot	Plot photographs (from 0m, along centreline)
	

Appendix C: Flora species list and plot data summary

List of species recorded in each BAM Vegetation Integrity plot, with cover scores.

Family	Scientific Name	Common Name	HTE	Growth form	BAM Plot # (% cover)						
					1	2	3	4	5	6	7
Malvaceae	*Abutilon oxycarpum*	Straggly Lantern-bush		Shrub (SG)	0.1		0.2		2		
Apocynaceae	*Alstonia constricta*	Quinine Bush		Tree (TG)					0.5		
Amaranthaceae	*Alternanthera pungens*	Khaki Weed	HTE	Non-Native						0.2	
Amaranthaceae	*Amaranthus deflexus*	Spreading Amaranth		Non-Native			0.1	0.1	0.1	0.1	0.1
Chenopodiaceae	*Atriplex muelleri*	Mueller's Saltbush		Forb (FG)	0.2		0.1			0.2	
Poaceae	*Austrostipa scabra*	Speargrass		Grass & grasslike (GG)					0.2		
Elatinaceae	*Bergia trimera*	Small Water-fire		Forb (FG)	0.1						
Euphorbiaceae	*Bertya* spp.			Shrub (SG)					10		
Euphorbiaceae	*Beyeria viscosa*	Sticky Wallaby Bush		Shrub (SG)		0.1	0.1	5	30	2	1
Asteraceae	*Bidens pilosa*	Cobbler's Pegs		Non-Native			0.5				0.1
Nyctaginaceae	*Boerhavia dominii*	Tarvine		Forb (FG)	0.1		2	2			
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy		Forb (FG)				0.1			
Capparaceae	*Capparis lasiantha*	Nepine		Other (OG)	0.2	0.1	0.1		0.5		
Casuarinaceae	*Casuarina cristata*	Belah		Tree (TG)			3				
Poaceae	*Cenchrus ciliaris*	Buffel Grass	HTE	Non-Native	0.5		0.1	10	20	20	
Poaceae	*Chloris*			Grass & grasslike (GG)	0.1				0.2		

Family	Scientific Name	Common Name	HTE	Growth form	BAM Plot # (% cover)						
					1	2	3	4	5	6	7
	divaricata										
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane		Non-Native	0.1	0.1					
Poaceae	*Sorghum* sp. (CROP)	Sorghum		Non-Native		70					
Euphorbiaceae	*Croton phebalioides*			Shrub (SG)			5		2		
Cucurbitaceae	*Cucumis myriocarpus*	Paddy Melon		Non-Native		0.2	0.1	0.2		0.5	
Poaceae	*Cynodon dactylon*	Common Couch		Grass & grasslike (GG)				5	5	10	
Poaceae	*Dactyloctenium radulans*	Button Grass		Grass & grasslike (GG)	0.1				0.1		
Fabaceae	*Desmodium brachypodum*	Large Tick-trefoil		Forb (FG)							0.1
Poaceae	*Digitaria eriantha*	Finger Panic Grass		Non-Native				1			
Chenopodiaceae	*Dysphania pumilio*	Small Crumbweed		Forb (FG)				0.1	0.1	0.2	0.1
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush		Forb (FG)			0.1	0.1	0.1		
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush		Shrub (SG)			0.1		0.2		
Poaceae	*Enneapogon* sp.	Nineawn Grass, Bottlewashers		Grass & grasslike (GG)				0.1			
Poaceae	*Enteropogon acicularis*	Curly Windmill Grass		Grass & grasslike (GG)					0.1		
Poaceae	Poaceae sp.	Unknown Native Grass		Grass & grasslike (GG)					0.5		
Poaceae	*Eragrostis cilianensis*	Stinkgrass		Non-Native				5	0.5		
Poaceae	*Eragrostis* sp.	Lovegrass		Grass & grasslike (GG)	20					0.2	
Myoporaceae	*Eremophila mitchellii*	Budda		Shrub (SG)			0.1		2		

Family	Scientific Name	Common Name	HTE	Growth form	BAM Plot # (% cover)						
					1	2	3	4	5	6	7
Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass		Grass & grasslike (GG)	0.1		5	5	2	2	1
Myrtaceae	*Eucalyptus melanophloia*	Silver-leaved Ironbark		Tree (TG)					5		
Euphorbiaceae	*Euphorbia dallachyana*			Forb (FG)		0.1					
Rutaceae	*Geijera parviflora*	Wilga		Shrub (SG)					0.5		
Fabaceae	*Glycine tabacina*	Variable Glycine		Other (OG)	0.1						
Solanaceae	*Lycium ferocissimum*	African Boxthorn	HTE	Non-Native	0.2		0.1		1		
Malvaceae	*Malvastrum americanum*	Spiked Malvastrum		Non-Native	20		0.2	5	0.5	5	
Malvaceae	*Malvastrum coromandelianum*	Prickly Malvastrum		Forb (FG)		0.1	0.1				
Fabaceae	*Medicago polymorpha*	Burr Medic		Non-Native	0.1						
Oleaceae	*Notelaea microcarpa*	Native Olive		Tree (TG)			0.1		0.1		
Oxalidaceae	*Oxalis perennans*			Forb (FG)	0.1						
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine		Other (OG)			0.1				
Poaceae	*Panicum coloratum*	Coolah Grass		Non-Native			0.1	1	2		
Poaceae	*Panicum decompositum*	Native Millet		Grass & grasslike (GG)		0.2	0.2				
Apocynaceae	*Parsonsia lanceolata*	Rough Silkpod		Other (OG)	0.1			0.1			
Poaceae	*Paspalidium gracile*	Slender Panic		Grass & grasslike (GG)			0.1				

Family	Scientific Name	Common Name	HTE	Growth form	BAM Plot # (% cover)						
					1	2	3	4	5	6	7
Solanaceae	*Physalis angulata*			Non-Native		0.2					1
Portulacaceae	*Portulaca oleracea*	Pigweed		Forb (FG)	0.1			0.2	0.3		1
Chenopodiaceae	*Rhagodia spinescens*	Thorny Saltbush		Shrub (SG)	0.2				1		
Chenopodiaceae	*Salsola australis*			Shrub (SG)	0.5		0.1	0.2		2	2
Lamiaceae	*Salvia reflexa*	Mintweed		Non-Native	5	0.1	60	30		10	30
Chenopodiaceae	*Sclerolaena muricata*	Black Rolypoly		Shrub (SG)	5		0.1	0.1			5
Fabaceae	*Senna artemisioides*			Shrub (SG)				0.1			0.1
Fabaceae	*Senna coronilloides*			Shrub (SG)				1			0.1
Poaceae	*Setaria incrassata*	Purple Pigeon Grass		Non-Native							1
Malvaceae	*Sida cunninghamii*	Ridge Sida		Forb (FG)					0.1		
Malvaceae	*Sida spinosa*			Non-Native							0.1
Solanaceae	*Solanum esuriale*	Quena		Forb (FG)						0.1	
Solanaceae	*Solanum nigrum*	Black-berry Nightshade		Non-Native							0.1
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach		Forb (FG)			0.1	0.1	0.2		
Poaceae	*Tragus australianus*	Small Burrgrass		Grass & grasslike (GG)	1			0.1	0.1	0.1	
Aizoaceae	*Trianthema triquetra*	Small Hogweed		Forb (FG)	0.1			0.1	0.2	0.1	
Zygophyllaceae	*Tribulus micrococcus*	Spineless Caltrop		Forb (FG)	0.2	0.2	2	1	0.1		1
Poaceae	*Urochloa*	Urochloa Grass		Non-Native	10		10	5		40	30

Family	Scientific Name	Common Name	HTE	Growth form	BAM Plot # (% cover)						
					1	2	3	4	5	6	7
	panicoides										
Verbenaceae	*Verbena officinalis*	Common Verbena		Non-Native	0.1						
Verbenaceae	*Verbena tenuisecta*			Non-Native	2			0.1			
Asteraceae	*Verbesina encelioides*			Non-Native	5			3		2	1
Asteraceae	*Vittadinia cuneata*	A Fuzzweed		Forb (FG)	0.1						
Asteraceae	*Xanthium occidentale*	Noogoora Burr	HTE	Non-Native		1					
Asteraceae	*Xanthium spinosum*	Bathurst Burr	HTE	Non-Native		0.2		0.1		0.1	0.5
Zygophyllaceae	*Zygophyllum apiculatum*			Forb (FG)			0.2		0.5		

BAM Plot Summary Data

Plot summary - COUNTS of SPECIES per growth form							
	Plot 1	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**	**Plot 7**
Tree (TG)	0	0	2	0	3	0	0
Shrub (SG)	4	1	7	5	8	2	5
Forb (FG)	8	3	7	8	8	4	3
Grass & grasslike (GG)	5	1	3	4	8	4	1
Fern (EG)	0	0	0	0	0	0	0
Other (OG)	3	1	2	1	1	0	0
Native	20	6	21	18	28	10	9
Non-native	10	7	9	12	6	9	10
Total spp count	**30**	**13**	**30**	**30**	**34**	**19**	**20**

Plot summary - Sum of COVER per native growth form group and HTE							
	Plot 1	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**	**Plot 7**
Tree (TG)	0	0	3.1	0	5.6	0	0
Shrub (SG)	5.8	0.1	5.7	6.4	47.7	4	8.2
Forb (FG)	1	0.4	4.6	3.7	1.6	0.6	1.2
Grass & grasslike (GG)	21.3	0.2	5.3	10.2	8.2	12.3	1
Fern (EG)	0	0	0	0	0	0	0
Other (OG)	0.4	0.1	0.2	0.1	0.5	0	0
Non-native	43	71.8	71.2	60.5	24.1	77.9	63.9
High Threat Weed	0.7	1.2	0.2	10.1	21	20.3	0.5

Appendix D: BAM calculator reports

NSW GOVERNMENT

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024870/BAAS21028/22/00032467	North Star Quarry - Reduced Footprint	24/11/2021
Assessor Name	Report Created	BAM Data version *
David Orchard	20/04/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS21028	Finalised	20/04/2022
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion												
1	445_Derived	Not a TEC	5.5	5.5	1.8	PCT Cleared - 90%	High Sensitivity to Potential Gain			2.50		0

BAM Credit Summary Report

2	445_Cropped	Not a TEC	0.8	0.8	0.24	PCT Cleared - 90%	High Sensitivity to Potential Gain			2.50		0
											Subtotal	**0**
											Total	**0**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
445_Derived	5.5	5.5	1.8			Vulnerable	Vulnerable	True	7
445_Cropped	0.8	0.8	0.24			Vulnerable	Vulnerable	True	1
								Subtotal	**8**
Miniopterus orianae oceanensis / Large Bent-winged Bat (Fauna)									
445_Derived	5.5	5.5	1.8			Vulnerable	Not Listed	True	7
445_Cropped	0.8	0.8	0.24			Vulnerable	Not Listed	True	1
								Subtotal	**8**
Ninox connivens / Barking Owl (Fauna)									
445_Derived	5.5	5.5	1.8			Vulnerable	Not Listed	False	5
445_Cropped	0.8	0.8	0.24			Vulnerable	Not Listed	False	1
								Subtotal	**6**

NSW GOVERNMENT

BAM Credit Summary Report

Tyto novaehollandiae / Masked Owl (Fauna)									
445_Derived	5.5	5.5	1.8			Vulnerable	Not Listed	False	5
445_Cropped	0.8	0.8	0.24			Vulnerable	Not Listed	False	1
								Subtotal	**6**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)									
445_Derived	5.5	5.5	1.8			Vulnerable	Not Listed	True	7
445_Cropped	0.8	0.8	0.24			Vulnerable	Not Listed	True	1
								Subtotal	**8**

Appendix E: Threatened species assessment

Ecosystem credit species – habitat assessment

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Artamus cyanopterus cyanopterus Dusky Woodswallow	V		No	The Dusky Woodswallow occurs throughout most of NSW however is sparsely scattered in, or largely absent from, much of the upper western region. The majority of breeding occurs on the western slopes of the Great Dividing Range. Primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open - sparse understory of eucalypt saplings and acacias, and understory of grasses, sedges and fallen woody debris. This species is sometimes found in farmland usually at the edges or forests or woodlands. The species migrates after breeding, to the north of NSW and south-eastern QLD, generally between March and May and do not return until breeding the following spring. Nesting occurs in trees or shrubs and is generally associated within an abundance of invertebrate food near watercourses.	The subject land is within the species known distribution. The species is known to occur within the vegetation PCT 445.	Assumed present
Chalinolobus picatus Little Pied Bat	V		No	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but need access to nearby open water.	The species is associated with PCT 445 and there are rock cuttings associated with the old quarry. The species could be present and utilise the site.	Assumed present
Chthonicola sagittata Speckled Warbler	V		Yes	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	The species is associated with PCT 445 and has been recorded locally. The species could be present and utilise the site.	Assumed present

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	V		No	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. The western boundary of the range of *Climacteris picumnus victoriae* runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper *Climacteris picumnus picumnus* which then occupies the remaining parts of the state. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	The subject land is within the species known distribution. The species is known to occur within the vegetation PCT 445.	Assumed Present
Daphoenositta chrysoptera Varied Sittella	V		Yes	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	The species is associated with PCT 445 and has been recorded locally. The species could be present and utilise the site.	Assumed Present
Dasyurus maculatus Spotted-tailed Quoll	V	E	No	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creek lines.	The subject land is within the species known distribution and the species could be present.	Assumed present

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Grantiella picta Painted Honeyeater	V	V	No	The Painted Honeyeater is endemic to mainland Australia, being found in Queensland and New South Wales west of the Great Dividing Range, through to northern Victoria. It is also found occasionally in the Northern Territory and may be a vagrant to South Australia. It is rare throughout its range. The Painted Honeyeater is found in dry open forests and woodlands and is strongly associated with mistletoe. It may also be found along rivers, on plains with scattered trees and on farmland with remnant vegetation. It has been seen in urban parks and gardens where large eucalypts are available.	The species is considered unlikely to be present due to habitat constraints: mistletoe is not present within the subject land.	Absent (habitat constraints not present)
Hirundapus caudacutus White-throated Needletail			No	The White-throated Needletail is widespread in across the coast of eastern and south-eastern Australia, and Tasmania and vagrant in the Northern Territory and in Western Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland.	The species is aerial and would not be present or inhabit or rely upon the terrestrial habitat at the site.	Absent
Melanodryas cucullate cucullata Hooded robin	V		Yes	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies *cucullata*) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies *picata*. Two other subspecies occur outside NSW. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	The subject land is within the species known distribution and the species could be present.	Assumed Present
Miniopterus orianae oceanensis Large Bent-winged Bat	V		No	Eastern Bentwing-bat occurs along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. This species has recently been renamed to *Miniopterus orianae oceanensis* or the large bent-winged bat, from *Miniopterus schreibersii subsp. oceanensis* or the eastern bent-wing bat.	The species is associated with PCT 445 and there are rock cuttings associated with the old quarry. The species could be present and utilise the site.	Assumed present

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Ninox connivens Barking owl (Foraging)	V		Yes	The Barking Owl is found throughout continental Australia except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina* species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance.	The subject land is within the species known distribution and the species could be present.	Assumed Present (foraging)
Phascolarctos cinereus Koala (foraging)	V	V	Yes	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	The subject land is within the species known distribution and the species could be present. Five records exist locally at North Star between 2004 and 2019. The proposal has been modified to not affect woodland habitat.	Absent - Not within the vegetation zones for the PCT (habitat degraded)
Pteropus poliocephalus Grey-headed Flying-fox	V	V		Grey-headed Flying-fox are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. 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.	The proposal has been modified to not affect woodland habitat.	Absent. The proposal has been modified to not affect woodland habitat.

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	V		Yes	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country.	The subject land is within the species known distribution and the species could be present.	Assumed Present
Stagonopleura guttata Diamond Firetail	V		Yes	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. This species is found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. It also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Foraging Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Breeding Nests built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting.	The subject land is within the species known distribution and the species could be present.	Assumed Present
Tyto novaehollandiae Masked owl (foraging)	V		No	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	The subject land is within the species known distribution and the species could be present.	Assumed Present (foraging)

Species credit species – description and site assessment

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Cadellia pentastylis Ooline	V	V	No	A medium-sized spreading tree usually about 10 m tall, and rarely to 25 m. Has glossy green leaves and single white flowers that produce a cluster of brown berries in clusters Occurs along the western edge of the North West Slopes from north of Gunnedah to west of Tenterfield. Also occurs in Queensland. General flowering period is October to January. Forms a closed or open canopy mixing with eucalypt and cypress pine species. Typically occurs on low- to medium-nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth.	All suitable habitat within the impact footprint was subjected to a targeted survey. The species was not detected on or near the subject land.	Absent (surveyed)
Chalinolobus dwyeri Large-eared Pied Bat	V	V	No	A small to medium-sized bat with long, prominent ears and glossy black fur. Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland to the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	The species is associated with PCT 445 and there are rock cuttings associated with the old quarry. The species could be present and utilise the site.	Assumed present
Homopholis belsonii Belson's Panic	V		Yes	Perennial tufted grass to 0.5 m high, with stems sparsely branched and an open panicle with solitary spikelets. Occurs on the northwest slopes and plains of NSW, mostly between Wee Waa, Goondiwindi and Glen Innes. It also occurs in Brigalow forests and temperate sub-humid woodlands in QLD, mainly in the Brigalow Belt South bioregion. Grows in dry woodland (e.g. *Belah* woodland) often on poor soils, although sometimes found in basalt-enriched sites north of Warialda and in alluvial clay soils. Habitat and ecology appear to be poorly known.	All suitable habitat within the impact footprint was subjected to a targeted survey. The species was not detected on or near the subject land.	Absent (surveyed)

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Jalmenus eubulus Pale Imperial Hairstreak	CE		No	A striking medium-sized butterfly, pale brown to white with black and iridescent markings. Occurs in central QLD and north NSW. In NSW it is found only in brigalow-dominated open forests and woodlands in northern areas of the state. Only known to breed in old-growth forest or woodland and does not appear to colonise regowth habitats following clearing or other major disturbance. Suitable habitat is dominated by brigalow (*Acacia harpophylla*) and Buloke (*Casuarina cristata*) on clay soils on flat to gently undulating plains, usually with scattered emergent eucalypts such as Poplar Box (*Eucalyptus populnea*) and low trees of Wilga (*Geijera parviflora*).	The site contains vegetation that is consistent with the required habitat for this species. The proposal has been modified to not affect woodland habitat. Areas proposed for the quarry are highly disturbed and degraded and lack trees of *Acacia harpophylla.*	Absent. The proposal has been modified to not affect woodland habitat.
Miniopterus orianae oceanensis Large Bent-winged Bat	V		No	Eastern Bentwing-bat occurs along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. This species has recently been renamed to *Miniopterus orianae oceanensis* or the large bent-winged bat, from *Miniopterus schreibersii subsp. oceanensis* or the eastern bent-wing bat.	The species is associated with PCT 445 and there are rock cuttings associated with the old quarry. The species could be present and utilise the site.	Assumed present
Ninox connivens Barking Owl	V		No	The Barking Owl is found throughout continental Australia except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina* species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance.	The subject land is within the species known distribution and the species could be present from time to time.	Assumed present

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Vespadelus troughtoni Eastern Cave Bat	V		No	A small chestnut-brown bat found both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	The species is associated with PCT 445 and there are rock cuttings associated with the old quarry. The species could be present and utilise the site.	Assumed present
Pteropus poliocephalus Grey-headed Flying-fox	V	V	No	Grey-headed Flying-fox are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. 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.	The proposal has been modified to not affect woodland habitat. There will be no suitable habitat or feed trees impacted.	Absent (habitat degraded/ absent)
Phascolarctos cinereus Koala	V	V	Yes	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	The subject land is within the species known. Five records exist locally at North Star between 2004 and 2019. However, the proposal has been modified to not affect woodland habitat.	Absent (habitat degraded/ absent)
Tyto novaehollandiae Masked Owl	V		No	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	The proposal has been modified to not affect woodland habitat. There will be no suitable habitat or hollow bearing trees impacted.	Assumed present

Additional threatened species previously recorded within 10km of the subject land (Bionet Wildlife Atlas records)

Species	NSW status	Comm status	Records within 10km	Description	Site assessment	Presence/ Absence
Hieraaetus morphnoides Little Eagle (foraging)	V		Yes	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing range escarpment. It occurs as a single population throughout NSW. The species occupies eucalyptus forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used. Breeding The species nests in tall living trees within a remnant patch. The species preys on birds, reptiles and mammals, occasionally large insects and carrion.	Not predicted for PCT 445 but has been recorded within 10km of the site. The proposal has been modified to not affect woodland habitat.	Potentially present
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	V		Yes	The Grey-crowned Babbler has two distinctive subspecies that intergrade to the south of the Gulf of Carpentaria. The eastern subspecies (temporalis occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. The species inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. The species feeds on invertebrates by foraging at the trunks of eucalyptus and other woodland trees or on the ground amongst litter and tussock grasses. Breeding Nests are built within the branches of shrubs or sapling eucalypts or in the outermost branches of large eucalypts.	Not predicted for PCT 445 but has been recorded within 10km of the site. The proposal has been modified to not affect woodland habitat.	Potentially present

Appendix F: MNES assessment

The EPBC Act protects nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as matters of national environmental significance. The EPBC Act policy *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE, 2013) forms the basis of determining if impact to protected matters is significant.

A Protected Matters Search identified three Wetlands, five Endangered Ecological Communities, 22 threatened species and 15 migratory species as potentially occurring within 10 km of the subject site.

The following tables give an overview of the assessments of these threatened entities and shows that the Proposed activity:

1. Is not likely to have a significant impact on a matter of national environmental significance. The matters of national environmental significance are:
    i. World heritage properties.
    ii. National heritage places.
    iii. Wetlands of international importance.
    iv. Threatened species and ecological communities.
    v. Migratory species.
    vi. Commonwealth marine areas.
    vii. The Great Barrier Reef Marine Park. And;
    viii. Nuclear actions (including uranium mines).
    ix. A water resource, in relation to coal seam gas development and large coal mining development.
2. Is not likely to have a significant impact on the environment in general (for actions by Commonwealth agencies or actions on Commonwealth land) or the environment on Commonwealth land (for actions outside Commonwealth land).

Notes:

Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:

a) is likely to be key source populations either for breeding or dispersal
b) is likely to be necessary for maintaining genetic diversity
c) is at or near the limit of the species range.

A ‘significant impact’ is an impact which is important, notable, or of consequence, having regard to its context or intensity (DoE, 2013).

Wetlands of International Importance	Proximity	Site assessment	Significance of Impact
Banrock Station Wetland complex	400 – 500 km	The subject land is not within close proximity of Banrock Station Wetland complex.	No impact
Riverland	400 – 500 km	The subject land is not within close proximity of Riverland.	No impact
The Coorong, and Lakes Alexandrina and Albert Wetland	500 – 600 km	The subject land is not within close proximity of The Coorong, and Lakes Alexandrina and Albert Wetland.	No impact

Threatened Ecological Community	Status	Assessment	Potential Impact
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Critically Endangered	The community does not occur on the subject land. Diagnostic trees *Eucalyptus coolabah* and *Eucalyptus largiflorens* are not present.	No impact
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	The community does not occur on the subject land. The site is not on alluvial plains.	No impact
Weeping Myall Woodlands	Endangered	The community does not occur on the subject land. *Acacia pendula* is not present.	No impact
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	The community does not occur on the subject land. No Yellow Box or Red Gum present.	No impact
Brigalow (*Acacia harpophylla* dominant and codominant)	Endangered	The listed ecological community is characterised by the presence of Brigalow (*Acacia harpophylla*) as one of the three most abundant tree species (Butler 2007), and either dominant or co-dominant with *Casuarina cristata* (Belah), other *Acacia*, or *Eucalyptus* species. Occasionally Belah, or species or *Acacia* or *Eucalyptus* may be more common than Brigalow within the broad matrix of Brigalow vegetation. The structure of the vegetation ranges from open forest to open woodland. The height of the tree layer varies from about 9 m in low rainfall areas (~ 500 mm per annum) to 25 m in higher rainfall areas (~ 750 mm per annum). A prominent shrub layer is usually present. Due to the absence of *Acacia harpophylla* on the subject site and the presence of >50% cover of non-native species, it is concluded that the vegetation on the subject site does not meet the	No areas of woodland that comprise a viable example of this TEC will be impacted. The proposal has been modified so as to not affect woodland areas. The area of the proposed quarry is highly disturbed and degraded and

		identification criteria for the TEC. Refer to comments against the diagnostic characteristics from the Conservation Advice for the TEC below.	lacks trees of *Acacia harpophylla*.

This Conservation Advice was approved by the Delegate of the Minister on 17 December 2013

1.7. Key diagnostic characteristics and condition thresholds

The national ecological community is limited to patches that meet the following key diagnostic characteristics and condition thresholds:

1.7.1. Step 1 Key diagnostic characteristics

A patch must include the following key diagnostic characteristics to be considered the Brigalow ecological community:

1) The presence of *Acacia harpophylla* as one of the most abundant tree species in the patch. *A. harpophylla* is either dominant in the tree layer, or co-dominant with other species (notably *Casuarina cristata*, other species of *Acacia*, or species of *Eucalyptus*).

Acacia harpohylla is present nearby but absent from the quarry site

AND

2a) In Queensland - the patch is in one of the following Qld bioregions (including outliers) **and** it meets the description of one of 16 Qld REs[2] determined at the time of the national listing of the Brigalow ecological community under the EPBC Act. The 16 REs are, as described by the Queensland Herbarium (2013):

In the **Qld Brigalow Belt Bioregion –** REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14 and 11.12.21;

In the **Qld Southeast Queensland Bioregion –** REs 12.8.23, 12.9-10.6 and 12.12.26; or,

In the **Qld Mulga Lands Bioregion –** RE 6.4.2.

OR

2b) In New South Wales - the patch meets one of the following NSW Vegetation Classification and Assessment (VCA) community descriptions. The NSW VCA communities are: VCA IDs 29, 31 and 35; as described in Benson et al. (2006)[3].

AND/OR

2c) The vegetation in the patch is brigalow regrowth with species composition and structural elements broadly typical of one of the identified Qld REs or NSW vegetation communities (although species density may be reduced). This can be assumed to be the case where it has been at least 15 years since it was last comprehensively cleared (not just thinned); unless direct evidence proves otherwise.

1.7.2. Step 2 Condition thresholds

A patch must meet the following condition thresholds to be considered the Brigalow ecological community:

3) The patch is 0.5 ha or more in size;

AND

4) Exotic perennial plants comprise less than 50% of the total vegetation cover of the patch, as assessed over a minimum sample area of 0.5 ha (100 m by 50 m), that is representative of the patch.

The vegetation on the proposed quarry site has some characteristic native species of the TEC, but is dominated by non-native species with cover >50%, including Salvia reflexa, Cenchrus ciliaris, Eragrostis cilianensis, Malvastrum americanum

[2] For complete descriptions of each RE refer to the Regional Ecosystem Description Database: http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/index.php

[3] At the time of listing, the Brigalow ecological community in NSW was described as including two NSW vegetation communities, the: Brigalow community of the northern floodplain; and, Brigalow outlier of the Mulga Lands bioregion. The NSW vegetation community classifications have since been updated.

Note: Species descriptions are sourced from DAWE (https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Anthochaera phrygia	Regent Honeyeater	CE	A striking black and yellow bird that has a patchy distribution between south-east Queensland and central Victoria. It primarily occurs in box-ironbark woodland, but also occurs in other forest types. The species primarily feeds on nectar and, to a lesser extent, insects and their exudates (lerps and honeydew). It mainly feeds on nectar from eucalypts and mistletoes and it prefers taller and larger diameter trees for foraging. **Low - Suitable habitat is not present on the subject land. Unlikely to occur.**	Unlikely, Negligible
Botaurus poiciloptilus	Australasian Bittern	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch. **Low - Associated with waterbodies and highly disturbed areas. No watercourses are within the subject land. Suitable habitat is not present on the subject land. Unlikely to occur.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Calidris ferruginea	Curlew Sandpiper	CE	In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia rather than migrating north. In NSW, they are widespread east of the Great Divide, especially in coastal regions. They are occasionally recorded in the Tablelands and are widespread in the Riverina and south-west NSW, with scattered records elsewhere. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters. **Low - No watercourses are within the subject land. Suitable habitat is not present on the subject land. Unlikely to occur.**	Unlikely, Negligible
Erythrotriorchis radiatus	Red Goshawk	V	Occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water. **Low - The inland location and absence of any nearby substantial waterbodies to encourage nesting means the subject land is not suitable habitat. Unlikely to occur.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Falco hypoleucos	Grey Falcon	V	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. 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. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid. **Low – absence of trees on the subject land reduce the suitability of this habitat for this species. Unlikely to occur**.	Unlikely, Negligible
Geophaps scripta scripta	Squatter Pidgeon (Southern)	V	Squatter Pigeon (southern) habitat is generally defined as open-forests to sparse, open-woodlands and scrub that are (Baldwin 1975; Beruldsen 1972; Cooper et al. 2014; EPA 2006; Frith 1982b; Leach 1988; North 1913-14; Squatter Pigeon Workshop 2011): - mostly dominated in the overstorey by *Eucalyptus, Corymbia, Acacia* or *Callitris* species - remnant, regrowth or partly modified vegetation communities, and - within 3 km of water bodies or courses. **Low – absence of trees on the subject land reduce the suitability of this habitat for this species. Unlikely to occur.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Grantiella picta	Painted Honeyeater	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. **Low – absence of trees and mistletoe on the subject land reduce the suitability of this habitat for this species. Unlikely to occur.**	Unlikely, Negligible
Polytelis swainsonii	Superb Parrot	V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Nest in small colonies, often with more than one nest in a single tree. Breed between September and January. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain. **Low – absence of trees on the subject land reduce the suitability of this habitat for this species. Unlikely to occur.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Rostratula australis	Australian Painted Snipe	E	The Australian Painted Snipe is restricted to Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. Breeding is often in response to local conditions; generally, occurs from September to December. Incubation and care of young is all undertaken by the male only. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter. **Low - The inland location and absence of any nearby substantial waterbodies means the subject land is not suitable habitat. Unlikely to occur.**	Unlikely, Negligible
Chalinolobus dwyeri	Large-eared Pied Bat	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies. **Moderate - The inland location and absence of any natural cliffs/rocky areas and forest means the subject site is low suitability habitat. The presence of the old mine excavations could be habitat. Low likelihood of occurrence.**	Potential. See EPBC Act test of significance (**Appendix G**)

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Dasyurus maculatus	Spot-tailed Quoll, (south-eastern mainland population)	E	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creek lines. **Low - The subject land is within the species known distribution however, the absence of trees and watercourses on the subject land reduce the suitability of this habitat for this species. Unlikely to occur.**	Unlikely, Negligible
Nyctophilus corbeni	Corben's Long-eared Bat, South-eastern Long-eared Bat	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, Bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. **Moderate –There is potential marginal foraging habitat for the species, which can utilize pastures and open woodlands. No records within 10km.**	Potential. See EPBC Act test of significance (**Appendix G**)

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Phascolarctos cinereus	Koala	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species (Martin & Handasyde 1999). Koala habitat can be broadly defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. The distribution of this habitat is largely influenced by land elevation, annual temperature and rainfall patterns, soil types and the resultant soil moisture availability and fertility. Preferred food and shelter trees are naturally abundant on fertile clay soils. Along the Great Dividing Range and the coastal belt throughout the species' range, Koalas inhabit moist forests and woodlands mostly dominated by Eucalyptus species. In coastal lowlands in Queensland and NSW, Koalas are also found in vegetation communities dominated by Melaleuca or Casuarina species (TSSC 2012p). On the western slopes, tablelands and plains in Queensland and NSW Koalas are found in sub-humid Eucalyptus-dominated forests and woodlands in riparian and non-riparian environments, and some Acacia-dominated forests and woodlands in non-riparian environments (Melzer et al. 2000). In the dry, subtropical to semi-arid environments in the western parts of the species' range, Koalas inhabit Eucalyptus-dominated forests and woodlands, particularly in the vicinity of riparian environments, and Acacia-dominated forests, woodlands and shrublands (Melzer et al. 2000; NSW DECC 2008; Sullivan et al. 2003a). Koalas are also known to occur in modified or regenerating native vegetation communities, as well as urban and rural landscapes where food trees or shelter trees may be highly scattered. There is a growing body of evidence that identifies the importance of shelter (non-food) trees to koalas. Crowther and colleagues (2013) expand on this and suggest that shelter trees are equally important as food trees and should be weighted as such when assessing habitat suitability. Shelter trees play an essential role in thermoregulation and are likely to be selected based on height, canopy cover and elevation (i.e. trees occurring in gullies are preferable) (Crowther et al. 2013). The difficulty in regards to shelter trees is that, unlike food trees, there is no identified sub-set of forest and woodland trees known to be shelter trees. The use of a particular tree species, or individual trees within a species is highly contextual and variable (Crowther et al. 2013). **Low – absence of trees on the subject land highly limits /negates the suitability of this habitat for this species. Unlikely to occur.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Cadellia pentastylis	Ooline	V	A medium-sized spreading tree usually about 10 m tall, and rarely to 25 m. Has glossy green leaves and single white flowers that produce a cluster of brown berries in clusters Occurs along the western edge of the North West Slopes from north of Gunnedah to west of Tenterfield. Also occurs in Queensland. General flowering period is October to January. Forms a closed or open canopy mixing with eucalypt and cypress pine species. Typically occurs on low- to medium-nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth. **Absent – Targeted surveys were conducted to determine whether this species occurs within or near the subject land. These surveys did not detect this species.**	No impact.
Dichanthium setosum	Bluegrass	V	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched. **Moderate – the subject land is on a basalt hill, with dark brown to red basalt soil. The species was not observed on the site, however the site was not traversed by targeted flora searches. No records of the species exist in the local area, the nearest being south at Warialda. The site is highly degraded and the species occurrence is possible but unlikely.**	Potential. See EPBC Act test of significance (**Appendix G**)
Homopholis belsonii	Belson's Panic	V	Perennial tufted grass to 0.5 m high, with stems sparsely branched and an open panicle with solitary spikelets. Occurs on the northwest slopes and plains of NSW, mostly between Wee Waa, Goondiwindi and Glen Innes. It also occurs in Brigalow forests and temperate sub-humid woodlands in QLD, mainly in the Brigalow Belt South bioregion. Grows in dry woodland (e.g. *Belah* woodland) often on poor soils, although sometimes found in basalt-enriched sites north of Warialda and in alluvial clay soils. Habitat and ecology appear to be poorly known. **Absent – A targeted survey determined that this species does not occur within the impact footprint.**	No impact.

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Lepidium monoplocoides	Winged Pepper-cress	E	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, with large numbers of historical records but few recent collections. There is a single collection from Broken Hill and only two collections since 1915, the most recent being 1950. Also previously recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin. Recorded more recently from the Hay Plain, south-eastern Riverina, and from near Pooncarie. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising *Eragrostis australasicus, Agrostis avenacea, Austrodanthonia duttoniana, Homopholis proluta, Myriophyllum crispatum, Utricularia dichotoma* and *Pycnosorus globosus*, on waterlogged grey-brown clay. Also recorded from a Maireana pyramidata shrubland. **Low – The species is not associated with any PCT recorded at the site. The subject land is not within the known range of the species nor associated with habitat at the site.**	Unlikely, Negligible
Tylophora linearis		E	Majority of linearis records occur in the central western region. Records from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie NR, Goobang NP and Beni SCA. Also has been recorded Hiawatha State Forest near West Wyalong in the south and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla and Allocasuarina luehmannii. Also grows in association with Acacia hakeoides, Acacia lineata, Melaleuca uncinata, Myoporum species and Casuarina species. **Low – The subject land is not associated with any PCT recorded at the site. The site is not within the known range of the species nor associated with habitat at the site.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Anomalopus mackayi	Five-clawed Worm-skink	V	The Five-clawed Worm-skink is found in the North West Slopes and Plains of north-east NSW and south-east Queensland, from the Ashford area west to Mungindi and Walgett in NSW and north to Dalby in Queensland. Occurs close to or on the lower slopes of slight rises in grassy White Box woodland on moist black soils, and River Red Gum-Coolibah-Bimble Box woodland on deep cracking loose clay soils. May also occur in grassland areas and open paddocks with scattered trees. **Moderate – the subject land is on a basalt hill, with dark brown to red basalt soil. The subject land is within the known distribution for the species. No records of the species exist within 10 km.**	Potential. See EPBC Act test of significance (**Appendix G**).
Apus pacificus	Fork-tailed Swift	Migratory	The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In NSW, the Fork-tailed Swift is recorded in all regions. Many records occur east of the Great Divide, however, a few populations have been found west of the Great Divide. These are widespread but scattered further west of the line joining Bourke and Dareton. Sightings have been recorded at Milparinka, the Bulloo River and Thurloo Downs. The Fork-tailed Swift is almost exclusively aerial, flying from less then 1 m to at least 300 m above ground and probably much higher. **Low – the species is almost exclusively aerial and does not breed in Australia.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Arenaria interpres	Ruddy Turnstone	Migratory	The Ruddy Turnstone is widespread within Australia during its non-breeding period of the year (Bamford et al. 2008), including from Tasmania in the south to Darwin in the north and many coastal areas in between. It is found in most coastal regions, with occasional records of inland populations (Higgins & Davies 1996). It strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed (C.D.T. Minton 2002, pers. comm.). In Australasia, the Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats. Surveys demonstrate that the Ruddy Turnstone can live away from coastal areas in habitats such river beds, and on inland lakes and adjacent farmland (Higgins & Davies 1996). **Low – the species is associated with coastal habitat, however is occasionally found occupying inland wetlands. No such wetlands exist within the subject land.**	Unlikely, Negligible
Myiagra cyanoleuca	Satin Flycatcher	Migratory	The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand (Blakers et al. 1984; Coates 1990a). In Queensland, it is widespread but scattered in the east, being recorded on passage on a few islands in the western Torres Strait. It is patchily recorded on Cape York Peninsula, from the Cape south to a line between Aurukun and Coen. The species is more widespread farther south, though still scattered, from Musgrave Station south to c. 24° S, mostly in coastal areas, but also on the Great Divide, and occasionally further west (Blakers et al. 1984). Satin Flycatchers are widespread in south-eastern Queensland, in the area from Fraser Island, west to Goombi and south to the NSW border. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. **Moderate – The species is not associated with any PCT recorded at the site, records of this species exist within 10km of the subject site. The species is associated with habitat at the site.**	Potential. See EPBC Act test of significance (**Appendix G**).

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Actitis hypoleucos	Common Sandpiper	Migratory	The Common Sandpiper mainly breeds in parts of Europe and Asia, and occasionally Africa. The population which migrates to Australia breeds in Russia, therefore only potential foraging habitat occurs within Australia. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks. **Low – the species is associated with coastal habitat, however is occasionally found occupying inland wetlands. No such wetlands exist within the subject land.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Calidris acuminata	Sharp-tailed Sandpiper	Migratory	The Sharp-tailed Sandpiper is a summer migrant from Arctic Siberia, being found on wetlands throughout Australia. It is also found in Indonesia, Papua New Guinea, the Solomon Islands, New Caledonia and New Zealand. It is a vagrant to India, Europe, western North America, Fiji and other parts of the central Pacific region. The species predominant threats are global habitat loss, reduction of water quality, disturbance, climate change and hunting practises. Within Australia the species is impacted by habitat loss and degradation. The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage, taking advantage of Australia's boom-and-bust ecology (BirdLife Australia). The Sharp-tailed Sandpiper prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewage farms, flooded fields, mudflats, mangroves, rocky shores and beaches. They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. They also forage among inundated vegetation of saltmarsh, grass or sedges. They forage in sewage ponds, and often in hypersaline environments. After rain, they may forage in paddocks of short grass, well away from water. **Low – the species is associated with coastal habitat, however is occasionally found occupying inland wetlands and flooded fields. The Barren Box Swamp is listed as predicted habitat for the species, 12km from subject land. The subject land does not have suitable aquatic habitat.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Calidris ferruginea	Curlew Sandpiper	CE Migratory	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. Generally, the species occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. **Low – The subject land does not contain any bodies of water and is outside predicted range. The Barren Box Swamp, partially within the 10km search area is within the species predicted range, however there are no records there.**	Unlikely, Negligible
Calidris melanotos	Pectoral Sandpiper	Migratory	The Pectoral Sandpiper breeds in northern Russia and North America. Within Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands. **Low – the species is associated with coastal habitat, however is occasionally found occupying inland wetlands. No records within 10 km. No such wetlands exist within the subject land.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Calidris tenuirostris	Great Knot	CE Migratory	In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps (Higgins & Davies 1996). Typically, the Great Knot roosts in large groups in open areas, often at the waters edge or in shallow water close to feeding grounds (Higgins & Davies 1996; Rogers 2001). It is known that in hot conditions, waders prefer to roost where a damp substrate lowers the local temperature (Rogers 1999b). A group of approximately 8610 birds have been recorded roosting at an inland claypan near Roebuck Bay in north-west Western Australia (Collins et al. 2001). **Low – The subject land does not contain any bodies of water and is outside predicted range. The Barren Box Swamp, partially within the 10km search area is within the species predicted range, however there are no records there.**	Unlikely, Negligible
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Migratory	Latham's Snipe breed in Japan and far eastern Russia during the northern hemisphere summer. They migrate south after the breeding season, travelling across Papua New Guinea to winter in eastern Australia. They're range extends throughout Queensland and west of the Great Dividing Range in NSW and Tasmania. Within Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's Snipe does not breed within Australian jurisdiction. The breeding range is confined to Japan and far eastern Russia. **Low – the species is associated with coastal habitat, however is occasionally found occupying inland wetlands and disturbed areas.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Limosa lapponica baueri	Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	Migratory	The bar-tailed godwit has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria. In Tasmania, the bar-tailed godwit has mostly been recorded on the south-east coast. In South Australia it has mostly been recorded around coasts from Lake Alexandrina to Denial Bay. In Western Australia it is widespread around the coast, from Eyre to Derby. Populations have also been recorded in the northern Australia, from Darwin east to the Gulf of Carpentaria. The bar-tailed godwit is a regular migrant to Christmas Island, Norfolk Island, Lord Howe Island. It has also been recorded on subantarctic islands such as Macquarie Island, Snares Islands, Auckland Islands and Campbell Islands (Higgins & Davies 1996). During the non-breeding period, the distribution of bar-tailed godwit (western Alaskan) is predominately New Zealand, northern and eastern Australia (Bamford et al. 2008). In Australia, *L. l. baueri* mainly occur along the north and east coasts (Garnett et al. 2011). **Low – The subject land does not contain any bodies of water and is outside predicted range. The Barren Box Swamp, partially within the 10km search area is within the species predicted range, however there are no records there.**	Unlikely, Negligible
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Migratory	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern Curlews are rarely recorded inland. In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. The Eastern Curlew breeds in Russia and north-eastern China but its distribution is poorly known. During the non-breeding season a few birds occur in southern Korea and China, but most spend the non-breeding season in north, east and south-east Australia. The birds may delay breeding until three to four years of age. Within Australia, immature birds, which do not migrate, move northward in winter. **Low - The subject land is outside of the species known range. There are no records within 10 km of the subject land. The species is not associated with the PCTs present.**	Unlikely, Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Pandion haliaetus	Osprey	CE Migratory	The breeding range of the Eastern Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in NSW; with a second isolated breeding population on the coast of South Australia, extending from Head of Bight east to Cape Spencer and Kangaroo Island (Abbott 1982; Barrett et al. 2003; Bischoff 2001; Blakers et al. 1984; Clancy 1991; Condon 1969; Dennis 2007a; Johnstone & Storr 1998; Marchant & Higgins 1993). The total range (breeding plus non-breeding) around the northern coast is more widespread, extending from Esperance in Western Australia to NSW, where records become scarcer towards the south, and into Victoria and Tasmania, where the species is a rare vagrant (Barrett et al. 2003; Blakers et al. 1984; Johnstone & Storr 1998; Marchant & Higgins 1993; Morris et al. 1981). The distribution of the species around the northern coast (south-western Western Australia to south-eastern NSW) appears continuous except for a possible gap at Eighty Mile Beach (Barrett et al. 2003; Blakers et al. 1984). There are no published estimates of the extent of occurrence of the Eastern Osprey within Australia. The area of occupancy of the Eastern Osprey in Australia is estimated at 117 400 km². The range of the species has contracted in south-eastern Australia since settlement (Olsen 1995; White 1985). There is a single historical breeding report from Saint Georges Basin in NSW (North 1912). Historical reports suggest that Eastern Ospreys were probably once uncommon in Tasmania from Bass Strait south to Recherche Bay (Gould 1865; Hall 1924; Le Souëf 1902; Littler 1910a; North 1912); and in South Australia, pairs formerly bred along the eastern coast of Spencer Gulf and along the lower Murray River (Dennis 2007a). **Low – The species is commonly associated with inland waterways and has a large and widespread population around the inland waterways. The subject land is not close to any rivers.**	Unlikely , Negligible
Tringa nebularia	Common Greenshank	Migratory	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (Higgins & Davies 1996). The species has been recorded in most coastal regions. It is widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions (Higgins & Davies 1996). **Low –The species is commonly associated with inland waterways and has a large and widespread population. The subject land does not contain any bodies of water. Record 23 km to the south-east.**	Unlikely , Negligible

Threatened species	Common Name	Commonwealth Status	Description and habitat suitability at the site	Potential Impact
Tringa stagnatilis	Marsh Sandpiper	Migratory	It is recorded in all regions of NSW but especially the central and south coasts and (inland) on the western slopes of Great Divide and western plains. In Victoria, most are found in Port Phillip Bay, but also Gippsland, Westernport Bay and the Western Districts. Inland records exist for Murray Valley, round Barmah, Kerang-Swan Hill and Mildura; also some from around Shepparton, west to Rupanyup and Hindmarsh and Albacutya Lakes. The species is a vagrant to Tasmania. In South Australia, most records are east of 137° E. Occasionally the species has been recorded in the south-east, mostly from The Coorong to Yorke Peninsula, including inland along Murray Valley. **Low – The species is commonly associated with inland waterways and has a large and widespread population around the inland waterways. . The subject land does not contain any bodies of water.**	Unlikely , Negligible
Motacilla flava	Yellow Wagtail		Minimal ecological information is available regarding the species. The species utilises continental Europe and Asia as residence and breeding and is a non-breeding visitor to Africa, using parts of northern Africa as passage between these areas. It is considered migratory to Australia with minimal information available as to its use of the continent. **Low – Little is known about this species; however it does not breed in Australia and is only known from coastal habitat, therefore is unlikely to occur on the subject land.**	Unlikely , Negligible

Appendix G: EPBC Act Test of significance

EPBC Act-listed Vulnerable Entities

Bluegrass (*Dichanthium setosum*)	
Significant Impact Guideline	**Assessment**
Lead to a long-term decrease in the size of an important population of a species	**No.** As the species was not detected during the field survey, and as no prior records of the species with the subject land are known, it is unlikely that any important population occurs within the subject site. Consequently, the loss of up to 2.03 ha of highly modified potential habitat for this species is unlikely to impact an important population.
Reduce the area of occupancy of an important population	**No.** It is unlikely that an important population is present within the subject land. For this reason, the loss of up to 2.03 ha of potential habitat for this species is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**No.** It is unlikely that an important population occurs within the subject land. Any fragmentation that results from this proposal will therefore not impact an important population.
Adversely affect habitat critical to the survival of a species	**No.** The subject land is unlikely to constitute critical habitat for this species as the species is not known from the site.
Disrupt the breeding cycle of an important population	**No.** It is unlikely that an important population occurs within the subject land. Impacts on the breeding cycle of any local occurrence of this species would not impact an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** As the species is not known from the subject land, it is unlikely that the loss of potential habitat will significantly impact it such that it is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Potential.** Construction activities can introduce biosecurity threats. Mitigation measures to prevent this are given in **Section 5**.

Bluegrass (*Dichanthium setosum*)	
Introduce disease that may cause the species to decline	**Potential.** Construction activities can introduce biosecurity threats. Mitigation measures to prevent this are given in **Section 5**.
Interfere with the recovery of the species.	**No.** As there is no known population within the subject land, the proposal is unlikely to interfere with the recovery of the species.
Conclusion	**No significant impact.** This assumes that mitigation measures are followed.

Large-eared Pied Bat (*Chalinolobus dwyeri*)	
Significant Impact Guideline	**Assessment**
Lead to a long-term decrease in the size of an important population of a species	**No.** The subject land has not been identified as containing an important population of this species. The subject land is not close to the edge of the species' range. The species prefers wooded areas and the subject land has been historically cleared. As only 2.03 ha of modified habitat will be impacted, it is unlikely that this proposal will lead to a long-term decrease in the size of any important population, should one be present.
Reduce the area of occupancy of an important population	**No.** The subject land has not been identified as containing an important population of this species. The species prefers woodland and the subject land has been historically cleared. As only 2.03 ha of modified habitat will be impacted, it is unlikely that this proposal will lead to a long-term decrease in the size of any important population, should one be present.
Fragment an existing important population into two or more populations	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. The subject land is not part of a large patch of native vegetation, as such, the proposal should not result in fragmentation of any important population, should one be present.
Adversely affect habitat critical to the survival of a species	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. The subject site is unlikely to constitute critical habitat for this species.
Disrupt the breeding cycle of an important population	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. Impacts to the breeding cycle of this species are likely to be minor or non-existent as the species would likely not be breeding in the rock quarry.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** Owing to the small area of impact, the absence of trees and limited native vegetation in the subject site, the proposal is unlikely to cause this species to decline.

Large-eared Pied Bat (*Chalinolobus dwyeri*)	
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Potential.** Construction activities can introduce or encourage the establishment of invasive species. Mitigation measures to prevent this are given in **Section 5**.
Introduce disease that may cause the species to decline	**Potential.** Construction activities can introduce biosecurity threats. Mitigation measures to prevent this are given in **Section 5**.
Interfere with the recovery of the species.	**No.** As there is no known important population within the subject land, and the impact area is only a small area of modified habitat, the proposal is unlikely to interfere with the recovery of the species.
Conclusion	**No significant impact.** This assumes that mitigation measures are followed.

Corben's Long-eared Bat (*Nyctophilus corbeni*)	
Significant Impact Guideline	**Assessment**
Lead to a long-term decrease in the size of an important population of a species	**No.** The subject land has not been identified as containing an important population of this species. Whilst the subject land is within the eastern edge of the species' range, it is not at the range limit. This species occurs sparsely in mallee, Bulloke, box and Brigalow/Belah communities but is more common in box/ironbark/cypress pine woodland. The subject land has been historically cleared. As only 2.03 ha of modified habitat will be impacted, it is unlikely that this proposal will lead to a long-term decrease in the size of any important population, should one be present.
Reduce the area of occupancy of an important population	**No.** The subject land has not been identified as containing an important population of this species. The species prefers woodland and the subject land has been historically cleared. As only 2.03 ha of modified habitat will be impacted, it is unlikely that this proposal will lead to a long-term decrease in the size of any important population, should one be present.
Fragment an existing important population into two or more populations	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. The subject land is not part of a large patch of native vegetation, as such, the proposal should not result in fragmentation of any important population, should one be present.
Adversely affect habitat critical to the survival of a species	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. The subject site is unlikely to constitute critical habitat for this species.
Disrupt the breeding cycle of an important population	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. Impacts to the breeding cycle of this species are likely to be minor or non-existent as the species would not be breeding in the rock quarry. Nearby dead trees may be utilized as maternity roosts but the species has been reported to use roosts for a single night and move on, so the proposal should not impact on breeding.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** Owing to the small area of impact, the absence of trees and limited native vegetation in the subject site, the proposal is unlikely to cause this species to decline.

Corben's Long-eared Bat (*Nyctophilus corbeni*)	
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Potential.** Construction activities can introduce or encourage the establishment of invasive species. Mitigation measures to prevent this are given in **Section 5**.
Introduce disease that may cause the species to decline	**Potential.** Construction activities can introduce biosecurity threats. Mitigation measures to prevent this are given in **Section 5**.
Interfere with the recovery of the species.	**No.** As there is no known important population within the subject land, and the impact area is only a small area of modified habitat, the proposal is unlikely to interfere with the recovery of the species.
Conclusion	**No significant impact.** This assumes that mitigation measures are followed.

Five-clawed Worm-skink (*Anomalopus mackayi*)	
Significant Impact Guideline	**Assessment**
Lead to a long-term decrease in the size of an important population of a species	**No.** The subject land has not been identified as containing an important population of this species. Whilst the subject land is close to the south-eastern most distribution of the species' range, it is not at the range limit. This species prefers woodland but also occurs in cropped lands on black soil. The subject land has been historically cleared and the majority of this proposal will focus on extracting rock, rather than disturbing black soil. As only 2.03 ha of modified habitat will be impacted, it is unlikely that this proposal will lead to a long-term decrease in the size of any important population, should one be present.
Reduce the area of occupancy of an important population	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. As only 2.03 ha of modified habitat will be impacted, it is unlikely that this proposal will lead to a long-term decrease in the size of any important population, should one be present.
Fragment an existing important population into two or more populations	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. The subject land is not part of a large patch of native vegetation, as such, the proposal should not result in fragmentation of any important population, should one be present.
Adversely affect habitat critical to the survival of a species	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. The subject site is unlikely to constitute critical habitat for this species.
Disrupt the breeding cycle of an important population	**No.** The subject land has not been identified as containing an important population of this species. This species prefers woodland, and the subject land has been historically cleared. Impacts to the breeding cycle of this species are likely to be minor as the burrowing species would not be breeding in the rock quarry.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** Owing to the small area of impact, and the rocky substrate, the proposal is unlikely to cause this species to decline.

Five-clawed Worm-skink (*Anomalopus mackayi*)	
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Potential.** Construction activities can introduce or encourage the establishment of invasive species. Mitigation measures to prevent this are given in **Section 5**.
Introduce disease that may cause the species to decline	**Potential.** Although there are no specific diseases of concern known for this species, construction activities can introduce biosecurity threats. Mitigation measures to prevent this are given in **Section 5**.
Interfere with the recovery of the species.	**No.** As there is no known important population within the subject land, and the impact area is only a small area of modified habitat, the proposal is unlikely to interfere with the recovery of the species.
Conclusion	**No significant impact.** This assumes that mitigation measures are followed.

EPBC Act-listed Migratory Species

Satin Flycatcher (*Myiagra cyanoleuca*)	
Significant Impact Guideline	**Assessment**
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The subject land is unlikely to constitute important habitat for this migratory species. As the species is widely distributed, and the subject land is heavily modified, no significant impact of the proposal on this species is anticipated.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No.** It is unlikely that an area of important habitat occurs within the subject land. Construction activities can introduce invasive species. Mitigation measures to prevent this are given in **Section 5**.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**No.** It is unlikely that an ecologically significant proportion of the population of this species occurs within the subject land. As the species is widely distributed, and the subject land is small and heavily modified, it is unlikely that the subject land is important for breeding, feeding, migrating, or resting. No significant impact of the proposal on this species is anticipated.
Conclusion	**No significant impact.**

Appendix H: Terms and abbreviations

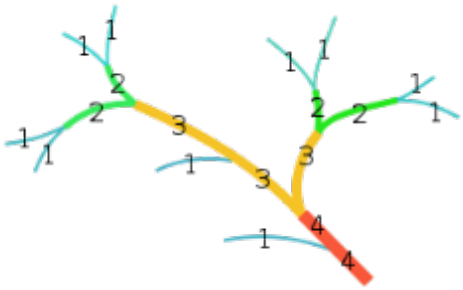
Terms and abbreviations used in this report

Abbreviation	Terminology	Description
BC Act	Biodiversity Conservation Act 2016 (NSW)	The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. This Act contains schedules relating to the listing of threatened species, populations and communities in NSW. It also outlines the framework regulating development impact assessments in relation to biodiversity.
	Biosecurity Act 2015 (NSW)	The broad objectives for biosecurity in NSW are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by • Preventing their entry into NSW • Quickly finding, containing and eradicating any new entries • Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements. The *Biosecurity Act 2015* provides a statutory framework to help achieve these objectives.
CAMBA	China-Australia Migratory Bird Agreement	A bilateral migratory bird agreement with China entered into in 1986. It provides an important mechanism for pursuing conservation outcomes for migratory birds, including migratory waterbirds.
	Cumulative impacts	Impacts, when considered together, lead to a stronger impact than any impact in isolation.
	Direct impacts	Directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.
DoEE	Australian Government Department of Environment and Energy	The Department of the Environment designs and implements the Australian Government's policies and programmes to protect and conserve the environment, water and heritage and promote climate action.
DP	Deposited Plan	A plan of land deposited in Land and Property Information (part of the Land Management Authority) and used for legal identification purposes. They most commonly depict a subdivision of a parcel of land.
EEC	Endangered Ecological Community	An ecological community identified by relevant legislation likely to become extinct or is in immediate danger of extinction.
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW).	Provides the legislative framework for land use planning and development assessment in NSW.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999	Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.

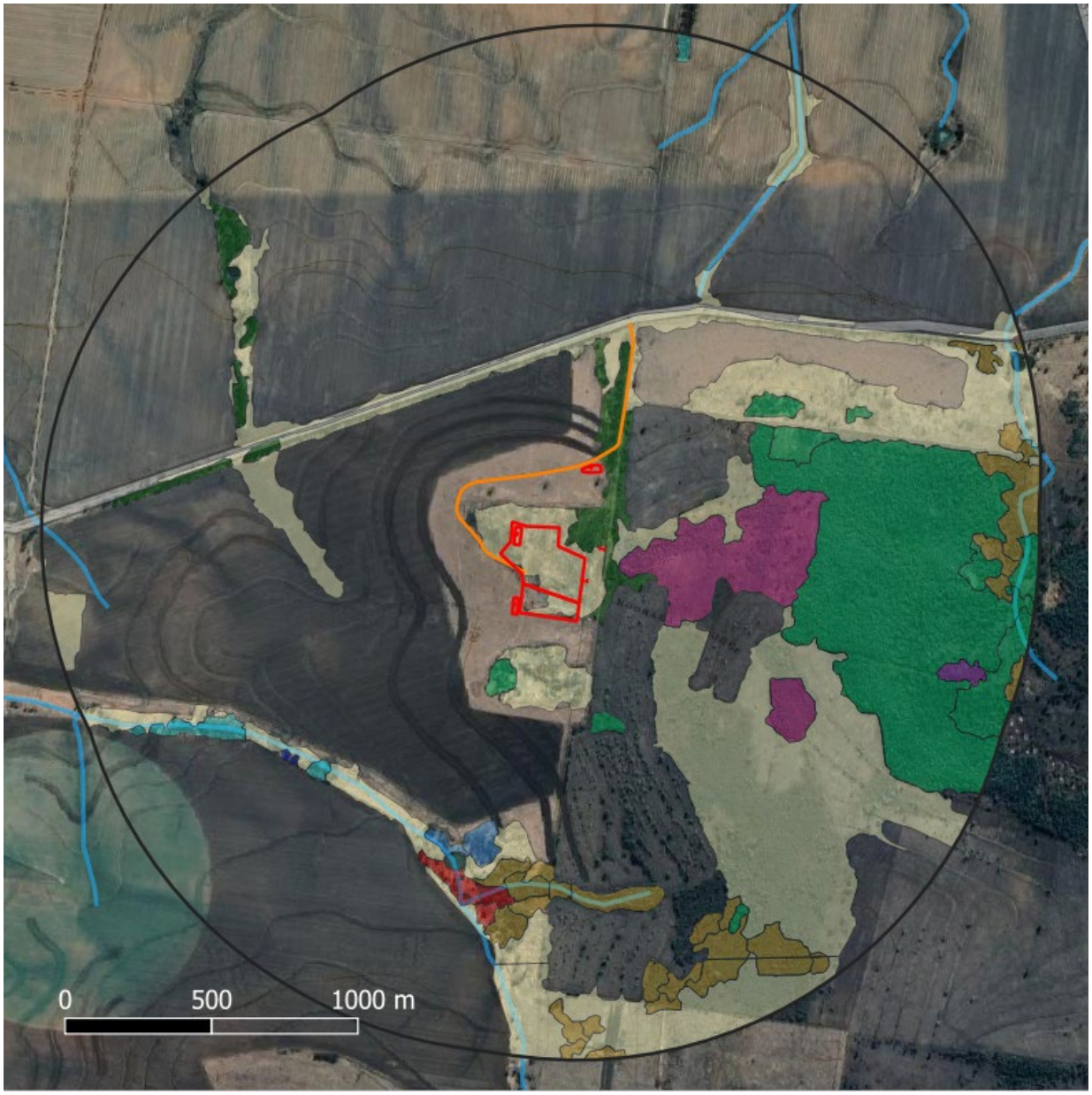
	(Commonwealth).	
FM Act	Fisheries Management Act 1994 (NSW)	The objects of this Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. This Act protects aquatic habitats and species which are not protected under the BC Act.
IBRA	Interim Biogeographic Regionalisation of Australia	The Interim Biogeographic Regionalisation for Australia (IBRA) is a biogeographic regionalisation of Australia developed by the Australian Government's Department of the Environment. Each region is a land area made up of a group of interacting ecosystems repeated in similar form across the landscape.
	Indirect impacts	Occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.
JAMBA	Japan-Australia Migratory Bird Agreement	A bilateral migratory bird agreement with Japan entered into in 1974. It provides an important mechanism for pursuing conservation outcomes for migratory birds, including migratory waterbirds.
KTP	Key Threatening Process	A key threatening process is defined as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. A requirement of their listing on the TSC Act is that the process adversely affects two or more threatened species, populations or ecological communities, or may cause species, populations or ecological communities not threatened to become threatened.
	Local population (species)	A local population of a threatened plant species comprises those individuals occurring in a defined area or a cluster of individuals extend into habitat adjoining and contiguous with the study area where the individuals could reasonably be expected to cross-pollinate. A local population of fauna species comprises those individuals known or likely to occur in in a defined area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area. The local population of migratory or nomadic fauna species comprises those individuals likely to occur in the study area from time to time.
	Local occurrence (EEC)	The ecological community present within the study area. However, the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of the ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.

	Low condition (vegetation)	Vegetation in low condition means: a) woody native vegetation with native over-storey percent foliage cover less than 50% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and where either: – less than 50% of ground cover vegetation is indigenous species, or – greater than 90% of ground cover vegetation is cleared OR b) native grassland, wetland or herbfield where either: – less than 50% of ground cover vegetation is indigenous species, or – more than 90% of ground cover vegetation is cleared If native vegetation is not in low condition, it is in moderate to good condition. The percentages for the ground cover calculations must be made in a season when the proportion of native ground cover vegetation compared to non-native ground cover vegetation in the area is likely to be at its maximum. NOTE: Clearing the habitat of threatened species, populations or communities for the purposes of reducing its condition prior to assessment under the methodology may be a breach of environmental legislation, including sections 118A and 118D of the *National Parks and Wildlife Act 1974* (NPW Act), the *Native Vegetation Act 2003* (NV Act) and/or the *Environmental Planning and Assessment Act 1979* (EP&A Act).
MNES	Matters of national environmental significance	Refers to the seven matters of national environmental significance outlined under the EPBC Act.
NPW Act	National Parks and Wildlife Act 1974 (NSW)	The objects of this Act are as follows: • The conservation of nature, including, but not limited to, the conservation of: • habitat, ecosystems and ecosystem processes, and • biological diversity at the community, species and genetic levels, and • landforms of significance, including geological features and processes, and • landscapes and natural features of significance including wilderness and wild rivers, The conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to: • places, objects and features of significance to Aboriginal people, and • places of social value to the people of New South Wales, and • places of historic, architectural or scientific significance, • Fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation, • Providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation. The objects of this Act are to be achieved by applying the principles of ecologically sustainable development.
OEH	Office of Environment and Heritage	The Office of Environment and Heritage (OEH) is a separate agency within the Planning and Environment cluster. OEH was formed on 4 April 2011 and works to protect and conserve the NSW environment, including the natural environment, Aboriginal country, culture and heritage and our built heritage, and manages NSW national parks and reserves.
PoEO Act	Protection of the Environment Operations Act 1997	The objects of this Act are as follows: • to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development, • to provide increased opportunities for public involvement and participation in environment protection, • to ensure the community has access to relevant and meaningful information about pollution,

		• to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms promoting: • pollution prevention and cleaner production, • the reduction to harmless levels of the discharge of substances likely to cause harm to the environment, • the elimination of harmful wastes, • the reduction in the use of materials and the re-use, recovery or recycling of materials, • the making of progressive environmental improvements, including the reduction of pollution at source, • the monitoring and reporting of environmental quality on a regular basis, • to rationalise, simplify and strengthen the regulatory framework for environment protection, • to improve the efficiency of administration of the environment protection legislation, • to assist in the achievement of the objectives of the *Waste Avoidance and Resource Recovery Act 2001*.
RAMSAR	Convention on Wetlands of International Importance	The Ramsar Convention's broad aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those remaining. This requires international cooperation, policy making, capacity building and technology transfer.
	Risk of extinction	The likelihood that the local population will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population.
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement	A bilateral migratory bird agreement with the Republic of Korea entered into in 2007. It provides an important mechanism for pursuing conservation outcomes for migratory birds, including migratory waterbirds.
RF Act	Rural Fires Act 1997	The objects of this Act are to provide: • for the prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts, and • for the co-ordination of bush firefighting and bush fire prevention throughout the State, and • for the protection of persons from injury or death, and property from damage, arising from fires, and • for the protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires, and • for the protection of the environment by requiring certain activities referred to in paragraphs (a)-(c1) to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the *Protection of the Environment Administration Act 1991*.
SEPP 44	State Environmental Planning Policy No.44 – Koala Habitat	This Policy aims to encourage the proper conservation and management of areas of natural vegetation with habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline: • by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and • by encouraging the identification of areas of core koala habitat, and • by encouraging the inclusion of areas of core koala habitat in environment protection zones.
Significant impact		A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity.
SIS	Species Impact Statement	A document included with an Environmental Impact Statement which details a full description of the action proposed, including its nature, extent, location, timing and layout and, to the fullest extent reasonably practicable, the information referred to in this section. The requirements as to the contents of an SIS for different categories of protected species are given in section 110 of the TSC

	Act.
Strahler stream order	Strahler stream order and are used to define stream size based on a hierarchy of tributaries. 

Appendix I: State Vegetation Type Map: Border Rivers Gwydir / Namoi Regional Native Vegetation Mapping



BRG_NamoiSVM_clipto1500m

- Belah - Wilga +/- White Box dry viney scrub woodland the NSW Brigalow Belt South Bioregion
- Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions
- Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion
- Candidate Native Grasslands
- Carbeen - White Box +/- Silver-leaved Ironbark grassy tall woodland on basalt hills, Brigalow Belt South Bioregion
- Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion
- Not Native
- Silver-leaved Ironbark - White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion
- Western Rosewood - Wilga - Wild Orange - Belah low woodland of the Brigalow Belt South Bioregion and eastern Darling Riverine Plains Bioregion
- White Box - cypress pine - Silver-leaved Ironbark shrub grass open forest / woodland of the northern Brigalow Belt South Bioregion and Nandewar Bioregion
- White Cypress Pine - Silver-leaved Ironbark - Wilga shrub grass woodland of the Narrabri-Yetman region, Brigalow Belt South Bioregion

Appendix J: EPBC Act referral guidelines for Koala

Site assessment as per Table 4 from the EPBC Act referral guidelines for the vulnerable Koala

Table 4: Koala habitat assessment tool

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.	

Koala occurrence: There are five records for Koala within 10 km of the subject land, from 2006 to 2019; all of the records have minimal location notes, so it is not possible to determine exactly where the records were made beyond 'Suburb only, North Star'.

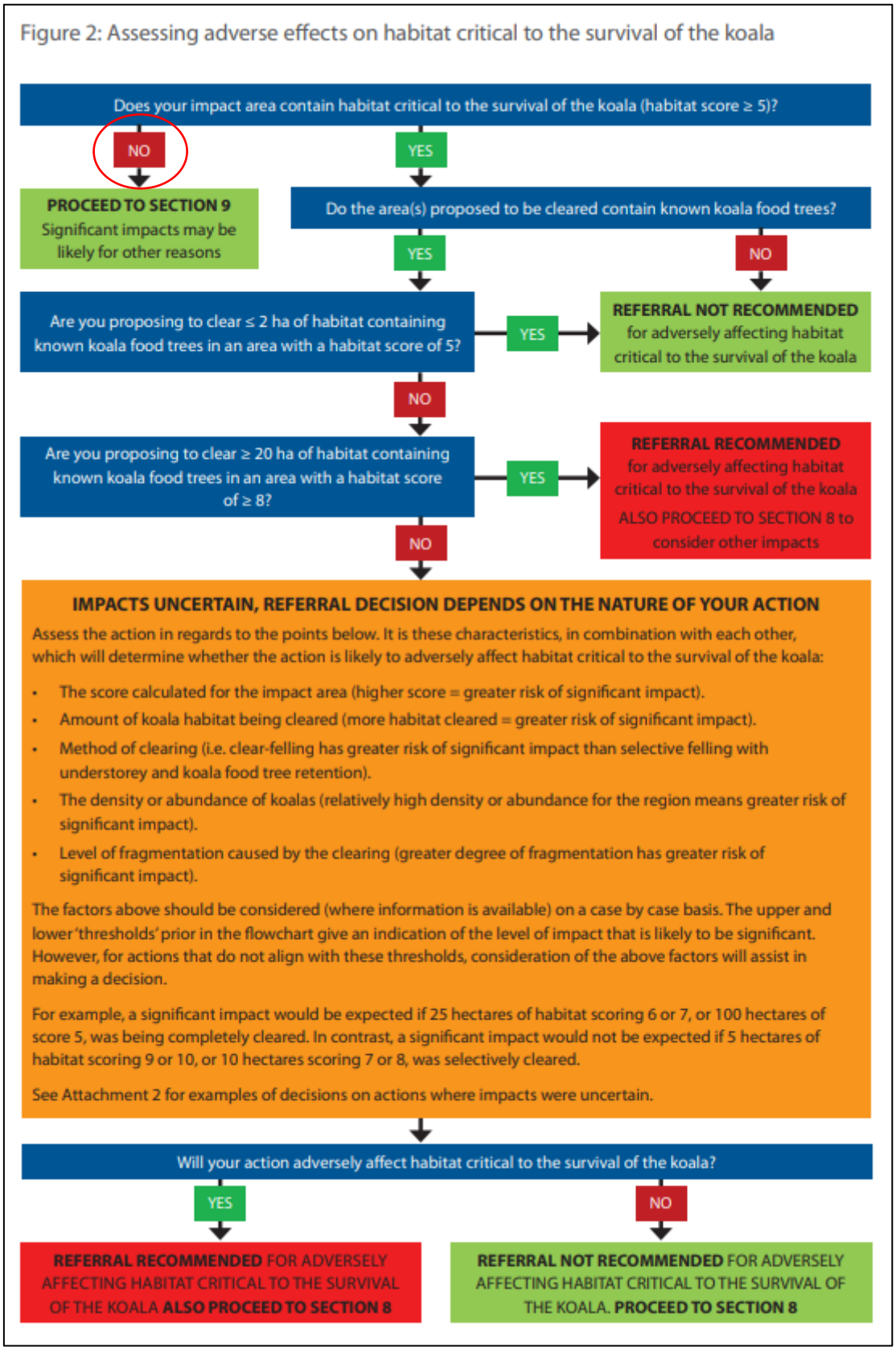
Vegetation composition: Some food tree species present within the subject land or nearby: *Eucalyptus melanophloia* is present within the subject land, *Eucalyptus populnea* is present adjacent the subject land.

Habitat connectivity: Vegetation within the subject land is fragmented and not connected to any large patches.

Key existing threats: There is likely to be some risk of vehicle strike and dog attack, though only minor.

Total score: 1. The subject land does not qualify as critical koala habitat (score < 5).

Site assessment as per Figure 2 from the EPBC Act referral guidelines for the vulnerable Koala



As per section 9 of the referral guidelines, the project was not found to adversely affect the habitat critical to the survival of the koala (**see above**), nor was the project found to interfere

substantially with the recovery of the koala through the introduction or exacerbation of key threats in areas of habitat critical to the survival of the koala.

The project will not increase the risks of dog attack as it will not be increasing access of dogs to any woodland area, since these areas are already highly fragmented in the landscape.

Vehicle strikes could be increased to some degree as a result of the project due to the site being a quarry and requiring truck access through the remnant woodland corridor north of the subject site. The recommended environmental safeguards in **Section 5.2** of this report include a speed limit of no more than 40 km/per hour for trucks entering and exiting the site.

The project will not increase the spread of disease or pathogens through a koala population. Additionally, the proposal will not cause fragmentation or a significant decline in available habitat for the species. The hydrological process of the habitat will not be impacted by the project.

There are five records for Koala within 10 km of the subject land, from 2006 to 2019; all of the records have minimal location notes, so it is not possible to determine exactly where the records were made beyond ‘Suburb only, North Star’. Considering the subject land is devoid of feed trees and shelter trees, it is unlikely to support a population of koalas. Based on the listed considerations the project is not found to interfere substantially with the recovery of the species.

No referral to the Commonwealth is considered to be required for potential impacts to the Koala.

Appendix 9

Air Quality Impact Assessment

This document has been prepared on behalf of **OzArk Environment and Heritage**:

Northstar Air Quality Pty Ltd,

Suite 1504, 275 Alfred Street, North Sydney, NSW 2060

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North Star Quarry

Air Quality Impact Assessment

Addressee(s):	**OzArk Environment and Heritage**
Site Address:	**5535 North Star Road, North Star NSW 2408**
Report Reference:	**21.1046.FR1V1**
Date:	**25 February 2021**

Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar Air Quality	GCG	MD
THE QUARRY	Final	Northstar Air Quality	GCG	MD
LEGISLATION REGULATION AND GUIDANCE	Final	Northstar Air Quality	GCG	MD
EXISTING CONDITIONS	Final	Northstar Air Quality	GCG	MD
METHODOLOGY	Final	Northstar Air Quality	GCG	MD
AIR QUALITY IMPACT ASSESSMENT	Final	Northstar Air Quality	GCG	MD
MITIGATION AND MONITORING	Final	Northstar Air Quality	GCG	MD
CONCLUSION	Final	Northstar Air Quality	GCG	MD

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
21	1046	F	R1	V1
Based upon the above, the specific reference for this version of the report is:				**21.1046.FR1V1**

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.



Martin Doyle **25th February 2021**

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Non-Technical Summary

OzArk Environment and Heritage has engaged Northstar Air Quality Pty Ltd on behalf of Regional Quarries Australia to perform an air quality impact assessment for the proposed development of a quarry located at 5535 North Star Road, North Star NSW 2408.

This report forms part of the Environmental Impact Statement prepared to accompany the development application for the Quarry under Part 4 of the *Environmental Planning and Assessment Act* 1979.

Emissions of particulate matter associated with construction phase and operational phase activities have been estimated, including a number of emission control measures proposed to be adopted. To ensure that the assessment provides an appropriately conservative approximation of the potential impacts at surrounding receptor locations, certain control measures which are proposed to be adopted have not been included in the assessment, specifically the watering of exposed areas. In this way, the predicted incremental impacts can be viewed as worst-case.

The air quality impact assessment presents an assessment of the impacts of activities associated with the maximum operational activity of the Quarry at 490 000 tonnes per year to service the Inland Rail Project, which is anticipated to occur on a single year within the first five years. After the peak year, the extraction rate is anticipated to reduce to 150 000 tonnes per year, and as such the assessment at the peak annual rate will address the risks of lower activity rates. An assessment of the potential air quality impacts along off-site transportation routes has also been provided. The air quality impact assessment has used a quantitative dispersion modelling approach, performed in accordance with the relevant NSW guidelines. The results of the assessment are presented as predicted incremental change, and as a cumulative impact accounting for the prevailing background air quality conditions.

The results of the air quality impact assessment indicate that at the peak extraction rate, the air quality criteria can be achieved. In periods when water may not be readily available, haul road watering may be restricted, and low silt aggregate may be used along internal haul roads, in conjunction with a lowering of vehicle speeds, to result in similar off-site impacts. As previously noted, the assessment of wind erosion has assumed that no control is applied, with the results indicating that control of this source of emissions is not critical to compliance with air quality criteria. It is stressed that watering of exposed areas will be performed when possible.

A Trigger Action Response Plan would be developed prior to Stage 1 operations which would link visible dust generation from all activities with wind conditions experienced at the Quarry site. A range of actions would be listed which would be adopted to reduce visible dust generation, until such time as the adopted trigger levels have reduced. It is noted that the adoption of a Trigger Action Response Plan is not critical to ensure compliance with the adopted air quality criteria, and its use should result in impacts being less than those predicted within this air quality impact assessment.

It is demonstrated that the Quarry can be operated in such a manner as to ensure compliance with all adopted air quality criteria, and the development should not be refused on the grounds of air quality.

CONTENTS

1. INTRODUCTION 7

1.1 Assessment Requirements 7

2. THE QUARRY 9

2.1 Overview 9

2.2 Identified Potential for Emissions to Air 16

3. LEGISLATION, REGULATION AND GUIDANCE 17

3.1 NSW EPA Approved Methods 17

3.2 Protection of the Environment Operations Act 1997 18

3.3 Protection of the Environment (Clean Air) Regulation 2010 18

4. EXISTING CONDITIONS 21

4.1 Surrounding Land Sensitivity 21

4.2 Meteorology 23

4.3 Air Quality 24

4.4 Topography 26

5. METHODOLOGY 29

5.1 Dispersion Modelling 29

5.2 Emissions Estimation 29

5.3 Emissions Controls 30

6. AIR QUALITY IMPACT ASSESSMENT 33

6.1 Particulate Matter - Annual Average PM_{10} and $PM_{2.5}$ 33

6.2 Particulate Matter – Annual Average Dust Deposition Rates 35

6.3 Particulate Matter - Maximum 24-hour Average 36

6.4 Emissions Associated with Offsite Transportation 41

7. MITIGATION AND MONITORING 45

7.1 Mitigation 45

7.2 Monitoring 46

8. CONCLUSION 47

9. REFERENCES 49

APPENDIX A **50**

APPENDIX B **53**

APPENDIX C **63**

APPENDIX D **67**

Tables

Table 1	Coverage of SEARs and other Government Agency requirements relevant to air quality	7
Table 2	Proposed characteristics of the Quarry operation at 490 000 tpa	14
Table 3	NSW EPA air quality standards and goals	17
Table 4	POEO (Clean Air) Regulation – General standards of concentration	18
Table 5	Discrete sensitive receptor locations used in the study	23
Table 6	Closest DPIE AQMS to the Quarry site	24
Table 7	Summary of background air quality used in the AQIA	26
Table 8	Summary of emission reduction methods adopted as part of Quarry operation	30
Table 9	Predicted annual average TSP, PM_{10} and $PM_{2.5}$ concentrations – 490 000 tpa	34
Table 11	Predicted annual average dust deposition – 490 000 tpa	35
Table 13	Predicted maximum incremental 24-hour PM_{10} and $PM_{2.5}$ concentrations	36
Table 14	Summary of contemporaneous impact and background – PM_{10}	37
Table 15	Summary of contemporaneous impact and background – $PM_{2.5}$	38
Table 16	Summary of emission reduction methods adopted as part of Quarry operation	45

Figures

Figure 1	Quarry location	10
Figure 2	Quarry layout	11
Figure 3	Conceptual on-site extraction operations	13
Figure 4	Population density and sensitive receptors surrounding the Quarry site	22
Figure 5	Statistical analysis of PM_{10} concentrations at Tamworth, 2016 to 2020	25
Figure 6	3-dimensional representation of topography surrounding the Quarry Site	27
Figure 7	Calculated uncontrolled & controlled annual particulate emissions	31
Figure 8	Calculated uncontrolled & controlled peak 24-hour particulate emissions	32
Figure 9	Incremental 24-hour PM_{10} concentrations	39
Figure 10	Incremental 24-hour $PM_{2.5}$ concentrations	40
Figure 11	Predicted maximum incremental 24-hour average PM_{10} at distance from roadside	41
Figure 12	Predicted maximum incremental 24-hour average $PM_{2.5}$ at distance from roadside	42

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1. INTRODUCTION

OzArk Environment and Heritage (OzArk) has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of Regional Quarries Australia Pty Ltd (the Applicant) to perform an air quality impact assessment (AQIA) for the proposed construction and operation of the North Star Quarry (the Quarry) located at 5535 North Star Road, North Star NSW 2408 (the Quarry site).

This AQIA forms part of the Environmental Impact Statement (EIS) prepared to accompany the development application for the Quarry under Part 4 of the *Environmental Planning and Assessment Act* 1979.

The AQIA presents an assessment of the impacts of activities associated with the construction/site establishment phase and operational phases of the Quarry. An assessment of the potential air quality impacts along off-site transportation routes has also been provided. The AQIA has used a quantitative dispersion modelling approach, performed in accordance with the relevant NSW guidelines. The results of the assessment are presented as predicted incremental change, and as a cumulative impact accounting for the prevailing background air quality conditions.

1.1 Assessment Requirements

Planning Secretary's Environmental Assessment Requirements (EAR 1494) have been provided for the Quarry by the NSW Department of Planning, Industry & Environment (DPIE) on 15 January 2021. The EARs included input from NSW Environment Protection Authority (EPA). **Table 1** provides a summary of the EARs relevant to this AQA.

Table 1 Coverage of SEARs and other Government Agency requirements relevant to air quality

Authority	Requirement	Relevant section(s)
SEARs	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 6
NSW EPA (21 September 2020)	Air quality including dust generation from the operation on the surrounding landscape and/or community	Section 6
	The EIS must demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act* 1997 and the Protection of the Environment Operations (Clean Air) Regulation 2010 (the "Clean Air Regulation").	Section 3.2 Section 3.3
	The EIS must include an air quality impact assessment (AQIA).	Section 6

Authority	Requirement	Relevant section(s)
	The AQIA must be carried out in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2016)	Section 3.1
	The EIS must detail emission control techniques and practices that will be employed at the site and identify how the proposed control techniques and practices will meet the requirements of the *POEO Act*, Clean Air Regulation and associated air quality limits or guideline criteria.	Section 3 Section 5.3 Section 7.1 Section 7.2

Further to the above, the policies, guidelines and plans which have been referenced during the performance of the AQIA include:

- Protection of the Environment Operations (Clean Air) Regulation 2010.
- Approved Methods for the Modelling and Assessment of Air Quality in NSW (NSW EPA, 2017).
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC, 2006).

2. THE QUARRY

The following provides a description of the Quarry and describes the potential sources of air emissions associated with the maximum proposed production of the Quarry (490 000 tpa).

2.1 Overview

The Applicant is proposing to develop the North Star Quarry, located at 5535 North Star Road, North Star, NSW within the Gwydir Shire Council local government area (LGA). The land is formally identified as Lot 7 Deposited Plan (DP) 755984 and Lot 1 DP 1227212, as presented in **Figure 1**. The Quarry site is located in an area zoned as Primary Production (RU1) in the Gwydir Local Environmental Plan (LEP) 2013.

The proposal is to establish an extractive industry producing a maximum of 490 000 tonnes (t) per year ($t \cdot yr^{-1}$) for a period of five years to service the Inland Rail Project and associated road upgrade projects and then 150 000 $t \cdot yr^{-1}$ for a period of ten years to service the general market in the local area. A maximum of 2.25 million tonnes (Mt) would be extracted over the fifteen-year life of the Quarry.

It is anticipated that the Quarry is likely to supply approximately 1 Mt of material to the Inland Rail Project. The Inland Rail Project may take three to five years to be completed and in any one year up to 490 000 t may be required from the Quarry. Therefore, to provide flexibility to adequately supply that demand, it is necessary to seek a maximum extraction capacity of 490 000 $t \cdot yr^{-1}$ for a period of 5 years. It is acknowledged, that if the Quarry operated at 490 000 $t \cdot yr^{-1}$ each year for 5 years, the total resource of 2.45 Mt would be exhausted. However, it is anticipated that only 1 Mt is likely to be required from the Quarry for the Inland Rail Project and associated road projects.

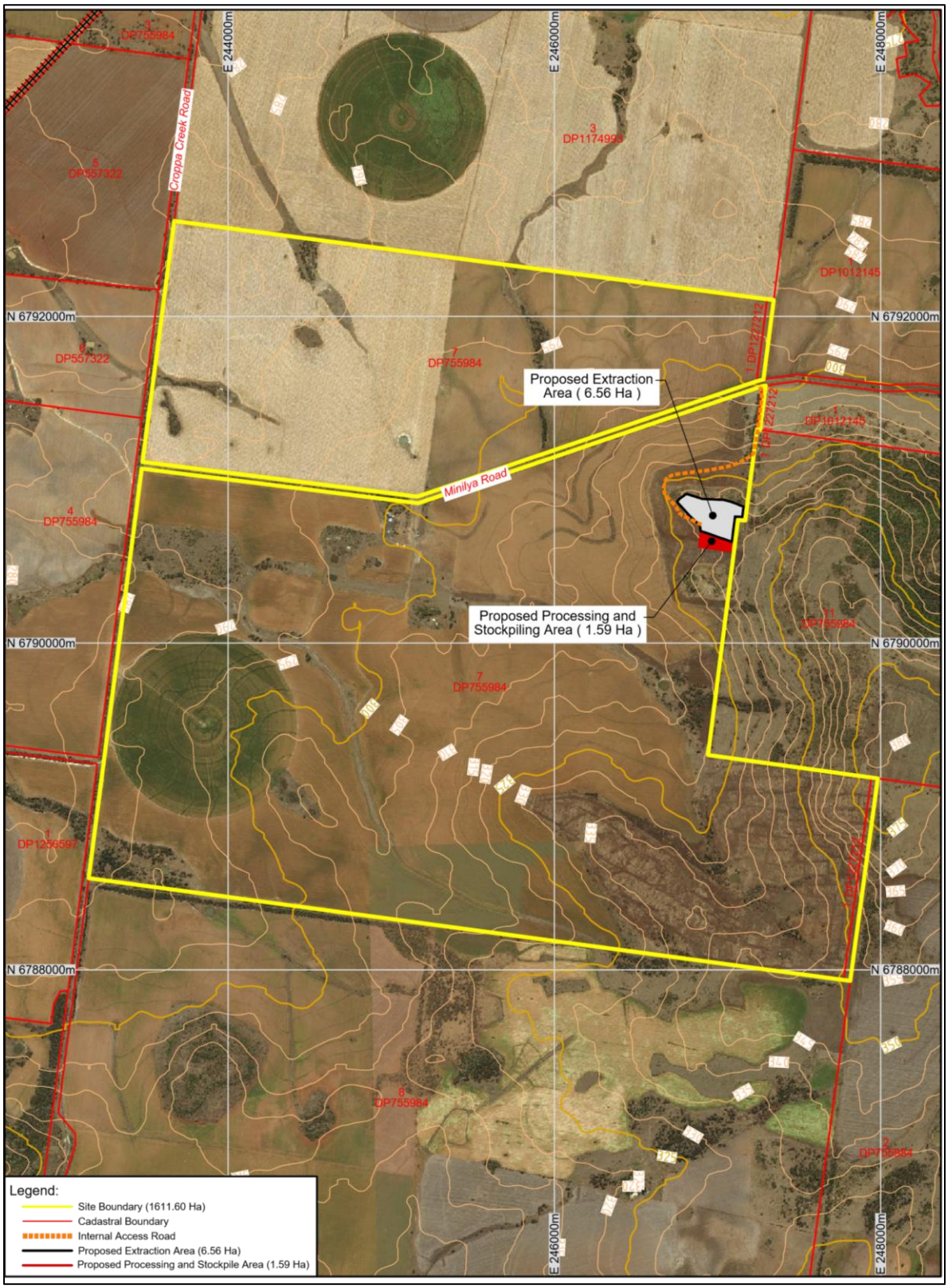
Following the completion of the Inland Rail Project and associated road projects, it is anticipated that the general demand for quarry materials from the Quarry would reduce to about 150 000 $t \cdot yr^{-1}$ for the local market. Whatever volume of material that remains after the Inland Rail Project has been completed would be available to meet that local demand. It is anticipated that up to 1.5 Mt would be available for the local market to be extracted over a 10-year period at 150 000 $t \cdot yr^{-1}$.

The proposed layout of the Quarry is presented in **Figure 2**.

Figure 1 Quarry location



Figure 2 Quarry layout



Source: Regional Group Australia. Drawing 2542.DRG.003. September 2020

The Quarry will include:

- Extraction of a maximum of 490 000 $t \cdot yr^{-1}$ within a period of 5 years, and then extraction of a maximum of 150 000 $t \cdot yr^{-1}$ for a period of 10 years;
- Extraction of a maximum of 2.45 Mt over the life of the quarry (noting that this is less than the aggregation of the above annual capacities, as discussed above);
- A maximum depth of extraction of RL 323 m Australian Height Datum (AHD);
- Conventional drill and blast techniques to extract the hard rock resource;
- Mobile plant to crush and screen the extracted material to produce a range of quarry products, including aggregates, railway ballast, road base and general fill;
- Stockpiling of quarry products;
- Loading and transportation of quarry products via the internal access road to the local road network via Minilya Road and Croppa Creek Road;
- Surface water management measures including sediment basins, diversion bunds and drains;
- Ancillary infrastructure, including temporary demountable site office and amenities; and,
- Progressive rehabilitation of the site to achieve a post extraction landform suitable for rural activities including but not limited to cattle grazing or cropping.

The site is approximately 1 611.6 hectares (ha) in area with the total area of the Quarry being 8.15 ha including a extraction area of 6.56 ha, a processing and stockpiling area of 1.59 ha, a sediment basin and associated surface water management measures, and the internal access road.

The hours of operation are proposed to be 6 am to 6 pm Monday to Friday and 7 am to 1 pm on Saturday with no operations on Sundays or public holidays. Blasting is proposed to occur on average once per month, and once per week during high demand periods, and from 9 am to 3 pm Monday to Friday.

Between 5 and 10 staff are anticipated to be required for the operation of the Quarry. Staff will be sourced locally where possible and if staff or support crews come from the wider region they will be accommodated in the local towns or Moree.

Construction traffic generated for the commissioning and decommissioning of the Quarry will be minimal and consist of vehicle movements for floating plant and equipment to and from the site.

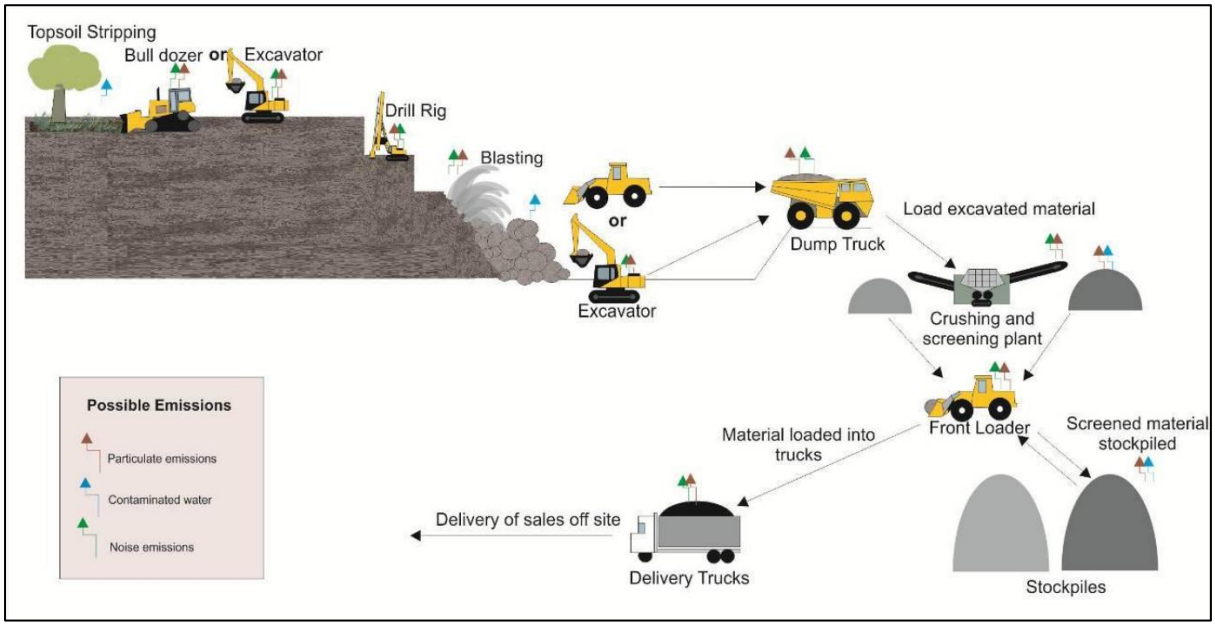
The Quarry would supply quarry materials to the Inland Rail Project and associated road projects. It is anticipated that access to the Inland Rail construction corridor would be available via Minilya Road to Croppa Creek Road, with trucks using the rail corridor to access any Inland Rail construction or stockpile sites. A mix of vehicle types would be used for product haulage, typically truck and trailer combinations, and B-doubles and Type 1 A-double road trains where approved routes are available. The payload capacity of these vehicles varies, and for the purpose of this assessment, an average payload of 38 t has been assumed, which is typical of the truck and trailer combinations.

Site establishment and construction activities would include:

- Construction of the internal access road;
- Construction of the access onto Minilya Road;
- Progressive vegetation clearing and soil removal within the areas approved for disturbance. Vegetation would be chipped for use in rehabilitation of the site. Any soil, where present and recoverable, would be stripped and either stockpiled for future use in rehabilitation activities or directly transferred to an area to be revegetated. Soil that is not immediately applied to active rehabilitation areas would be stockpiled, most likely within the processing and stockpile area, from where it would be easily accessed, when required. Topsoil that needs to be stockpiled for more than one month would be seeded to establish a stabilising groundcover.
- Construction of the sediment basin and surface water management measures;
- Construction of the processing and stockpile area;
- Delivery of the mobile processing plant and other mobile equipment; and,
- Delivery and establishment of the site office and amenities and other ancillary components.

Extraction would use standard quarrying methodologies that involve clearing, topsoil and overburden stripping, drilling and blasting, extraction, processing and stockpiling with the final products sold for use in the construction industry as shown in **Figure 3**.

Figure 3 Conceptual on-site extraction operations



Source: Regional Group Australia

Blasts would typically fragment between 20 000 to 50 000 t per blast but would fluctuate according to demand and safety requirements. Blasting would typically occur once per month but possibly up to once a week during peak periods.

The number of plant and equipment deployed on-site is anticipated to vary. A mobile crushing and screening plant would be established at the site to process the extracted material. Types of major plant and equipment deployed on-site may include, but not be limited to a bulldozer, grader, excavator, drill rig, off-road haul trucks, front-end loader and on-road haul trucks.

Given that the maximum proposed production of the Quarry is 490 000 $t \cdot yr^{-1}$, it is anticipated that the most significant air quality impacts on surrounding receptor locations would be experienced during this stage of operations. No significant changes in the locations of equipment, extraction areas, processing areas, or haulage routes are anticipated between stages, and therefore one scenario has been constructed to represent the likely maximum impacts of the Quarry operation. These impacts would appropriately represent the air quality impacts which are not anticipated to be exceeded during any stage of construction or operation.

Table 2 provides a summary of the operational characteristics of the Quarry during the period of maximum activity.

Table 2 Proposed characteristics of the Quarry operation at 490 000 tpa

Parameter	Maximum extraction
Operating hours (construction, extraction, processing, and haulage)	6 am to 6 pm, Monday to Friday 7 am to 1 pm Saturday No operations Sunday or Public Holiday Blasting will be limited to between 9 am and 3 pm Monday to Friday
Anticipated period of activity	5 years (for period of maximum extraction) a further 10 years at 150 000 $t \cdot yr^{-1}$
Working days per year	300
Annual rock extraction rate	490 000 $t \cdot yr^{-1}$
Average daily rock extraction rate	1 633 $t \cdot day^{-1}$
Maximum daily rock extraction rate	1 818 $t \cdot day^{-1}$
Annual overburden generation rate	19 680 $t \cdot yr^{-1}$
Average daily overburden generation rate	65.6 $t \cdot day^{-1}$
Number of blast holes drilled	50 to 100 per blast
Blast holes spacing	3 m
Blast hole depth	12 m
Blasting frequency	Once per month, up to once per week during peak periods
Mass of material removed per blast	20 000 to 50 000 t per blast

Parameter	Maximum extraction
Equipment (type, or equivalent) (*hours operation per day*)	Drill (Atlas Copco T35) (*2*) Excavator (CAT 345) (*10*) Front End Loader (CAT 980G) (*10*) Haul Truck (Volvo A40G) (*10*) Water Cart (Acco) (*12*)
Annual material processing rate	490 000 $t \cdot yr^{-1}$
Average daily processing rate	1 633 $t \cdot day^{-1}$
Maximum daily processing rate	1 818 $t \cdot day^{-1}$
Equipment (type, or equivalent) (*hours operation per day*)	Jaw Crusher (Metso L120) (*10*) Secondary Crusher (Metso HP300 or Impactor 1213S) (*10*) Screen (Warrior 20 x 8) (*10*) Generator (CAT 100kVa) (*10*)
Annual material haulage rate	490 000 $t \cdot yr^{-1}$
Average daily haulage rate	1 633 $t \cdot day^{-1}$
Maximum daily haulage rate	5 000 $t \cdot day^{-1}$
Haulage truck capacity	38 t
Annual vehicle trips	12 900
Peak daily vehicle trips (1-way)	132
Average daily vehicle trips (1-way)	46
Extraction area	6.56 ha
Processing and stockpile area	1.59 ha

Assumptions adopted in the construction of **Table 2** are presented below:

- An assessment of peak demand assumes that a maximum of 5 000 $t \cdot day^{-1}$ of material may be transported from the Quarry each day.
- The peak haulage rate of 5 000 $t \cdot day^{-1}$ is not reflected in the peak extraction and processing rates. Peak demand would be served from the stockpiles of material generated and stored in the 'Processing and Storage' area.
- Maximum daily extraction and processing rates are approximately 10 % greater than the average daily extraction rates and represent the maximum material extraction rates anticipated to be required to recharge stockpiles to serve peak demand.
- The peak demand is associated with the construction of the Inland Rail Project.
- Overburden is anticipated to be present at an average depth of 1 m across the Quarry site (Groundwork Plus, 2020). The quantity of overburden present and required to be moved and stored has been calculated on the anticipated depth, the area of the extraction area, and assuming a bulk overburden density of 1.5 $t \cdot m^{-3}$. No removal of overburden is assumed within the processing and storage area.

- The overburden extraction rate is estimated as:
  Extraction Area 65 600 m^2 x 1 m depth = 65 600 m^3 x 1.5 $t \cdot m^{-3}$ = 98 400 t / 5 years = 19 680 $t \cdot yr^{-1}$
  Note that the above calculation assumes that all overburden is removed during the first 5 years of operation, which is a conservative assumption.
- Exposed areas are assumed to be the maximum areas of extraction and stockpile and processing area. This is a highly conservative assumption.

2.2 Identified Potential for Emissions to Air

The processes which may result in the emission of pollutants to air during the operational phase would include:

- Drilling and blasting;
- Loading of haul trucks, transport, unloading, and storage of rock and overburden;
- Processing of rock, and storage in stockpiles;
- Loading product trucks with rock, and haulage offsite;
- Wind erosion of the extraction and processing areas; and,
- Emissions from vehicle, equipment, and generator exhaust.

The specific pollutants of interest associated with those activities are:

- Total suspended particulate (TSP);
- Particulate matter with an aerodynamic diameter of 10 microns (PM_{10}); and
- Particulate matter with an aerodynamic diameter of 2.5 microns ($PM_{2.5}$).

Emissions of oxides of nitrogen (NO_x) would be anticipated from blast fume, and (primarily) emissions of NO_x, carbon monoxide (CO) and sulphur dioxide (SO_2) related to diesel combustion would also be experienced (in addition to particulates considered above).

Given the distances between the Quarry and nearest sensitive receptors (approximately 2 kilometres ([km]), the frequency of blasting, and the quantity of equipment operating on site, it is not anticipated that emissions associated with diesel combustion, other than particulate matter which have been assessed, would be an issue of concern and have not been addressed further. In relation to blast fume, the timing of any blasts would be managed to ensure that meteorological conditions are appropriate for those to occur.

3. LEGISLATION, REGULATION AND GUIDANCE

3.1 NSW EPA Approved Methods

State air quality guidelines adopted by the NSW EPA are published in the *'Approved Methods for the Modelling and Assessment of Air Quality in NSW'* (NSW EPA, 2017) (the Approved Methods) which has been consulted during the preparation of this assessment report.

The Approved Methods lists the statutory methods that are to be used to model and assess emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria to be applied.

The criteria listed in the Approved Methods are derived from a range of sources (including National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC], Department of Environment [DoE], and World Health Organisation [WHO]).

The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW. The standards adopted to protect members of the community from health impacts in NSW are presented in **Table 3**.

Table 3 NSW EPA air quality standards and goals

Pollutant	Averaging period	Units	Criterion	Notes
Particulates (as PM_{10})	24 hours	$\mu g \cdot m^{-3}$ (a)	50	Numerically equivalent to the Ambient Air Quality National Environment Protection Measure (AAQ NEPM)(b) standards and goals.
	1 year	$\mu g \cdot m^{-3}$	25	
Particulates (as $PM_{2.5}$)	24 hours	$\mu g \cdot m^{-3}$	25	
	1 year	$\mu g \cdot m^{-3}$	8	
Particulates (as total suspended particulate [TSP])	1 year	$\mu g \cdot m^{-3}$	90	
Deposited dust	1 year	$g \cdot m^{-2} \cdot month^{-1}$(c)	2	Assessed as insoluble solids as defined by AS 3580.10.1
		$g \cdot m^{-2} \cdot month^{-1}$(d)	4	

Notes: (a): micrograms per cubic metre of air
(b): National Environment Protection (Ambient Air Quality) Measure
(c): Maximum increase in deposited dust level
(d): Maximum total deposited dust level

3.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations* (POEO) *Act* (1997) sets the statutory framework for managing air quality in NSW, including establishing the licensing scheme for major industrial premises and a range of air pollution offences and penalties.

Should the Quarry gain approval the operations would be defined as a scheduled activity under the POEO Act. As such, an Environment Protection Licence (EPL) would be required to be obtained from NSW EPA and once issued would contain a range of conditions related to minimisation of emissions from the site.

3.3 Protection of the Environment (Clean Air) Regulation 2010

The Protection of the Environment Operations (POEO) (Clean Air) Regulation (2010) sets standards of concentration for emissions to air from both scheduled and non-scheduled activities. For the activities performed at the Quarry, the POEO (Clean Air) Regulation provides general standards of concentration for scheduled premises which are presented in **Table 4** for the pollutants of relevance to this assessment. Requirements associated with nitrogen dioxide (NO_2) have been included in **Table 4** but have not been included as part of this impact assessment, for the reasons discussed in **Section 2.2**.

Table 4 POEO (Clean Air) Regulation – General standards of concentration

Air Impurity	Activity	Standard of Concentration (Group 6)[1]
Solid particles (total)	Any activity or plant (except as listed below)	50 $mg{\cdot}m^{-3}$
	Any crushing, grinding, separating or materials handling activity	20 $mg{\cdot}m^{-3}$
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	Any activity or plant (except boilers, gas turbines and stationary reciprocating internal combustion engines listed below)	350 $mg{\cdot}m^{-3}$

Note: (1) Group 6 – pursuant to application made on or after 1 September 2005

Further to the requirements in **Table 4** Part 4 Clause 15 of the POEO (Clean Air) Regulation requires that motor vehicles do not emit excessive air impurities which may be visible for a period of more than 10-seconds when determined in accordance with the relevant standard.

Schedule 8 of the POEO (Clean Air) Regulation indicates that burning of vegetation is prohibited, except with approval in the Gwydir Shire Council area. No burning of materials would be performed as part of the construction or operation of the Quarry.

All vehicles, plant and equipment to be used either at the Quarry site or to transport materials to and from the Quarry site will be maintained regularly and in accordance with manufacturers' requirements, where these vehicles are under the operational control of the operator.

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4. EXISTING CONDITIONS

4.1 Surrounding Land Sensitivity

4.1.1 Discrete Receptor Locations

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed. Typically, these locations are identified as residential properties although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

It is noted that in addition to the identified 'discrete' receptor locations, the entire modelling area is gridded with 'uniform' receptor locations (see **Section 4.1.2**) that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location sensitive to changes in air quality does not render the AQIA invalid, or otherwise incapable of assessing those potential risks.

To ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the Quarry site reside, population density data has been examined. Population density data based on the 2016 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km^2) grid, covering mainland Australia (ABS, 2017). Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities.

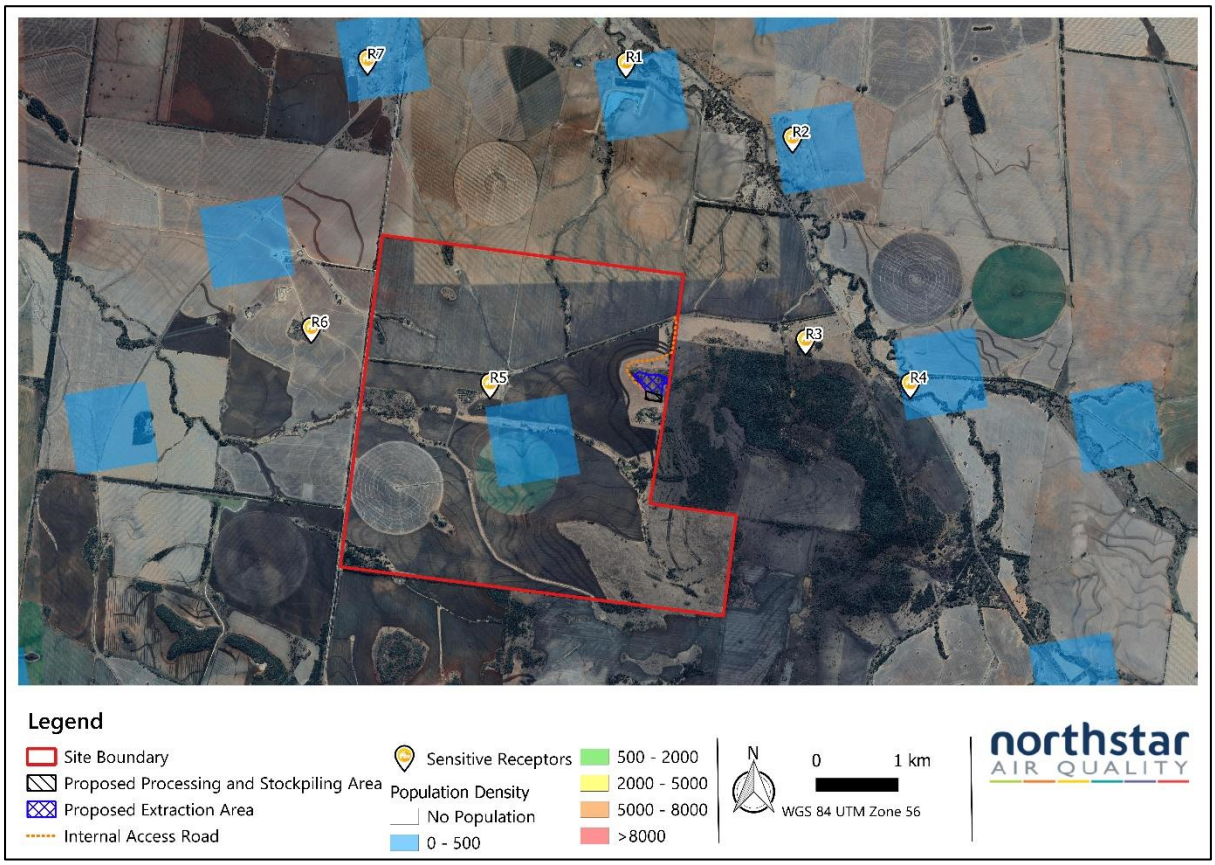
For clarity, the ABS use the following categories to analyse population density (persons·km^{-2}):

- Very high >8,000
- High >5,000
- Medium >2,000
- Low >500
- Very low <500
- No population 0

Using ABS data in a GIS, the population density of the area surrounding the Quarry site are presented in **Figure 4**. The Quarry site is located in an area of low to very low population density (between 0 and <500 persons·km^{-2}).

A number of residential locations surrounding the Quarry site have been identified and these receptors have been adopted for use within this AQIA as presented in **Table 5**.

Figure 4 Population density and sensitive receptors surrounding the Quarry site



Note: Areas with no colour represents a 1 km^2 grid cell with zero population

It is noted that Sensitive Receptors R3 and R5, which are both located 2 km from the Quarry are both owned by the landowner associated with the Quarry. Impacts have been predicted at these locations.

Figure 4 identifies a number of 1 km^2 grids that are identified by the ABS as being populated. The desk-top mapping study performed for this AQIA examined those grid cells to ensure all relevant receptor locations had been identified. For a number of cells, sheds were identified that appear to have been erroneously assumed to be residential properties, and for other cells no structures were identified.

Table 5 Discrete sensitive receptor locations used in the study

Rec. ID	Name	Lot	Land Use	Location (m, UTM 55)	
				Eastings	Northings
R1	S&S Doolin Pty Ltd	Lot 2 DP1174993	Residential	246 658	6 794 666
R2	Malcolm and Jennifer Doolin	Lot 25 DP45257	Residential	248 698	6 793 750
R3	Doolin Minilya Pty Ltd	Lot 1 DP1012145	Residential	248 857	6 791 274
R4	William & Diane Thompson	Lot 1 DP655384	Residential	250 139	6 790 741
R5	Doolin Minilya Pty Ltd	Lot 7 DP755985 & Lot 1 DP1227212	Residential	244 992	6 790 741
R6	Coppymurrumbilla Station Pty Ltd	Lot 4 DP755985	Residential	242 804	6 791 420
R7	James Smith	Lot 3 DP755984	Residential	243 492	6 794 703

4.1.2 Uniform Receptor Locations

Additional to the sensitive receptors identified in **Section 4.1.1**, a grid of uniform receptor locations has been used in the AQIA to allow presentation of contour plots of predicted impacts.

4.2 Meteorology

In accordance with the requirements of the NSW EPA Approved Methods, the AQIA is required to describe and account for the influence of the prevailing meteorological conditions.

The meteorology experienced within an area can govern the generation (in the case of wind dependent emission sources), dispersion, transport and eventual fate of pollutants in the atmosphere. The meteorology of the area surrounding the Quarry site has been examined using data collected by the Australian Government Bureau of Meteorology (BoM) at the Moree Aero Automatic Weather Station (AWS), which is approximately 75 km southwest of the Quarry site. This AWS is considered the most representative station for the area surrounding the Quarry site.

To provide a characterisation of the meteorology which would be expected at the Quarry site, a meteorological modelling exercise has been performed.

Data from the year 2017 have been selected for use in the AQIA to provide an approximation of 'representative' conditions surrounding the Quarry. This year has been selected through examination of meteorology and background air quality conditions for the five-year period 2016 to 2020. The year 2017 was selected as being most representative as wind speed and direction measured at Moree Aero AWS in 2017 were considered to be most representative of the five-year period examined.

A summary of the inputs and outputs of the meteorological modelling assessment, including model validation, is presented in **Appendix B**. This analysis includes a discussion of data availability and variability.

4.3 Air Quality

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional and global). The relative contributions of sources at each of these scales to the air quality at a location will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant should also be assessed. This 'background' (sometimes called 'baseline') air quality will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

The Quarry site is located at significant distance from any of the air quality monitoring stations (AQMS) operated by NSW DPIE. The locations of the nearest AQMS (listed by proximity) are briefly summarised in **Table 6** and presented in **Appendix C**. The year 2017 is indicated in **Table 6** as this is the year selected for assessment. Further information is provided below.

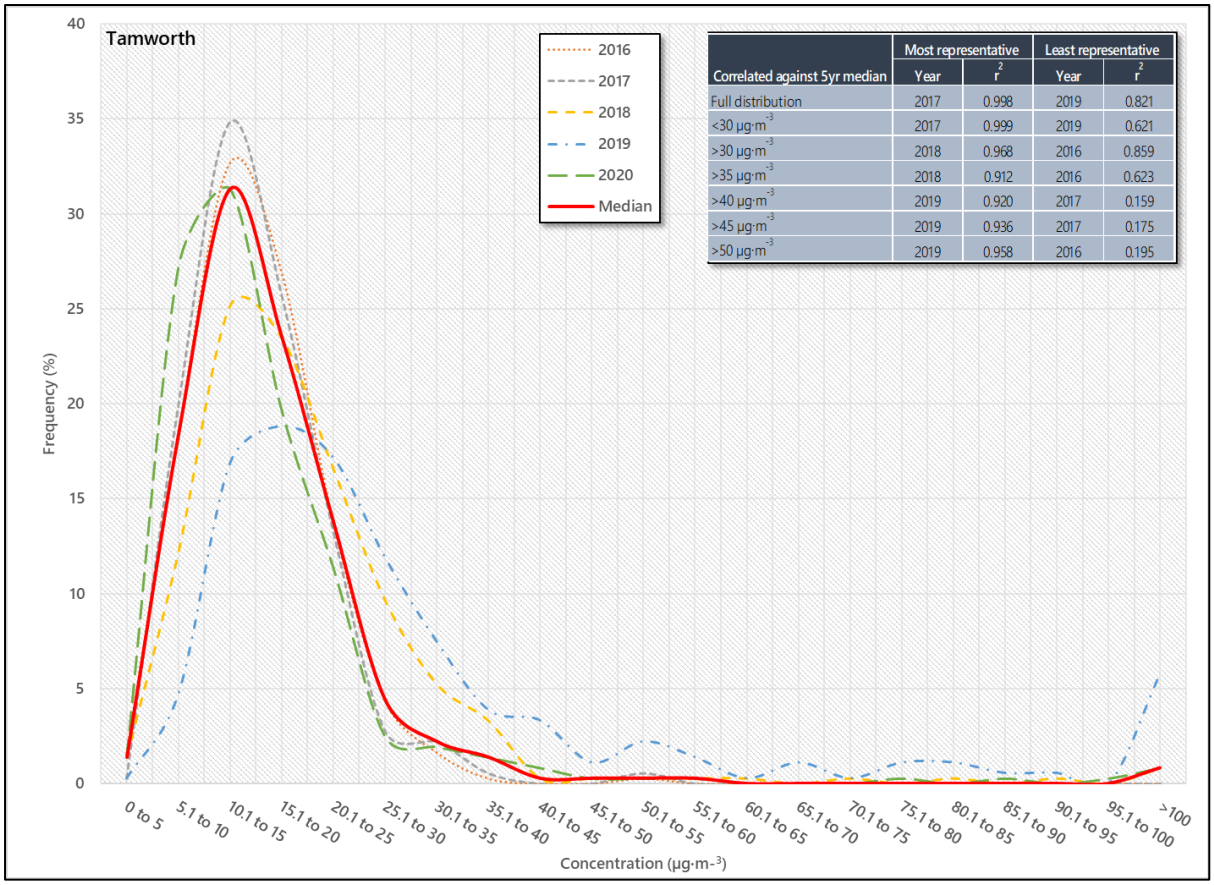
Table 6 Closest DPIE AQMS to the Quarry site

AQMS Location	Approximate distance to Quarry (km)	Screening Parameters			
		2017 Data	Measurements		
			PM_{10}	$PM_{2.5}$	TSP
Narrabri	157	×	✓	✓	×
Armidale	210	×	✓	✓	×
Gunnedah	220	×	✓	✓	×
Tamworth	239	✓	✓	✓	×

The closest representative AQMS with data available for the assessment year (see below) of 2017 is noted to be located at Tamworth and is considered to be the monitoring location most reflective of the conditions at the Quarry site. The adoption of air quality monitoring data, often collected at significant distances from proposed projects, to represent conditions at those locations is a routinely adopted approach in NSW. NSW DPIE operates an extensive air quality monitoring network, generally reflective of the most populated areas of the State. Site specific air quality monitoring funded by proponents can sometimes be used, although for the purposes of use within an AQIA, at least a full year of continuous measurement is required.

Data from the year 2017 have been selected for use in the AQIA to provide an approximation of 'representative' conditions surrounding the Quarry (see **Section 4.2**). This year has been selected through examination of meteorology and air quality for the five-year period 2016 to 2020. In terms of background air quality, the year 2017 was selected as being most representative as PM_{10} data measured at the Tamworth AQMS in 2017 were statistically shown to be most representative of the five-year median particulate distribution at that location, especially when considering the full data distribution (see **Figure 5**).

Figure 5 Statistical analysis of PM_{10} concentrations at Tamworth, 2016 to 2020



Correlated against 5yr median	Most representative		Least representative	
	Year	r^2	Year	r^2
Full distribution	2017	0.998	2019	0.821
<30 µg·m^{-3}	2017	0.999	2019	0.621
>30 µg·m^{-3}	2018	0.968	2016	0.859
>35 µg·m^{-3}	2018	0.912	2016	0.623
>40 µg·m^{-3}	2019	0.920	2017	0.159
>45 µg·m^{-3}	2019	0.936	2017	0.175
>50 µg·m^{-3}	2019	0.958	2016	0.195

Appendix C provides a detailed assessment of the background air quality monitoring data collected at the Tamworth AQMS.

It is noted that none of the AQMS identified in **Table 6** measured concentrations of TSP in the year 2017. These pollutants are of relevance to the expected emissions from the Quarry. Other sources of data have been adopted to allow representation of the TSP and $PM_{2.5}$ environment in the area surrounding the Quarry, and a full discussion is provided in **Appendix C**.

A summary of the air quality monitoring data used in this assessment is presented in **Table 7**.

Table 7 Summary of background air quality used in the AQIA

Pollutant	Ave Period	Measured Value	Notes
Particles (as TSP)	Annual $\mu g.m^{-3}$	36.5	Estimated on a TSP:PM_{10} ratio of 2.3404 : 1
Particles (as PM_{10})	24-hour $\mu g.m^{-3}$	Daily Varying	The 24-hour maximum PM_{10} concentration in 2017 at Tamworth was measured to be 54.1 $\mu g.m^{-3}$
	Annual $\mu g.m^{-3}$	15.6	
Particles (as $PM_{2.5}$)	24-hour $\mu g.m^{-3}$	Daily Varying	The 24-hour maximum $PM_{2.5}$ concentration in 2017 was calculated to be 21.6 $\mu g.m^{-3}$
	Annual $\mu g.m^{-3}$	7.8	
Dust deposition	Annual $g \cdot m^{-2} \cdot month^{-1}$	2	Difference in NSW EPA maximum allowable and incremental impact criterion

Note: Reference should be made to **Appendix C**

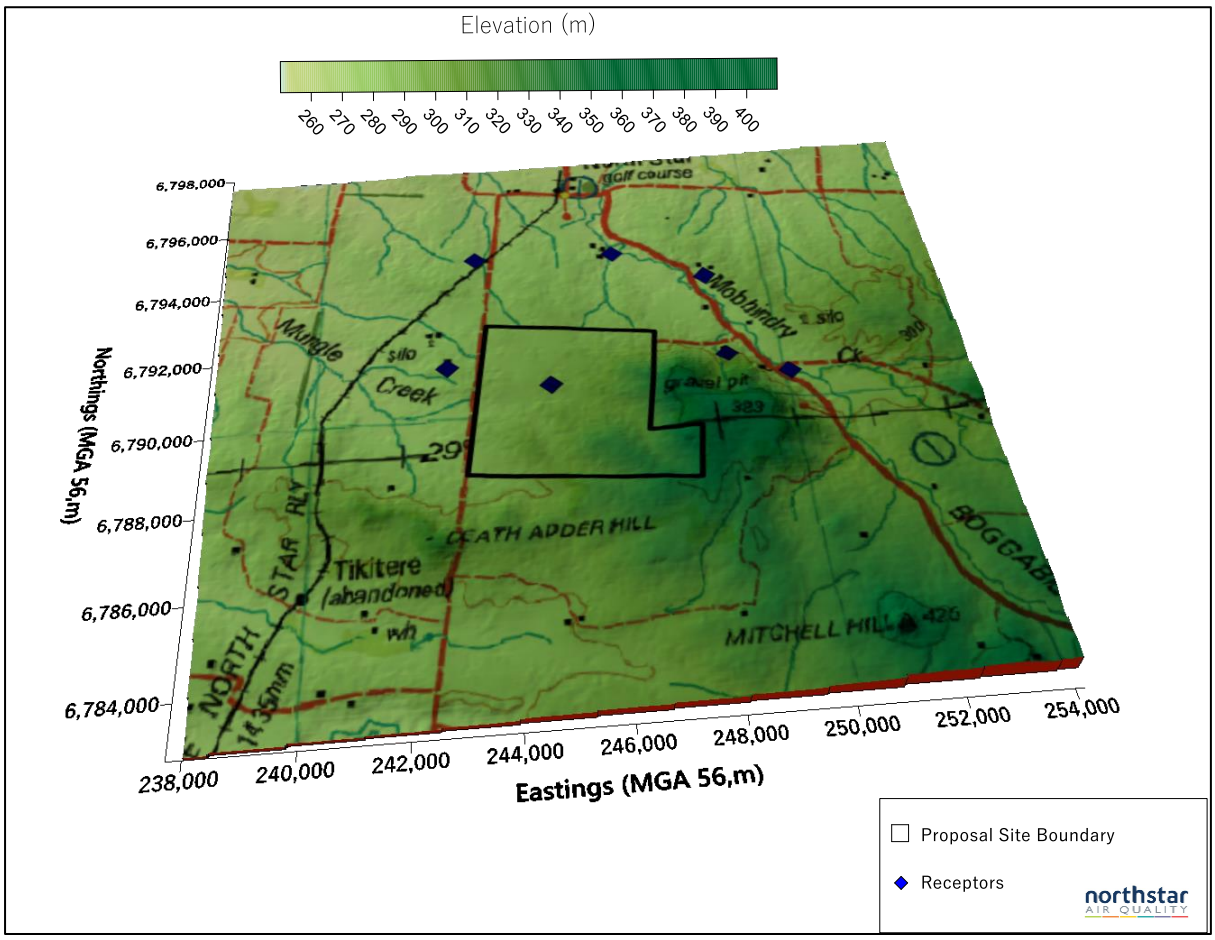
The AQIA has been performed to assess the contribution of the operations at the Quarry to the air quality of the surrounding area. A full discussion of how the Quarry may impact upon air quality is presented in **Section 6**.

4.4 Topography

The elevation of the Quarry site is between approximately 290 m and 350 m AHD. The topography between the Quarry site and nearest sensitive receptor locations is uncomplicated. A 3-dimensional representation of the topography surrounding the Quarry site is presented in **Figure 6**.

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Figure 6 3-dimensional representation of topography surrounding the Quarry Site



Source: Northstar Air Quality

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5. METHODOLOGY

5.1 Dispersion Modelling

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF atmospheric dispersion model. The modelling has been performed in CALPUFF 2-dimensional (2-D) mode. Given the flat (uncomplex) terrain and the proximity of the receptors to the Quarry site, a detailed assessment using a 3-D meteorological dataset is not warranted.

The 2-D meteorological dataset has been developed using The Air Pollution Model (TAPM, v 4.0.5) (see **Appendix B** for further information). An assessment of the impacts of the operation of activities at the Quarry has been performed which characterises the likely day-to-day operation of the Quarry, approximating average operational characteristics which are appropriate to assess against longer term (annual average) criteria for particulate matter. The likely peak activities at the Quarry have also been characterised to allow comparison of potential impacts against shorter term (24-hour) criteria for particulate matter.

The modelling scenarios provide an indication of the air quality impacts of the operation of activities at the Quarry site. Added to these impacts are background air quality concentrations (where available and discussed in **Section 4.2** and **Appendix C**) which represent the air quality which may be expected within the area surrounding the Quarry site, without the impacts of the Quarry itself.

The following provides a description of the determination of appropriate emissions of air pollutants resulting from the operation of the Quarry.

5.2 Emissions Estimation

The estimation of emissions from a process is typically performed using direct measurement or through the application of factors which appropriately represent the processes under assessment. This assessment has adopted emission factors for drilling, blasting, materials handling processes, movement of trucks on unpaved site roads, crushing and screening, and wind erosion contained within the US EPA AP-42 emission factor compendium (US EPA, 1995 and updates) to represent the emission of particulate matter resulting from the operations occurring at the Quarry site as described in **Section 2.2**. These factors are appropriate for adoption in Australia and are routinely adopted in the assessment of operations of this nature.

Two scenarios have been constructed which cover emissions associated with the operation of the Quarry at the maximum production rate (490 000 $t \cdot yr^{-1}$). One scenario reflects activities at their average rate, with impacts compared against annual average air quality criteria, and a further scenario reflects activities at peak daily activity rates, with impacts compared against 24-hour air quality criteria.

The potential emissions along offsite unpaved transportation routes, during the period of anticipated peak daily haulage have been quantified. Associated impacts have been assessed against the short term (24-hour) impact assessment criteria. Impacts of offsite transportation have been assessed in a different manner to the activities at the Quarry. Predicted incremental impacts along a nominal 500 m stretch of unsealed road leading from the Quarry site have been modelled to determine the impacts at distance from the road. Discussion is provided in relation to the potential distances of receptors from that transportation route.

A full description of the emission sources included in the assessment, and the emission factors and assumptions adopted are presented in **Appendix D**.

5.3 Emissions Controls

Emissions controls will be employed at the Quarry site. The application of these controls results in quantifiable reductions in the quantity of particulate matter being emitted as part of the Quarry operation.

A summary of the emissions reductions measures that would be adopted during the Quarry construction and operation is presented in **Table 8**. These emission reductions are outlined in the NPI EETM for Mining (NPI, 2012) and relevant AP-42 documentation (US EPA, 1995).

Table 8 Summary of emission reduction methods adopted as part of Quarry operation

Emission control method	Control efficiency (%)
Dust collection on drill rig	90
Application of water on haulage routes (internal)	50
Application of water sprays on materials crushing operations	77.7
Application of water sprays on materials screening operations	91.2
Retention of particulate matter within the pit, for activities occurring in the pit	50 (TSP), 5 (PM_{10}, $PM_{2.5}$)
Covering loads with a tarpaulin	Not quantified
Limit load sizes to ensure material is not above the level of truck sidewalls	Not quantified
Minimising travel speeds and distances	Not quantified

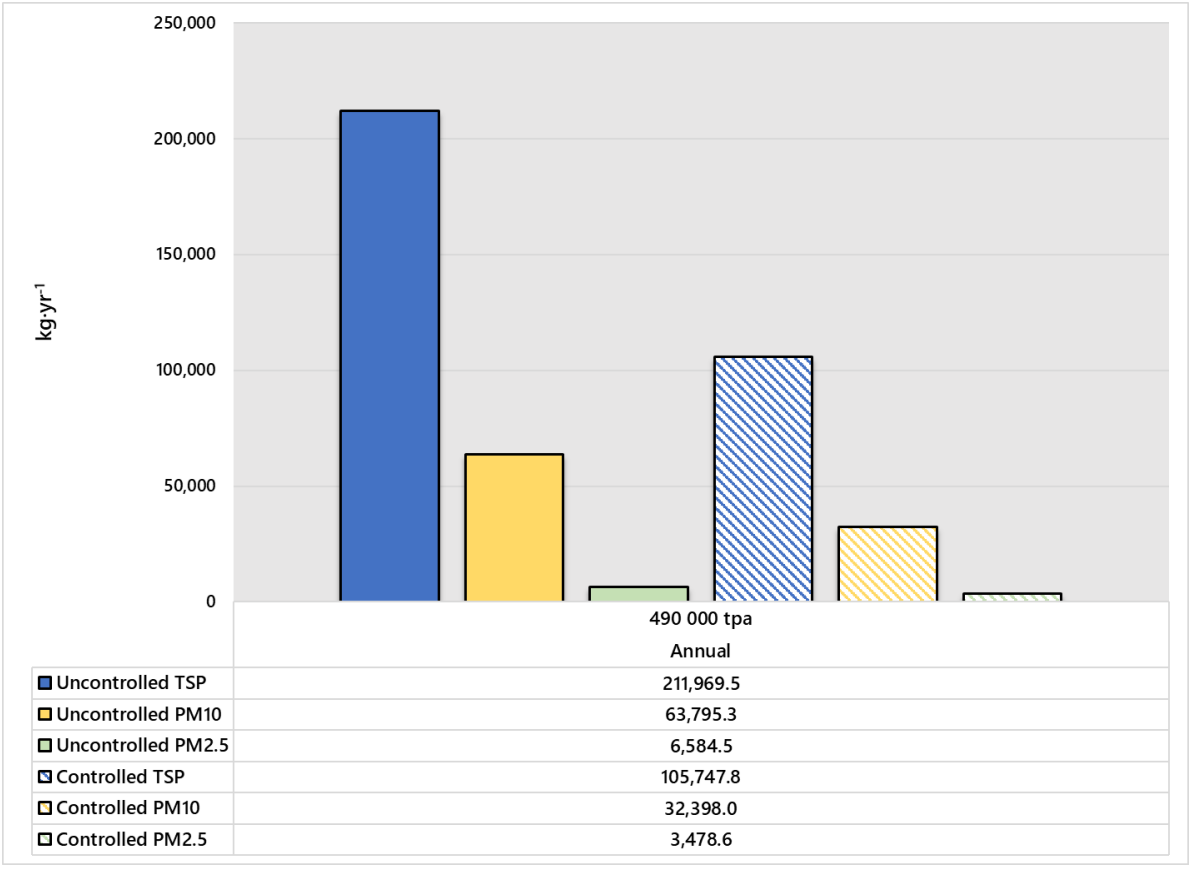
It is noted that the Applicant proposes to continually apply water to all exposed areas of the Quarry using the water truck. These emissions reductions have not been applied in the air quality modelling assessment. The continual application of water to large areas is likely to be unmanageable in periods of water shortage, and therefore the assessment seeks to provide assurances that the air quality criteria can be met at all surrounding sensitive receptor locations, without this additional level of control.

Watering of unpaved haulage routes on site has been assumed to occur continuously and an emission reduction of 50 % has been applied, which is consistent with the application of less than (<) 2 litres of water per square metre per hour ($L \cdot m^{-2} \cdot hr^{-1}$). Should water availability become an issue at the Quarry, or should visible dust be observed to be emitted from haulage routes, the proponent would apply low silt aggregate and reduce the speeds of vehicles along those routes. In this way, the emission reduction efficiencies associated with haulage route watering applied within this assessment can be maintained, even in conditions of water shortage.

The application of water sprays on processing equipment will be maintained continuously throughout the Quarry lifetime.

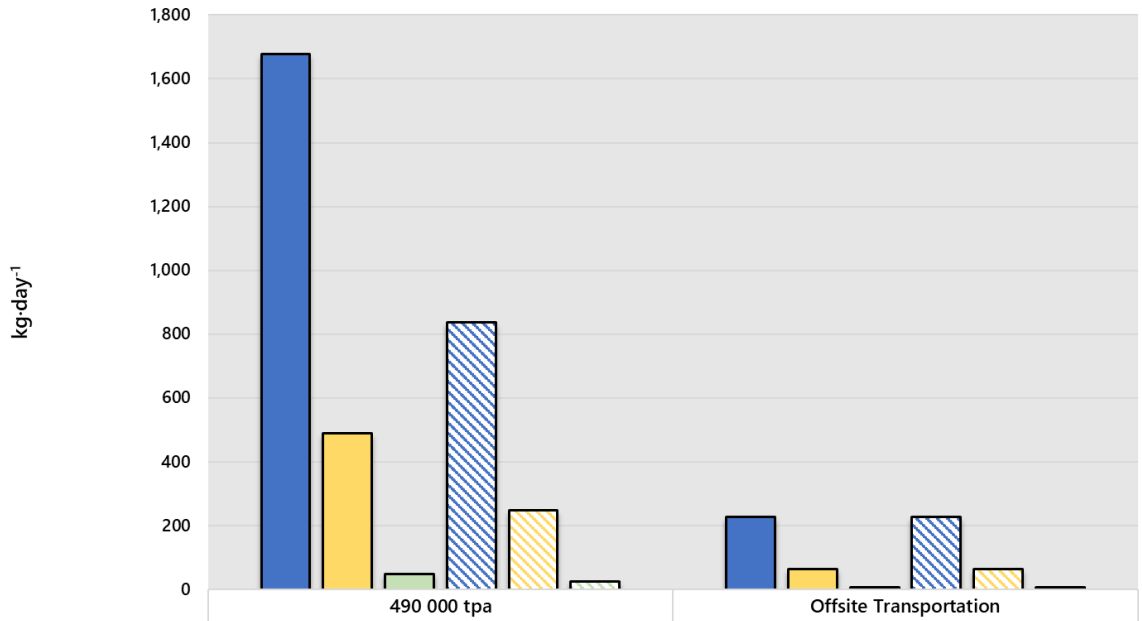
Based on the foregoing, and the information provided in **Appendix D**, the distribution of controlled particulate emissions in each stage of development is presented in **Figure 7** (annual emissions totals) and **Figure 8** (peak daily emissions). Note that emissions associated with offsite transportation of product are associated with 132 vehicles travelling along a nominal 500 m stretch of road and should not be directly compared to the emissions from other activities which are contained within the Quarry site.

Figure 7 Calculated uncontrolled & controlled annual particulate emissions



	490 000 tpa Annual
Uncontrolled TSP	211,969.5
Uncontrolled PM10	63,795.3
Uncontrolled PM2.5	6,584.5
Controlled TSP	105,747.8
Controlled PM10	32,398.0
Controlled PM2.5	3,478.6

Figure 8 Calculated uncontrolled & controlled peak 24-hour particulate emissions



	490 000 tpa 24 hr	Offsite Transportation 24 hr
Uncontrolled TSP	1,677.6	227.2
Uncontrolled PM10	489.0	64.6
Uncontrolled PM2.5	49.6	6.5
Controlled TSP	838.4	227.2
Controlled PM10	247.3	64.6
Controlled PM2.5	25.5	6.5

6. AIR QUALITY IMPACT ASSESSMENT

This section presents the results of the dispersion modelling assessment and uses the following terminology:

- Incremental impact – relates to the concentrations predicted as a result of the construction and operation of the Quarry in isolation.
- Cumulative impact – relates to the incremental concentrations predicted as a result of the construction and operation of the Quarry PLUS the background air quality concentrations discussed in **Section 4.3**.

The results are presented in this manner to allow examination of the likely impact of the Quarry in isolation and the contribution to air quality impacts in a broader sense.

In the presentation of results, the tables included shaded cells which represent the following:

Model prediction	Pollutant concentration / deposition rate less than the relevant criterion	**Pollutant concentration / deposition rate equal to, or greater than the relevant criterion**

6.1 Particulate Matter - Annual Average PM_{10} and $PM_{2.5}$

The predicted annual average particulate matter concentrations (as TSP, PM_{10} and $PM_{2.5}$) resulting from the operations at 490 000 $t \cdot yr^{-1}$ at the Quarry site are presented in **Table 9**.

The results indicate that predicted incremental concentrations of TSP, PM_{10} and $PM_{2.5}$ at receptor locations are low (less than (<) 1 % of the annual average TSP criterion, <2.1 % of the annual average PM_{10} criterion and less than or equal to (≤) 0.1 % of the $PM_{2.5}$ criterion).

The addition of existing background concentrations (refer **Section 4.3**) results in predicted concentrations of annual average TSP being less than 41.5 % and annual average PM_{10} being less than 64.5 % of the relevant criteria at the nearest receptors. Annual average $PM_{2.5}$ is predicted to be 7.8 $\mu g \cdot m^{-3}$, but not be exceeding the annual average criterion at the nearest receptors. The existing high background concentration of $PM_{2.5}$ is shown to already be greater than (>) 98.1 % of the relevant criterion.

Table 9 Predicted annual average TSP, PM_{10} and $PM_{2.5}$ concentrations – 490 000 tpa

Receptor	Annual Average Concentration (µg·m^{-3})								
	TSP			PM_{10}			$PM_{2.5}$		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
R1	0.1	36.5	36.6	<0.1	15.6	15.7	<0.1	7.8	7.9
R2	0.3	36.5	36.8	0.2	15.6	15.8	<0.1	7.8	7.9
R3	0.4	36.5	36.9	0.2	15.6	15.8	<0.1	7.8	7.9
R4	0.1	36.5	36.6	<0.1	15.6	15.7	<0.1	7.8	7.9
R5	0.9	36.5	37.4	0.5	15.6	16.1	<0.1	7.8	7.9
R6	0.2	36.5	36.7	0.1	15.6	15.7	<0.1	7.8	7.9
R7	<0.1	36.5	36.6	<0.1	15.6	15.7	<0.1	7.8	7.9
Criterion	-	90		-	25		-	8	

No contour plots of annual average TSP, PM_{10} or $PM_{2.5}$ are presented, given the minor predicted contribution from the operations at the Quarry at the nearest relevant sensitive receptors.

6.2 Particulate Matter – Annual Average Dust Deposition Rates

Table 10 present the annual average dust deposition predicted as a result of the operations at the Quarry at 490 000 tpa.

An assumed background dust deposition of 2 g·m^{-2}·month^{-1} is presented in **Table 10**, although comparison of the incremental concentration with the incremental criterion of 2 g·m^{-2}·month^{-1} is also valid (as discussed within **Section 1**). In either case, the resulting conclusions drawn are identical. Annual average dust deposition is predicted to meet the criteria at all receptors surrounding the Quarry where the predicted impacts at 490 000 tpa are <0.1% of the incremental criterion at receptor locations.

No contour plots of annual average dust deposition are presented, given the minor predicted contribution from the operations at the Quarry at the nearest sensitive receptors.

Table 10 Predicted annual average dust deposition – 490 000 tpa

Receptor	Annual Average Dust Deposition (g·m^{-2}·month^{-1})		
	Incremental Impact	Background	Cumulative Impact
R1	<0.1	2.0	2.1
R2	<0.1	2.0	2.1
R3	<0.1	2.0	2.1
R4	<0.1	2.0	2.1
R5	<0.1	2.0	2.1
R6	<0.1	2.0	2.1
R7	<0.1	2.0	2.1
Criterion	2.0	-	4.0

6.3 Particulate Matter - Maximum 24-hour Average

Presented in **Table 11** are the maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations predicted to occur at the nearest sensitive receptors as a result of the operations at the Quarry at peak activity rates. No background concentrations are included within this table. Maximum incremental concentrations are highlighted in bold.

Table 11 Predicted maximum incremental 24-hour PM_{10} and $PM_{2.5}$ concentrations

Receptor	Maximum incremental 24-hour average concentration ($\mu g \cdot m^{-3}$)	
	PM_{10}	$PM_{2.5}$
R1	5.8	0.6
R2	7.9	0.9
R3	**12.4**	**1.4**
R4	6.5	0.8
R5	12.1	1.3
R6	4.7	0.6
R7	5.6	0.8

The predicted incremental concentration of PM_{10} and $PM_{2.5}$ are demonstrated to be minor. At the receptor where the maximum 24-hour PM_{10} impact is expected to occur (receptor R3), operation of the Quarry at 490 000 tpa would contribute up to 24.9 % of the relevant criterion. Similarly, at the receptor where the maximum 24-hour $PM_{2.5}$ impact is expected to occur (receptor R3), operation of the Quarry at 490 000 $t \cdot yr^{-1}$ would contribute up to 5.6 % of the relevant criterion.

Table 12 and **Table 13** present the predicted maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations resulting from the operation of the Quarry, with background included. Results are presented for the receptor at which the highest incremental PM_{10} and $PM_{2.5}$ impacts have been predicted, and also for the receptors at which the highest cumulative impacts (increment plus background) have been predicted. These may be different receptors than those at which the highest incremental impacts are predicted.

The left side of the tables show the predicted concentration on days with the highest cumulative impact (principally driven by the highest background concentrations), and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations with the contemporaneous background values to derive the respective cumulative predictions.

Contour plots of the incremental contribution of the proposed operations at the Quarry site to the 24-hour average PM_{10} and $PM_{2.5}$ concentrations are presented in **Figure 8** and **Figure 10**.

Both tables indicate that the operations at the Quarry will not result in any exceedances of the 24-hour particulate criteria, even taking into account existing background conditions.

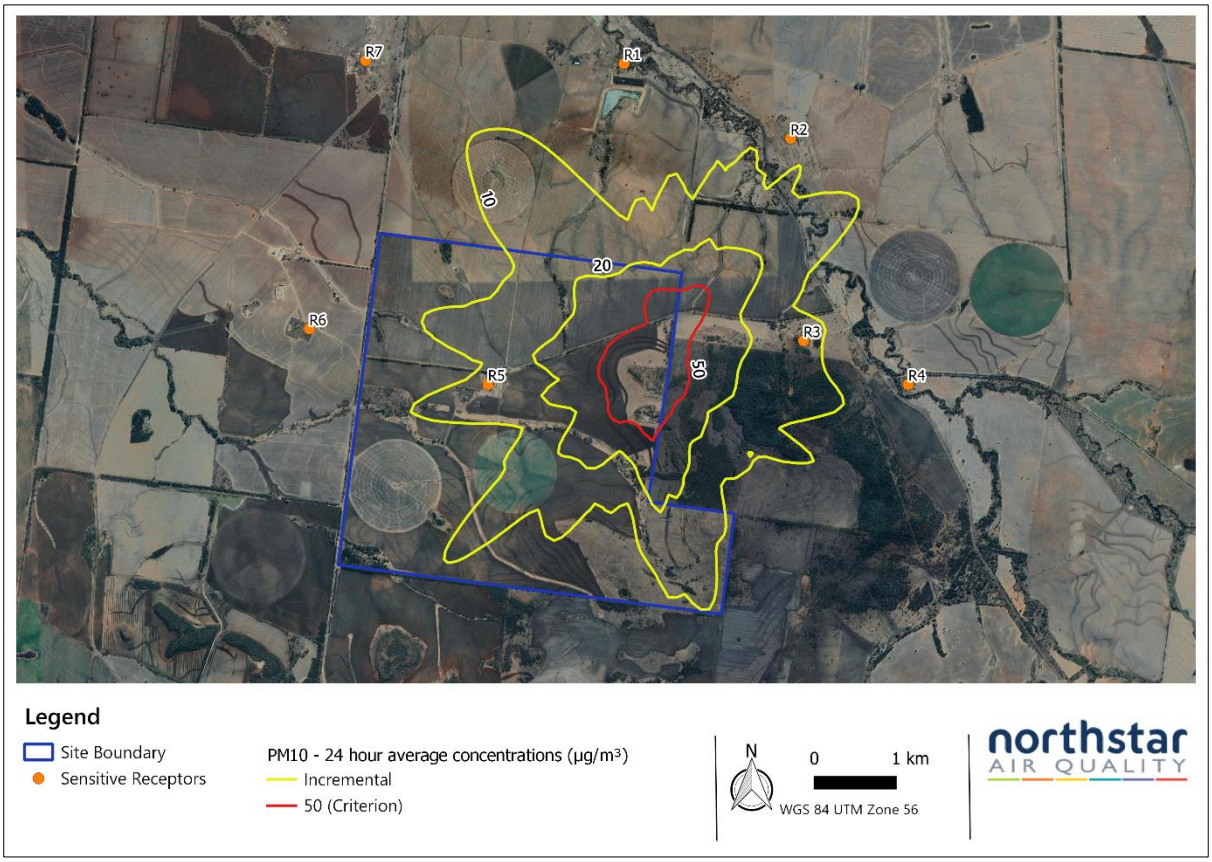
Table 12 Summary of contemporaneous impact and background – PM_{10}

Date	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$) – Receptor 2			Date	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$) – Receptor 3		
	Incremental Impact	Background	Cumulative Impact		Incremental Impact	Background	Cumulative Impact
10/04/2017	2.1	54.1	56.2	21/06/2017	12.4	15.5	27.9
12/02/2017	<0.1	50.9	51.0	24/06/2017	7.4	24.9	32.3
24/09/2017	<0.1	39.6	39.7	26/05/2017	6.8	18.3	25.1
23/08/2017	<0.1	36.9	37.0	22/10/2017	6.6	11.3	17.9
13/09/2017	<0.1	34.7	34.8	23/07/2017	6.2	15.6	21.8
13/02/2017	0.6	34.1	34.7	9/10/2017	6.1	8.7	14.8
29/03/2017	<0.1	34.0	34.1	19/07/2017	6.1	9.6	15.7
27/09/2017	<0.1	33.6	33.7	4/06/2017	6.0	10.9	16.9
26/10/2017	<0.1	32.7	32.8	4/08/2017	5.6	6.6	12.2
25/09/2017	<0.1	31.2	31.3	9/06/2017	5.6	8.6	14.2
These data represent the highest Cumulative Impact 24-hour PM_{10} predictions (outlined in red) as a result of the operation of the project.				These data represent the highest Incremental Impact 24-hour PM_{10} predictions (outlined in blue) as a result of the operation of the project.			

Table 13 Summary of contemporaneous impact and background – $PM_{2.5}$

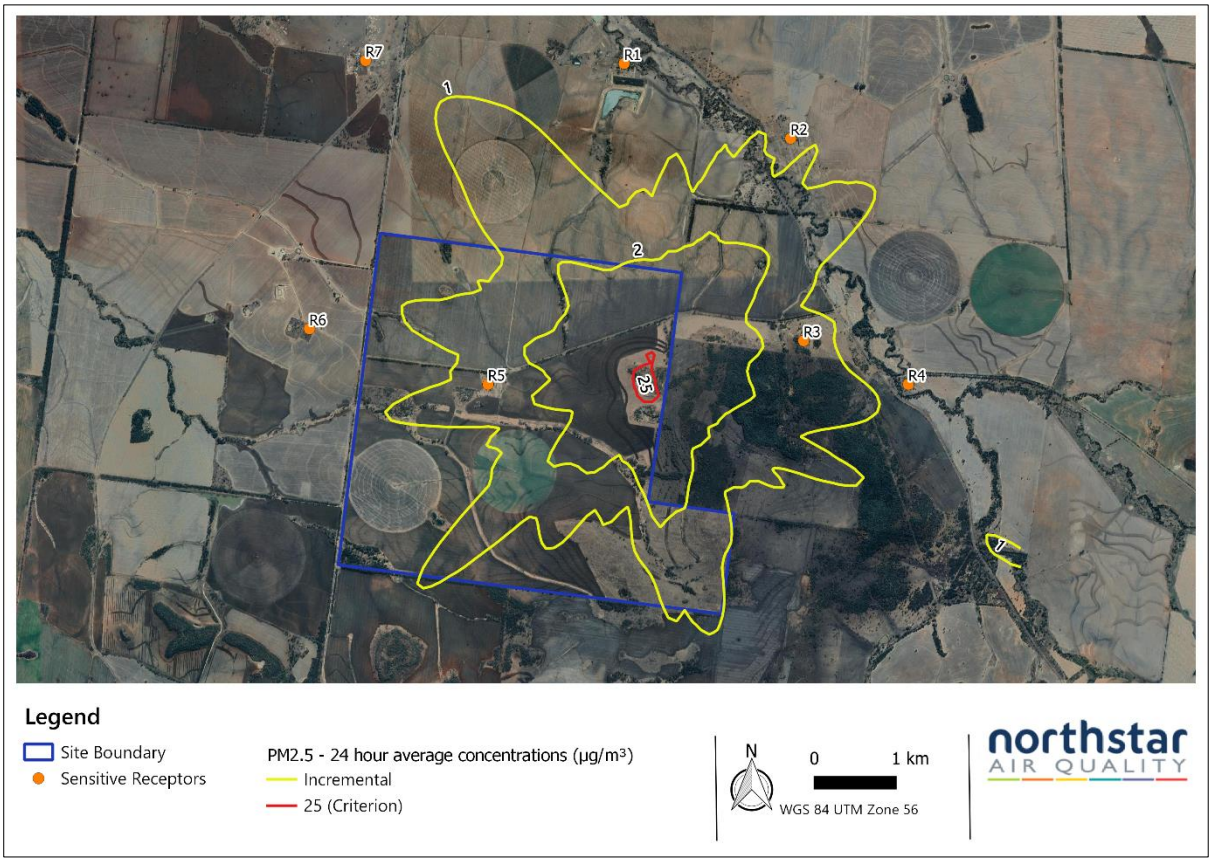
Date	24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – Receptor 5			Date	24-hour average $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – Receptor 3		
	Incremental Impact	Background	Cumulative Impact		Incremental Impact	Background	Cumulative Impact
23/08/2017	0.2	21.6	21.8	21/06/2017	1.4	10.1	11.5
13/02/2017	<0.1	21.5	21.6	24/06/2017	0.8	17.2	18.0
8/07/2017	<0.1	17.5	17.6	19/07/2017	0.7	6.4	7.1
24/06/2017	0.3	17.2	17.5	26/05/2017	0.7	11.4	12.1
2/07/2017	1.1	15.7	16.8	22/10/2017	0.7	4.6	5.3
27/07/2017	0.2	16.4	16.6	23/07/2017	0.7	14.2	14.9
14/02/2017	0.2	15.9	16.1	4/06/2017	0.7	9.7	10.4
22/07/2017	0.7	15.2	15.9	9/10/2017	0.7	4.5	5.2
16/07/2017	0.3	15.6	15.9	9/06/2017	0.6	9.0	9.6
17/07/2017	0.1	15.6	15.7	4/08/2017	0.6	5.3	5.9
These data represent the highest Cumulative Impact 24-hour $PM_{2.5}$ predictions (outlined in red) as a result of the operation of the Quarry.				These data represent the highest Incremental Impact 24-hour $PM_{2.5}$ predictions (outlined in blue) as a result of the operation of the Quarry.			

Figure 9 Incremental 24-hour PM_{10} concentrations



Note 1: Criterion = 50 µg·m^{-3} (cumulative)

Figure 10 Incremental 24-hour $PM_{2.5}$ concentrations



Note 1: Criterion = 25 µg·m^{-3} (cumulative)

6.4 Emissions Associated with Offsite Transportation

As required within the EARs (refer **Section 1.1**), an assessment of the impact of offsite transportation is required to be provided. Given that offsite transportation would be likely to peak in Stage 1 operations, with up to 132 peak daily vehicles trips (1-way) occurring between the hours of 6am and 6pm, this is the scenario which has been selected for assessment. The potential incremental impacts at distance from an unpaved road are presented in **Figure 11** and **Figure 12** for PM_{10} and $PM_{2.5}$ concentrations, respectively.

Figure 11 Predicted maximum incremental 24-hour average PM_{10} at distance from roadside

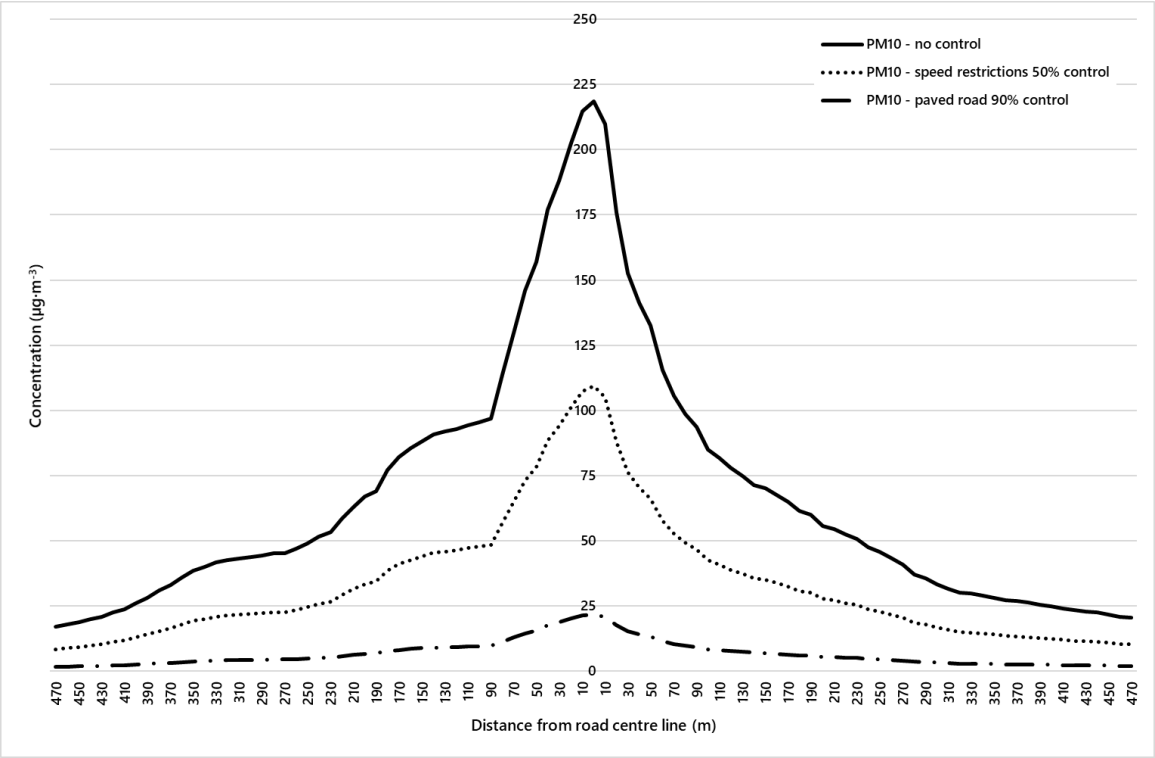
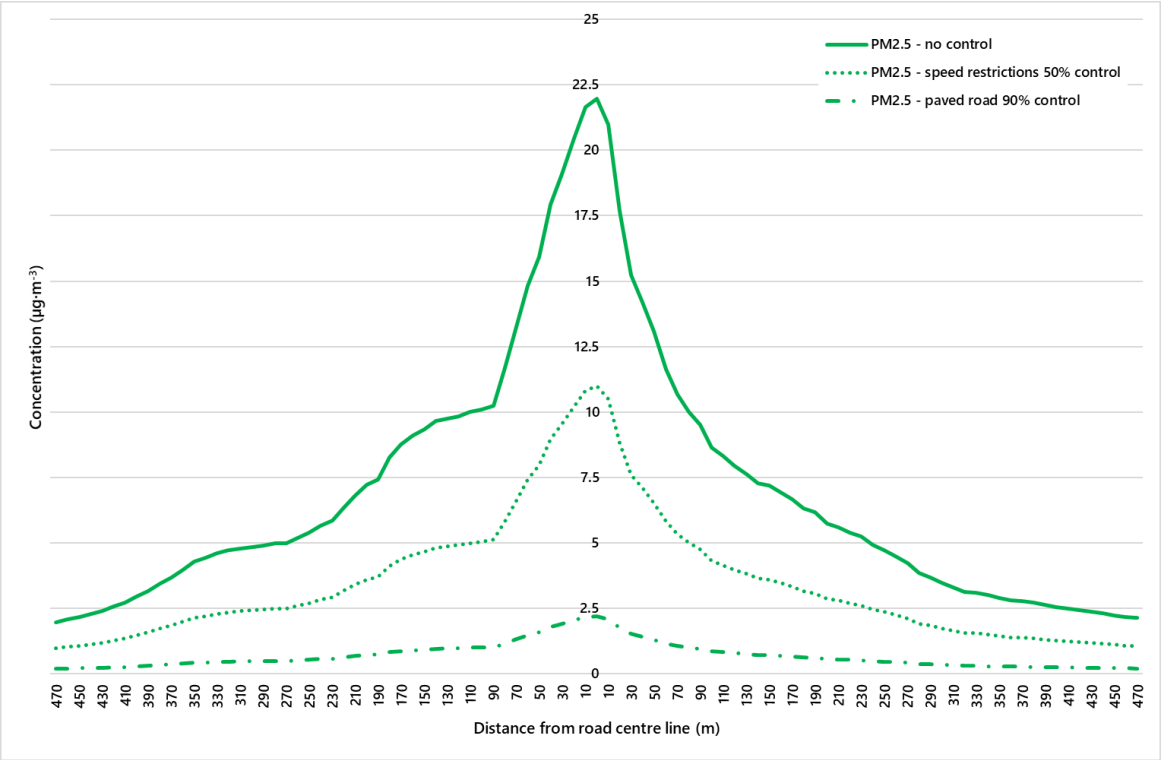


Figure 12 Predicted maximum incremental 24-hour average $PM_{2.5}$ at distance from roadside



The results indicate that concentrations of PM_{10} and $PM_{2.5}$ resulting from offsite transportation of product during peak periods in operations may be significant at distance from the road if uncontrolled. Receptor locations are identified at distances of approximately 160 m from Minilya Road (receptor R5), should trucks head west, and approximately 695 m from Croppa Creek Road (receptor R6) should trucks head east, once at the North Star Road junction.

A number of controls can be applied to the transportation of material on unpaved road surfaces, and may include the restriction of vehicle speeds, which can reduce emissions of particulate by between 50 % and 85 % if a reduction in speed from 65 $km \cdot hr^{-1}$ to 30 $km \cdot hr^{-1}$ is achieved (Katestone, 2011). Alternatively, emissions of particulate matter can be controlled by over 90 % should the surface be paved (Katestone, 2011). The impact of those emissions reductions is presented in **Figure 11** and **Figure 12** for PM_{10} and $PM_{2.5}$ respectively.

It is noted that the predicted impacts result from 132 vehicles leaving the Quarry each day during peak operations and therefore represent a worst-case scenario. Impacts during average operations would be likely to represent around a third of those impacts, with impacts in Stage 2 lower still.

It is recommended that a management plan is constructed which enforces vehicle speed restrictions when within 500 m of any residence which is located within a distance of 200 m of the offsite haulage route and road signs are placed at the appropriate locations to help enforce that control.

Should complaints be received by residents along the transport route, or should excessive dust be observed to be generated, surface treatments/improvements such as paving should be investigated and employed for those particular stretches of road. In reality, the paving of road surfaces should result in significantly greater than 90 % control of particulate emissions, although the road surfaces would be required to be constructed with sufficient camber to allow any silt which may settle to be flushed during any rainfall events.

It is considered that particulate matter generation during offsite transportation of product can be adequately managed through a combination of the above controls.

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7. MITIGATION AND MONITORING

7.1 Mitigation

Based on the findings of the operational phase air quality impact assessment, it is considered that the particulate control measures proposed to be implemented will be sufficient to ensure that exceedances of all particulate criteria would not be experienced as a result of the construction or operation of the Quarry.

No additional exceedances of the 24-hour PM_{10} or $PM_{2.5}$ criteria are predicted as a result of the proposed activities at the Quarry. The incremental contributions from the Quarry are predicted to be low and are not anticipated to significantly alter the air quality environment of the local area.

A number of mitigation measures are proposed to be implemented as part of the Quarry operation. Where defensible quantification of the control efficiencies afforded by these measures can be determined, these have been applied within the assessment.

The mitigation measures which will be used as part of the Quarry activities are summarised in **Table 14**.

Table 14 Summary of emission reduction methods adopted as part of Quarry operation

Emission control method	Control efficiency (%)
Road Haulage	
Surface treatment – application of water	50
Drilling	
Dust collection on drill rig	90
Materials Handling	
Covering loads with a tarpaulin	Not quantified
Limit load sizes to ensure material is not above the level of truck sidewalls	Not quantified
Minimising travel speeds and distances	Not quantified
Keep travel routes and materials moist	50
Materials Processing	
Application of water on crushing activities	77.7
Application of water on screening activities	91.2
Wind Erosion	
Application of water	(see below)
All Activities within Building	
Enclosure of activities	70
Off-site Unpaved Road Emissions	
Road speed reduction from 65 $km \cdot hr^{-1}$ to 30 $km \cdot hr^{-1}$	50 - 85

As previously discussed, the proponent proposes to continually apply water to all exposed areas of the Quarry using the water truck. Apart from on-site haulage routes, these emissions reductions have not been applied in any stage of construction or operation in the air quality modelling assessment. The continual application of water to large areas is likely to be unmanageable in periods of water shortage, and therefore the assessment seeks to provide assurances that the air quality criteria can be met at all surrounding sensitive receptor locations, without this additional level of control.

Watering of unpaved haulage routes on site has been assumed to occur continuously and an emission reduction of 50 % has been applied, which is consistent with the application of <2 $L \cdot m^{-2} \cdot hr^{-1}$. Should water availability become an issue at the Quarry, or should visible dust be observed to be emitted from haulage routes, the proponent would apply low silt aggregate and reduce the speeds of vehicles along those routes. In this way, the emission reduction efficiencies associated with haulage route watering applied within this assessment can be maintained, even in conditions of water shortage.

NSW EPA has requested that consideration be given to dust management techniques that can be used when water is limited or unavailable. It is respectfully considered that this assessment has demonstrated that impacts can be managed even when water is limited, through the adoption of alternative control techniques. It is noted that the model predictions assume that no control is applied to exposed areas, and therefore the impacts presented represent a potential worst-case scenario in that regard.

7.2 Monitoring

The predictions presented in this AQIA indicate that there would be no predicted exceedances of the adopted air quality criteria. It is not anticipated that any air quality monitoring would be required to be performed, although it is recommended that regular audits are performed to ensure that the Quarry site is implementing the air quality control measures appropriately, as outlined within this report.

NSW EPA has requested that a Trigger Action Response Plan (TARP) is considered to be developed for the Quarry site. A TARP identifies conditions (triggers) under which dust controls are applied, or activities are modified or ceased (actions) in response to increasing risk of elevated particulate concentrations at surrounding receptor locations. Given that no air quality monitoring is proposed, the increased risk of elevated particulate concentrations would be determined through examination of visible dust generation, and the observation of prevailing wind conditions (wind speed and direction). Wind conditions can be appropriately observed through the installation of a wind cone, and an appropriate trigger level which results in visible dust generation from all activities would be reviewed prior to Stage 1 operations. It is noted that the determination of these triggers is not critical to the compliance of air quality criteria at off-site locations, as the AQIA predicts compliance in all wind speed/direction combinations assessed (8,760 hours, or 1 full year of hourly meteorological predictions).

8. CONCLUSION

OzArk Environment and Heritage has engaged Northstar on behalf of Regional Quarries Australia Pty Ltd to perform an AQIA for the proposed development of a quarry located at 5535 North Star Road, North Star NSW 2408 (the Quarry site).

This AQIA forms part of the EIS prepared to accompany the development application for the Quarry under Part 4 of the *Environmental Planning and Assessment Act* 1979.

Emissions of particulate matter associated with construction phase and operational phase activities have been estimated, including a number of emission control measures proposed to be adopted. To ensure that the assessment provides an appropriately conservative approximation of the potential impacts at surrounding receptor locations, certain control measures which are proposed to be adopted have not been included in the assessment, specifically the watering of exposed areas. In this way, the predicted incremental impacts can be viewed as worst-case.

The AQIA presents an assessment of the impacts of activities associated with the maximum operational activity of the Quarry at 490 000 $t \cdot yr^{-1}$ to service the Inland Rail Project, which is anticipated to occur on a single year within the first five years. After the peak year, the extraction rate is anticipated to reduce to 150 000 $t \cdot yr^{-1}$, and as such the assessment at the peak annual rate will address the risks of lower activity rates. An assessment of the potential air quality impacts along off-site transportation routes has also been provided. The AQIA has used a quantitative dispersion modelling approach, performed in accordance with the relevant NSW guidelines. The results of the assessment are presented as predicted incremental change, and as a cumulative impact accounting for the prevailing background air quality conditions.

The results of the AQIA indicate that at the peak extraction rate, the air quality criteria can be achieved. In periods when water may not be readily available, haul road watering may be restricted, and low silt aggregate may be used along internal haul roads, in conjunction with a lowering of vehicle speeds, to result in similar off-site impacts. As previously noted, the assessment of wind erosion has assumed that no control is applied, with the results indicating that control of this source of emissions is not critical to compliance with air quality criteria. It is stressed that watering of exposed areas will be performed when possible.

A Trigger Action Response Plan (TARP) would be developed prior to Stage 1 operations which would link visible dust generation from all activities with wind conditions experienced at the Quarry site. A range of actions would be listed which would be adopted to reduce visible dust generation, until such time as the adopted trigger levels have reduced. It is noted that the adoption of a TARP is not critical to ensure compliance with the adopted air quality criteria, and its use should result in impacts being less than those predicted within this AQIA.

It is demonstrated that the Quarry can be operated in such a manner as to ensure compliance with all adopted air quality criteria, and the development should not be refused on the grounds of air quality.

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APPENDIX A

Report Units and Common Abbreviations

Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units. In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol. For example:

- 50 micrograms per cubic metre would be presented as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$; and,
- 0.2 kilograms per hectare per hour would be presented as 0.2 $kg \cdot ha^{-1} \cdot hr^{-1}$ and not 0.2 kg/ha/hr.

Table A1 Common Abbreviations

Abbreviation	Term
ABS	Australian Bureau of Statistics
AHD	Australian height datum
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AWS	automatic weather station
BoM	Bureau of Meteorology
°C	degrees Celsius
CO	carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPIE	NSW Department of Planning, Industry and Environment
EETM	emission estimation technique manual
EPA	Environmental Protection Authority
FEL	front end loader
GDA	Geocentric Datum of Australia
GIS	geographical information system
K	kelvin (-273°C = 0 K, ±1°C = ±1 K)
kW	kilowatt
MGA	Map Grid of Australia
$mg \cdot m^{-3}$	milligram per cubic metre of air
$mg \cdot Nm^{-3}$	Milligram per normalised cubic metre of air
$\mu g \cdot m^{-3}$	microgram per cubic metre of air
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
OEH	NSW Office of Environment and Heritage (now defunct)
PM	particulate matter

Abbreviation	Term
PM_{10}	particulate matter with an aerodynamic diameter of 10 µm or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 µm or less
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEE	Statement of Environmental Effects
TAPM	The Air Pollution Model
TPM	total particulate matter
TSP	total suspended particulates
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VKT	vehicle kilometres travelled

APPENDIX B

Meteorology

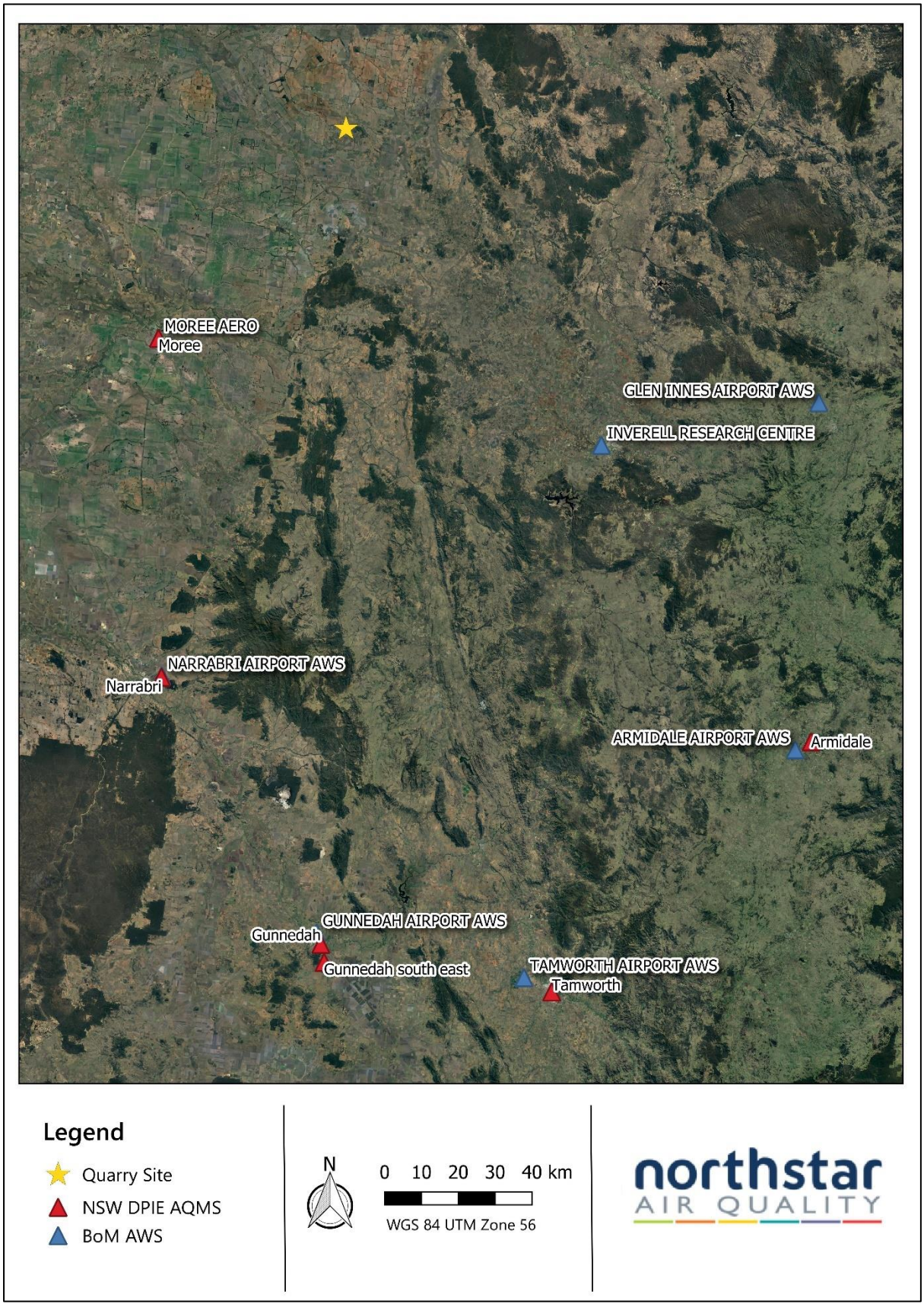
As discussed in **Section 4.2** a meteorological modelling exercise has been performed to characterise the meteorology of the Quarry site in the absence of site-specific measurements. The meteorological modelling has been based on measurements taken at a number of surrounding automatic weather stations (AWS) operated by the Australian Government Bureau of Meteorology (BoM).

A summary of the relevant AWS is provided in **Table B1** and also displayed in **Figure B1**.

Table B1 Details of the meteorological monitoring surrounding the Quarry site

Site Name	Source	Approximate Location (UTM)		Approximate Distance
		mE	mS	km
Moree Aero AWS #053115	BoM	776 048	6 734 368	75
Inverell Research Centre AWS #056018	BoM	314 580	6 704 582	109
Glen Innes AWS #056243	BoM	373 629	6 716 180	145

Figure B1 Meteorological and air quality monitoring surrounding the Quarry site

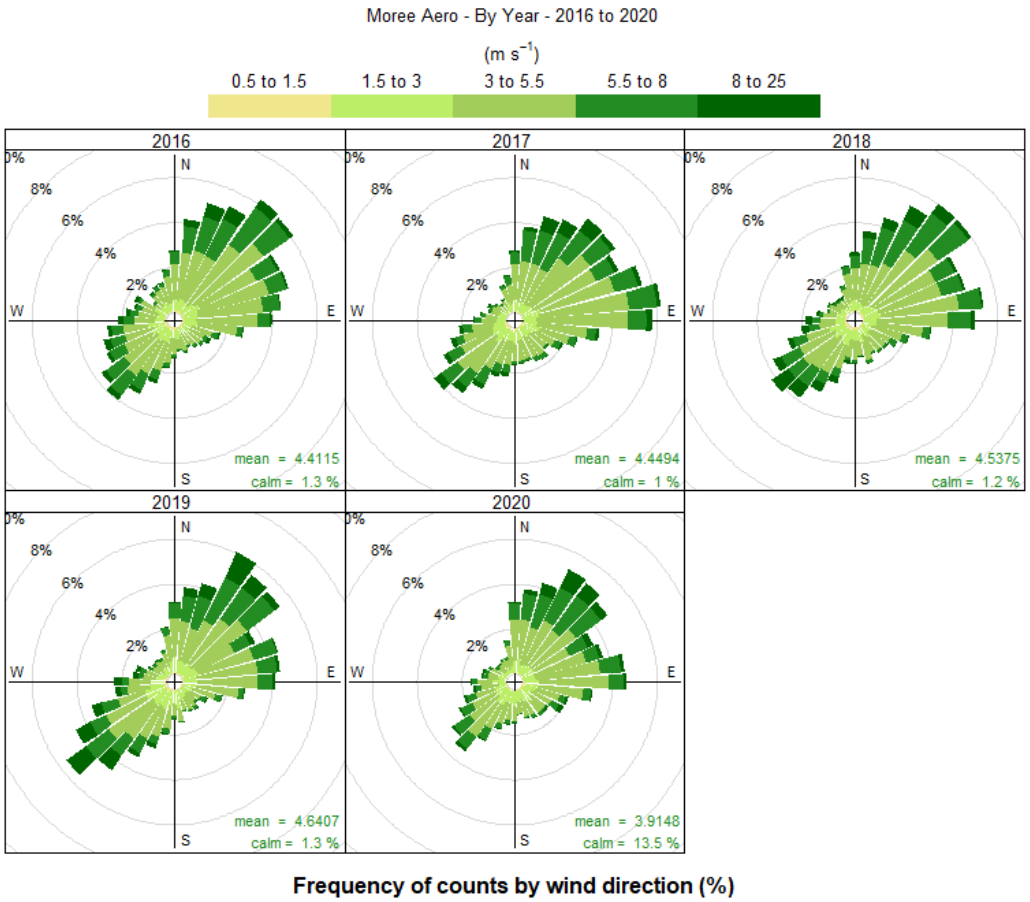


Meteorological conditions at Moree Aero AWS have been examined to determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for the most recent years of data (2016 to 2020) are presented in **Figure B2**.

The wind roses indicate that from 2016 to 2020, winds at Moree Aero AWS are predominantly experienced from the northeast with south-westerly components also evident.

The majority of wind speeds experienced at the Moree Aero AWS between 2016 and 2020 are generally in the range 1.5 meters per second ($m \cdot s^{-1}$) to 5.5 $m \cdot s^{-1}$ with the highest wind speeds (greater than 8 $m \cdot s^{-1}$) occurring from north-easterly and south-westerly directions. Winds of this speed are rare and occur during 6.7 % of the observed hours during the years. Calm winds (<0.5 $m \cdot s^{-1}$) prevail and occur more than 3.7 % of hours across the years.

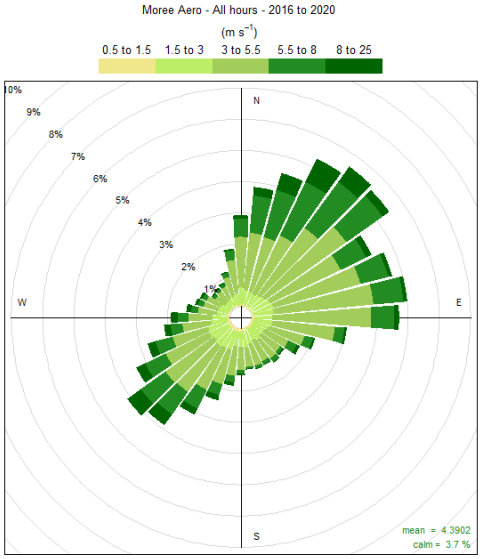
Figure B2 Annual wind roses 2016 to 2020, Moree Aero AWS



Given the similarities in the wind distribution across the years examined, data for the year 2017 has been selected for further assessment. Presented in **Figure B3** are the annual wind rose for the 2016 to 2020 period and the year 2017 and in **Figure B4** the annual wind speed distribution for Moree Aero AWS. These figures indicate that the distribution of wind speed and direction in 2017 is very similar to that experienced across the longer-term period.

It is concluded that conditions in 2017 may be considered to provide a suitably representative dataset for use in dispersion modelling.

Figure B3 Annual wind roses 2016 to 2020, and 2017 Moree Aero AWS



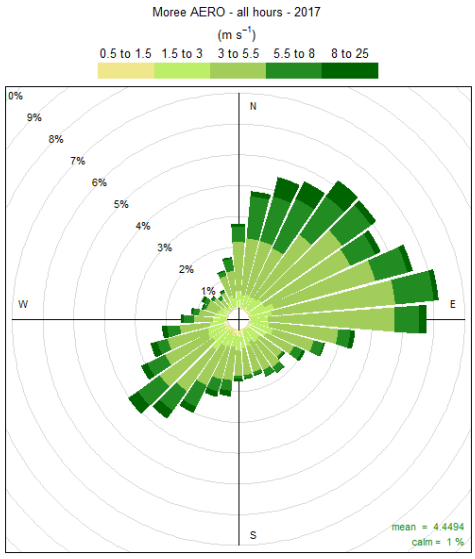
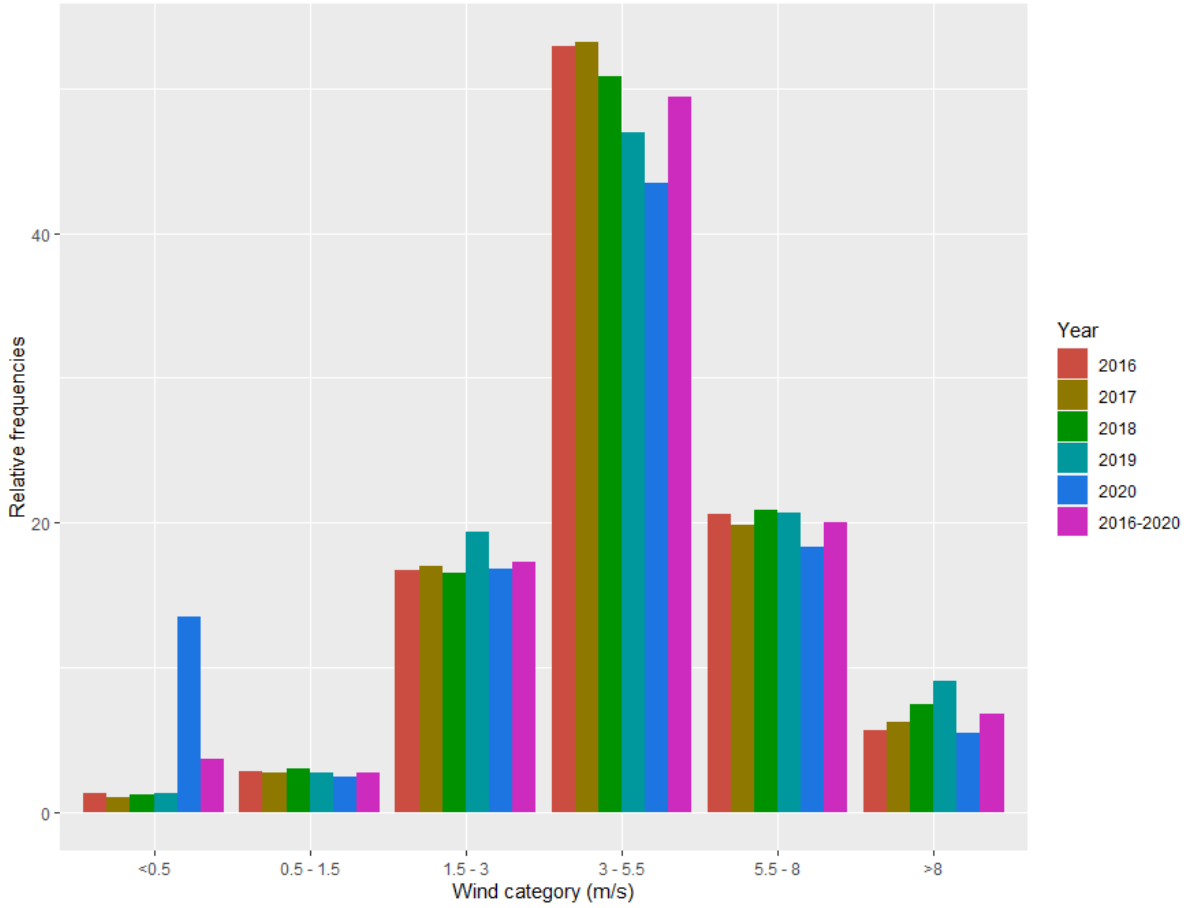


Figure B4 Annual wind speed distribution – Moree Aero AWS



Meteorological Modelling

The BoM data adequately covers the issues of data quality assurance, however it is limited by its location compared to the Quarry site. To address these uncertainties, a multi-phased assessment of the meteorological data has been performed.

In absence of any measured onsite meteorological data, site representative meteorological data for this Quarry was generated using the TAPM meteorological model in a format suitable for using the CALPUFF dispersion model (refer **Section 4.2**).

Meteorological modelling using The Air Pollution Model (TAPM, v 4.0.5) has been performed to predict the meteorological parameters required for CALPUFF. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

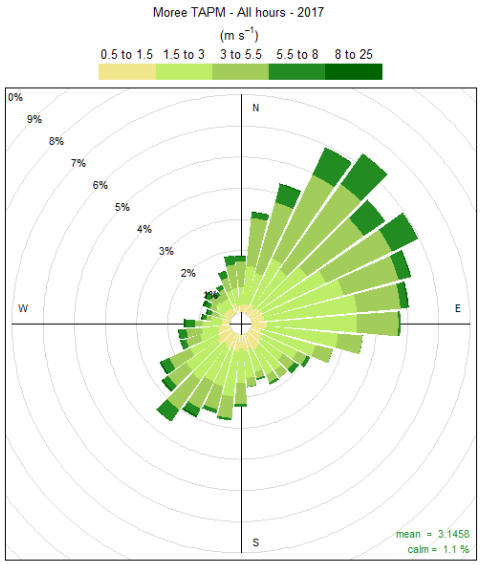
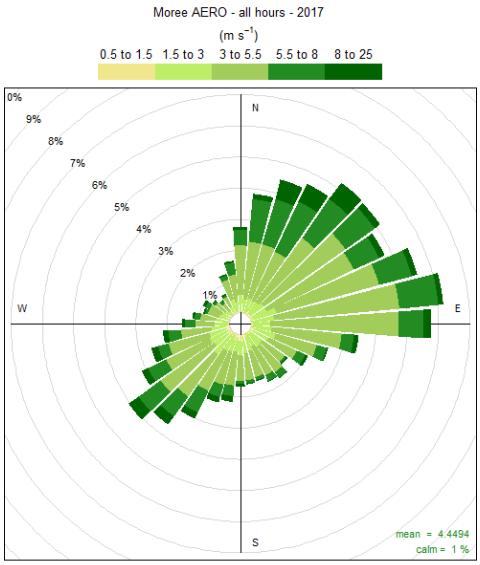
The parameters used in TAPM modelling are presented in **Table B2**.

Table B2 Meteorological parameters used for this study

TAPM v 4.0.5	
Modelling period	1 January 2017 to 31 December 2017
Centre of analysis	221 220 mE, 6 768 300 mN (UTM Coordinates)
Number of grid points	111 x 111 x 25
Number of grids (spacing)	4 (13 km, 6 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	No data assimilation

A comparison of the TAPM generated meteorological data, and that observed at the Moree Aero AWS are presented in **Figure B5**. These data generally compare well which provides confidence that the meteorological conditions modelled as part of this assessment are appropriate.

Figure B5 Modelled and observed meteorological data – Moree Aero AWS, 2017

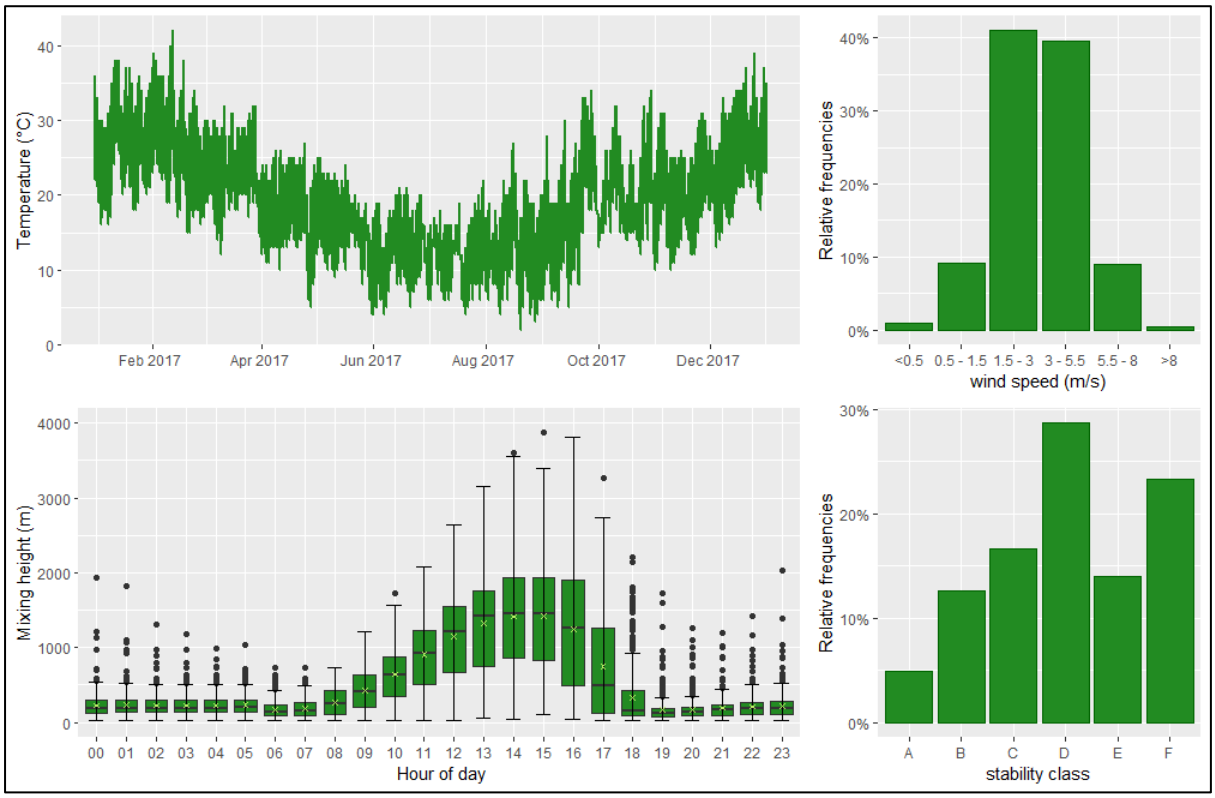
Moree Aero TAPM generated windrose	Observations at Moree Aero AWS
	
Frequency of counts by wind direction (%)	Frequency of counts by wind direction (%)

As generally required by the NSW EPA the following provides a summary of the modelled meteorological dataset. Given the nature of the pollutant emission sources at the Quarry site, detailed discussion of the humidity, evaporation, cloud cover, katabatic air drainage and air recirulation potential of the Quarry site has not been provided. Details of the TAPM predictions of wind speed and direction, mixing height, temperature and stability class at the Quarry site are provided in **Figure B6**.

The modelled temperature variations at the Quarry site during 2017 predicted a maximum temperature of 42°C on 12 February 2017 and a minimum temperature of 2°C on the 20 August 2017.

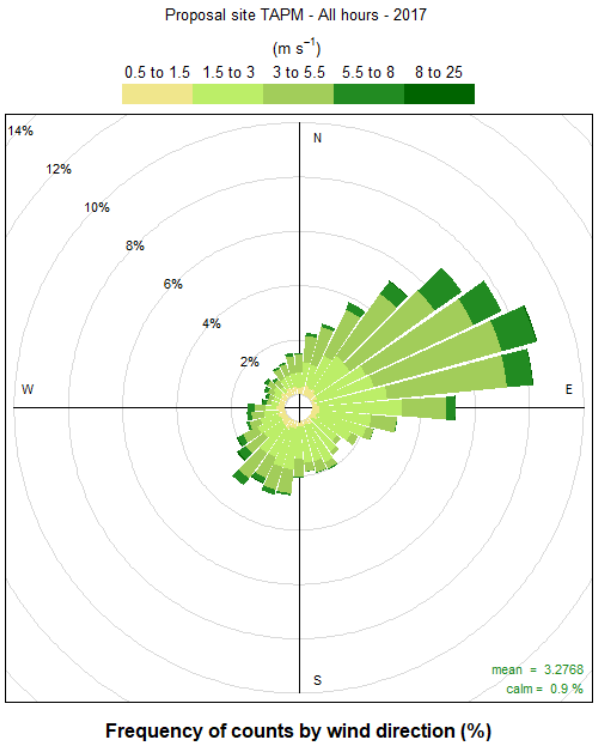
Diurnal variations in maximum and average mixing heights during the 2017 period shows that, as expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and growth of the convective mixing layer.

Figure B6 Predicted temperature, mixing height and wind speed frequency – Quarry site 2017



The modelled wind speed and direction at the Quarry site during 2017 are presented in **Figure B8**.

Figure B7 Predicted wind speed and direction – Quarry site 2017



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APPENDIX C

Background Air Quality Data

Air quality is not monitored at the Quarry site and therefore air quality monitoring data measured at a representative location has been adopted for the purposes of this assessment. Determination of data to be used as a location representative of the Quarry site and during a representative year can be complicated by factors which include:

- the sources of air pollutant emissions around the Quarry site and representative air quality monitoring station(s); and,
- the variability of particulate matter concentrations (often impacted by natural climate variability).

Air quality monitoring is performed by the NSW Department of Planning, Industry and Environment (DPIE) at four air quality monitoring station (AQMS) within a 240 km radius of the Quarry site. Details of the monitoring performed at these AQMS is presented in **Table C1** and **Figure B1**. As discussed in **Section 4.2** and **Section 4.3**, the year 2017 was selected for assessment based upon an analysis of meteorological and background air quality data.

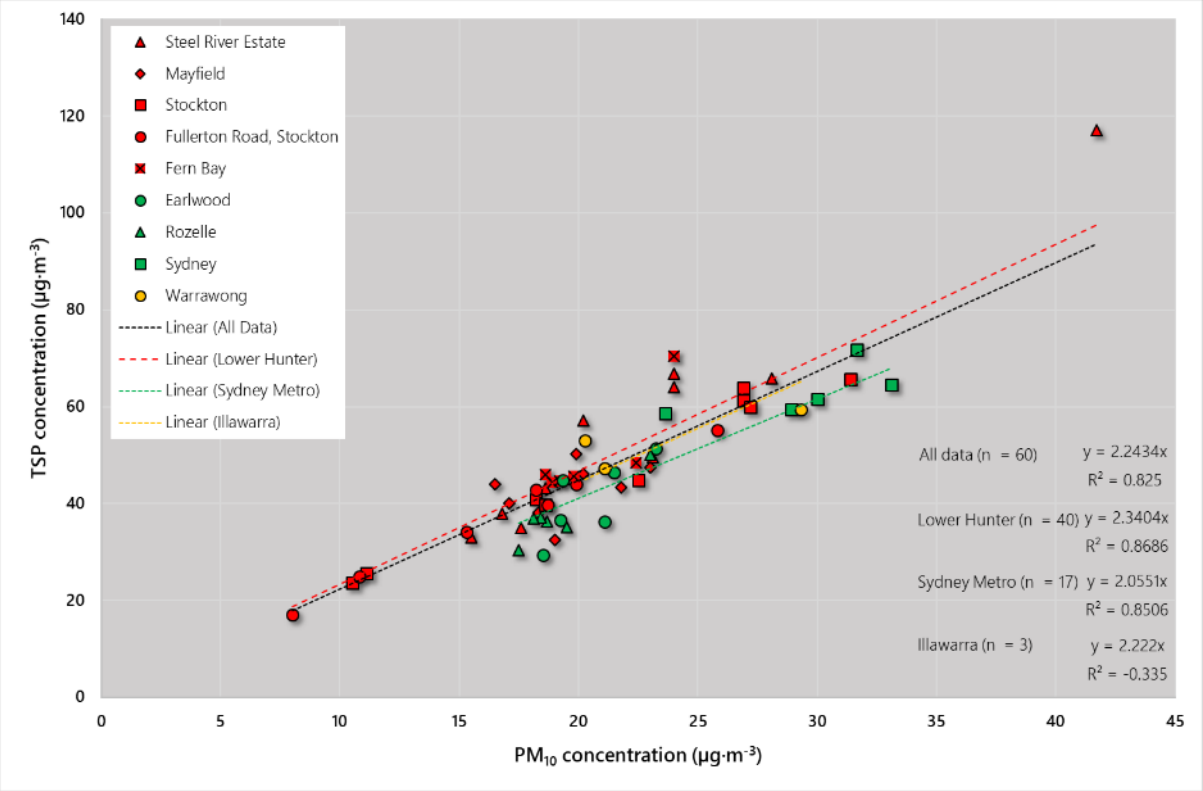
Table C1 Details of closest AQMS surrounding the Quarry

AQMS Location	Approximate distance to Quarry (km)	Screening Parameters			
		2017 Data	Measurements		
			PM_{10}	$PM_{2.5}$	TSP
Narrabri	157	×	✓	✓	×
Armidale	210	×	✓	✓	×
Gunnedah	220	×	✓	✓	×
Tamworth	239	✓	✓	✓	×

Based on the sources of AQMS data available, Tamworth was selected as the source of AQMS data for use in this assessment.

Concentrations of TSP are not measured at any AQMS surrounding the Quarry site. An analysis of co-located measurements of TSP and PM_{10} in the Lower Hunter (1999 to 2011), Illawarra (2002 to 2004), and Sydney Metropolitan (1999 to 2004) regions is presented in **Figure C1**. The analysis concludes that, on the basis of the measurements collected in all regions between 1999 to 2011, the derivation of a broad TSP:PM_{10} ratio of 2.3404 : 1 (i.e. PM_{10} represents ~43% of TSP) from the Lower Hunter is appropriate. In the absence of any more specific information, this ratio has been adopted within this AQIA, resulting in a background annual average TSP concentration of 36.5 $\mu g \cdot m^{-3}$ being adopted.

Figure C1 Co-located TSP and PM_{10} Measurements, Lower Hunter, Sydney Metro and Illawarra



Similarly, no dust deposition data is available for the area surrounding the Quarry. The incremental impact criterion of 2 $g \cdot m^{-2} \cdot month^{-1}$ as outlined within the Approved Methods has been adopted which effectively provides a background deposition level of 2 $g \cdot m^{-2} \cdot month^{-1}$ (the total allowable deposition being 4 $g \cdot m^{-2} \cdot month^{-1}$).

Graphs presenting the daily varying PM_{10} and $PM_{2.5}$ data recorded at Tamworth in 2017 are presented in **Figure C2** and **Figure C3**, respectively. It is noted that no exceedances of the maximum 24-hr average PM_{10} criterion were experienced at the Merriwa AQMS in 2013.

Figure C2 PM_{10} Measurements, Tamworth 2017

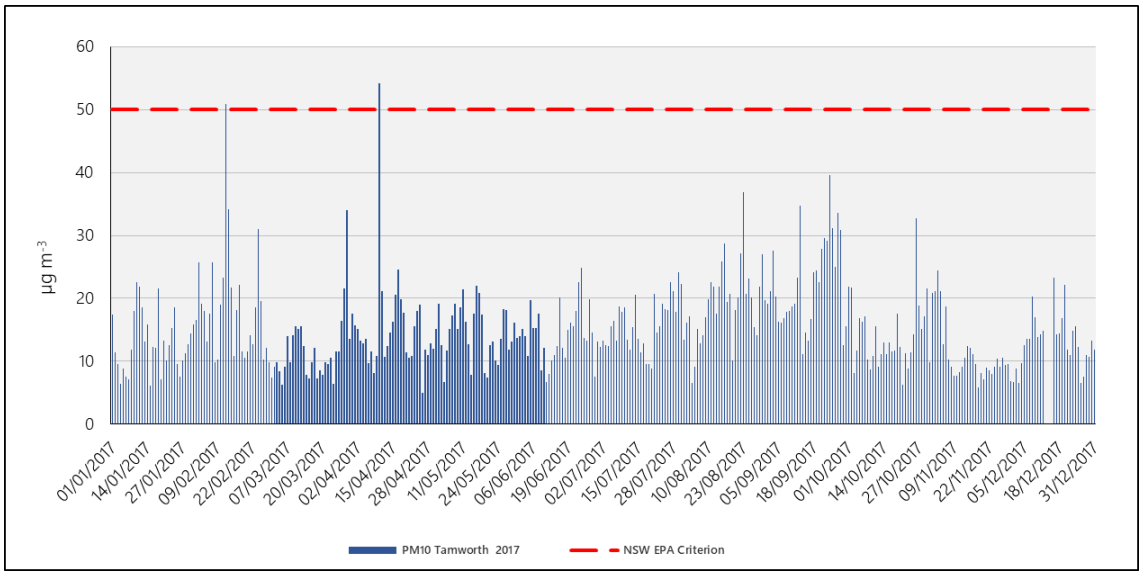
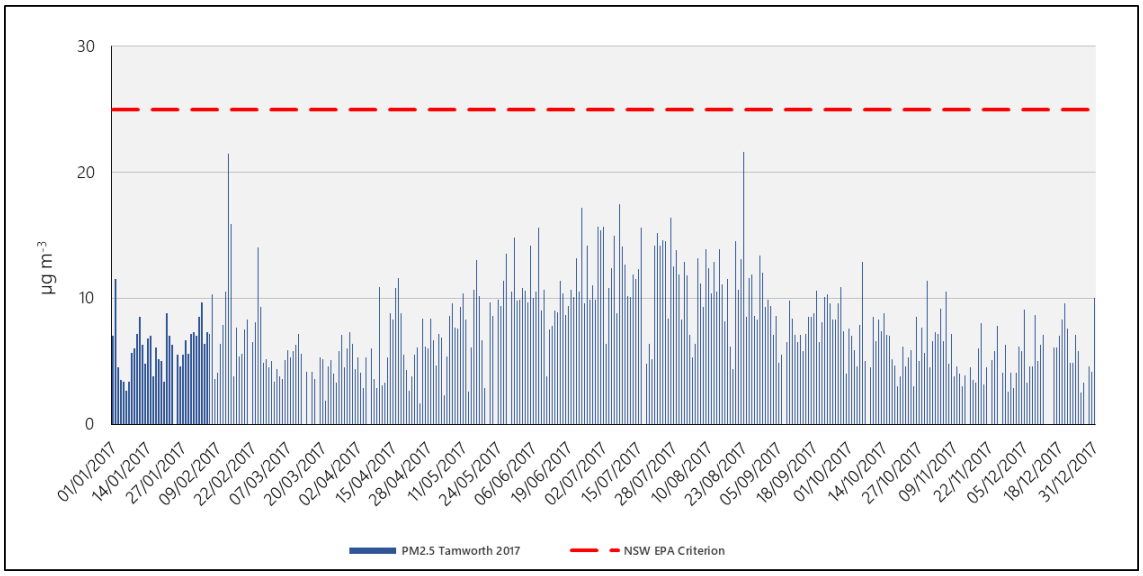


Figure C3 $PM_{2.5}$ Measurements, Tamworth 2017



APPENDIX D

Emissions Inventory

As outlined in **Section 2.2**, a number of operations to be performed as part of the Quarry operation have the potential to result in emissions of particulate matter. A detailed outline of the emission estimation techniques adopted to derive total emissions from the sources identified are presented below.

A detailed summary and justification of all parameters adopted within the emissions estimation calculations is provided. Emission factors are presented in alphabetical order.

The silt and moisture content of overburden, rock and product has been taken to be 2 % which is considered to represent a conservative assumption.

Blasting

The emissions of particulate matter from blasting operations have been estimated using emission factors presented in Section 11.9-2 of AP-42 (Western Surface Coal Mine) (US EPA, 1998). The emission factors are:

$$EF_{TSP}\ (kg.blast^{-1}) = 0.00022 \times (A)^{1.5}$$

$$EF_{PM_{10}}\ (kg.blast^{-1}) = 0.52 \times (EF_{TSP})$$

$$EF_{PM_{2.5}}\ (kg.blast^{-1}) = 0.03 \times (EF_{TSP})$$

where:

$EF_{(kg \cdot blast^{-1})}$ = emission factor for particulate matter

A = horizontal area (m^2), with blasting depth ≤ 21 m.

The quality rating for this emission factor is rated is rated C for TSP, D for PM_{15}, and D for $PM_{2.5}$.

Bulldozing (Overburden)

The emissions of particulate matter from the bulldozing (overburden [or material other than coal in the NPI]) process have been estimated using emission factors presented in Section 11.9-2 of AP-42 (Western Surface Coal Mining) (US EPA, 1998). The emission factor is:

$$EF_{TSP}\ (kg.hr^{-1}) = \frac{2.6 \times (s)^{1.2}}{(M)^{1.3}}$$

$$EF_{PM_{15}}\ (kg.hr^{-1}) = \frac{0.45 \times (s)^{1.5}}{(M)^{1.4}}$$

$$EF_{PM_{10}}(kg.hr^{-1}) = 0.75\ \times EF_{PM_{15}}$$

$$EF_{PM_{2.5}}\ (kg.hr^{-1}) = 0.105 \times EF_{TSP}$$

where:

$EF_{(kg \cdot hr^{-1})}$ = emission factor for particulate matter

$s_{(\%)}$ = silt content in %, by weight

$M_{(\%)}$ = moisture content of overburden in %, by weight

The quality rating for this emission factor is rated B for TSP, C for PM_{15}, D for PM_{10}, D for $PM_{2.5}$.

Crushing (Primary and Secondary)

Emissions of particulate matter resulting from the processing of materials (primary and secondary crushing) have been estimated using the emission factors presented in Section 11.19.2 of AP-42 (Crushed Stone Processing and Pulverised Mineral Processing) (US EPA, 2004).

The emission factors within table 11.19.2-1 have been adopted for the operations outlined above. No emission factors associated with primary or secondary crushing are available within AP-42 although emission factors for tertiary crushers can be used as an upper limit for primary or secondary crushing (US EPA, 2004). The control efficiency used for tertiary crushing is 77.7% as calculated in AP-42 (US EPA, 2004).

$PM_{2.5}$ emission factors are not available for uncontrolled crushing sources in AP-42 although have been taken to be 18% of PM10 as per controlled tertiary crushing in table 11.19.2-1 (US EPA, 2004)

For uncontrolled tertiary crushing (and uncontrolled primary and secondary crushing):

$$EF_{TSP}\ (kg.tonne^{-1}) = 0.0027$$

$$EF_{PM_{10}}\ (kg.tonne^{-1}) = 0.0012$$

$$EF_{PM_{2.5}}\ (kg.tonne^{-1}) = 0.00012$$

For controlled tertiary crushing (and controlled primary and secondary crushing):

$$EF_{TSP}\ (kg.tonne^{-1}) = 0.0006$$

$$EF_{PM_{10}}\ (kg.tonne^{-1}) = 0.00027$$

$$EF_{PM_{2.5}}\ (kg.tonne^{-1}) = 0.00005$$

The quality rating for these emission factors is: Tertiary Crushing (uncontrolled) = E & C (TSP & PM_{10} respectively), and Tertiary Crushing (controlled) = E, C & E (TSP, PM_{10} & $PM_{2.5}$ respectively). All other crushing emission factors calculated have a quality rating of U (no rating).

Drilling

Emissions of particulate matter resulting from drilling (overburden) operations have been estimated using the emission factors presented in Section 11.9-4 of AP-42 (Western Surface Coal Mining) (US EPA, 1998).

The emission factors within table 11.9-4 have been adopted for the operations outlined above. The emission factor is:

$$EF_{TSP}\ (kg.hole^{-1}) = 0.59$$

where:

EF_{TSP} = emission factor for total suspended particulate matter (kg per hole)

PM_{10} & $PM_{2.5}$ emission factors are not available in AP-42 although have been taken to be 52% of TSP for PM10 and, 3% of TSP for $PM_{2.5}$ as per AP-42 blasting (Table 11.9-2) (US EPA, 1998).

The quality rating for this emission factor is C.

Excavators/Frontend Loaders

Emissions associated with all loading and unloading operations have been characterised using the factor outlined in AP-42 for Batch Drop processes (Section 13.2.4.3) (US EPA, 2006b). This equation is consistent with that associated with the use of excavators, shovels and front end loaders outlined in the NPI EETM for Mining (NPI, 2012):

$$EF\ (kg \cdot tonne^{-1}) = k(0.0016)\ \frac{\left(\frac{U\ (m \cdot s^{-1})}{2.2}\right)^{1.3}}{\left(\frac{M\ (\%)}{2}\right)^{1.4}}$$

where:

$EF_{TSP\ (kg \cdot tonne^{-1})}$ = emission factor for total suspended particles

$EF_{PM_{10}\ (kg \cdot tonne^{-1})}$ = emission factor for total suspended particles

k_{TSP} = 0.74 for particles less than 30 micrometres aerodynamic diameter

$k_{PM_{10}}$ = 0.35 for particles less than 10 micrometres aerodynamic diameter

$k_{PM_{2.5}}$ = 0.053 for particles less than 2.5 micrometres aerodynamic diameter

U = mean wind speed ($m \cdot s^{-1}$)

M = material moisture content (% by weight)

The quality rating for this application is rated U (no rating).

Grading

The emissions of particulate matter from grading operations have been estimated using emission factors presented in Section 11.9-2 of AP-42 (Western Surface Coal Mine) (US EPA, 1998). The emission factor is:

$$EF_{TSP}\ (kg.VKT^{-1}) = 0.0034 \times (S)^{2.5}$$

$$EF_{PM_{10}}\ (kg.VKT^{-1}) = 0.60 \times (EF_{PM_{15}})$$

$$EF_{PM_{2.5}}\ (kg.VKT^{-1}) = 0.031 \times (EF_{TSP})$$

where:

$EF_{(kg \cdot VKT^{-1})}$ = emission factor for particulate matter

S = mean vehicle speed (km·hr^{-1}), taken to be 10 km·hr^{-1}.

The quality rating for this emission factor is rated C for TSP, D for PM_{10}, D for $PM_{2.5}$.

Screening

Emissions of particulate matter resulting from the screening of material have been estimated using the emission factors presented in Section 11.19.2 of AP-42 (Crushed Stone Processing and Pulverised Mineral Processing) (US EPA, 2004).

The emission factors within table 11.19.2-1 have been adopted for the operations outlined above. PM2.5 emission factors are not available for uncontrolled screening sources in AP-42 although have been taken to be 7% of PM10 as per controlled screening activities in table 11.19.2-1 (US EPA, 2004). The control efficiency used for screening is 91.2% as calculated in AP-42 (US EPA, 2004).

For uncontrolled screening:

$$EF_{TSP}\ (kg.tonne^{-1}) = 0.0125$$

$$EF_{PM_{10}}\ (kg.tonne^{-1}) = 0.0043$$

$$EF_{PM_{2.5}}\ (kg.tonne^{-1}) = 0.00030$$

For controlled screening:

$$EF_{TSP}\ (kg.tonne^{-1}) = 0.0011$$

$$EF_{PM_{10}}\ (kg.tonne^{-1}) = 0.00037$$

$$EF_{PM_{2.5}}\ (kg.tonne^{-1}) = 0.000025$$

The quality rating for these emission factors is: screening (uncontrolled) = E & C (TSP & PM_{10} respectively), and screening (controlled) = E, C & E (TSP, PM_{10} & $PM_{2.5}$ respectively). All other screening emission factors calculated have a quality rating of U (no rating).

Unpaved Roads

Emissions of particulate matter resulting from the movement of materials on unpaved roads have been estimated using the emission factors presented in Section 13.2.2 (Unpaved Roads) of AP-42 (US EPA, 2006a).

The emission factor in section 13.2.2 of (US EPA, 2006a) has been adopted for the operations of vehicles on unpaved roads:

$$EF_{(kg.VKT^{-1})} = 0.2819 \times k \times (\frac{s}{12})^{a} \times (\frac{W \times 0.907185}{3})^{b}$$

where:

$EF_{(kg.VKT^{-1})}$ = emission factor (kg per vehicle kilometre travelled) multiplied by 0.2819 to convert from lb per vehicle mile travelled

k = particle size multiplier (dimensionless)

s = surface material silt content (%)

W = mean vehicle weight (tons) multiplied by 0.907185 to convert from metric tonnes

The particle size multipliers for TSP, PM_{10} and $PM_{2.5}$ (k) are provided in (US EPA, 2006a) as 4.9, 1.5 and 0.15, respectively.

The quality rating for this application is rated B for TSP, B for PM_{10} and B for $PM_{2.5}$.

The silt content of unpaved haul roads at the Quarry site has been taken to be 8.3% which is consistent with haul roads at stone quarrying and processing sites (Table 13.2.2-1 of (US EPA, 2006a)).

The mean weight of vehicles use on site has been calculated based on the use of '40 t' dump trucks, such as the CAT A40G (or similar) which has a payload of 39 t, tare weight of 29.9 t and a loaded weight of 68.9 t (ritchiespecs.com). The average vehicle weight has therefore been calculated to be 49.4 t (metric).

Vehicles transporting product offsite have been assumed to have a payload of 38 t, tare weight of 18t and a loaded weight of 56 t, resulting in an average vehicle weight of 37 t.

Wind Erosion (Exposed Areas)

Emissions of particulate matter resulting from the wind erosion of exposed areas have been estimated using the emission factors presented in Section 11.9-4 of AP-42 (Western Surface Coal Mining) (US EPA, 1998).

The emission factors within table 11.9-4 have been adopted for the operations outlined above. The emission factor applies to the materials: seeded land, stripped overburden and graded overburden. The emission factor is:

$$EF_{TSP}\ (tonne.(hectare.year)^{-1}) = 0.85$$

where:

$EF_{TSP}\ (tonne.(hectare.year)^{-1})$= emission factor for total suspended particulate matter

PM_{10} and $PM_{2.5}$ emission factors are not available in AP-42 although have been taken to be 50% of TSP for PM_{10} and, 7.5% of TSP for $PM_{2.5}$ as per AP-42 section (13.2.5) for industrial wind erosion (US EPA, 2006c).

The quality rating for this emission factors is C.

490 000 tpa - 24-hour maximum

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·day^{-1})		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$
Drilling of blast holes	AP-42 - Drilling (Overburden) - Table 11.9-4	0.59	0.306	0.0177	kg·hole^{-1}	10	holes	Dust collection on drill rig (90%) Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	0.30	0.29	0.02
Blasting of fresh rock	AP-42 - Blasting (Coal or Overburden) - Table 11.9-2	4.02	2.09	0.12	kg·blast^{-1}	1	blasts	Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	2.01	1.99	0.11
Loading of haul truck (rock)	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	1,818	t	Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	1.01	0.91	0.14
Hauling rock to 'Processing and Storage Area'	AP-42 Unpaved roads - Section 13.2.2	3.93	1.11	0.111	kg·VKT^{-1}	47.55	VKT	Level 1 watering (50%)	93.50	26.59	2.66
Unloading of rock at 'Processing and Storage Area'	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	1,818	t		2.03	0.96	0.15
FEL loading Jaw Crusher at 'Processing and Storage Area'	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	1,818	t		2.03	0.96	0.15
Crushing of rock in Jaw Crusher	AP-42 - Primary crushing - Table 11.19.2.1	0.0027	0.0012	0.00022	kg·t^{-1}	1,818	t	Controlled crushing (77.7%)	1.09	0.49	0.09
Crushing of rock in Secondary Crusher	AP-42 - Secondary crushing - Table 11.19.2.1	0.0027	0.0012	0.00022	kg·t^{-1}	1,818	t	Controlled crushing (77.7%)	1.09	0.49	0.09
Screening of rock	AP-42 - Screening - Table 11.19.2.1	0.0125	0.0043	0.0003	kg·t^{-1}	1,818	t	Controlled screening (91.2%)	2.00	0.69	0.05

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·day^{-1})		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$
Loading material stockpiles from processing	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	1,818	t	Water sprays (50%)	1.01	0.48	0.07
Loading road trucks with product	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	5,000	t		5.57	2.64	0.40
Hauling of product from 'Processing and Storage Area' to road	AP-42 Unpaved roads - Section 13.2.2	3.45	0.982	0.0982	kg·VKT^{-1}	408	VKT	Level 1 watering (50%)	704.30	200.28	20.03
Wind erosion of 'Extraction Area'	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850.0	425.0	63.8	kg·ha^{-1}·yr^{-1}	6.6	ha		15.28	7.64	1.15
Wind erosion of 'Processing and Storage Area'	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850.0	425.0	63.8	kg·ha^{-1}·yr^{-1}	1.6	ha		3.70	1.85	0.28
Loading of overburden	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	66	t	Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	0.04	0.03	0.00
Hauling of overburden	AP-42 Unpaved roads - Section 13.2.2	3.93	1.118	0.1118	kg·VKT^{-1}	2	VKT	Level 1 watering (50%)	3.37	0.96	0.10
Unloading overburden in 'Processing and Storage Area'	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	66	t		0.07	0.03	0.01
								Total	**838.4**	**247.3**	**25.5**

490 000 tpa – Off Site Haulage of Product

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·day^{-1})		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$
Haulage of material offsite on unpaved roads	AP-42 Unpaved roads - Section 13.2.2	3.45	0.98	0.098	kg·VKT^{-1}	66[(A)]	VKT		227.2	64.6	6.5

Note (A): Assuming a 500 m section of road, and transporting 5,000 t per day in 38 t capacity vehicles.

490 000 tpa – Annual Average

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·yr^{-1})		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$
Drilling of blast holes	AP-42 - Drilling (Overburden) - Table 11.9-4	0.59	0.306	0.0177	kg·hole^{-1}	4,800	holes	Dust collection on drill rig (90%) Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	141.6	139.9	8.1
Blasting of fresh rock	AP-42 - Blasting (Coal or Overburden) - Table 11.9-2	4.02	2.09	0.12	kg·blast^{-1}	48	blasts	Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	96.6	95.5	5.5
Loading of haul truck (rock)	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	490,000	t	Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	273.1	245.4	37.2
Hauling rock to 'Processing and Storage Area'	AP-42 Unpaved roads - Section 13.2.2	3.93	1.11	0.111	kg·VKT^{-1}	12,815.38	VKT	Level 1 watering (50%)	25,201.7	7,166.5	716.6
Unloading of rock at 'Processing and Storage Area'	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	490,000	t		546.1	258.3	39.1
FEL loading Jaw Crusher at 'Processing and Storage Area'	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	490,000	t		546.1	258.3	39.1
Crushing of rock in Jaw Crusher	AP-42 - Primary crushing - Table 11.19.2.1	0.0027	0.0012	0.00022	kg·t^{-1}	490,000	t	Controlled crushing (77.7%)	295.0	131.1	23.6
Crushing of rock in Secondary Crusher	AP-42 - Secondary crushing - Table 11.19.2.1	0.0027	0.0012	0.00022	kg·t^{-1}	490,000	t	Controlled crushing (77.7%)	295.0	131.1	23.6
Screening of rock	AP-42 - Screening - Table 11.19.2.1	0.0125	0.0043	0.0003	kg·t^{-1}	490,000	t	Controlled screening (91.2%)	539.0	185.4	13.0

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·yr^{-1})		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$
Loading material stockpiles from processing	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	490,000	t	Water sprays (50%)	273.1	129.1	19.6
Loading road trucks with product	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	490,000	t		546.1	258.3	39.1
Hauling of product from 'Processing and Storage Area' to road	AP-42 Unpaved roads - Section 13.2.2	3.45	0.982	0.0982	kg·VKT^{-1}	39,974	VKT	Level 1 watering (50%)	69,021.8	19,627.3	1,962.7
Wind erosion of 'Extraction Area'	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850.0	425.0	63.8	kg·ha^{-1}·yr^{-1}	6.6	ha		5,576.0	2,788.0	418.2
Wind erosion of 'Processing and Storage Area'	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850.0	425.0	63.8	kg·ha^{-1}·yr^{-1}	1.6	ha		1,351.5	675.8	101.4
Loading of overburden	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	19,860	t	Pit retention (50% TSP, 5% PM_{10}, $PM_{2.5}$)	11.0	9.9	1.5
Hauling of overburden	AP-42 Unpaved roads - Section 13.2.2	3.93	1.118	0.1118	kg·VKT^{-1}	514.71	VKT	Level 1 watering (50%)	1,012.2	287.8	28.8
Unloading overburden in 'Processing and Storage Area'	AP-42 - Batch drop - Section 13.2.4.3	0.00111	0.00053	0.00008	kg·t^{-1}	19,860	t		21.9	10.4	1.6
								Total	**105,747.8**	**32,398.0**	**3,478.6**

Appendix 10

Noise & Vibration Impact Assessment

Noise and Vibration Impact Assessment

North Star Quarry
North Star, NSW

Prepared for: OzArk Environment and Heritage Management Pty Ltd
February 2021
MAC201229-01RP1

Muller Acoustic Consulting

Document Information

Noise and Vibration Impact Assessment

North Star Quarry

North Star, NSW

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MAC201229-01RP1	Final	15 February 2021	Dale Redwood		Oliver Muller	

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CONTENTS

1 INTRODUCTION 5

1.1 PROJECT DESCRIPTION 6

1.2 HOURS OF OPERATION 8

1.3 POTENTIALLY SENSITIVE RECEIVERS 8

2 NOISE AND BLASTING POLICY AND GUIDELINES 11

2.1 INTERIM CONSTRUCTION NOISE GUIDELINE 11

2.1.1 STANDARD HOURS FOR CONSTRUCTION 12

2.1.2 OUT OF HOURS CONSTRUCTION 12

2.1.3 CONSTRUCTION NOISE MANAGEMENT LEVELS 12

2.2 NOISE POLICY FOR INDUSTRY 14

2.2.1 PROJECT NOISE TRIGGER LEVELS 15

2.2.2 PROJECT INTRUSIVENESS NOISE LEVEL (PINL) 15

2.2.3 PROJECT AMENITY NOISE LEVEL (PANL) 15

2.2.4 MAXIMUM NOISE LEVEL ASSESSMENT 18

2.3 ROAD NOISE POLICY 18

2.4 ANZEC BLASTING GUIDELINES 19

3 ASSESSMENT CRITERIA 21

3.1 CONSTRUCTION NOISE MANAGEMENT LEVELS 21

3.2 OPERATIONAL CRITERIA 21

3.2.1 PROJECT INTRUSIVENESS NOISE LEVELS 21

3.2.2 PROJECT AMENITY NOISE LEVELS 22

3.2.3 PROJECT NOISE TRIGGER LEVELS 22

3.2.4 MAXIMUM NOISE ASSESSMENT TRIGGER LEVELS 23

3.3 ROAD TRAFFIC NOISE CRITERIA 23

3.3.1 RELATIVE INCREASE CRITERIA 24

3.4 ANZEC GUIDELINE BLASTING LIMITS 24

4 NOISE ASSESSMENT METHODOLOGY 25

4.1 CONSTRUCTION NOISE MODELLING PARAMETERS 25

4.2 OPERATIONAL NOISE MODELLING PARAMETERS 26
4.2.1 METEOROLOGICAL ANALYSIS 27
4.2.2 OPERATIONAL NOISE MODELLING SCENARIOS 27
4.2.3 SOUND POWER LEVELS - OPERATION 28
4.3 ROAD NOISE ASSESSMENT METHODOLOGY 29
4.4 BLASTING AND VIBRATION ASSESSMENT METHODOLOGY 30
4.4.1 AIR-BLAST OVERPRESSURE 30
4.4.2 GROUND-BORNE VIBRATION 30
5 NOISE MODELLING RESULTS AND DISCUSSION 31
5.1 CONSTRUCTION PHASE NOISE RESULTS 31
5.2 OPERATIONAL NOISE RESULTS 31
5.3 MAXIMUM NOISE LEVEL ASSESSMENT 32
5.4 TRAFFIC NOISE RESULTS 33
5.5 BLASTING RESULTS 34
5.5.1 EFFECTS OF VIBRATION ON INFRASTRUCTURE FROM BLASTING 34
5.5.2 EFFECTS OF BLASTING ON ANIMALS AND LIVESTOCK 35
6 NOISE MONITORING AND MANAGEMENT 37
6.1 NOISE MANAGEMENT MEASURES 37
6.2 NOISE MONITORING 37
7 CONCLUSION 39
APPENDIX A – GLOSSARY OF TERMS
APPENDIX B – NOISE MODEL CONTOURS

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by OzArk Environment & Heritage Management Pty Ltd (OzArk) on behalf of Groundwork Plus Pty Ltd (Groundwork Plus) to prepare a Noise and Vibration Impact Assessment (NVIA) to quantify potential noise emissions associated with the proposed North Star Quarry (the 'quarry'), located at North Star, NSW.

The NVIA is provided to accompany the Environmental Impact Statement (EIS) being prepared to assess the proposed construction and operation of the Quarry (the 'proposal'). The NVIA has been undertaken in accordance with the following policies and guidelines:

- NSW Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment and Climate Change (DECC), Interim Construction Noise Guideline (ICNG), 2009;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011;
- Australian Standard AS2187.2-2006 (AS2187.2) – Explosives-Storage and Use Part 2: Use of Explosives; and
- Australian and New Zealand Environment Council (ANZEC), 1990, Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A.**

1.1 Project Description

MAC understands that Regional Quarries Australia Pty Ltd (RQA) proposes to establish a hard rock (basalt) quarry at 5535 North Star Road, North Star, NSW on Lot 7 DP755984 and Lot 1 DP1227212 (the 'site') (refer **Figure 1**).

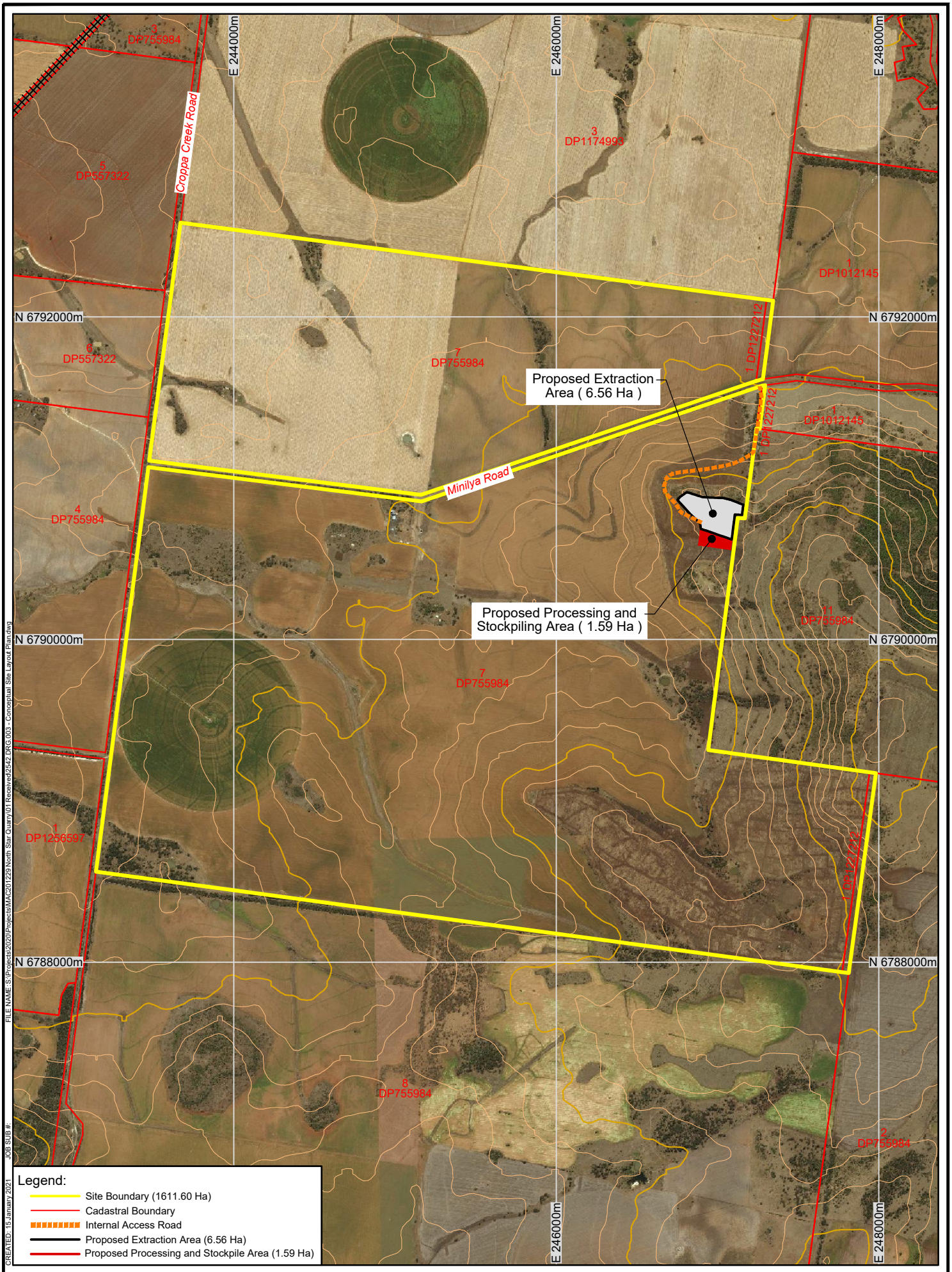
The proposed quarry would produce a maximum of 490,000 tonnes per annum (tpa) of quarry material for a period of five (5) years to service the Inland Rail Project and associated road upgrade projects, and then 150,000tpa for a period of ten (10) years to service the general market in the local area. A maximum of 2,450,000t would be extracted over the life of the quarry.

The total quarry area is 1611.60ha and the anticipated footprint would be 8.15ha, including an extraction area of 6.56ha and a processing and stockpiling area of 1.59ha. The quarry footprint would also include a sediment basin and associated surface water management measures and an internal access road.

The quarry development will occur with the initial construction phase consisting of construction of the internal access road, construction of the access onto Minilya Road, progressive vegetation clearing and soil removal, construction of surface water management measures, construction of the processing and stockpile area, delivery of mobile processing plant and other mobile equipment, and delivery and establishment of ancillary components. The duration of construction period mobilisation is three (3) to six (6) weeks.

Extraction would use standard quarrying methodologies that would involve clearing, topsoil and overburden stripping, drilling and blasting, extraction, and processing and stockpiling with final products sold for use in the construction industry. The maximum depth of the quarry will be RL 323m AHD with surrounding terminal benches of approximately 10m in height. The processing and stockpiling area will be established at about RL 332m AHD.

Processing operations will be undertaken on a campaign basis using a mobile crushing unit. The number of plant and equipment deployed on site is anticipated to vary with types of major plant and equipment likely to include bulldozer, grader, excavator, drill rig, off-road haul trucks, front end loader and on-road trucks.



FILE NAME: S:\Projects\2020\Projects\MAC201229 North Star Quarry\01 Received\2542.DRG.003 - Conceptual Site Layout Plan.dwg

JOB SUB #:

CREATED: 15 January 2021

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Figure 1: Conceptual Site Layout Plan

SCALE: 1:30,000 When Printed On A4 — 0 — 600m

DRAWING NUMBER: 2542.DRG.003

REVISION:

DATE: 12 January 2021

DRAWN: MRescar

PRINTED: 15 January 2021

CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE MGA / / 56

1.2 Hours of Operation

Table 1 presents the proposed hours of operation for the quarry.

Table 1 Hours of Quarry Operation

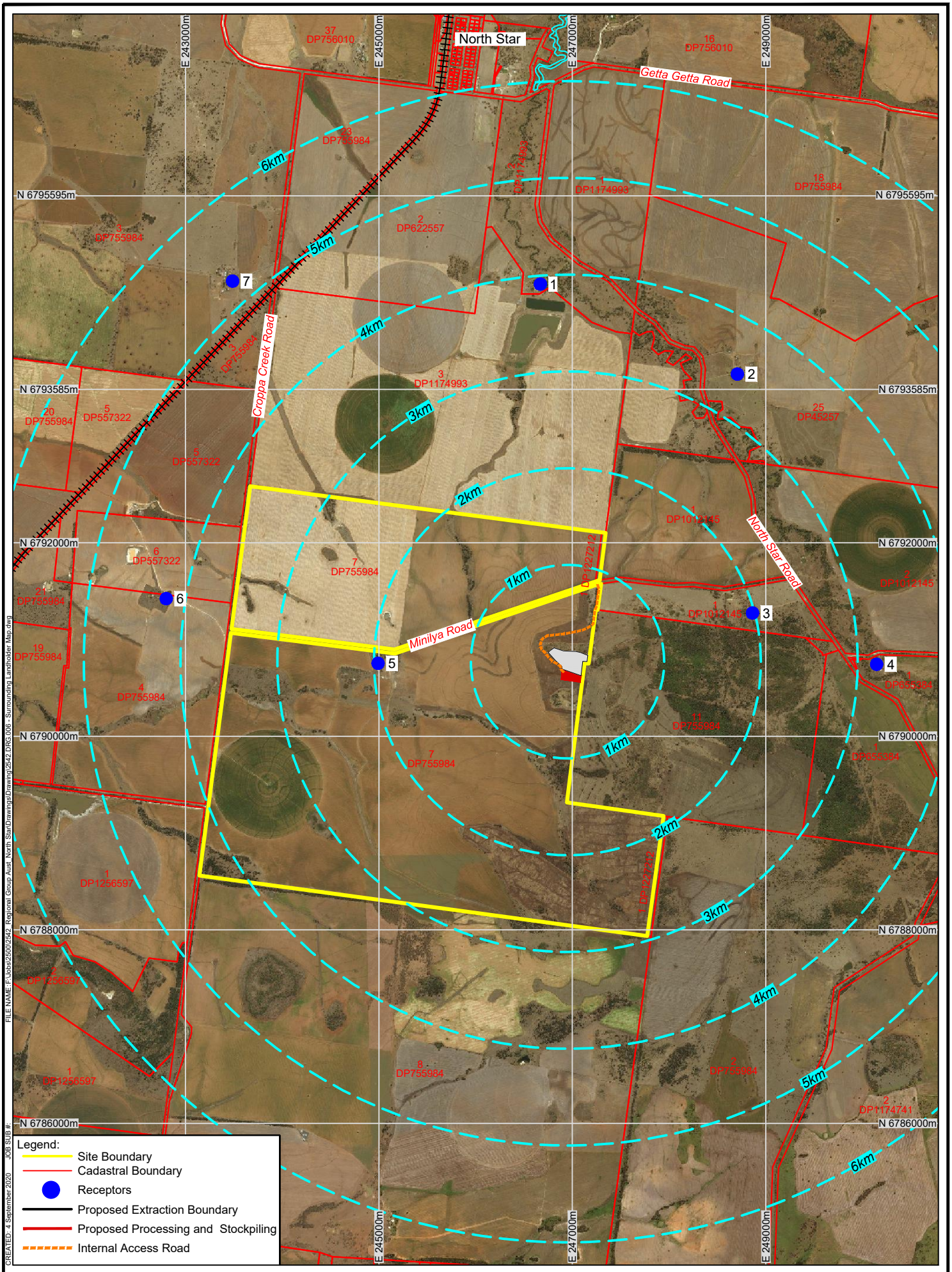
Activity	Monday to Friday	Saturday	Sunday / Public Holidays
Extraction, Processing, Loading and Truck Despatch	6am – 6pm	7am –1pm	N/A
Blasting	9am – 3pm	N/A	N/A

1.3 Potentially Sensitive Receivers

From review of aerial imagery and associated project information, the following potentially sensitive receivers have been identified. Receivers in the locality are primarily rural residential. **Table 2** presents a summary of receiver identification, address and MGA(56) coordinates. The location of the receivers are presented visually in **Figure 2**.

Table 2 Receiver Locations

Receivers	Address	MGA56 Coordinates	
		Easting	Northing
R1	5981 North Star Road	246658	6794640
R2	5788 North Star Road	248755	6793772
R3	5535 North Star Road	248833	6791264
R4	3241 Blue Nobby Road	250130	6790735
R5	5535 North Star Road	245010	6790740
R6	1835 Croppa Creek Road	242810	6791409
R7	2107 Croppa Creek Road	243498	6794691



FILE NAME: P:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.006 - Surrounding Landholder Map.dwg

JOB SUB #:

CREATED: 4 September 2020

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Figure 2: Surrounding Landholder Map

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DRAWING NUMBER: 2542.DRG.006

REVISION:

DATE: 4 September 2020

DRAWN: MRescar

PRINTED: 4 September 2020

CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE

MGA / / 56

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2 Noise and Blasting Policy and Guidelines

The following section summarises the relevant policy and guidelines for the proposal.

2.1 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA and is used to assist in setting statutory conditions in licences or other regulatory instruments.

The ICNG sets out procedures to identify and address the impact of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction proposals with typical durations of more than three weeks
- Qualitative, which is suited to short term infrastructure maintenance (for proposals with a typical duration of less than three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the relevant assessment locations, whilst the qualitative assessment methodology is a more simplified approach that relies more on noise management strategies.

2.1.1 Standard Hours for Construction

Table 3 summaries the ICNG recommended standard hours for construction works.

Table 3 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

2.1.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered out of hours work (OOH). The ICNG suggests that any request to vary the hours of construction activities as identified above shall be:

- considered on a case by case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours; and
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified; appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and all practicable and reasonable mitigation measures will be put in place.

2.1.3 Construction Noise Management Levels

Table 4 reproduces the ICNG management levels for residential receivers. The construction noise management levels are the sum of the management level and relevant rating background level (RBL) for each specific assessment period.

Table 4 Noise Management Levels		
Time of Day	Management Level $LA_{eq,15min}$[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB.	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA.	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB.	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

2.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

2.2.1 Project Noise Trigger Levels

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

2.2.2 Project Intrusiveness Noise Level (PINL)

The PINL ($LA_{eq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

For low noise environments, such as rural environments, minimum assumed RBLs apply within the NPI and can be adopted in lieu of completing background noise measurements. This is considered the most conservative method for establishing noise criteria for a project. These result in minimum intrusiveness noise levels as follows:

- Minimum Day RBL = 35dBA;
- Minimum Evening RBL = 30dBA; and
- Minimum Night RBL = 30dBA.

Due to the rural nature of the locality, the PINLs for the proposal have been determined based on the minimum RBL+5dBA.

2.2.3 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing on the project being assessed.

Additionally, Section 2.4 of the NPI states: "*to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows*":

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

Furthermore, where the PANL is applicable and can be satisfied, the assessment of cumulative industrial noise is not required.

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 5**.

Table 5 Amenity Criteria			
Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

2.2.4 Maximum Noise Level Assessment

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq(15min)}$ 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- L_{Amax} 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

2.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria that provide for a degree of amenity appropriate for the land use and road category.

For some industries such as mines and extractive industries, that are not served by arterial roads, a principal haulage route may be identified. The RNP indicates that where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for arterial/sub-arterial roads, recognising that they carry a different level and mix of traffic to local roads.

2.4 ANZEC Blasting Guidelines

Noise and vibration levels from blasting are assessable against criteria established in the Australian and New Zealand Environment Council (ANZEC) – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration. The blasting limits are generally consistent with the guideline levels contained within AS2187:2006 Part 2 – Explosives - Storage and Usage – Part 2. Where compliance is achieved, the risk of human annoyance is minimised.

Furthermore, for damage induced vibration, German Standard DIN 4150 - Part 3: 1999 provides the strictest guideline levels of vibration velocity for evaluating the effects of vibration in structures. Blasting and vibration induced damage criteria relevant to this assessment are presented in detail in Section 3.4.

The guidelines recommend that blasting should generally be permitted during the hours of 9am to 5pm Monday to Saturday only. Blasting should not occur on Sundays or Public Holidays. Furthermore, blasting should generally take place no more than once per day.

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3 Assessment Criteria

The following sections summarise the relevant noise and blasting criteria for the proposal.

3.1 Construction Noise Management Levels

Noise Management Levels (NMLs) for construction activities for all residential receivers are 45dB $LA_{eq(15min)}$ (RBL +10dB). Construction activities are planned for standard hours, however the relevant NML standard construction hours and out of hours periods are summarised in **Table 6**.

Table 6 Construction Noise Management Levels

Location	Assessment Period	RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
All Residential Receivers	Day (Standard Hours)	35	45 (RBL+10dBA)
	Evening (OOH Period 1)	30	35 (RBL+5dBA)
	Night (OOH Period 2)	30	35 (RBL+5dBA)

3.2 Operational Criteria

3.2.1 Project Intrusiveness Noise Levels

The PINLs for the Project are presented in **Table 7** and have been determined based on the RBL +5dBA.

Table 7 Intrusiveness Noise Levels

Receiver Type	Period[1]	Adopted RBL[2] dB LA_{90}	PINL dB $LA_{eq(15min)}$
Residential	Morning Shoulder	30	35
	Day	35	40

Note 1: Morning Shoulder – the period from 6am to 7am Monday to Saturday; Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

Note 2: Minimum RBLs adopted.

3.2.2 Project Amenity Noise Levels

The PANLs for residential receivers potentially affected by the Project are presented in **Table 8**.

Table 8 Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	Recommended ANL dB $LA_{eq(period)}$[2]	PANL dB $LA_{eq(15min)}$[3]
Residential Receivers	Rural	Morning Shoulder	40	43
		Day	50	53

Note 1: Morning Shoulder – the period from 6am to 7am Monday to Saturday; Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.

Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

3.2.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINL or the PANL. **Table 9** presents the derivation of the PNTL in accordance with the methodologies outlined in the NPI.

Table 9 Project Noise Trigger Levels

Receiver Type	Period[1]	RBL	PINL dB $LA_{eq(15min)}$	PANL dB $LA_{eq(15min)}$	PNTL dB $LA_{eq(15min)}$
Residential	Morning Shoulder	30	35	43	**35**
	Day	35	40	53	**40**

Note 1: Morning Shoulder – the period from 6am to 7am Monday to Saturday; Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

3.2.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 10** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 10 Maximum Noise Assessment Trigger Levels

Residential Receivers			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL 30+5dB	35	RBL 30+15dB	45
Highest	**40**	**Highest**	**52**

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays; Night 10pm to 8pm.

Note: As per Section 2.5 of the NPI, the highest of the two criteria are adopted as the trigger level.

3.3 Road Traffic Noise Criteria

In accordance with the RNP, this assessment has adopted the 'Freeway/arterial/sub-arterial road' category for the designated inbound and outbound transport routes, consistent with the classification of the haulage route as a 'principal haulage route'. **Table 11** reproduces the road traffic noise assessment criteria relevant for this road type.

Table 11 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of Project/development	Assessment Criteria - dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial road	Existing residences affected by additional traffic on existing freeways/sub-arterial/roads generated by land use developments	60dB(A) $L_{Aeq(15hr)}$	55dB(A) $L_{Aeq(9hr)}$

Note: For road noise assessments, the day period is from 7am to 10pm (ie there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

3.3.1 Relative Increase Criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered. Receivers experiencing increases in total traffic noise levels above those presented in **Table 12** due to the addition of project vehicles on the local road network should be considered for mitigation.

Table 12 Increase Criteria for Residential Land Uses

Road Category	Type of Project/Development	Total Traffic Noise Level Increase, dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $LA_{eq(15hr)}$ +12dB (external)	Existing traffic $LA_{eq(9hr)}$ +12dB (external)

3.4 ANZEC Guideline Blasting Limits

The ANZEC blasting limits for air-blast overpressure and ground vibration are presented in **Table 13**.

Table 13 ANZEC Guideline Blasting Limits

	Overpressure dB (Linear Peak)	Ground Vibration PPV (mm/s)
Recommended Maximum (95% of all blasts)	115	5
Level not to be exceeded	120	10
Long term goal for ground vibration	N/A	2

4 Noise Assessment Methodology

A computer model was developed to quantify quarry noise emissions to neighbouring receivers. DGMR (iNoise, Version 2021.0) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics – Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

4.1 Construction Noise Modelling Parameters

Construction activities are typically considered to be progressive and will occur at several different locations simultaneously. Noise emissions were modelled for the following four scenarios:

- Scenario 1 – Haul road upgrade works and construction of intersection;
- Scenario 2 – Clearing and grubbing of operational area;
- Scenario 3 – Bulk earthworks including construction of surface water management measures and processing and stockpile area; and
- Scenario 4 – Delivery and establishment of ancillary components.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

Noise emission data and assumptions used in this assessment are summarised in **Table 14**. The duration of the construction period mobilisation will be three to six weeks and will be undertaken during recommended standard construction periods. The construction modelling assessment adopted methodologies consistent with the operational assessment.

Table 14 Construction Equipment Sound Power Levels, Lw dBA re 10^{-12} W

Noise Source/Item	Lw/ Item
Scenario 1 – Haul Road Improvement Works	
Grader	112
Roller (Smooth Drum)	108
Road/Delivery Truck	103
Total – Haul Road Works	**114**
Scenario 2 – Clearing and Grubbing of Operational Area	
Bulldozer	111
Excavator	106
Wood Chipper	115
Total – Clearing and Grubbing	**117**
Scenario 3 – Bulk Earthworks	
Bulldozer	111
Excavator	106
Haul Truck (Moxy)	108
Total – Quarry Bench	**114**
Scenario 4 – Establishment of Ancillary Components	
Road/Delivery Truck	103
Mobile Crane	98
Elevated Work Platform	98
Hand Power Tools	101
Total – Ancillary Components	**111**

4.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the fixed plant and surrounding area, as derived from the plans for the proposal superimposed onto the surrounding land base topography. Where relevant, modifying factors in general accordance with Fact Sheet C of the NPI have been applied to calculations.

4.2.1 Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions, which increase noise levels by focusing soundwave propagation paths at a single point. Meteorological conditions that can enhance received noise levels include source to receiver winds and the presence of temperature inversions.

The NPI prescribes two options for the consideration of meteorological effects:

1. Adopt the default noise-enhancing meteorological conditions for all assessment periods for noise impact assessment without an assessment of how often these conditions occur; or

2. Determine the significance of noise-enhancing conditions through assessing the occurrence of prevailing winds and temperature inversions.

The significance of noise-enhancing meteorological conditions is based on a threshold of occurrence of 30% for source to receiver wind component speeds up to 3m/s during any seasonal period or F and G class stability categories for night periods over the winter months.

In accordance with the NPI, data collected from weather monitoring stations are typically considered relevant for assessing meteorological conditions for a radius of 30km from the station, provided the surrounding area is in the same topographical basin as the station. A review of Bureau of Meteorology (BOM) stations identifies that the nearest weather monitoring station to the quarry site is the Goondiwindi Airport station (ID: 041560) approximately 52km to the north. Hence, default noise-enhancing meteorological conditions have been applied as per Table D1 of the NPI (reproduced in **Table 15**).

Table 15 Modelled Site Specific Meteorological Parameters

Assessment Condition	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Morning Shoulder - Inversion	10°C	2m/s / all directions	90%	F
Day - Calm	20°C	3m/s / all directions	60%	D

Note: Morning Shoulder – the period from 6am to 7am Monday to Saturday; Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

4.2.2 Operational Noise Modelling Scenarios

The extraction operations of the quarry would be undertaken over two stages. Stage 1 operations would involve the extraction of up to 490,000tpa over 5 years to supply hard rock material to the Inland Rail Project and associated road upgrade projects. Stage 2 operations, to begin following the completion of the Inland Rail Project, would involve the extraction of up to 150,000tpa over 10 years to service local markets.

To represent the worst-case operational activities, one (1) modelling scenario was adopted to assess operational noise emissions during Stage 1 of the quarry. It is considered that where operational noise emissions for Stage 1 of the quarry are demonstrated to achieve the operational noise criteria, noise emissions during Stage 2 operations would also achieve the criteria.

The scenario is summarised below:

- Stripping of soil by bulldozer or excavator to expose the basalt resource. Soil would be either stockpiled within the Processing and Stockpile Area for future use in rehabilitation activities or directly transferred to an area to be revegetated;
- The in-situ rock would be fragmented using conventional drill and blast techniques;
- Extracted quarry material would be loaded into off-road haul by front-end loader or excavator and transported to the Processing and Stockpile Area;
- A mobile crushing unit (MCU), fed by front-end loader, will crush and screen the extracted material to produce a range of quarry products;
- After crushing, the quarry products would be distributed to stockpiles within the Processing and Stockpile Area; and
- Road trucks would transport the material offsite via the private haul road.

4.2.3 Sound Power Levels - Operation

Mobile plant noise emission data used in modelling for this assessment were obtained from the MAC noise database for relevant noise sources that are proposed to be used in the quarry. The noise emission levels used in modelling are summarised in Table 16.

Table 16 Equipment Sound Power Levels			
Item	dB $L_{Aeq(15min)}$ Sound Power Level (SWL)	Period of Operation	
Operational Noise Sources		**Day Period**	**Morning Shoulder**
Wood Chipper (x1)	115	✓	x
Drill Rig (x1)	114	✓	x
Bulldozer (x1)	111	✓	✓
Excavator (x1)	106	✓	✓
Dump Truck (x2)	105	✓	✓
Water Truck (x1)	101	✓	✓
Mobile Crushing Unit	113	✓	✓
Loader (x1)	106	✓	✓
Road Trucks (12/hr)	102	✓	✓
Sleep Disturbance Assessment (L_{Amax})			
Truck Loading	117	x	✓

Note 1: Morning Shoulder – the period from 6am to 7am Monday to Saturday; Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

4.3 Road Noise Assessment Methodology

The proposal would supply quarry materials to the Inland Rail Project and associated road projects. It is anticipated that access to the Inland Rail construction corridor would be available via Minilya Road to Croppa Creek Road, with trucks using the rail corridor to access any Inland Rail construction or stockpile sites. A mix of vehicle types would be used for product haulage, typically truck and dog trailer combinations and B-doubles and Type A-double road trains where approved routes are available.

It is anticipated that haulage would occur on a campaign basis to meet fluctuating demands of the infrastructure projects. The peak daily haulage to address short term demands for construction material for the Inland Rail Project or other time-critical works is assumed to be up to 132 laden truck loads per day (264 movements) during Stage 1 operations. During Stage 2 operations traffic generation assumed for average week daily traffic would be up to 14 laden truck loads per day (28 movements).

A review of the proposed haulage routes identified that the minimum setback of receptors from the centreline of the adjacent road are approximately 12m for residences adjacent to Edward Street in the township of North Star, and approximately 35m for residences adjacent to Buckie Road in the township of Croppa Creek. The assessment assumed up to 75% of project-related vehicles would travel in either direction to North Star or Croppa Creek per day.

The United States (US) Environment Protection Agency's road traffic calculation method was used to predict the L_{Aeq} noise levels from proposal related trucks travelling past existing receivers on Ostlers Lane. This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

4.4 Blasting and Vibration Assessment Methodology

4.4.1 Air-Blast Overpressure

Calculation of overpressure has been completed using the following AS2187.2 equation:

$$\mathrm{P} = K_a \left(\frac{R}{(Q^{1/3})} \right)^a$$

Where:

P = Pressure, in kilopascals;

Q = Effective explosives charge mass, in kilograms (MIC);

R = Distance from charge, in metres;

K_a = Site constant, a conservative value of 25 was adopted; and

a = Site exponent, a value of -1.45 was adopted.

The conversion of 'P' to unweighted decibels (dBZ) is completed using the following formula:

$$\mathrm{SPL} = 10\ x \log \left(\frac{P}{P_0} \right)^2$$

4.4.2 Ground-Borne Vibration

Preliminary estimations for vibration have been completed using the following AS2187.2 equation:

$$\mathrm{V} = K_g \left(\frac{R}{(Q^{1/2})} \right)^{-B}$$

Where:

V = ground vibration as vector peak particle velocity, in mm/s;

R = distance between charge and point of measurement, in m;

Q = maximum instantaneous charge (effective charge mass per delay), in kg;

K_g = a constant related to site and rock properties for estimation purposes, a value of 1140 was adopted as per AS2187.2 to predict the 50% chance of exceedance in "average conditions"; and

B = a constant related to site and rock properties for estimation purposes, a value of 1.6 was adopted.

5 Noise Modelling Results and Discussion

5.1 Construction Phase Noise Results

Predicted noise levels for the construction scenarios described in **Section 4.1** are provided in **Table 17**. The results of the analysis show that noise emissions from each of the construction scenarios are predicted to satisfy the relevant noise management levels at all receiver locations.

Table 17 Combined Noise Predictions – Construction Scenarios

Receiver	Predicted Noise Level, dB $LA_{eq(15min)}$				Day Period NML dB $LA_{eq(15min)}$	Compliant
	S1	S2	S3	S4		
R1	<30	<30	<30	<30	45	✓
R2	<30	<30	<30	<30	45	✓
R3	<30	<30	<30	<30	45	✓
R4	<30	<30	<30	<30	45	✓
R5	<30	<30	<30	<30	45	✓
R6	<30	<30	<30	<30	45	✓
R7	<30	<30	<30	<30	45	✓

5.2 Operational Noise Results

Predicted quarry operations include extraction, processing, product loading and transportation. The predicted noise levels at each receiver during noise-enhancing meteorological conditions are provided in **Table 18**. The noise contour maps for the quarry operations are provided in **Appendix B**.

The results of the predictive modelling show that noise emissions from the quarry satisfy the PNTL at all residential receivers, for each operational scenario as described in **Table 16**.

Table 18 Predicted Operational Noise Levels

Receiver	Predicted Noise Level dB $LA_{eq(15min)}$		PNTL dB $LA_{eq(15min)}$		Compliant
	Shoulder (Inversion)	Day (Prevailing Winds)	Shoulder	Day	
R1	<30	<30	35	40	✓
R2	<30	<30	35	40	✓
R3	31	32	35	40	✓
R4	<30	<30	35	40	✓
R5	34	36	35	40	✓
R6	<30	<30	35	40	✓
R7	<30	<30	35	40	✓

Note: Morning Shoulder – the period from 6am to 7am Monday to Saturday or 6am to 8am Sundays and public holidays; Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays.

5.3 Maximum Noise Level Assessment

In assessing sleep disturbance, a typical L_{Amax} noise source of 117dB was used to represent transient events associated with loading trucks with quarry products to the assessed residential receivers under F Class stability conditions (ie worst case).

The results of the analysis identify that maximum noise trigger levels will be satisfied for all residential receivers, hence no further assessment or detailed analysis is required. Predicted noise levels from L_{Amax} events are presented in **Table 19**.

Table 19 Predicted Maximum Noise Levels

Receiver	Period	Noise Predictions dB L_{Amax}	Trigger Level dB L_{Amax}
R1	Morning Shoulder	<30	52
R2		<30	52
R3		34	52
R4		<30	52
R5		37	52
R6		<30	52
R7		<30	52

Note: Morning Shoulder – the period from 6am to 7am Monday to Saturday or 6am to 8am Sundays and public holidays.

5.4 Traffic Noise Results

The results of the traffic noise calculations for operational road traffic are presented in **Table 20** for the closest residential receivers to Edward Street, North Star and Buckie Road, Croppa Creek, approximately 12m and 35m from the carriageway respectively.

Maximum dispatch from the quarry will be up to 132 loads per day (264 movements) and up to a maximum of 12 loads per hour (24 movements). There would be approximately 20 light vehicle movements associated with the proposal per day.

A review of the Transport for NSW Traffic Volume Viewer indicates that there are no published AADT volumes for the road network in the vicinity of the townships of North Star or Croppa Creek. It is understood however, that there are existing quarries within the locality that service the Inland Rail Project using the same haul routes. For the purpose of this assessment, it has been assumed that existing traffic on the local road network would comprise up to 264 heavy vehicle movements and up to 20 light vehicle movements.

Table 20 Operational Road Traffic Noise Levels – Residential Receivers

Offset Distance (m)	Assessment Criteria[1]	Traffic Noise dB $LA_{eq(period)}$		
		Existing Traffic Noise	Existing + Future Quarry Combined	Total Change
Edward Street, North Star				
12m	Day 60 dB $LA_{eq(15hr)}$	54.7	57.7	+3.0
	Night 55 dB $LA_{eq(9hr)}$	48.3	51.3	+3.0
Buckie Road, Croppa Creek				
35m	Day 60 dB $LA_{eq(15hr)}$	43.0	46.0	+3.0
	Night 55 dB $LA_{eq(9hr)}$	36.7	39.6	+2.9

Note 1: Day 7am to 10pm. Night 10pm to 7am.

The traffic noise contribution from the quarry is predicted to remain below the relevant day and night assessment criteria for the nearest residential receivers to the proposed haul routes.

5.5 Blasting Results

Blast overpressure and vibration have been calculated to each assessed receiver for the quarry adopting an MIC of up to 300kg. It is understood that the MIC of blasts at the quarry site would typically be less than 100kg, therefore the calculated blast overpressure and vibration results are considered to be highly conservative.

Calculated levels for overpressure and vibration have been compared to the relevant ANZEC criteria and are presented in **Table 21**. Results identify blasts of MICs up to 300kgs would satisfy relevant ANZEC overpressure and vibration criteria.

Notwithstanding, the proposed MIC blast patterns should be designed specifically to meet the relevant ANZEC guidelines at receivers and be completed in conjunction with an appropriate blast monitoring program.

Table 21 Blasting Emissions

Receiver ID	Distance to Charge km	Airblast Overpressure dBZ Peak	Ground Vibration mm/s
R1	3.8	102	0.21
R2	3.5	103	0.23
R3	2.1	110	0.54
R4	3.3	104	0.25
R5	1.8	112	0.69
R6	4.0	101	0.19
R7	5.0	99	0.13

5.5.1 Effects of Vibration on Infrastructure from Blasting

There are no items of significant infrastructure in the locality of the quarry. The closest sealed public road is North Star Road approximately 2.4km to the east of the quarry. Vibration levels at North Star Road are calculated to be below 5mm/s. Hence there are no significant vibration effects from blasting on public infrastructure.

5.5.2 Effects of Blasting on Animals and Livestock

Blast effects resulting from the quarry are predicted to be, at worst for overpressure up to 112dBZ, and for vibration up to 0.69mm/s at the nearby residential receiver locations. The calculated blast over pressure and vibration levels are well below the regulatory criteria and considerably lower than other sources of overpressure that horses or livestock are likely to be already subjected to such as lightning strikes which are typically between 120dBZ and 130dBZ[2].

[2] Equine Health Impact Statement – Drayton South Coal Project (2015)

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6 Noise Monitoring and Management

6.1 Noise Management Measures

Although it is demonstrated that noise levels are predicted to meet the relevant noise goals and no further mitigation measures are required, to proactively address any potential residual noise impacts, a noise management plan (NMP) may be considered for the quarry. The NMP will guide, manage, quantify and control noise emissions from the quarry through the implementation of feasible and reasonable best management practices. These may include:

- Scheduling the use of noisy equipment at the least-sensitive time of day;
- Strictly adhering to the proposed hours of operation;
- Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area;
- Keeping equipment well maintained and operating it in a proper and efficient manner;
- Employing 'quiet' practices when operating equipment, for example, positioning idling trucks in appropriate areas; and
- Running staff-education programs and regular tool box talks on the effects of noise and the use of quiet work practices.

The NMP may also address the use of best available technology including alternatives to tonal reversing alarms, efficient muffler design, and using enclosures, as well as reducing noise in transmission or at the receiver.

6.2 Noise Monitoring

It is recommended that the NMP includes a provision for attended noise monitoring within the community in response to received complaints, if any. The operator attended noise measurements and recordings would be conducted to quantify noise emissions from the quarry as well as the overall level of ambient noise.

When required, the operator shall quantify and characterise the energy equivalent (L_{Aeq}) intrusive noise level from the quarry over a 15-minute measurement period. In addition, the operator shall quantify and characterise the overall levels of ambient noise over the 15-minute measurement interval. It is recommended that instrumentation used during the monitoring is to be equivalent to a Type 1 meter with 1/3 octave band analysis and have audio recording functionality for post processing source identification. It is noted that 1/3 octave band analysis is required to establish whether modification factors in accordance with the NPI are to be applied.

All acoustic instrumentation used as part of the attended monitoring program must been designed to comply with the requirements of AS IEC 61672.1-2019, Electroacoustics - Sound level meters - Specifications and shall have current calibration certificates. All instrumentation shall be programmed to record statistical noise level indices in 15-minute intervals including L_{Amax}, L_{Amin} and L_{Aeq}.

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA. The measurement position(s) should be selected considering:

- weather conditions such as rain and wind, insect noise;
- the location and direction of any noise source/s;
- the most sensitive position at the affected receiver; and
- the need to avoid reflecting surfaces (where possible).

7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a NVIA of potential impacts from the proposed North Star Quarry near North Star, NSW. The assessment has quantified potential construction and operational noise emissions pertaining to extraction, processing, drilling and dispatch via road trucks, as well as blasting noise and vibration emissions.

The results of the NVIA demonstrate that construction and operational noise levels would achieve the relevant ICNG and NPI criteria for all assessment periods at each assessed receiver location during noise enhancing meteorological conditions.

An assessment of maximum noise levels demonstrated that noise emissions from the proposal are predicted to remain below the EPA trigger levels for sleep disturbance at all receiver locations.

The NVIA demonstrates that quarry related road traffic noise levels will meet the objectives of the RNP for the nearest residential receivers on Edward Street, North Star Road and Buckie Road, Croppa Creek.

Airblast overpressure and vibration levels are also predicted to meet the criteria at all assessed receivers for blasts up to 300kg MIC.

Based on the NVIA results, there are no noise or blasting related issues which would prevent the approval of the quarry. The results of the assessment show compliance with the relevant operational and road noise criteria. Additionally, the results of the assessment demonstrate compliance with the relative EPA and DECCW policies, without ameliorative measures being required.

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Appendix A – Glossary of Terms

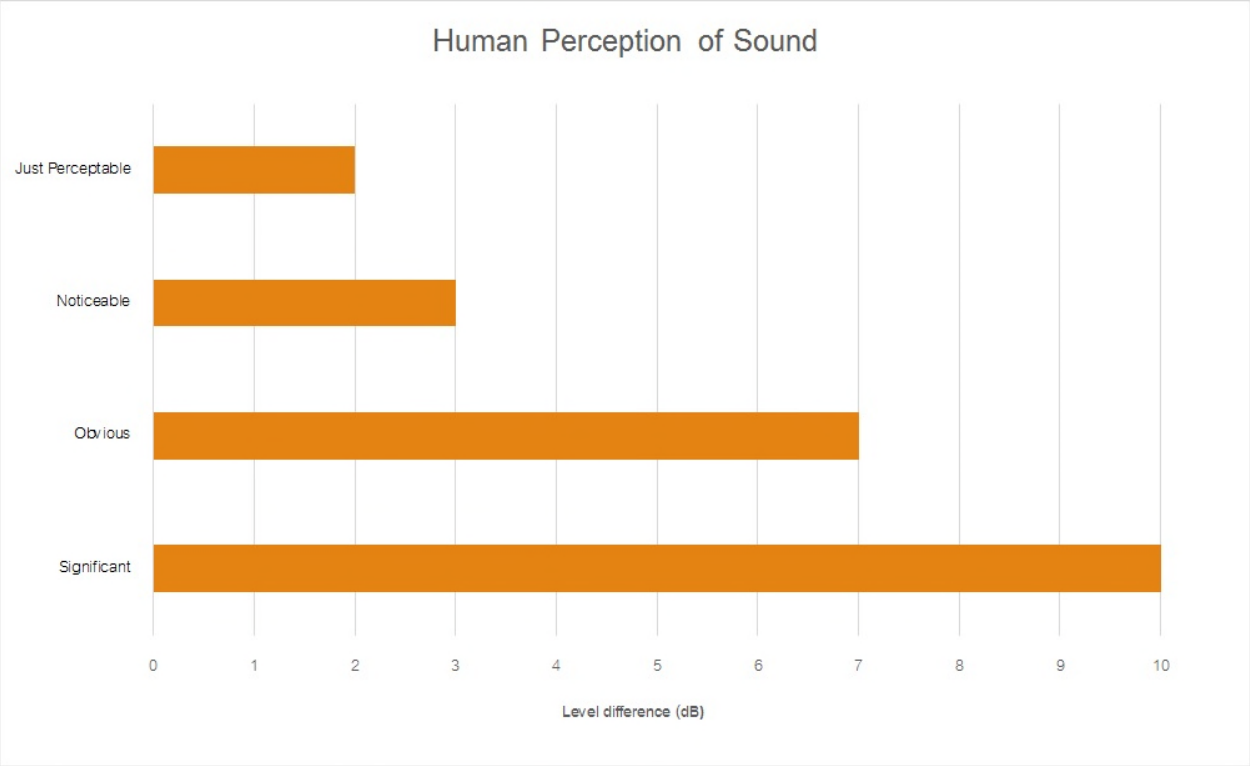
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA_{90} statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. In some cases the overall change in noise level is described in dB rather than dB(A), or dB(Z) which relates to the weighted scale.
dB(Z)	Linear Z-weighted decibels.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA_{10}	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA_{90}	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LA_{eq}	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LA_{max}	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

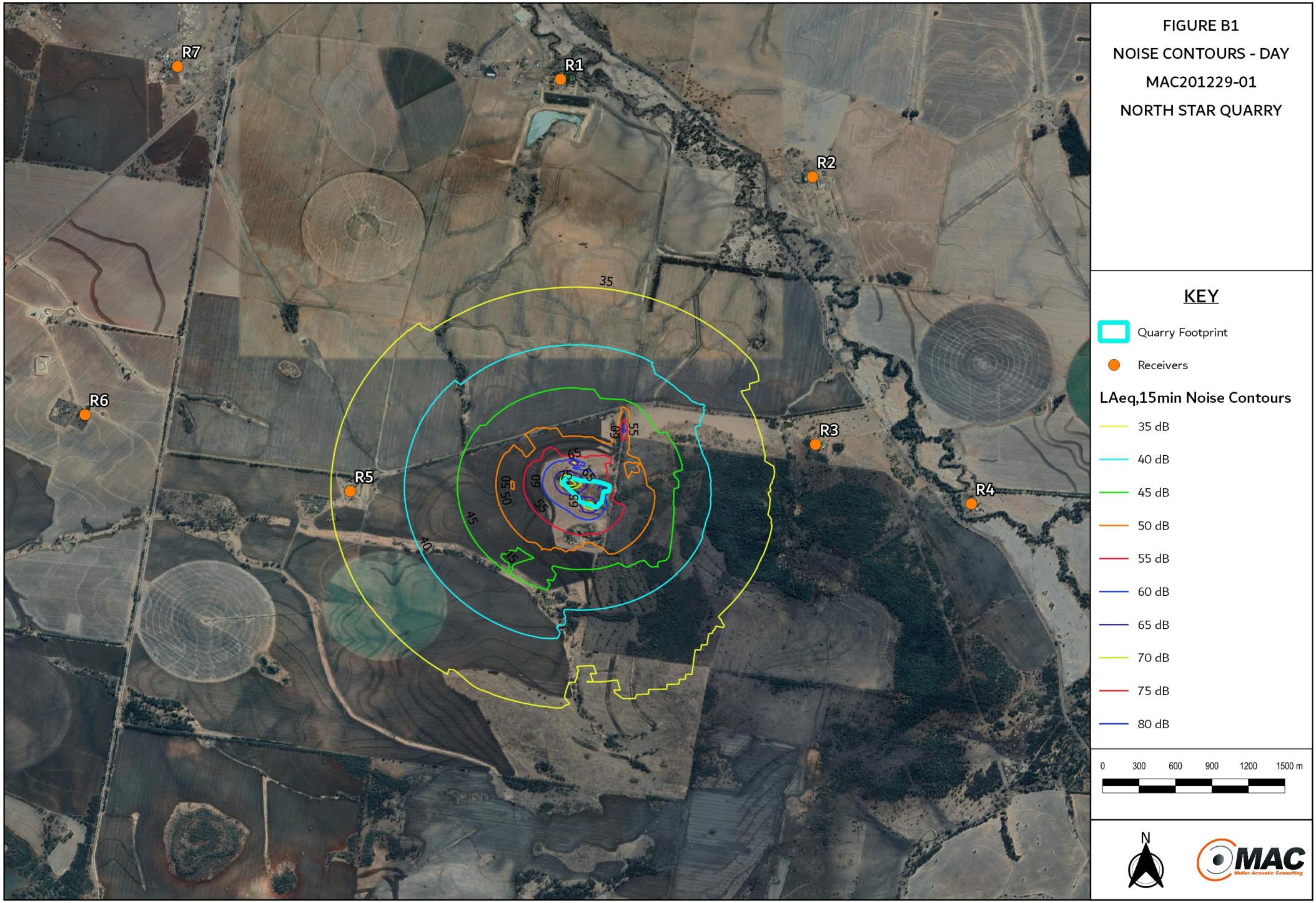
Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dB(A)	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix B – Noise Model Contours


R7
R1
R2
R6
R3
R5
R4
35
40
45
50
55
60
65
FIGURE B1
NOISE CONTOURS - DAY
MAC201229-01
NORTH STAR QUARRY
KEY
Quarry Footprint
Receivers
LAeq,15min Noise Contours
35 dB
40 dB
45 dB
50 dB
55 dB
60 dB
65 dB
70 dB
75 dB
80 dB
0 300 600 900 1200 1500 m
N
MAC
Muller Acoustic Consulting

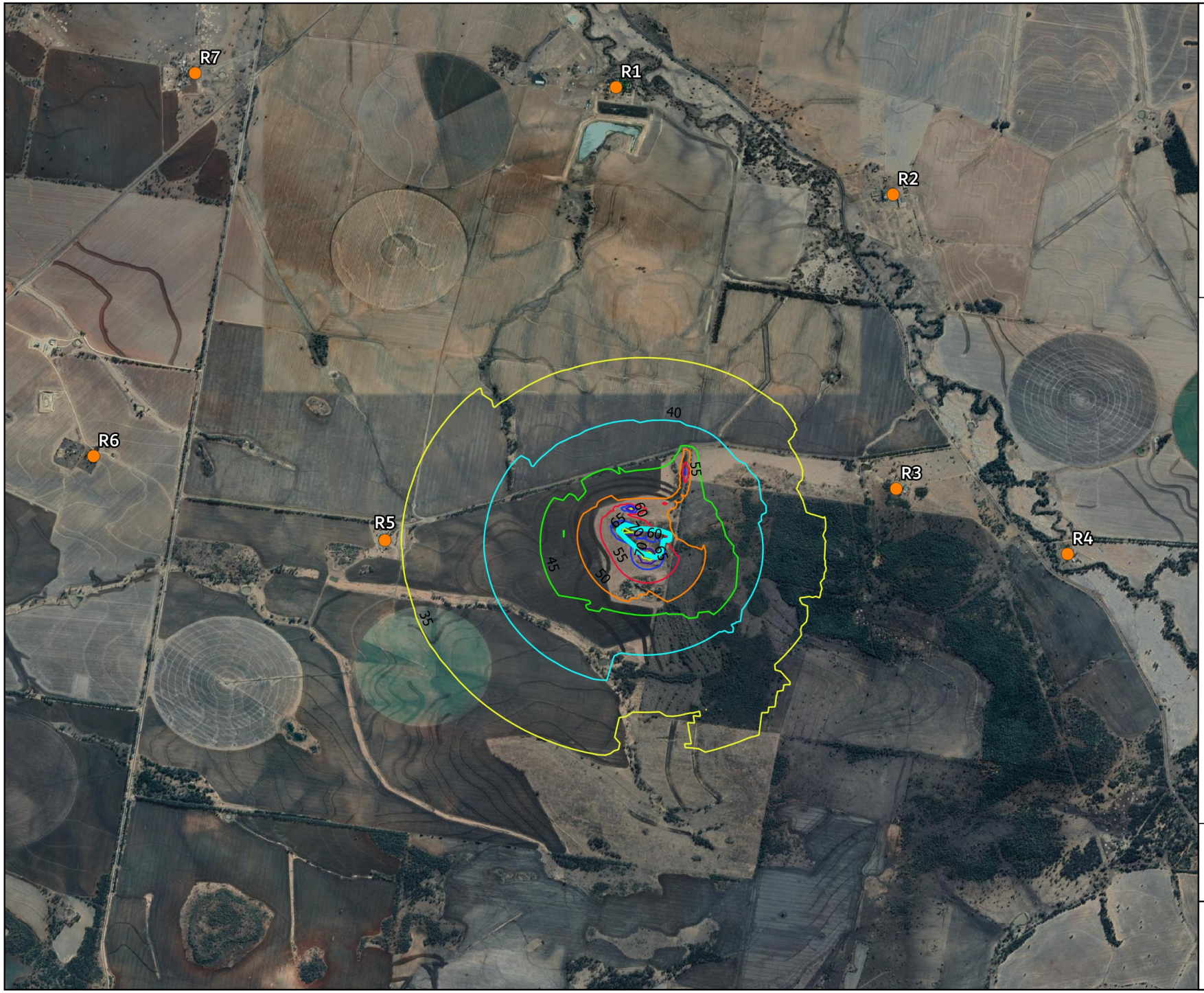


FIGURE B2

NOISE CONTOURS - NIGHT

MAC201229-01

NORTH STAR QUARRY

KEY

Quarry Footprint

Receivers

LAeq,15min Noise Contours

- 35 dB
- 40 dB
- 45 dB
- 50 dB
- 55 dB
- 60 dB
- 65 dB
- 70 dB
- 75 dB
- 80 dB

0 300 600 900 1200 1500 m

N

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Appendix 11

Surface Water Assessment

GROUNDWORK plus

NORTH STAR QUARRY
SURFACE WATER ASSESSMENT

Prepared for:
Regional Quarries Australia Pty Ltd

Date:
May 2021

File Ref:
2542.800.001

Document Control

Project/ Report Details

Document Title:	Surface Water Assessment
Principal Author:	M. Folker
Client:	Regional Quarries Australia Pty Ltd
Ref. No.	2542.800.001

Document Status

Issue	*Description*	*Date*	*Author*	*Reviewer*
1	Issued for EIS	January 2021	M. Folker	J. Lawler
2	Updated Layout	May 2021	M. Folker	J. Lawler

Distribution Record

Recipient	
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Table of Contents

1. Introduction 2
1.1 Project Overview 2
1.2 Scope of Assessment 2
1.3 Site Location 2
2. Erosion and Sediment Control Management 3
2.1 Site Topography 3
2.2 Proposed Erosion and Sediment Controls 3
2.2.1 Sediment Basin Sizing Calculations 3
3. Water Balance Assessment 4
3.1 Water Supply and Storage Infrastructure 4
3.2 Rainfall Data 4
3.2.1 Scenario 1 – Above Average Rainfall 4
3.2.2 Scenario 2 – Below Average Rainfall 4
3.3 Mean Daily Evaporation 4
3.4 Daily Groundwater Inflow 4
3.5 Catchment Hydrology 4
3.6 Water Balance Assessment 5
3.6.1 Water Balance Assessment Assumptions 5
3.6.2 Water Balance Assessment Results 5
3.7 Volumetric Water Licensing Requirements 5
3.8 Water Disposal Methods 6
3.8.1 Water Quality Assessment 6
4. Operational Management Plan 7
4.1 Stormwater Management Plan 7
5. Surface Water Management Implementation 13
5.1 Monitoring Investigation Indicators 13
5.2 Monitoring Management Measures 13
5.3 Auditing and Review 13
5.4 Reporting and Responsibility 13
5.5 Identification of Incident or Failure 14
5.6 Corrective Action 14
6. Conclusion 15
7. Reference List 16

FIGURES

Figure 1 Surface Water Management Plan *(Drawing No. 2542.DRG.009R1)*

ATTACHMENTS

Attachment 1 Sediment Basin Calculations
Attachment 2 Water Balance Assessment

1. Introduction

1.1 Project Overview

Groundwork Plus Pty Ltd ('Groundwork Plus') has been commissioned by Regional Quarries Australia Pty Ltd (RQA) (the client) to prepare a Surface Water Assessment (SWA) for the proposed North Star Quarry (the site) as part of the Environmental Impact Statement (EIS) for the development application.

1.2 Scope of Assessment

This SWA includes the following scope in order to adequately address the requirements of the EIS for the proposed quarry development:

- 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;

1.3 Site Location

The proposed North Star Quarry is located at located at 5535 North Star Road, North Star, NSW, 2408 on Lot 7 DP755984 and Lot 1 DP1227212 (the site). The site is 6km East of the Inland Rail Project site, approximately 6km South of North Star, 76 North East of Moree and 65km North North West of Warialda, in Northern New South Wales. The site is rural, freehold land registered to Doolin Minilya Pty Ltd (the landowner).

2. Erosion and Sediment Control Management

2.1 Site Topography

The proposed quarry is situated on the southern ridgeline as shown on **Figure 1 – Surface Water Management Plan**. The upper northern reaches of the quarry are situated at approximately RL 338m AHD, with the extraction proposed to reach RL 323m AHD. A higher bench for ancillary operations is proposed at RL 332m AHD.

2.2 Proposed Erosion and Sediment Controls

It is proposed to manage the disturbed quarry area by diverting all surface water to a sediment basin in the ancillary operations area, and a second basin forming the quarry sump to capture the extraction area. Clean water upstream is proposed to be diverted around the quarry area and return to natural pre-developed drainage lines as shown on **Figure 1 – Surface Water Management Plan**.

2.2.1 Sediment Basin Sizing Calculations

In order to meet the requirements of the EIS, the sediment basin is proposed to be designed, constructed and operated to retain the disturbed area runoff at the site in accordance with DECC (2008) *Managing Urban Stormwater - Soils and Construction (Volume 2E).*

As outlined in DECC (2008), the total upper settling storage requirements for sediment basins are calculated based on the following formula:

$Vs = 10 * R_{Y\%, 5\text{-day}} * Cv * A$, where:
A = Catchment Area (m^2)
C_v = Coefficient of Discharge
$R_{Y\%, 5\text{-day}}$ = 5 day rainfall depth (m) not exceeded for Y percent of rainfall events

In addition to the upper settling volume, a sediment storage zone is required to be accommodated based on a 2 month soil volume loss using the Revised Universal Soil Loss Equation (RUSLE) (shown below) or otherwise 50% of the settling volume (whichever is greater):

$V_{SED} = [0.17 \times A (R . K . LS \times 1.3 \times 1.0)] / 1.3$
A = Disturbed Catchment Area (m^2)
R, LS and K = RUSLE factors as per DECC

Table 1 – Sediment Basin Storage Requirements details the upper settling, sediment storage and subsequent total sediment basin storage requirements for the site, for capture of a 38.2 mm rainfall event, deemed the 5-day 90th percentile as per DECC 2008. Detailed calculations are included in **Attachment 1 – Sediment Basin Calculations.**

Table 1 – Sediment Basin Storage Requirements

Basin ID	Catchment area (ha)	Upper Settling Req'd Volume (ML)	Sediment Storage Req'd Volume (ML)	Total Required Volume (ML)	Proposed Volume (ML)
SB1	4.76	1.15	0.57	1.72	2.00
SB2	1.59	0.38	0.19	0.57	1.00

Based on the above, the total required sediment basin volumes are considered appropriate for erosion and sediment control management.

3. Water Balance Assessment

3.1 Water Supply and Storage Infrastructure

The quarry proposes to harvest surface water for reuse in operations through construction of two sediment basin structures as shown in on **Figure 1 – Surface Water Management Plan.** The sediment basins are proposed to be used for the treatment of surface water as discussed in **Section 2 - Erosion and Sediment Control Management**, and also for reuse into quarry operations. The total volume for the sediment basins is proposed to be 3.00ML. An additional clean water dam is proposed as a future option to the north of the extraction area, to maximise the site potential to capture and reuse available surface water. The clean water dam is to be constructed at the discretion of the quarry should additional surface water harvesting be sought or required for operations.

The extraction area will ultimately capture all rainfall events due to the proposed quarry extents below the natural surface, with excess water being reused into operations and/or treated to suitable water quality standards prior to releasing back into the receiving environment.

3.2 Rainfall Data

Rainfall data was sourced from the Bureau of Meteorology (BoM) for North Star station (53095) for the water balance, which is 13km from the site. To inform the calculations of the water balance daily rainfall records were downloaded and used for the for a higher degree of accuracy.

3.2.1 Scenario 1 – Above Average Rainfall

The year 1998 was selected as it has 100% data available for the year and received an annual rainfall depth of 774mm which is above average (627mm).

3.2.2 Scenario 2 – Below Average Rainfall

A second water balance scenario was selected against using the 2003 rainfall data, as it was a drier year at around 567mm (below the average 627mm).

3.3 Mean Daily Evaporation

Mean Daily Evaporation data was sourced from BoM for Moree Aero Station (053115) as it was the closest available (81km away), and is shown below in **Table 2 – Moree Mean Daily Evaporation.**

Table 2 – Moree Mean Daily Evaporation

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
mm	10.1	9.1	7.7	5.7	3.7	2.6	2.7	3.9	5.6	7.7	9.2	9.8

3.4 Daily Groundwater Inflow

As discussed in the EIS, there is no anticipated interception with the groundwater table, therefore groundwater flows are not considered in the water balance assessment.

3.5 Catchment Hydrology

The water balance assessment was estimated based on the hydrological parameters shown below in **Table 3 – Hydrological Parameters**. The surface water parameters were based on the supplied LiDAR survey.

Table 3 – Hydrological Parameters

Parameter	Value	Unit
Quarry Area (Sediment Basin SB1)	47,600	m²
Stockpile Area (Sediment Basin SB2)	15,900	m²

Clean water Catchment	66,900	m²
Sediment Basin capacity total	3,000	m³
Clean water dam (SD1) capacity	3,000	m³
Runoff Coefficient (quarry)	0.85	n/a
Assumed Daily Usage in Quarry	155	kL

3.6 Water Balance Assessment

3.6.1 Water Balance Assessment Assumptions

For the purpose of the water balance, the operations are anticipated to occur 5.5 days per week (Monday to Saturday morning, 50 weeks per year. The applicant intends to operate based on a daily water usage of 155kL which is proposed to be achieved through water saving strategies including implementation of a proprietary produce that can reduce water usage for the purposes of dust mitigation (Haulage DC by Polo Citrus Australia Pty Ltd).

Based on the proposed strategy, the annual water usage (including losses) is therefore estimated to be 59.5 ML per year, with a supply of 67.7 ML and 49.5 ML for above and below average rainfall years respectively.

3.6.2 Water Balance Assessment Results

Refer to **Attachment 2 – Water Balance Assessment** for a comprehensive daily breakdown of the water balance assessment. A summary of the results are shown for each scenario in the tables below.

Table 4 – Water Balance Assessment Results (Above Average Rainfall)

Inputs	Overland Flow into Sediment Basins	41.8	Values are in ML/year
	Overland Flow into Clean water dam	25.9	
Total water inputs		**67.7**	
Outputs	Evaporation from Dams	2.9	
	Total water required for processing *(includes dust suppression and operations)*	56.6	
Total water outputs		**59.5**	
Estimated Water Surplus		**8.2**	

Table 5 – Water Balance Assessment Results (Below Average Rainfall)

Inputs	Overland Flow into Sediment Basins	30.6	Values are in ML/year
	Overland Flow into Clean water dam	18.9	
Total water inputs		**49.5**	
Outputs	Evaporation from Dams	2.9	
	Total water required for processing *(includes dust suppression and operations)*	56.6	
Total water outputs		**59.5**	
Estimated Water Shortfall		**10.0**	

3.7 Volumetric Water Licensing Requirements

It is expected that water will be required to be sourced from external licensed water suppliers to meet the anticipated shortfalls for quarry operations. As outlined in the water balance assessment results, around 10ML per annum is expected in a drier than average year.

In the driest scenario, the water balance indicates water will need to be imported 63 days per year. In the above average rainfall scenario, the water balance indicates water will need to be imported 14 days per year. It is noted that these scenarios assume a total dam volume of 6ML, with additional surface water being able to be held in the quarry pit. To further reduce reliance on external supplies, additional surface water could be harvested by increasing the sediment basin and/or clean water dams, or a larger sump in the quarry pit to harvest additional surface water.

Based on the above it is expected that the quarry will be moderately self-sufficient in water supply, hence construction and operation of the development can be undertaken with any additional water requirements being reasonably obtained from an appropriately authorised and reliable licensed water supplier. The quarry will be responsible to ensure that any licensing requirements and other approvals required under the Water Act 1912 and/or Water Management Act 2000 are obtained.

During the days in the year where water could not be sourced from the quarry dam, the quarry would need to import up to 155m^3 (155,000L) of water for dust suppression (per day). In these events if the sediment basin is dry, water would be sourced from an appropriately authorised and licenced water supplier such as Gwydir Shire Council.

3.8 Water Disposal Methods

As demonstrated in **Attachment 2 – Water Balance Assessment**, there are 10 days per annum expected where water will be discharged due to the sediment basin and/or clean water dam exceeding capacity in the above average rainfall scenario, and 0 days per annum expected in the below average rainfall scenario.

3.8.1 Water Quality Assessment

The sediment basin will capture and treat stormwater prior to discharge in all cases, and the quarry will operate in accordance with the proposed operational management measures as outlined in **Section 4 – Operational Management Plan.**

Site specific water quality information is not currently available therefore the default discharge criteria has been adopted which is an approach consistent with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000).

4. Operational Management Plan

Provided below is the proposed Stormwater Operational Management Plan for implementation across the site.

4.1 Stormwater Management Plan

Purpose

Extraction and associated quarry operations that have the potential to impact on surface water runoff include:

- Vegetation clearing
- Topsoil stripping
- Overburden removals
- Excavation pit development
- Construction and maintenance of internal roads and hardstands
- Stockpiling of topsoil, raw feed and product
- Spillage during handling of materials
- Use and storage of oils, greases, fuels and other chemicals
- Accidental spillage of fuels, lubricants, or chemicals.

Performance Targets

It is proposed the quarry adhere to the extractive industry targets shown below for water quality release limits.

Proposed Water Quality Parameters

Parameter	100 percentile concentration limit
pH	6.5 – 8.5
Total Suspended Soils (TSS)	50 mg/L

Responsibilities

The Quarry Manager, or delegate, will be primarily responsible for the implementation of this plan.

Strategies/mitigation measures:

Strategies/mitigation measures for the management of surface water runoff and erosion and sediment transport from the site will be implemented in accordance the relevant approval conditions. Erosion and Sediment Control (ESC) measures for the site have been provided below for each main consideration when discussing ESC / Stormwater Management.

Erosion and Sediment Control

Site Management

Land-disturbing activities must be undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to:

- Allow stormwater to pass through the Site in a controlled manner and at non-erosive flow velocities up to the specified design storm discharge.
- Minimise soil erosion resulting from rain, water flow and/or wind.
- Minimise adverse effects of sediment runoff, including safety issues.
- Prevent, or at least minimise, environmental harm resulting from work-related soil erosion and sediment runoff.
- Ensure that the use of land/properties adjacent to the development (including roads) are not diminished as a result of the adopted ESC measures.

4.1 Stormwater Management Plan

Land Clearing

- Land clearing must be delayed as long as practicable and must be undertaken in conjunction with development of each stage of the quarry.
- Bulk tree clearing must occur in a manner that minimises disturbance to existing ground cover (organic or inorganic).
- Disturbance to natural watercourses (including bed and banks) and their associated riparian zones must be limited to the minimum practicable extent and be accompanied by the relevant approval.
- No land clearing shall be undertaken unless preceded by the installation of adequate drainage and sediment control measures, unless such clearing is required for the purpose of installing such measures, in which case, only the minimum clearing required to install such measures shall occur.
- Prior to land clearing, areas of protected vegetation, and significant areas of retained vegetation must be clearly identified (e.g. with high-visibility tape, or light fencing) for the purposes of minimising the risk of unnecessary land clearing.
- All reasonable and practicable measures must be taken to minimise the removal of, or disturbance to, those trees, shrubs and ground covers (organic or inorganic) that are intended to be retained.
- All land clearing must be undertaken in accordance with the Federal, State and Local Government Vegetation Protection/Preservation requirements and/or policies.
- Land clearing is limited to the minimum practicable extent during those periods when soil erosion due to wind, rain or surface water is possible.

Clean Water Diversion Drain

- Clean water diversion drains are to have greater than 90% vegetation coverage in those areas where rock armouring has not been designated. This coverage is required to be in-place prior to the designated wet season.
- Should the drain not naturally regenerate before the wet season, gully and sheet erosion may occur. Additional measures to promote vegetation growth will be required (as per IECA 2008).
- Seeding of the exposed areas using native grass species. The grass species will be required to have the following characteristics (as per IECA 2008).
  - Plants with a fibrous root system.
  - Plants that primarily grow horizontal rather than upright clumping plants.
  - Leguminous plants.
  - Non-invasive plants.
  - Avoid clumping or tussock forming grasses.
- Heavy rain during establishment period will likely cause erosion and sediment loss off-site. Additional measures may be required such as introduction of additional ground coverage over the area to reduce impact from water movement.

Site Access

- Site exit points must be appropriately managed to minimise the risk of sediment being tracked onto sealed, public roadways.
- Stormwater runoff from access roads and stabilised entry/exit points must drain to an appropriate sediment control device.

4.1 Stormwater Management Plan

Topsoil Management

- All reasonable and practicable measures must be taken to obtain the maximum benefit from existing topsoil.
- The top 100 mm of in-situ soils is to be stripped and stockpiled separately to subsoil materials for use in rehabilitation.

Stockpile Management

Stockpiles of erodible material that has the potential to cause environmental harm if displaced, must be:

- Adequately protected from wind, rain, concentrated surface flow and excessive upslope stormwater surface flows.
- Located at least 5 m from any hazardous area, retained vegetation or concentrated drainage line.
- Located up-slope of an appropriate sediment control system.
- A suitable flow diversion system must be established immediately up-slope of a stockpile.

Drainage Control

- Wherever reasonable and practicable, stormwater runoff entering the Site from external areas, and non-sediment laden (clean) stormwater runoff entering a work area or area of soil disturbance, must be diverted around or through that area in a manner that minimises soil erosion and the contamination of that water for all discharges up to the specified design storm discharge.
- All reasonable and practicable measures must be implemented to control flow velocities in such a manner than prevents soil erosion along drainage paths and at the entrance and exit
- Wherever reasonable and practicable, “clean” surface waters must be diverted away from sediment control devices and any untreated, sediment-laden waters.
- The internal drainage channel shall be constructed with silt traps. Such silt traps shall be cleared at regular intervals.
- Quarry and working benches shall be drained to the central drainage channel via channelling which shall have rubble placed in them to minimise the speed of water flow.

Sediment Control

- Efforts shall be employed to trap sediment within the Site, and as close as practicable to its source.
- Sediment traps must be installed and operated to both collect and retain sediment.
- The potential safety risk of proposed sediment control devices to Site workers, visitors and the public must be given appropriate consideration, especially those devices located within commonly accessible areas.
- All reasonable and practicable measures must be taken to prevent, or at least minimise, the release of sediment from the Site.
- Suitable all-weather maintenance access must be provided to all sediment control devices.
- Sediment control devices must be de-silted and made fully operational as soon as reasonable and practicable after a sediment-producing event, whether natural or artificial.
- Materials, whether liquid or solid, removed from sediment control devices during maintenance or decommissioning, must be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

4.1 Stormwater Management Plan

Site Maintenance

- All erosion and sediment control measures, including drainage control measures, must be maintained in proper working order at all times during their operational lives.
- Washing/flushing of sealed roadways must only occur where sweeping has failed to remove sufficient sediment and there is a compelling need to remove the remaining sediment (e.g. for safety reasons). In such circumstances, all reasonable and practicable sediment control measures must be used to prevent, or at least minimise, the release of sediment into receiving waters. Only those measures that will not cause safety and property flooding issues shall be employed. Sediment removed from roadways must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm.
- Sediment removed from sediment traps and places of sediment deposition must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm.
- Maintenance mowing must be done in a manner that will not damage the profile of formed, soft edges, such as the crest of earth embankments.

Flooding

The quarry is not located in a defined floodplain and flood risk is assumed low.

Monitoring and Maintenance

A summary schedule of the various inspections, performance criteria and responses that shall be performed on Site is shown below.

Monitoring and Maintenance of Stormwater Control Devices

Inspection	Minimum Frequency	Performance Criteria	Response
Inspect drainage lines including catch drains, contour drains and diversions	Quarterly, and prior to and following rainfall events	• erosion in areas adjacent to water conveyancing structures	• eroded areas shall be rip rapped as soon as practicable
		• overtopping of water conveyancing structures (identified by the scouring of the drain batters perpendicular to the direction of flow)	• the drain shall be cleaned of sediments and rip rap replaced to the original design specifications • rehabilitation with grasses in the catchment of the drain may be required to reduce sediment loadings of runoff
Inspect potential sediment storage capacity of	Quarterly or following major rainfall events	• maintain storage capacity	• sediment/grit shall be removed from the structure and used as filling in rehabilitation works

4.1 Stormwater Management Plan

	grit traps, sediment traps and Water Storage Areas			• recycle excavation pit water to ensure that adequate free storage is maintained for the collection and holding of runoff
	Waste containers	Quarterly	• waste is stored in appropriate containers • waste receptacles labelled	• ensure waste material is stored and disposed of properly
	Spill response stations	Quarterly and following use	• equipment is properly maintained	• maintain equipment • replace used equipment
	Maintenance / refuelling area	Quarterly	• fuel, oil spills	• clean up fuel spills and investigate source
			• contractor maintenance	• maintain contractor maintenance records
			• fuel storage integrity maintained	• investigate and repair potential leaks
Auditing	Stormwater management reviews are required to be carried out on a periodic basis to assess the implementation of the management strategies.			
Identification of Incident or Failure	Non-compliance with agreed performance criteria will be identified by: • Build-up of sediment off the Site • Excessive sediment build-up on the Site • Excessive erosion on the Site • Release of quarry materials from the Site • Poor vegetation establishment • Poorly maintained, damaged or failed ESC devices • Uncontrolled release from site for events less than the design event • Non-compliant water quality being released from Site.			
Corrective Action	After any identification of incident or failure, the source/cause is to be immediately located and the following measures implemented: • Build-up of sediment off the Site – the material must be collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; then on-site ESC measures amended, where appropriate, to reduce the risk of further sedimentation. • Excessive sediment build-up on the Site – collect and dispose of material, then amend up-slope drainage and/or erosion control measures as appropriate to reduce further occurrence. • Severe or excessive rill erosion – investigate cause, control up-slope water movement, re-profile surface, cover dispersive soils with a minimum 100mm layer of non-			

4.1 Stormwater Management Plan	
	dispersive soil, and stabilise with erosion control measures and vegetation as necessary. • Release of construction material from the Site – collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; then inspect litter and waste receptors. • Poor vegetation growth or soil coverage – plant new vegetation and/or mulch as required. • Sediment control failure – replace and monitor more frequently. Regular failures may mean that the sediment control location, alignment or installation may need to be amended. • Scour / erosion of Water Storage Area bunds will be required to be stabilised. If the release of excessive sediment and/or other materials off the Site occurs, or water quality monitoring indicates levels are not within the Water Quality Release, clean up deposition, and inspect all control measures. If monitored levels within any sediment basin does not conform to the release criteria for: • Suspended solids – flocculate and retest • pH – treat and retest.
Internal Reporting	A copy of all incidents and complaints will be stored at the Site within the incident and complaint register. All complaints and incidents must be recorded internally.

5. Surface Water Management Implementation

This plan will be reviewed periodically and will be updated as necessary to include revised quarry developmental layout plans, topographic plans and detailed designs and specifications of controls devices.

5.1 Monitoring Investigation Indicators

The following indicators are to be used to identify if the objectives of the plan are being met:

- Visible evidence of deterioration of baseline water quality of downstream watercourses that is directly attributable to the Site.
- Pollutant concentrations that exceed the water quality objectives.
- Visible significant erosion.
- Failure of control measures.

The triggering of an investigation indicator will require the following remedial actions:

- Locate the source of water quality deterioration.
- Prevent continuing deterioration with temporary controls.
- Repair existing controls, construct additional controls or modify procedures to prevent future deterioration in water quality.
- Review management plan and strategies in the event of significant deterioration in water quality.

5.2 Monitoring Management Measures

The following management measures will be implemented during facility operation:

- The **Quarry Manager** or authorised representative is to regularly inspect the stormwater management devices, particularly prior to forecasted wet weather and following major rainfall events to ensure that these devices are in good working order.
- The **Quarry Manager** or authorised representative is to ensure that drains and paved surfaces are kept free of wastes or other material, especially materials which may impact on runoff water quality.
- The **Quarry Manager** shall carry out general surveillance to qualitatively assess stormwater releases from Site during discharge events.

5.3 Auditing and Review

The effectiveness of the plan will be reviewed as necessary (e.g. following a change in Site operations) and at least once every three (3) years. The review shall take into account changes to Site activities, available surface water monitoring results, any complaints, pollution incidents and any corrective actions taken.

5.4 Reporting and Responsibility

- The **Quarry Manager** will be responsible for ensuring that stormwater devices constructed on the Site have adequate free water storage capacity.
- All complaints pertaining to water quality received will be recorded in the complaints register/log maintained on-site.
- The **Quarry Manager** or a suitably qualified consultant will prepare water monitoring records if and when required by the regulatory authority.
- Records, including results of any monitoring program undertaken on-site, complaints or incidents will be kept on-site for a minimum of five (5) years.

5.5 Identification of Incident or Failure

An incident or failure may include, but not be limited to:

- deterioration in surface water quality within waters discharged from Site
- receipt of a stormwater quality release complaint
- not maintaining on-site stormwater controls or treatment devices.

5.6 Corrective Action

If a discharge with significant variation in water quality occurs as a result of on-site operations, an investigation will be conducted and appropriate action taken to resolve the issue to the fullest practicable extent.

6. Conclusion

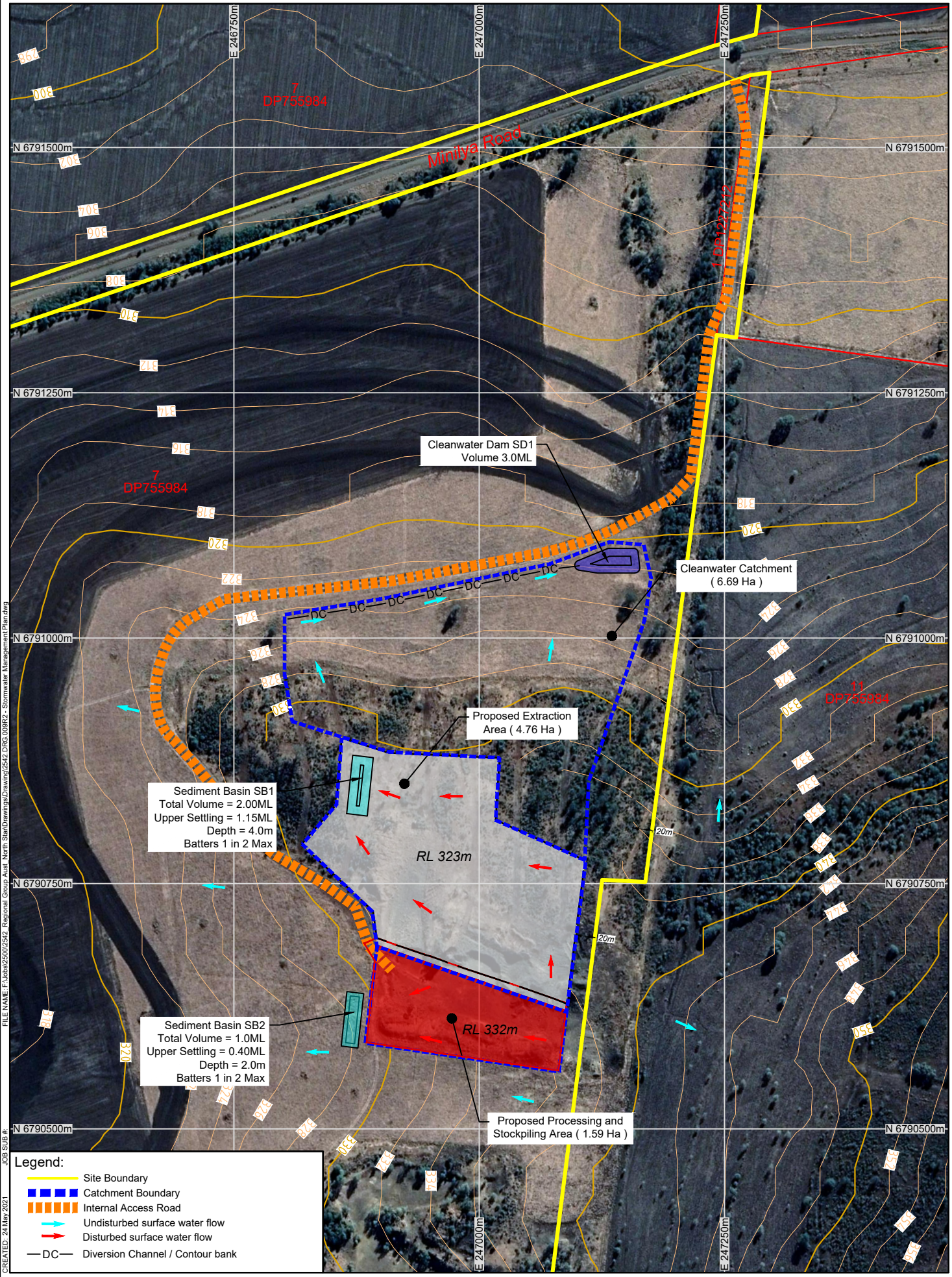
This assessment outlines the appropriate treatment measures and operational procedures to be adopted to integrate adequate stormwater management into daily operations and Site activity. Specifically, this document has prepared to ensure that appropriate measures have been developed to meet the requirements of the EIS for the development.

Operational procedures outlined in this SMP will assist to ensure compliance as a minimum standard.

7. Reference List

1. *International Erosion Control Association, Best Practice Erosion and Sediment Control: Book 2 and Book 4, 2008.*
2. DECC (2008) *Managing Urban Stormwater - Soils and Construction.*

figures



FILE NAME: F:\Jobs\2500\2542 Regional Group Aust North Star\Drawings\Drawing\2542.DRG.009R2 - Stormwater Management Plan.dwg

JOB SUB #:

CREATED: 24 May 2021

PROJECT: North Star Quarry

CLIENT: Regional Group Australia

TITLE: Figure 1 - Surface Water Management Plan

GROUNDWORK plus

PH: +61 7 3871 0411

WWW.GROUNDWORK.COM.AU

SCALE: 1:5,000 When Printed On A4 — 0 — 100m

DRAWING NUMBER: 2542.DRG.009

REVISION: 2

DATE: 24 May 2021 | DRAWN: MRescar

PRINTED: 24 May 2021 | CHECKED: JLawler

DATUM: HORIZONTAL / VERTICAL / ZONE

MGA / / 56

attachments

Attachment 1

Sediment Basin Calculations

Sediment Basin Storage Volume Estimation - Type F & D
IECA (June 2009)

GROUNDWORK plus

$V_s = 10 * R_{(Y\%, 5\text{-day})} * Cv * A$

A = 4.760 Ha

C_v = 0.63 Source: (Table B31, IECA)

$R_{(Y\%, 5\text{-day})}$ = 38.186 mm

V_s = 1,145 m^3

V_s = 1.15 ML

$V_{SED} = 0.5 * V_s$

V_{SED} = 0.57 ML

573 m^3

R (Y%, 5-day) Estimation (Source: BPESC, IECA, 2009)		
Location:	Site	
R(Y%)	90	
K1	33.5	
K2	14.2	
$I_{(1yr, 120hr)}$	0.716	
$R_{(Y\%, 5\text{-day})}$ =	38.186	Equation B8
$R_{(Y\%, 5\text{-day})}$ =		EPL
$R_{(Y\%, 5\text{-day})}$ =	38.186	Adopted

Sediment Basin Requires a Upper Settling Volume of	**1.15**	**ML**
Sediment Basin Requires a Sediment Storage Volume of	**0.57**	**ML**
Total Sediment Basin Storage Volume is	**1.72**	**ML**

Sediment Basin Storage Volume Estimation - Type F & D
IECA (June 2009)

GROUNDWORK plus

$V_s = 10 * R_{(Y\%,\ 5\text{-}day)} * Cv * A$

A = 1.590 Ha

C_v = 0.63 Source: (Table B31, IECA)

$R_{(Y\%,\ 5\text{-}day)}$ = 38.186 mm

V_s = 383 m^3

V_s = 0.38 ML

$V_{SED} = 0.5 * V_s$

V_{SED} = 0.19 ML

191 m^3

R (Y%, 5-day) Estimation (Source: BPESC, IECA, 2009)		
Location:	Site	
R(Y%)	90	
K1	33.5	
K2	14.2	
$I_{(1yr,\ 120hr)}$	0.716	
$R_{(Y\%,\ 5\text{-}day)}$ =	38.186	Equation B8
$R_{(Y\%,\ 5\text{-}day)}$ =		EPL
$R_{(Y\%,\ 5\text{-}day)}$ =	38.186	Adopted

Sediment Basin Requires a Upper Settling Volume of	**0.38**	**ML**
Sediment Basin Requires a Sediment Storage Volume of	**0.19**	**ML**
Total Sediment Basin Storage Volume is	**0.57**	**ML**

Attachment 2

Water Balance Assessment

Year	Month	Day	Daily Recorded Rainfall (mm)	Mean Daily Evaporation (mm)	Runoff Coefficient		Catchment Area - Quarry (m²)	Catchment Area - Stockpile (m²)	Inputs		Outputs		Volume of Water in Basin (m³)	Days no water	Predicted Frequency of Uncontrolled Discharge
					Quarry	Clean			Overland Flow runoff (m³)	Overland Flow Clean Dam (m³)	Evaporation (m³)	Water Used in Operations (m³)			
1998	1	1	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	0	1	0
1998	1	2	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	5000	0	0
1998	1	3	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4832.375	0	0
1998	1	4	0.2	10.1	0.85	0.5	63500	66900	10.795	6.69	12.625	155	4682.235	0	0
1998	1	5	0.4	10.1	0.85	0.5	63500	66900	21.59	13.38	12.625	155	4549.58	0	0
1998	1	6	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4381.955	0	0
1998	1	7	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4214.33	0	0
1998	1	8	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4046.705	0	0
1998	1	9	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3879.08	0	0
1998	1	10	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3711.455	0	0
1998	1	11	0.2	10.1	0.85	0.5	63500	66900	10.795	6.69	12.625	155	3561.315	0	0
1998	1	12	11	10.1	0.85	0.5	63500	66900	593.725	367.95	12.625	155	4355.365	0	0
1998	1	13	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4187.74	0	0
1998	1	14	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4020.115	0	0
1998	1	15	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3852.49	0	0
1998	1	16	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3684.865	0	0
1998	1	17	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3517.24	0	0
1998	1	18	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3349.615	0	0
1998	1	19	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3181.99	0	0
1998	1	20	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3014.365	0	0
1998	1	21	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2846.74	0	0
1998	1	22	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2679.115	0	0
1998	1	23	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2511.49	0	0
1998	1	24	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2343.865	0	0
1998	1	25	0.2	10.1	0.85	0.5	63500	66900	10.795	6.69	12.625	155	2193.725	0	0
1998	1	26	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2026.1	0	0
1998	1	27	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1858.475	0	0
1998	1	28	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1690.85	0	0
1998	1	29	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1523.225	0	0
1998	1	30	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1355.6	0	0
1998	1	31	0.6	10.1	0.85	0.5	63500	66900	32.385	20.07	12.625	155	1240.43	0	0
1998	2	1	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	1074.055	0	0
1998	2	2	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	907.68	0	0
1998	2	3	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	741.305	0	0
1998	2	4	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	574.93	0	0
1998	2	5	3.2	9.1	0.85	0.5	63500	66900	172.72	107.04	11.375	155	688.315	0	0
1998	2	6	11.8	9.1	0.85	0.5	63500	66900	636.905	394.71	11.375	155	1553.555	0	0
1998	2	7	0.2	9.1	0.85	0.5	63500	66900	10.795	6.69	11.375	155	1404.665	0	0
1998	2	8	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	1238.29	0	0
1998	2	9	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	1071.915	0	0
1998	2	10	10	9.1	0.85	0.5	63500	66900	539.75	334.5	11.375	155	1779.79	0	0
1998	2	11	7.4	9.1	0.85	0.5	63500	66900	399.415	247.53	11.375	155	2260.36	0	0
1998	2	12	47.6	9.1	0.85	0.5	63500	66900	2569.21	1592.22	11.375	155	6255.415	0	0
1998	2	13	4.6	9.1	0.85	0.5	63500	66900	248.285	153.87	11.375	155	6491.195	0	0
1998	2	14	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	6324.82	0	0
1998	2	15	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	6158.445	0	0
1998	2	16	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5992.07	0	0
1998	2	17	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5825.695	0	0
1998	2	18	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5659.32	0	0
1998	2	19	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5492.945	0	0
1998	2	20	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5326.57	0	0
1998	2	21	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5160.195	0	0
1998	2	22	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	4993.82	0	0
1998	2	23	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	4827.445	0	0
1998	2	24	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	4661.07	0	0
1998	2	25	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	4494.695	0	0
1998	2	26	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	4328.32	0	0
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1998	2	28	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	3995.57	0	0
1998	3	1	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3830.945	0	0
1998	3	2	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3666.32	0	0
1998	3	3	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3501.695	0	0
1998	3	4	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3337.07	0	0
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1998	3	8	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2678.57	0	0
1998	3	9	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2513.945	0	0
1998	3	10	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2349.32	0	0
1998	3	11	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2184.695	0	0
1998	3	12	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2020.07	0	0
1998	3	13	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1855.445	0	0
1998	3	14	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1690.82	0	0
1998	3	15	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1526.195	0	0
1998	3	16	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1361.57	0	0
1998	3	17	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1196.945	0	0
1998	3	18	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1032.32	0	0
1998	3	19	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	867.695	0	0
1998	3	20	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	703.07	0	0
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1998	3	22	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	373.82	0	0
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1998	3	24	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	44.57	0	0
1998	3	25	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	0	1	0
1998	3	26	33	7.7	0.85	0.5	63500	66900	1781.175	1103.85	9.625	155	2720.4	0	0
1998	3	27	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2555.775	0	0
1998	3	28	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2391.15	0	0
1998	3	29	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2226.525	0	0
1998	3	30	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2061.9	0	0
1998	3	31	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1897.275	0	0
1998	4	1	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1735.15	0	0
1998	4	2	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1573.025	0	0
1998	4	3	8	5.7	0.85	0.5	63500	66900	431.8	267.6	7.125	155	2110.3	0	0
1998	4	4	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1948.175	0	0
1998	4	5	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1786.05	0	0
1998	4	6	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1623.925	0	0
1998	4	7	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1461.8	0	0
1998	4	8	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1299.675	0	0
1998	4	9	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1137.55	0	0
1998	4	10	1	5.7	0.85	0.5	63500	66900	53.975	33.45	7.125	155	1062.85	0	0
1998	4	11	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	900.725	0	0
1998	4	12	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	738.6	0	0
1998	4	13	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	576.475	0	0
1998	4	14	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	414.35	0	0
1998	4	15	0.4	5.7	0.85	0.5	63500	66900	21.59	13.38	7.125	155	287.195	0	0
1998	4	16	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	125.07	0	0
1998	4	17	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	0	1	0
1998	4	18	0.4	5.7	0.85	0.5	63500	66900	21.59	13.38	7.125	155	0	1	0
1998	4	19	2.2	5.7	0.85	0.5	63500	66900	118.745	73.59	7.125	155	30.21	0	0
1998	4	20	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	0	1	0
1998	4	21	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	0	1	0
1998	4	22	1.8	5.7	0.85	0.5	63500	66900	97.155	60.21	7.125	155	0	1	0
1998	4	23	21.8	5.7	0.85	0.5	63500	66900	1176.655	729.21	7.125	155	1743.74	0	0
1998	4	24	0.2	5.7	0.85	0.5	63500	66900	10.795	6.69	7.125	155	1599.1	0	0
1998	4	25	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1436.975	0	0
1998	4	26	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1274.85	0	0
1998	4	27	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	1112.725	0	0
1998	4	28	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	950.6	0	0
1998	4	29	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	788.475	0	0
1998	4	30	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	626.35	0	0
1998	5	1	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	466.725	0	0
1998	5	2	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	307.1	0	0
1998	5	3	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	147.475	0	0
1998	5	4	12.8	3.7	0.85	0.5	63500	66900	690.88	428.16	4.625	155	1106.89	0	0
1998	5	5	22	3.7	0.85	0.5	63500	66900	1187.45	735.9	4.625	155	2870.615	0	0
1998	5	6	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2710.99	0	0
1998	5	7	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2551.365	0	0
1998	5	8	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2391.74	0	0
1998	5	9	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2232.115	0	0
1998	5	10	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2072.49	0	0
1998	5	11	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1912.865	0	0
1998	5	12	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1753.24	0	0
1998	5	13	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1593.615	0	0
1998	5	14	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1433.99	0	0
1998	5	15	4	3.7	0.85	0.5	63500	66900	215.9	133.8	4.625	155	1624.065	0	0
1998	5	16	4.6	3.7	0.85	0.5	63500	66900	248.285	153.87	4.625	155	1866.595	0	0
1998	5	17	1.8	3.7	0.85	0.5	63500	66900	97.155	60.21	4.625	155	1864.335	0	0
1998	5	18	18.8	3.7	0.85	0.5	63500	66900	1014.73	628.86	4.625	155	3348.3	0	0
1998	5	19	0.2	3.7	0.85	0.5	63500	66900	10.795	6.69	4.625	155	3206.16	0	0
1998	5	20	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	3046.535	0	0

1998	5	21	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2886.91	0	0
1998	5	22	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2727.285	0	0
1998	5	23	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2567.66	0	0
1998	5	24	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2408.035	0	0
1998	5	25	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2248.41	0	0
1998	5	26	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	2088.785	0	0
1998	5	27	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1929.16	0	0
1998	5	28	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1769.535	0	0
1998	5	29	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1609.91	0	0
1998	5	30	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1450.285	0	0
1998	5	31	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	1290.66	0	0
1998	6	1	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	1132.41	0	0
1998	6	2	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	974.16	0	0
1998	6	3	1	2.6	0.85	0.5	63500	66900	53.975	33.45	3.25	155	903.335	0	0
1998	6	4	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	745.085	0	0
1998	6	5	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	586.835	0	0
1998	6	6	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	428.585	0	0
1998	6	7	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	270.335	0	0
1998	6	8	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	112.085	0	0
1998	6	9	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	10	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	11	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	12	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	13	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	14	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	15	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	0	1	0
1998	6	16	12.8	2.6	0.85	0.5	63500	66900	690.88	428.16	3.25	155	960.79	0	0
1998	6	17	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	802.54	0	0
1998	6	18	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	644.29	0	0
1998	6	19	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	486.04	0	0
1998	6	20	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	327.79	0	0
1998	6	21	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	169.54	0	0
1998	6	22	18.6	2.6	0.85	0.5	63500	66900	1003.935	622.17	3.25	155	1637.395	0	0
1998	6	23	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	1479.145	0	0
1998	6	24	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	1320.895	0	0
1998	6	25	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	1162.645	0	0
1998	6	26	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	1004.395	0	0
1998	6	27	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	846.145	0	0
1998	6	28	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	687.895	0	0
1998	6	29	1.2	2.6	0.85	0.5	63500	66900	64.77	40.14	3.25	155	634.555	0	0
1998	6	30	18.4	2.6	0.85	0.5	63500	66900	993.14	615.48	3.25	155	2084.925	0	0
1998	7	1	9	2.7	0.85	0.5	63500	66900	485.775	301.05	3.375	155	2713.375	0	0
1998	7	2	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2555	0	0
1998	7	3	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2396.625	0	0
1998	7	4	4.4	2.7	0.85	0.5	63500	66900	237.49	147.18	3.375	155	2622.92	0	0
1998	7	5	1.4	2.7	0.85	0.5	63500	66900	75.565	46.83	3.375	155	2586.94	0	0
1998	7	6	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2428.565	0	0
1998	7	7	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2270.19	0	0
1998	7	8	0.6	2.7	0.85	0.5	63500	66900	32.385	20.07	3.375	155	2164.27	0	0
1998	7	9	0.6	2.7	0.85	0.5	63500	66900	32.385	20.07	3.375	155	2058.35	0	0
1998	7	10	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	1899.975	0	0
1998	7	11	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	1741.6	0	0
1998	7	12	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	1583.225	0	0
1998	7	13	1.4	2.7	0.85	0.5	63500	66900	75.565	46.83	3.375	155	1547.245	0	0
1998	7	14	0.6	2.7	0.85	0.5	63500	66900	32.385	20.07	3.375	155	1441.325	0	0
1998	7	15	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	1282.95	0	0
1998	7	16	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	1124.575	0	0
1998	7	17	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	966.2	0	0
1998	7	18	14.4	2.7	0.85	0.5	63500	66900	777.24	481.68	3.375	155	2066.745	0	0
1998	7	19	20.8	2.7	0.85	0.5	63500	66900	1122.68	695.76	3.375	155	3726.81	0	0
1998	7	20	0.2	2.7	0.85	0.5	63500	66900	10.795	6.69	3.375	155	3585.92	0	0
1998	7	21	3	2.7	0.85	0.5	63500	66900	161.925	100.35	3.375	155	3689.82	0	0
1998	7	22	11.8	2.7	0.85	0.5	63500	66900	636.905	394.71	3.375	155	4563.06	0	0
1998	7	23	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4404.685	0	0
1998	7	24	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4246.31	0	0
1998	7	25	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4087.935	0	0
1998	7	26	5.6	2.7	0.85	0.5	63500	66900	302.26	187.32	3.375	155	4419.14	0	0
1998	7	27	1.4	2.7	0.85	0.5	63500	66900	75.565	46.83	3.375	155	4383.16	0	0
1998	7	28	55.6	2.7	0.85	0.5	63500	66900	3001.01	1859.82	3.375	155	9085.615	0	0
1998	7	29	2	2.7	0.85	0.5	63500	66900	107.95	66.9	3.375	155	9102.09	0	0
1998	7	30	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	8943.715	0	0
1998	7	31	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	8785.34	0	0
1998	8	1	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	8625.465	0	0
1998	8	2	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	8465.59	0	0
1998	8	3	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	8305.715	0	0
1998	8	4	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	8145.84	0	0
1998	8	5	8.2	3.9	0.85	0.5	63500	66900	442.595	274.29	4.875	155	8702.85	0	0
1998	8	6	19.8	3.9	0.85	0.5	63500	66900	1068.705	662.31	4.875	155	10273.99	0	0
1998	8	7	0.4	3.9	0.85	0.5	63500	66900	21.59	13.38	4.875	155	10149.085	0	0
1998	8	8	0.8	3.9	0.85	0.5	63500	66900	43.18	26.76	4.875	155	10059.15	0	0
1998	8	9	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	9899.275	0	0
1998	8	10	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	9739.4	0	0
1998	8	11	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	9579.525	0	0
1998	8	12	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	9419.65	0	0
1998	8	13	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	9259.775	0	0
1998	8	14	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	9099.9	0	0
1998	8	15	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	8940.025	0	0
1998	8	16	39.8	3.9	0.85	0.5	63500	66900	2148.205	1331.31	4.875	155	12259.665	0	0
1998	8	17	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	12099.79	0	0
1998	8	18	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	11939.915	0	0
1998	8	19	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	11780.04	0	0
1998	8	20	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	11620.165	0	0
1998	8	21	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	11460.29	0	0
1998	8	22	10.4	3.9	0.85	0.5	63500	66900	561.34	347.88	4.875	155	12209.635	0	0
1998	8	23	19.4	3.9	0.85	0.5	63500	66900	1047.115	648.93	4.875	155	13745.805	0	0
1998	8	24	11	3.9	0.85	0.5	63500	66900	593.725	367.95	4.875	155	14547.605	0	0
1998	8	25	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	14387.73	0	0
1998	8	26	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	14227.855	0	0
1998	8	27	73	3.9	0.85	0.5	63500	66900	3940.175	2441.85	4.875	155	20000	0	1
1998	8	28	0.4	3.9	0.85	0.5	63500	66900	21.59	13.38	4.875	155	19875.095	0	0
1998	8	29	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	19715.22	0	0
1998	8	30	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	19555.345	0	0
1998	8	31	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	19395.47	0	0
1998	9	1	10.2	5.6	0.85	0.5	63500	66900	550.545	341.19	7	155	20000	0	1
1998	9	2	1	5.6	0.85	0.5	63500	66900	53.975	33.45	7	155	19925.425	0	1
1998	9	3	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19763.425	0	0
1998	9	4	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19601.425	0	0
1998	9	5	4	5.6	0.85	0.5	63500	66900	215.9	133.8	7	155	19789.125	0	1
1998	9	6	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19627.125	0	0
1998	9	7	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19465.125	0	0
1998	9	8	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19303.125	0	0
1998	9	9	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19141.125	0	0
1998	9	10	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18979.125	0	0
1998	9	11	2.8	5.6	0.85	0.5	63500	66900	151.13	93.66	7	155	19061.915	0	0
1998	9	12	1.2	5.6	0.85	0.5	63500	66900	64.77	40.14	7	155	19004.825	0	0
1998	9	13	13	5.6	0.85	0.5	63500	66900	701.675	434.85	7	155	19979.35	0	1
1998	9	14	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19817.35	0	0
1998	9	15	11.6	5.6	0.85	0.5	63500	66900	626.11	388.02	7	155	20000	0	1
1998	9	16	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19838	0	0
1998	9	17	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19676	0	0
1998	9	18	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19514	0	0
1998	9	19	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19352	0	0
1998	9	20	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19190	0	0
1998	9	21	1.8	5.6	0.85	0.5	63500	66900	97.155	60.21	7	155	19185.365	0	0
1998	9	22	0	5.6	0.85	0.5	63500	66900	0	0	7	155	19023.365	0	0
1998	9	23	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18861.365	0	0
1998	9	24	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18699.365	0	0
1998	9	25	4.6	5.6	0.85	0.5	63500	66900	248.285	153.87	7	155	18939.52	0	0
1998	9	26	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18777.52	0	0
1998	9	27	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18615.52	0	0
1998	9	28	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18453.52	0	0
1998	9	29	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18291.52	0	0
1998	9	30	0	5.6	0.85	0.5	63500	66900	0	0	7	155	18129.52	0	0
1998	10	1	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17964.895	0	0
1998	10	2	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17800.27	0	0
1998	10	3	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17635.645	0	0
1998	10	4	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17471.02	0	0
1998	10	5	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17306.395	0	0
1998	10	6	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17141.77	0	0
1998	10	7	17.2	7.7	0.85	0.5	63500	66900	928.37	575.34	9.625	155	18480.855	0	0
1998	10	8	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18316.23	0	0
1998	10	9	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18151.605	0	0
1998	10	10	5.4	7.7	0.85	0.5	63500	66900	291.465	180.63	9.625	155	18459.075	0	0
1998	10	11	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18294.45	0	0
1998	10	12	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18129.825	0	0

1998	10	13	18.2	7.7	0.85	0.5	63500	66900	982.345	608.79	9.625	155	19556.335	0	1
1998	10	14	0.4	7.7	0.85	0.5	63500	66900	21.59	13.38	9.625	155	19426.68	0	0
1998	10	15	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	19262.055	0	0
1998	10	16	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	19097.43	0	0
1998	10	17	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18932.805	0	0
1998	10	18	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18768.18	0	0
1998	10	19	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18603.555	0	0
1998	10	20	1	7.7	0.85	0.5	63500	66900	53.975	33.45	9.625	155	18526.355	0	0
1998	10	21	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18361.73	0	0
1998	10	22	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18197.105	0	0
1998	10	23	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	18032.48	0	0
1998	10	24	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	17867.855	0	0
1998	10	25	17	7.7	0.85	0.5	63500	66900	917.575	568.65	9.625	155	19189.455	0	1
1998	10	26	8.8	7.7	0.85	0.5	63500	66900	474.98	294.36	9.625	155	19794.17	0	1
1998	10	27	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	19629.545	0	0
1998	10	28	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	19464.92	0	0
1998	10	29	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	19300.295	0	0
1998	10	30	1.2	7.7	0.85	0.5	63500	66900	64.77	40.14	9.625	155	19240.58	0	0
1998	10	31	5.2	7.7	0.85	0.5	63500	66900	280.67	173.94	9.625	155	19530.565	0	0
1998	11	1	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	19364.065	0	0
1998	11	2	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	19197.565	0	0
1998	11	3	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	19031.065	0	0
1998	11	4	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18864.565	0	0
1998	11	5	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18698.065	0	0
1998	11	6	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18531.565	0	0
1998	11	7	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18365.065	0	0
1998	11	8	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18198.565	0	0
1998	11	9	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18032.065	0	0
1998	11	10	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	17865.565	0	0
1998	11	11	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	17699.065	0	0
1998	11	12	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	17532.565	0	0
1998	11	13	5.2	9.2	0.85	0.5	63500	66900	280.67	173.94	11.5	155	17820.675	0	0
1998	11	14	6.4	9.2	0.85	0.5	63500	66900	345.44	214.08	11.5	155	18213.695	0	0
1998	11	15	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18047.195	0	0
1998	11	16	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	17880.695	0	0
1998	11	17	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	17714.195	0	0
1998	11	18	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	17547.695	0	0
1998	11	19	17.6	9.2	0.85	0.5	63500	66900	949.96	588.72	11.5	155	18919.875	0	1
1998	11	20	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18753.375	0	0
1998	11	21	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18586.875	0	0
1998	11	22	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18420.375	0	0
1998	11	23	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18253.875	0	0
1998	11	24	2	9.2	0.85	0.5	63500	66900	107.95	66.9	11.5	155	18262.225	0	0
1998	11	25	8	9.2	0.85	0.5	63500	66900	431.8	267.6	11.5	155	18795.125	0	0
1998	11	26	2.6	9.2	0.85	0.5	63500	66900	140.335	86.97	11.5	155	18855.93	0	0
1998	11	27	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18689.43	0	0
1998	11	28	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18522.93	0	0
1998	11	29	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18356.43	0	0
1998	11	30	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	18189.93	0	0
1998	12	1	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	18022.68	0	0
1998	12	2	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	17855.43	0	0
1998	12	3	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	17688.18	0	0
1998	12	4	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	17520.93	0	0
1998	12	5	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	17353.68	0	0
1998	12	6	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	17186.43	0	0
1998	12	7	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	17019.18	0	0
1998	12	8	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	16851.93	0	0
1998	12	9	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	16684.68	0	0
1998	12	10	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	16517.43	0	0
1998	12	11	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	16350.18	0	0
1998	12	12	0.6	9.8	0.85	0.5	63500	66900	32.385	20.07	12.25	155	16235.385	0	0
1998	12	13	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	16068.135	0	0
1998	12	14	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15900.885	0	0
1998	12	15	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15733.635	0	0
1998	12	16	1	9.8	0.85	0.5	63500	66900	53.975	33.45	12.25	155	15653.81	0	0
1998	12	17	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15486.56	0	0
1998	12	18	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15319.31	0	0
1998	12	19	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15152.06	0	0
1998	12	20	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14984.81	0	0
1998	12	21	8	9.8	0.85	0.5	63500	66900	431.8	267.6	12.25	155	15516.96	0	0
1998	12	22	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15349.71	0	0
1998	12	23	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15182.46	0	0
1998	12	24	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	15015.21	0	0
1998	12	25	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14847.96	0	0
1998	12	26	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14680.71	0	0
1998	12	27	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14513.46	0	0
1998	12	28	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14346.21	0	0
1998	12	29	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14178.96	0	0
1998	12	30	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	14011.71	0	0
1998	12	31	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	13844.46	0	0
									41798.24	25903.68	2951.75	56575		14	10

Year	Month	Day	Daily Recorded Rainfall (mm)	Mean Daily Evaporation (mm)	Runoff Coefficient		Catchment Area - Quarry (m²)	Catchment Area - Stockpile (m²)	Inputs		Outputs		Volume of Harvested Water Remaining (m³)	Days no water	Predicted Frequency of Uncontrolled Discharge
					Quarry	Clean			Overland Flow Quarry (m³)	Overland Flow Clean Dam (m³)	Evaporation (m³)	Water Used in Operations (m³)			
2003	1	1	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	0	1	0
2003	1	2	6.6	10.1	0.85	0.5	63500	66900	356.235	220.77	12.625	155	5577.005	0	0
2003	1	3	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	5409.38	0	0
2003	1	4	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	5241.755	0	0
2003	1	5	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	5074.13	0	0
2003	1	6	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4906.505	0	0
2003	1	7	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4738.88	0	0
2003	1	8	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4571.255	0	0
2003	1	9	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4403.63	0	0
2003	1	10	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4236.005	0	0
2003	1	11	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	4068.38	0	0
2003	1	12	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3900.755	0	0
2003	1	13	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3733.13	0	0
2003	1	14	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3565.505	0	0
2003	1	15	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3397.88	0	0
2003	1	16	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3230.255	0	0
2003	1	17	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	3062.63	0	0
2003	1	18	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2895.005	0	0
2003	1	19	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2727.38	0	0
2003	1	20	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2559.755	0	0
2003	1	21	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2392.13	0	0
2003	1	22	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2224.505	0	0
2003	1	23	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	2056.88	0	0
2003	1	24	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1889.255	0	0
2003	1	25	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1721.63	0	0
2003	1	26	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1554.005	0	0
2003	1	27	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1386.38	0	0
2003	1	28	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1218.755	0	0
2003	1	29	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	1051.13	0	0
2003	1	30	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	883.505	0	0
2003	1	31	0	10.1	0.85	0.5	63500	66900	0	0	12.625	155	715.88	0	0
2003	2	1	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	549.505	0	0
2003	2	2	0.2	9.1	0.85	0.5	63500	66900	10.795	6.69	11.375	155	400.615	0	0
2003	2	3	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	234.24	0	0
2003	2	4	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	67.865	0	0
2003	2	5	9	9.1	0.85	0.5	63500	66900	485.775	301.05	11.375	155	688.315	0	0
2003	2	6	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	521.94	0	0
2003	2	7	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	355.565	0	0
2003	2	8	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	189.19	0	0
2003	2	9	1	9.1	0.85	0.5	63500	66900	53.975	33.45	11.375	155	110.24	0	0
2003	2	10	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	11	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	12	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	13	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	14	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	15	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	16	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	17	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	18	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	19	0.8	9.1	0.85	0.5	63500	66900	43.18	26.76	11.375	155	0	1	0
2003	2	20	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	21	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	0	1	0
2003	2	22	54.4	9.1	0.85	0.5	63500	66900	2936.24	1819.68	11.375	155	4589.545	0	0
2003	2	23	25.6	9.1	0.85	0.5	63500	66900	1381.76	856.32	11.375	155	6661.25	0	0
2003	2	24	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	6494.875	0	0
2003	2	25	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	6328.5	0	0
2003	2	26	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	6162.125	0	0
2003	2	27	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5995.75	0	0
2003	2	28	0	9.1	0.85	0.5	63500	66900	0	0	11.375	155	5829.375	0	0
2003	3	1	16.6	7.7	0.85	0.5	63500	66900	895.985	555.27	9.625	155	7116.005	0	0
2003	3	2	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6951.38	0	0
2003	3	3	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6786.755	0	0
2003	3	4	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6622.13	0	0
2003	3	5	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6457.505	0	0
2003	3	6	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6292.88	0	0
2003	3	7	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6128.255	0	0
2003	3	8	6	7.7	0.85	0.5	63500	66900	323.85	200.7	9.625	155	6488.18	0	0
2003	3	9	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6323.555	0	0
2003	3	10	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6158.93	0	0
2003	3	11	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	5994.305	0	0
2003	3	12	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	5829.68	0	0
2003	3	13	11.8	7.7	0.85	0.5	63500	66900	636.905	394.71	9.625	155	6696.67	0	0
2003	3	14	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6532.045	0	0
2003	3	15	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6367.42	0	0
2003	3	16	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6202.795	0	0
2003	3	17	7.6	7.7	0.85	0.5	63500	66900	410.21	254.22	9.625	155	6702.6	0	0
2003	3	18	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6537.975	0	0
2003	3	19	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6373.35	0	0
2003	3	20	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	6208.725	0	0
2003	3	21	46.6	7.7	0.85	0.5	63500	66900	2515.235	1558.77	9.625	155	10118.105	0	0
2003	3	22	7.8	7.7	0.85	0.5	63500	66900	421.005	260.91	9.625	155	10635.395	0	0
2003	3	23	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	10470.77	0	0
2003	3	24	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	10306.145	0	0
2003	3	25	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	10141.52	0	0
2003	3	26	2.2	7.7	0.85	0.5	63500	66900	118.745	73.59	9.625	155	10169.23	0	0
2003	3	27	4.2	7.7	0.85	0.5	63500	66900	226.695	140.49	9.625	155	10371.79	0	0
2003	3	28	15	7.7	0.85	0.5	63500	66900	809.625	501.75	9.625	155	11518.54	0	0
2003	3	29	6.2	7.7	0.85	0.5	63500	66900	334.645	207.39	9.625	155	11895.95	0	0
2003	3	30	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	11731.325	0	0
2003	3	31	0.4	7.7	0.85	0.5	63500	66900	21.59	13.38	9.625	155	11601.67	0	0
2003	4	1	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	11439.545	0	0
2003	4	2	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	11277.42	0	0
2003	4	3	1.6	5.7	0.85	0.5	63500	66900	86.36	53.52	7.125	155	11255.175	0	0
2003	4	4	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	11093.05	0	0
2003	4	5	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10930.925	0	0
2003	4	6	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10768.8	0	0
2003	4	7	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10606.675	0	0
2003	4	8	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10444.55	0	0
2003	4	9	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10282.425	0	0
2003	4	10	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10120.3	0	0
2003	4	11	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9958.175	0	0
2003	4	12	2	5.7	0.85	0.5	63500	66900	107.95	66.9	7.125	155	9970.9	0	0
2003	4	13	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9808.775	0	0
2003	4	14	8.2	5.7	0.85	0.5	63500	66900	442.595	274.29	7.125	155	10363.535	0	0
2003	4	15	4.6	5.7	0.85	0.5	63500	66900	248.285	153.87	7.125	155	10603.565	0	0
2003	4	16	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10441.44	0	0
2003	4	17	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10279.315	0	0
2003	4	18	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	10117.19	0	0
2003	4	19	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9955.065	0	0
2003	4	20	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9792.94	0	0
2003	4	21	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9630.815	0	0
2003	4	22	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9468.69	0	0
2003	4	23	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9306.565	0	0
2003	4	24	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	9144.44	0	0
2003	4	25	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	8982.315	0	0
2003	4	26	0.4	5.7	0.85	0.5	63500	66900	21.59	13.38	7.125	155	8855.16	0	0
2003	4	27	4.6	5.7	0.85	0.5	63500	66900	248.285	153.87	7.125	155	9095.19	0	0
2003	4	28	38.8	5.7	0.85	0.5	63500	66900	2094.23	1297.86	7.125	155	12325.155	0	0
2003	4	29	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	12163.03	0	0
2003	4	30	0	5.7	0.85	0.5	63500	66900	0	0	7.125	155	12000.905	0	0
2003	5	1	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	11841.28	0	0
2003	5	2	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	11681.655	0	0
2003	5	3	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	11522.03	0	0
2003	5	4	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	11362.405	0	0
2003	5	5	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	11202.78	0	0
2003	5	6	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	11043.155	0	0
2003	5	7	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	10883.53	0	0
2003	5	8	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	10723.905	0	0
2003	5	9	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	10564.28	0	0
2003	5	10	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	10404.655	0	0
2003	5	11	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	10245.03	0	0
2003	5	12	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	10085.405	0	0
2003	5	13	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	9925.78	0	0
2003	5	14	0.6	3.7	0.85	0.5	63500	66900	32.385	20.07	4.625	155	9818.61	0	0
2003	5	15	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	9658.985	0	0
2003	5	16	0.4	3.7	0.85	0.5	63500	66900	21.59	13.38	4.625	155	9534.33	0	0
2003	5	17	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	9374.705	0	0
2003	5	18	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	9215.08	0	0
2003	5	19	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	9055.455	0	0
2003	5	20	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	8895.83	0	0

2003	5	21	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	8736.205	0	0
2003	5	22	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	8576.58	0	0
2003	5	23	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	8416.955	0	0
2003	5	24	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	8257.33	0	0
2003	5	25	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	8097.705	0	0
2003	5	26	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	7938.08	0	0
2003	5	27	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	7778.455	0	0
2003	5	28	0.2	3.7	0.85	0.5	63500	66900	10.795	6.69	4.625	155	7636.315	0	0
2003	5	29	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	7476.69	0	0
2003	5	30	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	7317.065	0	0
2003	5	31	0	3.7	0.85	0.5	63500	66900	0	0	4.625	155	7157.44	0	0
2003	6	1	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	6999.19	0	0
2003	6	2	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	6840.94	0	0
2003	6	3	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	6682.69	0	0
2003	6	4	0.4	2.6	0.85	0.5	63500	66900	21.59	13.38	3.25	155	6559.41	0	0
2003	6	5	0.4	2.6	0.85	0.5	63500	66900	21.59	13.38	3.25	155	6436.13	0	0
2003	6	6	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	6277.88	0	0
2003	6	7	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	6119.63	0	0
2003	6	8	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5961.38	0	0
2003	6	9	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5803.13	0	0
2003	6	10	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5644.88	0	0
2003	6	11	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5486.63	0	0
2003	6	12	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5328.38	0	0
2003	6	13	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5170.13	0	0
2003	6	14	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	5011.88	0	0
2003	6	15	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4853.63	0	0
2003	6	16	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4695.38	0	0
2003	6	17	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4537.13	0	0
2003	6	18	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4378.88	0	0
2003	6	19	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4220.63	0	0
2003	6	20	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4062.38	0	0
2003	6	21	13.6	2.6	0.85	0.5	63500	66900	734.06	454.92	3.25	155	5093.11	0	0
2003	6	22	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4934.86	0	0
2003	6	23	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4776.61	0	0
2003	6	24	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4618.36	0	0
2003	6	25	6.4	2.6	0.85	0.5	63500	66900	345.44	214.08	3.25	155	5019.63	0	0
2003	6	26	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4861.38	0	0
2003	6	27	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4703.13	0	0
2003	6	28	2.2	2.6	0.85	0.5	63500	66900	118.745	73.59	3.25	155	4737.215	0	0
2003	6	29	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4578.965	0	0
2003	6	30	0	2.6	0.85	0.5	63500	66900	0	0	3.25	155	4420.715	0	0
2003	7	1	0.4	2.7	0.85	0.5	63500	66900	21.59	13.38	3.375	155	4297.31	0	0
2003	7	2	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4138.935	0	0
2003	7	3	15.8	2.7	0.85	0.5	63500	66900	852.805	528.51	3.375	155	5361.875	0	0
2003	7	4	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	5203.5	0	0
2003	7	5	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	5045.125	0	0
2003	7	6	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4886.75	0	0
2003	7	7	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4728.375	0	0
2003	7	8	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4570	0	0
2003	7	9	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4411.625	0	0
2003	7	10	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4253.25	0	0
2003	7	11	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4094.875	0	0
2003	7	12	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3936.5	0	0
2003	7	13	9.2	2.7	0.85	0.5	63500	66900	496.57	307.74	3.375	155	4582.435	0	0
2003	7	14	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4424.06	0	0
2003	7	15	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4265.685	0	0
2003	7	16	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	4107.31	0	0
2003	7	17	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3948.935	0	0
2003	7	18	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3790.56	0	0
2003	7	19	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3632.185	0	0
2003	7	20	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3473.81	0	0
2003	7	21	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3315.435	0	0
2003	7	22	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3157.06	0	0
2003	7	23	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2998.685	0	0
2003	7	24	10.2	2.7	0.85	0.5	63500	66900	550.545	341.19	3.375	155	3732.045	0	0
2003	7	25	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3573.67	0	0
2003	7	26	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3415.295	0	0
2003	7	27	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3256.92	0	0
2003	7	28	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	3098.545	0	0
2003	7	29	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2940.17	0	0
2003	7	30	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2781.795	0	0
2003	7	31	0	2.7	0.85	0.5	63500	66900	0	0	3.375	155	2623.42	0	0
2003	8	1	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	2463.545	0	0
2003	8	2	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	2303.67	0	0
2003	8	3	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	2143.795	0	0
2003	8	4	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1983.92	0	0
2003	8	5	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1824.045	0	0
2003	8	6	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1664.17	0	0
2003	8	7	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1504.295	0	0
2003	8	8	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1344.42	0	0
2003	8	9	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1184.545	0	0
2003	8	10	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1024.67	0	0
2003	8	11	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	864.795	0	0
2003	8	12	2.2	3.9	0.85	0.5	63500	66900	118.745	73.59	4.875	155	897.255	0	0
2003	8	13	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	737.38	0	0
2003	8	14	4.8	3.9	0.85	0.5	63500	66900	259.08	160.56	4.875	155	997.145	0	0
2003	8	15	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	837.27	0	0
2003	8	16	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	677.395	0	0
2003	8	17	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	517.52	0	0
2003	8	18	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	357.645	0	0
2003	8	19	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	197.77	0	0
2003	8	20	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	37.895	0	0
2003	8	21	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	0	1	0
2003	8	22	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	0	1	0
2003	8	23	0.8	3.9	0.85	0.5	63500	66900	43.18	26.76	4.875	155	0	1	0
2003	8	24	15.4	3.9	0.85	0.5	63500	66900	831.215	515.13	4.875	155	1186.47	0	0
2003	8	25	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	1026.595	0	0
2003	8	26	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	866.72	0	0
2003	8	27	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	706.845	0	0
2003	8	28	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	546.97	0	0
2003	8	29	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	387.095	0	0
2003	8	30	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	227.22	0	0
2003	8	31	0	3.9	0.85	0.5	63500	66900	0	0	4.875	155	67.345	0	0
2003	9	1	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	2	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	3	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	4	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	5	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	6	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	7	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	8	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	9	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	10	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	11	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	12	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	13	0.6	5.6	0.85	0.5	63500	66900	32.385	20.07	7	155	0	1	0
2003	9	14	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	15	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	16	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	17	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	18	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	19	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	20	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	21	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	22	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	23	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	24	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	25	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	26	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	27	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	28	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	29	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	9	30	0	5.6	0.85	0.5	63500	66900	0	0	7	155	0	1	0
2003	10	1	3.8	7.7	0.85	0.5	63500	66900	205.105	127.11	9.625	155	167.59	0	0
2003	10	2	54.2	7.7	0.85	0.5	63500	66900	2925.445	1812.99	9.625	155	4741.4	0	0
2003	10	3	2	7.7	0.85	0.5	63500	66900	107.95	66.9	9.625	155	4751.625	0	0
2003	10	4	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	4587	0	0
2003	10	5	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	4422.375	0	0
2003	10	6	1.6	7.7	0.85	0.5	63500	66900	86.36	53.52	9.625	155	4397.63	0	0
2003	10	7	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	4233.005	0	0
2003	10	8	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	4068.38	0	0
2003	10	9	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3903.755	0	0
2003	10	10	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3739.13	0	0
2003	10	11	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3574.505	0	0
2003	10	12	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3409.88	0	0

2003	10	13	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3245.255	0	0
2003	10	14	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	3080.63	0	0
2003	10	15	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2916.005	0	0
2003	10	16	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2751.38	0	0
2003	10	17	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2586.755	0	0
2003	10	18	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2422.13	0	0
2003	10	19	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2257.505	0	0
2003	10	20	5.2	7.7	0.85	0.5	63500	66900	280.67	173.94	9.625	155	2547.49	0	0
2003	10	21	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2382.865	0	0
2003	10	22	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2218.24	0	0
2003	10	23	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	2053.615	0	0
2003	10	24	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1888.99	0	0
2003	10	25	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1724.365	0	0
2003	10	26	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1559.74	0	0
2003	10	27	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1395.115	0	0
2003	10	28	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1230.49	0	0
2003	10	29	2.6	7.7	0.85	0.5	63500	66900	140.335	86.97	9.625	155	1293.17	0	0
2003	10	30	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	1128.545	0	0
2003	10	31	0	7.7	0.85	0.5	63500	66900	0	0	9.625	155	963.92	0	0
2003	11	1	0.2	9.2	0.85	0.5	63500	66900	10.795	6.69	11.5	155	814.905	0	0
2003	11	2	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	648.405	0	0
2003	11	3	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	481.905	0	0
2003	11	4	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	315.405	0	0
2003	11	5	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	148.905	0	0
2003	11	6	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	7	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	8	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	9	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	10	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	11	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	12	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	13	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	14	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	15	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	16	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	17	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	18	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	19	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	20	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	21	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	22	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	0	1	0
2003	11	23	24.6	9.2	0.85	0.5	63500	66900	1327.785	822.87	11.5	155	1984.155	0	0
2003	11	24	1.8	9.2	0.85	0.5	63500	66900	97.155	60.21	11.5	155	1975.02	0	0
2003	11	25	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	1808.52	0	0
2003	11	26	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	1642.02	0	0
2003	11	27	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	1475.52	0	0
2003	11	28	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	1309.02	0	0
2003	11	29	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	1142.52	0	0
2003	11	30	0	9.2	0.85	0.5	63500	66900	0	0	11.5	155	976.02	0	0
2003	12	1	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	808.77	0	0
2003	12	2	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	641.52	0	0
2003	12	3	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	474.27	0	0
2003	12	4	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	307.02	0	0
2003	12	5	59.8	9.8	0.85	0.5	63500	66900	3227.705	2000.31	12.25	155	5367.785	0	0
2003	12	6	20.8	9.8	0.85	0.5	63500	66900	1122.68	695.76	12.25	155	7018.975	0	0
2003	12	7	9.6	9.8	0.85	0.5	63500	66900	518.16	321.12	12.25	155	7691.005	0	0
2003	12	8	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	7523.755	0	0
2003	12	9	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	7356.505	0	0
2003	12	10	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	7189.255	0	0
2003	12	11	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	7022.005	0	0
2003	12	12	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6854.755	0	0
2003	12	13	7.2	9.8	0.85	0.5	63500	66900	388.62	240.84	12.25	155	7316.965	0	0
2003	12	14	0.4	9.8	0.85	0.5	63500	66900	21.59	13.38	12.25	155	7184.685	0	0
2003	12	15	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	7017.435	0	0
2003	12	16	1	9.8	0.85	0.5	63500	66900	53.975	33.45	12.25	155	6937.61	0	0
2003	12	17	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6770.36	0	0
2003	12	18	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6603.11	0	0
2003	12	19	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6435.86	0	0
2003	12	20	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6268.61	0	0
2003	12	21	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6101.36	0	0
2003	12	22	3.6	9.8	0.85	0.5	63500	66900	194.31	120.42	12.25	155	6248.84	0	0
2003	12	23	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	6081.59	0	0
2003	12	24	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5914.34	0	0
2003	12	25	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5747.09	0	0
2003	12	26	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5579.84	0	0
2003	12	27	3	9.8	0.85	0.5	63500	66900	161.925	100.35	12.25	155	5674.865	0	0
2003	12	28	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5507.615	0	0
2003	12	29	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5340.365	0	0
2003	12	30	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5173.115	0	0
2003	12	31	0	9.8	0.85	0.5	63500	66900	0	0	12.25	155	5005.865	0	0
									30614.62	18972.84	2951.75	56575		63	0

Appendix 12

Aboriginal Due Diligence & Historic Heritage Assessment Report



View over east portion of the study area.

ABORIGINAL ARCHAEOLOGICAL & HISTORIC HERITAGE IMPACT ASSESSMENT

NORTH STAR QUARRY

NORTH STAR, NSW

MAY 2021

DRAFT

Report prepared by

OzArk Environment & Heritage

for Groundwork Plus

on behalf of

Regional Quarries Pty Ltd

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DOCUMENT CONTROLS

Proponent	Regional Quarries Australia Pty Ltd
Client	Groundwork Plus
Document Description	Aboriginal Archaeological & Historic Heritage Impact Assessment: North Star Quarry, North Star NSW
File Location	OzArk Job No.
S:\OzArk EHM Data\Clients\Groundworks Plus\North Star Quarry_Nov 2020\Heritage\Report	2900

Document Status **V2.0 DRAFT**	Date 4 June 2021
Draft V1.1 Author to Editor OzArk 1st Internal (Series V1._ = OzArk internal edits)	V1.0–1.8 TF author, BC/JB edits 15/4/21–31/5/21 V1.9 BC edit 31/5/21 V1.10 JB review 4/6/21
Draft V2.0 Report Draft for release to client (Series V2._ = OzArk and Client edits)	V2.0 OzArk to client 4/6/21
FINAL V3._once latest version of draft approved by client	
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Enquiries should be addressed to OzArk Environment & Heritage.

Acknowledgement

OzArk acknowledge Traditional Owners of the area on which this assessment took place and pay respect to their beliefs, cultural heritage and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

ABBREVIATIONS AND GLOSSARY

AAIA	Aboriginal Archaeological Impact Assessment. An archaeological assessment with the purposes of assessing potential impacts to archaeological sites. Usually conducted using the Code of Practice survey guidelines.
AHIMS	Aboriginal Heritage Information Management System. Administered by Department of Premier and Cabinet, AHIMS is the central register of all Aboriginal sites within NSW.
AHIP	Aboriginal Heritage Impact Permit
Code of Practice	*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* under Part 6 NPW Act. Issued by DECCW (now Heritage NSW) in 2010, the Code of Practice is a set of guidelines that allows limited test excavation without the need to apply for an AHIP.
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement. A required document for major projects documenting all potential impacts to the environment, including heritage, that may arise due to the development.
Heritage NSW	Government department tasked with ensuring compliance with the NPW Act. Formerly known as the Office of the Environment and Heritage (OEH) or the Biodiversity and Conservation Division (BCD).
HHIA	Historic Heritage Impact Assessment. An archaeological assessment with the purposes of assessing potential impacts to historic archaeological sites.
NPW Act	*National Parks and Wildlife Act 1974*. Primary legislation governing Aboriginal cultural heritage within NSW.
SEARs	Secretary's Environmental Assessment Requirements issued by the DPIE.

EXECUTIVE SUMMARY

OzArk Environment & Heritage (OzArk) has been engaged by Groundworks Plus, on behalf of Regional Quarries Australia Pty Ltd (the proponent) to complete an Aboriginal Archaeological Impact Assessment (AAIA) and Historic Heritage Impact Assessment (HHIA) of 5535 North Star Road which has the potential to be impacted by the proposed hard rock quarry at North Star (the proposal). The proposal is in the Gwydir Shire Council Local Government Area.

The fieldwork component of this assessment was undertaken by OzArk Archaeologist, Taylor Foster, on Monday 19 April 2021. A visual inspection was conducted by the Toomelah LALC on 17 May 2021. The entirety of the survey area was assessed by pedestrian transects.

No Aboriginal sites, sensitive landforms or potential archaeological deposits were recorded during the survey. Further, no items of historic heritage significance were recorded.

Recommendations concerning Aboriginal cultural values and historical values within the study area are as follows:

1. The proposed work may proceed at North Star Quarry without further archaeological investigation under the following conditions:
    a) All land and ground disturbance activities must be confined to within the archaeological survey area, as this will eliminate the risk of harm to Aboriginal objects in adjacent landforms. Should the parameters of the Proposal extend beyond the assessed areas, then further archaeological assessment may be required.
    b) All staff and contractors involved in the proposed work should be made aware of the legislative protection requirements for all Aboriginal sites and objects.
2. This assessment has concluded that there is a low likelihood that the proposed work will adversely harm Aboriginal cultural heritage sites. However, if Aboriginal objects are identified during the construction and operation of the proposal, all work should cease and the procedures in the *Unanticipated Finds Protocol* (**Appendix 2**) should be followed.
3. In the event of skeletal remains being identified during the construction and operation of the proposal, the *Unanticipated Skeletal Remains Protocol* (**Appendix 3**) should be followed.
4. Inductions for work crews should include a cultural heritage awareness procedure to ensure they recognise Aboriginal artefacts (see **Appendix 4**) and are aware of the legislative protection of Aboriginal objects under the *National Parks and Wildlife Act 1974* and the contents of the *Unanticipated Finds Protocol.*

5. In the unlikely event that historical relics or deposits are unearthed during the proposed works, the *Historical Heritage Unanticipated Finds Protocol* (**Appendix 6**) should be followed.

CONTENTS

ABBREVIATIONS AND GLOSSARY III

EXECUTIVE SUMMARY IV

1 INTRODUCTION 1

1.1 Description of the proposal 1

1.2 Proposed work 1

1.3 Study area 1

2 THE ARCHAEOLOGICAL ASSESSMENT 3

2.1 Date of archaeological assessment 3

2.2 OzArk involvement 3

2.2.1 Field assessment 3

2.2.2 Reporting 3

2.3 Relevant legislation 3

2.3.1 State legislation 4

2.3.2 Commonwealth legislation 5

2.3.3 Applicability to the proposal 5

2.4 Assessment approach 5

2.5 Purpose and objectives 7

2.5.1 Aboriginal archaeological assessment objectives 7

2.6 Aboriginal community involvement 8

3 LANDSCAPE CONTEXT 9

3.1 Topography 9

3.2 Geology and soils 12

3.3 Hydrology 12

3.4 Vegetation 13

3.5 Climate 13

3.6 Land use history and existing levels of disturbance 13

3.7 Conclusion 14

4 ABORIGINAL ARCHAEOLOGY BACKGROUND 15

4.1 Ethno-historic sources of regional Aboriginal culture 15

4.2 Regional archaeological context 16
4.2.1 Development driven studies 17
4.3 Local archaeological context 18
4.3.1 Desktop database searches conducted 18
4.4 Predictive model for site location 19
4.4.1 Settlement strategies 20
4.4.2 Past land use 20
4.4.3 Previously recorded sites 20
4.4.4 Landform modelling 20
4.4.5 Conclusion 21
5 HISTORIC ARCHAEOLOGY BACKGROUND 23
5.1 Introduction 23
5.2 Brief history of North Star 23
5.3 Local context 23
5.3.1 Desktop database searches conducted 23
6 RESULTS OF ARCHAEOLOGICAL ASSESSMENT 24
6.1 Sampling strategy and field methods 24
6.2 Observations from the survey 25
6.2.1 Survey Unit 1 25
6.2.2 Survey Unit 2 25
6.2.3 Survey Unit 3 26
6.3 Effective survey coverage 29
6.4 Aboriginal objects recorded 30
6.5 Cultural values 33
6.6 Historical heritage items recorded 33
7 RECOMMENDATIONS 34
REFERENCES 36
APPENDIX 1: ABORIGINAL COMMUNITY CONSULTATION LOG 38
APPENDIX 2: AHIMS RESULTS 48
APPENDIX 3: ABORIGINAL HERITAGE: UNANTICIPATED FINDS PROTOCOL 49

APPENDIX 4: UNANTICIPATED SKELETAL REMAINS PROTOCOL 50

APPENDIX 5: ABORIGINAL HERITAGE: ARTEFACT IDENTIFICATION 51

APPENDIX 6: HISTORIC HERITAGE: UNANTICIPATED FINDS PROTOCOL 52

FIGURES

Figure 1-1: Aerial showing the location of the study area. 1
Figure 1-2: Aerial showing the study area. 2
Figure 3-1: Topography of the study area. 10
Figure 3-2: Survey units and area of disturbance within the study area. 11
Figure 3-3: Watercourses in relation to the study area. 12
Figure 4-1: Location of previously recorded AHIMS sites in relation to the study area. 19
Figure 6-1: Pedestrian coverage of the survey area. 24
Figure 6-2: Images of the study area. 26
Figure 6-3: Images of trees with scarring taken by TLALC. 31
Figure 6-4: Approximate location of mature trees with natural scarring. 32

TABLES

Table 1-1: Technical assessment (heritage) related SEARs. 6
Table 1-2: Agency project specific assessment recommendations. 6
Table 4-2: Site types and frequencies of AHIMS sites near the study area. 18
Table 4-1: Historic heritage: desktop-database search results. 23
Table 6-1: Effective survey coverage within the study area. 30
Table 6-2: Effective survey coverage and incidences of Aboriginal site recording. 30

1 INTRODUCTION

1.1 DESCRIPTION OF THE PROPOSAL

OzArk Environment & Heritage (OzArk) has been engaged by Groundworks Plus, on behalf of Regional Quarries Australia Pty Ltd (the proponent) to complete an Aboriginal Archaeological Impact Assessment (AAIA) and Historic Heritage Impact Assessment (HHIA) of 5535 North Star Road which has the potential to be impacted by the proposed hard rock quarry at North Star (the proposal). The proposal is in the Gwydir Shire Council Local Government Area (LGA) (**Figure 1-1**).

1.2 PROPOSED WORK

The proposal is to establish a quarry producing a maximum of 490,000 tonnes per year (t/yr) for a period of five years to service the Inland Rail Project and associated road upgrade projects. The proposal is to then produce 150,000 t/yr for a period of ten years to service the general market in the local area. A maximum of 2,450,000 tonnes would be extracted over the 15 year life of the quarry.

1.3 STUDY AREA

The proposed quarry site is located at 5355 North Star Road NSW on Lot 7 DP755984 and Lot 1 DP1227212. The impact area (herein referred to as the study area) is approximately 10 hectares (ha) of land and a 1.3-kilometre (km) access road. **Figure 1-2** shows the study area.

Figure 1-1: Aerial showing the location of the study area.

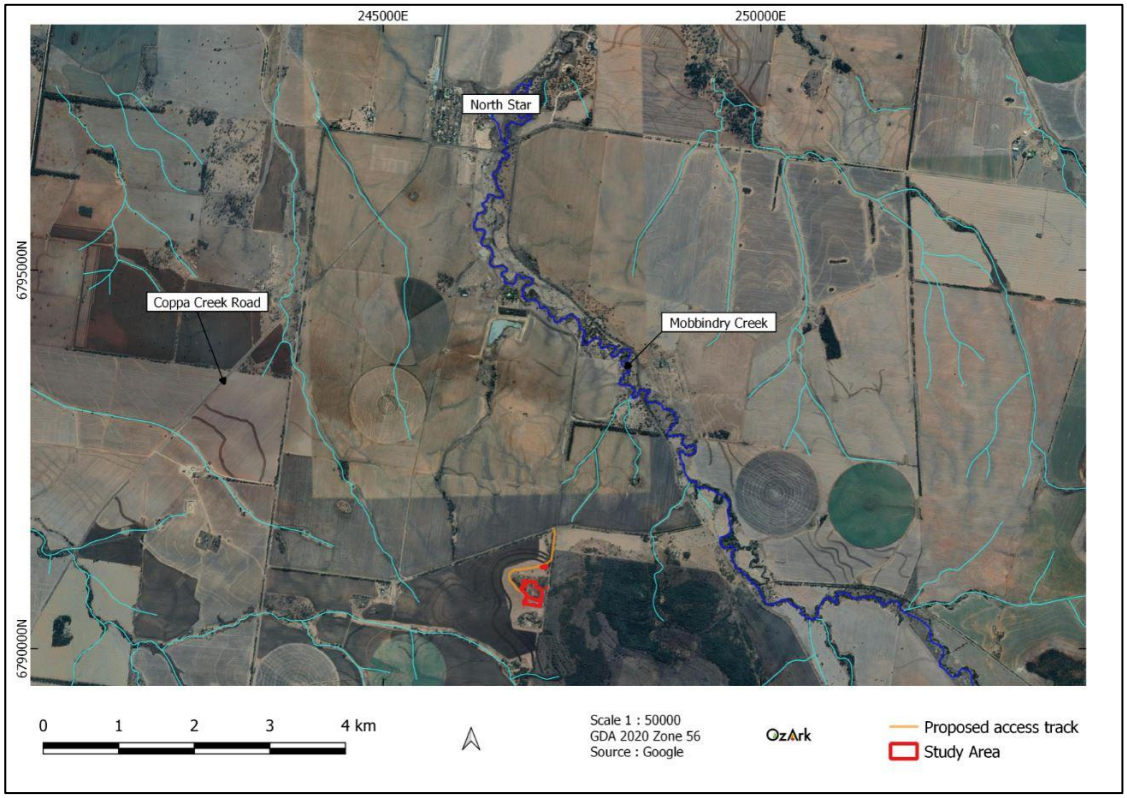


Figure 1-2: Aerial showing the study area.



2 THE ARCHAEOLOGICAL ASSESSMENT

2.1 DATE OF ARCHAEOLOGICAL ASSESSMENT

The fieldwork component of this assessment was undertaken by OzArk Archaeologist, Taylor Foster, on Monday 19 April 2021.

Due to unforeseen circumstances the Toomelah Local Aboriginal Land Council (TLALC) site officer was not able to attend the survey on the same day as OzArk. Due to this, a separate visual inspection was conducted by TLALC site officer, Malcolm Peckham, on 17 May 2021. A summary letter from the TLALC regarding site inspection is attached in **Appendix 7.**

2.2 OZARK INVOLVEMENT

2.2.1 Field assessment

The fieldwork component of the heritage assessment was undertaken by:

- Fieldwork Director: Taylor Foster (OzArk Archaeologist, BA [Archaeology & English] [Hons Archaeology] James Cook University)

2.2.2 Reporting

The reporting component of the heritage assessment was undertaken by:

- Author: Taylor Foster and Harrison Rochford (OzArk Cultural Heritage Specialist)
- Reviewer: Ben Churcher (OzArk Principal Archaeologist; BA [Hons], Dip Ed) and Dr Jodie Benton (OzArk Director; BA [Hons], PhD)

2.3 RELEVANT LEGISLATION

Cultural heritage is managed by several state and national Acts. Baseline principles for the conservation of heritage places and relics can be found in the *Burra Charter* (Burra Charter 2013). The *Burra Charter* has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The *Burra Charter* generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a state level.

Several Acts of parliament provide for the protection of heritage at various levels of government.

2.3.1 State legislation

Environmental Planning and Assessment Act 1979 (EP&A Act)

This Act established requirements relating to land use and planning. The framework governing environmental and heritage assessment in NSW is contained within the following parts of the EP&A Act:

- Part 4: Local government development assessments, including heritage. May include schedules of heritage items
    - Section 4.12: Approvals process for designated development
    - Section 4.46: Approvals process for integrated development.

National Parks and Wildlife Act 1974 (NPW Act)

The NPW Act provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Under the Act (Part 6), an Aboriginal object is defined as: any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

It is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the Act provides a series of defences against the offences listed in Section 86, such as:

- The harm was authorised by and conducted in accordance with the requirements of an *Aboriginal Heritage Impact Permit* (AHIP) under Section 90 of the Act;
- The defendant exercised 'due diligence' to determine whether the action would harm an Aboriginal object; or
- The harm to the Aboriginal object occurred during the undertaking of a 'low impact activity' (as defined in the regulations).

Under Section 89A of the Act, it is a requirement to notify the Secretary of the Department of Planning, Industry and Environment (DPIE) of the location of an Aboriginal object. Identified Aboriginal items and sites are registered on Aboriginal Heritage Information Management System (AHIMS) that is administered by the Department of Premier and Cabinet.

2.3.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act, administered by the commonwealth Department of Agriculture, Water and the Environment, provides a framework to protect nationally significant flora, fauna, ecological communities, and heritage places. The EPBC Act establishes both a National Heritage List and Commonwealth Heritage List of protected places. These lists may include Aboriginal cultural sites or sites in which Aboriginal people have interests. The assessment and permitting processes of the EPBC Act are triggered when a proposed activity or development could potentially have an impact on one of the matters of national environment significance listed by the Act. Ministerial approval is required under the EPBC Act for proposals involving significant impacts to national/commonwealth heritage places.

Other

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* is aimed at the protection from injury and desecration of areas and objects that are of significance to Aboriginal Australians. This legislation has usually been invoked in emergency and conflicted situations.

2.3.3 Applicability to the proposal

The current proposal will be assessed under Part 4 of the EP&A Act. The development application will be accompanied by an *Environmental Impact Statement* (EIS) as the proposal is classified as "Designated Development" under Schedule 2 of the *Environmental Planning & Assessment Regulation 2000* (EP&A Reg).

Any Aboriginal objects within the study area are afforded legislative protection under the NPW Act.

It is noted there are no Commonwealth or National Heritage listed places within the study area, and as such, the heritage provisions of the EPBC Act and other commonwealth Acts do not apply.

2.4 ASSESSMENT APPROACH

This AAIA and HHIA has been prepared following the appropriate guidelines, policies, and industry requirements:

- *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (Code of Practice; DECCW 2010).
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (the Guide; OEH 2011).
- *Historical Archaeology Code of Practice* (Heritage Council 2006).
- *Assessing Heritage Significance* (Heritage Office 2001).

This assessment has been prepared with reference to DPIE's Secretary's Environmental Assessment Requirements (SEARs) for the project, issued on 15 January 2021. The SEARs identify matters which must be addressed in the EIS and essentially form its terms of reference. **Table 2-1** lists individual requirements relevant to this Aboriginal cultural heritage and historic heritage impact assessment and where they are addressed in this report.

Table 2-1: Technical assessment (heritage) related SEARs.

Requirement	Section addressed
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.	**Section 2** to **Section 4**, **Section 6**
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 5** and **Section 6**

To inform the preparation of the SEARs, DPIE invited other government agencies to recommend matters to be address in the EIS. These matters were considered by the Secretary for DPIE when preparing the SEARs. Copies of the government agencies' advice to DPIE were attached to the SEARs.

Heritage Council of New South Wales and Heritage NSW raised matters relevant to the Aboriginal cultural heritage assessment. These matters are listed in **Table 2-2** and have been considered in preparing this assessment, as noted in the table. No agency specific assessment recommendations regarding historic heritage were provided.

Due to the small scale of the study area and the previous use of a large portion of the site for quarry operations, a site survey was conducted (as per the Code of Practice) with the intention of determining whether Aboriginal cultural values / sites are present. The inspection was conducted by both OzArk and a Traditional Owner representative of the Toomelah LALC. As no Aboriginal objects or cultural values were recorded within the study area, and because an AHIP would not be required, the assessment did not progress to formal Aboriginal community consultation or the production of an *Aboriginal Cultural Heritage Assessment Report* (ACHAR). It is therefore felt that the AAIA and HHIA approach, with Aboriginal community involvement, will ensure that appropriate consideration and protection of Aboriginal objects and cultural values will be achieved.

Table 2-2: Agency project specific assessment recommendations.

Requirement	Section addressed
Aboriginal cultural heritage	
The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological	**Section 2** to **Section 4**, **Section 6** The field assessment followed the Guide (Section 2) and the Code (Requirements 5–10).

Requirement	Section addressed
Investigation in NSW (OEH 2010), and be guided by the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales (DECCW 2011).	The reporting follows the Guide (Section 3) and the Code (Requirements 1–4, and 11 [although as an AAIA, not an ACHAR]). Requirement 12 of the Code will be followed.
Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.	**Section 2** As no Aboriginal objects will be harmed by the proposal and because there will be no requirement for an AHIP, formal Aboriginal consultation was not initiated. The involvement of the Toomelah LALC ensured that the cultural values of the study area are understood.
Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to Heritage NSW.	Not relevant. No Aboriginal cultural heritage values will be harmed by the proposal.
The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the ACHAR.	**Section 6**
The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts.	**Section 7** and **Appendix 3**
The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.	**Appendix 4**

2.5 PURPOSE AND OBJECTIVES

The purpose of the current study is to identify and assess heritage constraints relevant to the proposed works.

2.5.1 Aboriginal archaeological assessment objectives

The current assessment will apply the Code of Practice in the completion of an Aboriginal archaeological assessment to meet the following objectives:

Objective One: Undertake background research on the study area to formulate a predicative model for site location within the study area

Objective Two: Identify and record objects or sites of Aboriginal heritage significance within the study area, as well as any landforms likely to contain further archaeological deposits

Objective Three: Assess the likely impacts of the proposed work to Aboriginal cultural heritage and provide management recommendations.

2.6 ABORIGINAL COMMUNITY INVOLVEMENT

Site officer, Mr Malcom Peckham, from the Toomelah Local Aboriginal Land Council (LALC) participated in a pedestrian survey. Many discussions were also had with Mr Rex Weribone, the CEO of Toomelah LALC regarding the project site.

See **Appendix 1** for a log and copy of all correspondence with the Aboriginal community.

3 LANDSCAPE CONTEXT

An understanding of the environmental contexts of a study area is requisite in any Aboriginal archaeological investigation (DECCW 2010). It is a particularly important consideration in the development and implementation of survey strategies for the detection of archaeological sites. In addition, natural geomorphic processes of erosion and/or deposition, as well as humanly activated landscape processes, influence the degree to which these material culture remains are retained in the landscape as archaeological sites; and the degree to which they are preserved, revealed and/or conserved in present environmental settings.

The study area is situated within the Brigalow Belt South Bioregion which northern NSW and southern Qld, extending from south of Dubbo in central-western NSW to the mid-Qld coast. (NPWS 2003). Several major rivers flow through the bioregion including the MacIntyre, Gwydir, Namoi, Castlereagh, Goulburn, Talbragar and Macquarie Rivers, their catchments forming an integral part of the Murray-Darling River System.

3.1 TOPOGRAPHY

The majority of the study area is situated within the Yallaroi Basalts landscape (Mitchell 2002: 95) which includes rolling hills and flat top ridges on Tertiary basalt flows and has a general elevation between 250 and 400 metres (m). The study area is predominantly situated on a low ridge landform with an elevation of approximately 340 m.

While the study area is situated on a ridge, there is topographic variation across the area. The landforms present within the study area include flats (along the access track and within the southern portion of the study area), slopes (within the north of the study area), and elevated flats and ridge landforms (throughout the central portion of the study area) (see **Figure 3-1**). There is also a previously disturbed area which is exempt from landform classification due to the high level of modification (i.e. area of the existing quarry) which is shown on **Figure 3-1** photo 4.

The distribution of topography within the study area allows three distinct survey units to be developed. There are:

- Survey Unit 1 Slopes (**Figure 3-1** photo 1)
- Survey Unit 2 Elevated flats/ridgelines and upper slope (**Figure 3-1** photo 2)
- Survey Unit 3 Flat/plain landforms (**Figure 3-1** photo 3).

An aerial displaying the survey units and disturbed landforms within the study area can be seen in **Figure 3-2**.

Figure 3-1: Topography of the study area.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. View of a steeply sloping landform within the northwest of the study area (Survey Unit 1).</td><td>2. View of an elevated flat and upper slope landform unit within the south of the study area (Survey Unit 2).</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>3. View of flat landform within the study area (Survey Unit 3).</td><td>4. View of heavily modified and disturbed landform within the study area.</td></tr>
</table>

Figure 3-2: Survey units and area of disturbance within the study area.



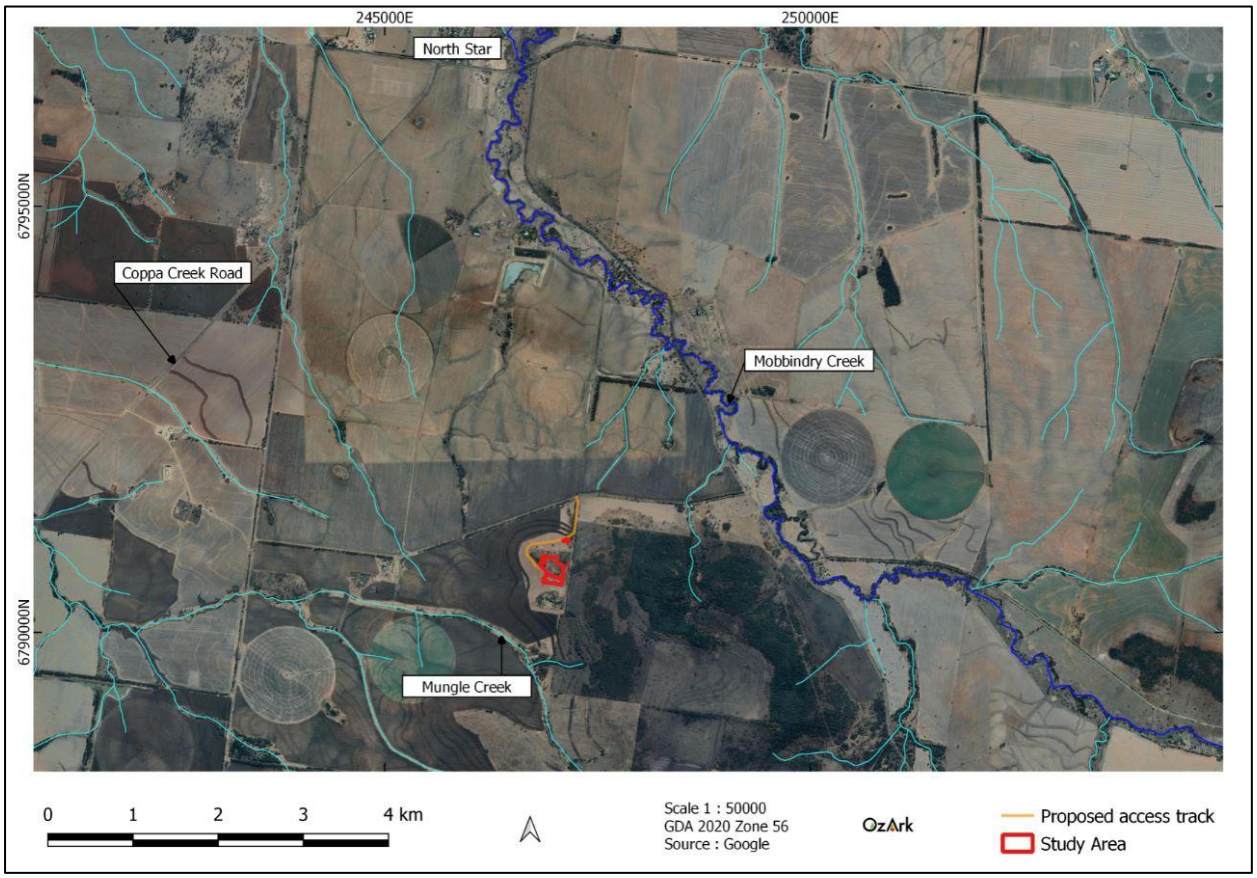
3.2 GEOLOGY AND SOILS

Within the Yallaroi Basalts landscape unit soils generally consist of shallow stony, red or brown, well-structured clays. Slopes and valley floors consist of similar, but thicker, soil. A small ridge is located along the southern-most portion of the study area and a moderate amount of basalt outcrop was present among black soil (see **Figure 3-1**: photo 1). Immediately north of the ridge, the area has been previously quarried and therefore soil and geological information cannot be determined (see **Figure 3-1**: photo 4). The northern portion of the study area, located within a ridge landform, has soils largely consisting of a black silty soil with occasional areas of brown silty loam and moderate amounts of basalt outcrop to the northwest within a slope landform (see **Figure 3-1**: photo 2).

3.3 HYDROLOGY

No watercourses transect the study area (see **Figure 3-3**). The closest semi-permanent watercourse is Mungle Creek, approximately 790 m to the southwest of the study area. The nearest major watercourse in Mobbindry Creek which, at its closest, is approximately 2.4 kilometres (km) east of the study area. A number of minor, unnamed ephemeral watercourses are near the study area, the closest being 270 m northeast of the proposed access track.

Figure 3-3: Watercourses in relation to the study area.



3.4 VEGETATION

The Yallaroi Basalts landscape, in the past, would have been predominantly of Eucalyptus species. The local Aboriginal communities would have had a vegetation community of river red gum corridor woodlands on all streams, and white box and ironbark open woodland on alluvial clays (Mitchell 2002: 95).

The vegetation of the study area and adjacent environs has changed significantly since colonial settlement and the establishment of agriculture, cultivation, and irrigation systems. Therefore, the vegetation types observed today are limited in terms of what vegetation was present at the time of traditional Aboriginal occupation.

The study area has been largely cleared of vegetation and significant modifications which have been undertaken in the form of ploughing and quarry works have hindered regrowth. Vegetation in the study area consists of grass and weed growth throughout the entirety of the study area. Small woodland corridors are also located within sloping landforms within the northeast and northwest of the study area and isolated pockets of woodland are also sporadically present.

3.5 CLIMATE

Temperatures in the region range from a mean maximum temperature between 18.4ºC and 34.3ºC while the mean minimum temperature is between 4.5ºC and 20.5ºC. The mean annual rainfall is 561 millimetres (mm) (BoM 2021).

3.6 LAND USE HISTORY AND EXISTING LEVELS OF DISTURBANCE

Since colonial settlement in the region, North Star and the surrounding area has been subject to a diverse land use history that has resulted in native vegetation clearing, cultivated and irrigated pastures, and road and rail development.

As a result, the study area has varying levels of disturbance throughout and natural soils have been displaced at a number of areas. For example, the land within the access track had been scraped and black soil had been overlain with a large amount of blue shale, while the south-western portion of the study area is within a flat landform that is partially disturbed (see **Figure 3-1**: photo 3). Along the far western portion of the study area, ploughing had caused soil disturbance and weed growth.

Major disturbance within the study area is due to previous quarry activities and associated ground disturbing works. The area of land effected by these disturbances accounts for approximately 40% of the study area. The study area also comprises land previously subject to clearing and grazing. The access track is across a cropped black soil plains landform. These activities have the potential to disturb Aboriginal sites, should they be present.

3.7 CONCLUSION

Review of the landscape context suggests that Aboriginal occupation of the study area and vicinity was likely to have occurred, though would have varied with the availability of local resources. The basalt outcrops may have been a suitable source of stone for tool manufacture. Mature, native tree species common to the area would have provided a resource for Aboriginal people in the past, although the distance of the study area to reliable water sources may have limited occupation. Resources suitable to support more permanent occupation would have been more readily available closer to permanent water sources, such as along Mobbindry and Mungle Creek outside the study area.

Historic settlement in the region also closely matches that of traditional Aboriginal occupation in that larger, more-permanent settlements are nearer to permanent water sources. While settlements are therefore likely to have been outside of the study area, the basalt-derived soils attracted colonists to the region of the study area for agricultural purposes. Therefore, while agricultural activities are widespread in the region of the study area, evidence of historic occupation in the study area is likely to be rare.

4 ABORIGINAL ARCHAEOLOGY BACKGROUND

4.1 ETHNO-HISTORIC SOURCES OF REGIONAL ABORIGINAL CULTURE

According to Tindale's (1974) and Horton's (1994) maps of 'tribal' boundaries, the proposal is located within the boundaries of Gamilaraay (also Kamilaroi, Gomeroi) ethno-linguistic group (see Austin et al. 1980). Gamilaraay land largely falls within current landscapes of semi-arid grasslands, although the exact characteristics of the land before colonial influence are difficult to establish. The region comprises part of the Aboriginal 'grain belt' that provided appropriate conditions for grass seed cultivation across central Australia.

Gamilaraay use of the land appears to have been balanced between cultivation and hunting of game, with a reported preference for the latter. Archaeological evidence suggests that seed-cakes made of harvested *panicum* species were consumed widely through Gamilaraay lands, with greater frequency of grinding stones on the plains west of the ranges (McBryde 1974). It is also likely that native plant food associated with the area such as melons (*Cucumis trigona*), potatoes (*milaan*), yams (*gubiyaay* or *Dioscorea sp.*) and oranges (*bambul*) were cultivated by the inhabitants of the region (O'Rourke 1995 151–3). Written sources from the early colonial period suggest that Gamilaraay peoples preferred animal food sources, especially possum, yabbies and fish (O'Rourke 1995 151).

The first recorded colonial journey into Gamilaraay country was John Oxley's second expedition (1818), travelling northwest on the Macquarie River up to the Macquarie Marshes and heading back east through the Pilliga. His records indicate that he passed through Gamilaraay country, being closely watched by its first people, from Baradine past Boggabri before reaching the ranges near Walcha (Oxley 1820: 109–12). The cautious reaction of the first group of Aboriginal people the party encountered, before they reached the Warrumbungle Range, suggests that the local population had interacted with colonial settlers before (Oxley 1820: 109).

Oxley's written account, often inadvertently, displays aspects of the multifaceted relationship of Gamilaraay peoples with their country before colonial occupation: a man threw his firestick at Oxley (Oxley 1820: 108); widespread use of fire for hunting (Oxley 1820: 135) and descriptions of open woodland managed by burning (Oxley 1820: 80; cf. Rolls 1981: 7, 127); and the country Oxley frequently criticises for being uninhabitable also supported a 'numerous' population (Oxley 1820: 108).

Oxley's exploratory journey into Gamilaraay country was too difficult and roundabout for settlers and graziers to follow (Rolls 1981: 8). Searching for more reliable routes, the surveyor-general Sir Thomas Livingstone Mitchell (1839) described two Aboriginal villages journeying across the Moree plains. The first village was located on the Gwydir River and the second village was located on a lagoon between Collarenebri and Bellata and comprised seven huts of substantial construction, neatly thatched with dry grass and reeds (Mitchell 1839: 121).

4.2 REGIONAL ARCHAEOLOGICAL CONTEXT

Prior to 1985, no systematic, regional based archaeological studies had been undertaken in the area and studies near North Star are scarce, however, a number of relevant regional studies are summarised below.

In 1985 Balme mapped the previously known (prior to 1984) sites within the Moree Plains Shire of which approximately 60 were presented, being primarily scarred trees (18) and carved trees (13), followed by Bora/ceremonial grounds (11), open camp sites (6), burials (6), contact sites (3), rock engravings (2) and grinding grooves (1) (Balme 1985). Her major aim was to assess the representativeness of these previously recorded sites, including their relative proportions, to the archaeological resource in Moree Plains Shire as a whole, and also to look at other factors that may affect site distribution. Her study thus necessarily involved a considerable survey component, which targeted all the four major landforms mapped within the Shire.

As a result of this fieldwork, many more sites were recorded (Balme 1985) of which scarred trees and open camp sites were the most numerous. Most were recorded close to water or on elevated areas more distant from water (although these were often occupied by modern farmhouses and were thus difficult to survey). Erosion (either bank or surface) had exposed a number of sites. The conclusion drawn from Balme's study indicated that the previously registered sites were not representative of the overall archaeological resource and that almost all sites of aesthetic value had disappeared. Previously covered campsites are now being exposed by erosion associated with development and/or cultivation (Balme 1985: 73)

Covering the Moree area within a wider regional context was the North-Central Rivers study also undertaken by Balme (1986). Balme examined site location in conjunction with their preservation, both in the face of natural and incursive processes. Findings concluded that apart from the effect of historic impacts on sites, the greatest influence on the distribution of sites was geomorphic processes affecting site preservation and subsequent processes leading to site exposure (Balme 1986: 182). Balme also found there was little scope for the assessment of the chronology of prehistoric sites as so few datable contexts have been located.

In 2002, a significant amount of research was also undertaken during the Department of Environment, Climate Change and Water Western Regional Assessment: Brigalow Belt South Bioregion (BBSB), which targeted public land including Travelling Stock Reserves (TSRs), which often were associated with waterways. The most common site type recorded within the 'northern outwash zone', which encompasses the study area, were scarred trees. Purcell (NPWS 2002: 192) notes that it is likely that the creek systems were used to support the movement of people from the eastern hill regions to the broad plains in the west. The results of this survey calculated that sites occurred within 100 m of water in this black soil plain landform, although, on rare occasions small scatters of stone artefacts were recorded over 700 m from water.

4.2.1 Development driven studies

Information from development driven assessments focused on a small area can complement the findings of research studies discussed above.

In 2017 Umwelt conducted archaeological investigation for the Australian Rail and Track Corporation (ARTC) Narrabri to North Star Inland Rail component. During the survey from Narrabri to North Star, 19 previously unrecorded sites were identified. Of the sites identified one is located in the North Star area, approximately 4.5 km northeast of the study area. The site, AHIMS #02-4-0090 (NNS AS6) is a low density artefact scatter located within a slope landform. The artefacts were present within a small exposure on an access track within the existing rail corridor. The scatter consists of five stone artefacts comprising a silcrete flake, a mudstone retouched flake, a chalcedony flake, and two mudstone flakes. No other artefacts were identified within the site area. The site was regarded as having a low archaeological significance and it was thought the presence of the site reflected the close proximity to water as it was located on the south-eastern side of an unnamed tributary.

In 2016 OzArk conducted archaeological investigation for a proposed water pipeline from Boggabilla to Toomelah, approximately 40 km north of the study area. During the survey, five Aboriginal scarred trees were recorded. The presence of permanent water sources in the Macintyre River and Whalan Creek, the presence of mature, native vegetation and the registration of previously recorded scarred trees in similar landforms were believed to contribute to the high likelihood of recording scarred trees. Previously recorded scarred trees present in the locality appear to have a close relationship with the Macintyre River and associated drainage lines with all recorded scarred trees being located within 200 m of these waterways. Other site types, such as isolated finds or open camp sites, were considered possible but less likely to occur due to the high level of disturbance to the land via the construction of roads and associated table drains, the construction of houses, the presence of grey cracking soils / black soil plains that characterise the floodplains which tend to displace archaeological evidence, and most importantly, flooding. Quarry sites and stone procurement sites had potential to occur should rock outcropping be present, however, no rock outcropping was observed.

In 2020 OzArk conducted studies for the Gwydir Shire Council for the Warialda Heavy Truck Bypass. The OzArk study area was approximately a 2.3 km alignment located east of the town of Warialda. No Aboriginal objects or sites were recorded which was attributed to disturbances related to track construction and the substantial distance from permanent waterways indicating that the area was not ideal for occupation. It was also noted that the assessed road corridor was linear and narrow providing little opportunity to encounter sites in adjacent landforms with higher archaeological potential.

Although few studies near North Star have been conducted, certain archaeological characteristics of the Moree plains region have been well examined and assist in building a predictive model of site location. The studies indicate open camp sites and scarred trees are the most common site types in the greater region and occur most frequently close to reliable water sources. While proximity to water is an important factor, elevation above flood prone landforms and hydrological disturbance is also associated with site location and preservation.

4.3 LOCAL ARCHAEOLOGICAL CONTEXT

4.3.1 Desktop database searches conducted

A search of the AHIMS database on 15 April 2021 returned nine records for Aboriginal heritage sites within the designated search area (GDA Zone 56 Eastings: 242000–252000, Nothings: 6786000–6796000 with no buffer). **Table 4-1** shows the frequency of site types in the area and **Of the** nine sites, there are eight artefact sites and one culturally modified tree. The closest site is approximately 4.3 km southeast of the study area and is an artefact site. The limited number of Aboriginal sites within the area surrounding the proposal is likely due to the limited archaeological investigation in the area and the high levels of disturbance which may have impacted or redistributed archaeological sites. While the AHIMS results suggest that the potential for *in situ* Aboriginal objects within the study area is low, the data is not the result of large scale or systematic method of identifying Aboriginal archaeological sites and therefore cannot be taken independently as a reflection of past Aboriginal occupation patterns.

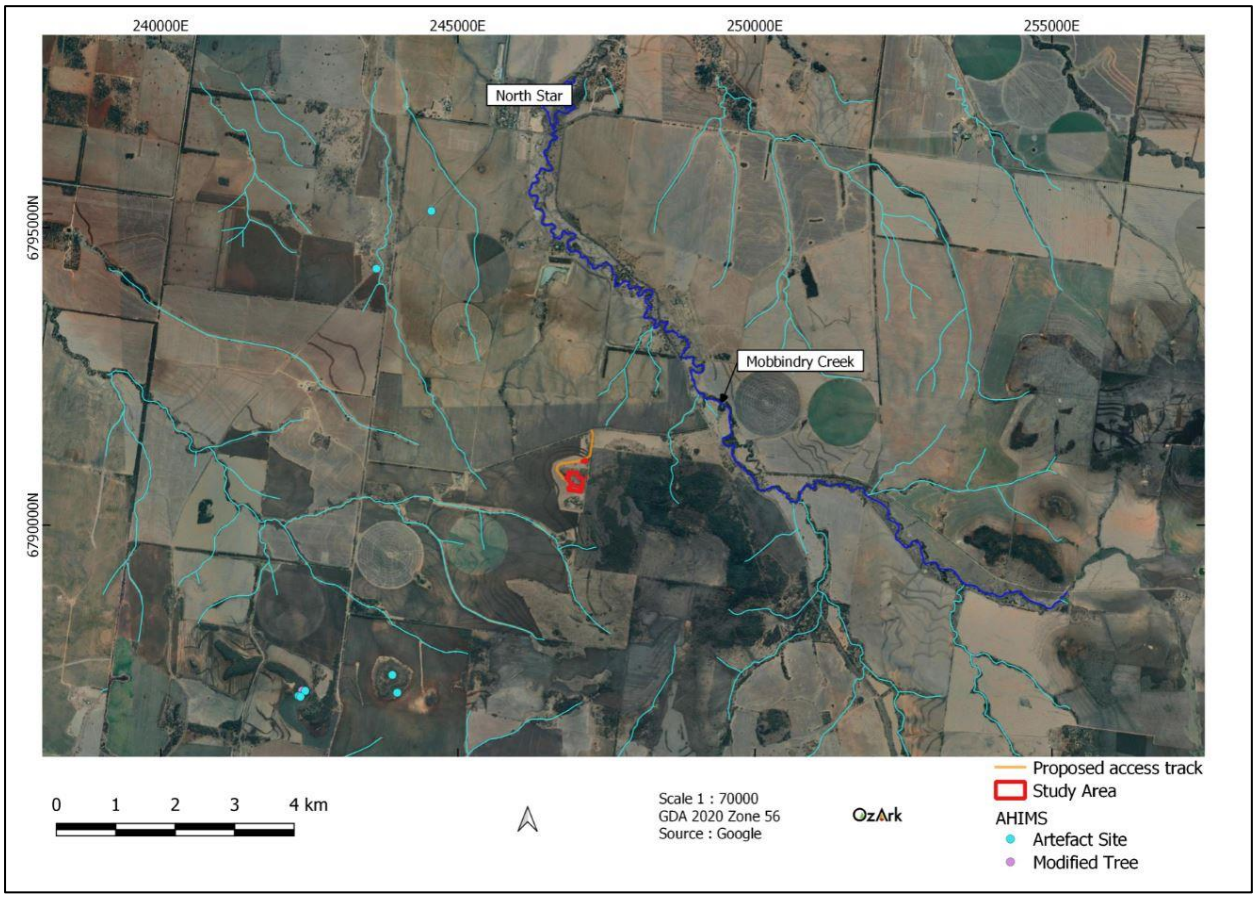
Figure 4-1 shows the location of the AHIMS sites that have been recorded near the study area.

Table 4-1: Site types and frequencies of AHIMS sites near the study area.

Site Type	Number	% Frequency
Artefact scatter or isolated find	8	88.9
Modified tree	1	11.1
Total	**9**	**100**

Of the nine sites, there are eight artefact sites and one culturally modified tree. The closest site is approximately 4.3 km southeast of the study area and is an artefact site. The limited number of Aboriginal sites within the area surrounding the proposal is likely due to the limited archaeological investigation in the area and the high levels of disturbance which may have impacted or redistributed archaeological sites. While the AHIMS results suggest that the potential for *in situ* Aboriginal objects within the study area is low, the data is not the result of large scale or systematic method of identifying Aboriginal archaeological sites and therefore cannot be taken independently as a reflection of past Aboriginal occupation patterns.

Figure 4-1: Location of previously recorded AHIMS sites in relation to the study area.



4.4 PREDICTIVE MODEL FOR SITE LOCATION

Across Australia, numerous archaeological studies in widely varying environmental zones and contexts have demonstrated a high correlation between the permanence of a water source and the permanence and/or complexity of Aboriginal occupation. Site location is also affected by the availability of and/or accessibility to a range of other natural resources including: plant and animal foods; stone and ochre resources and rock shelters; as well as by their general proximity to other sites/places of cultural/mythological significance. Consequently, sites tend to be found along permanent and ephemeral water sources, along access or trade routes or in areas that have good flora/fauna resources and appropriate shelter.

In formulating a predictive model for Aboriginal archaeological site location within any landscape it is also necessary to consider post-depositional influences on Aboriginal material culture. In all but the best preservation conditions very little of the organic material culture remains of ancestral Aboriginal communities survives to the present. Generally, it is the more durable materials such as stone artefacts, stone hearths, shells, and some bones that remain preserved in the current landscape. Even these, however, may not be found in their original depositional context since these may be subject to either (a) the effects of wind and water erosion/transport—both over short- and long-time scales—or (b) the historical impacts associated with the introduction of

European farming practices including grazing and cropping, land degradation, and farm related infrastructure. Scarred trees, due to their nature, may survive for up to several hundred years but rarely beyond.

4.4.1 Settlement strategies

The archaeological studies undertaken within the vicinity of the study area provides information to obtain an understanding of the nature and distribution of archaeological sites within the region. Although there is some conjecture about the relationship between stream order, site numbers and densities, the general pattern is that most sites are recorded close to watercourses. As mentioned in **Section 3.3**, the closest natural waterways are an unnamed tributary of the Mungle Creek approximately 790 m southwest of the study area and Mobbindry Creek approximately 4.3 km east of the study area. The topography of the surrounding landforms to the study area would have allowed transitory movement between watercourses across the landscape. The lack of a reliable water source in the vicinity indicates that the study area is unlikely to have supported long-term occupation, however, the presence of outcropping basalt may have attracted people to the area to procure raw material for stone tool manufacture.

4.4.2 Past land use

Crucial for the preservation of archaeological deposits is the history of past land use in an area. The study area is classified as ‘grazing native vegetation’. Much of this vegetation consists of revegetated trees and grasses, as the area has been previously cleared and there are only a few mature native trees remaining, mostly in the far west and eastern portions of the study area. Agricultural practices undertaken across region are also likely to have had an impact on archaeological sites due to the modification of waterways and ploughing of self-mulching soils. The study area has been previously used as a quarry and much of the natural A-horizon of the soil profile is likely to have been removed or disturbed.

4.4.3 Previously recorded sites

The nearby AHIMS results indicate that the most common site types identified at the study area are artefact scatters and isolated finds. The study area is some distance from a permanent or semi-permanent source of water, and this suggests that any site recording will have a low artefact density and a low complexity of tool types.

4.4.4 Landform modelling

A consideration of the landforms within the study area enables a prediction regarding the type and distribution of sites to be made. Artefact scatters are most likely within the elevated flat areas of the study area and less likely on steeply sloping sections of the ridge. However, where there

are basalt outcrops in slope landforms, Aboriginal quarrying activity may be present. Modified trees are possible in any of the landforms if there are suitable mature native trees in the area.

4.4.5 Conclusion

Based on knowledge of the environmental contexts of the study area and a desktop review of the known local and regional archaeological record, the following predictions are made concerning the probability of those site types being recorded within the study area:

Isolated finds may be indicative of: random loss or deliberate discard of a single artefact, the remnant of a now dispersed and disturbed artefact scatter, or an otherwise obscured or sub-surface artefact scatter. They may occur anywhere within the landscape but are more likely to occur in topographies where open artefact scatters typically occur.

- As isolated finds can occur anywhere, particularly within disturbed contexts, it is predicted that this site type could be recorded within the study area.

Open artefact scatters are defined as two or more artefacts, not located within a rock shelter, and located no more than 50 m away from any other constituent artefact. This site type may occur almost anywhere that Aboriginal people have travelled and may be associated with hunting and gathering activities, short- or long-term camps, and the manufacture and maintenance of stone tools. Artefact scatters typically consist of surface scatters or sub-surface distributions of flaked stone discarded during the manufacture of tools but may also include other artefactual rock types such as hearth and anvil stones. Less commonly, artefact scatters may include archaeological stratigraphic features such as hearths and artefact concentrations which relate to activity areas. Artefact density can vary considerably between and across individual sites. Small ground exposures revealing low density scatters may be indicative of a background scatter rather than a spatially or temporally distinct artefact assemblage. These sites are classed as 'open', that is, occurring on the land surface unprotected by rock overhangs, and are sometimes referred to as 'open camp sites'.

Artefact scatters are most likely to occur on level or low gradient contexts, along the crests of ridgelines and spurs, and elevated areas fringing watercourses or wetlands. Larger sites may be expected in association with permanent water sources.

Topographies which afford effective through-access across, and relative to, the surrounding landscape, such as the open basal valley slopes and the valleys of creeks, will tend to contain more and larger sites, mostly camp sites evidenced by open artefact scatters.

- This site type is the most common in the area, however, as most of the study area is distant to permanent water, this site type is not predicted to be highly likely. Additionally, the activities from vegetation and land clearing, and later stock grazing, are likely to have displaced artefact scatters, should they have been present. Prior to disturbances

in the area, it is considered that artefact scatters would be more likely to the south and east of the study area closer to the resources of the Mungle and Mobbindry Creek.

Aboriginal scarred trees contain evidence of the removal of bark (and sometimes wood) in the past by Aboriginal people, in the form of a scar. Bark was removed from trees for a wide range of reasons. It was a raw material used in the manufacture of various tools, vessels and commodities such as string, water containers, roofing for shelters, shields and canoes. Bark was also removed because of gathering food, such as collecting wood boring grubs or creating footholds to climb a tree for possum hunting. Due to the multiplicity of uses and the continuous process of occlusion (or healing) following removal, it is difficult to accurately determine the intended purpose for any example of bark removal. Scarred trees may occur anywhere old growth trees survive. The identification of scars as Aboriginal cultural heritage items can be problematical because some forms of natural trauma and European bark extraction create similar scars. Many remaining scarred trees probably date to the historic period when bark was removed by Aboriginal people for both their own purposes and for roofing on early European houses. Consequently, the distinction between European and Aboriginal scarred trees may not be clear.

- The partial clearance of native vegetation from within the study area indicates that the occurrence of this site type has been reduced. However, the pockets of existing vegetation may reveal culturally modified, or scarred, trees.

Quarry sites and stone procurement sites typically consist of exposures of stone material where evidence for human collection, extraction and/or preliminary processing has survived. Typically, these involve the extraction of siliceous or fine grained igneous and meta-sedimentary rock types for the manufacture of artefacts. The presence of quarry/extraction sites is dependent on the availability of suitable rock formations.

- This site type could be recorded within the study area as the basalt outcropping present would provide a suitable resource for stone tool manufacture.

5 HISTORIC ARCHAEOLOGY BACKGROUND

5.1 INTRODUCTION

The current assessment will apply the Heritage Council *Historical Archaeology Code of Practice* (Heritage Council 2006) in the completion of a historical heritage assessment, including field investigations.

5.2 BRIEF HISTORY OF NORTH STAR

European settlement of North Star, NSW began in 1888 when the Sutton family took up land holdings in the area. The surrounding areas were cultivated for grazing sheep and by 1910 wool distribution had commenced bring business from surrounding districts. There is some evidence of a hotel run by the Sutton family operating at this time before closing in 1925. A post office was established in 1916 and the Boggabilla Railway line was opened in 1932. By 1938, a church hall and school had been constructed in North Star. With the logistical boon of the railway line and station, the North Star become another viable cereal crop production area during the 1930s and 1940s. This is reflected in the establishment of a silo and loading facilities in 1955. Despite being successful grazing and then cultivation hub, North Star never grew into a large town (FFJV 2020).

5.3 LOCAL CONTEXT

5.3.1 Desktop database searches conducted

A desktop search was conducted on the following databases to identify any potential previously recorded heritage within the study area. The results of this search are summarised in **Table 5-1**.

Table 5-1: Historic heritage: desktop-database search results.

Name of Database Searched	Date of Search	Type of Search	Comment
National and Commonwealth Heritage Listings	15/4/2021	Gwydir Shire Council LGA	No listing within the North Star area.
State Heritage Listings	15/4/2021	Gwydir Shire Council LGA	39 results were returned for sites within the Gwydir Shire Council LGA, however, none are within the North Star area.
Local Environmental Plan (LEP)	15/4/2021	Gwydir LEP 2013	26 items are listed on the LEP but no results returned for the North Star area.

A search of the Heritage Council of NSW administered heritage databases and the Gwydir LEP 2013 returned no records for historical heritage sites within the North Star area. It is predicted based on the lack of previous historic sites and the location of the property that the recording of historic sites within the study area is unlikely.

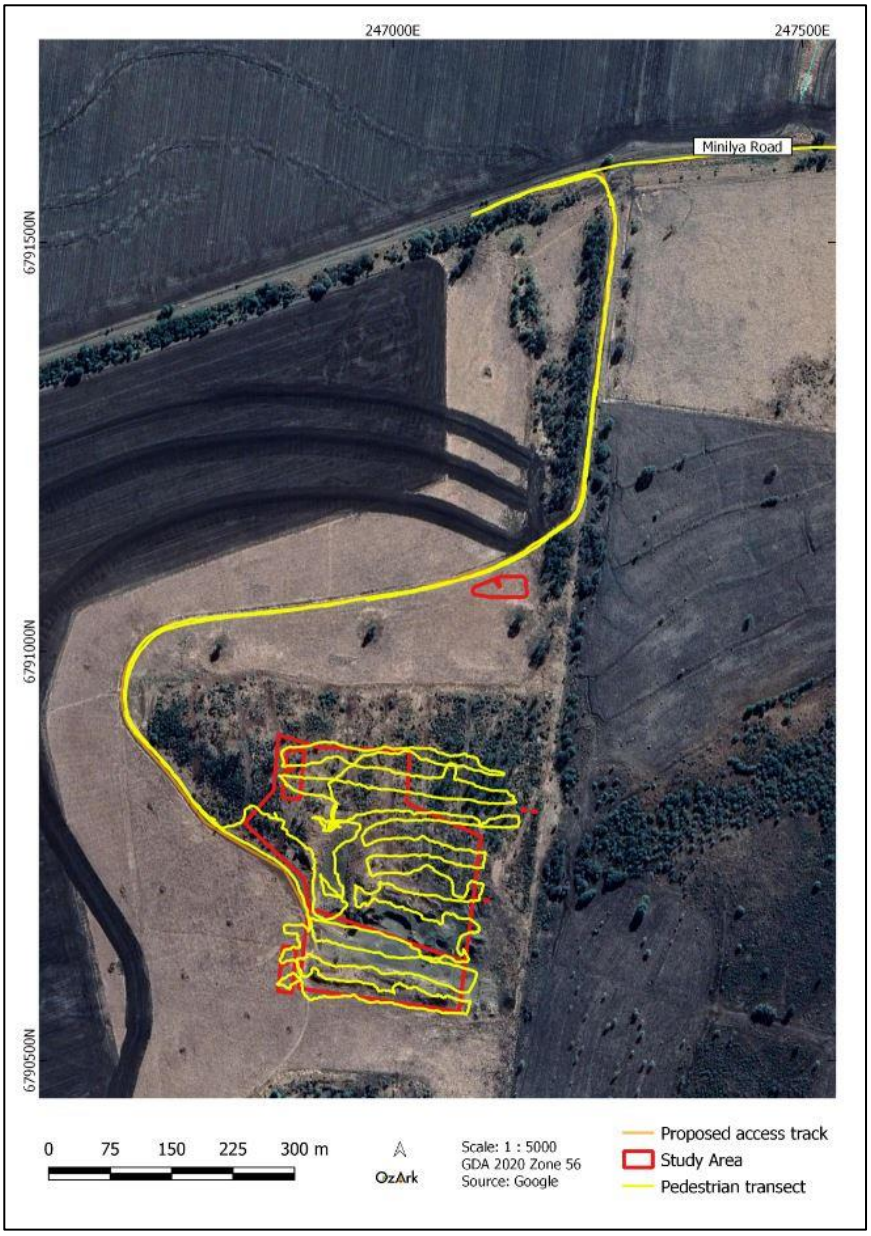
6 RESULTS OF ARCHAEOLOGICAL ASSESSMENT

6.1 SAMPLING STRATEGY AND FIELD METHODS

Standard archaeological field survey and recording methods were employed in this study (Burke & Smith 2004). The pedestrian survey followed the Code of Practice. The historic archaeological survey was undertaken in tandem with the Aboriginal archaeological survey.

The entirety of the survey area was assessed by pedestrian transects. This excludes the area of the existing quarry extraction, as these areas have already been heavily disturbed and modified. This also excludes the steeply sloping landform within the north-western portion of the study area as it was unable to reasonably be traversed. Panasonic GPS tablets were used during the pedestrian survey to capture spatial data (**Figure 6-1**). General notes pertaining to the survey and ground cover were kept by the archaeologist.

Figure 6-1: Pedestrian coverage of the survey area.



6.2 OBSERVATIONS FROM THE SURVEY

High levels of disturbance from quarrying are present in the central portion of the study area, and across all the study area, approximately 40% has been affected by previous ground disturbing activities associated with quarrying and agriculture. Rock piles and evidence of dumping are located to the immediate south, east, and west of the quarry. Within these areas, piles of basalt cobbles, some with facets, are present. However, the facets are not of Aboriginal origin, and appear to be cobbles broken during quarrying, and not exhibiting Aboriginal flaking characteristics. This conclusion was reached due to the high amount of landform modification in the vicinity of these piles and the lack of surface artefacts that would be expected to be present if this were the result of Aboriginal quarrying.

Three main landforms are present outside areas of disturbance and these were divided into three survey units as specified in **Section 3**. These three units consist of elevated ridge landforms, slope landforms and flat, plain landforms. Observations from each survey unit are detailed below.

6.2.1 Survey Unit 1

Survey Unit 1 is comprised of sloping landforms which are located predominantly in the northern and north-western portions of the study area (see **Figure 3-2**). Soils consist of a sticky black soil, with minor patches of brown silty loam present within the far north of the unit (**Figure 6-2**: photo 1). Vegetation throughout Survey Unit 1 comprised of relatively new regrowth. Remnants of more undisturbed vegetation remain in steeply sloping landforms in the northwest of Survey Unit 1 (**Figure 6-2**: photo 2). Ground surface visibility (GSV) was generally moderate across these areas.

In the far-northern area of Survey Unit 1, the land starts sloping gently to the north. This area is quite exposed. A copse of trees is present within the north-eastern portion of the study area consisting of younger regrowth. Within the north-western area of Survey Unit 1, more vegetation is present, along with basalt outcrops (**Figure 6-2**: photo 3). At the north-western edge of the study area, the slope is steep and not easily traversed.

6.2.2 Survey Unit 2

Survey Unit 2 comprises of elevated flats/ridgelines and upper slope landforms (see **Figure 3-2**). The central to northern portions of the study area are located within this elevated landform (where the land has not been previously quarried). The study area becomes less disturbed towards the north and GSV was low within this area. The northern portion of Survey Unit 2 was partially modified (**Figure 6-2**: photos 4 & 5), including the excavation of seven artificial drainage channels running north–south (**Figure 6-2**: photo 6).

The southern and central portions of Survey Unit 2 has been heavily modified with the exception of a low ridgeline at the far southern edge of the study area. The ridgeline has minimal

disturbances, although the dumping of rubbish and the movement of some rocks was noted (**Figure 6-2**: photos 7 & 8). GSV within this area was moderate–high. There were minimal areas of vegetation along the low ridgeline and scatterings of basalt outcrop are present. Immediately north of this ridgeline, within the southern and central portions of the study area, the land has been subject to quarrying.

6.2.3 Survey Unit 3

Survey Unit 3 comprises of flat/plain landforms (see **Figure 3-2**). The landforms within this unit have been heavily disturbed due to ploughing. Flat landforms are predominantly located at the south of the study area. Soils consist of black, sticky soils, and vegetation has largely been cleared for agricultural purposes.

In the far north of the study area, the ridge slopes gently into another flat landform. This flat landform has been intersected by a dirt access track that runs east–west. The proposed access track had been scraped and laid with imported blue shale (**Figure 6-2**: photo 9). Vegetation here has predominantly been cleared.

Figure 6-2: Images of the study area.



1. View of soils within an elevated flat and upper slope landform unit within the study area.



2. View of a steeply sloping landform within the north-western portion of the study area.





3. View of rock outcrop and soil on a slope landform in the north-western portion of the study area.	4. View of heavily modified and disturbed landform within the south of the study area.
	
5. View of a heavily modified area in the south to central portion of the study area.	6. View of an artificial drainage disturbance area within the central east portion of the study area.
	
7. Image of dumping in elevated landform in the centre of the study area, with machinery in the background.	8. Image of dumping to the immediate south of the highly disturbed area.
	
9. View north along the access track.	10. Rock piling to the immediate south of the highly disturbed area.

	
11. Rock piling to the immediate south of the highly disturbed area.	12. Rock with facets removed, not assessed to be the result of Aboriginal quarrying.

6.3 EFFECTIVE SURVEY COVERAGE

Two of the key factors influencing the effectiveness of archaeological survey are GSV and ground surface exposure (GSE). These factors are quantified to ensure that the survey data provides adequate evidence for the evaluation of the archaeological materials across the landscape. For the purposes of the current assessment, these terms are used in accordance with the definitions provided in the Code of Practice.

GSV is defined as:

> *… the amount of bare ground (or visibility) on the exposures which might reveal artefacts or other archaeological materials. It is important to note that visibility, on its own, is not a reliable indicator of the detectability of buried archaeological material. Things like vegetation, plant or leaf litter, loose sand, stone ground or introduced materials will affect the visibility. Put another way, visibility refers to 'what conceals'* (DECCW 2010: 39).

GSE is defined as:

> *… different to visibility because it estimates the area with a likelihood of revealing buried artefacts or deposits rather than just being an observation of the amount of bare ground. It is the percentage of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground. Put another way, exposure refers to 'what reveals'* (DECCW 2010: 37).

Table 6-1 calculates the effective survey coverage within the study area. In general, **Table 6-1** presents an approximation of the amount of ground surface able to be seen at any location within particular landform units. The GSV was variable depending on landform. The GSV was low–moderate across the sloping landforms (GSV was 40% within a GSE of 20%), with short grasses, present on the ground surface. The effective coverage for the part of the study area is 8%. On the elevated flats and upper slope landforms, the GSV was approximately 75% within a GSE of 30%. The effective coverage for this landform is 22.5%. Within flat plain landforms the GSV was moderate to high (GSV was 80% within a GSE of 50%). The effective coverage for this landform is 40%.

Heavily modified landforms comprise of 40% of the study area and have not been included within the effective survey coverage.

Table 6-1: Effective survey coverage within the study area.

Survey Unit	Landform	Survey Unit Area (sq m)	Visibility %	Exposure %	Effective Coverage Area (sq m) (= Survey Unit Area x Visibility % x Exposure %)	Effective Coverage % (= Effective Coverage Area / Survey Unit Area x 100)
1	Slopes	9540	40	20	763	8%
2	Elevated flats/ridgelines and upper slope	21213	75	30	4772	22.5%
3	Flat/plain landforms	7513	80	50	3005	40%

Table 6-2 demonstrates that despite relatively high survey efficacy within the flat/plains landforms and the elevated flats/ridgelines and upper slope landforms (40% and 22.5% respectively), no Aboriginal sites or features were recorded during the survey.

Table 6-2: Effective survey coverage and incidences of Aboriginal site recording.

Landform	Landform area (sq m)	Area Effectively Surveyed (sq m) (= Effective Coverage Area)	% of Landform Effectively Surveyed (= Area Effectively Surveyed / Landform x 100)	Number of Sites	Number of Artefacts or Features
Elevated flats and upper slope	21213	4772	22.5%	0	0
Slopes	9540	763	8%	0	0
Flat/plain landforms	7513	3005	40%	0	0

6.4 ABORIGINAL OBJECTS RECORDED

No Aboriginal objects were recorded within the study area during the visual inspection and no landforms were identified as having potential to contain Aboriginal objects in subsurface archaeological deposits. The lack of recorded sites is thought to be correlative with the distance of the study area to sources of reliable water. No areas of outcropping stone showed any evidence of Aboriginal quarrying activates.

In addition, the large amount of disturbance due to previous quarrying and related ground disturbing works within the study area may have disturbed and/or dispersed sites had they once been present. Additional disturbances in the study area which were not able to be identified at a desktop level included some pre-existing dirt tracks throughout the study area, some ploughing in the far southwest, and minor rubbish dumping.

Furthermore, areas of low disturbance are located within steeply sloping landforms that have a lower archaeological potential due to their unsuitability as occupation sites.

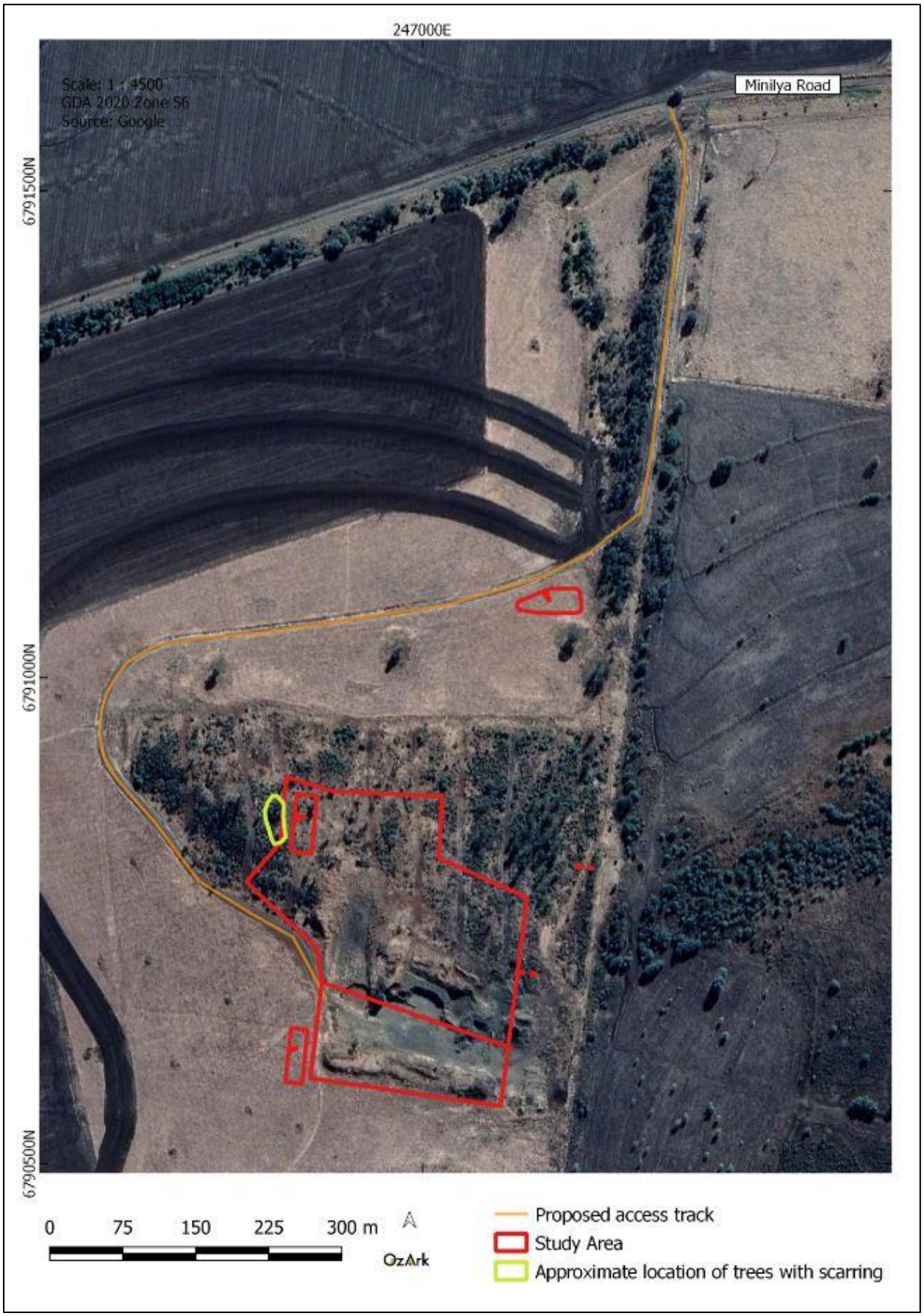
As a result of their inspection of the study area, the Aboriginal community identified three trees with scarring along the north-western boundary of the study area, along the slope landform (see **Figure 6-3** and **Figure 6-4**). These scars are not believed to be the result of cultural marking, but

rather natural trauma to the trees. However, it is still recommended that mature trees are not impacted where possible.

Figure 6-3: Images of trees with scarring taken by TLALC.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. Image of tree with scarring (1).</td><td>2. Image of tree with scarring (2).</td></tr>
<tr><td>  </td><td>3. Image of tree with scarring (3).</td></tr>
</table>

Figure 6-4: Approximate location of mature trees with natural scarring.



6.5 CULTURAL VALUES

Social or cultural value refers to the spiritual, traditional, historical, or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them.

Places of social or cultural value have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods, or events. Communities can experience a sense of loss should a place of social or cultural value be damaged or destroyed.

There is not always consensus about a place's social or cultural value. Because people experience places and events differently, expressions of social or cultural value do vary and, in some instances, will be in direct conflict. When identifying values, it is not necessary to agree with or acknowledge the validity of each other's values, but it is necessary to document the range of values identified.

Social or cultural value can only be identified through consultation with Aboriginal people. This could involve a range of methodologies, such as cultural mapping, oral histories, archival documentation, and specific information provided by Aboriginal people specifically for the investigation.

The inspection of the study area by Mr Malcom Peckham, from the Toomelah LALC did not identify any other potential archaeological sites or specific cultural values within the study area. A letter received by OzArk from Mr Rex Weribone and Mr Peckham on the 6 June 2021 read:

> *"The survey went well and we didn't find anything of cultural values within the new study area. We feel that this particular site holds no cultural materials of significance to the local tradition owner groups."*

The full letter is attached in **Appendix 7.**

6.6 HISTORICAL HERITAGE ITEMS RECORDED

No significant historic items were recorded within the study area and the potential for historic values to be present is considered very low.

While the study area contained pieces of old machinery related to previous quarrying activity in the study area (for example, **Figure 6-2**: photo 7), all items were assessed as having no heritage value.

7 RECOMMENDATIONS

Under Section 89A of the NPW Act it is mandatory that all newly-recorded Aboriginal sites be registered with AHIMS. As a professional in the field of cultural heritage management it is the responsibility of OzArk to ensure this process is undertaken.

To this end it is noted that no Aboriginal sites were recorded during the assessment and no landforms were assessed as having potential to contain archaeological deposits.

It is also noted that the survey did not record any significant heritage items in the study area and no landforms were assessed as having potential to contain historical archaeological deposits.

The following recommendations are made based on these impacts and with regard to:

- Legal requirements under the terms of the NPW Act whereby it is illegal to damage, deface or destroy an Aboriginal place or object without the prior written consent of Heritage NSW
- The findings of the current investigations undertaken within the survey area
- The interests of the Aboriginal community.

Recommendations concerning Aboriginal cultural values and historical values within the study area are as follows:

1. The proposed work may proceed at North Star Quarry without further archaeological investigation under the following conditions:
    a) All land and ground disturbance activities must be confined to within the archaeological survey area, as this will eliminate the risk of harm to Aboriginal objects in adjacent landforms. Should the parameters of the Proposal extend beyond the assessed areas, then further archaeological assessment may be required.
    b) All staff and contractors involved in the proposed work should be made aware of the legislative protection requirements for all Aboriginal sites and objects.
2. This assessment has concluded that there is a low likelihood that the proposed work will adversely harm Aboriginal cultural heritage sites. However, if Aboriginal objects are identified during the construction and operation of the Proposal, all work should cease and the procedures in the *Unanticipated Finds Protocol* (**Appendix 2**) should be followed.
3. In the event of skeletal remains being identified during the construction and operation of the Proposal, the *Unanticipated Skeletal Remains Protocol* (**Appendix 3**) should be followed.

4. Inductions for work crews should include a cultural heritage awareness procedure to ensure they recognise Aboriginal artefacts (see **Appendix 4**) and are aware of the legislative protection of Aboriginal objects under the *National Parks and Wildlife Act 1974* and the contents of the *Unanticipated Finds Protocol.*
5. In the unlikely event that historical relics or deposits are unearthed during the proposed works, the *Historical Heritage Unanticipated Finds Protocol* (**Appendix 6**) should be followed.

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APPENDIX 1: ABORIGINAL COMMUNITY CONSULTATION LOG

Aboriginal Consultation Log –North Star Quarry			
Date	**Organisation**	**Comment**	**Method**
15-Apr-21	Toomelah Local Aboriginal Land Council	Rebecca Hardman (RH) phoned and spoke to receptionist, need to call back after 10:30am	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned back - N/A	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned back spoke to Rex, he requested RH send Email and Rex will respond. Thinks should have site officer but wants more information first	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH sent invite to fieldwork	Email
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned - N/A	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH received Email confirming receipt of invite	Email
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned - message left on automated msg bank	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned - N/A	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH sent Email following up to see if able to get a site officer for Monday	Email
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned - N/A	Phone
15-Apr-21	Toomelah Local Aboriginal Land Council	RH Phoned - N/A	Phone
16-Apr-21	Toomelah Local Aboriginal Land Council	Taylor Foster (TF) Phoned Rex chasing site officer, he said he had forgotten to follow up on site officer but would organise and call back before COB	Phone
16-Apr-21	Toomelah Local Aboriginal Land Council	TF Phoned Rex N/A	Phone
16-Apr-21	Toomelah Local Aboriginal Land Council	TF Phoned Rex N/A	Phone
16-Apr-21	Toomelah Local Aboriginal Land Council	TF Phoned Rex N/A	Phone
16-Apr-21	Toomelah Local Aboriginal Land Council	TF sent follow up Email chasing site officer	Email
19-Apr-21	Toomelah Local Aboriginal Land Council	Rex Phoned TF- said had no site officers available	Phone
19-Apr-21	Toomelah Local Aboriginal Land Council	Sheridan Baker (SB) rang and spoke to Rex. Site officer is definitely not available today due to Sorry business. Rex is happy to organise another time /day.	Phone
19-Apr-21	Toomelah Local Aboriginal Land Council	RH received Email: *I have spoken to Sheridan about the timing of the CH site assessment, and feel the consultation process is somewhat flawed from your end. We feel that we should be afforded ample time to respond to this request?* *Therefore we are requesting the site assessment to be rescheduled to a more suitable time. To allow the participation of Toomelah CH Site Officer in site inspections at North Star.* *Secondly we have not been given the opportunity to negotiate our own rates for CH clearance works and agree on approximate fees chargeable for this type of field work.* *The CH Site Officer Daily Rates are as follows:*	Email

Aboriginal Consultation Log –North Star Quarry			
Date	**Organisation**	**Comment**	**Method**
		1. Site Officer x 1 x @ $100 per hr *2. Travel Kilometres x @0.72cents km* *3. Accommodation x @ 134.00 per night* *4. Meals x @105.00 per day* *These are standard rates and fees we charge project proponents for CH works, however it also depends upon the duration of the fieldwork or preliminary site investigations.* *If you have any questions please do not hesitate in contacting me.*	
26.4.21	Toomelah Local Aboriginal Land Council	RH thanked Rex and noted will be in touch when has more information to discuss	Email
26.4.21	Toomelah Local Aboriginal Land Council	RH received: *That's great, thank you.*	Email
28.4.21	Toomelah Local Aboriginal Land Council	Jodie Benton (JB) Phoned left message for call back	Phone
28.4.21	Toomelah Local Aboriginal Land Council	JB sent email: *I did just call and leave a message for you regarding the North Star Quarry project.* *I just wanted to have a chat to see what we can arrange re a site visit from a site officer. It is a small area not too far from Toomelah, so let's talk about how we can approach this.* *If you could call me at your earliest convenience that would be great J*	Email
29.4.21	Toomelah Local Aboriginal Land Council	RH Phoned landline left message for call back	Phone
29.4.21	Toomelah Local Aboriginal Land Council	RH Phoned mobile left message for call back	Phone
29.4.21	Toomelah Local Aboriginal Land Council	Rex called back but hang up before being transferred	Phone
29.4.21	Toomelah Local Aboriginal Land Council	JB called Rex back immediately and left message	Phone
29.4.21	Toomelah Local Aboriginal Land Council	JB called Rex back immediately still no answer	Phone
3.5.21	Toomelah Local Aboriginal Land Council	JB called Rex discussed site officer attending site. Rex requested more info of site location and then will let JB know who will attend and when.	Phone
3.5.21	Toomelah Local Aboriginal Land Council	JB sent email with location map	Email
6.5.21	Toomelah Local Aboriginal Land Council	TF called Toomelah LALC to get update regarding the date and details of site officer attending site. Was told a message would be passed onto Rex and he would get in contact.	Phone
6.5.21	Toomelah Local Aboriginal Land Council	TF called TLALC – no response	Phone
6.5.21	Toomelah Local Aboriginal Land Council	TF called Rex, said he would be sending out site officer Malcolm Peckham on the 10/5/21.	Phone
10-May-21	Toomelah Local Aboriginal Land Council	Malcolm Peckham called TF worried about site access due to rain. TF called property holder who confirmed might be difficult. TF called Malcolm to discuss, Malcolm will go out 11/5/21 instead. TF to confirm site access with property holder before heading out.	Phone
11-May-21	Toomelah Local Aboriginal Land Council	TF called Malcolm after calling landowner to confirm site would be fine to travel to. Malcolm said he had overbooked and could not do it but would over next two days.	Phone

Aboriginal Consultation Log –North Star Quarry			
Date	**Organisation**	**Comment**	**Method**
13-May-21	Toomelah Local Aboriginal Land Council	TF called Malcom to confirm he would be going out to site. Malcom said he would try to get to it today and would let us know. Said worst case scenario is he goes out Monday.	Phone
13-May-21	Toomelah Local Aboriginal Land Council	TF called Malcolm - no response	Phone
13-May-21	Toomelah Local Aboriginal Land Council	TF called Rex - no response	Phone
14-May-21	Toomelah Local Aboriginal Land Council	TF called TLALC - no response, left message	Phone
14-May-21	Toomelah Local Aboriginal Land Council	TF called Rex - unable to get through	Phone
14-May-21	Toomelah Local Aboriginal Land Council	TF called Malcolm - no response, left message	Phone
14-May-21	Toomelah Local Aboriginal Land Council	TF received message from Malcolm - he said he was away today and could not get in touch however he has organised the job to be undertaken Monday	Phone
17-May-21	Toomelah Local Aboriginal Land Council	TF received call from Malcolm, said he was on his way to site	Phone
17-May-21	Toomelah Local Aboriginal Land Council	TF received call from Malcolm, he had completed thorough site inspection. Recorded three trees with rips he wanted us to check out to confirm whether or not cultural scars. Stated that other than possible trees, no other sites were identified.	Phone
17-May-21	Toomelah Local Aboriginal Land Council	TF received email of photos from RAPS	Email
17-May-21	Toomelah Local Aboriginal Land Council	TF responded to email with thanks and also request for location map as discussed on phone call.	Email
18-May-21	Toomelah Local Aboriginal Land Council	Malcolm called TF to say they were just having technical difficulties but that he would send through the map with tree locations soon. TF informed that OzArk did not believe trees had cultural value. TF asked if Malcolm would send written document briefing OzArk on site inspection and cultural values of the area. TF to send email with formal request.	Phone
18-May-21	Toomelah Local Aboriginal Land Council	TF emailed LALC requesting written summary of FW and cultural values present or not with the area.	Email
19-May-21	Toomelah Local Aboriginal Land Council	Malcolm sent through location map	Email
25-May-21	Toomelah Local Aboriginal Land Council	TF emailed follow up request for FW summary	Email
25-May-21	Toomelah Local Aboriginal Land Council	TF emailed with updated study area in relation to the trees	Email
25-May-21	Toomelah Local Aboriginal Land Council	TF called Malcolm following up on requested summary. Malcolm said he would send it this afternoon or tomorrow morning.	Email
26-May-21	Toomelah Local Aboriginal Land Council	Malcom responded to email to TF saying if the trees were out of the impact area, then the project is fine to go ahead. TF responded reiterating need to written letter from the LALC	Email
28-May-21	Toomelah Local Aboriginal Land Council	TF called Malcolm chasing letter. Left message.	Phone
28-May-21	Toomelah Local Aboriginal Land Council	TF called TLALC chasing Malcolm. Not there, left a message with receptionist.	Phone
28-May-21	Toomelah Local Aboriginal Land Council	TF sent another follow up email	Phone
28-May-21	Toomelah Local Aboriginal Land Council	"TF received text from Malcolm reading ""Hi Taylor, just confirming that I attended a survey site south of North Star. I	Phone

Aboriginal Consultation Log –North Star Quarry			
Date	**Organisation**	**Comment**	**Method**
		spend a few hours there. The survey went well and we didn't find any cultural values within the study area."" ""Hi Taylor, we are away for another funeral away from the office. Hope that helps"	
28-May-21	Toomelah Local Aboriginal Land Council	TF responded: "Hi Malcolm thank you for your message. I will put your message in the report at its draft stage for now but when you are back in the office next week could you please send it as a letter. It would be really appreciated. I'm sorry to hear you are at another funeral. I send my condolences."	Phone
31-May-21	Toomelah Local Aboriginal Land Council	TF received email from TLALC "Sorry Taylor I was a bit busy today Just giving you an update on the survey we took out on the North Star Quarry. I attended a survey site south of North Star. The survey went well and we didn't find anything of cultural values within the new study erea. We at Toomelah land council would like an update report form AzArk. Thanks Malcolm "	Email
04-Jun-21	Toomelah Local Aboriginal Land Council	Tf sent follow up letter regarding offical summary letter.	Email
04-Jun-21	Toomelah Local Aboriginal Land Council	TF received site inspection summary letter from Toomelah LALC	Email

Invitation to fieldwork

OzArk Environment & Heritage
ABN 59 104 582 354
Dubbo
Queanbeyan
Newcastle
T: 02 6882 0118
enquiry@ozarkehm.com.au
www.ozarkehm.com.au
145 Wingewarra St
PO Box 2069
DUBBO NSW 2830

15 April 2021

Members
Toomelah Local Aboriginal Land Council
PO Box 261
BOGGABILLA NSW 2409
toomelahlandcouncil@gmail.com

ABORIGINAL HERITAGE ASSESSMENT - NORTH STAR QUARRY, NORTH STAR NSW

Dear Members,

OzArk has been engaged by Groundwork Plus, on behalf of the proponent Regional Quarries Australia Pty Ltd (RQ) who are proposing to construct a hard rock quarry located at 5535 North Star Road, North Star NSW (**Figure 1**). The proposed study area is approximately 10 hectares (ha) of land and a 1.3-kilometre (km) access road (**Figure 2**).

OzArk would like to invite you to provide one (1) site officer to participate in the half (1/2) day field work, scheduled for Monday 19th April 2021.

WE DO NOT CURRENTLY HAVE A COPY OF YOUR CURRENT WORKERS COMPENSATION CERTIFICATE, PLEASE SUBMIT A CURRENT COPY TO OZARK TO CONFIRM YOUR INTEREST IN THE FIELDWORK

FIELD WORK DATE:	Monday 19th April 2021
TIME TO MEET:	8am
LOCATION TO MEET:	Vicarage Cafe 9-11 Edward St North Star NSW 2408 (**Figure 3**)
DURATION:	One half (1/2) day
FEE OFFER:	The fee offered is [redacted] for the half day of participation in the fieldwork for the experienced Site Officer (excl. GST). This fee is all inclusive of travel, travel time, fuel, accommodation, meal expenses and participation in the field work. Breaks are not paid.
OZARK FIELD DIRECTOR:	Taylor Foster 0411 120 545
INVOICES:	Invoices are to be addressed to: OzArk Environment & Heritage C/- Rebecca Hardman PO Box 2069

Dubbo, NSW 2830
rebecca@ozarkehm.com.au

PLEASE NOTE: THE ABOVE FIELDWORK MAY BE CANCELLED AT SHORT NOTICE DUE TO CIRCUMSTANCES OUTSIDE OUR CONTROL. SHOULD THIS HAPPEN WE WILL CONTACT YOU AS SOON AS POSSIBLE AND ATTEMPT TO RESCHEDULE FOR A LATER DATE.

COVID-19 REQUIREMENT: YOUR SITE OFFICER WILL BE REQUIRED TO FILL IN AND SIGN THE ATTACHED FORM PRIOR TO ENTERING THE WORK SITE. PLEASE ENSURE THAT YOUR SITE OFFICER WILL BE ABLE TO ANSWER 'NO' TO THE QUESTIONS ON THIS FORM.

You must ensure that you or your representative has enough water and snacks / lunch for the duration of the fieldwork.

Personal Protective Equipment (PPE) – your site officer will need:

- Long pants and long sleeve shirt
- High visibility safety shirt / vest
- Enclosed, sturdy footwear
- Water / Sunscreen / Hat.

You or your representative must be physically fit and will need to identify if you have any medical conditions / allergies that should be known to other people participating in the fieldwork in the event of an emergency. The OzArk field director will send home anyone who they determine to be 'unfit for work' or who may pose a WH&S risk to themselves or others.

Please note, if you are a sending a representative who has any underlying medical conditions or severe allergies, it is important that they have on their person appropriate treatment such as asthma inhalers or EpiPens and notify us accordingly.

As previously noted, due to NSW WH&S legislation we need to have on record current Workers Compensation insurances before going into the field. Unfortunately, we will **NOT** be able to allow participation in the fieldwork without seeing your **current Workers Compensation Certificate of Currency**. These can be emailed through to rebecca@ozarkehm.com.au.

Please advise our office by **Thursday 15th April 2021**, if you are available as well as the name and contact number of the site officer who will participate in the fieldwork. After this date, if we have not heard from you, we will either proceed with the survey with the OzArk archaeologist only or offer this position to other relevant groups.

If you have any feedback or relevant cultural heritage knowledge that you would like to offer, please discuss with the archaeologist during the fieldwork or contact our office.

Should you have any queries in relation to the enclosed information please do not hesitate to contact our office.

Kind regards,

Rebecca Hardman
Office Manager

OzArk Environment & Heritage

Figure 1: Location of the project site.

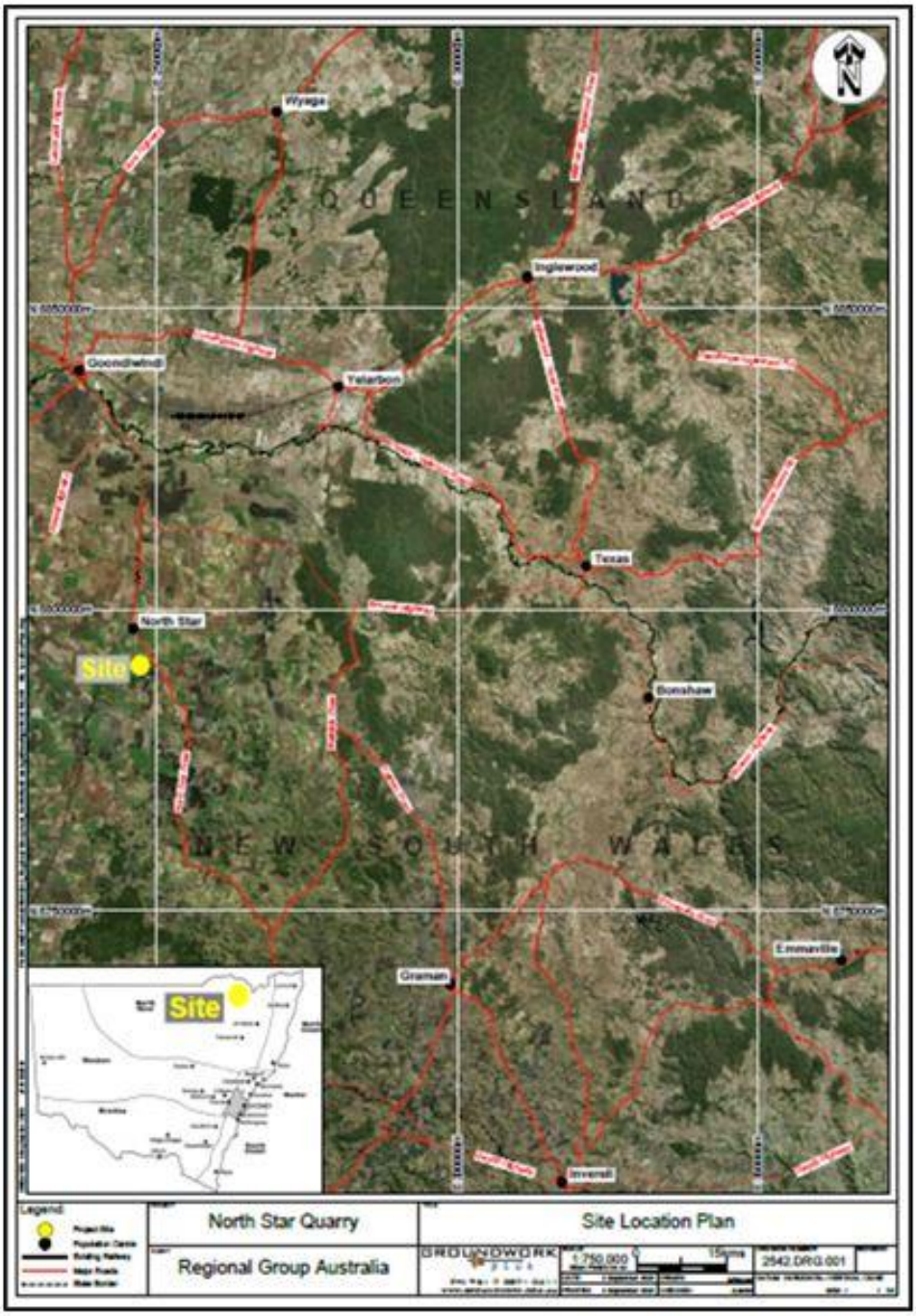


Figure 2. Detail of the Project Site (approximate).

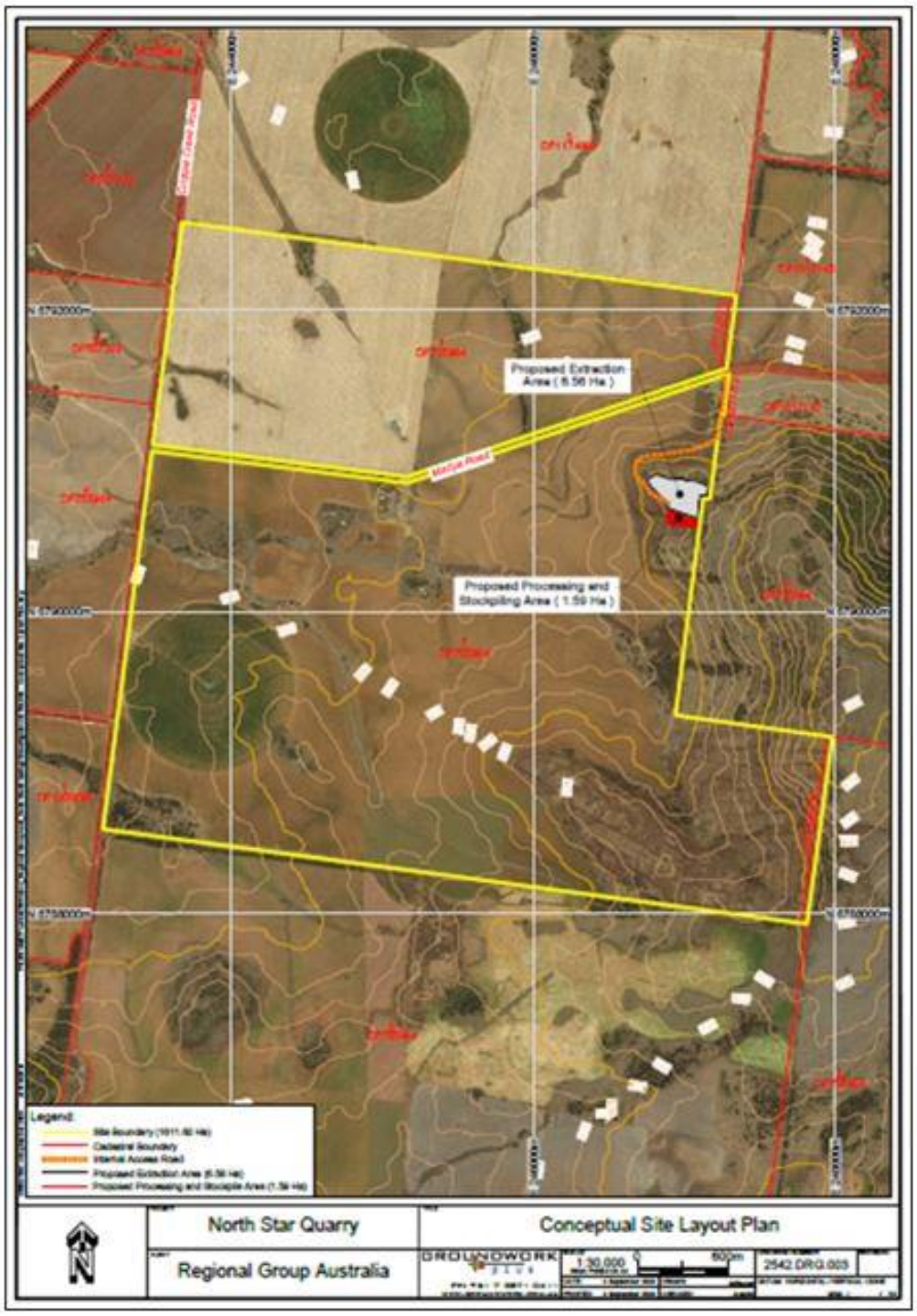


Figure 3. Meeting Location.



OzArk Environment & Heritage

- All workers will be required to **fill in and sign this form on the morning of the fieldwork**. OzArk will bring copies of the form on the day. The form is reproduced here so that it is understood what will be required, **on acceptance of this fieldwork, please confirm you will be able to complete this form and answer 'no'**.

OzArk Environment & Heritage ABN 59 104 582 354
Dubbo T: 02 6882 0118 145 Wingewarra St
Queanbeyan enquiry@ozarkehm.com.au PO Box 2069
Newcastle www.ozarkehm.com.au DUBBO NSW 2830

COVID-19 RELATED ILLNESS REPORTING FORM

Instructions

- To be completed by all members of an OzArk work crew, including subcontractors and/or community volunteers. All members of the fieldwork team are referred here to as 'workers'.
- If a worker answers **Yes** to any question below, please send this form to sheridan@ozarkehm.com.au

Date	
Time	
Worker name	
Worker mobile number	
Site / Location	
Name of OzArk Field Director	

Question		Yes	No
1.	Have you travelled overseas in the last 14 days?		
2.	In the last 14 days, have you travelled domestically from a location that has an active Covid-19 public health order in place?		
3.	Have you had contact with a confirmed or suspected case of Covid-19 (Coronavirus)		
4.	Are you experiencing flu like symptoms? i.e. fever, sore throat, cough, fatigue, difficulty breathing?		
5.	Do you currently have a fever > 37.3 degrees?		

If my health condition changes at any point during work from the above, I will ensure that I inform the OzArk Fieldwork Director immediately.

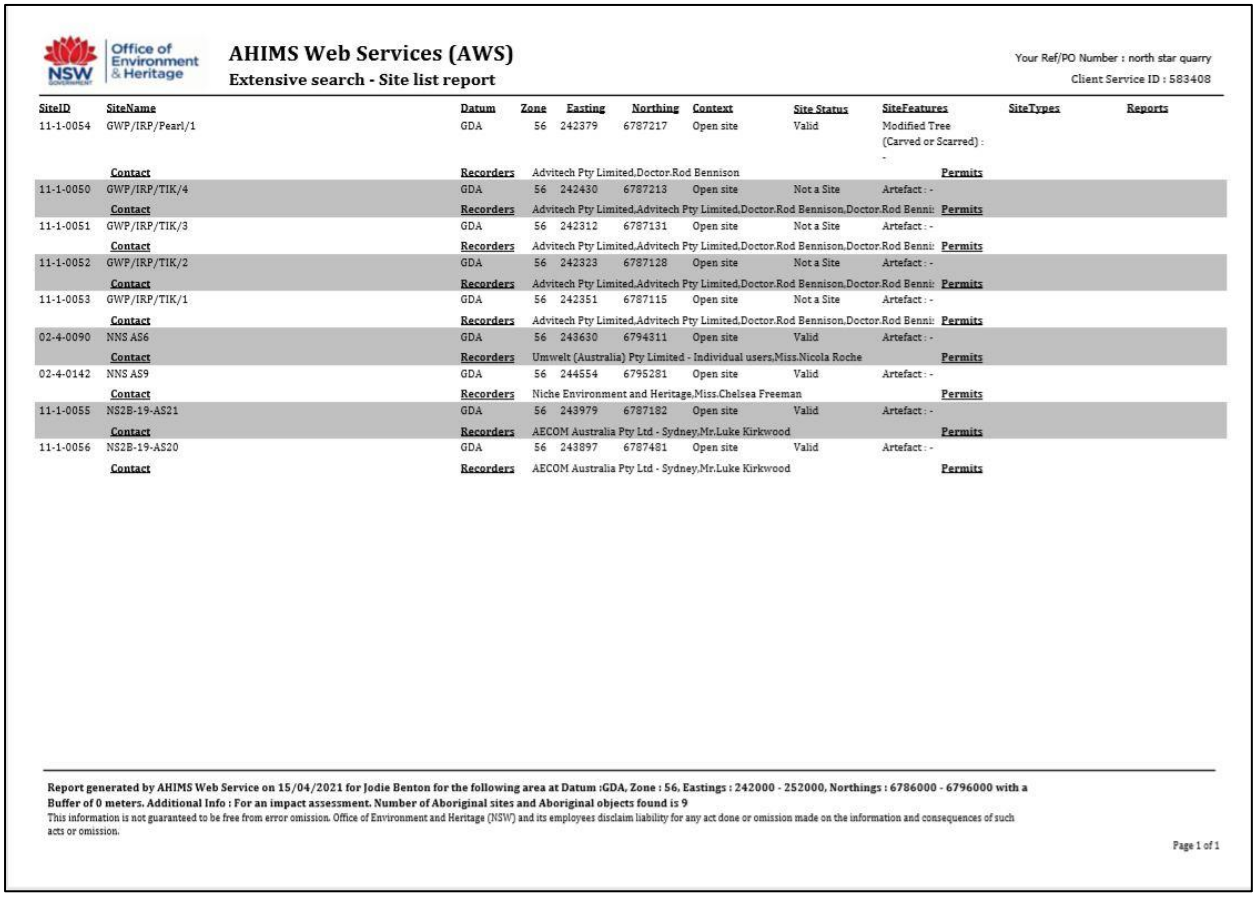
Worker Signature	
Date	

If you have answered **Yes** to 1, 2 or 3, do not enter the workplace, self-isolate as per the relevant current public health order.

If you have answered **Yes** to 4 and 5, do not enter the workplace, contact your GP by phone to arrange a medical assessment.

If you answered **No** to all of the above, you are able to enter the workplace.

APPENDIX 2: AHIMS RESULTS



Office of Environment & Heritage

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : north star quarry

Client Service ID : 583408

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
11-1-0054	GWP/IRP/Pearl/1	GDA	56	242379	6787217	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	Contact	Recorders	Advitech Pty Limited,Doctor.Rod Bennison					Permits		
11-1-0050	GWP/IRP/TIK/4	GDA	56	242430	6787213	Open site	Not a Site	Artefact : -		
	Contact	Recorders	Advitech Pty Limited,Advitech Pty Limited,Doctor.Rod Bennison,Doctor.Rod Benni:					Permits		
11-1-0051	GWP/IRP/TIK/3	GDA	56	242312	6787131	Open site	Not a Site	Artefact : -		
	Contact	Recorders	Advitech Pty Limited,Advitech Pty Limited,Doctor.Rod Bennison,Doctor.Rod Benni:					Permits		
11-1-0052	GWP/IRP/TIK/2	GDA	56	242323	6787128	Open site	Not a Site	Artefact : -		
	Contact	Recorders	Advitech Pty Limited,Advitech Pty Limited,Doctor.Rod Bennison,Doctor.Rod Benni:					Permits		
11-1-0053	GWP/IRP/TIK/1	GDA	56	242351	6787115	Open site	Not a Site	Artefact : -		
	Contact	Recorders	Advitech Pty Limited,Advitech Pty Limited,Doctor.Rod Bennison,Doctor.Rod Benni:					Permits		
02-4-0090	NNS AS6	GDA	56	243630	6794311	Open site	Valid	Artefact : -		
	Contact	Recorders	Umwelt (Australia) Pty Limited - Individual users,Miss.Nicola Roche					Permits		
02-4-0142	NNS AS9	GDA	56	244554	6795281	Open site	Valid	Artefact : -		
	Contact	Recorders	Niche Environment and Heritage,Miss.Chelsea Freeman					Permits		
11-1-0055	NS2B-19-AS21	GDA	56	243979	6787182	Open site	Valid	Artefact : -		
	Contact	Recorders	AECOM Australia Pty Ltd - Sydney,Mr.Luke Kirkwood					Permits		
11-1-0056	NS2B-19-AS20	GDA	56	243897	6787481	Open site	Valid	Artefact : -		
	Contact	Recorders	AECOM Australia Pty Ltd - Sydney,Mr.Luke Kirkwood					Permits		

Report generated by AHIMS Web Service on 15/04/2021 for Jodie Benton for the following area at Datum :GDA, Zone : 56, Eastings : 242000 - 252000, Northings : 6786000 - 6796000 with a Buffer of 0 meters. Additional Info : For an impact assessment. Number of Aboriginal sites and Aboriginal objects found is 9

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Page 1 of 1

APPENDIX 2: ABORIGINAL HERITAGE: UNANTICIPATED FINDS PROTOCOL

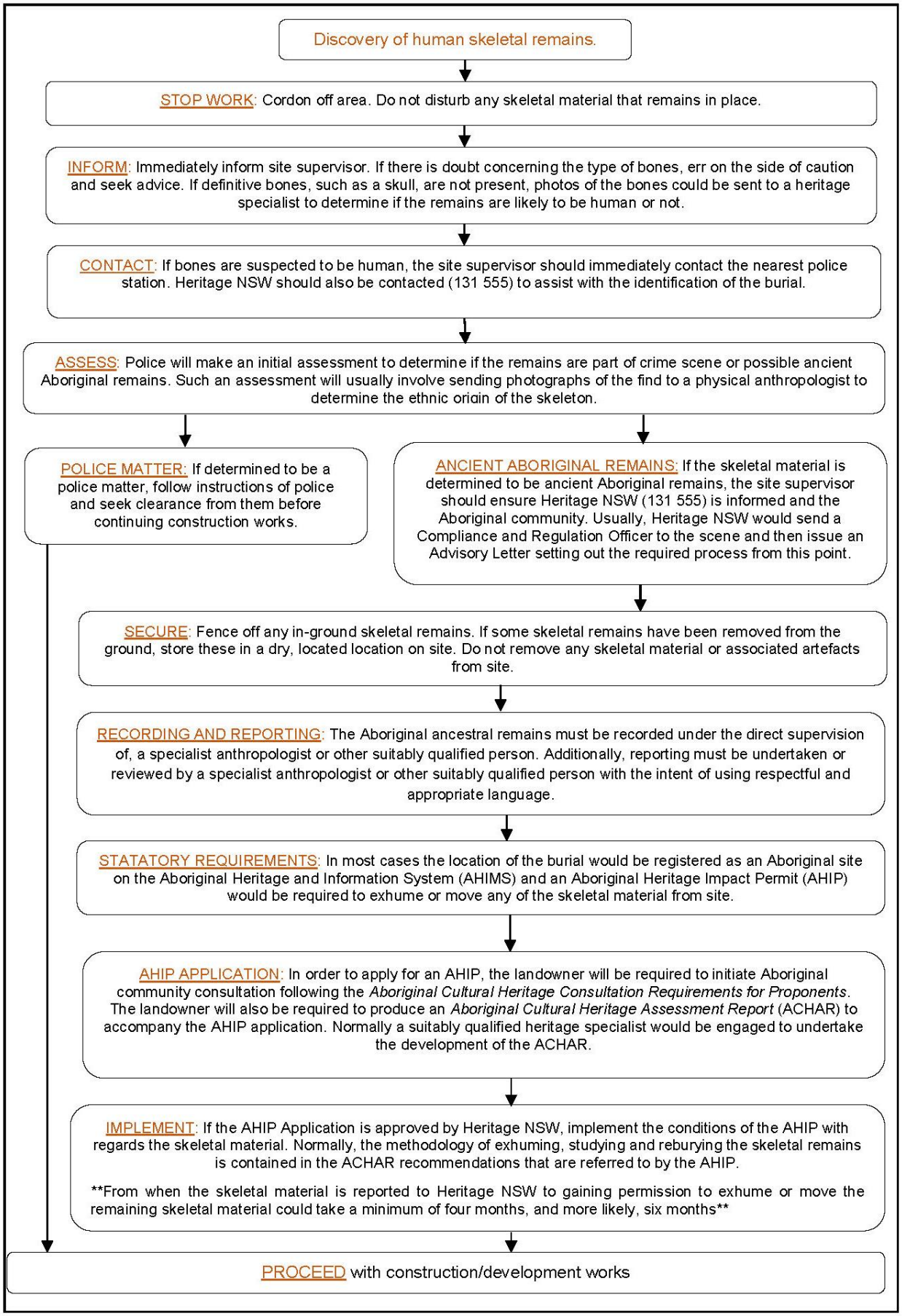
An Aboriginal artefact is anything which is the result of past Aboriginal activity. This includes stone (artefacts, rock engravings etc.), plant (culturally scarred trees) and animal (if showing signs of modification; i.e. smoothing, use). Human bone (skeletal) remains may also be uncovered while onsite.

Cultural heritage significance is assessed by the Aboriginal community and is typically based on traditional and contemporary lore, spiritual values, and oral history, and may also take into account scientific and educational value.

Protocol to be followed in the event that previously unrecorded or unanticipated Aboriginal object(s) are encountered:

1. If any Aboriginal object is discovered and/or harmed in, or under the land, while undertaking the proposed development activities, the proponent must:
    a. Not further harm the object
    b. Immediately cease all work at the particular location
    c. Secure the area so as to avoid further harm to the Aboriginal object
    d. Notify Heritage NSW as soon as practical on (02) 9873 8500 (heritagemailbox @environment.nsw.gov.au), providing any details of the Aboriginal object and its location
    e. Not recommence any work at the particular location unless authorised in writing by Heritage NSW.
2. In the event that Aboriginal burials are unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and Heritage NSW contacted.
3. Cooperate with the appropriate authorities and relevant Aboriginal community representatives to facilitate:
    a. The recording and assessment of the find(s)
    b. The fulfilment of any legal constraints arising from the find(s), including complying with Heritage NSW directions
    c. The development and implementation of appropriate management strategies, including consultation with stakeholders and the assessment of the significance of the find(s).
4. Where the find(s) are determined to be Aboriginal object(s), recommencement of work in the area of the find(s) can only occur in accordance with any consequential legal requirements and after gaining written approval from Heritage NSW (normally an Aboriginal Heritage Impact Permit).

APPENDIX 3: UNANTICIPATED SKELETAL REMAINS PROTOCOL



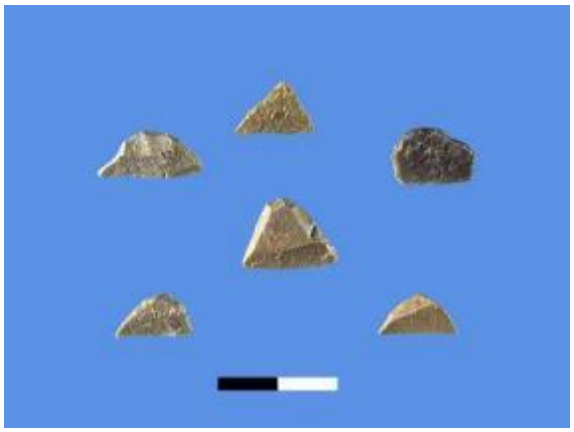
APPENDIX 4: ABORIGINAL HERITAGE: ARTEFACT IDENTIFICATION



Retouched blades (scale = 1cm)



Flakes



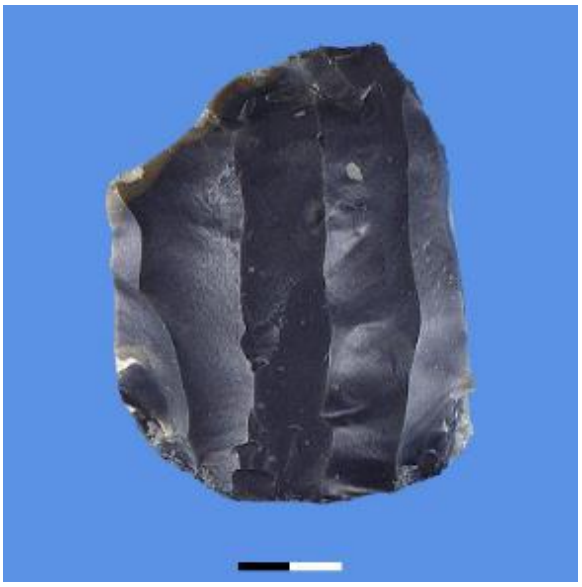
Microliths (scale = 1cm)



Scraper (scale = 1cm)



Flake characteristics (scale = 1cm)



Core from which flakes have been removed (scale = 1cm)

APPENDIX 5: HISTORIC HERITAGE: UNANTICIPATED FINDS PROTOCOL

A historic artefact is anything which is the result of past activity not related to the Aboriginal occupation of the area. This includes pottery, wood, glass and metal objects as well as the built remains of structures, sometimes heavily ruined.

Heritage significance of historic items is assessed by suitably qualified specialists who place the item or site in context and determine its role in aiding the community's understanding of the local area, or their wider role in being an exemplar of state or even national historic themes.

The following protocol should be followed if previously unrecorded or unanticipated historic objects are encountered:

1. All ground surface disturbance in the area of the finds should cease immediately, then:
    a) The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be halted
    b) The site supervisor will be informed of the find(s).
2. If finds are suspected to be human skeletal remains, then NSW Police must be contacted as a matter of priority.
3. If there is substantial doubt regarding the historic significance for the finds, then gain a qualified opinion from an archaeologist as soon as possible. This can circumvent proceeding further along the protocol for items which turn out not to be significant. If a quick opinion cannot be gained, or the identification is that the item is likely to be significant, then proceed to the next step.
4. Notify Heritage NSW as soon as practical on (02) 9873 8500 (heritagemailbox @environment.nsw.gov.au) providing any details of the historic find and its location.
5. If in the view of the heritage specialist or Heritage NSW that the finds appear not to be significant, work may recommence without further investigation. Keep a copy of all correspondence for future reference.
6. If in the view of the heritage specialist or Heritage NSW that the finds appear to be significant, facilitate the recording and assessment of the finds by a suitably qualified heritage specialist. Such a study should include the development of appropriate management strategies.
7. If the find(s) are determined to be significant historic items (i.e. of local or state significance), any re-commencement of ground surface disturbance may only resume following compliance with any legal requirements and gaining written approval from Heritage NSW.

APPENDIX 7: SITE INSPECTION SUMMARY LETTER FROM TOOMELAH LALC

Toomelah Local Aboriginal Land Council
Lot 25 Tucka Tucka Road
PO BOX 261 BOGGABILLA NSW 2409
Ph/Fax 0746 762 348 ABN 64 204 405 993
Email: toomelahlandcouncil@gmail.com

Date: 04/06/2021

Taylor Foster
OzArk Environment & Heritage
Archaeologist
02 6882 0118

Re: North Star Quarry (Borrow Pit) - Cultural Heritage Site Assessment

Hi Taylor,

I have summarized briefly on the site inspection of North Star Quarry (Borrow Pit).

I attended a survey site south of North Star where previously road base material had been extracted from this site. The site area was heavily impacted by previous ground disturbances and quarry type extraction works.

The survey went well and we didn't find anything of cultural values within the new study area."

We feel that this particular site holds no cultural materials of significance to local traditional owner groups and should any new areas be identified as potential quarry sites.

Please contact Toomelah LALC to engage our CH Officers to conduct further cultural clearance works that may need to be undertaken in the future.

Yours truly

Rex Weribone
CEO Toomelah LALC

Appendix 13

Groundwater Impact Assessment

Ground Doctor Pty Ltd

Groundwater Impact Assesment

~

North Star Quarry
5535 North Star Road
North Star, NSW

~

On Behalf Of:
Regional Quarries Australia Pty Ltd



12 March 2021
2021-GD003-RP1-FINAL

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Project Details	
Business Unit:	Environmental
Project Number:	2021-GD003
Project /Document Title:	Groundwater Impact Assessment North Star Quarry 5535 North Star Road North Star, NSW

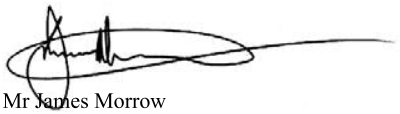
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Review Date:	12 March 2021
File Name:	2021-GD003-RP1-FINAL
Report Status:	FINAL
Reports Issued:	Electronic PDF

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 ASSESSMENT OBJECTIVES 1
1.2 SCOPE OF WORK 1
1.3 LIMITATIONS OF THIS REPORT AND AUTHORISATION 1

2 PROJECT DESCRIPTION 2

3 EXISTING ENVIRONMENT 3

3.1 SITE DETAILS 3
3.2 EXISTING SITE FEATURES AND USE 3
3.3 SURROUNDING LAND-USES 3
3.4 TOPOGRAPHY AND DRAINAGE 3
3.5 GEOLOGY 4
3.6 HYDROGEOLOGY 5
3.6.1 Relevant Groundwater Management Units 5
3.6.2 Registered Groundwater Works 5
3.6.3 Groundwater Assessment Boreholes 5
3.7 GROUNDWATER DEPENDANT ECOSYSTEMS 6
3.8 CULTURALLY SIGNIFICANT GROUNDWATER SITES 7
3.9 CONTAMINATION SOURCES 7

4 GROUNDWATER IMPACT ASSESSMENT 7

4.1 AQUIFER INTERFERENCE 7
4.2 GROUNDWATER QUALITY IMPACTS 8

5 CONCLUSION 9

6 REFERENCES 10

LIST OF ANNEXURES

ANNEX A: FIGURES

ANNEX B: GROUNDWATER WORKS SUMMARY FORMS

ANNEX C: BOREHOLE AND MONITORING BORE CONSTRUCTION LOGS

1 Introduction

This report presents the findings of a Groundwater Impact Assessment of the proposed North Star Quarry (the proposed development). The report was prepared by Ground Doctor Pty Ltd (Ground Doctor) for Regional Quarries Australia Pty Ltd (the proponent).

The proposed development would establish an extractive industry producing a maximum of 490,000 tonnes (t) per year for a period of five years to service the Inland Rail Project, associated road upgrade projects and ongoing regional demand for quarry products.

1.1 Assessment Objectives

The Groundwater Impact Assessment has been prepared to accompany a Development Application to Gwydir Shire Council.

NSW Department of Planning, Industry and Environment (DPIE) Environmental Assessment Requirements (EARs) for the proposal development specify that the development application include an assessment of potential impacts to quantity and quality of groundwater resources that may be impacted by the proposed development.

The objective of this assessment was to establish whether the proposed development would adversely impact groundwater quantity and groundwater quality.

1.2 Scope of Work

Ground Doctor completed the following work.

- Reviewed legislation and guidance relevant to groundwater management to identify potential constraints and requirements on the proposed development.
- Reviewed available groundwater bore data and geological information to assess the location and characteristics of groundwater aquifers located within and surrounding the proposed development.
- Identified and described available groundwater bore data to assess existing groundwater users in the vicinity of the proposed development.
- Installed three monitoring bores within or close to the proposed extraction area to assess the depth to groundwater, or to confirm its absence within the proposed extraction footprint.
- Conducted a review of potential groundwater quality and quantity impacts based on the characterisation of the groundwater environment and activities proposed.
- Provided recommendations to mitigate or manage Project related groundwater impacts.

1.3 Limitations of this Report and Authorisation

The findings of this report are based on the Scope of Work outlined in *Section 1.2,* which is described in more detail in the following sections of this Report. Ground Doctor performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental consulting profession. No warranties, express or implied are made.

The results of this assessment are based upon the information documented and presented in this report. All conclusions and recommendations regarding the Project Site are the professional opinions of Ground Doctor personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Ground Doctor assumes no

responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Ground Doctor, or developments resulting from situations outside the scope of work detailed in this Report.

The results of this assessment are based on the conditions identified at the time the works were undertaken. Ground Doctor will not be liable to revise the report to account for any changes in site characteristics, regulatory requirements, assessment criteria or the availability of additional information, subsequent to the issue date of this Report.

2 Project Description

This Development Application seeks consent to establish a hard rock quarry and processing plant. The proposal is summarised as follows.

- A maximum of 2,450,000t would be extracted from the quarry over the proposed fifteen year life of the quarry. The proposed development would primarily aim to service the Inland Rail Project for its first five years of operation, with maximum anticipated production rate of 490,000t/yr. The quarry would also supply quarry products for other local demands throughout its fifteen year life, but it is anticipated that demand would fall to approximately 150,000t/yr for the last ten years of operation.

- The proposed extraction area will have a footprint of approximately 6.6ha. It will be up to 400m long and 200m wide. The maximum depth of extraction will be 323m AHD which is less than 20m below the pre-development surface elevation.

- Conventional drill and blast techniques will be used to extract the hard rock resource. Blasts would typically fragment between 20,000 to 50,000t per blast but would fluctuate according to demand and safety requirements. Blasting would typically occur once per month but possibly up to once a week during peak periods.

- Mobile plant will be used to haul, crush and screen the extracted material to produce a range of quarry products including aggregates, railway ballast, road base and engineering fill.

- Crushed product will be processed and stockpiled on Site. The processing and stockpiling areas will occupy an area of approximately 1.6ha.

- Quarry products will be loaded and transported to market by road. An internal access road will be constructed to provide access to the extraction and processing area via Manilya Road.

- Surface water management infrastructure including sediment basins, diversion bunds and drains will be designed and constructed as appropriate.

- The proposed development will include the construction or establishment of ancillary infrastructure including a temporary demountable site office and amenities, electricity supply and storage areas.

- Potable water supply will utilise rainwater tanks with a fallback of water supply by road tanker if necessary. Hardwired telecommunications are not proposed. Electricity will be supplied by diesel generator. A self bunded above ground diesel tank would be utilised to store diesel for use in the generator (if required).

- The proposed development will include progressive rehabilitation of the post extraction landform. The final landform will be made suitable for continued rural use.

3 Existing Environment

3.1 Site Details

The proposed North Star Quarry is located at 5535 North Star Road, North Star, NSW. The Site is comprised of land described as Lot 7 DP755984 and Lot 1 DP1227212 (the Site).

The Site has a total area of approximately 16.1km^2 (1611ha). The proposed extraction and processing areas are located adjacent to the eastern Site boundary and occupy a total area of approximately 8.2ha. The proposed extraction area will occupy and area of approximately 6.6ha and the proposed processing area will occupy an area of approximately 1.6ha.

The regional setting of the Site is shown in *Figure 1* of *Annex A*. The Site boundary and proposed extent of the extraction area is shown in *Figure 2* of *Annex A*.

The proposed extraction area is located approximately 6km east of the Inland Rail Project site, approximately 6km south of North Star and approximately 50km south south east of Goondiwindi.

The site is rural, freehold land registered to Doolin Minilya Pty Ltd (the landowner).

3.2 Existing Site Features and Use

The Site is situated within an agricultural property ("Minilya") that is mostly open space that has been cleared and used for broadacre cropping and livestock grazing. The Site use is predominantly dryland cropping. Two centre pivot irrigators are located in the central and south west portions of the Site. The irrigation systems rely of groundwater from on-Site groundwater bores (see *Section 3.6*). Some remnant or re-established native vegetation remains on elevated areas and along drainages that are not cropped.

Rock has previously been extracted from the southern side of the proposed extraction area and from an outcrop located approximately 160m south of the proposed extraction area. These parts of the Site include former excavations and stockpiles of overburden or extracted material.

Livestock sheds and grain silos are located in an area approximately 1.6km to the west of the proposed extraction area.

3.3 Surrounding Land-uses

Land surrounding the Site is predominantly open space used for broadacre cropping and livestock grazing, consistent with land-use within the Site.

Elevated areas to the east of the proposed extraction are not cleared, presumably due to presence of shallow bedrock. Remnant or re-established vegetation is present in these elevated areas.

The nearest dwelling to the proposed extraction and processing areas is situated approximately 1.7km east. This dwelling is within 5535 North Star Road, North Star, NSW but is not within the Site boundary.

3.4 Topography and Drainage

Regional topography is illustrated in the topographic map presented as *Figure 3* of *Annex A*. A detailed topographic map of the proposed extraction and processing area and immediate surrounds is presented as *Figure 4* of *Annex A*.

The Site has a regional gradient from south east to north west. The south east corner is the highest part of the site reaching an elevation of approximately 380m AHD. The north west corner and mid-western boundary are the lowest parts of the Site with elevations less than 290m AHD.

Mungle Creek rises in the south east corner of the Site and flows in a west north west direction, leaving the Site approximately mid-way along the western boundary.

Two unnamed drainage lines run from the centre of the Site toward the north west and west north west.

The proposed extraction area is located at the north west tip of Booraba Ridge. The highest points of Booraba Ridge within the proposed extraction area are approximately 342m AHD. Booraba Ridge reaches a maximum elevation of approximately 380m AHD approximately 1.7km to the south east of the proposed extraction area.

From the highest points of the proposed extraction area surrounding land slopes to the north on the northern side, to the south west and west on the western side, with an average gradient of approximately 5-10%. The average gradient decreases with distance away from the ridgeline.

At its closest point to the proposed extraction area Mungle Creek is located approximately 900m south east. At this location the surface elevation is approximately 310m AHD. Drainage lines to the north west of the proposed extraction area have an elevation of approximately 300m AHD 800m to the west north west of the proposed extraction area.

3.5 Geology

The "*Goodiwindi 1:250,000 Geological Series Sheet SH56-1*" indicates that the proposed quarry is situated on an outcrop of tertiary "*basalt, tuff, agglomerate*". The mapping indicates that the tertiary volcanics are most likely to overlie the "*Walloon Coal Measures*". The "*Walloon Coal Measures*" are described as "*very labile to sublabile sandstone, calcareous in places, minor mudstone and siltstone*".

Groundwork Plus (2020) provides the following summary of the extraction area geology based on previous resource delineation assessments.

- The proposed extraction area is situated in an area of Cainozoic Mafic Volcanics commonly occurring as basalt lava flows (up to 65 million years old).
- The basalt sits above a Jurassic Sedimentary sequence of rocks (145 to 201 million years old) including sandstone and clay.
- The resource on the Site consists of two low lying hills close to the eastern Site boundary.
- The basalt layer was thicker and fresher to the east, thinning and weathering to the west.
- Resource drilling indicated that claystone and sandstone exists below the basalt.
- There is typically 1m of overburden (soil) over 2 to 3m of weathered to moderately weathered basalt before intersecting fresh basalt.

Geology encountered by Ground Doctor during subsurface investigation around the proposed extraction area (see *Section 3.6.3*) was consistent with the information presented by Groundwork Plus (2020).

3.6 Hydrogeology

3.6.1 Relevant Groundwater Management Units

The Site is located within an area with two groundwater management units.

Water occurring in the Great Artesian Basin (GAB) is part of the GAB "Eastern Recharge Zone" Groundwater Management Unit.

The Great Artesian Basin (GAB) consists of sedimentary sequences with layers of porous and permeable sandstones which alternate with low permeability shales, siltstones and mudstones. The Permian strata underlying the GAB and the Cretaceous shales overlying the GAB are excluded from the application of this Water Sharing Plan.

Geological units beneath the near surface basalt at the Site are part of the GAB "Eastern Recharge Zone Management Unit.

Geological units not within the GAB are within the Murray Darling Basin Fractured Rock "New England Fold Belt" Groundwater Management Unit.

3.6.2 Registered Groundwater Works

Ground Doctor conducted a search of the NSW Water groundwater works database (https://realtimedata.waternsw.com.au, 3 March 2021) for registered groundwater works located within an approximate 2km radius of the proposed extraction and processing areas.

Figure 5 of *Annex A* shows the locations of registered groundwater works relative to the Site boundary and proposed extraction and processing areas.

The search identified 2 registered groundwater works within the 2km search radius. Given the absence of bores in the search area Ground Doctor obtained records for an additional 6 nearby groundwater works, which included an additional 4 groundwater works located within the Site.

A summary of the registered bore details is presented as *Table B1* of *Annex B*. Groundwater Work Summary Forms for the identified registered works are also presented in *Annex B*.

The identified groundwater works were installed into geological units of the GAB Eastern Recharge Zone. Groundwater work summary forms indicated that bore depths ranged from 187m to 375m below surface level. Groundwater was typically identified in relatively thin sandstone layers encountered at depths ranging from 50m to 370m below ground level. Recorded bore yields ranged from 0.4 to 8.0L/s. Where water quality was described it was described as "fresh".

Recorded standing water levels ranged 30m to 113m below ground level. Surface elevation at each bore was approximated using the digital elevation model within Google Earth (2021) so that relative groundwater elevation could be estimated. Estimates of relative groundwater elevations ranged 239m AHD to 270m AHD, more than 50m below the maximum proposed depth of excavation of the proposed development (323m AHD).

The identified groundwater works were registered for a range of purposes including stock, domestic, irrigation and industrial use. It is inferred that some of the identified groundwater works are utilised to supply water to centre pivot irrigators located in the western portion of the Site.

3.6.3 Groundwater Assessment Boreholes

Ground Doctor drilled three boreholes at the site to assess depth to groundwater within the proposed extraction area. The three selected monitoring bore locations are shown in *Figure 4* of *Annex A*.

Monitoring Bore 1 (MB1) was installed approximately 50m to the south east of the proposed extraction area. MB2 was installed approximately 20m to the west of the proposed extraction area. MB3 was installed within the proposed extraction area, close to the northern edge of the proposed extraction area.

Borehole details are summarised in *Table 1*. Borehole and monitoring bore construction logs are presented as *Annex C*.

Table 1: Monitoring Bore Location and Depth

Bore ID	Easting MGA94 Zone 56	Northing MGA94 Zone 56	Surface RL (m AHD	Depth (m bgl)	Bottom of Hole RL (m AHD)	Hole Status
MB1	247145	6790554	341m	25m	316m	Dry
MB2	246699	6790913	327m	19m	308m	Dry
MB3	247043	6790862	336m	25m	311m	Dry

Boreholes were drilled on 28 and 29 January 2021. Boreholes were drilled using air rotary methods with a down hole hammer (90mm bit). Boreholes were drilled by Mr Georgel Ivan (NSW Class 6 Driller's Licence No. 2199).

Ground Doctor aimed to advance boreholes at least 5m below the maximum depth of proposed excavation. Borehole depths range from 19m to 25m below ground level. Ground Doctor used estimates of surface elevation obtained from the Intergovernmental Committee on Surveying and Mapping (2021) 2m digital elevation model (see surface elevation contours presented in *Figure 4* of *Annex A*) to estimate surface elevation at each monitoring bore location. Based on digital elevation model surface contours boreholes reached depths ranging 308m AHD to 316m AHD, which were at least 7m below the proposed maximum depth of excavation (323m AHD).

Boreholes typically encountered clay, basalt and weathered basalt in the upper 3m to 10m of the subsurface. Basalt was underlain by claystone at all locations to the maximum depth of drilling.

Ground Doctor logged the drill cuttings, closely inspecting them for signs of water bearing strata, but did not identify any evidence of groundwater inflow to the boreholes. Once boreholes had reached the targeted depth drilling ceased.

Monitoring bore casing was installed so that the absence of groundwater could be confirmed. Monitoring bores were constructed of 50mm ID Class 18 PVC blank casing and machine slotted screens. In each borehole screened intervals were placed in the lower 9m of the borehole. The remainder of the bores were constructed with blank casing. At each monitoring bore the annulus around the screen and casing was filled with 3-5mm gravel to a depth at least 1m over the top screened interval. A bentonite seal at least 3m thick was then placed on top of the gravel pack. The remainder of the annulus was backfilled with drill cuttings. Steel stick-up monuments were concreted over the top of the PVC at the ground surface to protect the casing.

Each monitoring bore was checked for the presence of water several hours after installation but all bores were found to be dry.

Ground Doctor re-visited the site on 15 February 2021, approximately 16 days after the monitoring bores bore had been installed. Each bore was gauged and was found to be dry.

Data collected by Ground Doctor indicates that groundwater will not be encountered within the proposed excavation.

3.7 Groundwater Dependant Ecosystems

The "*Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020"* did not identify any high priority Groundwater Dependant Ecosystems (GDEs) within 2km of the proposed extraction and processing area.

The "*Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020"* did not identify any high priority Groundwater Dependant Ecosystems (GDEs) within 2km of the proposed extraction and processing area. The "*Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020"* indicates there is a high probability that major drainages in the north Star area (including Mungle Creek) have medium to high value groundwater dependant vegetation.

At its closest point to the proposed extraction area Mungle Creek is located approximately 900m south east. At this location the surface elevation is approximately 310m AHD, approximately 13m below the maximum depth of the proposed extraction area.

3.8 Culturally Significant Groundwater Sites

Culturally significant sites that rely on groundwater were not identified within a 2km radius of the proposed extraction and processing areas.

3.9 Contamination Sources

Ground Doctor conducted a search of the NSW EPA list of sites notified under Section 60 of the Contaminated Land Management (CLM) Act 1997. The search was conducted on 3 March 20201. There were no notifications listed for the Site or within a 2km radius of the proposed extraction area.

4 Groundwater Impact Assessment

4.1 Aquifer Interference

The *Water Management Act 2000* defines an aquifer interference activity as that which involves any of the following:

- the penetration of an aquifer,
- the interference with water in an aquifer,
- the obstruction of the flow of water in an aquifer,
- the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations, and/or
- the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.

Groundwater was not encountered in three boreholes drilled at least 6m below the maximum proposed depth of excavation. Recorded standing water levels for the nearest eight registered groundwater works to the proposed extraction area indicate that the regional water table is at least 50m below the maximum proposed depth of excavation.

The proposed development is not an aquifer interference activity. The proposed development will not penetrate an aquifer, will not interfere with water in an aquifer, will not obstruct the flow of water and will not require dewatering of an aquifer. The proposed development does not propose to utilise groundwater as part of the water supply.

4.2 Groundwater Quality Impacts

The proposed development involves blasting, crushing and screening of excavated rock. The proposed activities have little if any potential to add contaminants that could adversely change groundwater quality. ‘

The proposed use of explosives within the excavation has potential to introduce nutrients to the extraction area, which could potentially impact on the underlying water quality. This risk is considered comparable to use of nitrogen containing fertilisers at the ground surface within the Site and within surrounding agricultural properties. Use of nitrogen containing explosives is unlikely to have adverse impacts to water quality and/or change the beneficial use category of groundwater resources beneath the proposed extraction area. Potential impacts associated with use of nitrogen containing explosives are considered acceptable.

The proposed development will involve operation and minor maintenance of plant at the ground surface. Spillage of fuel, lubricants and hydraulic fluids poses a risk to underlying groundwater quality. Risks posed by leaks of fuel and lubricants from excavation machinery are similar to those posed by use of agricultural machinery within the Site and on surrounding agricultural properties. This risk could be adequately managed by the establishment of dedicated vehicle servicing and refuelling areas and appropriate management controls.

Hazardous and non-hazardous chemicals to be used as part of the proposed development would be managed in accordance with the specifications of the Material and Safety Data Sheets (MSDS) and relevant management plans.

The following measures would be implemented to further minimise adverse environmental impacts associated with storage and use of chemicals as part of the proposed development.

- All chemicals would be stored and used in accordance with the manufacturer’s instructions and the relevant MSDS.
- All liquid chemicals would be stored within an impermeable bunded area with a capacity of at least 110% of the capacity of the largest container.
- Chemicals with the potential to react with each other would not be stored in the same area to prevent any reactions between them in the event of a spill.
- Only the minimum volume of chemicals required for the ongoing operation of the proposed development would be stored within the Site.
- MSDS and appropriate spill management equipment would be available in the vicinity of all chemical storage areas.
- Personnel who will use chemicals would be provided with the appropriate training in the proper handling techniques.

5 Conclusion

Subsurface assessment around the proposed extraction area and a review of NSW registered bore records indicates that the proposed development is not an aquifer interference activity. The proposed development will not penetrate an aquifer, will not interfere with water in an aquifer, will not obstruct the flow of water and will not require dewatering of an aquifer. The proposed development does not propose to utilise groundwater as part of the water supply. The proposed development would not reduce the quantity of groundwater available in underlying aquifers.

The proposed development includes some activities that have potential to impact quality of underlying groundwater. The risks to groundwater quality posed by the proposed development are proportional to those posed by the existing agricultural use of the Site and surrounding land. Potential risks to groundwater quality can be managed by implementing appropriate procedures for storage and use of chemicals, and refuelling and maintenance of plant and machinery. The proposed development does not pose an unacceptable risk to groundwater quality.

6 References

- Geological Survey of NSW (1972), Goondiwindi Australian 1:250,000 Geological Series Sheet SH 56-1, First Edition.

- Groundwork Plus Pty Ltd (2020) "*Request for Secretary's Environmental Assessment Requirements*", Letter from Groundwater Plus to NSW Department of Planning, Industry and Environment dated 8 September 2020, Reference 2542 DA1 003.

- NSW Department of Land and Water Conservation (1997), *NSW State Groundwater Policy and Framework Document*.

- NSW Department of Land and Water Conservation (1997), *NSW State Groundwater Quantity Protection Policy*.

- NSW Department of Land and Water Conservation (1997), *NSW State Groundwater Quality Protection Policy*.

- NSW Department of Land and Water Conservation (1997), *NSW State Groundwater Dependant Ecosystems Policy*.

- NSW Department of Primary Industries Office of Water (2012), NSW Aquifer Interference Policy, September 2012.

- NSW Government Spatial Information Exchange website maps.six.nsw.gov.au, viewed on 3 March 2021.

- Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020.

- Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020

- Water NSW Database Groundwater Works Data and Groundwater Elevation Data, https://realtimedata.waternsw.com.au/water.stm, 3 March 2021.

Annex A

Figures



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Legend:

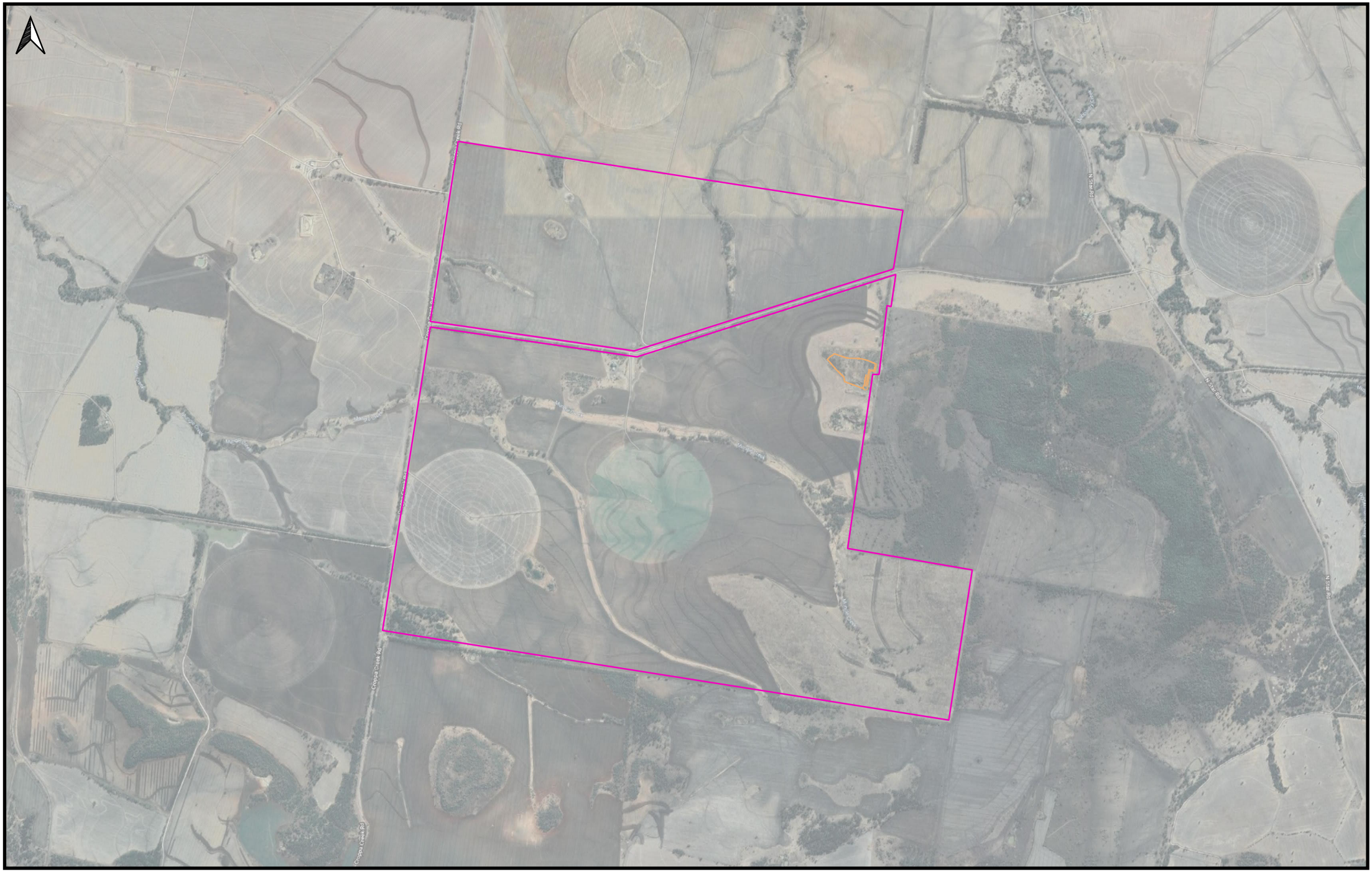
Site Location

0 10 20 km

Figure 1: Site Location

Job Name: Groundwater Impact Assessment - North Star Quarry

Job Number: 2021-GD003-RP1

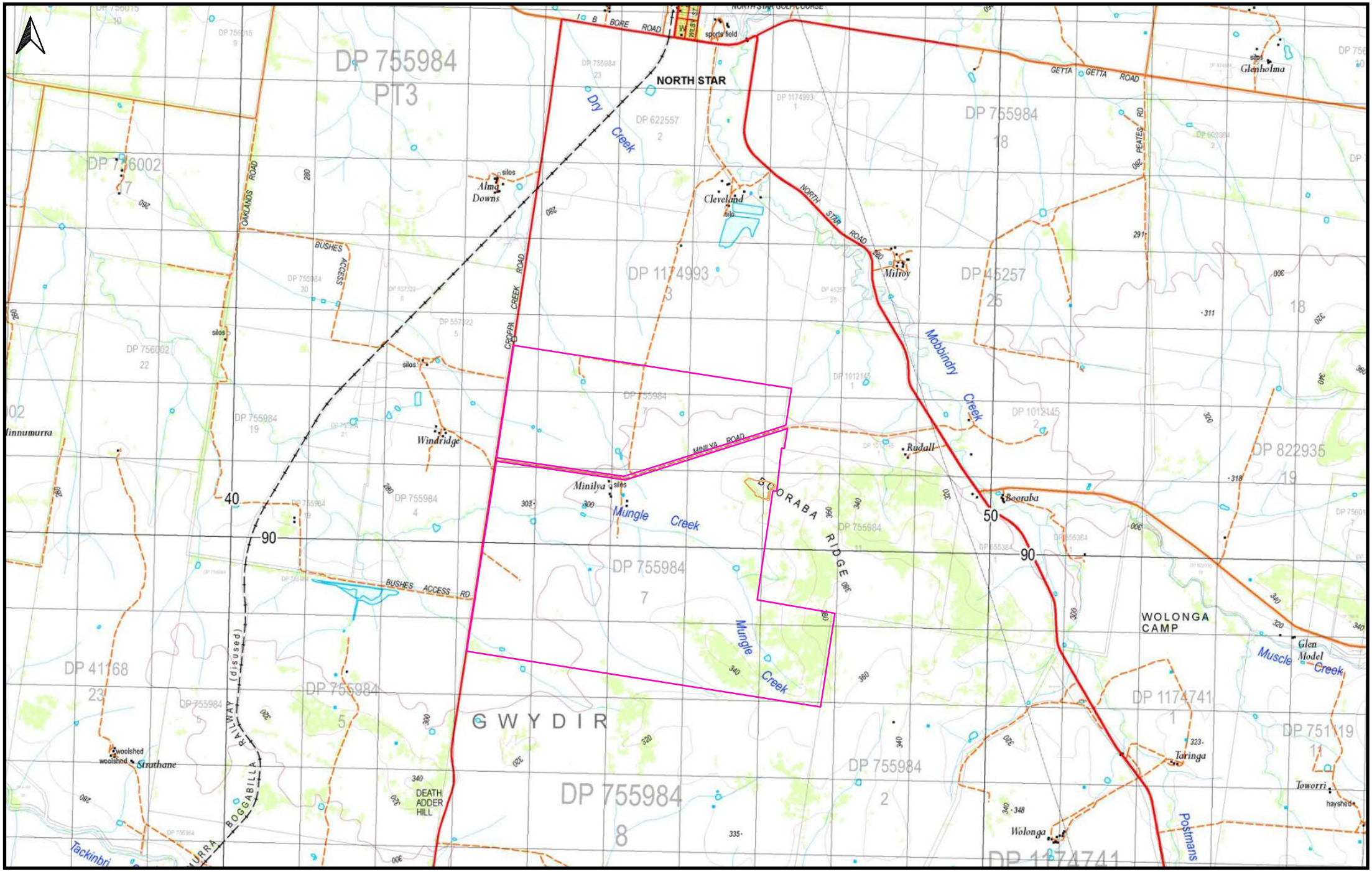


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Figure 2: SIte Boundary and Conceptual Pit Area

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Job Number: 2021-GD003-RP1



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Legend:

- Conceptual Pit Area
- Site Boundary

0 1 2 km

Figure 3: Regional Topography

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Legend:

- Conceptual Pit Area
- Elevation Contours (m AHD)
- Monitoring Bore Locations

0 0.1 0.2 km

Figure 4: Local Topography and Monitoring Bore Locations

Job Name: Groundwater Impact Assessment - North Star Quarry

Job Number: 2021-GD003-RP1


2km Radius from Centre of Pit
GW005939
GW093556
GW059658
GW010967
GW901418
GW970551
GW018899
GW016381
GW030612
Mindya Rd
Mindya Rd
Mindya Rd

Annex B

Groundwater Work Summary Forms

Table B1 - Groundwater Works Summary Form Information

Work ID	Work Type	Status	Owner Type	Purpose	Complete Year	Final Depth	Drilled Depth	Salinity	SWL (m bgl)	Water Bearing Zones (WBZ)	Inferred Ground Level mAHD	SWL (mAHD)	Upper WBZ (mAHD)	Yield (L/s)	Distance from Excavation Centre	Direction	Geology Summary
GW005939	Bore	Current	Private	Stock and Domestic	1935	197.8	197.8	Fresh	-	45.1m (Sandstone) 104-105m (Sandstone) 146-147m (Sandstone) 177-198m (Sandstone)	298	254	254	0.4	2100m	WNW	Sandstone and Shale (0-197.8m)
GW010967	Bore	-	Private	Stock and Domestic	1954	187.2	187.1	Fresh	42.1	126-130m (Sandstone) 181-186m (Sandstone)	306	268	180	0.5	2300m	SW	Sandstone and Shale (0-187.2m)
GW011112	Bore	Current	Private	Stock	1955	265.2	265.2	Fresh	30.5	56-57m (Shale) 90-91m (Sandstone) 177-180m (Sandstone) 253-265m (Sandstone and Shale)	284	253	228	0.5	2700m	NNW	Clay (0-12m) Sandstone and Shale (12-265.2m)
GW018899	Bore	Current	Private	Stock	1961	221.3	221.3	-	113.4	59-60m (Sandstone) 196-197m (Sandstone) 211-216m (Sandstone)	330	270	270	-	2100	E	Clay (0-21m) Sandstone and Shale (21-221.3m)
GW059658	Bore	Current	Private	Domestic	1950	-	-	-	-	-	-	-	-	-	2200m	W	-
GW093556	Bore	Current	Government NSW	Monitoring	2008	382	382	-	59.8	248-312m (Sandstone) 321-371m (Sandstone)	299	239	51	8	1900m	W	Clay (0-12m) Sandstone and Shale (12-382m)
GW901418	Bore	Current	Private	Irrigation, Domestic, Stock, Industrial	1995	375	375	-	42.2	-	296	254	-	-	3600m	SW	-
GW970551	Bore	Supply Obtained	Private	Stock	2012	292	292	-	91.5	261-292m (Sandstone and Mudstone)	328	236	67	0.5	190m	E	Clay (0-2m) Siltstone and Claystone (2-161m) Sandstone and Shale (161-263m) Mudstone (263-292m)

WaterNSW
Work Summary

GW005939

Licence: 90WA810043 **Licence Status:** CURRENT

Authorised Purpose(s): STOCK,DOMESTIC
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore - GAB
Work Status:
Construct.Method: Cable Tool
Owner Type: Private

Commenced Date:
Completion Date: 01/09/1935
Final Depth: 197.80 m
Drilled Depth: 197.80 m

Contractor Name: (None)
Driller:
Assistant Driller:

Property: MINILYA NSW
GWMA: 601 - GREAT ARTESIAN BASIN
GW Zone: 012 - EASTERN RECHARGE GROUNDWATER SOURCE
Standing Water Level (m):
Salinity Description: Fresh
Yield (L/s): 0.380

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	7//755984
Licensed:	STAPYLTON	BOORABA	Whole Lot 7//755984

Region: 90 - Barwon
River Basin: 025 - MacIntyre
Area/District:
CMA Map: 8940-S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6791556.000
Easting: 245227.000
Latitude: 28°58'43.3"S
Longitude: 150°23'07.0"E

GS Map: -
MGA Zone: 56
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	197.80	152			Cable Tool
1	1	Casing		0.00	55.80	152			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
45.10	45.10	0.00	Consolidated			0.03			
104.20	105.10	0.90	Consolidated			0.20			
146.30	146.90	0.60	Consolidated			0.38			
176.80	197.80	21.00	Consolidated						

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.52	1.52	Sand Soil	Sand	
1.52	8.83	7.31	Sandstone	Sandstone	
8.83	18.89	10.06	Clay Yellow Sandy	Clay	
18.89	24.07	5.18	Sandstone	Sandstone	
24.07	27.73	3.66	Shale Grey	Shale	
27.73	36.57	8.84	Sandstone	Sandstone	
36.57	42.97	6.40	Shale Grey	Shale	
42.97	54.86	11.89	Sandstone Grey Water Supply	Sandstone	
54.86	65.53	10.67	Shale Grey	Shale	
65.53	75.28	9.75	Sandstone	Sandstone	
75.28	104.24	28.96	Shale Grey	Shale	
104.24	105.15	0.91	Sandstone Water Supply	Sandstone	
105.15	117.65	12.50	Shale	Shale	
117.65	119.17	1.52	Sandstone	Sandstone	
119.17	128.01	8.84	Shale Grey	Shale	
128.01	128.62	0.61	Sandstone	Sandstone	
128.62	131.36	2.74	Shale	Shale	
131.36	135.02	3.66	Sandstone	Sandstone	
135.02	140.51	5.49	Shale Grey	Shale	
140.51	146.30	5.79	Sandstone	Sandstone	
146.30	146.91	0.61	Sandstone Water Supply	Sandstone	
146.91	151.79	4.88	Sandstone	Sandstone	
151.79	154.83	3.04	Shale	Shale	
154.83	168.24	13.41	Sandstone	Sandstone	
168.24	176.78	8.54	Shale	Shale	
176.78	197.81	21.03	Sandstone Water Supply	Sandstone	

***** End of GW005939 *****

Warning To Clients: This raw data has been supplied to the WaterNSW by drillers, licensees and other sources. WaterNSW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

WaterNSW
Work Summary

GW010967

Licence: **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore - GAB
Work Status:
Construct.Method: Cable Tool
Owner Type: Private

Commenced Date: **Final Depth:** 187.10 m
Completion Date: 01/01/1954 **Drilled Depth:** 187.20 m

Contractor Name: (None)
Driller:
Assistant Driller:

Property: **Standing Water Level (m):** 42.100
GWMA: **Salinity Description:** Fresh
GW Zone: **Yield (L/s):** 0.520

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	7//755984
Licensed:			

Region: 90 - Barwon **CMA Map:** 8940-S
River Basin: 025 - MacIntyre **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6789644.000 **Latitude:** 28°59'45.3"S
Elevation Source: Unknown **Easting:** 245161.000 **Longitude:** 150°23'03.0"E

GS Map: - **MGA Zone:** 56 **Coordinate Source:** PR.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	187.20	152			Cable Tool
1	1	Casing		-0.50	122.30	152			Seated

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
126.20	129.80	3.60	Consolidated	48.80		0.32			
181.10	186.20	5.10	Consolidated	42.10		0.52			

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

0.00	10.06	10.06	Clay	Clay	
10.06	30.18	20.12	Sandstone	Sandstone	
30.18	47.24	17.06	Shale	Shale	
47.24	57.91	10.67	Sandstone	Sandstone	
57.91	60.96	3.05	Shale	Shale	
60.96	67.67	6.71	Sandstone	Sandstone	
67.67	85.04	17.37	Shale	Shale	
85.04	156.06	71.02	Sandstone Water Supply	Sandstone	
156.06	165.20	9.14	Shale	Shale	
165.20	187.15	21.95	Sandstone Water Supply	Sandstone	

***** End of GW010967 *****

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WaterNSW
Work Summary

GW011112

Licence: 90WA810214 **Licence Status:** CURRENT

Authorised Purpose(s): STOCK
Intended Purpose(s): STOCK

Work Type: Bore - GAB
Work Status:
Construct.Method: Cable Tool
Owner Type: Private

Commenced Date:
Completion Date: 01/03/1955
Final Depth: 265.20 m
Drilled Depth: 265.20 m

Contractor Name: (None)
Driller:
Assistant Driller:

Property: N/A NSW
GWMA: 601 - GREAT ARTESIAN BASIN
GW Zone: 012 - EASTERN RECHARGE GROUNDWATER SOURCE
Standing Water Level (m): 30.500
Salinity Description: Fresh
Yield (L/s): 0.510

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	6//755984
Licensed:	STAPYLTON	BOORABA	Whole Lot //

Region: 90 - Barwon
River Basin: 025 - MacIntyre
Area/District:
CMA Map: 8940-S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6793157.000
Easting: 246601.000
Latitude: 28°57'52.3"S
Longitude: 150°23'59.0"E

GS Map: -
MGA Zone: 56
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	265.20	152			Cable Tool
1	1	Casing	Threaded Steel	-0.30	139.90	152			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
56.40	57.00	0.60	Fractured	30.50		0.01			
90.20	91.10	0.90	Consolidated	30.50		0.29			
176.80	180.10	3.30	Consolidated			0.51			
253.00	265.10	12.10	(Unknown)			0.13			

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	12.19	12.19	Clay Soft Sandstone	Clay	
12.19	18.29	6.10	Sandstone	Sandstone	
18.29	22.86	4.57	Shale Grey Hard	Shale	
22.86	28.04	5.18	Shale Sandstone	Shale	
28.04	31.39	3.35	Sandstone Grey	Sandstone	
31.39	39.01	7.62	Shale Grey	Shale	
39.01	56.39	17.38	Sandstone Grey	Sandstone	
56.39	67.67	11.28	Shale Grey	Shale	
67.67	70.10	2.43	Sandstone	Sandstone	
70.10	90.22	20.12	Shale Grey	Shale	
90.22	91.14	0.92	Sandstone Water Supply	Sandstone	
91.14	96.01	4.87	Shale Grey	Shale	
96.01	96.93	0.92	Sandstone	Sandstone	
96.93	108.81	11.88	Shale Grey	Shale	
108.81	116.13	7.32	Sandstone Grey Puggy	Sandstone	
116.13	121.01	4.88	Shale Grey	Shale	
121.01	128.93	7.92	Shale Puggy	Shale	
128.93	144.17	15.24	Shale Grey	Shale	
144.17	152.40	8.23	Sandstone Puggy	Sandstone	
152.40	170.38	17.98	Shale Grey Hard	Shale	
170.38	176.78	6.40	Sandstone Fine	Sandstone	
176.78	180.14	3.36	Sandstone Water Supply	Sandstone	
180.14	231.34	51.20	Sandstone Puggy	Sandstone	
231.34	246.89	15.55	Sandstone Hard	Sandstone	
246.89	252.98	6.09	Sandstone Water Supply	Sandstone	
252.98	254.51	1.53	Sand Coarse Water Supply	Sand	
254.51	259.08	4.57	Sandstone Sand Water Supply	Sandstone	
259.08	265.18	6.10	Shale Puggy Water Supply	Shale	

***** End of GW011112 *****

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WaterNSW
Work Summary

GW018899

Licence: 90WA810298 **Licence Status:** CURRENT

Authorised Purpose(s): STOCK
Intended Purpose(s): STOCK

Work Type: Bore - GAB
Work Status:
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date: 01/04/1961
Final Depth: 221.30 m
Drilled Depth: 221.30 m

Contractor Name: (None)
Driller:
Assistant Driller:

Property: WIRRALAH EAST NSW
GWMA: 601 - GREAT ARTESIAN BASIN
GW Zone: 012 - EASTERN RECHARGE GROUNDWATER SOURCE
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	11//755984
Licensed:	STAPYLTON	BOORABA	Whole Lot //

Region: 90 - Barwon
River Basin: 025 - MacIntyre
Area/District:
CMA Map: 8940-S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6790339.000
Easting: 248721.000
Latitude: 28°59'25.3"S
Longitude: 150°25'15.0"E

GS Map: -
MGA Zone: 56
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Threaded Steel	-0.50	174.20	152			
1	1	Casing	Threaded Steel	0.00	4.90	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
59.10	60.30	1.20	Consolidated			0.08			
196.00	197.20	1.20	Consolidated	113.40		0.27			
211.50	216.30	4.80	Consolidated			0.40			

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.52	1.52	Topsoil	Topsoil	
1.52	9.44	7.92	Clay	Clay	
9.44	13.10	3.66	Clay Sandstone Bands	Clay	
13.10	20.72	7.62	Clay	Clay	
20.72	26.51	5.79	Clay Sandstone Bands	Clay	
26.51	30.17	3.66	Sandstone	Sandstone	
30.17	30.48	0.31	Rock Hard	Rock	
30.48	39.31	8.83	Sandstone	Sandstone	
39.31	39.62	0.31	Rock Hard	Rock	
39.62	59.13	19.51	Sandstone	Sandstone	
59.13	60.35	1.22	Sandstone Coarse Water Supply	Sandstone	
60.35	74.37	14.02	Sandstone	Sandstone	
74.37	79.55	5.18	Sandstone Shale Bands	Sandstone	
79.55	84.12	4.57	Shale	Shale	
84.12	85.34	1.22	Sandstone Shale Bands	Sandstone	
85.34	91.44	6.10	Sandstone	Sandstone	
91.44	92.65	1.21	Rock Hard	Rock	
92.65	169.77	77.12	Sandstone Shale Bands	Sandstone	
169.77	185.92	16.15	Sandstone Hard	Sandstone	
185.92	195.98	10.06	Sandstone	Sandstone	
195.98	197.20	1.22	Sandstone Coarse Water Supply	Sandstone	
197.20	211.53	14.33	Sandstone	Sandstone	
211.53	216.40	4.87	Sandstone Coarse Water Supply	Sandstone	
216.40	221.28	4.88	Sandstone Hard	Sandstone	

***** End of GW018899 *****

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WaterNSW
Work Summary

GW059658

Licence: 90WA831567 **Licence Status:** CURRENT

Authorised Purpose(s): DOMESTIC
Intended Purpose(s): DOMESTIC

Work Type: Bore - GAB
Work Status: Supply Obtained
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:**
Completion Date: 01/01/1950 **Drilled Depth:**

Contractor Name: (None)
Driller:
Assistant Driller:

Property: MINILYA NSW **Standing Water Level (m):**
GWMA: - **Salinity Description:**
GW Zone: - **Yield (L/s):**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	7//755984
Licensed:	STAPYLTON	BOORABA	Whole Lot //

Region: 90 - Barwon **CMA Map:** 8940-S
River Basin: 025 - MacIntyre **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6790781.000 **Latitude:** 28°59'08.3"S
Elevation Source: Unknown **Easting:** 245028.000 **Longitude:** 150°22'59.0"E

GS Map: - **MGA Zone:** 56 **Coordinate Source:** GD.,ACC.MAP

Remarks

09/03/1987: NO DATA AVAILABLE - BORE SUNK IN 1950
12/11/2009: Reviewed data - nothing to update.

***** End of GW059658 *****

Warning To Clients: This raw data has been supplied to the WaterNSW by drillers, licensees and other sources. WaterNSW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

WaterNSW
Work Summary

GW093556

Licence: **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore - GAB
Work Status: Instrumented
Construct.Method: Rotary Mud
Owner Type: NSW Office of Water

Commenced Date: **Final Depth:** 382.00 m
Completion Date: 10/05/2008 **Drilled Depth:** 382.00 m

Contractor Name: DWE GROUNDWATER DRILLING
Driller: Edward Noel Williams
Assistant Driller: Joel Ray

Property: **Standing Water Level (m):** 59.800
GWMA: **Salinity Description:**
GW Zone: **Yield (L/s):** 8.000

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	7//755984
Licensed:			

Region: 90 - Barwon **CMA Map:** 8940-S
River Basin: 025 - MacIntyre **Grid Zone:** **Scale:**
Area/District:

Elevation: 298.26 m (A.H.D.) **Northing:** 6790901.000 **Latitude:** 28°59'04.3"S
Elevation Source: Unknown **Easting:** 245332.000 **Longitude:** 150°23'10.4"E

GS Map: - **MGA Zone:** 56 **Coordinate Source:** GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	225.00	222			Rotary Mud
1		Hole	Hole	225.00	382.00	152			Rotary Mud
1	1	Casing	Pressure Cemented	-1.01	225.00	168	158		Seated on Bottom, Riveted
1	1	Casing	Steel - Erw	205.00	382.00	140	130		Seated on Bottom, Kwik-lock, S: 372.00-382.00m
1	1	Opening	Slots - Vertical	282.00	291.00	140		0	Casing - Plasma-cut Slot, Steel - ERW, Welded - Collar, SL: 300.0mm, A: 1.00mm
1	1	Opening	Slots - Vertical	327.00	336.00	140		0	Casing - Plasma-cut Slot, Steel - ERW, Welded - Collar, SL: 300.0mm, A: 1.00mm
1	1	Opening	Slots - Vertical	354.00	363.00	140		0	Casing - Plasma-cut Slot, Steel - ERW, Welded - Collar, SL: 300.0mm, A: 1.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
248.00	312.00	64.00	Unknown	59.80		8.00			
321.00	371.00	50.00	Unknown						

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	Topsoil, black	Topsoil	
1.00	12.00	11.00	Clay, yellow	Clay	
12.00	13.00	1.00	Sandstone, weathered	Sandstone	
13.00	17.00	4.00	Sandy Clay, yellow	Invalid Code	
17.00	18.00	1.00	Sandstone, weathered	Sandstone	
18.00	22.00	4.00	Sandy Clay, yellow	Invalid Code	
22.00	24.00	2.00	Sandstone, very hard, weathered	Sandstone	
24.00	165.00	141.00	Shale, sandy, grey	Shale	
165.00	194.00	29.00	Shale, sandy, light grey	Shale	
194.00	206.00	12.00	Shale	Shale	
206.00	210.00	4.00	Sandstone	Sandstone	
210.00	248.00	38.00	Shale, sandy	Shale	
248.00	312.00	64.00	Sandstone, fine	Sandstone	
312.00	321.00	9.00	Shale	Shale	
321.00	371.00	50.00	Sandstone	Sandstone	
371.00	382.00	11.00	Shale	Shale	

Remarks

10/05/2008: Form A Remarks:
Nat Carling, 3-June-2008: GPS provided by hydrogeologist, Steel ERW casing was pressure cemented from 0-2225m. Geologist log entered.
Comments provided on geologist log: Slots were selected from drill samples.
07/08/2014: SJM L 59.77swl H 60.12swl recal to 60.12
06/07/2017: BDK L57.86swl H 57.86swl
22/05/2018: SJM BDK replace sim out 60575601 4n /in 800022577447 2n
01/02/2019: SJM BDK L 74.77swl H 75.25swl / add 6.5m to sensor cable
15/07/2019: Replace battery New s/n D12180

***** End of GW093556 *****

Warning To Clients: This raw data has been supplied to the WaterNSW by drillers, licensees and other sources. WaterNSW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

WaterNSW
Work Summary

GW901418

Licence: 90CA811247 **Licence Status:** CURRENT

Authorised Purpose(s): IRRIGATION,STOCK,DOMESTIC,INDUSTRIAL (LOW SECURITY)
Intended Purpose(s): IRRIGATION

Work Type: Bore - GAB
Work Status: Supply Obtained
Construct.Method: Rotary
Owner Type: Private

Commenced Date:
Completion Date: 10/01/1995
Final Depth: 375.00 m
Drilled Depth: 375.00 m

Contractor Name: ARFRAC DRILLING PTY LTD
Driller: Alan Francis Ryan
Assistant Driller:

Property: DYERS/GLENHOMA GLENHOMA NORTH STAR 2408 NSW
GWMA: 601 - GREAT ARTESIAN BASIN
GW Zone: 012 - EASTERN RECHARGE GROUNDWATER SOURCE
Standing Water Level (m): 42.150
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	7//755984
Licensed:	STAPYLTON	BOORABA	Whole Lot 7//755984

Region: 90 - Barwon
River Basin: 025 - MacIntyre
Area/District:
CMA Map: 8940-S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6789461.000
Easting: 243865.000
Latitude: 28°59'50.3"S
Longitude: 150°22'15.0"E

GS Map: -
MGA Zone: 56
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	2.00	400			Auger
1		Hole	Hole	2.00	267.00	308			Rotary Mud
1		Hole	Hole	267.00	375.00	10			Rotary Mud
1		Hole	Hole	375.00	382.00	150			Rotary Mud
1	1	Casing	Steel	0.00	2.00	356	336		Cemented
1	1	Casing	Steel	0.50	267.00	219	206		Cemented

Remarks

10/01/1995: Form A Remarks:
details incomplete, no compostie log sent by client.

***** End of GW901418 *****

Warning To Clients: This raw data has been supplied to the WaterNSW by drillers, licensees and other sources. WaterNSW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

WaterNSW
Work Summary

GW970551

Licence: **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s): STOCK

Work Type: Bore - GAB
Work Status: Supply Obtained
Construct.Method: Rotary Mud
Owner Type: Private

Commenced Date: **Final Depth:** 292.00 m
Completion Date: 25/11/2012 **Drilled Depth:** 292.00 m

Contractor Name: AFRAC DRILLING
Driller: Alan Francis Ryan
Assistant Driller: R Holland

Property: **Standing Water Level (m):** 91.500
GWMA: **Salinity Description:**
GW Zone: **Yield (L/s):** 0.500

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	STAPYLTON	BOORABA	11//755984
Licensed:			

Region: 90 - Barwon **CMA Map:** 8940-S
River Basin: 425 - DARLING RIVER **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6790339.000 **Latitude:** 28°59'25.3"S
Elevation Source: Unknown **Easting:** 248618.000 **Longitude:** 150°25'11.2"E

GS Map: - **MGA Zone:** 56 **Coordinate Source:** GPS - Global

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	28.00	335			Rotary Mud
1		Hole	Hole	28.00	233.00	250			Rotary Mud
1		Hole	Hole	233.00	292.00	150			Rotary Mud
1		Annulus	Cement	0.00	233.00	250	168		PL:Reverse Circulated
1	1	Casing	Pressure Cemented Casing	-0.50	233.00	168	155		Cemented, Welded - Butt
1	1	Casing	Pressure Cemented Casing	-0.30	27.70	273	257		Cemented, Welded - Butt
1	1	Casing	Pvc Class 12	232.00	292.00	140	124		Cemented
1	1	Opening	Slots - Vertical	235.00	290.00	140		0	Mechanically Slotted, PVC Class 12, SL: 75.0mm, A: 1.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
261.00	292.00	31.00	Unknown	91.50		0.50			530.00

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	Soil; black, clayey	Soil	
1.00	2.00	1.00	Clay; dark brown	Clay	
2.00	6.00	4.00	Claystone; white, weathered	Claystone	
6.00	9.00	3.00	Siltstone; light cream, weathered	Siltstone	
9.00	27.00	18.00	Siltstone; yellow, weathered	Siltstone	
27.00	54.00	27.00	Siltstone; light grey	Siltstone	
54.00	161.00	107.00	Mudstone/Siltstone, grey	Mudstone	
161.00	162.00	1.00	Sandstone; white, cemented	Sandstone	
162.00	261.00	99.00	Shale; light grey	Shale	
261.00	263.00	2.00	Sandstone; white	Sandstone	
263.00	292.00	29.00	Mudstone; medium grey	Mudstone	

Remarks

25/11/2012: Form A Remarks:
Nat Carling, 25-Nov-2013; GPS provided by the drillers. Pressure cemented Steel - ERW casing was installed.

***** End of GW970551 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Annex C

Borehole and Monitoring Bore Construction Logs

Borehole ID: MB1

Project No.: 2021-GD003

Project Name: Groundwater Impact Assessment - North Star Quarry

Client: Regional Quarries Australia Pty Ltd

Site Address: 5535 North Star Road, North Star, NSW

Ground Doctor Pty Ltd

22 Tamworth Street
PO Box 6278
DUBBO NSW 2830

ph: 0407 875 302
fx: (02) 8607 8122
admin@grounddoc.com.au

SUBSURFACE PROFILE				SAMPLE		CONSTRUCTION	
Depth (m)	Symbol	Description	Depth/Elev.	Sample ID	PID / Odour	Well Diagram	Materials Used
		Ground Surface	0.0				Steel stick-up monument 0.7m above ground
		CLAY: Black, dry to moist, high plasticity.	1.0				
		CLAY: Mottled brown and grey, dry, medium plasticity, tending to basalt.	1.8				
		BASALT: Grey, hard, dry.	6.2				Annulus backfilled with drill cuttings (0.4-9.0m)
		CLAY: Mottled light grey and brown, moist, medium plasticity.	8.0				
		CLAY: Mottled red and brown, moist, medium plasticity.	9.0				
		CLAY: Mottled white and red-brown, moist, medium plasticity.	13.0				50mm Class 18 uPVC Blank Casing (-0.7-15.4m) Annulus sealed with bentonite (9.0-13.0m)
		CLAY: Mottled brown and white, dry, medium plasticity.	19.5				Annulus backfilled with 3-5mm gravel (13.0-24.4m) 50mm ID Class 18 uPVC Screen (15.4-18.4m)
		CLAY: Mottled grey and brown, dry to moist, medium plasticity.	25.0				50mm ID Class 18 uPVC Screen (21.4-24.4m) End Cap (24.4m) Hole collapse (24.4-25.0m)
		End of Hole in Clay at 25.0m. Target depth reached.					

Drilled By: Ivan Drilling (Georgel Ivan)

Drill Method: Air Rotary - Down Hole Hammer

Drill Date: 28 January 2021

Hole Size: 90mm

Datum:

Sheet: 1 of 1

Borehole ID: MB2

Project No.: 2021-GD003

Project Name: Groundwater Impact Assessment - North Star Quarry

Client: Regional Quarries Australia Pty Ltd

Site Address: 5535 North Star Road, North Star, NSW

Ground Doctor Pty Ltd

22 Tamworth Street
PO Box 6278
DUBBO NSW 2830

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fx: (02) 8607 8122
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SUBSURFACE PROFILE				SAMPLE		CONSTRUCTION	
Depth (m)	Symbol	Description	Depth/Elev.	Sample ID	PID / Odour	Well Diagram	Materials Used
		Ground Surface	0.0				
0		**CLAY:** Black, dry to moist, high plasticity.	0.5				Steel stick-up monument 0.7m above ground
1		**BASALT:** Grey, hard, dry.					Annulus backfilled with drill cuttings (0.4-3.0m)
2			2.5				
3		**CLAY:** Mottled white brown, dry, medium plasticity.					50mm Class 18 uPVC Blank Casing (-0.7-9.5m)
4							
5							
6							Annulus sealed with bentonite (3.0-8.0m)
7							
8							
9			9.0				Annulus backfilled with 3-5mm gravel (8.0-18.5m)
10		**CLAY:** Mottled grey and brown, dry, medium plasticity.					
11							50mm ID Class 18 uPVC Screen (9.5-12.5m)
12							
13							
14							
15							
16							50mm ID Class 18 uPVC Screen (15.5-18.5m)
17							
18			18.7				End Cap (18.5m)
19		**End of Hole in Clay at 18.7m. Target depth reached.**					Hole collapse (18.5-18.7m)
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							

Drilled By: Ivan Drilling (Georgel Ivan)

Drill Method: Air Rotary - Down Hole Hammer

Drill Date: 28 January 2021

Hole Size: 90mm

Datum:

Sheet: 1 of 1

Borehole ID: MB3

Project No.: 2021-GD003

Project Name: Groundwater Impact Assessment - North Star Quarry

Client: Regional Quarries Australia Pty Ltd

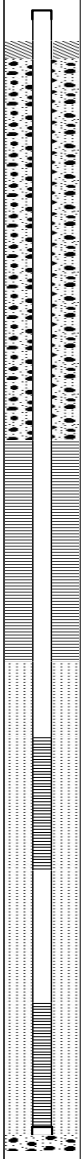
Site Address: 5535 North Star Road, North Star, NSW

Ground Doctor Pty Ltd

22 Tamworth Street
PO Box 6278
DUBBO NSW 2830

ph: 0407 875 302
fx: (02) 8607 8122
admin@grounddoc.com.au

SUBSURFACE PROFILE				SAMPLE		CONSTRUCTION	
Depth (m)	Symbol	Description	Depth/Elev.	Sample ID	PID / Odour	Well Diagram	Materials Used
		Ground Surface	0.0				Steel stick-up monument 0.7m above ground
		CLAY: Black, dry to moist, high plasticity, with some basalt cobbles.	1.0				
		Weathered BASALT: Basalt and clay, mottled brown and grey, dry, medium plasticityt.	5.0				Annulus backfilled with drill cuttings (0.4-9.0m)
		BASALT: Grey, hard, dry.	9.5				
		CLAY: Mottled white and light brown, dry, medium plasticity.	12.0				50mm Class 18 uPVC Blank Casing (-0.7-15.7m)
		CLAY: Mottled white, red and brown, dry, medium plasticity.	14.0				Annulus sealed with bentonite (9.0-14.0m)
		CLAY: Mottled brown and light grey, moist, medium plasticity.	17.0				Annulus backfilled with 3-5mm gravel (14.0-24.7m)
		CLAY: Grey with brown mottling, moist, mediuam plasticity.	20.0				50mm ID Class 18 uPVC Screen (15.7-18.7m)
		CLAY: Mottled grey and brown, dry, medium plasticity.	25.0				50mm ID Class 18 uPVC Screen (21.7-24.7m)
		End of Hole in Clay at 25.0m. Target depth reached.					End Cap (24.7m)
							Hole collapse (24.7-25.0m)



Drilled By: Ivan Drilling (Georgel Ivan)

Drill Method: Air Rotary - Down Hole Hammer

Drill Date: 29 January 2021

Hole Size: 90mm

Datum:

Sheet: 1 of 1



Drill cuttings from MB1. 1m Intervals Left to Right and top to bottom.



Completed monitoring bore MB1.



Drill cuttings from MB2. 1m Intervals Left to Right and top to bottom.



Completed monitoring bore MB2.



Drill cuttings from MB3. 1m Intervals Left to Right and top to bottom.