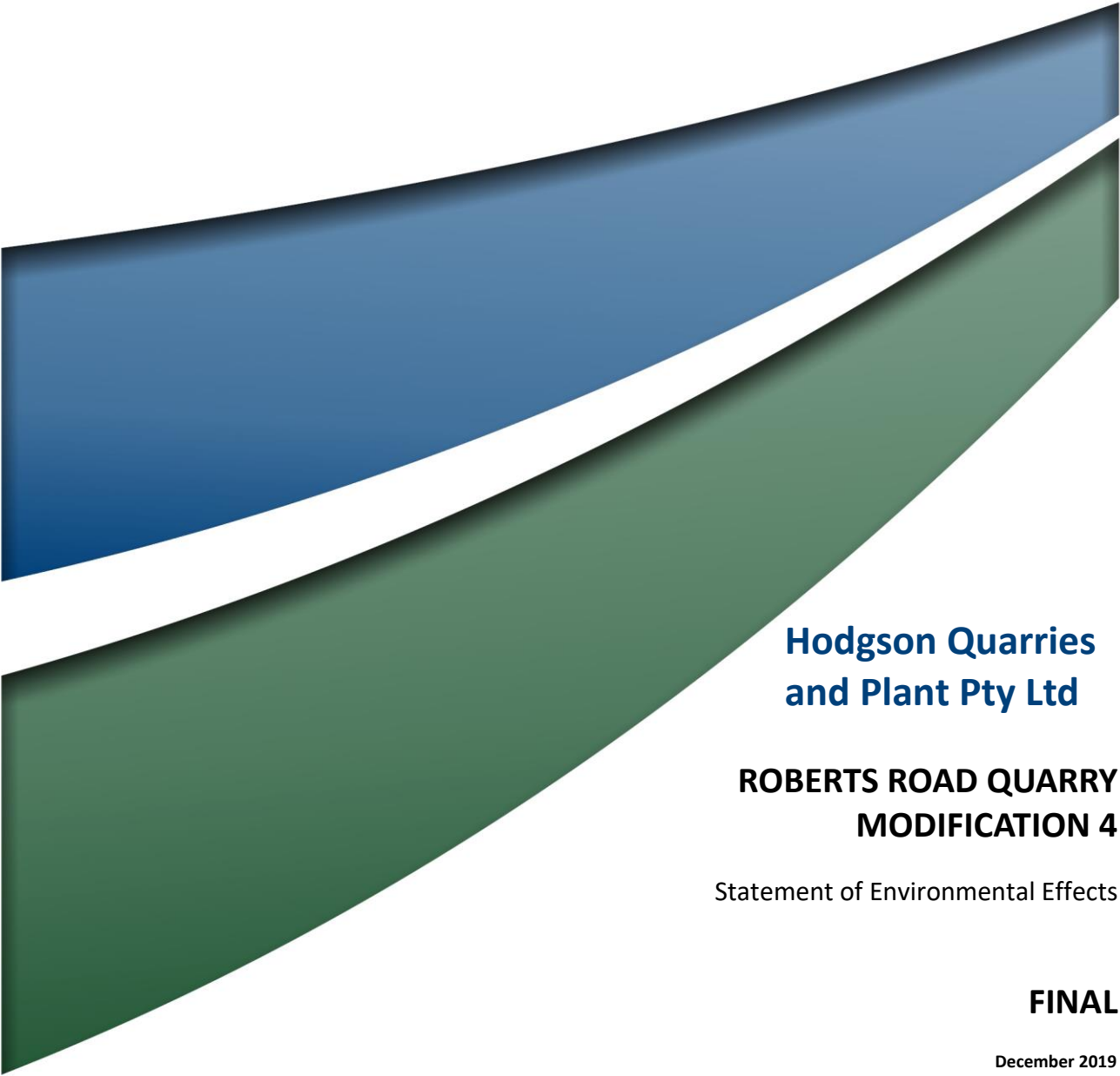




**Hodgson Quarries
and Plant Pty Ltd**

**ROBERTS ROAD QUARRY
MODIFICATION 4**

Statement of Environmental Effects

FINAL

December 2019

Hodgson Quarries and Plant Pty Ltd

ROBERTS ROAD QUARRY MODIFICATION 4

Statement of Environmental Effects

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Hodgson Quarries and Plant Pty Ltd

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Report No. 4465/R02
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Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Alex Irwin	5 November 2019	Alex Irwin	5 November 2019
Final	Alex Irwin	4 December 2019	Alex Irwin	4 December 2019

Executive Summary



Background

Hodgson Quarries and Plant Pty Ltd (the Applicant) operates the Roberts Road Quarry (the Quarry) located on Roberts Road at Maroota, NSW. Development consent (DA 267-11-99), which provides for the extraction and on-site processing of sand and pebbles for a period of 25 years, was originally granted to the Quarry by the Minister for Urban Affairs and Planning in 2000.

The Applicant is seeking to modify DA 267-11-99 to allow for the importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) which would be used predominantly to backfill the extraction area to construct a free-draining final landform. Selective processing and blending of VENM and ENM with high sand content is also proposed.

The Proposed Modification

The key components of the Proposed Modification are as follows.

- The importation of VENM and ENM, principally to backfill the extraction area and create a final landform which better integrates with the surrounding landforms.
- On-site processing of selected, high sand content VENM and ENM for sale or blending with sand produced from the in situ resources prior to sale.
- While back loading of trucks would be encouraged, the proposed importation of VENM and ENM would require an increase in the number of traffic movements permitted each day (from 100 to 140).
- An extension to the period of approval of DA 267-11-99, from 2025 to 2030, to reflect the remaining sand resource to be extracted from within the existing approved extraction footprint.
- Removal of a condition limiting the area of exposed and active quarry extents in order to allow for backfill and rehabilitation of the completed sections of the Quarry with VENM and ENM.

Approval for the proposed changes is being sought by under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act)

Need for the Proposed Modification

The benefits of the Proposed Modification are as follows.

- The modified final landform, to be constructed using the imported VENM and ENM, would allow for a return to natural drainage to the north and provide a landform more sympathetic to the surrounding landforms and more conducive to future agricultural or horticultural land use.
- The Quarry provides an alternative location, with a beneficial use, for the disposal of VENM and ENM to licensed waste management facilities (thereby increasing the storage capacity of these for general solid waste).
- Blending imported VENM and ENM with extracted materials would extend the life of the Quarry and assist in the supply of high quality construction materials into the Sydney local and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and will contribute to the security and economic viability of the Sydney construction industry along with supply to other key sand markets.
- Providing for the complete extraction of the sand resource (through extension to the period of the development consent) for which approval has been granted.

The Proposed Modification would therefore provide for improved environmental outcomes for the Quarry, through the construction of a final landform which returns environmental flows and better integrates with the surrounding topography, whilst providing added security of supply for construction materials to Sydney.

Environment Impacts

This Statement of Environmental Effects (SEE) includes a detailed assessment of the potential environmental and social impacts of the Proposed Modification and identifies the management and mitigation measures that will be implemented as part of the Proposed Modification. A brief summary of the key findings of the assessment process is provided in **Table ES1**.

Table ES1 Summary of the Key Environmental Impact Assessment Findings

Environmental issues	Overview of Potential Impacts
Surface Water	The Water Management System (WMS) for the Quarry will remain largely unchanged from the existing Quarry WMS, with the main change being an increase in the potential for discharge of sediment laden water from the Quarry Site as backfilling creates the free-draining landform. Additional erosion and sediment controls will be implemented to minimise erosion from the imported VENM/ENM and to control any sediment entrained in runoff. Water treatment measures would also be implemented to ensure discharges from the final landform do not exceed any proposed limit conditions. Therefore, the impacts to downstream water quality are considered to be negligible during the final landform establishment period. Prior to the establishment of the final landform, the Applicant will apply to vary EPL 6535. This will include a licenced discharge point to allow surplus water to be discharged from a sediment basin constructed at the discharge point of the Quarry Site during the period between the construction of the final landform and the completion of rehabilitation. The sediment basin would be converted to a final water storage, allowing for the capture of surface water up to the landowners licensed allocation and discharge to the Coopers Creek catchment to the north.

Environmental issues	Overview of Potential Impacts
Noise	Road traffic noise modelling was undertaken and the results indicate the predicted increase in road traffic noise would be below 1dB(A). This increase in road traffic noise associated with increased truck movements is considered to be negligible. While the Applicant does not intend on introducing any new noise sources on the Quarry Site, noise modelling has been undertaken to review likely performance against the existing noise criteria of DA 267-11-99 when VENM/ENM management activities are undertaken. Assuming the implementation of the operational controls and management measures currently implemented and identified in the Quarry's Operational and Road Noise Management Plan, this modelling confirmed that compliance with noise criteria can be achieved at the receivers surrounding the Quarry.
Air quality	Dust emissions as a result of the modified operations have been estimated for worst-case operating scenarios and meteorological conditions. Compliance with annual average criteria for PM₁₀, total suspended particulates and dust deposition is predicted. Noting annual average PM_{2.5} background concentrations already exceed the 8 µg/m³ assessment criteria, the predicted incremental increase as a result of the Proposed Modification of between 0.4 µg/m³ and 0.5 µg/m³, are unlikely to impact significantly on surrounding receivers. With respect to maximum 24-hour average emissions, a small number of additional exceedances of PM₁₀ have been predicted at the receivers closest to the Quarry Site. No additional exceedances of PM_{2.5} were predicted. These results indicate that the Proposed Modification is unlikely to significantly increase emissions from the Quarry, however, operations should implement additional measures to: 1. minimise site contributions during days of elevated background PM₁₀ concentrations, and 2. review the conditions when extractive and emplacement activities take place towards the perimeter of the Quarry.
Traffic and transport	The Proposed Modification would result in an increase to the daily traffic volumes for the Quarry from 100 to 140 trucks per day. No increase is proposed for the existing hourly maximum of 20 trucks per hour. A Traffic Impact Assessment was undertaken to include an additional 140 trucks per day along Old Northern Road. As the Proposed Modification includes an extension to the period of operation from 2025 to 2030, background growth to 2030 was included in the assessment. The results indicate the increase to the total traffic flows represent an increase of less than 2% of the total traffic flows and are well within the capacity of the road network. No change to the level of service provided by the Roberts Road / Old Northern Road intersection is predicted. The assessment also concludes that the proposed increase in truck movements would not impact adversely on overall road safety, including on local bus services.
Waste Management	Existing waste generated during operation of the Quarry includes general solid waste (putrescible, non-putrescible and recyclable), waste oils and greases, tyres and screened waste. The Proposed Modification would require management of VENM and ENM (classified waste materials for which exemptions from licensing apply where applied to land). Existing waste would be managed in accordance with current Quarry management and contingency methods and VENM/ENM would be accepted and applied to land or stockpiled in accordance with the relevant Resource Recovery Exemption. Therefore, the potential for pollution at the Quarry was determined to be low. A biosecurity risk assessment was also undertaken and the results indicate that the biosecurity hazards associated with the importation of VENM/ENM to the Quarry would be low.

Environmental issues	Overview of Potential Impacts
Visual Amenity, Rehabilitation and Land Use	The Proposed Modification seeks to remove Condition 29(c) of DA 267-11-99 which requires the quarry to provide for <i>‘a planting and watering regime to ensure that no more than 3 hectares of the site are exposed and active at any one time’</i>. While this would result in larger areas being ‘active and exposed’ at any given time over the remaining life of the Quarry, existing views of Quarry operations are unlikely to increase when viewed from vantage points surrounding the Quarry Site. Impacts on visual amenity would be further mitigated by: • progressive rehabilitation of the backfilled extraction area, • construction, vegetation and maintenance of bund walls along the Roberts Road and Old Northern Road perimeter of the Quarry Site, • dust suppression measures, and • focus on general housekeeping and waste management on the Quarry Site. The Proposed Modification provides for an improved final landform which has a reduced slope and returns environmental flows to the north. The modified landform would better integrate with surrounding topography and result in a positive impact on visual amenity, reduce the risk of erosion and would support agricultural and horticultural activities in the long term.
Socio-Economic Impacts	The principal issue of concern for the local community relates to heavy vehicle traffic and additional impacts identified include noise, visual, dust, water and land use. Positive impacts identified for the community involves economic contributions made by quarry operators to local businesses and employment opportunities for local residents. The proposed importation of VENM/ENM to the Quarry would allow the Quarry to operate over a longer time period, providing benefits for the local community and the broader Sydney region (in the provision of sand products). The socio-economic impact assessment considered potential direct and indirect benefits and assessed there would be a net socio-economic benefit from the Proposed Modification.

Further details of the predicted environmental and social impacts of the Proposed Modification are provided in the main text of this SEE and associated technical reports. The SEE includes commitments by the Applicant to the implementation of management, mitigation and offset measures to minimise the predicted impacts of the Proposed Modification.

Conclusion

The Proposed Modification has been evaluated against the principles of Ecologically Sustainable Development (ESD), section 1.3 (Objects) and section 4.15 (Evaluation) of the EP&A Act and relevant clauses and requirements of local, regional and state planning instruments. This assessment confirms the Proposed Modification to be consistent with the relevant principles and requirements in each case.

On considering the balance of the potential impacts of the Proposed Modification on the environment and community, and the benefits of and the need for the proposed changes, it would be reasonable to consider that with the implementation of the management, mitigation and offset measures proposed by the Applicant, the benefits of the Proposed Modification outweigh the impacts.

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1.0 Introduction

1.1 Scope

The Roberts Road Quarry (the Quarry) is operated by Hodgson Quarries and Plant Pty Ltd (the Applicant) on Lots 1 and 2 DP 228308, and Lot 2 DP 312327, at Maroota within The Hills Shire Council Local Government Area (LGA). The Quarry has approval for the extraction and on-site processing of sand from the Maroota Sand geological formation located on the Hornsby Plateau, north-west of Sydney. Access to the Quarry is from Roberts Road which intersects with Old Northern Road from which quarry products are distributed (both to the north-west towards Wisemans Ferry Road and south-east towards Pennant Hills Road) (refer to **Figure 1.1**).

The Quarry has been in operation since the 1990s supplying a range of sand and pebble products to the building and construction industry. It has been operated under the current development consent (DA 267-11-99) as State Significant Development following approval by the Minister for Urban Affairs and Planning in 2000 under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Applicant is seeking to modify DA 267-11-99 under section 4.55(2) of the EP&A Act to allow for the following additions and modifications to Quarry operations (the Proposed Modification).

- The importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM), principally to backfill the extraction area and create a final landform which better integrates with the surrounding landforms.
- On-site processing of selected VENM and ENM for sale or blending with sand produced from the in situ resources prior to sale.
- An increase in the number of traffic movements permitted each day (from 100 to 140) to reflect the proposed importation of VENM and ENM.
- An extension to the period of approval of DA 267-11-99 (to May 2030) to reflect the remaining sand resource to be extracted (from 2025 to 2030).
- Removal of a condition limiting the area of exposed and active quarry extents in order to allow for backfill and rehabilitation of the completed sections of the Quarry with VENM and ENM.

Further details of the Proposed Modification are provided in **Section 4.0**.

The Applicant has engaged Umwelt (Australia) Pty Ltd (Umwelt) to undertake the assessment of environmental impacts of the Proposed Modification, which forms the basis of this Statement of Environmental Effects (SEE).

1.2 The Applicant

Hodgson Quarries and Plant Pty Ltd is a private company established to operate quarries, market the materials produced and maintain mobile equipment for hire. The principal of Hodgson Quarries and Plant Pty Ltd, Mr Martin Hodgson has been involved in extractive industries for over 40 years. Mr Martin Hodgson is assisted on-site by Mr Stuart Reed, Compliance Manager, himself with many years' experience in extractive industries. The Applicant has operated the Quarry since 2004.

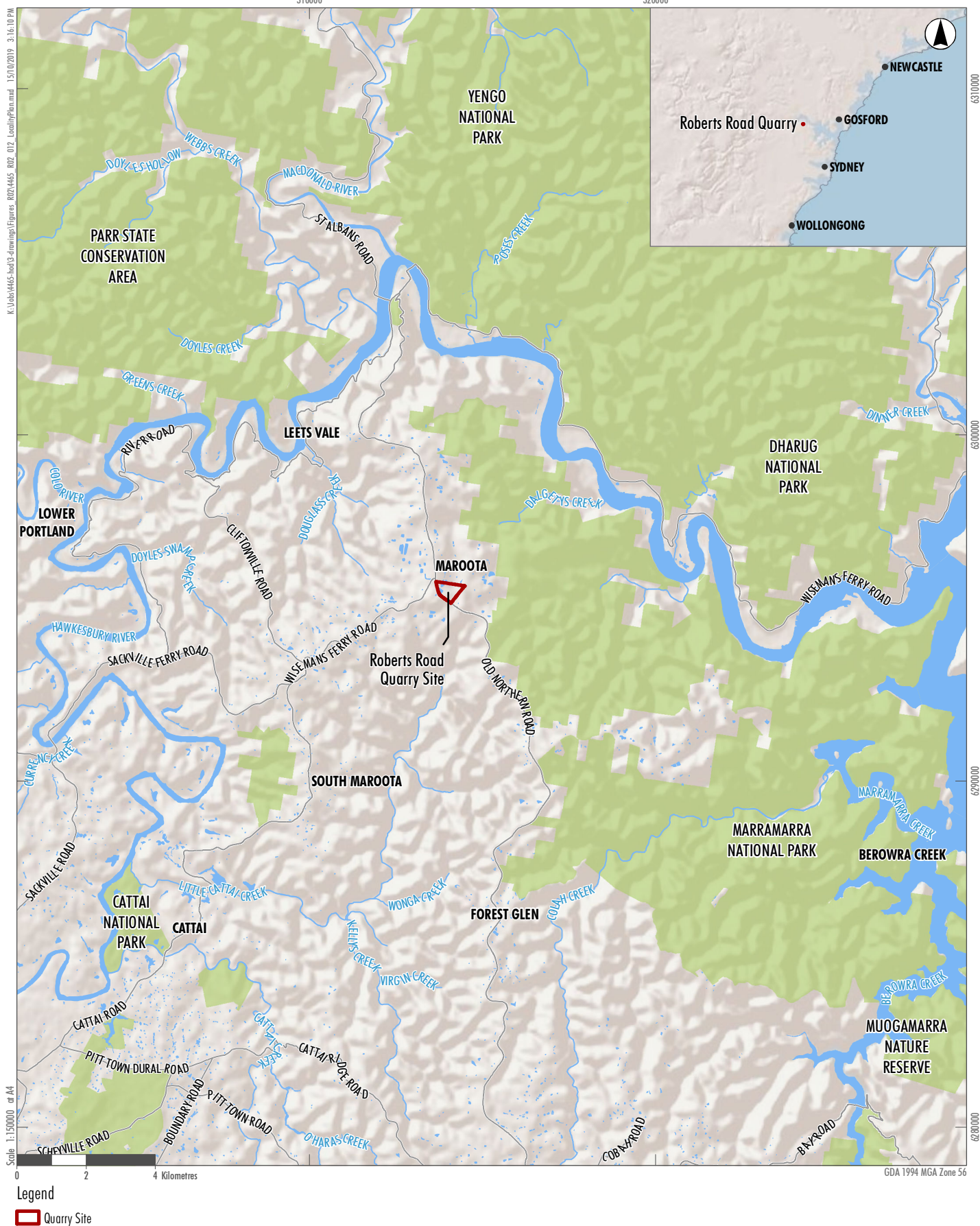


FIGURE 1.1
Locality Plan

1.3 Site Location, Property Description and Ownership

The Quarry is located at Maroota NSW, in the outer north-western suburbs of Sydney, approximately 50 kilometres (km) from the Sydney CBD within The Hills Shire Council LGA. The Quarry is located on three lots as described in **Table 1.1** at the corner of Roberts Road and Old Northern Road, Maroota (refer to **Figure 1.2**).

Table 1.1 Property Description and Ownership

Lot	Deposited Plan	Ownership
1	DP 228308	M. Hodgson
2 (part)	DP 228308	Dr L. S. Martin
2	DP 312327	G. Hodgson

The Applicant operates the Quarry with the landowners who consent to the lodgement of the Proposed Modification and operations as described in this document.

The Quarry Site covers an area of approximately 27.8 hectares (ha), of which approximately 22.5 ha comprises the approved extraction area (refer to **Figure 1.2**). The majority of the Quarry Site infrastructure and processing plant is located within the footprint of the extraction area. An area of 0.9 ha in the north-western corner of the site is occupied by a commercial nursery (Sunrise Nursery).

1.4 Planning Approval History

A timeline of approval history for quarrying operations on the site is provided in **Table 1.2**.

Table 1.2 Approval History Timeline

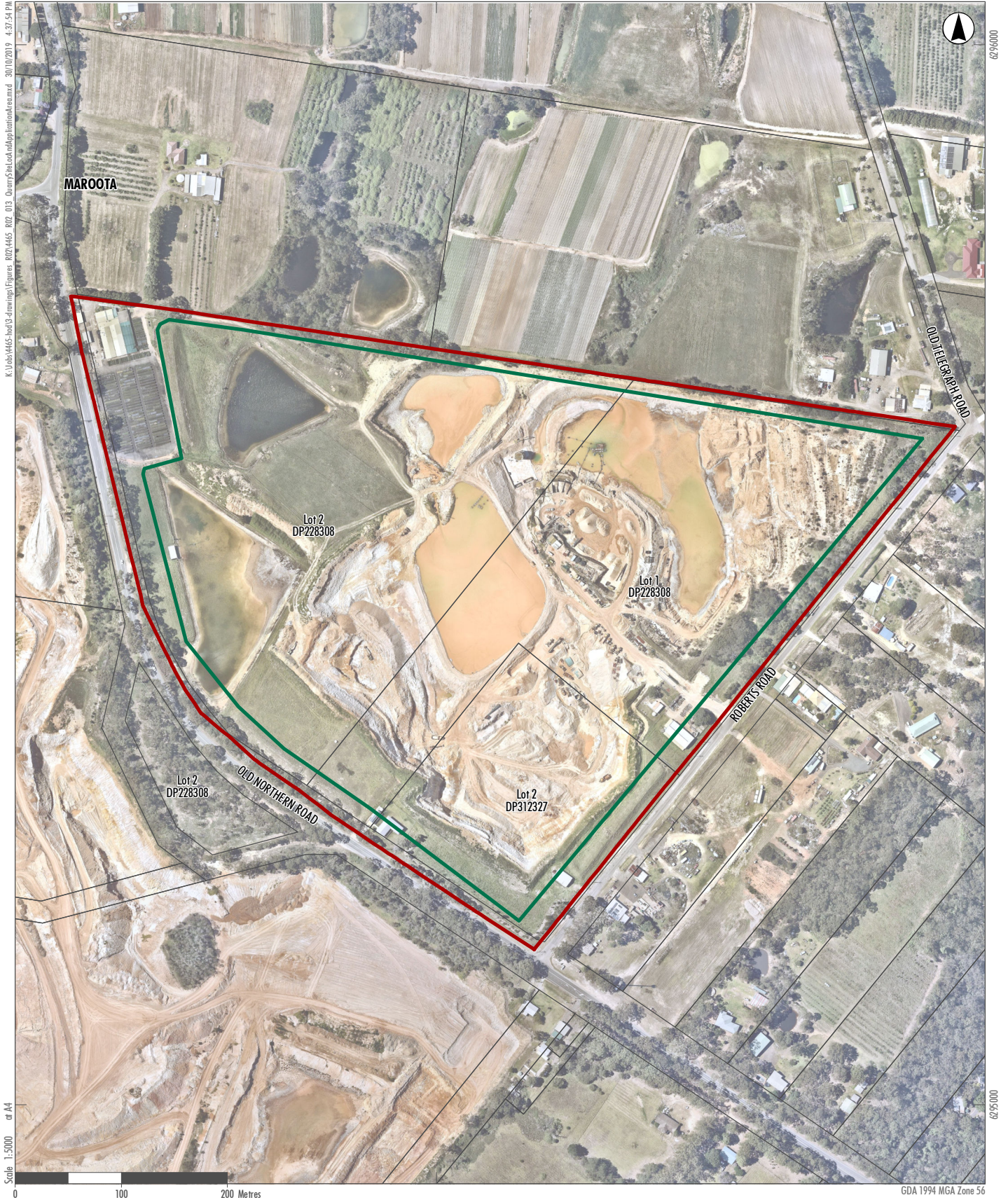
Approval date	Description
31 May 2000	Original Quarry Development Application DA 267-11-99
29 November 2000	Modification 1 for an amendment to the method of extraction and construction of an acoustic bund wall
18 August 2015	Modification 3 for an interim extension to the approved life of the Quarry of one year
18 March 2016	Modification 2 for an amendment to the dam construction process and modification of the sequence, process of extraction and extension of the life of extraction until 31 May 2025

1.5 Environmental Assessment Requirements

The Applicant has consulted with the Department of Planning, Infrastructure and Environment (DPIE) in relation to the Environmental Assessment Requirements (EARs) for the Proposed Modification. The DPIE confirmed the EARs in a letter dated 18 March 2019. A copy of this correspondence is provided in **Appendix 2** and the requirements are summarised in **Table 1.3**.

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Legend
 Quarry Site
 Approved Extraction Area

FIGURE 1.2

Quarry Site Location and Application Area

Table 1.3 Environmental Assessment Requirements

Requirement	Relevant SEE Section
Ensure that the assessment is prepared in accordance with the following: • <i>NSW Noise Policy for Industry</i> (2017) • <i>NSW Road Noise Policy</i> (2011) • <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i> (2016) • <i>Voluntary Land Acquisition Mitigation Policy</i> (2018).	Section 7.4 and Section 7.5.1
Air Quality and Noise • Demonstrate that the modification and any potential increase to the quarry's production capacity would not produce exceedances in the quarry's noise and air quality criteria, and that assessments of both noise and air quality sufficient to demonstrate this outcome are provided with the SEE.	Section 7.4 and Section 7.5.1
Permissibility • Provide detail regarding the permissibility of the Proposed Modification under <i>The Hills Local Environmental Plan 2012</i>. • Specifically, demonstrate if the Proposed Modification is considered ancillary to the existing quarry or whether it constitutes a new development.	Section 5.4 and Section 5.2.1
VENM/ENM Fill Provide the following with respect to VENM/ENM fill: • Likely sources of VENM/ENM for the site, including a description of any potential contaminants and a description on how the VENM/ENM would be stored and handled on site. • Quantity of imported material which would be blended with on-site material to produce saleable products. • Proportion of the imported material which would be VENM and ENM. • Procedures and protocols proposed to safeguard potential impacts from the imported ENM on the Maroota Sands aquifer.	Section 4.2.2 and Section 4.2.7 and Section 7.3
Rehabilitation • Outline how the proposed final landform of the quarry site will be achieved if the required quantity of VENM/ENM cannot be sourced. • Provide information regarding the proposed changes to the final landform of the quarry site, including drainage lines and any onsite detention ponds. • Detail the measures that will be implemented to reduce erosion and sedimentation associated with runoff leaving the quarry site.	Section 7.3 and Section 7.9
Consultation • Undertake consultation with all relevant stakeholders, such as government agencies and affected residents, including relevant landholders downstream of the drainage lines. • Fully document the outcomes of the proposed Community Engagement Strategy.	Section 6.0

1.6 Management of Investigations

The SEE has been prepared by Mr Alex Irwin (B.Sc(Hons)), Principal Environmental Consultant of Umwelt (Australia) Pty Ltd (Umwelt) on behalf of the Applicant. Mr Irwin was assisted in the preparation of the SEE by Ms Ruth Tapp (B.Nat.Res.(Hons)), Environmental Scientist, and the following Umwelt specialist personnel.

- Mr Chris Bonomini (B.Eng.(Chem)(Hons)) prepared the surface water assessment (refer to **Section 7.3**).
- Mr David Davis (B.Eng.(Mech)(Hons)) prepared the noise impact assessment (refer to **Section 7.4**).
- Dr Anne Schneider (PhD, M.Sc., B.Sc.) assisted in the assessment of rehabilitation (refer to **Section 7.9**).

The following external specialist consultancies were engaged by the Applicant and managed by Umwelt to provide specialist environmental assessments.

- Air Quality Impact Assessment – Jacobs Pty Ltd (Jacobs)
Mr Luke Spencer (B.Eng.(Hons)(Env), CPEng).
- Traffic Impact Assessment – Seca Solution Pty Ltd (Seca)
Mr Shaun Morgan (N.Dip (C.Eng) (UK), Road Safety Auditor (Level 3 – Lead Auditor).

Community Consultation was undertaken by Mr Martin Hodgson and Mr Stuart Reed of Hodgson Quarries & Plant, who also provided technical information on current and proposed operations. Environmental monitoring data was obtained through the Roberts Road Quarry website hosted by VGT Environmental Compliance Solutions Pty Ltd (VGT). Ms Lisa Thomson and Ms Sinead Kelly of VGT also provided supplementary environmental data on request.

1.7 Structure of the Document

This SEE has been prepared in accordance with the EP&A Act and Regulation (refer to SEE Statement of Authorship in **Appendix 1**) and the Environmental Assessment Requirements for Modification 4 provided by the DPIE (refer to **Appendix 2**). The SEE comprises a main text component and supporting studies, which are included as appendices. An overview of the layout of the main text is presented in **Table 1.4** below.

Table 1.4 Environmental Assessment Structure

SEE Section	Environmental Assessment Details
Executive Summary	Provides a brief overview of the Proposed Modification, the major outcomes of the environmental assessment and key project commitments to mitigate potential impacts.
Section 1.0	Provides the background for the Proposed Modification, key Proposed Modification details, the Applicant and the assessment team.
Section 2.0	Provides the site context and details about the existing environment.
Section 3.0	Identifies the existing approvals, describes the existing operations and identifies the activities to be modified.
Section 4.0	Describes the Proposed Modifications to approved activities. The need for the Proposed Modification is justified along with a review of alternatives considered in the development of the Proposed Modification.
Section 5.0	Provides a description of the current planning context for the Proposed Modification.

SEE Section	Environmental Assessment Details
Section 6.0	Describes the stakeholder consultation process undertaken as part of the Proposed Modification and environmental assessment process.
Section 7.0	Provides a comprehensive analysis and assessment of the potential environmental and community impacts of the Proposed Modification.
Section 8.0	Provides a summary of proposed management and mitigation commitments for the Proposed Modification.
Sections 9.0	Provides a conclusion and justification for the Proposed Modification.
Section 10.0	References

2.0 Site Context

The following provides an overview of key environmental features of the Quarry Site and surrounds as relevant to the assessment of the Proposed Modification. Key features of the local setting are identified on **Figure 2.1**.

2.1 Land Use and Zoning

The site and adjacent land area is zoned RU1 – Primary Production under *The Hills Local Environmental Plan 2012*. The zone has among its objectives the facilitation of the economic extraction of materials from land and the subsequent rehabilitation of that land. Extractive industries are permissible with consent on land zoned RU1 – Primary Production.

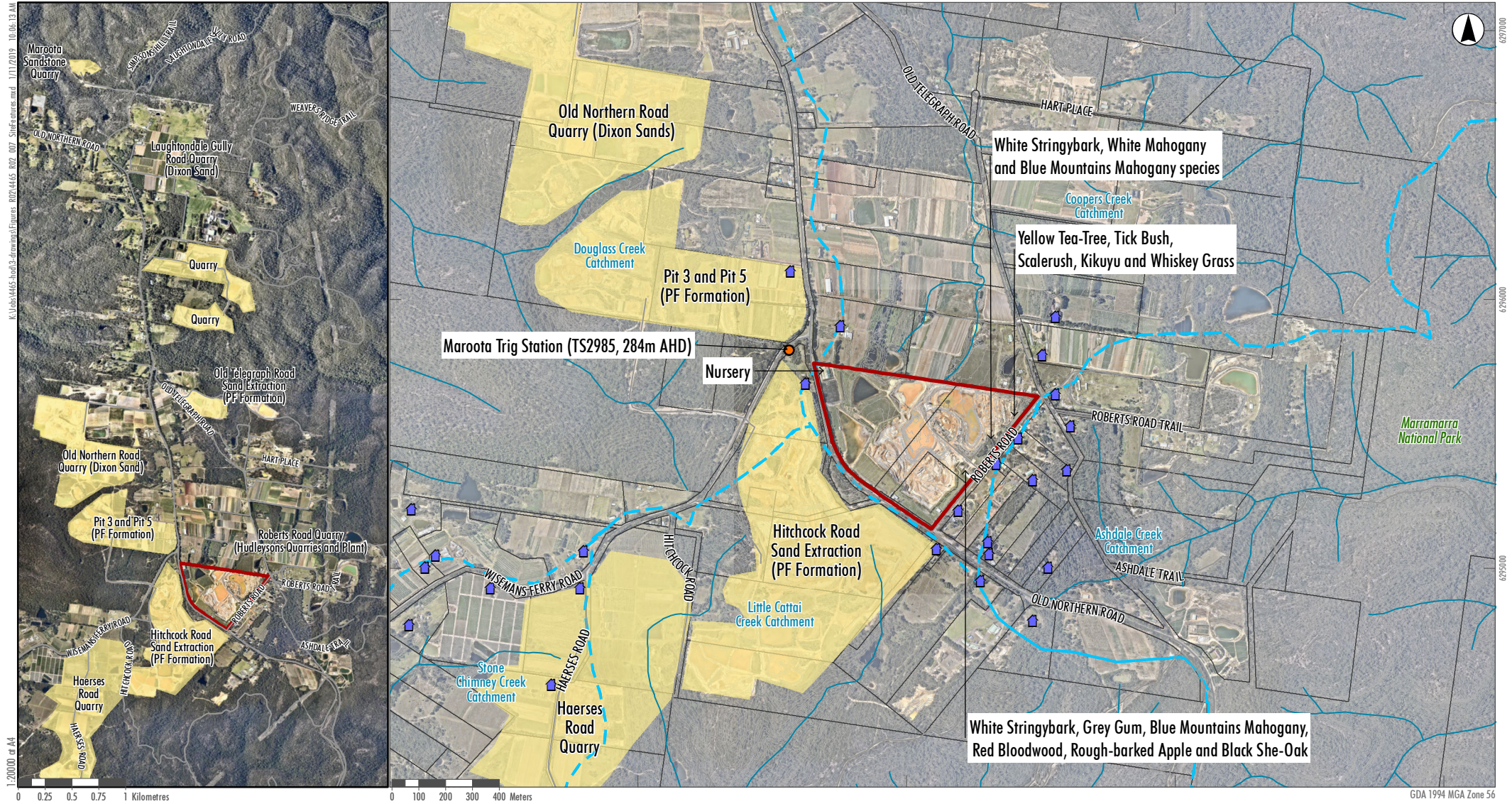
The site has been operated as a quarry since the 1990s. Prior to this the site was used for agricultural purposes and in particular as an orchard and plant nursery. The north-western corner of the site remains in use as a commercial plant nursery.

The surrounding area is dominated by agriculture, extractive industry, rural-residential land and National Parks, the closest of which is Marramorra National Park just over 1 km to the east of the site (refer to **Figure 2.1**). The surrounding region is a significant area for quarrying, with at least nine quarries located within the local area, as shown in **Figure 2.1**.

2.2 Topography and Drainage

The topography of the local setting is typical of the Hawkesbury Sandstone plateau and is surrounded by steep valleys and massive cliff faces. The relief ranges from 170 m Australian Height Datum (AHD), south of the Quarry Site to 240.7 m AHD at the Maroota Trig Station (approximately 440 m west of the Quarry Site). Within the Quarry Site elevations range from approximately 226 m at the south-western end along Old Northern Road to approximately 192 m AHD on the northern boundary. The existing landform of the Quarry Site has been highly disturbed by the approved Quarry operations (refer to **Figure 2.1**).

The general drainage pattern of the site is in a northerly direction along a natural creek line which joins a tributary of Coopers Creek approximately 2 km to the north, before eventually flowing into the Hawkesbury River. Further information on local drainage is provided in **Section 7.3.1**.



Legend

- Quarry Site
- Catchment Boundary (see also Figure 7.3)
- Residential Receivers
- Local Quarries
- Roads
- Watercourse
- Topographic contours (2m)

FIGURE 2.1
Local Setting and Land Use

2.3 Geology

The Maroota area is known for its production of sand, which represents a valuable resource to the building industry. The sand is obtained from two main geological sources: the Tertiary aged Maroota Sands and the weathered profiles of the underlying Triassic Hawkesbury Sandstone.

The Maroota Sands comprise a sequence of interbedded and poorly sorted sands, gravels and clays derived from the eroded and reworked material of the Hawkesbury Sandstone and Permian conglomerates. The Maroota Sands occur as a channel system of fluvial and alluvial origin and were deposited by a Tertiary-age river system cut into the Triassic sandstone bedrock, giving rise to the highly irregular surface on the Hawkesbury Sandstone. The irregularity of the surface of the Hawkesbury Sandstone bedrock results in the thickness of the Maroota Sand formation being not directly related to the present topography. The Maroota Sand formation attains maximum thickness of 39 m at the Maroota Trig Station, while north of Maroota the thickness is variable and commonly not more than 5 m.

The Hawkesbury Sandstone is a widespread formation occupying a large portion of the Sydney Basin, comprising a thick sequence of cemented quartz sandstone with well-developed shale layers and bands. The weathered profile of the Hawkesbury Sandstone, which is the primary target of other quarrying operations in the area, is of variable thickness and can be as much as 15 m deep.

As illustrated by **Figure 2.2**, the Quarry occurs over the Tertiary Maroota Sands formation and encounters layers of predominantly clay material within the larger sand resource.

2.4 Groundwater

Groundwater is present within the Maroota Sands and the underlying Hawkesbury Sandstone. Groundwater in each of these two formations is regionally extensive and forms a regional water table in each. Localised groundwater is also present in perched aquifers within the Maroota Sands, as well as on top of or within the Hawkesbury Sandstone, above the regional water tables. Thus, localised groundwater may be intersected at a number of elevations above the regional water table levels.

The management of groundwater resources is controlled by the *Water Management Act 2000* (WM Act) and *The Greater Metropolitan Region Groundwater Sources Water Sharing Plan 2011* (GMRGS WSP) (NOW, 2011). The GMRGS WSP defines two water sources for the locality.

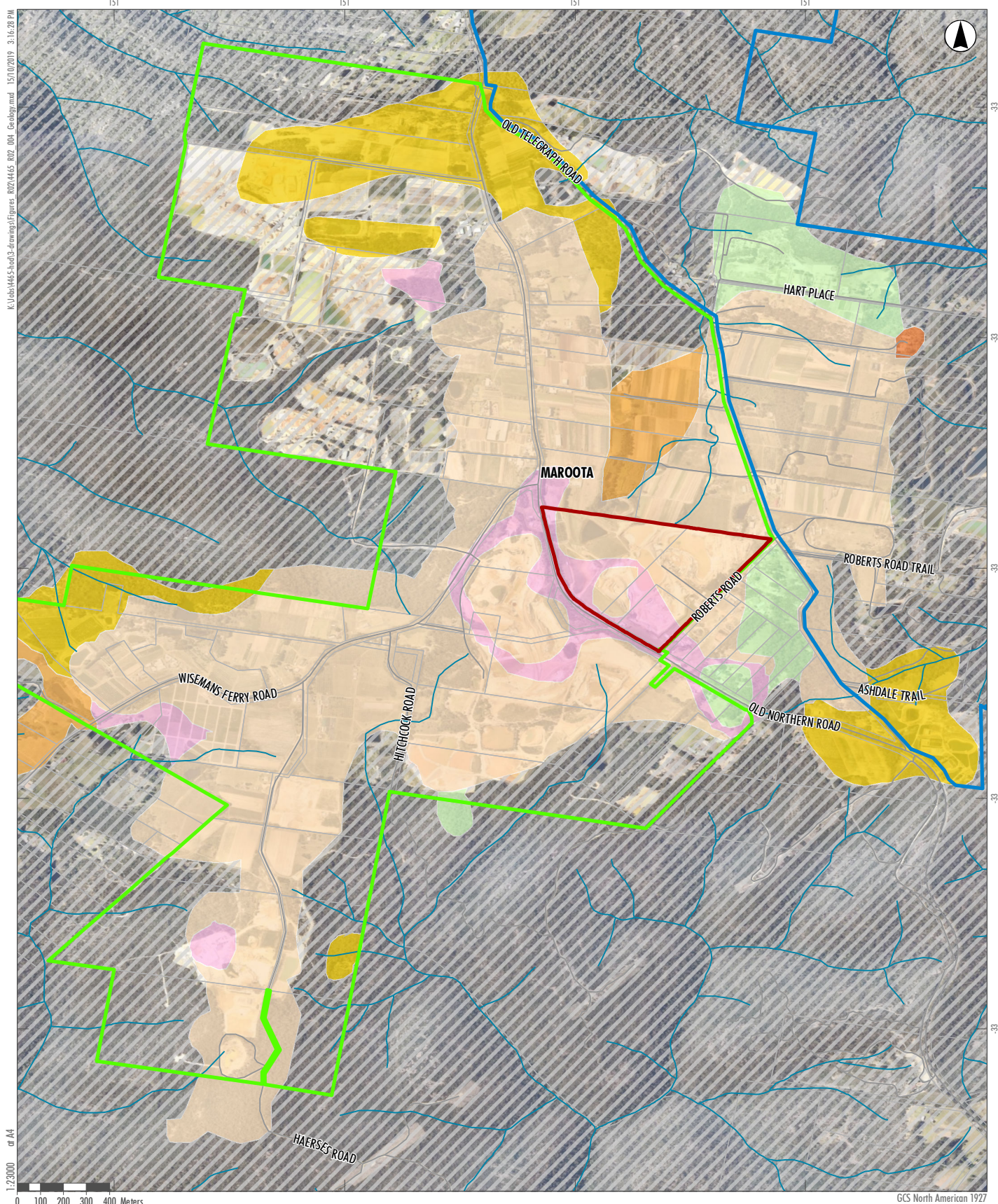
- The Maroota Tertiary Sands Groundwater Source (MTSGS) which occurs in the Maroota Sands deposit and in the upper (weathered) part of the Hawkesbury Sandstone (eluvial sands).
- The Hawkesbury Sandstone, a regional fractured rock aquifer that forms part of the Sydney Central Basin Groundwater Source (SCBGS).

A schematic representation of these aquifers, which references the geological formation of **Figure 2.2**, is provided in **Figure 2.3**.

The MTSGS is directly recharged by infiltration of rainfall and local runoff, and downward percolation to the water table, or to any perched water table present. The SCBGS is recharged by infiltration of rainfall and runoff in areas where fresh rock outcrops at the ground surface, or through downward leakage from overlying Maroota Sands, alluvium or eluvium. Groundwater levels in both units display fluctuations that relate to episodic recharge associated with major rainfall events. The recharge responses are particularly marked in the Maroota Sands (Dundon, 2018).

The water level of the MTSGS has been monitored and recorded at the Quarry (from 13 monitoring bores) since 2005 with a strong relationship between rainfall and groundwater level confirmed (Dundon, 2018). Based on this monitoring data, Dundon (2018) established that the Maroota Sands regional water table is only present within the central part of the Quarry Site, as the top of the Hawkesbury Sandstone rises above this water table level across the western and eastern flanks of the paleovalley. Dundon (2018) also established a Wet Weather High Groundwater Level (WWHGL) for the aquifers below the Quarry where Condition 17 of DA 267-11-99 defines the WWHGL as the *'rolling average of all recorded groundwater level measurements at any monitoring location on the site, as first recorded following any rainfall event of at least 50 mm over any 24-hour period, and as contour mapped using this data'*.

Below the Quarry, the WWHGL has been calculated using the water level data from the historical monitoring records for all available monitoring bores on the site, taken immediately after any rainfall exceeding 50mm in any day (as recorded at the BoM Maroota (Old Telegraph Road) meteorological station). The WWHGL of the Maroota Sands deposit rises from 184 m AHD in the north to 186 m AHD in the south. The WWHGL of the Hawkesbury Sandstone occurs below this elevation rising from 175 m AHD to 179 m AHD in a north-west to south-east direction (Dundon, 2018).



0 100 200 300 400 Meters

GCS North American 1927

Legend

Quarry Site

SREP9-2 area within Hornsby LGA

SREP9-2 area within The Hills LGA

Cadastral boundary

Watercourse

Roads

Surface Geology

Holocene

Eluvial sand

Basalt

Tertiary

Maroota sand - Clay and silty clay

Maroota sand - Clayey gravel, gravelly sand, clayey sand, pebbly sand and sand

Maroota sand - Ferruginised sand and silty clay

Triassic

Ashfield shale - Shale and laminate

Hawkesbury sandstone - Quartzose sandstone with shale lenses

FIGURE 2.2

Local Geology and Groundwater

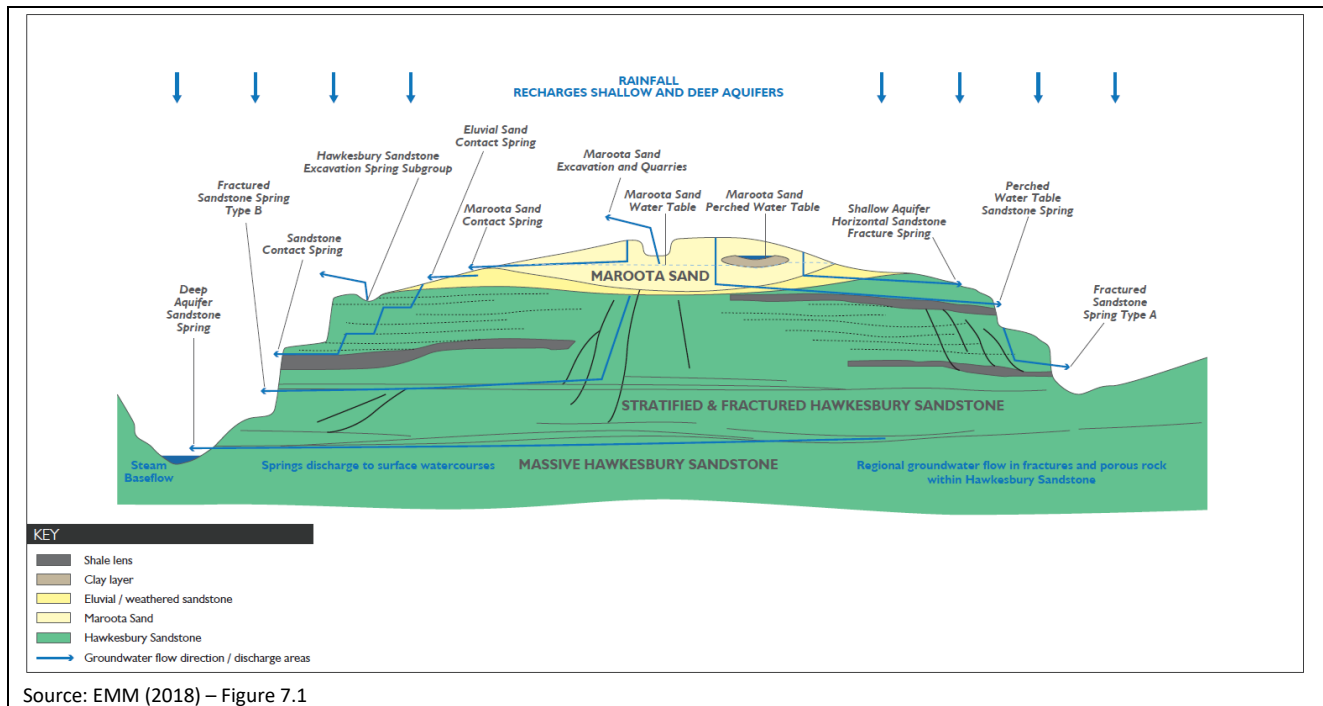


Figure 2.3 Conceptual Hydrogeological Model – Maroota Sands and Hawkesbury Sandstone

In accordance with DA 267-11-99 and the Quarry *Groundwater Management Plan* (Dundon, 2018), the WWHGL will continue to be reviewed based on groundwater monitoring data and extraction will remain at least 2 m above this level. Direct impact on local groundwater is therefore not expected.

2.5 Biodiversity

The Quarry Site represents a mostly cleared and highly disturbed environment dominated by introduced pasture and herbs. As noted in the Quarry *Flora and Fauna Management Plan* (VGT Compliance Solutions Pty Ltd and NGH Environmental, 2016), and identified on **Figure 2.1**, the most notable remnant native vegetation remaining includes:

- a strip of trees along the southern fence line including white stringybark, grey gum, blue mountains mahogany, red bloodwood, rough-barked apple and black she-oak
- a stand of white stringybark, white mahogany and a few blue mountains mahogany species to the north of the Quarry entrance
- a scrubby area and stand of trees containing yellow tea-tree, tick bush, scale-rush, kikuyu and whisky grass also north of the Quarry entrance.

Suitable habitat for native fauna is very limited on the Quarry Site with no suitable tree hollows for bats, birds and arboreal mammals. The dams on the Quarry Site provide limited habitat for waterfowl and frogs.

2.6 Sensitive Receivers

A number of private residences are located within close proximity to the Quarry Site, along Roberts Road, Old Telegraph Road and Old Northern Road, as shown in **Figure 2.1**. Extraction is currently approved to within 30 m of Old Northern Road and Roberts Road and 10 m of the northern boundary of Lots 1 and 2 DP 228308.

3.0 Existing Operations

3.1 Existing Approvals

In addition to DA 267-11-99, which has been modified three times since approval in May 2000, the Applicant holds Environment Protection Licence (EPL) 6535 for the scheduled activities of crushing, grinding or separating and extractive activities (as listed in Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act)). EPL 6535 establishes conditions relating to air, water and noise emissions from the site.

The site also holds a number of licences issued under the *Water Management Act 2000*, for the operation of groundwater bores and dams. Locations of these bores and dams are shown on **Figure 3.1** and a summary of licences and their current status is provided in **Table 3.1**.

Table 3.1 Water Licences Summary

Licence No.	Identification	Allocation	Purpose	Expiry
Surface Water Access and Use				
WAL 26163	Nursery Dam	264.0 ML per year	Irrigation	16/02/2026
Groundwater Access and Use				
WAL 24163	PB1	45.0 ML per year	Extraction	14/06/2025
WAL 24157	PB2	6.0 ML per year	Extraction	Continuing

3.2 Description of Existing Operations

3.2.1 Resource, Product and Markets

3.2.1.1 Resources

A recent resource assessment of the Quarry completed by VGT Environmental Pty Ltd identified 2,900,000 m³ of combined sand, sandstone and clay remaining within the approved extraction area (see **Appendix 3**). Further analysis by VGT identified that this included approximately 235,000 m³ of clay (see **Appendix 4**). Excluding the clay and applying an average density of 2.0 t/m³, approximately 5.3 million tonnes (Mt) of sand and sandstone remain to be extracted.

The in situ resource to be extracted will remain unchanged by the Proposed Modification.

The Applicant is proposing to import VENM and ENM, both as a backfill material to assist in the rehabilitation of the Quarry, as well as a feed stock for crushing, screening and washing to produce sand products. Section 4.2.2 provides a description of the VENM and ENM importation and management.

3.2.1.2 Products and Market

The Quarry currently produces a range of coarse, fine and ultra-fine sand and pebble products to the Sydney construction and landscaping market.

No change to the current product range or key markets is proposed.

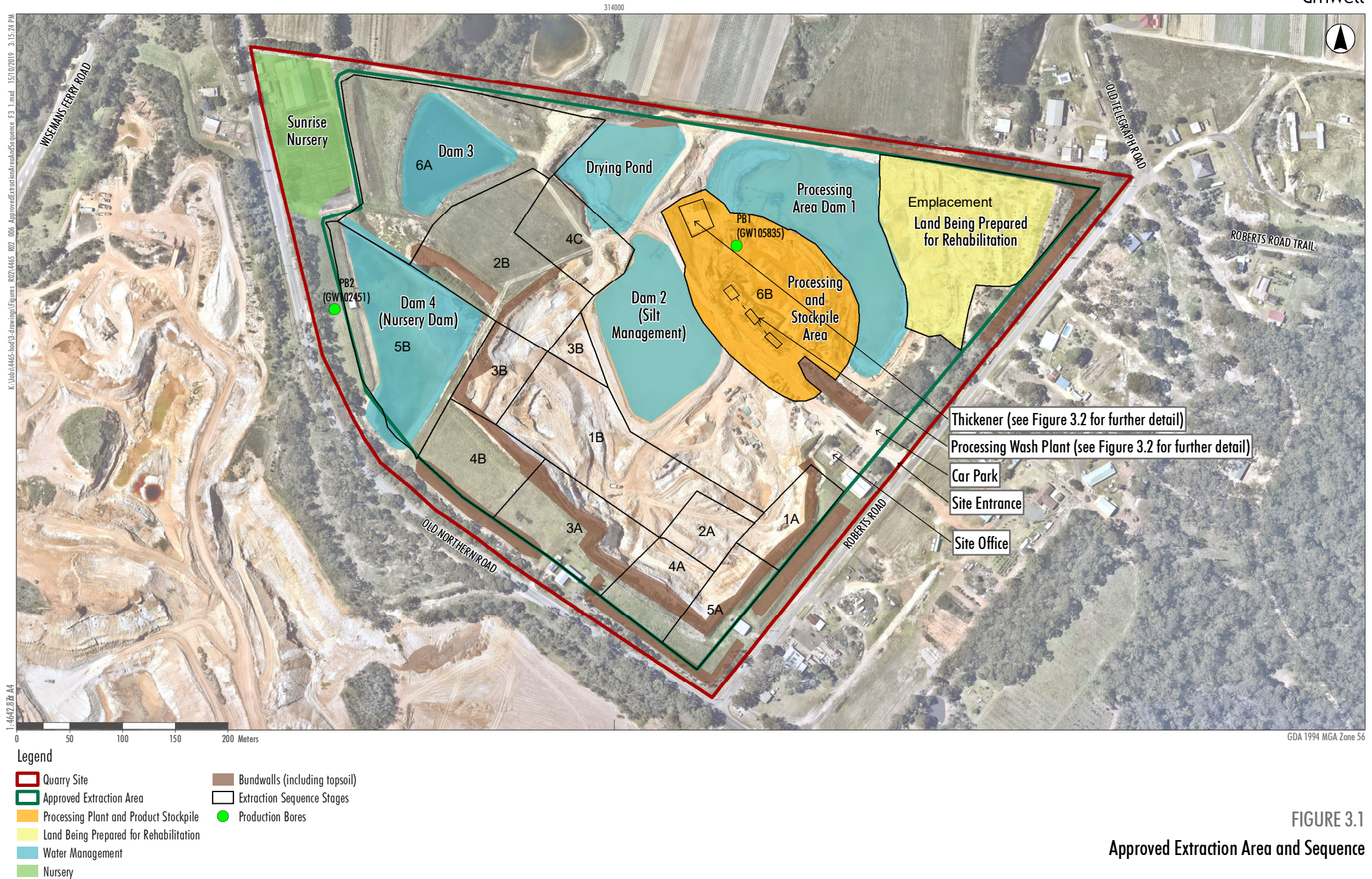


FIGURE 3.1
Approved Extraction Area and Sequence

3.2.2 Extraction

3.2.2.1 Extraction Area

Extraction is approved to within 30 m of Old Northern Road and Roberts Road and 10 m of the northern boundary of Lots 1 and 2 DP 228308 (refer to **Figure 3.1**).

Extraction is also required to remain at least 2 m above the wet weather high groundwater level of the regional Maroota Sands aquifer (185 m AHD as identified by Dundon Consulting Pty Ltd as part of a Groundwater Study Report in 2018 (Dundon, 2018)).

No modification to the approved extraction area is proposed.

The proposed importation and use of VENM and ENM as a backfill material would require additional areas of the extraction area to remain exposed for longer periods of time. Section 4.2.4 provides a description of the proposed modified management of active and exposed areas of the Quarry.

3.2.2.2 Extraction Operations

Following the stripping of topsoil for future reapplication over the final landform, the sand, clay and pebble material is extracted using an excavator and either stockpiled for in-pit dry screening or loaded onto a dump truck and transported to the processing area.

Extraction of sand is contingent upon a water supply dam in order to wash the clay from the material won.

Extraction takes place across the site in a staged manner, as defined in the site *Environmental Management Strategy* (VGT, 2018).

No modification to the method of extraction is proposed.

3.2.2.3 Extraction Sequence

The current sequence of extraction involves progressive development to the south and west from the currently central extraction area (refer to **Figure 3.1**). Eventually, Dams 3 and 4 are to be drained and sand resource extracted, followed finally by the relocation of the processing plant and extraction from this area.

While the extraction sequence is not prescribed by DA 267-11-99, *Condition 29(c)* limits the area of active extraction which can be operated at any one time requiring “... *that no more than 3 hectares of the site are exposed and active at any one time*”.

A modified extraction sequence is proposed to allow for more effective backfilling with VENM and ENM. It is also proposed to remove the limitation on exposed and active areas to allow for the proposed backfilling operations. The Proposed Modification to extraction sequence and management of active areas is described in Section 4.2.4.

3.2.4 Processing

The excavated material is, as required, fed to a dry screen operated within the extraction area to remove large rocks and organic material prior to transfer to the processing plant (refer to **Figure 3.1**). The raw or dry screened feedstock is then delivered to the primary processing plant which incorporates the following components.

- A loading hopper which feeds a vibrating wet screen and log washer.
- A second vibrating screen which separates the larger diameter pebble from the sand and clay. Pebble is subsequently delivered by conveyor to stockpile, while the sand and clay is delivered via belt feeder to a mixing tank where the fines component (silt and fine clay) is removed. An electric pump at the water storage dam (Process Dam 1) pumps water to the mixing tank via a pipeline. The mixing of sand and water in the wash plant allows for the heavier sand to fall to the bottom of the tank with the smaller diameter silts and clays remaining suspended in the water.
- The heavier sands are then screened into various size fractions and stockpiled adjacent to the plant area for drying and sale.
- The water/silt mixture (tailings) is pumped to a tailings bin before being pumped to a thickener for dewatering, with the water returned to the processing circuit and dewatered tailings pumped to silt ponds constructed within the extraction area where it is spread in thin layers to dry. Liberated water is drained to the water dam for re-use in the processing plant.
- Water is periodically drawn off the silt ponds and returned to the washing circuit. The consolidated tailings are to be incorporated as a backfill material in the preparation of the final landform.

Figure 3.2 presents (schematically) the layout of the primary processing plant, in its current arrangement, noting that this may be subject to variation in arrangement and specific equipment over the life of the Quarry to satisfy changes to the characteristics of the raw feed and product specific requirements.

For every tonne of raw feed (sand/silt), approximately 5.4 kL of water is required to remove the silt which represents between 20 and 30% of the raw feed by volume. Approximately 4 to 8% of the water added is retained within the product sand (and reduced to a product sand moisture content of 4 to 5% as a result of evaporation and seepage from stockpile). A further 5 to 15% is lost to evaporation of seepage from the Drying Pond, although this has been reduced through the operation of the thickener which minimise the volume of water sent to the Drying Pond. The water is ultimately recycled from the Drying Pond as the silt settles and is periodically excavated and used to backfill the completed areas of the extraction area as part of Quarry rehabilitation (refer to **Section 3.2.9**).

Other than the possibility of VENM and ENM feed stock being processed, no modification to the processing operations of the Quarry are proposed.

3.2.5 Transportation

The Quarry is accessed via a sealed driveway which intersects with the northern side of Roberts Road, approximately 290 m to the east of the junction between Roberts Road and Old Northern Road (refer to **Figure 3.1**). Road registered trucks are directed to the sales stockpile where they are loaded by front-end-loader before dispatch from the Quarry via weighbridge and the same entrance.

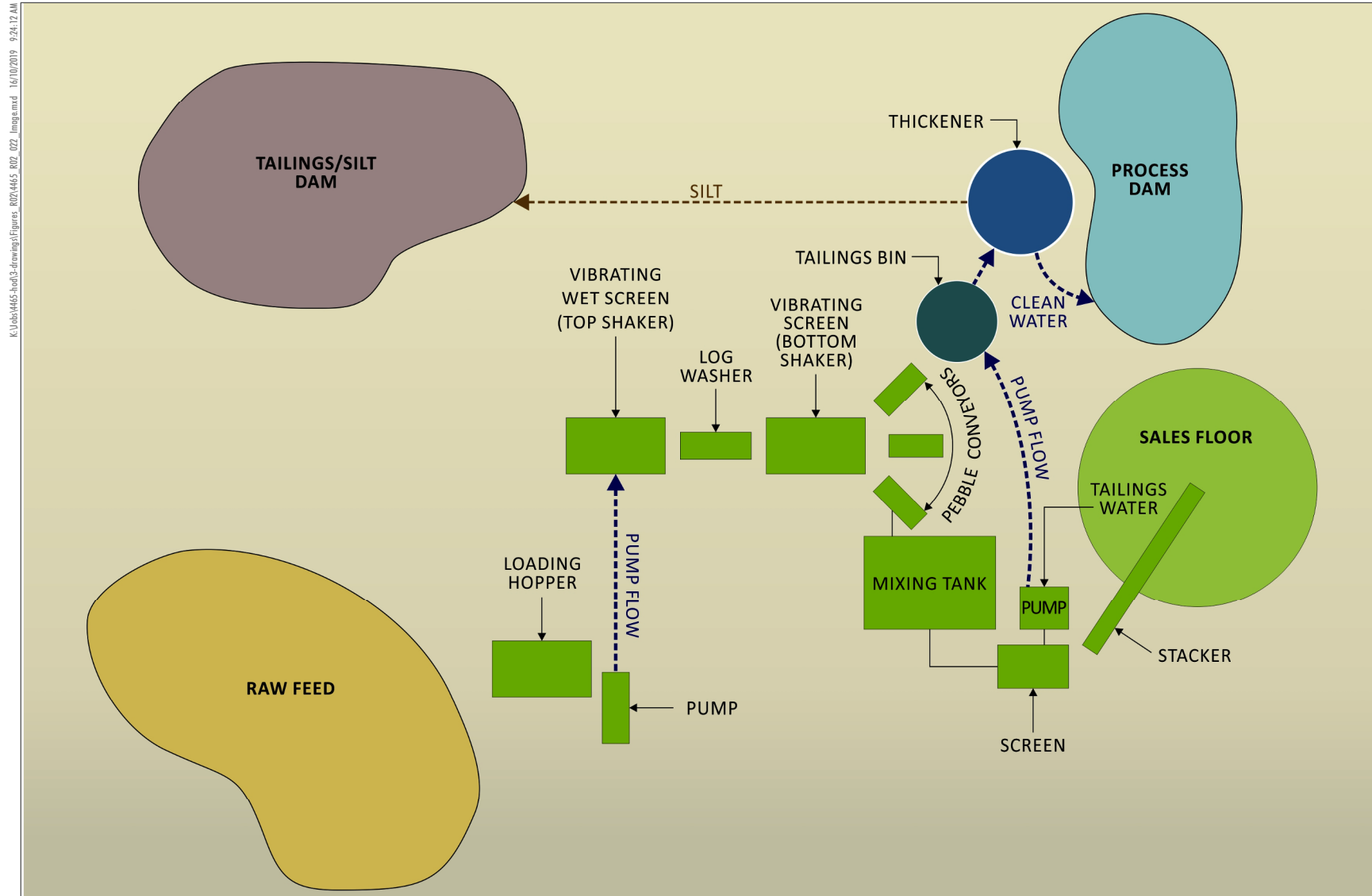


FIGURE 3.2
Operations Schematic

DA 267-11-99 allows for the movement of up to 50 laden trucks (100 movements) per day and a maximum of 20 movements per hour. The trucks deliver sand and other quarry products principally to the Sydney construction market with approximately 20% heading south-east on Old Northern Road towards Pennant Hills Road and the majority (approximately 80%) heading north-west before turning onto Wisemans Ferry Road 900 m north of Roberts Road.

To account for the importation of VENM and ENM, the Applicant proposes an increase in the number of daily traffic movements generated by the Quarry. The Proposed Modification and management of traffic movements is described in Section 4.2.5.

3.2.6 Site Infrastructure and Equipment

The following key infrastructure of the Quarry is identified on **Figure 3.3**.

- Site office and parking. The main Quarry office is located within a converted residence and adjoining demountable structure located adjacent to the Quarry entrance. Car parking for 1 to 2 vehicles is provided at the Quarry office, with parking for a further 3 to 4 vehicles provided in a designated visitor car parking area on the opposite site of the Quarry entrance driveway.
- A calibrated weighbridge is located opposite the main Quarry office.
- A bunded fuel and oil storage area provides for the storage of 21,000 L of diesel fuel and up to 5,000 L of oil. The bunded area includes space for IBCs which contain any waste oil collected from mobile equipment operating at the Quarry.
- Internal roads are maintained as required to allow for efficient movement of mobile equipment, haul trucks and road-registered trucks. As far as practicable, these roads are managed to avoid interaction between the on-site and road-registered fleets.
- A series of water storage dams are maintained on the Quarry Site. Dams 1 and 2 are managed primarily for the collected and clarification of water discharged from the processing operations. Dams 3 and 4 are managed preferentially for the containment of clean water runoff which is drawn on by the processing operations (as described in **Section 3.2.3**).

In addition to the above infrastructure, **Table 3.2** identifies the mobile fleet currently operated at the Quarry, noting that this may change over the life of the Quarry.

Table 3.2 Current Mobile Equipment

Equipment	Use	No. used on site	Usage (h/day)
Excavator - PC350 Komatsu	Sand excavation	1	8
Excavator - ZX240 Hitachi	Sand excavation	1	2
Excavator - ZX330 Hitachi	Sand excavation	1	8
Front-end Loader - L180G Volvo	Loading trucks (raw feed, reject and products)	2	8
Bulldozer - 375A Komatsu	Surface stripping, landform creation and miscellaneous earthmoving tasks	1	1
Dump Truck A40D - Volvo	Transfer of raw feed and reject	2	8
Water Cart	Dust minimisation	1	3

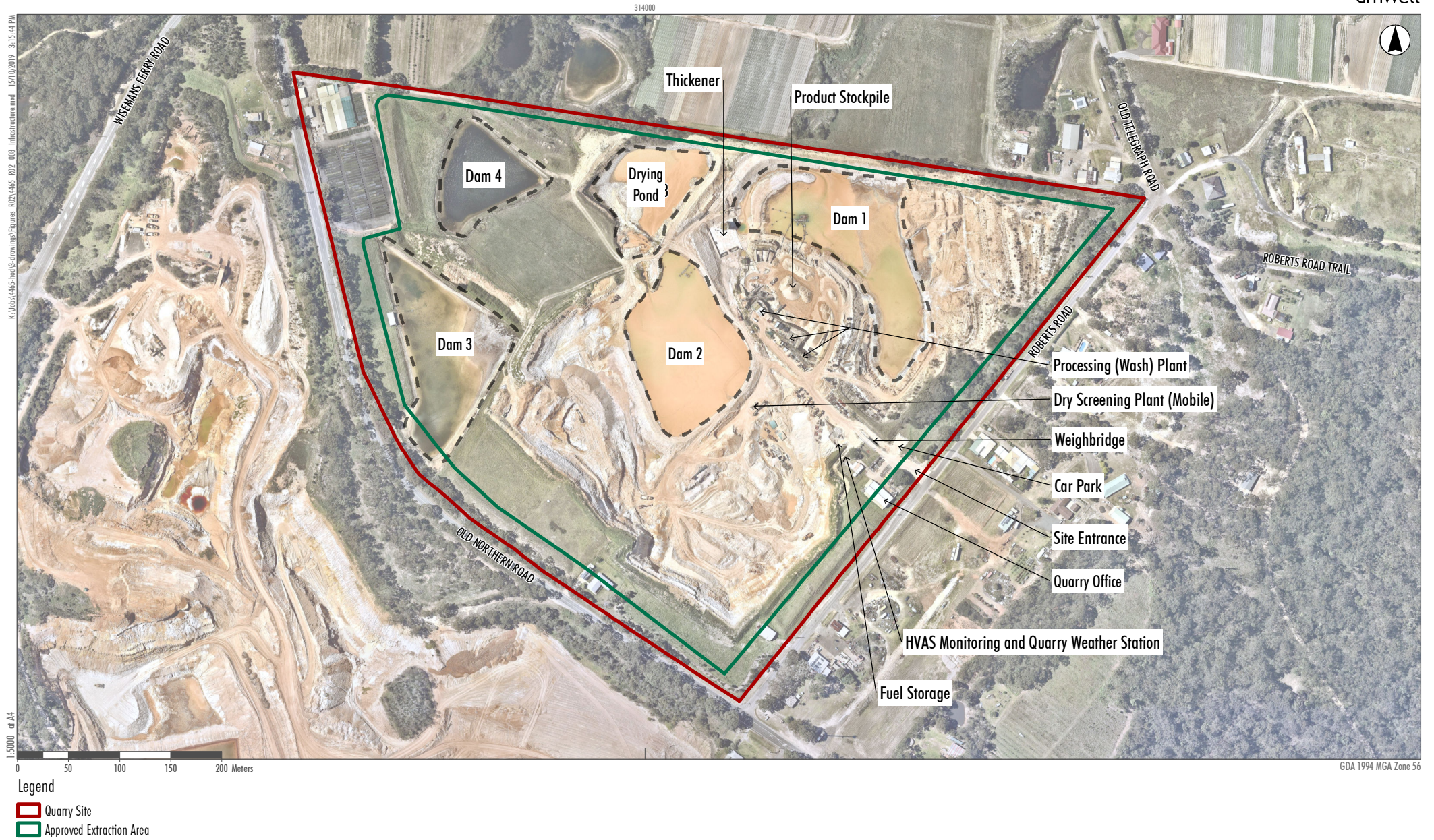


FIGURE 3.3
Quarry Infrastructure

The Proposed Modification would require an increase in the utilisation of the quarry's mobile fleet, as well as modified use of the Quarry front-end loaders, for management of the VENM and ENM. This is described in Section 4.2.2.4.

3.2.7 Operating Hours and Workforce

The current approved hours of operation for the Quarry are as follows:

- Construction: 7.00 am to 6.00 pm Monday to Friday
- Extraction and Processing: 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturdays
- Vehicle loading: 6.00 am to 6.00 pm Monday to Friday and 6.00 am to 1.00 pm Saturdays.

No works are undertaken on Sundays or Public Holidays. The Quarry has a current workforce of 10 full-time employees.

No modification to hours of operation or workforce is proposed.

3.2.8 Services and Utilities

The Quarry Site is serviced by electricity and telecommunications networks but is not connected to potable water or sewerage services. Operational water used for dust suppression and product washing is sourced from water captured and stored on site in the water storage dam.

Water for drinking and washing is drawn from rainwater tanks sited near the office, workshop and lunch-room. Wastewater from showers and toilets is treated via an onsite wastewater treatment system.

No modification to the services and utilities of the Quarry is proposed.

3.2.9 Rehabilitation

Rehabilitation of the Quarry is approved to be undertaken in accordance with the Quarry *Landscape and Rehabilitation Plan* (LRP) (VGT, 2017). The overall objective of Quarry rehabilitation is to produce a final landform that is safe, stable and non-polluting, is integrated with surrounding landforms as far as is reasonable and feasible and to minimise visual impacts when viewed from surrounding land.

The current approved plan for the final landform is to create an internally draining basin with perimeter slopes of approximating 3 Horizontal : 1 Vertical (3H:1V) (refer to **Figure 3.4**). The final landform, which will retain the various vegetated bund walls surrounding the extraction area, is approved to be revegetated as a predominantly native grassland with an intended final land use for future agricultural activities. The bund walls, extraction area perimeter and current stands of woodland vegetation around the Quarry Site are to be maintained as native woodland to provide visual screening and habitat for native fauna.

The landform is to be constructed using the silts washed from the sand and consolidated in the Drying Pond (Dam 2) or thickener. The clay bands which are present through the sand resource (refer to **Appendix 4**) also provide a source of backfill material for landform construction. The LRP provides for a variety of revegetation methods, dependent on final slope and proximity to drainage, including:

- hydromulch application (flat or very shallow slopes)
- tubestock planting (on slopes of <3H:1V)
- application of jute mesh and pocket planting of tubestock (on slopes of ≥3H:1V).



Legend

- | | |
|---|--|
| Quarry Site | Native Vegetation |
| 5m contour | Native Woodland |
| Rehabilitated Landform/Community | Retained Infrastructure |
| Nursery | Retained/Undisturbed Vegetation |
| Water Storage | |
| Native Grassland | |

FIGURE 3.4
Approved Final Landform

Figure Three of the LRP (included as **Appendix 5**), provides further detail on the final landform revegetation strategy.

The floor of the constructed basin will remain above the WWHGL and fall very gently to the east to form a dam. The battered faces will be constructed with clay overburden and interburden, as well as the consolidated silt collected in the silt ponds, and vegetated primarily with endemic native vegetation.

As a result of the proposed importation VENM and ENM and application of these materials to land, the final landform to be constructed would be modified. Section 4.2.7 provides a description of the proposed modified final landform. Section 7.9 provides a review of the proposed rehabilitation of the Quarry against objectives.

3.3 Environmental Management

The Quarry has an established environmental management system (EMS) which comprises of an *Environmental Management Strategy*, a range of environmental management plans (EMPs) and an environmental monitoring program. The *Environmental Management Strategy* provides the strategic context for the environmental management of the quarry, while the EMPs provide detail on the management of key environmental issues. The EMS and EMPs have been developed in accordance with the conditions of the current development consent.

As the Proposed Modification would be a continuation of the existing Quarry operations, ongoing implementation of the EMS would be the most efficient and effective way to manage site operations. The existing EMS will therefore be updated to reflect the changes associated with the Proposed Modification and implemented for the ongoing operations, pending approval of the modification.

The key existing EMPs that will assist in the management of operations undertaken as part of the Modification include:

- Operational Environmental Management Plan
- Air Quality Management Plan
- Water Management Plan, incorporating sub-plans for both groundwater and surface water
- Noise Management Plan
- Flora and Fauna Management Plan
- Construction Environmental Management Plan
- Landscape and Rehabilitation Plan
- Pollution and Incident Response Management Plan.

Details of how these plans will be updated and applied to the Proposed Modification, are discussed in the relevant environmental assessment section of this report (refer to **Section 7.0**).

3.4 Environmental Performance

The latest Annual Review and Compliance Report for the Quarry covers the period January to December 2018 and was prepared by VGT Environmental Compliance Solutions Pty Ltd (VGT) in 2019 (VGT 2019) as required under Condition 6 (Conditions Compliance Report) and 66 (Annual Review) of the consolidated development consent (DA267-11-99).

The review assessed the performance of the Quarry against the conditions of the consolidated consent, EPL and water management licences. The main findings of the review are outlined below:

- There were no complaints received by the Quarry during the reporting period.
- Dust deposition (insoluble solids), total suspended particulates (TSP), and particulate matter less than 10 µm in diameter (PM₁₀) were all compliant with consolidated consent criteria and predictions from environmental assessments.
- The particulate matter less than 2.5 µm in diameter (PM_{2.5}) exceeded the NEPM advisory guideline (25 µg/m³ for 24 hours) six times in the reporting period. On each occasion, the reported PM_{2.5} concentration was higher than the corresponding PM₁₀ concentration indicating an error in reporting. If the respective results for PM_{2.5} and PM₁₀ were reversed, the number of exceedances would be reduced to four. On analysis of each exceedance, it was determined these were most associated with hot, dry windy conditions and periods of clearing and ploughing on an adjacent property.
- No uncontrolled surface water discharges occurred during the reporting period.
- Water depth monitoring showed that all surface water bodies were above the level of the groundwater in both Maroota Sands and Hawkesbury Sandstone aquifers during the reporting period.
- Attended noise monitoring identified that operational and road noise emissions generated by the Quarry complied with relevant statutory noise limits during the reporting period. Furthermore, project related noise emissions are generally masked by extraneous non-quarry sources.

Limited rehabilitation has been undertaken on the site due to the cell staging that has been required. As a result, and following receipt of the 2018 Annual Review, the DPIE requested clarification of the calculation of active and exposed areas and, if non-compliant, a commitment and timing for a return to compliance.

The Applicant subsequently provided the DPIE with the requested information, and a return to compliant operations was completed by 31 March 2019. In light of the Proposed Modification to import and use VENM and ENM as backfill material on the Quarry Site, restricting 'exposed and active' areas to 3 ha will be impractical. The Proposed Modification therefore seeks a modification to Condition 29(c) to remove reference to the limit on 'exposed and active' areas.

4.0 Proposed Modification

4.1 Summary of the Proposed Modification

A summary of the key components of the Proposed Modification compared to the existing approved operations is provided in **Table 4.1**.

Table 4.1 Comparison of Approved Operations and Proposed Modification

Aspect	Approved Operations	Proposed Modification
Limits of production	Not specified (limited by transport movements)	480,000 tpa
Extraction method	Manual excavation (no blasting)	No change
Maximum depth of extraction	Restricted to 2 m above the wet weather high groundwater level of the regional aquifer	No change
Quarry footprint	Restricted by 30 m buffer to Old Northern Road and Roberts Road and 10 m to northern property boundary	No change
Material importation	None	Up to 40 truck movements per day for the importation of VENM and ENM (refer to Section 4.2.2)
Material processing	In-pit dry screening, wet screening and sand washing	In-pit dry screening, wet screening and sand washing plus selected blending with imported VENM and ENM (refer to Section 4.2.3)
Exposed and active areas	3 hectares	No limits (refer to Section 4.2.4)
Overburden management	Bund and dam construction and void backfill (rehabilitation)	No change
Product transport	Maximum of 100 truck movements per day at a maximum rate of 20 truck movements per hour	Maximum of 140 truck movements per day at a maximum rate of 20 truck movements per hour (refer to Section 4.2.5)
Site access	Via sealed driveway on Roberts Road	No change
Employment	Up to 10 full time employees	No change
Hours of operations	As described in Section 3.2.7	No change
Quarry life	31 May 2025	31 May 2030 (refer to Section 4.2.6)
Rehabilitation and final landform	Internally draining basin (depth 187 mAHD) constructed using clay overburden/interburden and consolidated silts	Free draining basin (subject to availability of VENM and ENM) to the north constructed using clay overburden, imported VENM and ENM and consolidated silts (refer to Section 4.2.7)

A description of the proposed changes is provided in the following sections.

4.2 Description of the Proposed Modifications

4.2.1 Overview

As identified through **Section 3.0**, Quarry operations are to continue generally in accordance with the current limits and restrictions imposed by DA 267-11-99. The following provides a description of the key changes to Quarry operations proposed by this modification.

4.2.2 VENM and ENM Management

4.2.2.1 Classification

The material to be used for filling will consist of material classified as VENM or ENM. The *Protection of the Environment Operations Act 1997* (POEO Act) defines VENM as:

‘virgin excavated natural material means natural material (such as clay, gravel, sand, soil or rock fines):

- (a) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities, and
- (b) that does not contain any sulfidic ores or soils or any other waste,

and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.’

The *Excavated Natural Material Exemption 2014* (ENM Exemption) under Part 9, Clause 91 and 92 of the *Protection of the Environment Operations (Waste) Regulation 2014* (POEO (Waste) Reg.) defines ENM as:

‘Excavated natural material is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

- a) been excavated from the ground, and
- b) contains at least 98% (by weight) natural material, and
- c) does not meet the definition of Virgin Excavated Natural Material in the Act.

Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos, Acid Sulfate Soils (ASS), Potential Acid Sulfate soils (PASS) or sulfidic ores.’

4.2.2.2 Volume

While subject to availability and market, the Applicant has targeted the importation of between 800 and 1,200 t of VENM and ENM daily. This equates to between 200,000 and 320,000 tpa and between 2,000,000 and 3,000,000 t over the remaining life of the Quarry. While subject to some variability, an average density of the loose material to be imported has been estimated as 1.67 t/m³.

To account for possible fluctuation in the availability of VENM and ENM over the life of the Quarry, the final landform has been considered based on the availability of 1,200,000 m³ (2,000,000 t) and 2,000,000 m³ (3,000,000 t) backfill material. Backfill material includes VENM, ENM, clay overburden and consolidated silts.

4.2.2.3 Importation Management and Control

A VENM/ENM Importation Protocol would be developed and implemented prior to the commencement of material importation. The VENM/ENM Importation Protocol would specify the relevant requirements in relation to:

- source material
- site validation and tracking procedures
- method of transportation
- stockpiling of fill material
- placement and certification of fill material.

The VENM/ENM Importation Protocol would require that for each potential source of fill material an assessment report is prepared to confirm that the potential fill material is suitable for use within the Quarry. The assessment report would, as a minimum, include:

- a description of the source material
- the anticipated volume of the material to be imported from the site
- the fill source location
- photographs showing the condition of the site
- NATA stamped laboratory analysis certificates (where required), including Quality Assurance/Quality Control Data
- an assessment of whether the material is VENM or ENM in accordance with the requirements of the POEO Act and POEO (Waste) Reg.

Where the material imported is ENM, the assessment report must include a validation certificate that complies with the requirements of the ENM Exemption. The validation certificate must demonstrate that the fill material is free from contaminants and weeds, that it is suitable for its intended purpose and land use, and that it will not pose an unacceptable risk to human health or the environment.

A material tracking register is to be maintained to ensure that only VENM or ENM is imported to the site. A Quarry staff member would be assigned during importation campaigns to verify loading dockets and record delivery details. Site access will be locked after hours to prevent unauthorised dumping of material.

4.2.2.4 Application to Land

On exhaustion of the sand resource from sections of the approved extraction area, the Applicant would excise these from extraction operations and create an access road and tipping point for trucks delivering the VENM and ENM.

The Quarry bulldozer and one of the front-end loaders would be used to load, push and profile the VENM and ENM material to:

- create a flat surface for tipping
- profile the tipped VENM and ENM into the preferred landform.

While no additional equipment would be required to enable the additional backfill operations to be completed, utilisation of the current mobile fleet would increase (refer to **Table 4.2**). Specifically, the bulldozer would potentially be fully utilised each day for the pushing and profiling of the VENM and ENM to create the final landform.

Table 4.2 Modified Mobile Equipment Schedule

Equipment	Used for	No	Usage (hr per day)
Excavator - PC350 Komatsu	Excavation	1	8
Excavator - ZX240 Hitachi	Excavation	1	2
Excavator - ZX330 Hitachi	Excavation	1	8
Front-end Loader - L180G Volvo	Loading trucks and management of imported VENM and ENM prior to profiling	2	8
Bulldozer - 375A Komatsu	Surface stripping, VENM and ENM profiling and miscellaneous earthmoving tasks	1	8
Dump Truck A40D - Volvo	Transfer of raw feed and reject	2	8
Water Cart	Dust minimisation	1	6

Note: **bold** references modification from existing operations

The Applicant is targeting a final landform which is free-draining, thereby reinstating natural drainage and catchments at the conclusion of Quarry operations (refer to **Section 4.2.7**).

4.2.3 Processing Operations

A portion of the imported VENM or ENM, which is of high sand content, may be used to blend with on-site sand to produce additional material for sale. The likely source of such material would be friable sandstone from tunnelling or construction projects where the material is able to make up at least 30% of the final product.

This material would be identified prior to delivery to the Quarry and placed in stockpiles either adjoining the raw feed sand stockpiles or within the extraction area away from active extraction or backfill activities.

From stockpiles, the material would be screened to either remove large rocks and organic material, or produce a specific size fraction. Screened material unsuitable for this purpose would be managed as backfill material (refer to **Section 4.2.2.4**).

The screened sandstone/sand would then be stockpiled along with the extracted in situ sand for sale or further blending with the extracted in situ sand resources. Blending may be undertaken by manual combination using available mobile equipment, e.g. front-end loader or excavator, or as a supplementary feedstock to the processing circuit as described in **Section 3.2.3**.

It is noted that prior to processing and sale of the imported ENM in this way, the Applicant would:

- ensure that EPL 6535 has been varied to include Resource Recovery and Waste Storage as activities,
- provide for the payment of the relevant waste levy in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014* (POEO (Waste) Reg), or
- obtain a specific Resource Recovery Exemption for the processed material.

This would extend, and therefore maximise, the life of the extractable resource within the Quarry.

4.2.4 Exposed and Active Area Management

Condition 29(c) of DA 267-11-99 requires the Quarry to provide for ‘a planting and watering regime to ensure that no more than 3 hectares of the site are exposed and active at any one time’. The proposed importation and use of VENM and ENM as backfill material on the Quarry Site makes this limitation impractical as the Applicant will be required to operate an extraction area as well as a VENM/ENM backfill area concurrently. The Applicant also notes that the composition and properties of the sand also varies across the site. As a result, the Applicant undertakes extraction from different extraction areas with the Quarry to allow for concurrent extraction of coarser (low clay content) and finer (higher clay content) sand which allows for optimal blending and production to suit a variety of customers.

Figure 4.1 provides an indicative illustration of the proposed active and exposed areas of the Quarry considering the importation and land application of the VENM and ENM and operation of separate coarse sand and fine sand extraction area (noting this sequence may be subject to variation over the life of the Quarry). As illustrated in **Figure 4.1**, the active and exposed areas would be much larger than the current 3 ha limit.

The potential impact on the increased active and exposed areas on air emissions and visual amenity are assessed in **Sections 7.5** and **7.8** respectively.

4.2.5 Traffic Management

To accommodate the importation of VENM and ENM, the Proposed Modification also includes an increase to the approved daily truck movements from 100 movements (50 laden trucks) to 140 movements.

Where possible, the Applicant would seek to undertake ‘double trucking’ whereby an inbound laden truck (VENM/ENM) would unload and then be reloaded with Quarry product for despatch.

No change to the approved hours of operation is proposed, nor any increase to the maximum number of hourly traffic movements (20 movements).

4.2.6 Production Limit and Quarry Life

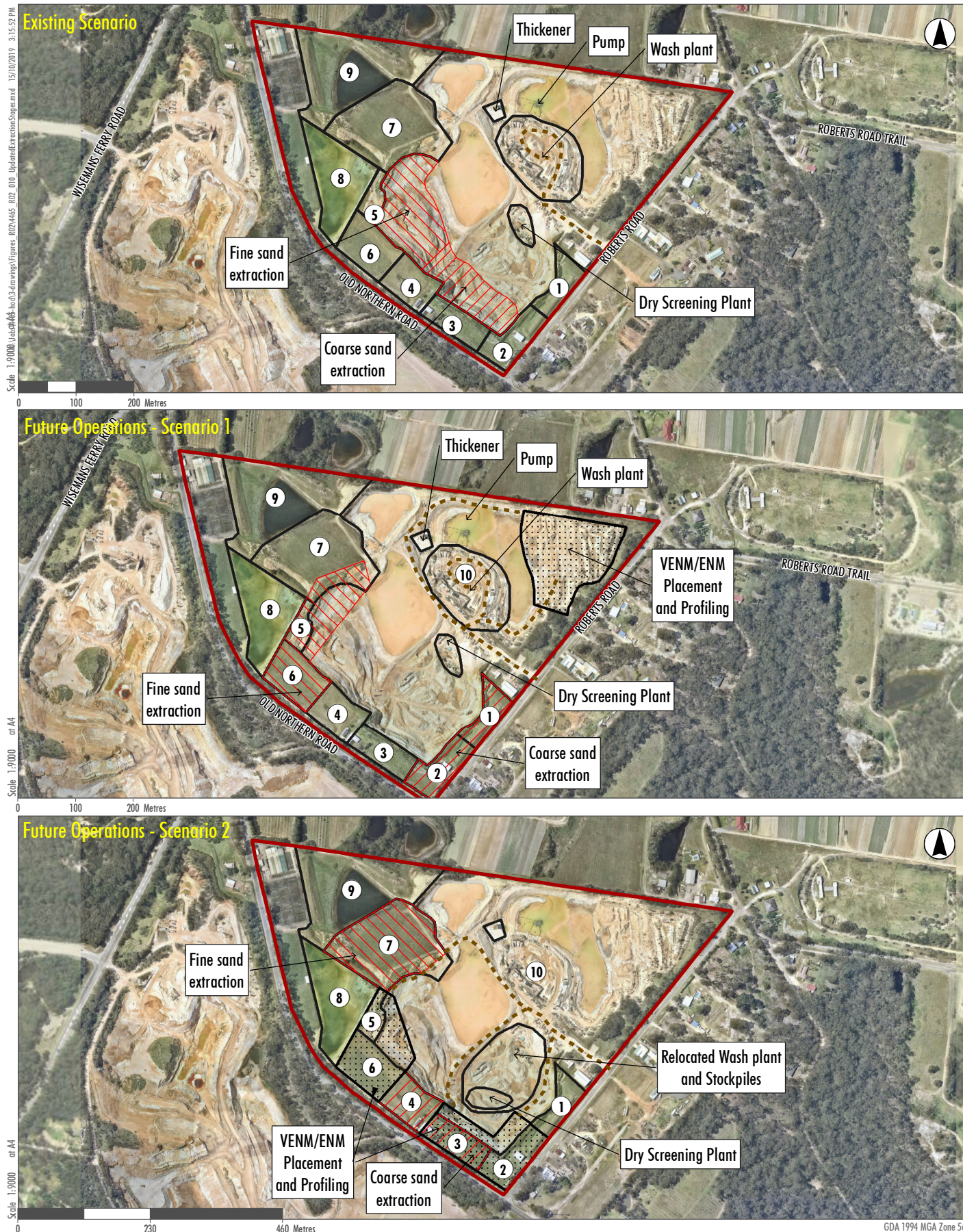
4.2.6.1 Production Limit

There is currently no limit on the production rate imposed by DA 267-11-99, with production being effectively limited by the number of laden trucks which may be dispatched from the Quarry. Based on the delivery of the maximum 50 laden trucks per day, six days per week, with an average payload of 32 t and operations 50 weeks per year, a practical maximum of 480,000 tpa is imposed. Noting the proposed increase in daily truck movements or an increase in the average payload of trucks would allow for an increase in this theoretical production limit, the Applicant proposes to retain 480,000 tpa as a production limit for the Quarry.

4.2.6.2 Quarry Life

Based on the recent assessment of available resource (refer to **Appendix 3**), incorporation of a small proportion of imported VENM/ENM into Quarry products, and production at the maximum rate of 480,000 tpa, the Quarry would continue to operate for a further 11 years.

An extension to the period of approved operations of 5 years (to 31 May 2030) is therefore proposed.



- Legend**
- Quarry Site
 - Quarry Features
 - Coarse sand extraction
 - Fine sand extraction
 - VENM/ENM Placement and Profiling
 - Road Truck Routes

Image Source: Nearmap (2018) Data source: DFSI (2017, 2019)

FIGURE 4.1

Indicative Quarry Operating Sequence

4.2.7 Final Landform and Rehabilitation

4.2.7.1 Final Landform and Land Use

Two conceptual final landforms have been developed to account for possible variability of available backfill material. The two landforms are based on

- 1,200,000 m³ available backfill material (refer to **Figure 4.2**)
- 2,000,000 m³ available backfill material (refer to **Figure 4.3**).

Both conceptual final landscapes are designed to be free draining. A final dam that drains to the Cooper Creek Catchment to the north would be retained in the vicinity of the current Processing Area Dam 1. The dam would be located at 190 m RL and therefore will be above the wet weather high groundwater level (185m RL) and the required 2 m freeboard mark. All other dams as well as any existing tracks and all infrastructure items, besides the existing Nursery in the north, would be removed and rehabilitated.

The landform reshaped with 1,200,000 m³ fill material would have slopes ranging from 6° (approximately 9.5 Horizontal: 1 Vertical (9.5H: 1V)) in the eastern sections to 11° (approximately 5H: 1V) in the western sections of the final landform over a flat floor and dam which drains to the north. The landform reshaped with 2,000,000 m³ fill material would produce slopes of approximately 6° to 8° across the whole landform over a final dam which drains to the north.

Currently, the proposed final landform includes the retention of the amenity bunds to be constructed along Old Northern Road and Roberts Road. It is expected these are to be located in the 30 m buffer strip between the final landform and Old Northern Road and are expected to have established native woodland vegetation at the completion of Quarry operations. Subject to the preparation of a Quarry closure plan, these bunds could be removed and the replanted with native woodland species.

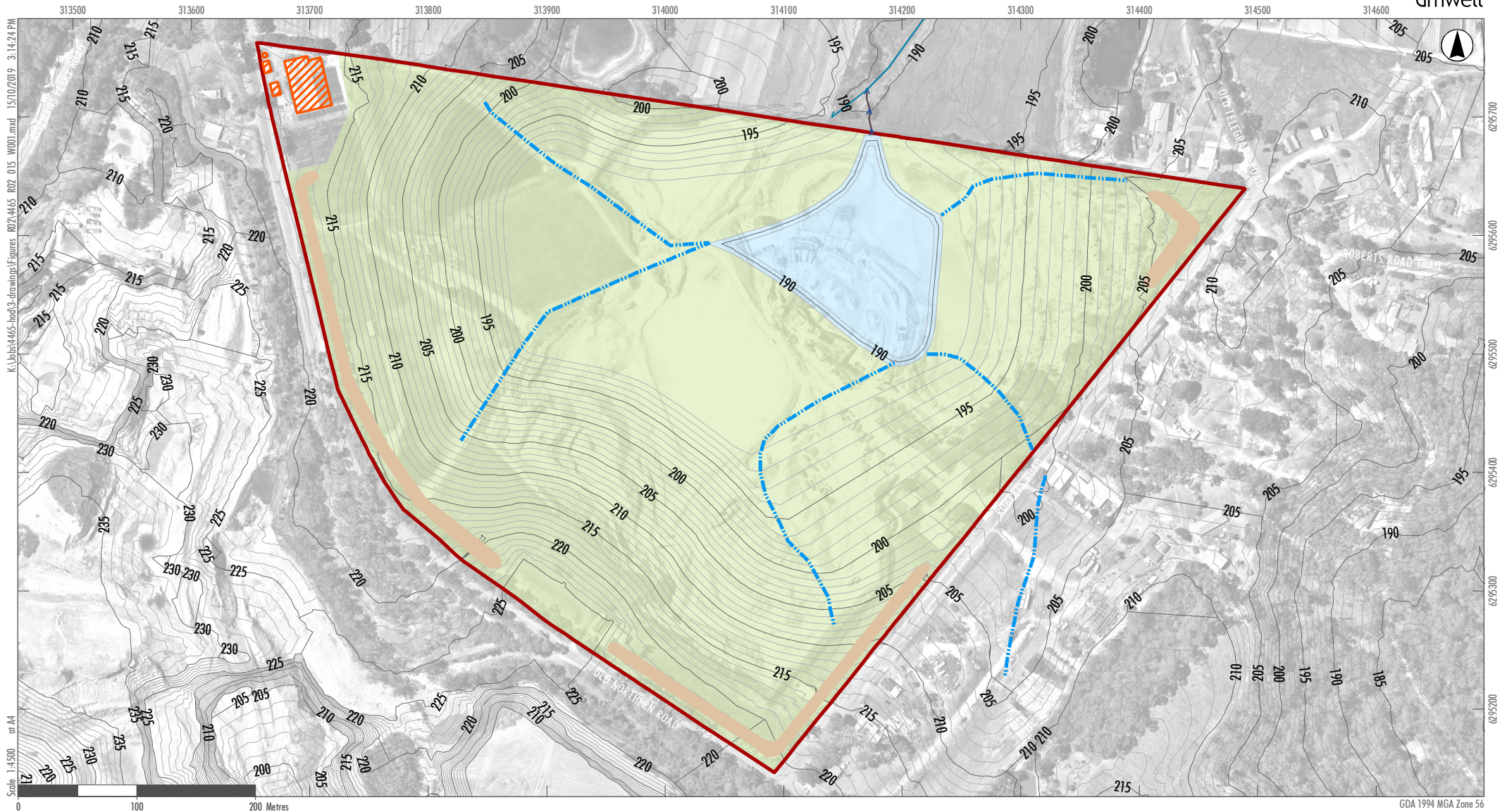
The final land use of the site remains to be established, however, it would be suitable for native biodiversity conservation, the current approved rehabilitation strategy, as well as recommencement of agricultural or horticultural activities. Rehabilitation objectives and completion criteria are discussed further in **Section 7.9**, while future land use options are assessed in **Section 7.10**.

4.2.7.2 Rehabilitation Methods and Procedures

Progressive rehabilitation of areas no longer required for extraction, silt/water management or backfill would be undertaken as soon as reasonably practicable. Rehabilitation will commence in the south east and continue in accordance with the extraction sequence (refer to **Figure 3.1**).

Reshaping of the area will occur in the following general sequence:

- backfill with VENM and ENM
- overlain by consolidated silts
- overlain by clay overburden
- overlain by subsoil (up to 300 mm)
- overlain by topsoil (approximately 100 mm).

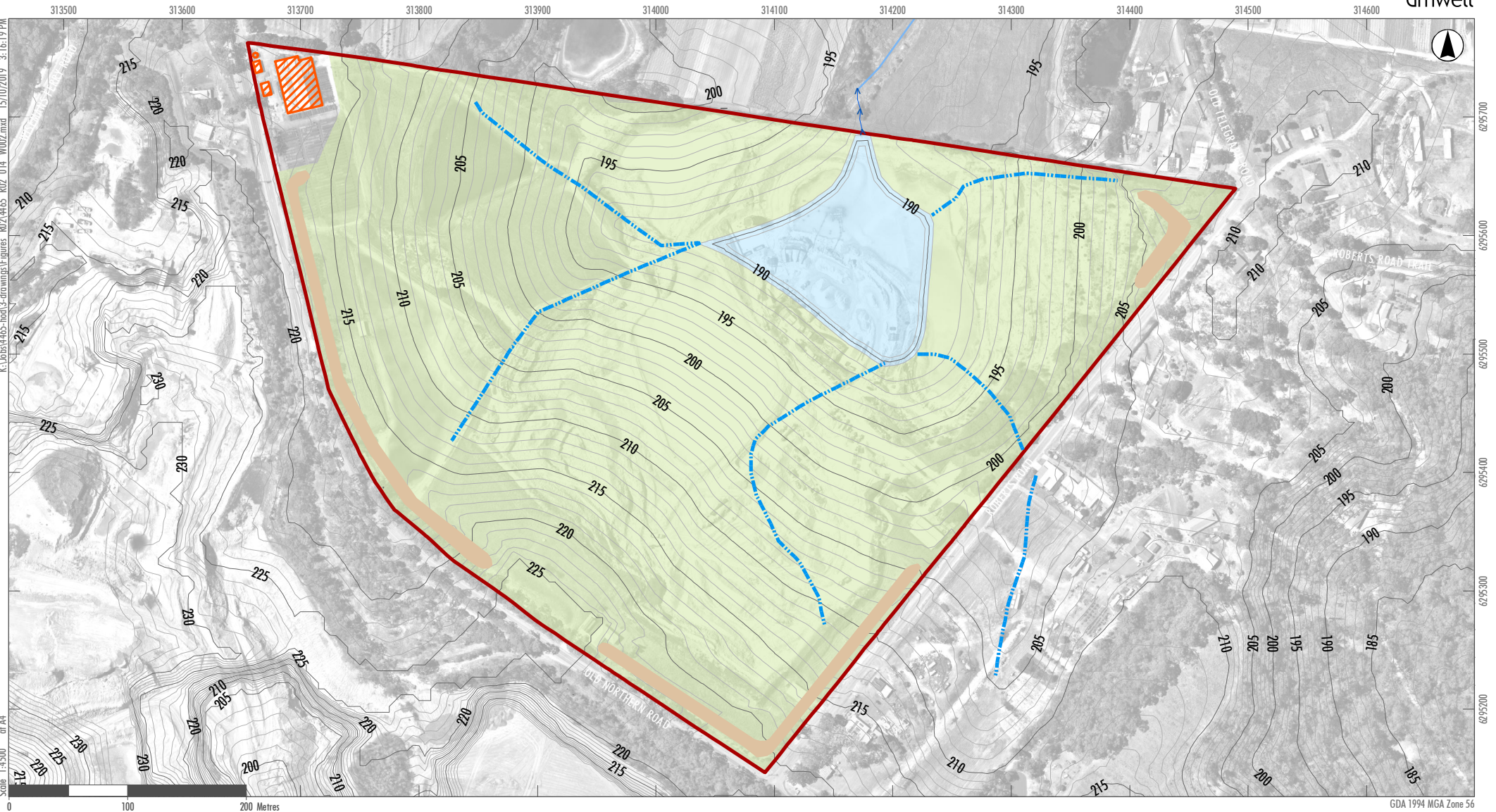


Legend

- | | | |
|--|---|---|
| Quarry Site | Final Landform / landuse | — Option 1 - Final Landform |
| — Sediment Dam 1 Discharge Drain | Final Dam | --- Major Countours (5m) |
| — Existing Watercourse | | --- Minor Countours (1m) |
| Retained Nursery Infrastructure | | |
| Bundwall (indicative) | | |
| --- Internal Drainage Lines (indicative) | | |

Image Source: Nearmap (December 2018) Data source: Umwelt (2019); NSW LPI DTDB/DCDB (2018)

FIGURE 4.2
Proposed Final Landform – 1,200,000 m3 Fill



Legend

- | | | |
|--|---|---|
| Quarry Site | Final Landform / landuse | — Option 2 - Final Landform |
| — Sediment Dam 1 Discharge Drain | Revegetated Area | — Major Countours (5m) |
| — Existing Watercourse | Final Dam | — Minor Countours (1m) |
| Retained Nursery Infrastructure | | |
| Bundwall (indicative) | | |
| - - - Internal Drainage Lines (indicative) | | |

FIGURE 4.3
Proposed Final Landform – 2,000,000 m3 Fill

It is noted that some variation from this sequence may occur subject to the particular VENM/ENM disposed, availability of silts or clays, and/or quality or available quantity of subsoil/topsoil.

All materials would be delivered through back end dumping and levelled through dozer push. The consolidated silts will be weed free, without large rocks or debris and ripped to 300 mm depth before application of subsoil.

Shaping of the final landform would initially be aimed at achieving the final landform with 2,000,000 m³ fill (refer to **Figure 4.3**). Should volumes of ENM/VENM received be less than anticipated over the initial years of operations placement and profiling would revert to the landform with 1,200,000 m³ fill (refer to **Figure 4.2**).

There are a variety of rehabilitation treatments proposed to achieve revegetation.

1. Direct seed application to the topsoil layer of the gently sloping landform. An application of water and fertilizer may be applied (depending on seasonal conditions), however, irrigation of the landform will be discouraged to avoid habituation of the vegetation to higher moisture levels.
2. Hydromulching may be undertaken around the final dam and any other areas of steeper slopes or subject to more concentrated water flows. Spraying of hydromulch is to occur immediately after topsoil has been placed or the surface has been prepared.
3. Tubestock planting on retained bunds, extraction area perimeter and other select areas to promote diverse vegetation communities. Organic mulch would be added immediately after spreading of topsoil and the tubestock would be planted into depressions of approximately 100 mm deep. Fertiliser, water retention crystals and protective mattering would be applied as necessary depending on seasonal conditions and/or potential for grazing.
4. Tubestock planting in jute matting for steep finished slopes. Where slopes in excess of 2.5H:1V are to be retained, the spread topsoil would be secured with the jute matting. Organic mulch would be added immediately after spreading of topsoil and the tubestock would be planted into depressions of approximately 100 mm deep. Fertiliser, water retention crystals and protective mattering would be applied as necessary depending on seasonal conditions and/or potential for grazing.

Vegetation composition, application rates and planting densities are carried out in accordance with the sites landscapes and rehabilitation plan.

4.2.7.3 Rehabilitation Monitoring and Maintenance

A rehabilitation monitoring program will be implemented to include the aspects outlined below.

Rehabilitation Monitoring

Annual inspections of rehabilitated areas will be undertaken over the life of the Project to assess soil conditions and erosion, drainage and sediment control structures, runoff water quality, revegetation germination success, plant health and weed infestation. Where necessary, remediation measures will be implemented and rehabilitation procedures will be amended accordingly with the aim of continually improving rehabilitation standards.

The objective of this monitoring is to evaluate the progress of rehabilitation towards fulfilling long term land use objectives and criteria. The monitoring program will be continued until it can be demonstrated that rehabilitation has satisfied the rehabilitation and closure criteria. Information from this monitoring program will also be used to refine rehabilitation and closure criteria as required.

Rehabilitation Care and Maintenance

Dependent upon the outcomes of the rehabilitation monitoring as outlined above, the scope of the rehabilitation care and maintenance may include the following:

- weed and feral animal control
- erosion and sediment control works
- re-seeding of rehabilitation areas that may have failed
- maintenance fertilising
- repair of fence lines, access tracks and other general related land management activities.

Watering of selected areas may be carried out as required.

4.3 Justification and Alternatives

4.3.1 Justification

There are many major infrastructure projects and private development sites within the Sydney Metropolitan, western and northern Sydney areas that generate VENM/ENM and the Quarry will provide an alternative destination for the placement of this material. The NSW government and specifically the EPA currently operate a 5 yearly Waste Avoidance Resource Recovery Strategy (WARR). The WARR outlines future directions and supports investment in infrastructure, encourages innovation and improvements in recycling behaviour (EPA 2017). The Project will contribute to achieving a key element of the WARR, which is increasing waste diverted from landfill to 75%.

Furthermore, the approved final landform for the Quarry Site currently provides for a water holding basin which interrupts natural drainage to the northeast (within the Coopers Creek catchment). The placement of imported VENM and ENM within completed sections of the Quarry would promote the reinstatement of natural drainage in the final landform and a more productive final land use of the Quarry area consistent with surrounding land uses.

The Proposed Modification would assist in extending the life of the in situ sand resource through selective blending with imported VENM and ENM feed stock. This would extend the life of the Quarry which provides a long-term, high quality supply of construction materials into the Sydney local and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and will contribute to the security and economic viability of the Sydney construction industry along with supply to other key sand markets.

4.3.2 Alternatives

The key alternative considered to the Proposed Modification is one of doing nothing; that is, continuing to operate in accordance with the existing consent and quarry plan. The 'do nothing' option is considered undesirable as it does not allow the Applicant to maximise the efficient use of an existing resource nor to divert a considerable quantity of VENM and ENM from landfill. It would result in the under-utilisation of a site already subject to quarrying and a final landform that does not maximise the future agricultural use of the site.

It is acknowledged that the Quarry could continue without the proposed changes, however, the changes provide benefits to the Sydney region construction industry and they can be undertaken without resulting in significant environmental impacts on the community, as identified in this SEE. In these circumstances, it is considered that the 'do nothing' option is not an appropriate alternative.

5.0 Statutory and Planning Framework

5.1 Commonwealth Legislation

5.1.1 Environmental Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on Matters of National Environmental Significance (MNES). These matters are:

- World Heritage Places
- National Heritage Places
- Wetlands of International Significance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth Marine Parks
- Nuclear actions (including uranium mines)
- A water resource, in relation to coal seam gas development and large coal mining development.

The Proposed Modification will not have a significant impact on any of the above matters therefore no further consideration under the EPBC Act is required.

5.2 State Legislation

5.2.1 Environmental Planning and Assessment Act, 1979

The EP&A Act is administered by the DPIE and local government. It is the primary legislation governing environmental planning and assessment in NSW.

Section 1.3 Objects of the Act

The objects of the EP&A Act, and how these are addressed in the SEE, are identified in **Table 5.1**.

Table 5.1 Objects of the EP&A Act

Object	Addressed in Section
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,	Section 7.7 (Waste Management) Section 7.11 (Socio-economic Impacts)
to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Section 9.1.4 (Ecological Sustainable Development)

Object	Addressed in Section
to promote the orderly and economic use and development of land,	Section 7.9 (Rehabilitation) Section 7.10 (Land Use), Section 7.11 (Socio-economic Impacts)
to promote the delivery and maintenance of affordable housing,	Not Applicable
to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	Not Relevant (refer to Section 7.2)
to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	Not Relevant (refer to Section 7.2)
to promote good design and amenity of the built environment,	Not Applicable
to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	Not Applicable
to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	Not Applicable
to provide increased opportunity for community participation in environmental planning and assessment.	Section 6.2 (Community Consultation), Section 7.11 (Socio-economic Impacts)

It is considered that the Proposed Modification addresses the relevant objects of the EP&A Act. Critically, the Proposed Modification will facilitate the future development of land by rehabilitating the site to a landform suitable for agricultural pursuits. Measures to protect the environment are described throughout **Section 7.0**, summarised in **Section 8.0**, with application of the principles of Ecological Sustainable Development discussed in **Section 9.1.4**. The public have been consulted regarding the Proposed Modification and have been given the opportunity to provide input to the SEE process (refer to **Section 6.2**), with impacts on local amenity and the social setting considered in detail in **Section 7.11**, and will be provided the opportunity to make a submission during the exhibition process.

Section 4.55 Modification of consents—generally (Substantially the Same Development)

As DA 267-11-99 was granted under Part 4 of the EP&A Act in May 2000 and classified as State Significant Development (SSD), modification to the development consent is sought under Section 4.55(2) of the EP&A Act. Modification under Section 4.55(2) requires that the consent authority is “*satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all)*”.

With respect to the Proposed Modification, while the importation of VENM and ENM represents an additional development activity on the Quarry Site, i.e. operation of a waste management facility, the proposed importation and application of the VENM and ENM represents an ancillary operation to that of the extractive industry and one which provides for a net environmental benefit (both in relation to the creation of a final landform more sympathetic to the surrounds and providing a beneficial use for material which otherwise could be sent to a licensed landfill).

With respect to the intensity of operation at the Quarry, the maximum approved production level would remain the same and no increase in the maximum approved disturbance footprint of the Quarry is proposed. A small increase in truck movements is proposed, however, this has been assessed as not significantly impacting on road condition, capacity or performance (refer to **Section 7.6**). The management

of VENM and ENM would require the operation of equipment on the Quarry Site for longer periods, however, this increase in activity has been assessed and are to be managed by implementation of operational and environmental controls to ensure that these modifications do not impact on 'material and essential' elements of the development as originally approved.

On the basis that the additional development activity (VENM and ENM management) is ancillary and beneficial to the extractive industry development, does not require any significant intensification of operations and would be managed to limit impacts on the environment and surrounding landholders, it is concluded that the modified development will be substantially the same as the Quarry development and can be modified under section 4.55(2) of the EP&A Act.

The Minister for Planning and Public Spaces (or as delegated) is the consent authority.

5.2.2 Protection of the Environment Operations Act 1997

The objectives of the POEO Act are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecologically sustainable development. The POEO Act provides for an integrated system of licensing and contains a core list of activities requiring Environment Protection Licences (EPL) from the Environment Protection Authority (EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the POEO Act.

Application of waste to land is considered a scheduled activity in accordance with Clause 39 of Schedule 1 of the POEO Act. However, under the *Protection of the Environment Operations (Waste) Regulation 2014* (2014 Waste Regulation), the EPA has the power to grant exemption from the requirement for an EPL and to pay the waste levy, where it can be demonstrated that the use of the waste is bona-fide, fit-for-purpose and causes no harm to the environment or human health, rather than a means of waste disposal.

The *Excavated Natural Material Resource Recovery Order 2014* (ENM Resource Recovery Order) and *Excavated Natural Material Resource Recovery Exemption 2014* (ENM Resource Recovery Exemption) applies to ENM that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an EPL for a scheduled activity, to track waste, pay the waste levy and miscellaneous reporting requirements to the EPA.

All fill material entering the site which will be applied to land as part of the proposed backfill operation will meet the requirements of the ENM Resource Recovery Order or a specific resource recovery order issued by the EPA for the site.

In order to process the VENM or ENM imported to the Quarry for sale, and as noted in **Section 4.2.3**, the Applicant will either:

- obtain a specific Resource Recovery Order for the processed product, or
- vary the Environment Protection Licence (EPL) held by the Quarry to include Resource Recovery and Waste Storage as activities.

The Applicant currently holds EPL 6535 for the approved Quarry activities. Should the Proposed Modification be approved, the EPL may need to be modified to accommodate the proposed changes.

5.2.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) controls the extraction and use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near water sources in NSW. 'Water

sources' are defined very broadly to include any river, lake, estuary or place where water occurs naturally on or below the surface of the ground and NSW coastal waters.

Part 2 of the WM Act applies to the requirement to obtain a licence for the 'taking of water' from a water source. An access licence entitles its holder to specified shares in the available water within a specified water management area or from a specified water source. It enables the licence holder to take water from the environment in accordance with specified rates and conditions under the terms of the licence. The licensing provisions apply to areas of NSW that have a water sharing plan (WSP).

For surface water, the site is located within the *Greater Metropolitan Region Unregulated River Water Sources Water Sharing Plan*, which became operational in July 2011. This WSP covers six water sources which are made up of a total of 87 management zones. The Project is located within the Hawkesbury and Lower Nepean Rivers Water Source and the Lower Hawkesbury River Management Zone.

For groundwater, the site falls within the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* which become operational in July 2011. This WSP covers 13 groundwater sources on the east coast of NSW. The Project is located within the Maroota Tertiary Sands groundwater source.

The Applicant currently holds two water access licences for the Roberts Road site, as described in detail in **Table 3.1**. No additional water licences are expected to be required under the WM Act to cater for the Proposed Modification.

Part 3 of the WM Act specifies approval requirements for water use, water management works approvals and activity approvals. There are two kinds of activity approvals including controlled activity approvals and aquifer interference approvals.

Controlled activity approvals confer a right for the holder to carry out a specified controlled activity on waterfront land which is defined as land within 40 m of a river, lake, estuary or shoreline. The definition of controlled activities includes the deposition of material (whether or not extractive material) on land and the definition of a river includes 'any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved'.

The Proposed Modification involves emplacing clean fill material within 40 m of an intermittent drainage channel and therefore triggers the need for a controlled activity approval under section 91(2) of the WM Act.

The Proposed Modification will not trigger the need for an aquifer interference approval as the Quarry will remain at least 2 m above the wet weather high groundwater level of the regional Maroota Sands aquifer.

5.2.4 Other State Legislation

A summary of the other State environmental and planning legislation potentially relevant to the Proposed Modification is provided in **Table 5.2**.

Table 5.2 Summary of State Legislation

Act	Comment	Further approval required?
<i>National Parks & Wildlife Act 1974 (NP&W Act)</i>	An Aboriginal Heritage Impact Permit is required under Section 90 of the NP&W Act to harm an Aboriginal object. The site does not contain any identified Aboriginal archaeological sites and as such there is currently no requirement to obtain specific approvals relating to Aboriginal cultural heritage.	No
<i>Water Act 1912</i>	This Act has been repealed by the <i>Water Management Act 2000</i> ; however, some of the licensing provisions remain in force where the water source is not covered by a water sharing plan. The Quarry is within an area covered by a water sharing plan and is therefore administered under the <i>Water Management Act 2000</i> (refer to Section 5.2.3).	No
<i>Heritage Act 1977</i>	No heritage sites will be affected and no excavation permits are required under this Act for works associated with the Proposed Modification.	No
<i>Environmentally Hazardous Chemicals Act 1985</i>	The EPA is granted power under the <i>Environmentally Hazardous Chemicals Act 1985</i> to assess and control chemicals and declare substances to be chemical wastes. A licence is required for any storage, transport or use of prescribed chemicals. The Proposed Modification will not result in any changes to the storage, transport or use of prescribed chemicals.	No
<i>Roads Act 1993</i>	The <i>Roads Act 1993</i> determines the rights of the public and adjacent landowners to use public roads, and establishes procedures for the opening and closing of public roads. Under the Act applications are required to be made for the closure of roads and for works in road reserves. No road closures or road works are proposed as part of the modification.	No
<i>Crown Land Management Act 2016</i>	The <i>Crown Land Management Act 2016</i> commenced on 1 July 2018 to improve the way that Crown reserves are managed and to strengthen community involvement. As noted above, no road closures or road works are proposed as part of the Modification and no areas of Crown land would be affected.	No
<i>Biodiversity Conservation Act 2016 (BC Act)</i>	A licence under this Act is not required for any activity undertaken in accordance with a development consent granted under the EP&A Act and therefore no approvals are required.	No

5.3 State Environmental Planning Policies

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

The State and Regional Development (SRD) SEPP commenced on 1 October 2011, on the date Part 3A of the EP&A Act was repealed, to identify development that is State significant development, State significant infrastructure and critical State significant infrastructure, or regionally significant development. While the Quarry was identified as State Significant Development (SSD) prior to this date, Clause 11 of the SRD SEPP is relevant in that it identifies that development control plans do not apply to SSD.

5.3.2 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across NSW and, amongst other things, allows for development for the purpose of recycling of construction and demolition material or the disposal of virgin excavated natural material or clean fill to be permitted with consent anywhere mining or extractive industries are permitted to be undertaken.

The policy recognises the enhanced rehabilitation outcomes that can be achieved through importation of clean fill to sites previously disturbed by extractive operations. The project is consistent with the aims and objectives of the policy and will allow for the recycling and beneficial reuse of fill material.

Division 23 of the ISEPP includes definitions and consent requirements of Waste or Resource Management facilities. In accordance with Clause 121 (3) of the Infrastructure SEPP:

Development for the purpose of the recycling of construction and demolition material, or the disposal of virgin excavated natural material (as defined by the POEO Act) or clean fill, may be carried out by any person with consent on land on which development for the purpose of industries, extractive industries or mining may be carried out with consent under any environmental planning instrument.

Extractive industries are permissible with consent in the RU1 Primary Production zone of *The Hills Local Environmental Plan 2012*. Therefore, importing of VENM, ENM and other clean fill material for the purpose of site rehabilitation is considered permissible with consent in accordance with the ISEPP.

5.3.3 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (EISEPP) regulates the permissibility and assessment requirements for mining, petroleum production, extractive industries and related development. The EISEPP outlines where various extractive industry activities are permissible both with and without development consent. The EISEPP also defines mining, petroleum production and extractive industries developments that are prohibited, exempt or complying developments.

Part 3 of the EISEPP requires specific matters to be considered in relation to development applications. These include:

- Compatibility with other surrounding land-uses (including other extractive industries) (refer to **Section 7.10**)

- Natural resource and environmental management (refer to **Section 3.3** and **3.4**)
- Resource recovery (refer to **Section 4.2.3**)
- Transport (refer to **Section 7.6**)
- Rehabilitation (refer to **Section 7.9**).

5.3.4 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. The aim of this policy is to link the permissibility of a proposal to its safety and pollution control performance. The assessment process establishes whether the proposal is potentially hazardous or offensive and if this is not the case, SEPP 33 is not applicable.

Existing operations within the Quarry are not considered as hazardous or offensive. The Proposed Modification will not result in any changes to the existing operations which would alter either of these classifications, therefore no further assessment has been undertaken.

5.4 Regional Planning Instruments

5.4.1 Sydney Regional Environmental Plan No 9-Extractive Industry (No 2-1995)

Sydney Regional Environmental Planning Policy No. 9 - Extractive industries (SREP 9) aims to:

- facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area by identifying land which contains extractive material of regional significance, and
- permit, with the consent of the council, development for the purpose of extractive industries on land described in Schedule 1 or 2, and
- ensure consideration is given to the impact of encroaching development on the ability of extractive industries to realise their full potential, and
- promote the carrying out of development for the purpose of extractive industries in an environmentally acceptable manner, and
- prohibit development for the purpose of extractive industry on the land described in Schedule 3 in the Macdonald, Colo, Hawkesbury and Nepean Rivers, being land which is environmentally sensitive.

Roberts Road Quarry is located within the land identified in Schedule 2 of SREP 9. As such, development for the purposes of extractive industries is to be permitted with council consent taking into account relevant environmental issues. However, as identified in **Section 5.2.1** the Minister for Planning and Public Spaces is the consent authority for the Proposed Modification.

5.5 Local Planning Instruments

5.5.1 The Hills Local Environment Plan 2012

The Quarry Site lies entirely within The Hills Shire LGA with local environmental planning provisions undertaken in accordance with The Hills Local Environment Plan 2012 (The Hills LEP). Notwithstanding the fact that Clause 5 of the EI SEPP that the planning provisions of the SEPP prevail over those of The Hills LEP, the following sections consider the key planning provisions which apply to the Proposed Modification.

Permissibility

The Quarry is located on land zoned RU1 Primary Production. Extractive industries are permissible with development consent within land zoned RU1.

Heritage Conservation

Miscellaneous provision 5.10 of The Hills LEP provides for the conservation of:

- a) environmental heritage of The Hills Shire
- b) the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views
- c) archaeological sites
- d) Aboriginal objects and Aboriginal places of heritage significance.

A review of The Hills LEP Heritage Map Sheets HER_010 and HER_018 confirm there are no identified sites of environmental heritage on or adjoining the Quarry Site. As the Proposed Modification does not seek to increase the disturbance footprint of the Quarry, no further assessment of impacts on heritage are warranted.

Acid Sulfate Soils

Additional local provision 7.1 of The Hills LEP requires the potential for development on acid sulfate soils to be considered prior to determination.

A review of The Hills LEP Acid Sulfate Soils Terrestrial Biodiversity Map Sheets CL1_010 and CL1_018 confirm there is no mapped acid sulfate soils on or surrounding the Quarry Site.

Earthworks

Additional local provision 7.2 of The Hills LEP has the noted objective to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

The impact of earthworks associated with the Proposed Modification are considered throughout **Section 7.0** to address the requirements of Clause 7.2(3).

Flood Planning

Additional local provision 7.3 of The Hills LEP has the noted objectives to:

- a) minimise the flood risk to life and property associated with the use of land

- b) allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change
- c) avoid significant adverse impact on flood behaviour and the environment.

Noting there are no flood planning maps for the Hills LEP, the Quarry is located high in the catchment and would be unaffected by flooding generated by a 1:100 average recurrence interval (ARI) event. A detailed flood impact assessment to address the requirements of Clause 7.3(3) is therefore not required.

Terrestrial Biodiversity

Additional local provision 7.4 of The Hills LEP has the noted objective to maintain terrestrial biodiversity by:

- a) protecting native fauna and flora
- b) protecting the ecological processes necessary for their continued existence
- c) encouraging the conservation and recovery of native fauna and flora and their habitats.

The proposed disturbance footprint of the Quarry is not located over environmentally sensitive biodiversity, as nominated by The Hills LEP Acid Sulfate Soils Terrestrial Biodiversity Map Sheets CL1_010 and CL1_018. Noting the Proposed Modification does not involve any additional disturbance to vegetation beyond that already approved, no further assessment of biodiversity is warranted.

5.5.2 The Hills Development Control Plan

Clause 11 of the SRD SEPP confirms that development control plans do not apply to SSD.

6.0 Stakeholder Engagement

Consultation has been undertaken to inform stakeholders about the Proposed Modification, to obtain their views and identify any issues of concern to be investigated and addressed as part of the SEE.

6.1 Authority Consultation

6.1.1 Department of Planning and Environment

In regard to the Proposed Modification, the Applicant has consulted with DPIE regarding the proposed changes to operations, the planned approval pathway and approach to the environmental assessment. The DPIE confirmed the key environmental issues for the Proposed Modification in a reply dated 18 March 2019 (refer to **Appendix 2**). The DPIE was generally satisfied with the proposed approach to this assessment and based on the information provided in the Preliminary Environmental Assessment (PEA) (Umwelt, 2019) did not issue formal Environmental Assessment Requirements (EARs). However the matters listed in **Table 1.3** were requested for consideration in the environmental assessment.

6.1.2 Other Agencies

Feedback on the Proposed Modification was sought from seven other NSW government departments and The Hills Shire Council, and their responses are detailed in **Table 6.1** below.

Table 6.1 Agency Consultation

Agency	Assessment requirements	Addressed in
The Hills Shire Council	<i>Council raised concerns regarding the proposed importation of VENM and ENM to the site. The importation of these materials would partially change the use of the site from an 'extractive industry' to a 'waste and resource management facility'. As such, it is considered that a new Development Application is required to substantiate the proposed change in activities on the site and the change in definition of the use.</i> <i>The proposed increase in vehicle movements and extension to the timeframe for extraction may also potentially impact on amenity to adjoining property owners and further add to the need for a new DA.</i>	Section 5.2.1 Sections 7.6 and 7.11
Environment Protection Authority	Air Quality - Undertake an air assessment in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and Approved Methods for the Sampling and Analysis of Air Pollutants in NSW, including: • a description of the existing air quality and meteorology using existing information and site representative ambient monitoring data; • an outline of the point and fugitive sources of all pollutant emissions and the resulting ground level concentrations of all pollutants at all sensitive receivers; • a description of the effects and significance of resulting pollutant concentrations on the environment, human health, amenity and regional ambient air quality standard and goals; and • details of the mitigation measures proposed in managing the any additional impacts of air emission from the Proposed Modification.	Section 7.4 and Appendix 8

Agency	Assessment requirements	Addressed in
Environment Protection Authority	Noise - Undertake a noise assessment in accordance with the Noise Policy for Industry (2017), including: • details of the existing background (LA90) and ambient (LAeq) noise levels; • details of all monitoring of existing ambient noise levels, including a statement justifying the choice of monitoring site and the procedure used to choose the site, taking into account the noise sensitive receptors and most affected locations; • a description of the dominant and background noise sources at the site; • day, evening and night assessment background levels for each day of the monitoring period; and • the final rating background level (RBL) value. Water - Undertake an assessment of the impacts on surface and groundwater, including: • an outline of how the total water cycle considerations are to be addressed as a result of the modification; • total water balances; • demonstration of how the impact on water resources are minimised; • the type, volume, proposed treatment and management and re-use methods for stormwater; • the type, volume, proposed treatment, and management and re-use methods for wastewater; and • identification of any impacts on and management of groundwater.	Section 7.5 Section 7.3
DPIE, Resources Regulator	It is noted that there is no Mining Title covering the Roberts Road Quarry and it is understood that no Mining Title is required as operations do not involve the processing or sale of prescribed minerals, specifically Group 5 (Clay Minerals). As such, the Resources Regulator, Compliance Operations section has no jurisdiction over this site and no comments to provide on the Proposed Modification.	Noted
Roads and Maritime Services	No response formal assessment requirements were provided by the RMS.	Noted (refer to Section 7.6)
Office of Environment and Heritage	No response formal assessment requirements were provided by the OEH (now the Biodiversity Conservation Division of DPIE).	Noted
NSW Heritage Council	The Heritage Division has no issues or concerns in relation to State Heritage matters, and therefore are not a relevant stakeholder in this instance.	Noted

Agency	Assessment requirements	Addressed in
Department of Industry – Water and Natural Resources Access Regulator	<i>The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.</i>	Sections 3.1 and 7.3
	<i>A detailed and consolidated site water balance.</i>	Section 7.3.3
	<i>Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.</i>	Section 7.3.6
	<i>Proposed surface and groundwater monitoring activities and methodologies.</i>	Section 7.3.6
	<i>Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans.</i>	Section 5.2.3 and 7.3
Department of Primary Industries – Agriculture	<i>A biosecurity (pests and weeds) risk assessment outlining the likely plant, animal and community risks from imported material.</i>	Section 7.7.3.2
	<i>A biosecurity response plan to manage identified weed/pest animal risks.</i>	

6.2 Community Consultation

The key mechanism used for community involvement in relation to the Proposed Modification was the distribution of a Community Information Sheet (CIS) to residents surrounding the Quarry. The Community Information Sheet, attached as **Appendix 6**, provided details of the proposal and the environmental assessment process to be undertaken. The CIS also contained contact details so that members of the community could raise issues or request further information about the Proposed Modification.

Approximately 20 copies of the CIS were distributed in the immediate local area in July 2019. Copies were left in the letterbox of residences along Roberts Road, Old Northern Road and Old Telegraph Road.

Between 23 July and 10 August, Mr Martin Hodgson and Mr Stuart Reed of the Applicant visited residents at the locations identified on **Figure 6.1**. These one-on-one discussions focussed on the residents understanding of current operations, any concerns held and any concerns or questions regarding the Proposed Modification. In each case, no issues were raised regarding current operations nor concerns regarding the Proposed Modification. Overall the Quarry is viewed positively by those residing around it with an understanding that it is an existing feature of the Maroota locality and impacts positively on the lives of those employed at the Quarry and in related industries. This neutral to positive response to consultation is supported by the complaints register of the Quarry which is managed by VGT Environmental Compliance Solutions. Since January 2011, there has not been a single complaint lodged against the Quarry.

Further review and discussion on issues that could potentially impact on the local socio-economic setting are discussed in **Section 7.11**.



FIGURE 6.1
Consultation Coverage

7.0 Environmental Impact Assessment

7.1 Identification of Key Environmental and Community Issues

The key environment and community issues that need to be assessed in this SEE have been identified through consideration of:

- The existing approved operations and description of the Proposed Modification (refer to **Sections 3.0 and 4.0**).
- The findings of the original environmental assessments for the operation (Nexus Environmental Planning Pty Ltd (Nexus), 1999; Nexus, 2000; Nexus, 2015a; and Nexus, 2015b) and the Project Overview and Preliminary Environmental Assessment (Umwelt, 2019) prepared for this modification.
- The planning and environmental context for the locality (refer to **Sections 1.2, 1.4, 2.0, 5.0 and 7.0**).
- The environmental risk analysis of potential environmental impacts associated with the Proposed Modification (refer to **Section 7.2**).
- Feedback from the community and government agencies on the issues that they felt were relevant to the Proposed Modification and Roberts Road Quarry more generally (refer to **Section 6.0**).
- The findings of baseline studies completed as part of preparation of the SEE and the issues that were identified as requiring further assessment.

The issues identified as being relevant to the Proposed Modification are assessed in detail in the following sections.

7.2 Preliminary Risk Analysis

A preliminary environmental risk analysis was undertaken for the Proposed Modification to identify, from a technical perspective, the key environmental and community issues and the level of assessment required as part of the SEE process.

The method used for the environmental risk analysis encompassed the following key steps:

- Identify each element of the Proposed Modification.
- Identify the environmental and community aspects and potential impacts/risks associated with each element of the Proposed Modification in the context of the existing approved operations (that is, whether or not there is a change to the impacts approved as part of the existing approvals for the quarry).
- Assess the potential scope of the impact/risk to determine the key issues requiring further assessment and the level of assessment required.

The outcomes of the preliminary environmental risk analysis are detailed in **Table 7.1**.

Table 7.1 Preliminary Environmental Risk Analysis

Environmental Aspect	Preliminary Risk Analysis	Further Assessment Required?
Surface water	Management of surface water is proposed to remain largely unchanged from that described in the existing Surface Water Management Plan however the proposed importation of VENM and ENM would introduce a potential source of contamination to surface water runoff, with the potential change in the final landform to a free draining basin increasing the risk of a pollution event to downstream catchments. A surface water impact assessment has therefore been undertaken.	Yes, refer to Section 7.3
Noise	The Proposed Modification has the potential to result in changes to noise emissions from the Quarry and a detailed noise impact assessment has been undertaken.	Yes, refer to Section 7.5
Air quality	The Proposed Modification has the potential to change the impact of the Quarry on local air quality and a detailed assessment has been undertaken.	Yes, refer to Section 7.4
Traffic	Increased traffic movement associated with the Proposed Modification has the potential to impact local traffic and a detailed traffic assessment has been undertaken.	Yes, refer to Section 7.6
Waste	While the importation and application of the VENM and ENM to land is exempt from licensing as a waste disposal activity, the proposed reprocessing of the VENM and ENM would require a variation to the existing EPL to include Resource Recovery activities. A review of waste management practices has also been undertaken. DPI Agriculture has raised the issue of likely plant, animal and community risks from imported VENM/ENM material and a biosecurity risk assessment has therefore been undertaken.	Yes, refer to Section 7.7
Visual	The proposed importation of VENM and ENM will require modification to the final landform and rehabilitation of the Quarry Site. While considered to be of an overall positive impact, these modifications could result in some Quarry areas remaining exposed for longer as the void is filled to establish the proposed modified final landform. An assessment of visual impacts has therefore been undertaken.	Yes, refer to Section 7.8
Rehabilitation and final landform	The proposed importation of VENM and ENM will require modification to the final landform and rehabilitation of the Quarry Site. While considered to be of an overall positive impact, these modifications will require consideration of surface water management during and following landform construction. The integration of the Proposed Modification into the existing rehabilitation and landscape management strategy is therefore addressed in this EA.	Yes, refer to Section 7.9
Land use	There will be no change to the extraction area, extraction depth or extraction method as a result of the Proposed Modification. While the Proposed Modification would introduce a new activity, being the importation and use of VENM and ENM to backfill and rehabilitate the extraction area, this effectively complements the existing operations and land use. A review of impact on land use and land resources has been undertaken.	Yes, refer to Section 7.10

Environmental Aspect	Preliminary Risk Analysis	Further Assessment Required?
Biodiversity	A flora and fauna assessment of the site was undertaken as part of studies for the original development consent for the Quarry (AES Environmental Consultancy, 1999). The study identified three threatened species that either occurred, or were likely to occur, on the site (<i>Acacia bynoeana</i> , turquoise parrot and glossy black cockatoo). An eight-part test of significance was undertaken for each species (as required under the <i>Threatened Species Conservation Act 1995</i>) and concluded that the original development would not have a significant impact on any of the three species. The Proposed Modification does not require any additional vegetation clearing, therefore no additional field survey or biodiversity assessment has been undertaken.	No
Aboriginal and Historic Heritage	An archaeological survey of the site was undertaken as part of studies for the original development consent for the Quarry (Corkhill, 1999). No Aboriginal archaeological sites or areas of potential archaeological deposit were identified. Additionally, given the past and current extractive activities, previous clearing and its relatively small size, the archaeological report concluded that there are unlikely to be any significant undetected, undisturbed Aboriginal sites or areas of potential archaeological deposit in the area surveyed. No increase in the approved impact footprint is proposed and no additional impact on heritage is likely therefore no further assessment has been undertaken.	No
Groundwater	The Proposed Modification would not result in any change to the potential interception of the groundwater table with the limit on depth of extraction to remain in place. The potential for contamination of the regional aquifer as a result of leachate from imported VENM and ENM would be managed to such an extent that the risk is considered low and no further assessment of groundwater has been undertaken.	No, refer to Sections 4.2.2 and 7.7
Soils and agriculture	There will be no additional disturbance area as a result of the Proposed Modification. The proposed importation of VENM/ENM and the resultant change in final landform will be beneficial for possible future agricultural use as it will provide a free-draining landform that is more similar to the pre-existing condition of the site than that currently approved. Soil erosion issues are addressed as part of the surface water assessment (see below) and no further assessment of soil/agricultural impacts has been undertaken.	No
Hazards	Existing operations within the Quarry are not considered as hazardous or offensive, according to the definitions in SEPP 33. The Proposed Modification will not result in any changes to the existing operations which would alter this classification, therefore no further assessment has been undertaken.	No
Public infrastructure	The Proposed Modification will not result in any changes to public infrastructure.	No
Socio-economic	The socio-economic impacts of the Quarry will remain substantially unchanged, with no significant changes to the scope or scale of impacts on the community. However, noting local amenity could be affected by the proposed changes, there is the potential for impacts (actual or perceived) on the social setting.	Yes, refer to Section 7.11

7.3 Surface Water

7.3.1 Existing Environment

7.3.1.1 Catchment

The Quarry is located approximately 5 km west-south west of the Hawkesbury River and lies within the Hawkesbury-Nepean catchment, a large coastal catchment covering a total area of 21,400 km² (NSW Office of Water, 2010).

Water licencing in this catchment is governed by the *Water Management Act 2000* under the Water Sharing Plan (WSP) for Greater Metropolitan Region Unregulated River Water Sources, which commenced on 1 July 2011. The WSP is divided into six water sources with each water source containing a number of management zones. The Quarry is located within the Lower Hawkesbury River Management Zone of the Hawkesbury and Lower Nepean Rivers Water Sources.

7.3.1.2 Licensing

7.3.1.2.1 Environment Protection Licence

The Quarry holds Environmental Protection Licence (EPL) 6535 for quarrying operations, however, no licenced discharge point (LDP) for site water and no water quality monitoring requirements are specified in the licence. The only condition specifically relating to pollution of waters is contained in *Section 3 Limit conditions* of the EPL:

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

7.3.1.2.2 Water Access Licences

As identified in **Section 3.1**, three water access licences (WALs) are held by the Quarry Site landowners (refer to **Table 7.2**). These include surface water licence WAL 26163 and groundwater licences WAL 24157 and WAL 24163 (for extraction of groundwater via production bores PB1 and PB2). Water sourced under WAL 26163 and WAL 24157 is used for irrigation by the on-site nursery operation which is owned and operated separately to the Quarry. No water for Quarry operations is sourced under WAL 26163 and WAL 24157. Water sourced from bore PB1 under WAL 24163 is used to supplement surface water captured within the Quarry WMS for quarrying operational water demands.

Table 7.2 Water Access Licences

WAL Number	Associated Works Approval	Land Holdings	Works	Extraction Limit (ML/yr) ¹	Site Identification
Surface Water					
26163	10CA104888	Lot 2, DP 228308	Work 1 65mm centrifugal pump Work 2 Bywash dam	264	NA
Groundwater					
24163	10WA114817	Lot 1, DP228308	Work 1 Bore (168.3mm)	45	Bore PB1
24157	10CA114819	Lot 2, DP 228308	Work 1 Bore (168.3mm)	6	Bore PB2

¹ Extraction limit assuming a full allocation of 1 ML for each unit share

7.3.1.3 Drainage

The Quarry Site sits at a high point along the Hornsby Plateau and is bordered by Old Northern Road to the south and west, Roberts Road to the east and farmland along the northern boundary. Elevations range from 226 m AHD at the south-western boundary at Old Northern Road to 192 m AHD at the northern boundary.

Prior to development, the site and upslope areas drain in a northerly direction via natural drainage lines into Cooper's Creek approximately 2 km north of the site (refer to **Figure 7.1**). Cooper's Creek flows in an easterly direction to the confluence with Dalgety's Creek which drains to the Hawkesbury River approximately 5 km to the east-north east of the Quarry (refer to **Figure 7.1**). Since development, site runoff and runoff from a relatively small upslope catchment is captured in the site water storages.

7.3.1.4 Soils

Soils at the Quarry Site are classified on eSPADE, NSW Soil and Land Information's online mapping tool (accessed 29 March 2019), as 'Disturbed Terrain' with areas adjacent to the Quarry classified as the 'Maroota Soil Landscape'. The soils of the Maroota Soil Landscape are up to 1 m deep on crests and slopes, with high permeability at the heads of drainage lines that pose a high erosion hazard. They are strongly acidic soils with low fertility and have potential for localised water logging. Soils are classified as soil hydrological group B, having low to moderate runoff potential. Other soil characteristics relating to erosion hazard and sediment transport are included in **Table 7.3**.

Table 7.3 Soil Characteristics

Characteristic	Value
Soil hydrologic group	B
Soil erodibility	Moderate to high
Soil loss class	1 to 7
Soil texture group	Type F

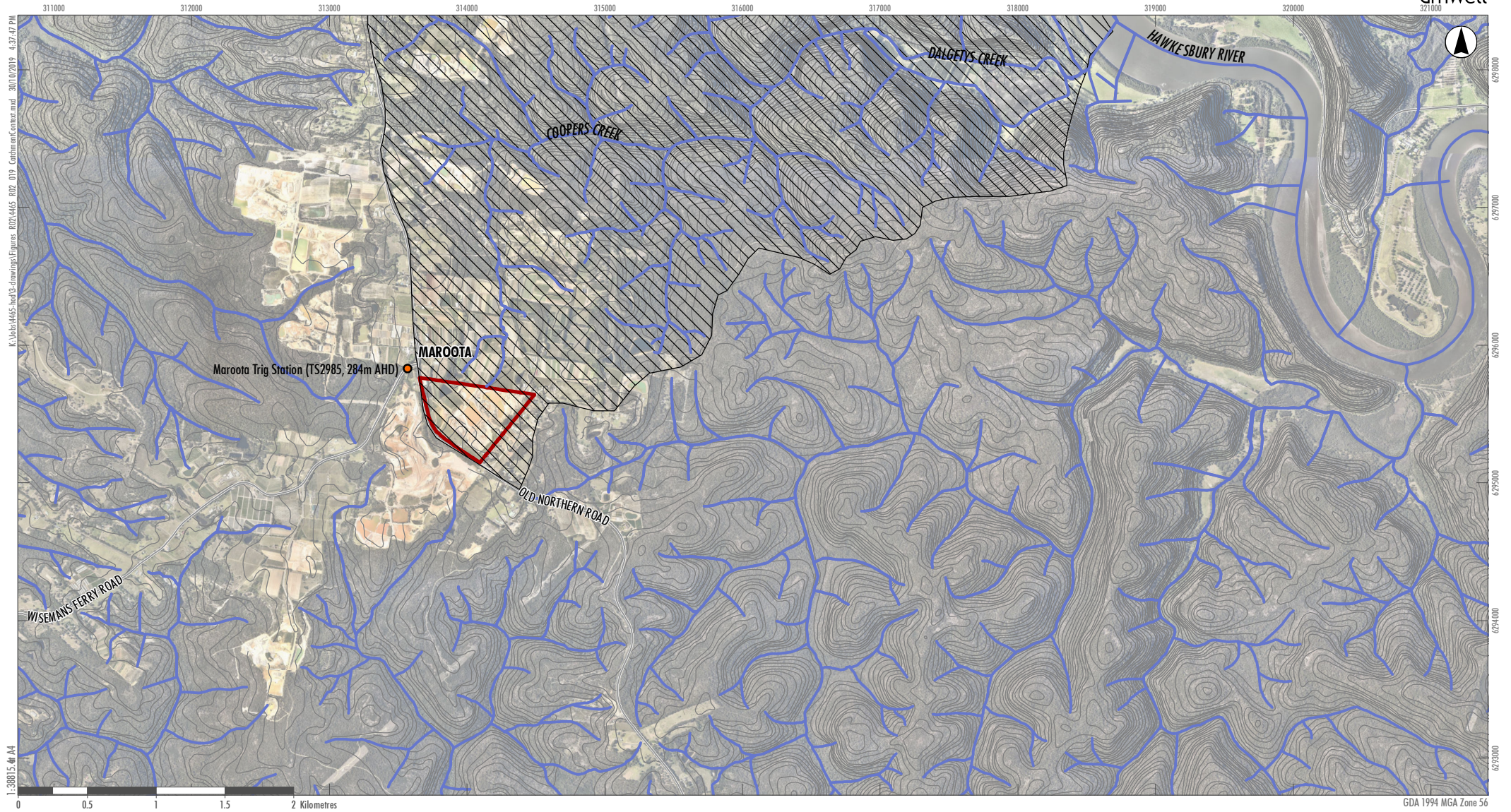
Source: Surface Water Management Plant, Maroota Quarry (VGT, 2018b)

7.3.1.5 Rainfall and Evaporation

There are several Bureau of Meteorology (BoM) stations recording daily rainfall within 10 km of the Quarry with the three nearest and most recent being:

- Maroota (Old Telegraph Road) station (station 067014) approximately 0.4 km to the north
- Gunderman (Wisemans Ferry Road) station (station 067040) approximately 6.4 km to the east, and the
- Wisemans Ferry (Old Post Office) station (station 061119) approximately 8.8 km to the north.

Given the proximity to the Quarry, the Maroota (Old Telegraph Road) station (station 067014) is considered to have the rainfall data set most representative of rainfall at the Quarry. Rainfall data records begin in September 1925 for station 067014, but a data gap exists for the period 1953 to 1962. Nearby stations, Gunderman (Wisemans Ferry Road) (station 067040) and the Wisemans Ferry (Old PO) (station 061119) do not provide sufficient data to fill this gap but have been used to fill other gaps to prepare a more daily record for the years 1926 to 1953 and 1963 to 2018. The statistics for the infilled rainfall data set for the Old Telegraph Road BoM station are summarised in **Table 7.4**.



Legend

- Quarry Site
- Coopers Creek Dalgety's Creek Catchment
- Topographic Contours
- Watercourse

FIGURE 7.1
Catchment Context

Table 7.4 Annual Rainfall for years 1926 to 1953 and 1963 to 2018

Statistic	Annual Rainfall (mm)
10 th percentile	604
50 th percentile	918
90 th percentile	1267

Source: Maroota (Old Telegraph Road) BoM station (station 067014), Gunderman (Wisemans Ferry Road) (station 067040) and Wisemans Ferry (Old Post Office) (station 061119)

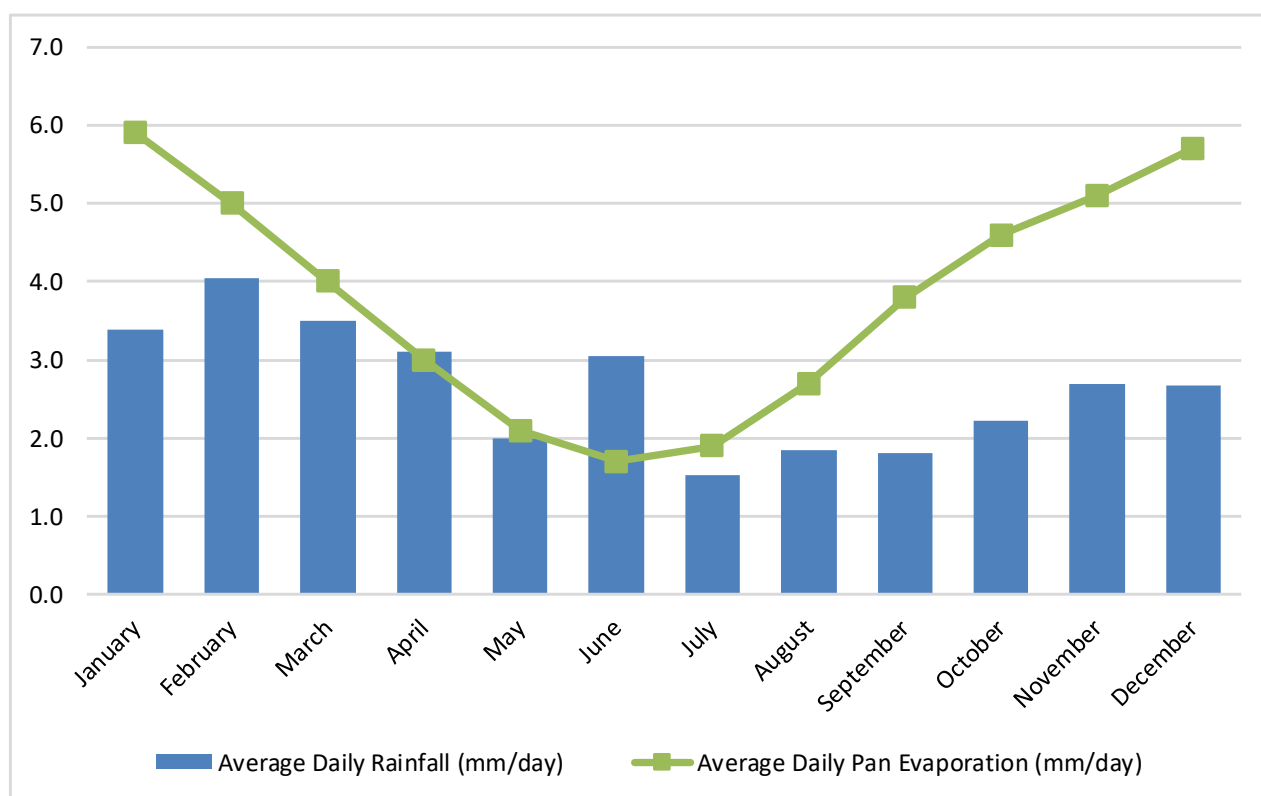
The BoM station recording daily evaporation nearest to the Quarry is the University of Western Sydney (UWS) Hawkesbury Campus BoM station (station 067021) (station 067021), located approximately 26 km south-west of the Quarry. Average daily pan evaporation recorded at station 067021 for the period 1973 to 2019 is presented in **Table 7.5**.

Table 7.5 Average Daily Pan Evaporation for Years (1973 to 2019)

Month	Average Daily Pan Evaporation (mm/day)
January	5.9
February	5.0
March	4.0
April	3.0
May	2.1
June	1.7
July	1.9
August	2.7
September	3.8
October	4.6
November	5.1
December	5.7
Annual	3.8

Source: University of Western Sydney (UWS) Hawkesbury Campus BoM station (station 067021)

Results show the minimum average daily pan evaporation of 1.7 mm/day occurs in June, while the maximum average of 5.9 mm/day occurs in January. The average daily pan evaporation across all months is 3.8 mm/day. **Chart 7.1** presents the average daily rainfall for the infilled daily rainfall data set for the Old Telegraph Road BoM station (station 067014) and the average daily pan evaporation recorded at station UWS Hawkesbury station (067021).



Source: (Maroota (Old Telegraph Road) station (station 067014), Gunderman (Wisemans Ferry Road) station (station 067040) and the Wisemans Ferry (Old PO) station (station 061119)) and average daily pan evaporation for Richmond UWS Hawkesbury station (station 067021)

Chart 7.1 Average Daily Rainfall and Pan Evaporation

© Umwelt, 2019

7.3.1.6 Water Quality Objectives and Baseline Water Quality

NSW Water Quality Objectives

NSW Water Quality Objectives (WQOs) are agreed environmental values and long-term goals for NSW's surface waters used across NSW to guide catchment management. No WQOs have been specified by the NSW Office of Environment and Heritage (OEH) for the Hawkesbury-Nepean catchment. As such, the water quality parameters presented in **Table 7.6**, which are the default trigger values for slightly disturbed ecosystems in south-east Australia from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council (ANZECC, 2000), could be applied as preliminary WQOs for the receiving water quality in the drainage line to the north of the quarry. While the revised *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG) (Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia) were released in 2018, the default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems are yet to be updated. As such, the ANZECC 2000 guidelines have been presented.

Table 7.6 Default Trigger Values for Physical And Chemical Stressors For South-East Australia for Slightly Disturbed Ecosystems ANZECC (2000)

Parameter	Units	WQO
pH	pH Units	6.5 – 8.5
Electrical Conductivity	µS/cm	125 – 2200
Turbidity	NTU	6 – 50

Baseline Receiving Water Quality

As the Quarry has not undertaken any baseline water quality monitoring in receiving waters, a search of nearby quarry operations websites for publicly available receiving water quality data was undertaken. The Soil and Water Management Plan for the Old Northern Road Quarry of Dixon Sand (Penrith) Pty Ltd (Dixon Sand), located approximately 2.2 km northwest of the Quarry, contains water quality data for a local stream with the monitoring point identified as SW19 (refer to **Figure 7.2**). The water quality monitoring in the stream at SW19 was undertaken between July 2003 and July 2005 by Dixon Sand and the results are presented in **Table 7.7**. The pH values recorded in the stream at SW19 are generally much lower than the ANZECC 2000 default trigger value range.

Table 7.7 Stream Surface Water Quality (SW19 Monitoring Location July 2003 to July 2005)

Parameter	Minimum	20th Percentile	50th Percentile	80th Percentile	Maximum
pH	<2.0	4.0	4.2	4.8	7.1
TSS (mg/L)	<2.0	2.0	2.0	8.0	17
Turbidity (NTU)	0.1	0.1	0.3	3.8	21

Source: Old Northern Road Quarry Soil and Water Management Plan (Dixon Sand, 2018)

Site Water Quality

The results for site water quality monitoring undertaken by the Quarry on 27 July 2017 and from January 2018 to January 2019 are presented in **Table 7.8** and **Table 7.9**. The site water sources monitored include groundwater bore PB1 (screened in the Hawkesbury Sandstone groundwater source), groundwater monitoring wells MW1, MW5, MW6, MW8, MW10, MW11 and MW 13 (screened in the Maroota Sands groundwater source), groundwater monitoring wells PB1, MW7, MW9 and MW12 (screened in the Hawkesbury Sandstone groundwater source) and the four water storage dams, Dam 1 (Processing Dam), Dam 2 (Holding Dam), Dam 3 (North Nursery Dam) and Dam 4 (South Nursery Dam). Inflows to Dam 1 and Dam 2 include runoff from disturbed Quarry catchments, groundwater sourced from PB1 and recirculated water from the Processing Plant. Inflows to Dam 3 and Dam 4 include runoff from the upslope undisturbed catchment and the Nursery operation.

The water quality monitoring data presented in **Table 7.8** and **Table 7.9** shows pH levels for Dam 1 and Dam 2 are below the ANZECC 2000 default trigger range (refer to **Table 7.6**). The low pH results correspond with the pH of groundwater (except for MW6) as well as the pH of the stream to the northwest of the Quarry monitored by Dixon Sand. However, the pH for Dam 3 and Dam 4 suggests that runoff from undisturbed areas around the Quarry catchment is likely to have a pH that is within or just above the ANZECC 2000 default trigger range (refer to **Table 7.6**).

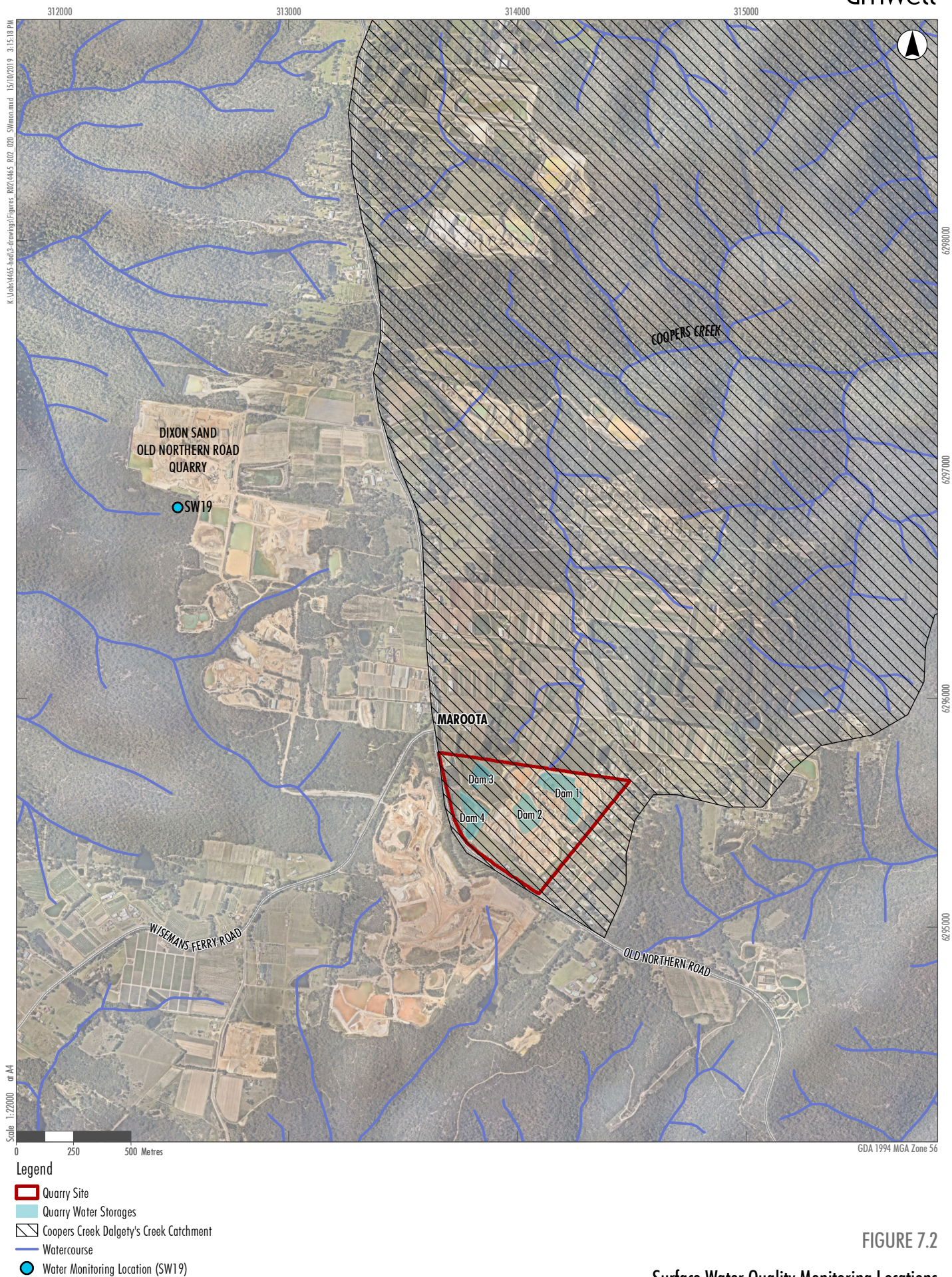


FIGURE 7.2

Surface Water Quality Monitoring Locations

Table 7.8 Surface Water and Groundwater Quality 2017 - 2019

Parameter	Units	Dam 1			Dam 2			Dam 3		
		Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
pH	pH units	4.38	4.58	4.94	4.29	4.47	4.70	6.61	7.24	7.80
Electrical Conductivity (EC)	µS/cm	100	167	229	112	190	254	133	184	223
Total Dissolved Solids (TSS)	mg/L	63	106	143	70	117	159	77	114	139
Chlorine	mg/L	23	38	57	24	38	57	20	31	36
Sulphate	mg/L	2	3	4	2	4.5	8	9	15	21
Total Alkalinity (CaCO ₃)	mg/L	¹	¹	¹	¹	¹	¹	13	13	13
Calcium	mg/L	0.5	0.7	0.8	0.5	0.7	0.9	3.5	4.3	5.3
Magnesium	mg/L	1.1	2.3	3.7	1.2	2.3	3.7	3.3	4.3	5.3
Sodium	mg/L	11.0	20.2	29.0	12.0	20.6	30.0	13.0	16.0	17.0
Potassium	mg/L	1.8	2.8	4.3	1.6	2.8	4.1	3.6	5.2	6.0

¹ All results less than the limit of detection

Source: VGT (2019)

Table 7.9 Surface Water and Groundwater Quality 2017 - 2019

Parameter	Units	Dam 4			Maroota Sands Groundwater ¹			Hawkesbury Sandstone Groundwater ²		
		Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
pH	pH units	6.62	7.88	9.00	4.03	5.30	10.31 ³	4.03	5.09	5.89
Electrical Conductivity (EC)	µS/cm	116	153	188	103	219	424	94	157	322
Total Dissolved Solids (TSS)	mg/L	63	94	117	55	137	265	59	104	215
Chlorine	mg/L	20	27.4	32	18	44	84	13	27	50
Sulphate	mg/L	3	7	8	1	7	61	2	10	23
Total Alkalinity (CaCO ₃)	mg/L	15	15	15	5	50	87	11	23	35
Calcium	mg/L	1.7	2.1	2.8	0.6	2.5	7	1	2.1	3.6
Magnesium	mg/L	2.7	3.4	4.4	0.8	5.0	18	0.5	2.7	12
Sodium	mg/L	13.0	15.6	18.0	12.0	28.2	110.0	12.0	26.1	59.0
Potassium	mg/L	2.2	2.7	3.2	0.5	1.9	4.6	0.5	1.6	4.5

¹ Groundwater water quality statistics include results for MW1, MW5, MW6, MW8, MW10, MW11 and MW 13

² Groundwater water quality statistics include results for PB1, MW7, MW9 and MW12

³ High pH value was recorded at MW6. All MW6 pH results were significantly higher than the results recorded for all other groundwater samples.

Source: VGT (2019)

Annual compliance reviews confirm that no controlled or uncontrolled discharges have occurred at the Quarry. No LDP exists for the Quarry and it is unlikely that one will be included in the licence for the extraction phase of the Quarry operation based on results of the water balance (VGT, 2018b).

7.3.2 Potential Impacts

The potential impacts to surface water resources associated with the Proposed Modification to Quarry operations are:

- Rainfall runoff with poor water quality discharging from the operational Quarry or final landform to the downstream environment.
- Surface water take associated with the final landform exceeding the land holding entitlement.

7.3.3 Water Management

7.3.3.1 Existing Water Management System

The existing water management system (WMS) at the Quarry Site (refer to **Figure 7.3**) is comprised of four (4) primary catchments, each with an associated water storage. Quarry operations occur within Catchment 1 and 2, while the Nursery operation is located within Catchment 3 and 4. The Existing Quarry WMS operates independently of the Nursery WMS and inflows from Catchment 3 and 4 would only occur in extremely high rainfall events resulting in spills from Dam 3 and/or Dam 4 to the Existing Quarry WMS.

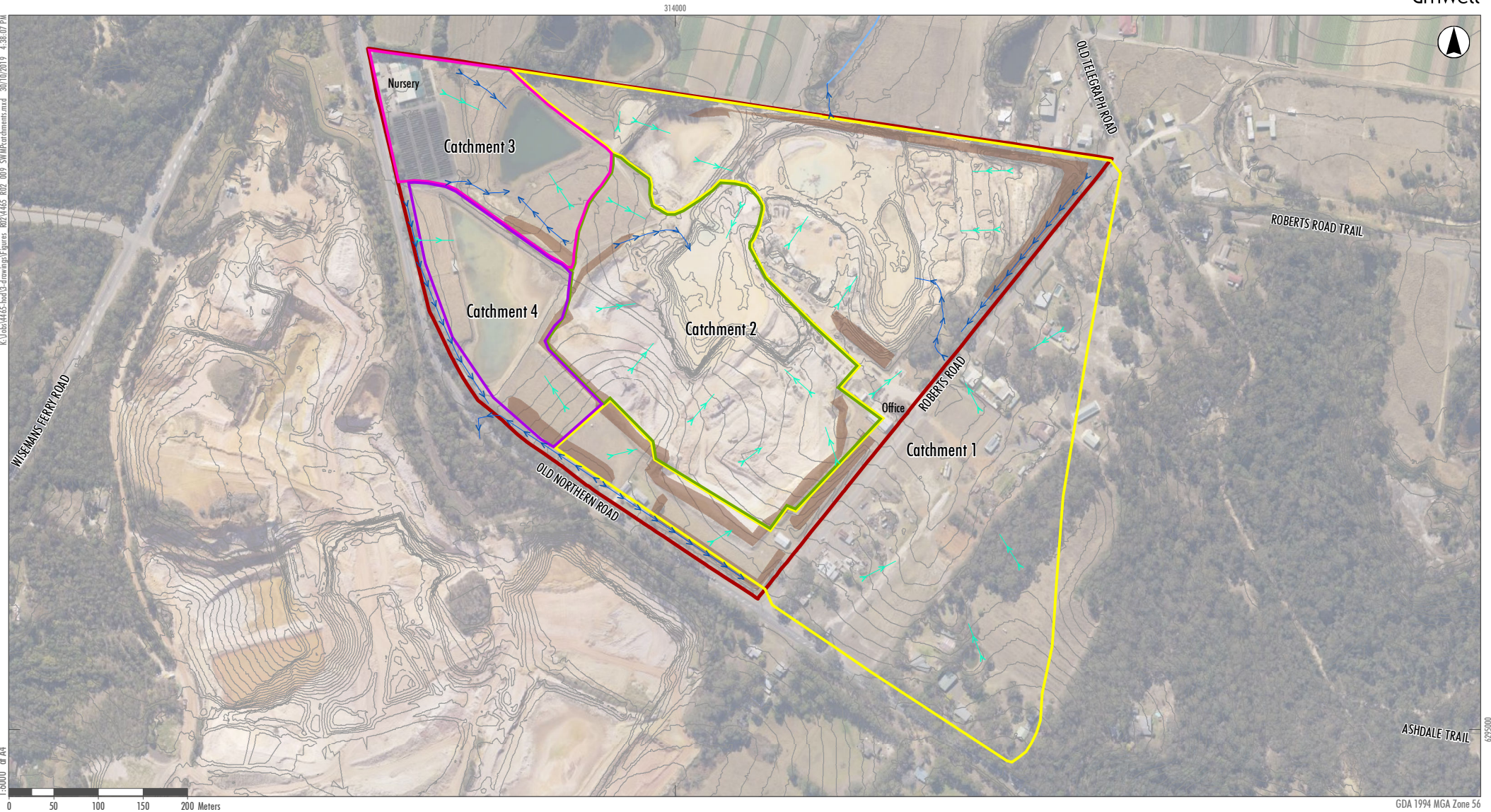
Catchment 1 has an area of approximately 26 ha, comprising both disturbed (extraction areas and Processing Plant) and undisturbed areas including a large undisturbed off site area southeast of Roberts Rd. Catchment 1 drains to Dam 1 (the Processing Dam), the lowest point on the Quarry Site. Dam 1 also receives water transfers from Dam 2 (the Holding Dam). Water captured in Dam 1 is used for material processing in the Processing Plant and site wide dust suppression activities (stockpiles, haul roads, exposed areas). Dam 1 has an estimated total capacity of 119 ML but typically operates with much lower inventories, with inventories expected to vary with climatic conditions.

Catchment 2 has an area of approximately 5.3 ha and is primarily comprised of disturbed areas (stockpiles and extraction areas) with a small portion of undisturbed land to the west of Dam 2. Inflows to Dam 2 include runoff from Catchment 2 and tailings slurry from the Processing Plant. Water is decanted from Dam 2 to Dam 1 for reuse via a riser pipe. Dam 2 has an approximate capacity of 24.4 ML. As the extraction area is developed, the area of Catchment 2 will increase, with the areas of Catchments 3 and 4 reducing by an equivalent amount.

Existing Water Balance

The Quarry Environmental Impact Statement (EIS) (Nexus, 1999) presented a predictive water balance that indicated the Quarry would have adequate operational water security during dry periods and sufficient storage capacity to ensure there would be no spills to the environment from the Quarry WMS.

Further water balance assessment work has been undertaken since the original Quarry EIS and is presented in the Quarry *Surface Water Management Plan* (SWMP) (VGT, 2018b). The water balance assessment undertaken by VGT and presented in the SWMP suggests that water deficits may arise during dry periods.



Legend

- Quarry Site
- Flow Direction
- Drainage line
- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Existing watercourse
- Bundwalls (including topsoil)
- Topographic contours (2m)

Image Source: Neermag (2019) Data source: Umwelt (2019), NSW LPI DTDB/DCOB (2018)

FIGURE 7.3
Existing Surface Water Management System

The Quarry relies on a secure source of water to meet operational demands. Water for Quarry operations is sourced from:

- rainfall runoff captured within the WMS (in Dam 1 and Dam 2)
- groundwater sourced from PB1 under WAL 24163
- potable water import for amenities use

The Quarry operational water demands and losses are:

- haul road dust suppression
- stockpile and exposed area dust suppression
- Processing Plant demands, i.e. product moisture losses
- evaporative losses from water storage surfaces
- irrigation of areas undergoing rehabilitation
- water storage seepage losses (considered negligible in the SWMP water balance (VGT, 2018b))

Should water supply be limited as a consequence of low rainfall conditions, the Quarry will curtail extraction and processing operations to ensure sufficient water is available to maintain ambient air quality controls (i.e. dust suppression) as a priority. Water for dust suppression will also be supplied from off-site water sources as required (e.g. potable water delivered by tanker).

Given the WMS and water sources and demands/losses for the extraction phase of the Quarry operation will not change substantially, the existing water balance has not been revised (refer to **Section 7.3.3.2**)

7.3.3.2 Proposed Water Management System

The WMS for the Quarry during the operational phase will remain generally unchanged from the Existing Quarry WMS (refer to **Section 7.3.3.1**). Extractive operations at the Quarry are planned to generally progress in a westerly direction and through Dam 3 and then Dam 4.

Imported VENM/ENM will be stockpiled in areas where extraction has been completed to the maximum depth and, where possible, shaping and planting of the final landform will commence. The final stages of extraction also include accessing the resource under the current Processing Plant location with the Processing Plant and stockpiles to be relocated to the immediate south west of the Office (between Dam 2 and Roberts Road). **Figure 4.1** presents an indicative sequence of extraction, VENM/ENM management and processing plant relocation over the life of the Quarry.

The conceptual final landform designs presented in **Figure 4.2** and **4.3** have been developed with consideration of the planned staging of extractive operations. Backfilling and shaping will generally progress from the eastern side of the Quarry, around the southern boundary and then into the western side in the later stages of extractive operations. As discussed in **Section 4.2.7.1**, the final landform has been considered for a lower and upper volume VENM/ENM available to construct the final landform. In both cases (refer to **Figures 4.2** and **4.3**), gradients across the final landform would range from 6° up to 11° providing a stable and free draining landform.

Throughout the Quarry's extraction phase, the water storage capacity within the Quarry WMS will be maintained and therefore the likelihood of off-site discharge will remain unchanged and low. However, the stockpiling and handling of VENM/ENM will introduce additional material to the site that could contribute to an increase in entrained sediment in runoff. Additional erosion and sediment controls will be implemented to firstly minimise erosion from the imported VENM/ENM and secondly control any sediment entrained in runoff. All erosion and sediment controls (ESCs) will be implemented in accordance with Landcom's *Managing Urban Stormwater Volume 1* (Landcom, 2004) and *Volume 2e Mines and Quarries* (DECC, 2008). The Quarry SWMP will be updated to include appropriate ESCs to address the additional erosion and sediment risks associated with VENM/ENM importation, handling and final landform development. The following ESCs are typical of the measures that are likely to be implemented during VENM/ENM importation, handling and final landform development:

- Ensure stockpiles of erodible material that have the potential to cause environmental harm if displaced are:
 - Appropriately protected (for example, seeded or covered) from wind, rain, concentrated surface flow and excessive up-slope stormwater surface flows.
 - Constructed on the contour at least 2 m (preferably 5 m) away from hazard areas, particularly areas of likely concentrated water flows, e.g. roads, slopes steeper than 10% etc.
 - Stabilised (provided with an appropriate protective cover (synthetic, mulch, or vegetative)) if they are to be in place for more than 10 days.
- Stockpiles are to have sediment fencing installed on the downslope side and a diversion bund installed on the upslope side as per Standard Drawing SD4-1 Stockpiles to protect from run-on water.
- Appropriate protection of reworked landform (for example, seeded, mulched or other covering) from wind, rain, concentrated surface flow and excessive up-slope stormwater surface flows will be provided.
- Energy dissipation will be installed on slopes at 80 m intervals where required.

Following the completion of extraction from areas of the Quarry imported VENM/ENM will be used to backfill the void area with the landform shaped (to achieve the landform of **Figure 4.2** or **Figure 4.3**) and planted. Placement of VENM/ENM would initially be aimed at the final landform provided by **Figure 4.2**, however, should volumes of VENM/ENM received be less than anticipated over the initial years of operations placement and profiling would revert to the landform of **Figure 4.3**).

As filling of the Quarry void progresses the WMS water storage capacity will be reduced and the likelihood of spills from the WMS will increase. As extraction is completed, Quarry water demands will be further reduced as sand processing is ceased. As such, the landform will incorporate Sediment Basin 1 which will be designed, constructed and operated in accordance with the Blue Book to manage a 5 day 95th percentile rainfall event. Sediment Basin 1 is represented as the water storage on **Figures 4.2** and **4.3**. All ESCs will be managed and maintained until full stabilisation of the landform is achieved, i.e. > 70% ground cover across the whole of the disturbed area within the catchment. As illustrated in **Figures 4.2** and **4.3**, Sediment Basin 1 will remain as a site water storage after the final landform has been adequately rehabilitated subject to the landholder maintaining sufficient surface water licence entitlement (refer to **Section 7.3.4**).

Table 7.10 presents the Sediment Basin 1 design basis and minimum design capacities. Given the uncertainty with respect to the soil characteristics of the VENM/ENM to be imported, the design calculations have conservatively assumed the soils will be hydrologic group D. In reality, the surface is likely to be more permeable and therefore the volumetric runoff coefficient (C_v) less (with resultant reduction in runoff). Allowing for a sediment zone capacity equal to 50% of the required settling zone volume, the total capacity of Sediment Basin 1 is required to be 30.3 ML (refer to **Table 7.10**).

Table 7.10 Sediment Basin 1 Preliminary Design

Dam	Soil Hydrologic Group	Runoff Coefficient (C _v)	5-Day Rainfall, 95 th Percentile (mm)	Catchment Area (ha)	Settling Zone Volume (ML)	Sediment Storage Volume (ML)	Total Basin Volume (ML)
Dam 1 (Final Landform)	D	0.79	69.4	36.9	20.2	10.1	30.3

Water drawn from Sediment Basin 1 would be used for dust suppression and irrigation of the rehabilitating final landform. However, the water demands associated with rehabilitation are unlikely to consume all of the water captured in Sediment Basin 1 during wet periods. As such, for a period between final landform construction and completion of rehabilitation to produce a non-polluting, free-draining landform, the Quarry would be required to discharge water from Sediment Basin 1 to the downstream environment so as to maintain the minimum settling and sediment storage volumes.

Therefore, at some time in the future, prior to the establishment of the proposed free draining landform, the Applicant will apply to vary EPL 6535 to include an LDP to allow surplus water captured in Sediment Basin 1 to be discharged to the drainage line immediately to the north of the Quarry (refer to **Figure 7.3**). It is noted this discharge will only be required on the landform becoming free-draining. The predicted Sediment Basin 1 discharge volumes and frequencies are provided in **Section 7.3.3.3**.

7.3.3.3 Final Landform Water Balance

7.3.3.3.1 Model Description

A daily time step water balance model (the Model) for the final landform was prepared using GoldSim modelling software to estimate the rehabilitation irrigation demands and the volumes and frequency of discharges from Sediment Basin 1. The bases and assumptions are listed below:

- Rainfall inflows were based on rainfall data sourced from the Maroota (Old Telegraph Road) BoM station (station 067014) with data gaps infilled with rainfall records from the Gunderman (Wisemans Ferry Road) (station 067040), Wisemans Ferry (Old Post Office) (station 061119) and UWS Hawkesbury Campus BoM station (station 067021). A total of 85 years of daily rainfall data was modelled.
- Evaporation outflows were based on UWS Hawkesbury Campus BoM station (station 067021).
- Runoff was estimated using the Australian Water Balance Model (AWBM). The AWBM was initially calibrated to the average regional runoff (ARR) at the Quarry Site of 0.8 ML/ha/year (NSW Farm Dam Calculator, 2019). Given the final landform is likely to be constructed from fill that is not endemic to the local catchment, the AWBM parameters were then adjusted to predict a higher average annual runoff of 0.9 ML/ha/year to ensure discharge volume and frequency estimates were by the Model were conservative.
- The catchment area to be irrigated is 25 ha.
- A maximum watering rate of 20 mm per day including rainfall. i.e. Irrigation demand is equal to 20 mm minus daily rainfall depth.
- A minimum annual irrigation demand (including rainfall) of 183 ML/year. This has been based on an average watering rate of 2 mm/day (731 mm/year) which approximately equates to a 25th percentile rainfall year for the modelled historical rainfall data set.

- Controlled discharges occur when irrigation demands are lower than the required Sediment Basin 1 dewatering rate (i.e. the minimum dewatering rate to restore the settling zone capacity within five days following a rainfall event). The volume of controlled discharge on a particular day is estimated as the minimum Sediment Basin 1 dewatering rate minus the calculated irrigation volume on that day.

7.3.3.3.2 Results

The following water balance results are based on the minimum Sediment Basin 1 settling zone volume to accommodate a 5 day 95th percentile rainfall event. Should Sediment Basin 1 be installed with a settling zone volume in excess of the minimum required capacity, the frequency and volume of discharges could be expected to be lower and water shortfalls during dry conditions could be smaller.

Table 7.11 presents the gross water balance for the final landform during the period prior to the establishment of adequate vegetative cover. The gross water balance accounts for the minimum irrigation demand (refer to **Section 7.3.3.3.1**) and excludes controlled discharges.

Table 7.11 Gross Water Balance

Statistic	Result (ML/year)
10 th Percentile	-11.8
50 th Percentile	4.3
90 th Percentile	24.8

Water balance modelling indicates that the final landform WMS will operate with neutral to small surplus median water balance and have a need to discharge surplus water for median to wet rainfall years. The modelling results also indicate that water imports may be required during dry years if the assumed minimum irrigation rates are to be maintained.

Table 7.12 presents the predicted number of days that controlled discharges from Sediment Basin 1 will be required and **Table 7.13** presents the predicted annual controlled discharge volumes from Sediment Basin 1. **Table 7.14** presents the predicted number of spill events (events may occur over consecutive days) from Sediment Basin 1 and **Table 7.15** presents the predicted annual spill volumes from Sediment Basin 1.

Table 7.12 Controlled Discharge Days

Statistic	Result (days/year)
Minimum	3
10 th Percentile	8
50 th Percentile	15
90 th Percentile	27
Maximum	51

Table 7.13 Controlled Discharge Volumes

Statistic	Result (ML/year)
Minimum	0.0
10 th Percentile	0.4
50 th Percentile	4.3
90 th Percentile	24.8
Maximum	81.9

Table 7.14 Sediment Basin 1 Spill Events

Statistic	Result (events/year)
Minimum	0
10 th Percentile	0
50 th Percentile	0
90 th Percentile	0
Maximum	2

Table 7.15 Sediment Basin 1 Spill Volumes

Statistic	Result (ML/year)
Minimum	0.0
10 th Percentile	0.0
50 th Percentile	0.0
90 th Percentile	0.0
Maximum	20.9

Controlled discharge frequency ranges from a minimum of three days per year to a maximum of 51 days per year. During dry years, controlled discharges are predicted to be minimal while discharge volumes are expected to range from 4 to 82 ML/year during median and wet years. It is proposed that controlled discharges will be regulated by the site EPL which will include water quality discharge concentration limits (refer to **Section 7.3.5.2**). Controlled discharges are expected to be required until adequate vegetative cover (approximately 70%) is achieved over the final landform and final landform catchment runoff can be considered clean.

Spills from Sediment Basin 1 are only predicted during wet rainfall years in high or prolonged rainfall events. This is a consequence of the relatively low runoff yield for the local catchment and the modelled maximisation of captured runoff reuse for irrigation. The predicted maximum annual spill volume of 20.9 ML presented in **Table 7.15** occurred across three days for a modelled historical rainfall period (4/8/1986 to 10/8/1986) where there was approximately 486 mm of rainfall preceding and throughout the spill event.

7.3.4 Surface Water Entitlement and Licensing

All water extraction in NSW, apart from some exemptions for government authorities and basic landholder rights extractions, must be authorised by a water licence. Harvestable rights, which are a basic landholder right under the *Water Management Act 2000*, allow a landholder to capture and use up to 10% of the average regional runoff from a landholding. Basic landholder rights are exempt from volumetric licensing requirements, however, water extracted under basic landholder rights must be taken into consideration when assessing licensing requirements. Water take under harvestable rights is typically managed by sizing site dams to the Maximum Harvestable Rights Dam Capacity (MHRDC) which equates to 10% of the average regional runoff for the landholding area.

Based on a total landholding of 28 ha and an average regional runoff of 0.8 ML/ha, the landholding has a MHRDC of 2.24 ML which is less than the proposed Sediment Basin 1 capacity of 30.3 ML.

However, the existing surface water licence WAL 26163 and works approval 10CA104888, which apply to the Quarry Site landholding, allows the capture of up to 264 ML/year of surface water runoff in Dam 3 and Dam 4. As extraction progresses Dam 3 and Dam 4 will be quarried through and all runoff on site will be directed to the Quarry WMS water storages (i.e. Dam 1 and Dam 2). As such, a variation will be required to allow continued surface water take under WAL 26163 and use of the captured water for operational Quarry water demands. Another variation to works approval 10CA104888 may be required as the final landform is developed with all surface water runoff from the site being captured in Sediment Basin 1.

7.3.5 Monitoring

7.3.5.1 Receiving Waters

Currently, the Applicant does not intend on discharging water from the Quarry Site. Prior to the cessation of Quarry operations, when a return to a free draining landform would be established, or in the event the Applicant wishes to establish an LDP, water quality monitoring would be undertaken in the drainage line directly to the north of the Quarry. Given the Quarry has not discharged to this drainage line, and is unlikely to do so for the operational life of the Quarry (VGT, 2018b), the data collected would be considered to be representative of the drainage line water quality in the absence of quarry impacts.

Monitoring would initially be undertaken on a monthly basis for a period of 24 months to prepare a data set that can be used to define site specific trigger values in accordance with ANZECC 2000. Once trigger values are established monitoring could be reduced in frequency or ceased, reverting to monthly when the Quarry ceases extraction and processing operations when discharges from the final landform WMS are expected. Monthly water quality monitoring will continue until adequate vegetation coverage of approximately 70% of the final landform has been established and runoff from the site can be considered clean. **Table 7.16** presents the proposed water quality monitoring program.

Table 7.16 Proposed Baseline Water Quality Monitoring Program

Parameter	Units	Initial Frequency
pH	-	Monthly*
EC	µS/cm	
TSS	mg/L	
Turbidity	NTU	

*Monitoring will be undertaken quarterly after an initial 24 month period but revert to monthly when extraction and processing operations at the Quarry cease.

7.3.5.2 Discharges

As discussed in **Section 7.3.3.2** controlled discharges from the proposed final landform sediment basin (Sediment Basin 1) are predicted to be required and an EPL variation will be required to incorporate a LDP. Discharge water quality and volume monitoring will be undertaken as presented in **Table 7.17**. Any future discharge concentration limit conditions for the parameters presented in **Table 7.17** will be informed by the proposed baseline water quality monitoring data (refer to **Section 7.3.5.1**). Controlled discharge volumes will be either directly measured using a flow meter or estimated based on the discharge pump duty flow rate and run time.

Table 7.17 Proposed Discharge Water Quality Monitoring

Parameter	Units	Frequency
pH	-	Monthly during discharge
EC	µS/cm	
TSS	mg/L	
Turbidity	NTU	
Volume	ML	During discharge

7.3.5.3 Erosion and Sediment Controls

Monitoring and maintenance of all erosion and sediment controls will be undertaken in accordance with the Blue Book. The site WMP will be updated to include procedures and checklists for erosion and sediment control monitoring and maintenance.

7.3.6 Impact Assessment and Mitigation Measures

When importing VENM/ENM during the extraction phase of the Quarry operation the WMS water storage capacity will remain unchanged. Given previous predictive water balances indicated the Quarry would have sufficient storage capacity to ensure no spills to the environment from the Quarry WMS (refer to **Section 7.3.3.1**), the risk of discharge from the Quarry WMS is considered to be unchanged in the extraction phase. Therefore the impacts to downstream water quality are considered to be negligible during the extraction phase of Quarry operations.

As the final landform is established the WMS water storage capacity will gradually be diminished. The final landform will, however, incorporate Sediment Basin 1 which will be designed, constructed and operated to manage a five day 95th percentile rainfall event in accordance with the Blue Book. Runoff captured in Sediment Basin 1 will be used for irrigation of the final landform catchment.

To ensure Sediment Basin 1 is managed to maintain sufficient capacity to accommodate the 5 day 95th percentile rainfall event within five days following rainfall, it is proposed to vary site EPL 6535 to include an LDP allowing for surplus water from the final landform WMS to be discharged off-site (refer to **Sections 7.3.3.2** and **7.3.5.2**). It is expected that EPL 6535 will include discharge concentration limit conditions for a range of pollutants including pH, EC and TSS. Hodgson's Quarry Products will implement any required water treatment measures to ensure discharges do not exceed any proposed limit conditions. Water quality management in Sediment Basin 1 will continue until adequate vegetative cover (approximately 70%) is achieved over the final landform and final landform catchment runoff can be considered clean. Therefore the impacts to downstream water quality are considered to be negligible during the final landform establishment period.

The Quarry currently operates in accordance with a *Surface Water Management Plan* (SWMP) (VGT, 2018b) which describes the diversion and storage of clean and dirty water flows within the Quarry Site, management of seepage and potential water contamination, and erosion and sediment control. The management measures nominated in the SWMP will continue to be implemented with the SWMP to be reviewed and updated following approval of the Proposed Modification to account for any changes resultant from the proposed importation of VENM and ENM, expanded active operating areas and modifications to the final landform.

The estimated surface water entitlement (surface water licence and harvestable rights) for the final landform (refer to **Section 7.3.4**) land holding will exceed the surface take associated with Sediment Basin 1. In fact, the final landform design will result in an increase in flows to the downstream environment when compared to the extraction phase operation. Given the surface water entitlement for the final landform land holding is considered adequate, no impacts associated with loss of catchment yield are expected. Rather a positive impact is expected as a result of the final landform design returning water to the downstream environment.

7.4 Air Quality

7.4.1 Scope

An assessment of the air quality impacts of the Proposed Modification has been prepared by Jacobs Group (Australia) Pty Limited (Jacobs) in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (EPA, 2016). The Air Quality Impact Assessment (AQIA) (Jacobs, 2019) is provided in **Appendix 7** and a summary of findings is presented below.

7.4.2 Existing Environment

7.4.2.1 Meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature, and atmospheric stability.

A meteorological station is operated onsite at the Quarry adjacent to the Site Entrance and office area (refer to **Figure 3.3**). Annual statistics from meteorological wind data collected at the Quarry from 2014 to 2018 are provided in **Table 7.18**.

Table 7.18 Annual Statistics from Meteorological Data Collected at the Quarry (2014 to 2018)

Statistic	2014	2015	2016	2017	2018
Per cent complete (%)	85.1	97.6	99.9	91.6	99.9
Mean wind speed (m/s)	1.0	0.9	1.1	1.0	1.1
99 th percentile wind speed (m/s)	4.9	4.0	5.4	4.9	5.8
Percentage of calms (%)	46.0	49.7	46.0	49.2	49.9
Percentage of winds >6 m/s (%)	0.3	0.1	0.3	0.3	0.6

Source: Jacobs (2019)

For air quality assessments, a minimum one year of hourly data is required, which means that almost all possible meteorological conditions, including seasonal variations, are considered in the model simulations.

For the purpose of modelling impacts on local air quality, the 2018 calendar year was selected as the meteorological modelling year for the following reasons:

- 2018 had a higher data capture rate compared with 2017, 2016 and 2015.
- A higher frequency of calm conditions was recorded in 2018. Calm conditions typically lead to higher predictions of ground-level concentrations as these conditions are often associated with poor dispersion whereby any dust emissions disperse more slowly and allow higher concentrations to exist for extended periods of time.
- Contemporaneous background data is available for 2018, to allow a more detailed review of changes in the number of exceedances.

7.4.2.2 Background Air Quality Levels

Emissions to air will occur from a variety of activities including material extraction, material handling, material transport, processing, and wind erosion of stored materials and exposed surfaces. These emissions would mainly comprise of particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM₁₀) and particulate matter with equivalent aerodynamic diameter of 2.5 microns or less (PM_{2.5}). There would also be relatively minor emissions from machinery exhausts such as carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter.

Jacobs (2019) reviewed data collected from three deposited dust gauges and a high volume air sampler (HVAS) on the Quarry Site, as well as a tapered element oscillating microbalance (TEOM) at the nearby Maroota Public School, and estimated background levels that apply at sensitive receptors are as follows:

- annual average PM₁₀ concentrations of 17 µg/m³
- annual average PM_{2.5} concentrations of 13 µg/m³
- annual average TSP concentrations of 32 µg/m³
- annual average dust deposition of 2.1 g/m²/month.

A more detailed review of available monitoring data and establishment of background levels is provided by Jacobs (2019) (refer to **Appendix 7**).

7.4.3 Air Quality Criteria

The EPA has developed assessment criteria for:

- TSP, to protect against nuisance amenity impacts
- PM₁₀ and PM_{2.5} to protect against health impacts
- deposited dust, to protect against nuisance amenity impacts.

Most of the EPA criteria are drawn from national standards for air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPM). These criteria are outlined in **Table 7.19** and apply to existing and potential sensitive receptors such as residences, schools and hospitals.

Table 7.19 NSW EPA Impact Assessment Criteria for Key Emissions

Pollutant	Averaging Period	Criteria	Source
PM ₁₀	24-hour	50 µg/m ³	EPA (2016)/DoE (2016)
	Annual	25 µg/m ³	
PM _{2.5}	24-hour	25 µg/m ³	EPA (2016)/DoE (2016)
	Annual	8 µg/m ³	
TSP	Annual	90 µg/m ³	EPA (2016)/NHMRC (1996)
Deposited dust (insoluble solids)	Annual (maximum increase)	2 g/m ² /month	EPA (2016)/NERDDC (1998)
	Annual (maximum total)	4 g/m ² /month	
Nitrogen dioxide (NO ₂)	1-hour	246 µg/m ³	EPA (2016)/NEPC (1998)
	Annual	62 µg/m ³	

In accordance with the NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018), voluntary mitigation or acquisition rights may apply where, even with best practice management, the development contributes to exceedances of the particulate matter criteria specified in **Table 7.19**. The applicability of the VLAMP has been reviewed by Jacobs (2019) in the context of the certainty of potential air quality risks of the Proposed Modification.

7.4.4 Assessment Methodology

7.4.4.1 Approach

The AQA has been prepared in consideration of the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (2016) using a Level 2 assessment approach, and with an emphasis on emissions of particulate matter (PM), the key pollutant typically associated with quarrying operations. The approach included three key elements as follows:

1. Identification of key representative operational scenarios and development of emissions inventories for each scenario.
2. Development and running of a dispersion model based on the local terrain, meteorological conditions and proposed locations of key emission sources of the Proposed Modification.
3. Assessment of the predicted emission and deposition levels at sensitive receivers generated by the modified Quarry operations and prediction of cumulative impacts when background air quality is accounted for.

A summary of these three key components of the methodology is provided below, with a full description included in **Appendix 7**.

7.4.4.2 Emissions Inventories

Total dust emissions for the Quarry were estimated based on material handling schedule, equipment listing and Quarry plans and identifying the location and intensity of dust generating activities.

As part of the assessment, dust emission inventories were developed for the following modelled scenarios:

- Existing operations, at the approved extraction rate, for comparison with future operations.

- Proposed Modification with VENM/ENM filling at northeast corner of the Quarry.
- Proposed Modification with VENM/ENM filling at southeast corner of the Quarry.

The locations of the various emission sources for each scenario are provide by *Figures 7-1 to 7-3* of the AQIA (refer to **Appendix 7**).

The total estimated emissions for the above scenarios are provided in **Table 7.20** and the full inventories are presented in **Appendix 7**. The increase in estimated emissions for the two Proposed Modification scenarios compared to the existing scenario are associated with the hauling, unloading and placement of VENM/ENM materials.

Table 7.20 Estimated Emissions from the Quarry

Pollutant	Estimated Annual Emission (kg/y)		
	Existing	Proposed Modification (North)	Proposed Modification (South)
TSP	36,612	47,282	47,826
PM ₁₀	13,770	17,256	17,373
PM _{2.5}	960	1,459	1,465

7.4.4.3 Dispersion Modelling

The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources, and the model predictions have been compared with relevant air quality criteria. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions.

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model.

7.4.4.4 Cumulative Impacts

Recognising that the Quarry currently exists and that the Proposed Modification represents the continuation of quarrying activities up to the same maximum approved rate of extraction, albeit with an increase in activity arising from the importation of VENM/ENM products, assessment of the predicted incremental change from existing to proposed operations has been assessed. To provide this assessment of cumulative impact, Jacobs (2019) define “Cumulative” as the “Project” (as modelled) minus “Existing” (as modelled) plus “Background”. This approach provides for the cumulative impacts of neighbouring quarries and other industry as the contributions from these are contained in the background levels.

7.4.5 Impact Assessment

The incremental and cumulative concentrations of airborne particulate matter and deposited dust were predicted at the receivers RR01 to RR13 surrounding the Quarry Site (refer to **Figure 7.4**). The following provides a summary of the modelling predictions and assessment of impacts provided by Jacobs (2019) (refer to **Appendix 7**).

7.4.5.1 Annual average PM₁₀, TSP, and deposited dust

The results of the modelling indicate that the predicted annual average PM₁₀, TSP and dust deposition at the nearest sensitive receiver locations all comply with the impact assessment criteria.

7.4.5.2 Annual average PM_{2.5}

The annual average PM_{2.5} background concentration in 2018 (13.5 µg/m³) already exceeded the 8 µg/m³ assessment criteria in the Approved Methods. Increases of up to 0.5 µg/m³ (i.e. around 4%) and 0.4 µg/m³ (i.e. approximately 3%) were predicted for the Proposed Modification with VENM/ENM filling in the north and south of the Quarry Site respectively. The contribution of the existing Quarry to PM_{2.5} concentrations is less than 1 µg/m³ at all nearest receivers. This means that the existing (and proposed) Quarry operation is not likely to be the cause of background annual average PM_{2.5} concentrations which exceed the 8 µg/m³ criterion.

7.4.5.3 24-hour average PM₁₀ and PM_{2.5}

The 24-hour averaged PM₁₀ (2018) background air quality data already exceeded the EPA's 50 µg/m³ assessment criteria on up to six days per year. For these types of situations where background concentrations are already elevated, the Approved Methods requires the determination of whether "additional exceedances of the impact assessment criteria will occur as a result of the proposed activity". This analysis was performed at the four nearest receivers in different directions from the site.

24-hour average PM₁₀

With VENM/ENM importation taking place at the northeast corner of the Quarry Site, no additional exceedances were predicted to occur at RR01. One additional exceedance per year was predicted at RR03 and RR08. Four additional days where concentrations exceeded 50 µg/m³ in the year were predicted at RR12.

For the alternative option involving VENM/ENM importation occurring in the southeast corner, no additional instances of daily PM₁₀ concentrations above 50 µg/m³ were predicted at RR01, RR03 and RR08. One additional exceedance per year was predicted at RR12. On this day it is noted that the background concentration was 47 µg/m³ and contributions from the site were 5 µg/m³.

24-hour average PM_{2.5}

Daily background PM_{2.5} concentrations in 2018 were also measured to occasionally exceed the 25 µg/m³ impact assessment criteria. The same assessment approach was applied, with the average ratio of PM₁₀ to PM_{2.5} measured at the HVAS used to scale the daily PM₁₀ to estimate daily PM_{2.5} at the TEOM. Since PM_{2.5} data from the HVAS were only available to April 2018, the June and December 2018 gaps in the TEOM dataset were filled using the annually averaged PM_{2.5} concentration (13 µg/m³).

With VENM/ENM importation taking place at the northeast corner of the site no additional exceedances were predicted to occur at RR01, RR03, RR08 and RR12. For the alternative option involving VENM/ENM importation occurring in the southeast corner, no additional instances of daily PM_{2.5} concentrations above 25 µg/m³ were predicted at receivers RR01, RR03, RR08 and RR12).



Legend

- Quarry Site
- Residential Receivers

FIGURE 7.4
Sensitive Receivers

7.4.5.4 Greenhouse Gas Emissions

The Quarry generates emissions of greenhouse gases associated with:

- electricity use on site
- burning of fuel by plant and equipment on site
- burning of fuel associated with the transport of products to market.

With respect to the Proposed Modification, a small increase in greenhouse gas emissions is likely as a result of the increased movement of trucks to and from the Quarry Site and increased operation of some mobile equipment associated with the placement and profiling of VENM and ENM. Overall, however, the increase in diesel consumption would result in a very minor increase in emissions when considered in the context of national and global emissions. Furthermore, the transport and management of these materials would be required, i.e. at another location, regardless of the Proposed Modification and as such the impact on net greenhouse gas emissions could be reduced if the transport distance between source and disposal site is reduced.

Notwithstanding the above, the Applicant will investigate and where feasible, implement initiatives to reduce energy consumption and greenhouse gas emissions throughout the life of the Project.

7.4.5.5 Summary and Interpretation

While Jacobs (2019) predicts some additional exceedances of criteria as a result of the Proposed Modification, in most cases, these additional exceedances were primarily the result of elevated background concentrations. In the only case where Quarry operations were identified as the major contributor to the exceedance, the primary source of emissions was extraction, i.e. an activity which is already approved.

The results indicate that the Proposed Modification is unlikely to significantly increase emissions from the Quarry, however, operations should implement additional measures to:

1. minimise site contributions during days of elevated background PM₁₀ concentrations, and
2. review the conditions when extractive and emplacement activities take place towards the perimeter of the Quarry.

Such measures are nominated in **Section 7.4.6**. On the basis of the implementation of these, it is assessed that the Proposed Modification would not have an unacceptable impact on local air quality.

With respect to the VLAMP, while it is assessed that while additional exceedances of daily PM₁₀ criteria could occur, direct application of acquisition or mitigation rights to receivers is not considered appropriate on the basis that these predictions are:

- based on conservative modelling which displays high sensitivity to meteorological conditions, and
- generally reflect high background concentrations of PM₁₀.

To ascertain whether operations present an actual rather than potential risk, the Applicant will continue to monitor the concentration of deposited dust and airborne particulate matter in accordance with the *Air Quality Management Plan* for the Quarry. The particulate matter monitoring in particular will illustrate whether the Quarry poses a real risk to neighbouring landowners of increased airborne particulate matter concentrations, or whether environmental factors associated with the local and regional setting will continue to be the primary cause of any elevated concentrations.

7.4.6 Monitoring and Management

Exceedances of air quality criteria are more likely when background concentrations are elevated, i.e. $\geq 40 \mu\text{g}/\text{m}^3$. Such conditions are most likely during hot, dry and windy conditions. To proactively identify and appropriately plan for these conditions before they occur, local meteorological forecasts should be reviewed each day. Where unfavourable meteorological conditions are forecast, the intensity (including number of trucks), types and location of activities and the controls to be implemented should be reviewed and adjusted.

Routine inspections to review whether the planned intensity, types, location and level of activities and the levels of controls in place remain adequate, or whether operations need to be scaled back or temporarily suspended should be undertaken. These inspections should review and record factors such as whether:

- dust is emanating from Quarry operations,
- the efficacy of control measures is being impaired, and
- meteorological conditions have changed so that wind is blowing dust in the direction from the Quarry to the nearest surrounding receivers.

The Applicant will also continue to monitor the concentration of deposited dust and airborne particulate matter in accordance with the *Air Quality Management Plan* for the Quarry. This monitoring data will allow the Applicant to review relative concentrations of PM_{10} and $\text{PM}_{2.5}$ and assess whether additional monitoring at receivers identified as potentially effected by additional exceedance of daily maximum criteria is required. The *Air Quality Management Plan* should be updated to include trigger levels for such supplementary monitoring.

7.5 Noise

7.5.1 Scope

An assessment of the potential noise impacts of the Proposed Modification has been completed by quantifying the difference in noise levels expected at receivers between those assessed and approved for the existing operations (by Wilkinson Murray Pty Ltd as part of a noise assessment for Modification 2 (WMPL, 2015)) and those of the proposed modification. The modified Quarry operations would remain substantially the same as those currently approved, with the relevant acoustic differences between the Quarry, as assessed by the MOD2 noise assessment, and the proposed modification as follows.

- The increased use of the Quarry bulldozer and front-end Loader to profile the VENM and ENM imported to the Quarry (currently these plant are utilised only occasionally for landform construction and profiling activities when sufficient clay waste or consolidated silt is available).
- An increase in the number of trucks accessing the site per day.

As identified in **Section 3.2.6**, the bulldozer and front-end loader to be used for VENM and ENM management are currently already in use at the Quarry. These noise sources were included in the modelling of noise completed by WMPL (2015), however, have been assessed as separate noise sources for the purpose of the noise assessment.

The Noise Impact Assessment (NIA) has been undertaken in accordance with the requirements of the NSW Noise Policy for Industry (EPA, 2017) (NPfI) and the NSW Road Noise Policy (DECC, 2011) (RNP) and can be reviewed in full as **Appendix 8**. The following provides a summary of the methods, results and assessment of impacts of the NIA.

7.5.2 Existing Environment

7.5.2.1 Local Setting

The noise climate in the area surrounding the Quarry Site, as measured annually at three residential receivers surrounding the Quarry Site (MAC 2016, 2017, 2018, 2019) is dominated by traffic, wind, birds and other ambient rural sources as the main noise sources in the local setting.

7.5.2.2 Sensitive Receivers

No sensitive locations such as schools, churches or major urban development are located near the Quarry Site. However, there are 13 residential receivers immediately surrounding the Quarry Site (refer to **Figure 7.4**).

7.5.2.3 Quarry Noise

The noise monitoring completed annually by Muller Acoustic Consulting (MAC) at three residential locations (refer to **Figure 7.4**), has confirmed that the Quarry contribution to local noise levels (averaged over a 15 minute period, $L_{Aeq,15\text{ min}}$) at these receivers varies as follows.

- From inaudible to 40 dB(A) between 6am and 7am.
- From inaudible to 41 dB(A) between 7am and 6pm.

7.5.3 Noise Criteria

7.5.3.1 Operational Noise Criteria

Operational noise criteria are prescribed for the Quarry by *Condition 47* of DA 267-11-99 and Condition L2 of EPL 6535. Noting these criteria are not consistent, the Quarry has adopted the criteria of the development consent for assessment of compliance purposes which are as follows.

For typical operations, noise from the premises must not exceed:

- an $L_{Aeq,15\text{ min}}$ of 43dBA (7am to 6pm) Monday to Saturday,
- an $L_{Aeq,15\text{ min}}$ of 40dBA (6am to 7am) Monday to Saturday, and
- an $L_{A1,1\text{ min}}$ of 50dBA (6am to 7am) Monday to Saturday.

It is noted these criteria do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Applicant has advised the DPIE in writing of the terms of this agreement.

Annual noise compliance monitoring has confirmed operations have complied with these criteria.

7.5.3.2 Road Noise Criteria

Traffic noise limits are provided by Condition 48 of DA 267-11-99 MOD 3. Traffic noise from the development is not to exceed the following noise limits at any affected residence on minor roads:

- an $L_{Aeq, 1 \text{ hour}}$ of 55 dB(A) between 7am and 10pm, and
- an $L_{Aeq, 1 \text{ hour}}$ of 50 dB(A) between 10pm and 7am.

Where existing L_{Aeq} traffic noise levels already exceed these criteria, the development is to ensure that traffic noise from the development does not result in an increase of more than 2 dB(A).

Annual noise compliance monitoring has confirmed operations have complied with these criteria.

With respect to the Proposed Modification, no change to the maximum number of hourly truck movements are proposed. As a result, the road noise criteria provided in the RNP (DECC, 2011) is relevant to assessment of road noise impacts associated with the Proposed Modification.

*For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use developments**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.*

The NSW EPA Application Note “Applying the NSW Road Noise Policy” further states:

The 2 dB increase applies to both the relevant day and night assessment criteria.

The time periods for the day and night assessment criteria are defined in the RNP as:

- $L_{Aeq, (15 \text{ hour})}$ represents the L_{Aeq} noise level for the period 7.00am to 10.00pm.
- $L_{Aeq, (9 \text{ hour})}$ represents the L_{Aeq} noise level for the period 10.00pm to 7.00am.

7.5.4 Assessment Methodology

7.5.4.1 VENM and ENM Importation and Application

Noise levels associated with the proposed modification have been predicted using the same modelling software and the same prediction method used by WMPL (2015), that is the Cadna/A proprietary noise modelling software using the ISO 9613 noise prediction method. The ISO 9613 noise prediction method (using the default parameters) calculates the long-term average noise levels from noise sources under moderate noise-enhancing meteorological conditions.

Existing Noise Sources (Extraction and Processing) Modelling

The noise level predictions of WMPL (2015) considered the following noise sources considered typical of operations at the Quarry, i.e. equipment as described in **Table 3.2**.

- 1 × excavator at base of excavation.
- 2 × dump trucks continuously between face and processing area.
- 1 × loader feeding processing plant managing stockpiles.
- 1 × diesel screen/conveyers.

- 1 × processing and washing plant/conveyers.
- 1 × loader loading haul trucks/managing stockpiles.
- 3 × road trucks in 15 minutes taking product off site.
- 1 x bulldozer located at the highest elevation within the extraction or emplacement area closest to surrounding receivers.

These noise sources were modelled for each of the approved extraction stages identified in **Figure 3.1**, assuming the adoption of the noise management measures nominated in **Section 7.5.6**.

VENM/ENM Management Noise Sources Modelling

While noting that the Applicant intends on using existing equipment (loader and bulldozer) for the management of VENM and ENM, the NIA considered these as separate noise sources to those of the approved operations and modelled by WMPL (2015). The NIA placed these on the existing Emplacement Area at the north-eastern corner of the Quarry Site (refer to *Figure 4.2* of the NIA) to assess the effect of these activities on the noise levels received at the closest receivers to these activities (RR03, RR06, RR08 and RR10).

Predicted noise levels from the VENM/ENM management activities were combined with the predicted noise levels of WMPL (2015) and compared against the existing Quarry noise limits of DA 267-11-99.

Section 3.0 of the NIA provides further detail on the assessment methodology.

7.5.4.2 Road Traffic Increase

The modification proposes an increase from a maximum of 100 to 140 truck movements per day. The modification does not propose to increase the maximum number of truck movements per hour of operation. Consequently the only impact will be the change in the total number of truck movements during the daytime period (7.00 am to 10.00 pm).

The potential road traffic noise impact of the proposed modification has been assessed by estimating the relative increase in $L_{Aeq(15 \text{ hour})}$ traffic noise levels during the daytime period 7.00 am to 10.00 pm as a result of the increased numbers of truck movements in and out of the quarry during the hours of operation 7.00 am to 6.00 pm.

The projected traffic (2020) for Old Northern and Wisemans Ferry Roads are shown in **Table 7.21**. The traffic projections were based on a growth rate of 2% as advised by traffic consultants SECA (2019) (refer to **Appendix 9**) from the data collected by Nexus (1999).

Table 7.21 Average Two-Way Traffic Volumes

Average Daily Vehicles (7 days)	Old Northern Road (Receiver RR12)		Wisemans Ferry Road (1700 Wisemans Ferry Road)	
	1999	2020	1999	2020
Total Vehicles	2026	3071	1769	2681
Light Vehicles	1844	2795	1589	2408
Heavy Vehicles	183	277	180	273

The relative increase in noise levels associated with the increased truck movements was assessed at the reference locations nominated in **Table 7.21**. In order to estimate the increase in the daytime 7.00 am to 10.00 pm period noise levels $L_{Aeq(15 \text{ hour})}$ the relative proportion of this projected traffic was estimated to be 75% of total 24-hour volumes. The existing distribution of Quarry trucks has been assumed, i.e. 80% of trucks will access the Quarry from the north, turning left onto Roberts Road from Old Northern Road, and 20% from the south, turning right onto Roberts Road from Old Northern Road.

All vehicles were assumed to be travelling at the sign-posted speed limit for each of the roads.

7.5.5 Results

7.5.5.1 VENM and ENM Importation and Application

The predicted noise levels at receivers are presented in **Table 7.22**.

Table 7.22 Predicted Noise Levels at Receivers $L_{Aeq,15 \text{ min}}$ dB(A)

Receiver	Existing Noise Source Modelling (Location of Typical activities + Dozer Location) ¹	Noise Prediction (WMPL, 2015)	Noise Prediction (VENM/ENM Noise Sources)	Combined Operations
RR03	1A + emplacement area	37	35	39
RR10	1A + emplacement area	42	39	44
	5A + extraction area	43	39	44
RR02	6b + extraction area	38	38	41
RR12	5A + extraction area	40	39	43
RR01	6b + extraction area	35	35	38
RR06	1A + emplacement area	38	32	39
RR08	1A + emplacement area	41	38	43

Note 1: Refer to **Figure 3.1**

The predicted noise levels from the proposed modification would comply with the noise limit of 43 dB(A) $L_{Aeq(15 \text{ minute})}$ at all receivers, except for minor 1 dB(A) exceedances at Receiver RR10. As the noise predictions of **Table 7.22** are based on worst-case site noise emissions, it is expected that compliance with noise limits will be achievable by adherence to the ongoing noise control strategies in the Quarry Operational and Road Noise Management Plan (ORNMP) (MAC, 2016). These are discussed further in **Section 7.5.6**.

7.5.5.2 Road Traffic Increase

The maximum increase in $L_{Aeq(15 \text{ hour})}$ road traffic noise levels, as a result of the increase truck movements, is predicted to be 0.3 dB(A). This is well below the RNP (DECC, 2011) assessment criteria (2dB(A)) increase) and consequently the increased truck movements is expected to result in negligible noise impact.

7.5.6 Noise Management and Mitigation

The Applicant would continue to implement the operational controls and management measures currently implemented and identified in the Quarry's ORNMP (MAC, 2016). These measures, and modifications relevant to the proposed modification which are identified in underlined italics, are summarised as follows:

- All approved hours of operation will be strictly adhered to.
- Prior to the commencement of extraction or VENM and ENM placement and profiling, in each new stage, a bund will be pushed up around the stage perimeter, i.e. between the operational area and noise receivers.
- Other temporary bunds are to be established when extraction and/or VENM and ENM placement and profiling occurs in close proximity to the property boundary of neighbouring receivers. Prior to constructing the bunds, consultation with the neighbouring residence is sought which provided clear lines of communication between the quarry and community.
- All excavators used on site are fitted with acoustic mufflers that achieve a noise level of 76dBA at 7m.
- On addition of any replacement or upgrade of equipment, these will be screen tested for noise emissions when introduced to site. The screening tests are designed to ensure new or modified equipment operates with a sound power level equivalent to or less than identified in the ORNMP.
- All employees and contractors working at the Quarry will undergo a project induction, during which personnel will be made aware of the location of noise sensitive receivers and the mitigation measures to be implemented to reduce noise impact to the community. Records of noise training and awareness for all staff and contractors will be held on site.
- Signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site.

Other noise management measures to be applied as necessary will include.

- Operations at exposed locations and under unfavourable weather conditions, e.g. winds blowing towards noise receivers, will be modified, where necessary, to reduce potential noise-related impacts.
- All relevant equipment will be regularly serviced to ensure sound power levels of each item remains equivalent to or less than the SPLs nominated in the ORNMP (MAC, 2016).
- The internal road network will be maintained to the current standard and if any new roads are proposed these will be constructed to similar standards to limit body noise from empty trucks.
- Maintenance work on all plant and equipment will only be undertaken outside the standard hours of operation if these are inaudible at all residential premises surrounding the Quarry Site.

7.5.7 Monitoring

In accordance with the ORNMP, attended noise monitoring is currently undertaken at three locations annually to measure operational and road traffic noise. The monitoring includes a contingency monitoring program in the event non-compliant noise levels are recorded as follows.

If attended noise monitoring indicates that noise generated from the Quarry is higher than noise limit criteria the following actions will occur:

- On observation of an exceedance, the person undertaking the monitoring will contact the Quarry Manager and inform them of the noise level and location of the noise exceedance.
- The Quarry Manager will immediately investigate the source of the noise and make necessary arrangements to alter operations to reduce noise levels.
- The Quarry Manager will inform the person undertaking the noise monitoring when site operations have been altered.
- The person undertaking the monitoring will recheck and confirm noise levels with the Plant Manager.

The proposed method, locations and frequency of noise monitoring will be reviewed

On the basis of ongoing compliance (2016-2019), annual monitoring is considered adequate. However, should a trend for increasing noise levels be identified, it is recommended the monitoring frequency increase to six monthly or quarterly until noise levels reduce again.

7.6 Traffic and Transport

7.6.1 Scope

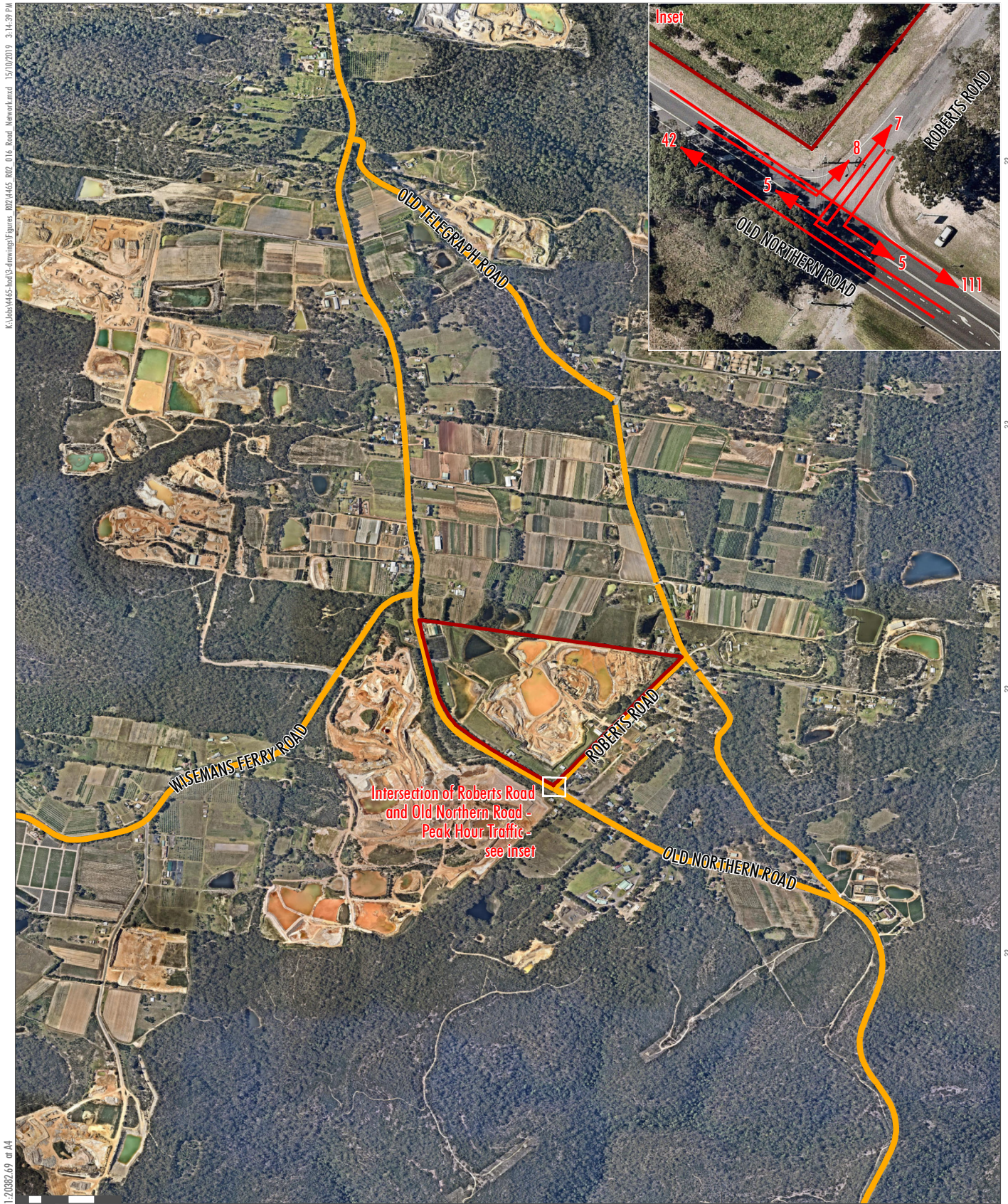
A Traffic Impact Assessment has been prepared for the Proposed Modification by Seca Solution and is summarised below. The full report is presented in **Appendix 9**. The assessment was undertaken to determine the traffic impacts of the proposed increase in daily truck movements in accordance with the requirements of Austroads Guidelines and Section 2.3 of the *RMS Guide to Traffic Generating Developments* (NSW Roads and Traffic Authority, 2002), which provides the structure for the reporting of key issues to be addressed when determining the impacts of traffic associated with a development.

7.6.2 Existing Traffic Environment

Access to the Quarry is available via a single vehicle access directly off Roberts Road, as shown in **Figure 7.5**. Roberts Road is a local rural road which provides access to the Quarry and several other land holdings and intersects with Old Telegraph Road to the east which provides access to further landholdings and another unrelated quarry operation. To the west, Roberts Road intersects with Old Northern Road. Old Northern Road is a collector road which originates at Wisemans Ferry on the Hawkesbury River and travels through north-western Sydney before terminating at Windsor Road on approach to the M2 Motorway.

DA 267-11-99 allows for the movement of up to 50 laden trucks (100 movements) per day and a maximum of 20 movements per hour. The trucks deliver sand and other quarry products principally to the Sydney construction market with approximately 20% heading south-east on Old Northern Road towards Pennant Hills Road and the majority (approximately 80%) heading north-west before turning onto Wisemans Ferry Road 900 m north of Roberts Road.

The site access is located on the northern side of Roberts Road, approximately 290 m east of the intersection with Old Northern Road. Roberts Road in this location offers a straight horizontal alignment allowing for good visibility in each direction along its length. Sight distance to the right (south-west) is 290 m with clear visibility to Old Northern Road, whilst sight distance to the left (north-east) is 220 m. These distances are in compliance with the sight distances for access driveways to commercial vehicle facilities as outlined in *Australian Standard AS 2890.2-2002 Parking facilities - Off-street commercial vehicle facilities*.



0 100 200 300 400 Meters

GCS North American 1927

Legend

- Quarry Site
- Local Road Network
- Traffic Movements (peak hour)

FIGURE 7.5

Local Road Network

The intersection of Old Northern Road and Roberts Road was also assessed, with visibility to the left out of Roberts Road being 300 metres, whilst visibility to the right is 278 m. Sight distance requirements at intersections are outlined in the *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2017), with safe intersection sight distance (SISD) being the critical requirement. For the posted speed limit of 90km/hr along Old Northern Road a SISD of 214 m is required. As such, the intersection satisfies Austroads requirements in regard to sight distance.

The layout of the Old Northern Road – Roberts Road intersection also includes a channelised right turn lane for turning movements into Roberts Road, which has a storage length of approximately 35 m with approximately 20 m of additional storage available within the painted median. This allows storage for at least two quarry trucks with through traffic still able to pass along Old Northern Road. Given the relatively low traffic flows and minimal delays for turning movements observed during the site work this turn lane is considered to have sufficient capacity (Seca Solution, 2019).

Seca Solution undertook a traffic survey at the intersection of Old Northern Road and Roberts Road to determine the current peak hour traffic flows in this location. This survey was completed on 4 December 2018 between 7.00 am and 9.00 am, with the peak hour determined as 7.15 am to 8.15 am. The survey established the peak traffic volumes through the Roberts Road – Old Northern Road intersection as follows:

- The two-way movements along Roberts Road during the intersection AM peak hour were 25 vehicles.
- The two-way flows on Old Northern Road were 166 vehicles during the intersection AM peak hour.
- Heavy vehicles represented 18% (32 vehicles) of the total flows recorded through the intersection.

The *Guide to Traffic Generating Developments* (RTA, 2002) notes that peak hourly flows typically represent 8 to 12% of daily flows, and based on this proportion the daily flows on Old Northern Road and Roberts Road would be in the order of 1,660 vehicles per day and 250 vehicles per day respectively. Using the Sidra Intersection 8 modelling package, the intersection was identified as operating with a Level of Service (LoS) A, with minimal delays or queuing for all turning movements (refer to **Table 7.23**).

Table 7.23 Sidra Analysis Old Northern Road – Roberts Road (2018 Survey Traffic)

Movement	Level of Service	Average Delay (s)	Back of Queue (m)
Right turn into Roberts Road	A	5.9	0.1
Left turn out of Roberts Road	A	6.2	0.4
Right turn out of Roberts Road	A	7.3	0.4
Left turn into Roberts Road	A	6.2	0.0

Quarry-generated truck movements currently show significant hourly and day to day variation, depending on market demands. During the December 2018 survey the quarry was not operating at its approved capacity of 20 vehicles per hour. To assess the operation of the Old Northern Road – Roberts Road intersection during maximum operations (up to 20 truck movements) during the peak hour, the Sidra analysis was repeated including an allowance for an additional 10 inbound and 10 outbound trucks. This is in addition to the truck flows already recorded during the traffic survey which accounted for the movements of trucks associated with the quarry operating on that day and also included other background traffic. The resulting LoS remained as A, with very minor increases to average delay and queuing (refer to **Table 7.24**). The intersection will continue to operate at the highest LoS allowing for the maximum hourly truck movements for the site.

Table 7.24 Sidra Analysis Old Northern Road – Roberts Road (Maximum Quarry Traffic)

Movement	Level of Service	Average Delay (s)	Back of Queue (m)
Right turn into Roberts Road	A	6.3	0.2
Left turn out of Roberts Road	A	6.6	1.2
Right turn out of Roberts Road	A	8.4	1.2
Left turn into Roberts Road	A	6.4	0.0

7.6.3 Proposed Changes to Traffic

The Proposed Modification seeks to increase the daily traffic volumes from 100 to 140 trucks per day, with no increase proposed for the existing hourly maximum of 20 trucks per hour. Instead the project shall see the additional heavy vehicle movements spread over the course of the day during periods of high demand.

All truck access will remain via the existing site access direct onto Roberts Road, with the existing distribution of vehicles onto Old Northern Road to be maintained.

The Proposed Modification is also seeking to extend the life of quarry operations by an additional five years to 2030.

7.6.4 Impact Assessment

To allow for assessment of the potential daily traffic flows in 2030, an annual increase of 2% per annum was applied for through movements along Old Northern Road. This rate accounts for increased flows associated with the growth of other quarry operations in the area. Along Roberts Road an allowance for growth of 1% per annum was applied to cater for other quarry operations, including the quarry located on Old Telegraph Road off Roberts Road, which recently began operation. The above growth rates were applied to the intersection flows through to 2030 with the results outlined in **Table 7.25**.

It can be seen from **Table 7.25** that the intersection will continue to operate at the highest LoS allowing for the maximum hourly truck movements and background growth through to 2030.

Table 7.25 Sidra Analysis Old Northern Road – Roberts Road (2030/Maximum Quarry Traffic)

Movement	Level of Service	Average Delay (s)	Back of Queue (m)
Right turn into Roberts Road	A	6.4	0.3
Left turn out of Roberts Road	A	6.7	1.4
Right turn out of Roberts Road	A	9.0	1.4
Left turn into Roberts Road	A	6.4	0.0

Based on the traffic survey completed in December 2018, the current two-way daily traffic flows along Old Northern Road (to the north of Roberts Road) are in the order of 1,660 vehicles per day. It is known that the quarry was operating at the time of the survey, with some of these movements therefore relating to the existing quarry operations. However, in order to ensure a worst-case assessment of the impact of the Proposed Modification on daily traffic flows, an allowance for an additional 140 vehicles per day associated with the modified quarry has been included.

Based on the 80/20 (north/south) distribution of quarry traffic this equates to:

- 112 vehicles moving to the north along Old Northern Road
- 28 vehicles moving to the south along Old Northern Road.

These increases represent less than 2% of the total traffic flows and are well within the capacity of the road network.

Allowing for background growth to 2030, flows on Old Northern Road (north of Roberts Road) could be in the order of 2,200 including the Proposed Modification to the quarry. This is still well within the capacity of the road.

With regards to impacts on road safety, it is noted that there is an existing school bus stop along Roberts Road. During the December 2018 survey two buses were observed (at approximately 7.15 am and 8.30 am). Both turned left into and left out of the intersection of Old Northern Road and Roberts Road.

Given the low traffic flows along Roberts Road and the good visibility for quarry trucks, it is considered the proposed increase in daily truck movements will not impact upon the operation of these buses. The hourly approval for the site will not change and as such the existing situation will remain with no identifiable safety issues for Roberts Road. Similarly as there is no proposed change to hourly operations the TIA concluded that there would be no impact on school bus operations.

7.6.5 Monitoring and Management

Based on the findings of the TIA presented in **Appendix 9**, no change to the existing traffic management measures implemented by the quarry are considered necessary for the Proposed Modification.

7.7 Waste Management

7.7.1 Waste Types

Waste would be both generated by operations on the Quarry Site as well as the VENM and ENM accepted to the Quarry Site before either being:

- applied to land in accordance with the relevant Resource Recovery Exemption; or
- further processed and blended with in situ sand resources to produce sand products.

No special waste, liquid waste, hazardous waste or putrescible solid waste would be accepted by the Quarry.

7.7.2 Waste Management Measures

7.7.2.1 Quarry Generated Waste

Table 7.28 provides a summary of the waste types, controls and safeguards that would be applied to the waste generated on the Quarry Site. **Table 7.28** also identifies contingency management in the event of incidents which have the potential to result in pollution to the surrounding environment.

Table 7.26 Waste Controls, Safeguards and Contingency Management

Waste Type	Storage	Disposal	Contingency
General solid waste (putrescible)	Covered bins will be located within the general area of the quarry office and amenities. Where bins would be located in open areas, they would be fitted with animal-proof lids.	Bins would be collected and the contents disposed at a licensed waste disposal facility.	In the event waste volumes exceed that able to be managed by local waste collection service, the Applicant would arrange for private delivery of waste to licensed landfill facility.
General solid waste (recyclables)	Covered bins located within general area of the Quarry infrastructure for the collection of recyclable materials.	Bins would be collected and transported to an appropriate recycling facility.	
General solid waste (non-putrescible)	Bin and designated adjoining area within general processing, stockpiling and office area for the collection of scrap metals, wood waste, empty containers not containing contaminated.	Bins and scrap material would be collected and the contents disposed at a licensed waste disposal facility or licenced scrap metal recycling facility.	
Waste oils and greases	Placed within bunded storage area.	Collected as required by a licensed waste contractor and transported to an appropriately licensed facility for recycling.	Any leakage, spillage or ground contamination would be managed in accordance with the Quarry's Pollution Incident Response Management Plan (PIRMP).
Tyres	Tyres would be securely stored until removed from site or used for another purpose.	Tyres would be removed from site for re-use elsewhere or recycling in accordance with the RRO and RRE for types issued under Part 9 of POEO (Waste) Reg.	N/A
Screened waste	Temporarily stockpiled within the extraction area.	As sufficient volumes are stockpiled, these would be returned to the quarry as backfill and incorporated into the final landform.	In the event of runoff from these stockpiles creating a sedimentation hazard, additional bunds and other controls would be implemented in accordance with the Blue Book.

7.7.2.2 Imported VENM and ENM

In addition to waste produced on site, the Proposed Modification aims at introducing two new waste streams to the site, namely VENM and ENM. The classifications of these waste materials is provided in **Section 4.2.2.1**.

Key features for the management of VENM and ENM are as follows.

- VENM would only be accepted after the generator supplies Virgin Excavated Natural Material Certification in accordance with the requirements of the NSW EPA.
- ENM would only be accepted in accordance with the ENM Resource Recovery Order. The ENM would only be accepted after the generator supplies a written statement of compliance with the ENM criteria.
- In order to avoid the introduction of waste that does not fall under the VENM or ENM classification, the following will be implemented.
 - Development of a material tracking register that stores as a minimum
 - Location of source site
 - Contact person at the source site
 - Volume and description of material received
 - Log of vehicles delivering the material
 - Reference number of sighted paperwork
 - GIS co-ordinates of the location where VENM/ENM is transported to on site.
 - Before accepting VENM/ENM to site all relevant paperwork proving that the material is VENM/ENM will be sighted and stored on site. Acceptable documentation must be in accordance with the relevant Order or requirements for VENM.
 - The material tracking register must be filled out every time VENM/ENM is accepted to site.
- ENM applied to land (as backfill) would be undertaken in accordance with the ENM Resource Recovery Exemption. To avoid any potential confusion over application practices, VENM would also be applied to land in accordance with the ENM Resource Recovery Exemption.
- For VENM or ENM not immediately disposed of to land, a database would be maintained to ensure that materials subject to further processing or blending, or retained in stockpile for 12 months, are identified for the purpose of identification and payment of any waste levy applicable in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014* (POEO (Waste) Reg).
- Prior to any screening or blending of the accepted ENM, relevant application would be made to the EPA, in accordance with the *Guidelines on Resource Recovery Exemptions (Land Application of Waste Materials as Fill)* (DECCW, 2011), for a specific resource recovery order and exemption for the material to be produced.
- Should an applicable Resource Recovery Exemption not be obtained, the Applicant would ensure that the relevant activity type (Resource Recovery and Waste Storage) and scale is included on EPL 6535 and the appropriate waste levy is paid in accordance with the POEO (Waste) Reg.

7.7.3 Impact Assessment

7.7.3.1 Pollution Potential

Waste generated by on-site extraction and other activities would be managed appropriately and assuming adherence to the management and contingency measures nominated in **Table 7.28**, should not pose significant risk of pollution to the surrounding environment.

VENM and ENM would be accepted under relevant Resource Recovery Orders and therefore may be applied to land (in accordance with the relevant Resource Recovery Exemption) or stockpiled for future sale and despatch from the Project Site without significant potential for pollution.

It is therefore assessed that the Proposal provides for appropriate waste management which reduces the risk of pollution or contamination to acceptably low levels. It is recommended, however, that a Waste Reveal and Handling Management Plan is prepared to further describe waste management procedures, protocols, monitoring and response to pollution incidents. The *Waste Management Plan* should be prepared in conjunction with the *Quarry Pollution Incident Response Management Plan*.

7.7.3.2 Biosecurity Risk

A biosecurity risk assessment was undertaken, in accordance with the DPI Task Risk Assessment. **Table 7.28** outlines the risk ratings which were applied during the risk assessment based on the classification of consequence (severity) described in **Table 7.27**.

Table 7.27 Consequence Rating

Severity Level	Area of consequence		
	Animal health and welfare Plant health	Human health, safety and well-being	Environmental
1 Insignificant	Isolated impact on a single enterprise	Medical treatment only	Change from normal conditions within environmental regulatory limits Environmental effects are within site boundaries.
2 Minor	Limited animal or plant impacts on single enterprise.	Loss-time injury	Short-term and/or well-contained environmental effects. Minor remedial actions probably required.
3 Moderate	Some animal or plant impacts on multiple properties across a region. Animal welfare impacts across a region	1-10 major injuries requiring hospitalisation and numerous days lost or medium-term occupational illness	Impacts external ecosystems and considerable remediation is required
4 Major	Considerable animal or plant impacts on multiple properties across a region. Animal welfare impacts across multiple regions.	Single fatality and/or 10-20 major injuries/ permanent disabilities/ chronic diseases.	Long-term environmental impairment in neighbouring or valued ecosystems. Extensive remediation required.
5 Extreme	Significant animal or plant impacts on multiple regions. Widespread animal welfare issues.	Multiple fatalities and/or >20 major injuries/ permanent disabilities/ chronic disease.	Irreversible large scale environmental impact with loss of valued ecosystems.

Source: Modified after Task risk assessment template V4 (DPI, 2018)

Table 7.28 Risk Rating

		Likelihood				
		E. Rare (e.g. once every 100 to 1000 years)	D. Unlikely (e.g. once every 10 to 100 years)	C. Possible (e.g. once every 1 to 10 years)	B. Likely (e.g. 2 - 10 times a year; could occur monthly or quarterly)	A. Almost certain (e.g. >10 times per year; could occur daily or weekly)
Consequence	5 Extreme	Medium	High	High	Very high	Very high
	4 Major	Low	Medium	High	High	Very high
	3 Moderate	Low	Medium	Medium	High	High
	2 Minor	Low	Low	Medium	Medium	Medium
	1 Insignificant	Low	Low	Low	Low	Medium

Source: Modified after Task risk assessment template V4 (DPI, 2018)

The risk rankings shown in **Table 7.28** are considered to be:

- Low: Broadly acceptable, ongoing monitoring is required
- Medium: Tolerable, active management is required
- High: Undesirable, intervention is required
- Very high: Generally intolerable, urgent attention is required

Identified biosecurity hazards applicable for the Proposed Modification are plant diseases being imported onto the Quarry Site, the introduction of weeds to the Quarry and dust from the Quarry affecting the health of people on neighbouring properties. The risk assessment ranked the risks of the biosecurity hazards as low (**Table 7.29**).

Table 7.29 Biosecurity Risk Rating

Risk	Risk Management Measure	Likelihood	Consequence	Rating
Introduction of disease onto site or exporting disease from site	Biomass (e.g. mulch) will not be accepted to site. Implement “Clean in - Clean out” principles for all vehicles/personnel moving onto and off the Quarry Site including: • changing/cleaning footwear; • maintaining personal hygiene; and • cleaning of vehicle and equipment. The vegetation of the quarry will be regularly inspected and any signs of disease will be referred to the relevant Government Agency for review.	D	2	Low

Risk	Risk Management Measure	Likelihood	Consequence	Rating
Introduction, propagation and spread of weed species.	VENM/ENM will not include significant soil materials which may contain weed seeds. VENM/ENM will be inspected on arrival to the Quarry Site. Regular weed surveys will be carried out and reported in the Annual Review. Weed spraying will be undertaken as required.	C	1	Low
Dispersal of dust or other particulate matter VENM/ENM	Use water for dust suppression as required	B	1	Low

7.7.3.3 NSW Waste Avoidance and Resource Recovery Strategy 2014–21

The following considers the Proposed Modification against the targets of the NSW Waste Avoidance and Resource Recovery Strategy 2014–21 (EPA, 2014).

Key Result Area 1: Avoid and reduce waste generation

Target: By 2021–22, reduce the rate of waste generation per capita

The Proposed Modification would import waste materials which could otherwise report to landfill and either utilise as part of site rehabilitation, i.e. use of VENM and ENM to create a final landform more amenable to future agriculture, or production of materials for use elsewhere, i.e. sand products. As a result, this would reduce the overall waste generated within NSW.

Key Result Area 2: Increase recycling

Target: By 2021–22, increase recycling rates for:

- *municipal solid waste from 52% (in 2010–11) to 70%*
- *commercial and industrial waste from 57% (in 2010–11) to 70%*
- *construction and demolition waste from 75% (in 2010–11) to 80%.*

By providing a location for specific low risk wastes to be processed and recycled (either as specialty soil and gravel products or in rehabilitation), the net volume delivered to municipal waste facilities would be reduced. Furthermore, the Proposed Modification provides for the acceptance and re-use of ENM, a form of construction and demolition waste, thereby providing an additional location for recycling this form of waste.

Key Result Area 3: Divert more waste from landfill

Target: By 2021–22, increase the waste diverted from landfill from 63% (in 2010–11) to 75%

As noted above, the Proposed Modification provides an alternative to landfill for the nominated low risk waste materials.

Key Result Area 4: Manage problem wastes better

Target: By 2021–22, establish or upgrade 86 drop-off facilities or services for managing household problem wastes statewide

This area and target has no relevance to the Proposal.

Key Result Area 5: Reduce litter

Target: By 2016–17, reduce the number of litter items by 40% compared with 2011–12 levels and then continue to reduce litter items to 2021–22

The Proposed Modification has identified the quarry generated wastes and provided for appropriate methods of managing these to prevent litter (refer to **Section 7.7.2.1**).

Key Result Area 6: Reduce illegal dumping

Target: From 2013–14, implement the NSW Illegal Dumping Strategy 2014–16 to reduce the incidence of illegal dumping statewide. As part of this strategy, by 2016–17:

- establish baseline data to allow target-setting in other parts of the state.

On approval, the Quarry Site would provide a location for specific low risk waste materials to be accepted. This could reduce the possibility of illegal dumping of these wastes.

7.7.3.4 Conclusion

No significant impacts are expected as a result of the Proposed Modification which would allow for low risk waste materials to be imported to the Quarry (subject to confirmation as VENM or ENM) and either applied to land in accordance with the ENM Resource Recovery Exemption or processed for sale as sand after obtaining a specific Resource Recovery Order or payment of the relevant waste levy. The strategies outlined in **Section 7.7.2**, will minimise the risk that any material that could cause pollution will be accepted into the Quarry. The biosecurity risk assessment ranked all biosecurity hazards as low (refer to **Section 7.7.3**).

7.8 Visual Amenity

7.8.1 Existing Visual Environment

Bounded by Old Northern Road to the west, Roberts Road to the south and Old Telegraph Road to the east, the Quarry operations are visible from these roads. The following reviews the current and potential future views of the approved Quarry operations from these roads and properties located along these. The locations of the six photos referenced in the following sub-sections are identified on **Figure 7.6**.

7.8.1.1 Roberts Road

Views of the Quarry from Roberts Road, as well as the residential properties on the eastern side of Roberts Road, are largely obscured by the vegetated bund wall to the south of the Site Entrance and a combination of a bund wall and remnant native vegetated to the north of the Site Entrance. Quarry buildings and limited views into the Quarry Site are available at the Site Entrance. **Plates 7.1** and **7.2** present views from Roberts Road which illustrate the effectiveness of the vegetated bund.



Plate 7.1 View from Roberts Road
(towards south-west)

© Umwelt, 2018



Plate 7.2 View from Roberts Road
(towards north-east)

© Umwelt, 2018

Plates 7.1 and **7.2** illustrates that the vegetated bund wall provides an effective screen of activities at the southwestern corner preventing views of Quarry operations. Notably, the vegetated bund wall featured in **Plate 7.1** is to extend to the north-western corner to screen views as extraction progresses to the north.

7.8.1.2 Old Northern Road

A vegetated bund wall which extends from Roberts Road and established trees in the road easement currently obscures views of Quarry Operations. **Plates 7.3** and **7.4** present panorama photos from the north-western corner (at the commercial nursery) and south-western corner (at Roberts Road) of the Quarry.



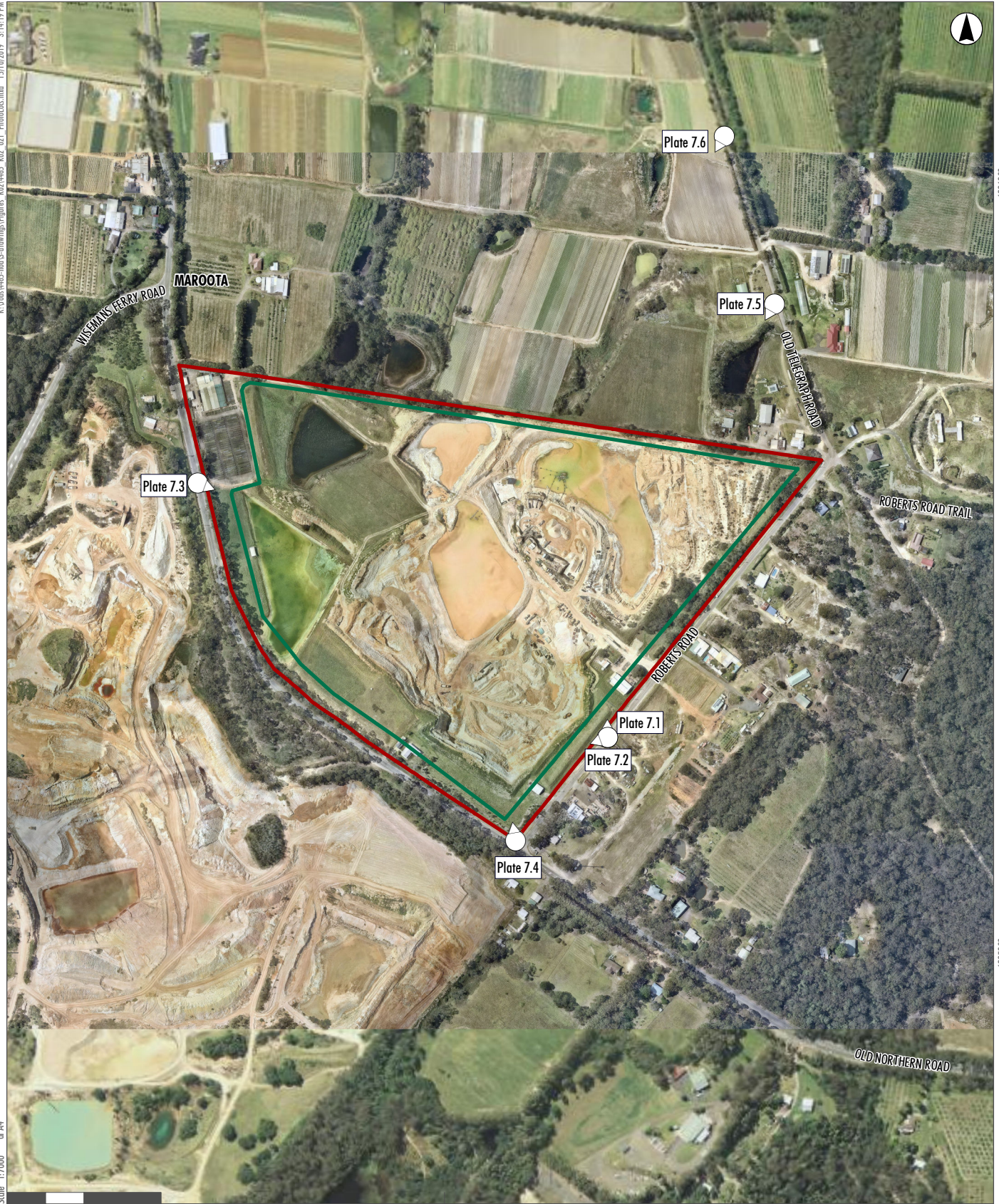
Plate 7.3 View from Old Northern Road (North-western Corner of the Extraction Area – Sunrise Nursery)

© Umwelt, 2018

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Scale 1:7000 at A4



6296000

6295000

GDA 1994 MGA Zone 56

- Legend**
- Quarry Site
 - Approved Extraction Area
 - Viewpoint Location and direction

FIGURE 7.6

Photo locations



Plate 7.4 View from Old Northern Road (Roberts Road Intersection) featuring vegetated bund wall

© Umwelt, 2018

In **Plate 7.3**, Dam 4 (which will be incorporated into the extraction area) is visible in the foreground with the active extraction face just visible behind this. In the background, the current emplacement area at the north-eastern corner of the Quarry Site is visible, as are feedstock sand stockpiles associated with the processing plant.

With the exception of the nursery, there are no residences or other buildings accessed from Old Northern Road which have direct views of the Quarry.

7.8.1.3 Old Telegraph Road

Local topography slopes to the north and northeast from Old Northern Road and Roberts Road and as a result the greatest exposure of the Quarry operations is from Old Telegraph Road and the properties accessed from Old Telegraph Road to the north and northeast of the Quarry Site. **Plates 7.5** and **7.6** provide indicative views of the Quarry Site from Old Telegraph Road.



Plate 7.5 View from 100 Old Telegraph Road

© Umwelt, 2018



Plate 7.6 View from (opposite) 149 Old Telegraph Road

© Umwelt, 2018

Notably, the current views of the Quarry represent the most exposed the operations are likely to be with further extraction to be screened by retained vegetation visible on the right hand side of the background of both photos.

It is evident that the visual impact of these views of Quarry operations are enhanced by the colour contrast of the exposed sand and clay. It is also evident that vegetated bunds would be of limited effect given rising topography and distance between the vantage points and the extraction area. Progressive rehabilitation to be undertaken in accordance with Quarry RLMP (*Figure Three* of which is provided as **Appendix 5**) will reduce the visual effect of the Quarry over time with this limiting the area of the Quarry Site which is 'active and exposed' at any given time.

Notably, the Applicant has not received any complaints from local landowners and residents regarding the visual impact of the Quarry operations. It is considered likely that this is a result of various factors including:

- general good performance of the Applicant in managing air emissions, noise and other factors with the potential to impact on the amenity of local landowners
- community acceptance of land uses that result in ground disturbance, e.g. extractive industry, agricultural/horticultural operation
- relatively small scale of the Quarry operations.

7.8.2 Proposed Changes to the Visual Environment

The Proposed Modification involves a request to remove Condition 29(c) of DA 267-11-99 which requires the quarry to provide for '*a planting and watering regime to ensure that no more than 3 hectares of the site are exposed and active at any one time*'. The proposed importation and use of VENM and ENM as backfill material on the Quarry Site makes this limitation impractical as the Applicant will be required to operate an extraction area as well as a VENM/ENM backfill area concurrently. The Applicant also notes that the composition and properties of the sand also varies across the site. As a result, the Applicant undertakes extraction from different extraction area with the Quarry (as illustrated by **Figure 4.1**) to allow for concurrent extraction of coarser (low clay content) and finer (higher clay content) sand which allows for optimal blending and production to suit a variety of customers.

As a result, the Applicant proposes that larger areas of the Quarry extraction area would be 'active and exposed' than the current 3 ha limit. This larger area of active and exposed operations notwithstanding, and as illustrated by **Plates 7.5** and **7.6**, views of extraction activities are unlikely to get any larger than those currently available from Old telegraph Road. As such, the increase in active and exposed area should have limited effect on local views.

It should also be noted that with the proposed importation of VENM and ENM to the Quarry Site, the final landform will be constructed with a significantly reduced slope. This would make the final landform more amenable to the quicker establishment of vegetation and transition to a landform and land use more sympathetic to the local surrounds. **Section 7.9** discusses the changes to rehabilitation and the final landform and **Section 7.10** considers impacts on land use as a result of the Proposed Modification in further detail.

7.8.3 Management Measures

The key management measures required to minimise impacts on local visual amenity are as follows.

- Retain and maintain stands of native vegetation along the boundary of the Quarry Site with Old Northern, Roberts and Old Telegraph Roads.
- Extend the bund wall along Old Northern Road and vegetate with native grasses, shrub and tree species.

- Implement progressive rehabilitation of the constructed landform.
- Implement dust suppression as nominated in **Section 7.5**.
- Continue engagement with surrounding landowners to ensure extraction and rehabilitation is being undertaken to the satisfaction of these landowners (to minimise impact on local visual amenity).

7.8.4 Impact Assessment

In the short to medium term, the removal of or modification to Condition 29(c) of DA 267-11-99 may result in an increase in the area of active and exposed operations. However, this impact would be mitigated given that:

- The views from Old telegraph Road and properties to the north and northeast of the Quarry are unlikely to be larger than currently available.
- The maintenance and extension of vegetated bund wall between the extraction area and Old Northern and Roberts Roads.
- The retention of stands of native vegetation within or adjoining the Old Northern, Old Telegraph and Roberts Roads easements.
- Implementation of dust suppression as described in **Section 7.5**.

It is not anticipated that the proposed Modification, including the removal of Condition 29(c) of DA 267-11-99 would result in any significant change in local visual amenity in the short to medium term.

In the long term, the change to the final landform due to the proposed importation of VENM and ENM is assessed as likely to have a positive impact on local visual amenity. Noting the modified operations do not propose any increase to the total disturbance footprint of the Quarry, do not propose to alter the overall revegetation strategy of the final landform, and would provide for a reduced slope of the final landform (likely to lead to better integration with surrounding topography, improved revegetation and final land use outcomes), the impact of the proposed Modification in the long-term is assessed to be positive.

7.9 Rehabilitation and Final Landform

7.9.1 Introduction

Section 4.2.7 reviews the proposed rehabilitation of the Quarry in light of the Proposed Modification. This section considers the implications of the nominated changes to the final landform on the established rehabilitation objectives and completion criteria approved by DA 267-11-99.

7.9.2 Rehabilitation Objectives and Completion Criteria

7.9.2.1 Rehabilitation Objectives

Noting the Proposed Modification to the final landform described in **Section 4.2.7** and presented on **Figures 4.2** and **4.3**, the rehabilitation objectives as approved by DA 267-11-99 have been reviewed (refer to **Table 7.30**).

Table 7.30 Rehabilitation Objectives and Impact of Proposed Modification

Feature	Objective	Impact of Proposed Modification
Site (as a whole)	Safe, stable and non-polluting	No change as overarching rehabilitation goals remain the same
	Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land	Positive impact. Backfilling the site with additional VENM and ENM will create a free draining landform which will result in better integration with surrounding land.
Surface Infrastructure	Decommissioned and removed, unless the Secretary agrees otherwise	No change, surface infrastructure will be removed unless otherwise agreed. Dam storage capacity of Lot 2 DP228308 will be reinstated.
Quarry Benches	Landscaped and vegetated using native tree and understorey species	The modified final landform will remove the requirement for benches in the final landform.
Quarry Pit Floor	Landscaped and revegetated using improved pasture species, native trees and understorey species	No change to revegetation strategy. Backfilling with additional VENM and ENM will create a free draining landform which will result in better integration with surrounding land.
Final Void	Minimise the height and slope of batters	Backfilling with additional VENM and ENM will create a free draining landform and removal of a 'void'. The slope of the final landform will be reduced resulting in a landform which is better integrated with surrounding land. No change to final void batters
Community	Ensure public safety	No change. The reduced slopes and removal of a final void will generate a positive impact for future public safety.
	Minimise the adverse socio-economic effects of quarry closure	No change. The gentler slopes and free draining nature of the final landform will allow for post-quarry use of the landform for agricultural, horticultural or residential activity or development.

7.9.2.2 Preliminary Completion Criteria

Completion criteria will be utilised to demonstrate achievement of rehabilitation objectives/performance standards. The preliminary closure and rehabilitation completion criteria for the Modification are outlined in **Table 7.33**, along with the likely effect of the Proposed Modification on these criteria.

Table 7.31 Preliminary Closure and Rehabilitation Completion Criteria

Aspect	Preliminary Completion Criteria	Effect of Proposed Modification
Decommissioning	All infrastructure which does not have a potential future use associated with the post-quarrying land use will be removed, unless such removal has a greater environmental impact than rehabilitating the area with the infrastructure remaining in place. Removal of all services which do not have a potential future use associated with the post-quarrying land use (power, water, communications).	No change. • surface infrastructure will be removed unless otherwise agreed. • Dam storage capacity of Lot 2 DP228308 will be reinstated.
Landform	No significant erosion is present that would constitute a safety hazard or compromise the capability of supporting the final land use.	The proposed modified landform would promote the achievement of these criteria given: • the reduced slope and free-draining nature of the landform proposed, and • reduced reliance on contour banks.
	Contour banks are stable and there is no evidence of overtopping or significant scouring as a result of runoff.	
	Surface is free of any hazardous materials.	
Soil	Topsoil or a suitable alternative has been spread uniformly over the rehabilitation surface.	No change. Refer to Section 4.2.7.2.
Water	Runoff water quality from the site does not pose a threat to downstream water quality.	Reduced slope of the final landform resulting in improved stability and reduced erosion hazard would promote achievement of this criteria.
Vegetation	There is no significant weed infestation.	No change. Refer to Section 4.2.7.2.
	Native vegetation areas have established within the rehabilitated proposed extraction area.	
	Trees planted as part of rehabilitation have reached maturity, maturity being defined as when trees are capable of producing fruits and flowers.	
Bushfire Hazard	Appropriate bushfire controls are implemented.	No change.

The Quarry closure criteria will be reviewed and revised throughout the Quarry life and used as the basis for further refinement following:

- the commencement of rehabilitation activities
- consideration of the results of rehabilitation monitoring programs
- consideration of any stakeholder feedback.

7.9.3 Assessment of Impact

Importing VENM and ENM will provide for a free-draining landform with slopes reduced from between 3H: 1V (18°) and 2.5H: 1V (22°) as currently approved to < 11° (5H: 1V or less).

Surface water runoff speed decreases with decreasing slope angles and thus the risk of erosion is reduced and infiltration into the growth medium increases. This is likely to result in a reduction of revegetation failure.

A reduction in slope will result in a better incorporation of the final landform into the surrounding land, as slopes between 6° to 11° are generally in better accordance with natural slopes compared to slopes between 18° and 22°.

Impacts to final land use as a result of this Proposed Modification are discussed in **Section 7.10**.

7.10 Land Use

7.10.1 Existing Land Use

The existing land uses of the Roberts Road Quarry Site are quarrying, water capture and storage for a commercial nursery, a nursery operation and a rural residential dwelling.

The predominant land uses within the immediate vicinity of the site are as follows.

- Residential properties along Roberts Road, Old Telegraph Road, Old Northern Road and Wisemans Ferry Road.
- Agricultural (grazing), horticultural (orchards) and market garden activities on these properties.
- Bushland, including remnant vegetation on private properties and national park, the closest of which is Marramarra National Park just over 1 km to the east of the site.
- Quarrying operations, with at least five sand/sandstone quarries located within 5 km of the site (refer to **Figure 2.1**).

7.10.2 Impacts to Land Use

The Proposed Modification would not result in any additional disturbance to that currently approved. As a result, the Proposed Modification is not predicted to result in any adverse impacts on the surrounding land uses over the life of the Quarry. The direct impacts of the Modification will be limited to the Quarry Site and assessment of amenity issues such as noise, air quality and visual have identified that the quarry operations will not result in significant impacts on surrounding land uses.

The Quarry is a substantial distance from any major residential areas. The closest being Windsor located approximately 21 km to the south west, Rouse Hill located approximately 24 km to the south south-west and Hornsby located approximately 27 km to the south east. There would be no impact to major residential areas as a result of the Modification.

As the Quarry is rehabilitated in accordance with the modified final landform, the Proposed Modification is likely to provide for a beneficial impact on the final land use of the Quarry Site by leaving a landform more conducive to a continuation of agricultural and horticultural activities. Furthermore, by creating a free draining landform, the availability of water to land downstream of the Quarry Site would be improved which would generate a beneficial effect on land uses downstream.

7.11 Socio-economic Impacts

7.11.1 Introduction

Social impact assessment (SIA) is an approach to predicting and assessing the likely consequences of a proposed action in social terms and developing options and opportunities to improve social outcomes. Best practice SIA is participatory and involves understanding impacts from the perspectives of those involved in a personal, community, social or cultural sense to provide a complete picture of potential impacts, their context and meaning.

The generally agreed international principles relating to SIA (Vanclay, 2003) identify social impacts as the matters affecting, directly or indirectly:

- People's way of life, that is: how they live, work, play and interact with one another on a day to day basis.
- Their culture, that is: their shared beliefs, customs, values and language or dialect.
- The community, that is: its cohesion, stability, character, services and facilities.
- Their political system, such as: the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose.
- Their environment, such as: the quality of the air and water people use, the availability and quality of the food they eat, the level of hazard or risk, dust and noise they are exposed to, the adequacy of sanitation, their physical safety, and their access to and control over resources.
- Their health and wellbeing: health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity.
- Their personal and property rights: particularly whether people are economically affected or experience personal disadvantage which may include a violation of their civil liberties.
- Their fears and aspirations, that is: their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

As is the case with any type of change, some individuals or groups within the community may benefit, while others may experience negative impacts. If negative impacts are predicted, it is the role of the SIA to determine how such impacts may be addressed effectively to reduce the degree of social disruption to those affected. If positive impacts are predicted, the aim of the SIA is to maximise these opportunities and identify how they might be further enhanced.

7.11.2 Methodology

7.11.2.1 Approach

The SIA for the project has involved a number of key phases:

- Developing a profile of the social context in which the Proposed Modification is located and summarising the issues of relevance to the communities of interest.
- Identifying the impacts and opportunities that are most important to the local community in relation to the Proposed Modification.

- Assessing and predicting the significance of impacts associated with the Proposed Modification through the application of a 'risk-based approach'; integrating both perceived and technical assessment of risk. This approach affords greater integration with the broader environmental assessment work so that impacts of relevance to technical specialists and community members are adequately discussed and considered in the impact assessment process.
- Developing strategies that address and manage the predicted social impacts associated with the Proposed Modification and those which may enhance opportunities in a manner that values existing community aspirations and assets.
- Identifying what will require monitoring should the project be approved and how any unanticipated social impacts that may result from the project will be identified.

7.11.2.2 Project Stakeholders

Social impact assessment involves the cooperation and coordination of a number of 'social partners' or 'stakeholders'. Stakeholders may be affected groups or individuals that:

- live nearby the resource/project
- have an interest in the proposed action or change
- use or value a resource
- are interested in its use, or
- are forced to relocate.

As part of the SIA for the Proposed Modification, the key stakeholders have been identified as follows.

- Landowners and residents of properties surrounding the Quarry Site.
- The Hills Shire Council.
- Other government agencies and regulatory authorities.
- Employees and prospective employees of the Quarry.
- Residents of The Hills Shire LGA.

7.11.2.3 Mechanisms for engagement

A number of mechanisms have been utilised to obtain the input of various stakeholder groups. The mechanisms to engage with local landholders, key stakeholders and the wider community during the preparation of the SIA are outlined in **Table 7.34**.

Table 7.32 Engagement Mechanisms

Stakeholder Group	Engagement
Local Community	• Distribution of a Community Information Sheet (CIS) with information on the Proposed Modification to eight properties surrounding the Quarry Site. • One on one meetings with the eight property owners provided with a CIS. • Ad hoc correspondence between individual property owners and the Applicant and consultants. Refer also to Section 6.2

Stakeholder Group	Engagement
Maroota Community	The Broader Maroota community has been provided with various opportunities over the last few years to comments on the operations of local quarries, either through community consultative committees, representation to individual quarry operators or forums created for recent or ongoing modifications to other quarry operations.
The Hills Shire Council	A Preliminary Environmental Assessment issued to Council in April 2019 outlining the key components and inviting comment and identification of key assessment requirements. Refer also to Section 6.1.2
Other Government Agency	As above
Employees	Employee briefings provided.

7.11.3 Social Profile

7.11.3.1 Demographic and Economic Profile of Maroota

Analysis of key demographic data from the 2016 Census found that:

- the population of Maroota was 617 people with the median age of 39 years
- approximately a quarter (24.5%) of the houses in Maroota were rentals, approximately a third of the houses were owned with a mortgage (32.4%) and the remainder was owned outright (36.7%)
- the majority of the households in Maroota were families (80.2%)
- most households had children either as a family household (45.5%) or single parent family (16.0%)
- the median weekly household income in Maroota (\$1,761), which is below the median weekly household income of The Hills Shire LGA (\$2,363) but above the median weekly household income of NSW (\$1,486)
- unemployment in Maroota is low (2%), below the unemployment rate of The Hills Shire LGA (4.6%) and NSW (6.3%)
- the top industries of employment in Maroota are vegetable growing (outdoors) (9.0%), road freight transport (6.3%), mineral sand mining (5.0%) and nursery production (3.6%).

Key characteristics of Maroota and The Hills LGA more broadly are as follows.

- The LGA comprises a diverse range of land uses, including suburban, rural residential, industrial/commercial and bushland. The area around Maroota is predominantly bushland and rural residential, while the more southern areas of the LGA are more suburban in nature.
- These land uses are also reflected in the key industries of employment in Maroota, namely vegetable growing, road freight transport, mineral sand mining and nursery production.
- Population projections suggest that the population will grow rapidly over the next two decades and also age, with the proportion of persons aged over 75 years expected to also increase over this timeframe.
- Maroota is seen to have a higher than average level of socio-economic advantage.

- Maroota has lower costs of living (rental prices) compared with NSW, however this is not consistent throughout the LGA, where the average rental costs are higher than NSW.
- For Maroota and the LGA, unemployment rates are below the State, while workforce participation rates are above the State average.

Table 7.33 summarises the findings of the social profile indicating the strengths and vulnerabilities of Maroota and The Hills Shire LGA.

Table 7.33 Summary of Social Profile

	Strengths	Vulnerabilities
Environment	Abundant and diverse natural resources, including sand resources, agricultural lands and bushland	Potential land use conflicts Housing developments and industry impacting on environment
Community	Significant population growth Lower proportions of lone person households	Low levels of cultural diversity Limited community services and facilities in Maroota
Infrastructure	Metro-Northwest train line increasing connection of the LGA to the Sydney metropolitan area Road upgrades	Disparity in infrastructure between northern and southern suburbs Limited public transport in Maroota Housing developments concentrated in the southern suburbs
Economic	Lower costs of living Above State average household income	Importance of extractive industry as a key employer
Industry	Diverse economy Low unemployment	Industry dependent on natural resources (e.g. sand quarries, agriculture)

The analysis suggests that the Maroota area is a socially robust community.

7.11.3.2 Community Issues Analysis

Roberts Road Residents

Those residents consulted as part of community engagement for the Proposed Modification did not identify any issues of concern with respect to the current or proposed future operations of the Quarry.

Maroota

The responses to various community forums associated with local quarry operations have been reviewed to provide an indication as to the issues of greatest significance to the Maroota community (including the Maroota Public School).

The minutes of Community Consultative Committees (CCC) for quarries operated by PF Formation (Hitchcock Road Quarry and Old Telegraph Road Quarry) and Dixon Sand Pty Ltd (Haerses Road Quarry and Old Northern Road Quarry) held over the last several years have been reviewed and indicated the principal issue of concern raised relates to heavy vehicle traffic.

On review of other community forums associated with the surrounding quarries, most notably the Proposed Modification to Haerses Road Quarry (Umwelt, 2019), the key issues raised by the local community relate to impacts on social amenity associated with the following:

- Traffic: in particular the potential impact on road safety, road conditions and congestion.
- Noise: associated with both truck movements on local roads and on-site quarry operations.
- Visual: associated with changes to views within the local setting.
- Dust: and effect on local amenity.
- Water: and the potential to impact on surrounding land uses.
- Land use: as it impacts on current and potential future use of resident properties and surrounds.
- Economic: principally in relation to the positive opportunities that may be created by local contribution and investment by quarry operators.

7.11.3.3 Analysis and Prediction of Social Impacts

This section provides an assessment of the perceived and predicted social impacts that may occur as a result of the Proposed Modification. This section provides an overview of the potential issues affecting social amenity, expected as a result of the Proposed Modification, addressed via analysis and assessment of outcomes of consultation (refer to **Section 6.2**), review of the predicted effects on the biophysical environment (refer to **Sections 7.3 to 7.10**) and the effects of similar projects of this size and magnitude.

Prioritisation of the potential social impacts and the development of impact mitigation, amelioration and enhancement strategies are assessed on the severity of outcomes reflected during technical analysis. Relevant social impact characteristics that have been considered include:

- **Extent** – geographical area affected by the impact (or the proportion of people or population groups affected).
- **Duration** – the timeframe over which the impact occurs.
- **Severity** – scale or degree of change from the existing condition as a result of an impact.
- **Sensitivity** – Susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, including value or importance to the community.

The assessment is undertaken using a consequence and likelihood framework i.e. assessing the consequence of a given social impact factor (e.g. catastrophic, major, negligible) against the likelihood that it will occur (e.g. almost certain, likely, possible), to determine the overall risk assessment of the social impact as 'low', 'moderate' or 'high'. Both positive and negative impacts are considered in this regard, with slight adjustments made to the approach to reflect positive impacts e.g. level of concern becomes level of interest, severity become scale of improvement or benefit, sensitivity becomes importance of the improvement or benefit and the equity of its distribution etc.

In consideration of limited primary data pertaining to potential positive and negative impacts of the Proposed Modification, **Table 7.34** provides a summary of impacts and the social impact ranking assessed using the criteria outlined above.

Table 7.34 Potential Positive and Negative Social Impacts of the Proposed Modification

Social Amenity		Affected Parties	Duration	Potential Social Impact	Social Impact Ranking
Noise	Increased Quarry and road traffic noise	Local Residents	Life of the Quarry	Social amenity Effect on health and wellbeing	Moderate
Air quality	Dust emissions	Local Residents	Life of the Quarry	Nuisance/amenity impacts of dust Effect on health and wellbeing	Moderate
Traffic	Driver Behaviour/ Safety	Road Users Local Residents	Long term	Potential for accident and increased danger to road users.	Low
Visibility	Impact on views from external vantage points	Local Residents Road Users	Short term over the Life of the Quarry	Reduced amenity of landholdings Reduced property values	Low
Water resources	Adverse impact on quality or availability of water	Water Users	Life of the Quarry	Negative effect on landholder business or use	Low
Land Use	Modified final landform	Local Residents	Life of Quarry and beyond	Improved final landform and greater post Quarry land use options	High (Positive)
Economic	Employment	Local and Regional Residents	Long term	Extended employment opportunities	High (Positive)

7.11.4 Social Impact Management and Community Enhancement Strategies

Considering the potential positive and negative social impacts of the Proposed Modification, **Table 7.37** identifies impact management and community enhancement strategies to be applied.

Table 7.35 Impact Management and Community Enhancement Strategies

Issue	Potential Impacts to stakeholders	Management or Enhancement Strategies
Way of life Culture Community	Reduced amenity as a result of increased active disturbance area visible to surrounding properties and minor changes to noise and dust emissions	- Operational controls, safeguards and practices to ensure ongoing compliance with criteria. - Promote and enforce safe driving practices. - Progressive rehabilitation of completed sections of the Quarry. - Improvement to final landform (more sympathetic to surrounding landforms). - Final landform to provide for return to agricultural and horticultural land use.

Issue	Potential Impacts to stakeholders	Management or Enhancement Strategies
Environment	Potential increase in impacts e.g. traffic, noise, air emissions, and visibility	- Extraction and rehabilitation sequence to provide for progressive rehabilitation - Operational controls and safeguards to be implemented to minimise noise and dust emissions of the Quarry received at surrounding residences. - Final landform provides for return to free draining landform and improved environmental flows. - Ongoing monitoring of impacts to be continued with appropriate contingency strategies included in EMS.
Health and wellbeing	Potential health related impacts including air and noise pollution	- Operational controls and safeguards to be implemented to minimise noise and dust emissions of the Quarry received at surrounding residences. - No increase in production or change to approved methods of on-site operations. - Promote and enforce safe driving practices.
Personal and property rights	Increased active disturbance area and traffic with the potential to reduce local amenity	- Management of impacts associated with traffic, noise, air quality and visibility as above. - Final landform provides for return to agricultural and horticultural land use.
Fears and aspirations	Reduced amenity impacting on the value held by residents of their property and local setting.	- Management of impacts associated with traffic, noise, air quality and visibility as above. - Final landform provides for return to agricultural and horticultural land use.
Economic contribution	Local employment and regional economic benefits of a sustainable extractive industry.	- Continue to employ locally and invest in the local and regional economy. - Final landform provides for return to agricultural and horticultural land use.

7.11.5 Assessment of Impacts

After considering the possible impacts of the Proposed Modification on the socio-economic environment and proposed management strategies to address these, the residual adverse and beneficial impacts are considered as follows:

Adverse Impacts

- (i) A small number of properties would be subject to minor changes in noise and air emissions received.
- (ii) The area of active disturbance visible from a small number of properties would increase until progressive rehabilitation completed.
- (iii) The life of the Quarry, and therefore period over which surrounding properties are subject to quarry impacts, could be increased as the in situ resource is blended with selected imported sandstone VENM and ENM materials and to enable the maximum backfill of the landform and complete rehabilitation of the Quarry Site.

Beneficial/Positive Impacts

- (i) The Proposed Modification would provide a location for the disposal of VENM and ENM generated by Sydney construction and allow for the creation of an improved final landform. The Project will contribute to achieving a key element of the EPA's Waste Avoidance Resource Recovery Strategy (WARR), which is increasing waste diverted from landfill to 75%.
- (ii) The Proposed Modification would allow for the sustainment of employment opportunities within The Hills Shire LGA.
- (iii) The Proposed Modification would allow for continued investment in equipment upgrade and maintenance associated with the introduction of VENM/ENM management at the Quarry.
- (iv) The Proposed Modification would provide for flow-on benefits to the economy through the expenditure of wages paid to employees, profits made on the sale of quarry profits and through the purchase of goods and services for the ongoing operation of the Quarry.
- (v) The Quarry would continue to supply important construction materials to local and Sydney markets.

7.11.6 Conclusion

In terms of the impact of the Proposed Modification to residents and local community, it is unlikely that the broader community will be greatly impacted by the Proposed Modification above and beyond current levels, given that change to current operations is not likely to greatly change the offsite impacts of the quarry operations from that which is currently approved. The assessment of impacts presented throughout this report illustrates that as a result of the proposed design features, operational safeguards, controls and management measures, the impacts on local amenity associated with the Proposed Modification have been appropriately considered and addressed.

Employment opportunities would be sustained and increased which has potential to have a positive impact for local businesses through incidental spending in the local area. Furthermore, the proposed incorporation of the VENM/ENM importation, selective processing and disposal to the completed extraction area would enable the benefits associated with the Quarry to be continued over a longer period of time.

The impact of the Proposed Modification on current and future land uses on and surrounding the Quarry Site has been considered. Importantly, as impacts would be restricted to the Quarry, the Proposed Modification would not adversely impact on the current land use(s) of surrounding properties. Furthermore, the Proposed Modification would provide for a landform more sympathetic and therefore of greater aesthetic appeal and allow for more productive future use of the landform.

The broader economic impact of the Modification will be the provision of high quality sand materials for the Sydney and regional markets which will largely be used in the construction of new homes. The Proposed Modification would also provide an additional and alternative location for the disposal of VENM and ENM from Sydney construction projects which depending on the location of the construction site may be more cost effective than other existing locations.

Considering the potential direct and indirect socio-economic benefits against those deemed to be adverse, it is assessed that there would be a net socio-economic benefit resultant from the approval of the Proposed Modification.

8.0 Statement of Commitments

The Proposed Modification seeks to import VENM and ENM to backfill the extraction area and to process VENM and ENM on-site for sale or to blend with sand produced from the in situ resources prior to sale. The ongoing implementation of the EMS is the most efficient and effective way to manage the changes associated with the Proposed Modification. Consequently, pending approval of the Proposed Modification, the EMS will be updated to reflect these changes to ensure effective management of ongoing operations.

Table 8.1 summarises the environmental management commitments that will be implemented for the Proposed Modification. It is noted that these commitments exclude those already in place and documented within the various environmental management plans of the Quarry.

Table 8.1 Summary of Environmental Management Commitments

Environmental Management Measures
Traffic and Transport
- Continue to abide by and enforce the <i>Maroota Local Traffic Management Policy</i> - Restrict daily truck movements to 140 movements - Continue to cap truck movements at 20 movements per hour
Noise
Continue to implement the <i>Operational and Road Noise Management Plan</i> (MAC, 2016)
Air Quality
- Review and update the <i>Air Quality Management Plan</i> (VGT, 2016b) to include: - Proactive meteorological forecasting to identify and plan for hot, dry and windy conditions, - Contingency plans for such conditions, - Routine inspections to review whether planned activities and levels of controls are adequate, or whether modifications are required, and - Provision of triggers for additional monitoring. - Reviewing opportunities for improvement in diesel use and energy efficiency when purchasing or replacing equipment at the quarry to reduce greenhouse gas emissions.
Groundwater
- Maintain the maximum extraction depth at least 2 m above the wet weather groundwater level - The wet weather groundwater level will continue to be reviewed at least every three years and extraction levels modified as required - Continue to implement the <i>Groundwater Management Plan</i> (Dundon, 2018b), including groundwater monitoring
Surface Water
- Update the approved <i>Surface Water Management Plan</i> (VGT, 2018) to account for the modified extraction area and importation of VENM and ENM - Incorporate procedures and checklists for erosion and sediment control monitoring and maintenance of VENM and ENM application areas
Visual Amenity
- Retain and maintain stands of native vegetation along the boundary of the Quarry Site with Old Northern, Roberts and Old Telegraph Roads - Extend the bund wall along Old Northern Road and vegetate with native grasses, shrub and tree species - Implement progressive rehabilitation of the constructed landform

Environmental Management Measures
• Implement dust suppression in accordance with the Air Quality Management Plan (VGT, 2016b) • Continue engagement with surrounding landowners to ensure extraction and rehabilitation is being undertaken to the satisfaction of these landowners (to minimise impact on local visual amenity) • Review and update the <i>Landscape and Rehabilitation Plan</i> (VGT, 2017) to reflect the modified final landform and sequence of extraction and backfill
Rehabilitation and Final Landform
• Construct a free-draining final landform • Review and update the <i>Landscape and Rehabilitation Plan</i> (VGT, 2017) to reflect the modified final landform and sequence of extraction and backfill
Social
• Continue engagement with surrounding landowners to ensure extraction and rehabilitation is being undertaken to the satisfaction of these landowners (to minimise impact on local amenity and socio-economic setting)

9.0 Evaluation and Justification of the Proposed Modification

9.1 Introduction

This SEE has been prepared by Umwelt to assist in the assessment of the likely environmental and social impacts associated with the Proposed Modification. The potential impacts have been identified and carefully assessed following consideration of the design features, operational controls and management measures currently in place or proposed.

On the basis of the assessment of each potential impact, the Proposed Modification can be justified as the residual impacts on the biophysical environment are either understood and determined to be acceptable, or can be predicted and appropriately managed, there would be no notable additional socio-economic impacts and the consequences of not proceeding are considered more adverse than proceeding. Each of these factors considered in the justification of the Proposed Modification are presented below.

9.2 Evaluation

9.2.1 Residual Environmental Impacts

The potential environmental impacts of the Proposed Modification have been identified through a process involving:

- assessment of the site characteristics
- consultation with government agencies
- consultation with surrounding landowners
- expert technical assessments.

The key issues identified were the subject of comprehensive technical assessment to identify and assess the potential impacts of the Proposed Modification on the existing environment and community. The results of these assessments are detailed in **Section 7.0** and the appendices of this SEE.

The environmental and social impacts of the Proposed Modification have been minimised through the identification and commitment to various operation controls, safeguards and management measures in consideration of environmental constraints.

With the existing and proposed measures to avoid, minimise or manage impacts associated with the Proposed Modification, it is anticipated that the Quarry can continue to operate within acceptable environmental standards without significantly adversely impacting the environment or local community.

9.2.2 Ecologically Sustainable Development

9.2.2.1 Principles of Ecologically Sustainable Development

The EP&A Act aims to encourage ecologically sustainable development (ESD) within NSW. As outlined in **Section 1.1**, the Proposed Modification requires approval under Section 4.55 of the EP&A Act. As such, the consent authority needs to be satisfied that the quarry is consistent with the principles of ESD. This section provides an assessment of the Proposed Modification in relation to the principles of ESD.

To justify the Proposed Modification with regard to the ESD principles, the benefits of the quarry in an environmental and socio-economic context, with the Proposed Modification, should outweigh any negative impacts. The ESD principles encompass the following:

- The precautionary principle
- Inter-generational equity
- Conservation of biological diversity
- Valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

9.2.2.2 The Precautionary Principle

In making decisions about developments, the application of the precautionary principle is guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and an assessment of the risk-weighted consequences of various options.

In order to achieve a level of scientific certainty in relation to potential impacts associated with the Proposed Modification, this SEE has undertaken an evaluation of all the key components. Detailed assessment of all key issues and necessary management procedures has been conducted and is documented in this SEE.

The assessment process has involved a detailed study of the existing environment and the use of engineering and scientific modelling and study to assess and determine potential impacts as a result of the Proposed Modification. To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

The decision making process for the design, impact assessment and development of management processes has been transparent in the following respects:

- Relevant government authorities and community representatives were consulted during SEE preparation (refer to **Section 6.0**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.
- The approved quarry incorporates environmental management plans, procedures and environmental monitoring that will be revised in regard to the Proposed Modification. In addition, the management controls that will be implemented by the Applicant as part of the Proposed Modification have been clearly specified in **Section 8.0** and DA 267-11-99 for the approved Quarry.
- This SEE has been undertaken on the basis of the best-available scientific information about the Proposed Modification. Where uncertainty in the data used in the assessment has been identified, a conservative worst-case analysis has been undertaken and contingency measures have been identified to manage that uncertainty.

9.2.2.3 Intergenerational Equity

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, biodiversity and productivity.

The Proposed Modification would provide ongoing high quality supply of sand and gravel products into the Sydney market. This supply will assist to meet the current and growing demand for high quality sand products. As part of quarrying operations a comprehensive rehabilitation strategy has been developed, including an approved Landscape and Rehabilitation Management Plan (LRMP). The LRMP provides a description of the strategies that will be used to rehabilitate the areas disturbed by quarrying operations and will be updated as part of the implementation of the Proposed Modification.

As detailed in **Section 7.0**, the Proposed Modification can be undertaken without having a significant impact on the local environment or community. The environmental management measures discussed in **Sections 7.0 and 8.0** have been developed to minimise the impact of the Proposed Modification on the environment and community to the greatest extent reasonably practicable.

The management of environmental issues as outlined in this SEE will assist to maintain the health, diversity and productivity of the environment for future generations whilst also realising the benefits of the quarrying operations.

9.2.2.4 Conservation and Biological Diversity

The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. It is noted that the Proposed Modification would not require any additional disturbance to biodiversity, remaining within the approved impact footprint of DA 267-11-99.

The lack of additional impact notwithstanding, the approved LRMP for the Quarry ensures that native vegetation will be established in the rehabilitated extraction area which will assist in improving the ecological values of the site in the medium to long term. The LRMP is to be reviewed and updated to account for the Proposed Modification following determination.

9.2.2.5 Valuation and Pricing Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

The Proposed Modification optimises the valuation and pricing of the sand resource with minimal impact by maximising the efficient extraction of the resource at the existing Quarry and extending the life of the resource through blending with VENM/ENM of appropriate quality. The Proposed Modification also optimises the value of the remaining imported VENM/ENM through its use in the Quarry final landform.

Feasibility considerations during the design process for the Proposed Modification have included the costs of integration of effective management measures to minimise potential environmental and social impacts.

9.2.3 Environmental Planning & Assessment Act 1979 Considerations

9.2.3.1 Section 4.15 - Evaluation

In determining an application for the modification of development consent, the consent authority must take into consideration such of the matters referred to in Section 4.15(1) of the EP&A Act (as relevant to the development). These matters for consideration by the consent authority and the sections where they are addressed in this SEE are provided in **Table 9.1**.

Table 9.1 Section 4.15 Matters for Consideration

Matters for Consideration	Relevant SEE Section
(a) the provisions of:	
(i) any environmental planning instrument	Section 5.0
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	Section 5.0
(iii) any development control plan,	Not Applicable based on SSD provisions refer to Section 5.3.1
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	Not applicable
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	Not applicable as the development does not represent any of the development types nominated by Clause 92 of the EP&A Reg
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	Section 7.0
(c) the suitability of the site for the development,	Sections 1.3, 2.3, 7.0 and 9.3.1
(d) any submissions made in accordance with this Act or the regulations	Noted but not yet applicable
(e) the public interest	Sections 4.3, 7.11 and 9.3.3

9.2.3.2 Objects of the EP&A Act

Table 9.2 provides a short description of how the Proposed Modification and this SEE have addressed and satisfy section 1.3 (Objects) of the EP&A Act.

Table 9.2 Objects of the EP&A Act

Object	SEE Coverage
(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,	Socio-economic effects are assessed in Section 7.11 , with the Proposed Modification likely to provide for a net positive socio-economic benefit. The Proposed Modification would incorporate measures to avoid or mitigate impacts to the environment (Section 7.0) and provide for an improved final landform outcome (Section 7.9 and 7.10).
(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The principles of ecologically sustainable development have been considered in Section 9.2.2 .

Object	SEE Coverage
(c) to promote the orderly and economic use and development of land,	The Proposed Modification would promote: - the continued operation and extension of the Quarry to maintain and extend the supply of construction materials to Sydney, - the beneficial use of VENM and ENM (which otherwise could be disposed of to licensed landfill), - an improved final landform and land use outcome The Proposed Modification would continue to contribute to the local and regional economy and community for the extended Quarry life.
(d) to promote the delivery and maintenance of affordable housing,	The Proposed Modification would not limit the provision of affordable housing in The Hills LGA. As the Quarry would provide sand, an important construction material for housing, the Proposed Modification does promote this objective.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The Proposed Modification would be unlikely to have any additional impact on threatened population, species or community.
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The Proposed Modification does not require any additional disturbance to that already approved and therefore is unlikely to result in any impact to cultural heritage.
(g) to promote good design and amenity of the built environment,	The Proposed Modification would have no impact on the built environment.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The Proposed Modification does not require construction of buildings.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	The SEE includes a review of the relevant State, regional and local environmental planning regulations, plans and strategies including how these have been addressed (Section 5.0).
(j) to provide increased opportunity for community participation in environmental planning and assessment.	The Hills Council, various government agencies and local landholders were consulted during the planning of the Proposed Modification and preparation of the SEE (Section 6.0).

9.3 Justification

9.3.1 Suitability of the Site

The Quarry is located within a rural environment in an area dominated by extractive industries, as discussed in **Section 1.0**. The site is considered suitable for the Proposed Modification for the following reasons:

- The site contains extensive sand resources and is located within proximity to markets for these resources.

- No additional disturbance is required to the site which has produced sand for the Sydney market since original approval in May 2000.
- The Quarry Site provides a significant storage capacity for 'clean fill' material generated by the Sydney construction industry and would allow for the construction of a landform more sympathetic to the surroundings and with greater potential for post-Quarry land use.
- Suitable safe access to Roberts Road and old Northern Road is provided from the Quarry Site without impacting adversely on the local road network.
- The site is located within a Primary Production zone and the development is consistent with the objectives of the zone.
- The Proposed Modification is compatible with surrounding land uses and can co-exist with these existing uses.
- The Proposed Modification provides for a modified final landform which would be more stable, non-polluting, more sympathetic to the surrounding landforms and more conducive to post-quarry land uses which contribute to ongoing social and economic well-being of the Maroota community.

9.3.2 Benefits of the Proposed Modification

The key benefits of the Proposed Modification are as follows.

- The efficient extraction of the resource at the existing quarry would be maximised through selective processing and blending of imported materials, thereby delaying or eliminating the need for further quarry development on another less suitable greenfield site.
- The Quarry provides for the beneficial use of VENM and ENM resources that may otherwise be disposed of to waste management facilities.
- The Proposed Modification provides for a final landform which would return environmental (water) flows, be more sympathetic to surrounding topography and maximise the potential for post-quarry beneficial use of the site.
- The Proposed Modification would allow for the continued and additional employment at the Quarry.
- The Proposed Modification would result in ongoing operational expenditure that will have flow-on economic benefits for the region.
- The environmental impact of the Proposed Modification would be managed within acceptable environmental standards.

9.3.3 Need for the Proposed Modification

Furthermore, the approved final landform for the Quarry Site currently provides for a water holding basin which interrupts natural drainage to the northeast (within the Coopers Creek catchment). The placement of imported VENM and ENM within completed sections of the Quarry would promote the reinstatement of natural drainage in the final landform and a more productive final land use of the Quarry area consistent with surrounding land uses.

The need for the Proposed Modification can be justified on two principal grounds:

1. The Quarry Site provides an alternative location for the disposal of VENM and ENM generated by construction projects across Sydney. The application as a backfill to the completed extraction area of the Quarry would allow for the landform of the Quarry to be improved whilst reducing the volume of VENM and ENM which could be sent to landfill (thereby reducing the capacity of these facilities to accept other solid waste which cannot be used for land application purposes). The Proposed Modification would contribute to achieving a key element of the EPA's 5 yearly Waste Avoidance Resource Recovery Strategy (WARR), being an increase in the diversion of waste from landfill by 75%.
2. The Proposed Modification would assist in extending the life of the in situ sand resource through selective blending with imported VENM and ENM feed stock. This would extend the life of the Quarry which provides a long-term, high quality supply of construction materials into the Sydney local and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and will contribute to the security and economic viability of the Sydney construction industry along with supply to other key sand markets.

9.3.4 Consequences of Not Proceeding

Should the Proposed Modification not proceed, the consequences are likely to include the following:

- A site for the safe application of clean fill material generated by the Sydney construction market would be lost, with this increasing the potential for these materials to be sent to licensed landfill sites (thereby reducing the capacity of these to accept other solid waste).
- The potential to extend the life of the sand resource through selective processing and blending of imported VENM and ENM, thereby reducing the need for development of other greenfield sites, would be foregone.
- The ability to construct a free-draining landform which promotes a return of environmental flows and provides for a landform more sympathetic to the surrounds and more likely to provide for future economic use of the land would be foregone.
- The ability of the Quarry to contribute to future shortfalls in the production of sand would be foregone. Any shortfall in the production of sand to meet the anticipated demand would have a negative impact on the NSW economy as follows:
 - A reduction in the direct contribution of production to the NSW economy, which was estimated to be \$366 million by DTIRIS (2013) and \$405 million by the Institute of Quarrying Australia (IQA).
 - Increased supply costs as a result of reduced availability (supply) or requirement to source from locations more distant to markets (in particular the Greater Sydney metropolitan area).
 - Indirect impacts on the NSW economy as a result of reduced construction activity in response to either increased cost or reduced supply of concrete and other construction materials.
- The potential for continued employment at the Quarry and flow-on benefits to the economy would be foregone.
- This in turn could prevent the additional employment which would follow an increase in production or lead to a loss in employment should the Quarry cease to operate.

9.4 Conclusion

The Proposed Modification can be justified as the residual impacts on the biophysical environment are understood and where unavoidable can either be managed to reduce the impact as far as practically possible. No significant adverse socio-economic impacts are expected as a consequence of the Proposed Modification, however, various positive contributions to the local economy, regional objectives for waste reduction and construction industry would result.

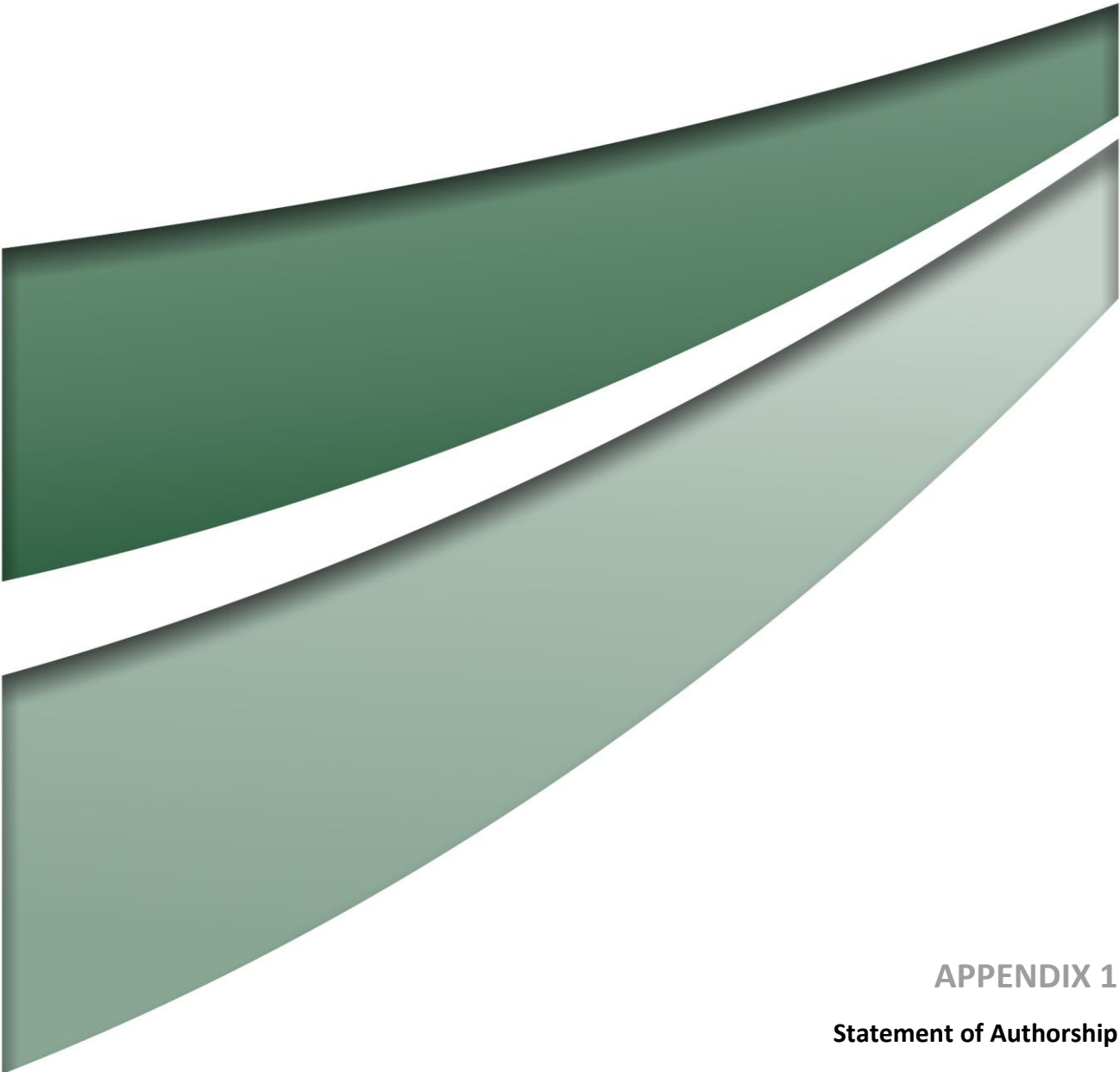
On balance the positive contribution the Proposed Modification would make to the local, regional and State setting indicate that the consequences of not proceeding are considered more adverse than proceeding.

10.0 References

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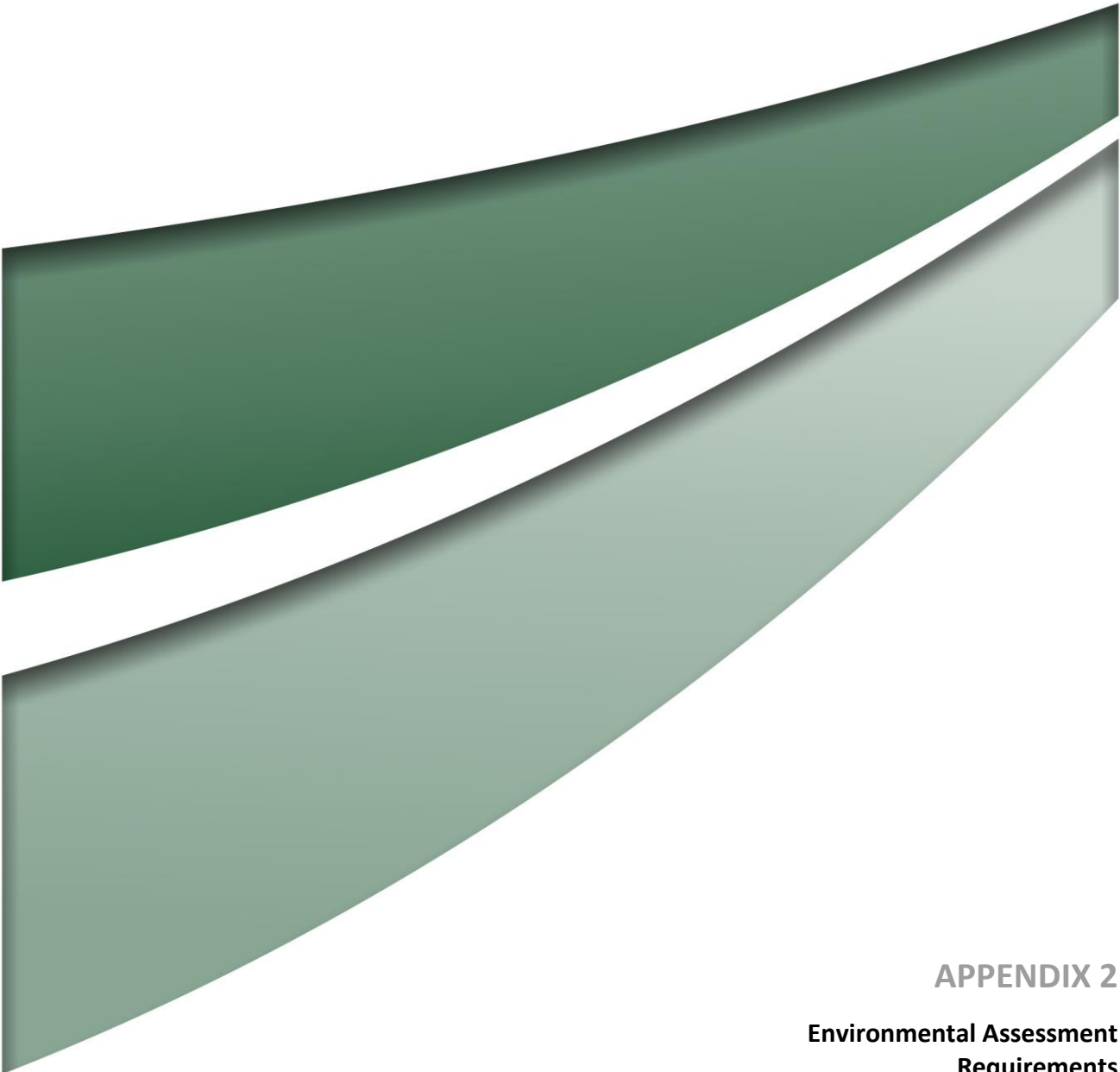
APPENDIX 1

Statement of Authorship

Project Team

Umwelt (Australia) Pty Limited – SEE Preparation	
Alex Irwin, Principal Environmental Consultant – B.Sc (Hons)	Project Director / Project Manager
Ruth Tapp, Environmental Engineer - B.Nat.Res.(Hons)	SEE Preparation
Anne Schneider, Soil Scientist - PhD, M.Sc., B.Sc.	SEE Preparation
Chris Bonomini, Senior Engineer - Water, Process and Risk - B.Eng.(Chem)(Hons)	Surface Water Assessment and Water Balance Assessment
Dave Davis, Principal Acoustician - B.Eng.(Mech)(Hons)	Noise Impact Assessment
Amanda Buckeridge, Senior Acoustician – B.Env.Sc.	Noise Impact Assessment
Thomas Hall, Graduate Acoustician - B.Env.Sc.	Noise Impact Assessment
Roshni Sharma, GIS Specialist – M.Sc.&Tech., M.Sc., B.Env.Sc(Hons).	Drafting, Graphic Design
Leanne Ott, Project Administrator	Report Formatting and Document Control

Other Specialist Investigations	
Jacobs Pty Ltd Luke Spencer Shane Lakmaker	Air Quality Impact Assessment
SECA Solution Sean Morgan	Traffic Impact Assessment



APPENDIX 2

Environmental Assessment Requirements

Alex Irwin
Principal Environmental Consultant
Umwelt (Australia) Pty Ltd
Office 1, 3 Hampden Drive
ORANGE NSW 2800

Via email: airwin@umwelt.com.au

Dear Mr Irwin

**Roberts Road Sand Quarry - (DA 267-11-99)
Modification 4 – Environmental Assessment Requirements**

I refer to your email dated 11 March 2019 seeking Environmental Assessment Requirements (EARs) for the above proposal. The Department understands that the proposed modification involves:

- importing up to 320,000 tonnes per annum (tpa) of Virgin Excavated Natural Material (VENM) and/or Excavated Natural Material (ENM) for use in landform rehabilitation;
- increasing the maximum allowable daily truck movements from 100 to 140 per day (70 inbound and 70 outbound);
- extending the life of the quarry by 5 years (to 2030);
- amending the final landform to a free-draining basin; and
- removing condition 29(c) from the existing conditions of approval, requiring the quarry to ensure that no more than 3 hectares of the site are exposed and active at any one time.

The Department has reviewed the Preliminary Environmental Assessment (PEA) provided and is generally satisfied with the proposed approach to the preparation of the Statement of Environmental Effects (SEE). Based on the information provided, the Department does not intend to issue formal EARs for the proposed modification. However, you should ensure that the assessment is prepared in accordance with the following:

- *NSW Noise Policy for Industry* (2017);
- *NSW Road Noise Policy* (2011);
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2016); and
- *Voluntary Land Acquisition Mitigation Policy* (2018).

The Department also requests that you give particular consideration to the following matters.

Air Quality and Noise

The Department notes that the project currently has no limit on resource extraction, and that production is currently limited by truck movements. The modification seeks approval to increase the maximum allowable truck movements from 100 to 140 per day, which has the potential to increase production from 480,000 tpa to 672,000 tpa. The Department is likely to consider either a maximum resource extraction limit or a maximum production limit. Any proposal that the company wishes to put forward to this regard will be considered.

The Department further notes that the modification seeks to remove a condition which requires the quarry to ensure that no more than 3 hectares of the site are exposed and active at any given time.

Given these issues, the Department considers that the SEE must demonstrate that the modification and any potential increase to the quarry's production capacity would not produce exceedances in the quarry's noise and air quality criteria, and that assessments of both noise and air quality sufficient to demonstrate this outcome must be provided with the SEE.

Permissibility

- Please provide more detail regarding the permissibility of the proposed modification under *The Hills Local Environment Plan 2012*. Specifically, please demonstrate if the proposed modification is considered ancillary to the existing quarry or whether it constitutes a new development.

VENM/ENM Fill

- Please provide additional information on the likely sources of VENM/ENM for the site, including a description of any potential contaminants and a description on how the VENM/ENM would be stored and handled on site.
- Clarify the quantity of the imported material which would be blended with on-site material to produce saleable products.
- Confirm which proportion of the imported material would be VENM and ENM respectively.
- Outline the procedures and protocols proposed to safeguard potential impacts from the imported ENM on the Maroota Sands aquifer.

Rehabilitation

- Please outline how the proposed final landform of the quarry site will be achieved if the required quantity of VENM/ENM cannot be sourced.
- Please provide more information regarding the proposed changes to the final landform of the quarry site, including drainage lines and any onsite detention ponds.
- Please detail the measures that would be implemented to reduce erosion and sedimentation associated with runoff leaving the quarry site.

The Department would like to emphasise the importance of consultation with all relevant stakeholders, such as government agencies and affected residents, including relevant landholders downstream of the drainage lines. The Department requests that you fully document the outcomes of the proposed Community Engagement Strategy in the SEE.

Should you have any questions in relation to the above, please contact Rob Beckett at the details above.

Yours sincerely



Howard Reed

18.3.19

Director

Resource Assessments

From: [Kristine McKenzie](#)
To: [Alex Irwin](#)
Date: Tuesday, 16 April 2019 12:09:49 PM
Attachments: [image002.png](#)

Hi Alex,

Re: Hodgsons Quarry – existing consent DA 267-11-99 at Roberts Road, Maroota.

I have reviewed the Project Overview and Preliminary Environmental Assessment and raise concerns regarding the proposed importation of VENM and ENM to the site. The importation of these materials would partially change the use of the site from an 'extractive industry' to a 'waste and resource management facility'. As such, it is considered that a new Development Application is required to substantiate the proposed change in activities on the site and the change in definition of the use.

The proposed increase in vehicle movements and extension to the timeframe for extraction may also potentially impact on amenity to adjoining property owners and further add to the need for a new DA.

The final documents submitted must also consider the requirements of Council's DCP requirements under DCP Part B Section 1 – Rural, Part 2 which contains Council's requirements for extractive industry operations.

Regards,

logo



Kristine McKenzie

Principal Executive Planner

+61298430319 | kmckenzie@thehills.nsw.gov.au

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2153

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DOC19/313616-1
Your Ref.

Alex Irwin
Principal Environmental Consultant
Umwelt (Australia) Pty Ltd
Level 3, 50 York Street
Sydney NSW 2000

24 April 2019

Dear Mr Irwin

RE: EPA Response to Roberts Road Quarry Modification 4 (DA267-11-99)

I refer to your correspondence dated 9 April 2019 seeking EPA advice in relation to the environmental impact assessment for the application to modify DA267-11-99 for Hodgson Quarries and Plant Pty Ltd located at Roberts Road on Lots 1 and 2 DP228308 and Lot 2 DP312327 Maroota (the premises).

The EPA understands that the proposed modification involves:

- the importation of up to 320,000t per year of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) for landform rehabilitation;
- onsite processing of some VENM and ENM for sale through blending with on-site materials;
- increase of the approved daily truck movements from 100 to 140 movements per day;
- an extension to the period of approved operations from May 2025 to May 2035 to reflect the remaining sand resources available for extraction; and
- removal of a current development approval condition limiting the exposed and active areas of the quarry for up to 3 hectares at any one time.

HB Maroota Pty Ltd holds Environmental Protection Licence 6535 (the EPL) to undertake crushing, grinding or separating and extractive industry at the premises. The proposed reprocessing of the VENM and ENM, EPL 6535 will require a variation licence application to include resource recovery and/or waste processing (non-thermal treatment) activities.

The EPA has considered the details of the preliminary environmental assessment and recommends that the following be included in the final environmental assessment.

Air Quality

The additional processing of some VENM and ENM materials, increase in daily truck movements and additional area exposure has the potential to increase the generation of dust (PM10 & PM2.5) and other pollutant emission beyond the boundary of the premises. It is therefore recommended that you undertake an air assessment in accordance with the *Approved Methods for the Modelling and assessment of Air Pollutants in NSW* and *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW*, including:

Phone 131 555	Fax +61 2 9995 5999	PO Box 668	L13, 10 Valentine Ave
Phone +61 2 9995 5555	TTY 133 677	Parramatta	Parramatta NSW
(from outside NSW)	ABN 43 692 285 758	NSW 2124 Australia	2150 Australia
			info@epa.nsw.gov.au
			www.epa.nsw.gov.au

- a description of the existing air quality and meteorology using existing information and site representative ambient monitoring data;
- an outline of the point and fugitive sources of all pollutant emissions and the resulting ground level concentrations of all pollutants at all sensitive receivers;
- a description of the effects and significance of resulting pollutant concentrations on the environment, human health, amenity and regional ambient air quality standard and goals; and
- details of the mitigation measures proposed in managing the any additional impacts of air emission from the proposed modification.

Noise

The additional activities proposed have the potential to increase the generation of noise beyond the boundary of the premises. It is therefore recommended that you undertake a noise assessment in accordance with the *Noise Policy for Industry* (2017), including:

- details of the existing background (LA90) and ambient (LAeq) noise levels;
- details of all monitoring of existing ambient noise levels, including a statement justifying the choice of monitoring site and the procedure used to choose the site, taking into account the noise sensitive receptors and most affected locations;
- a description of the dominant and background noise sources at the site;
- Day, evening and night assessment background levels for each day of the monitoring period; and
- the final rating background level (RBL) value.

Additionally, the noise assessment report should include:

- a plan showing the assumed location of each noise source for each predicted scenario of the noise impact assessment;
- a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site, including the worst case scenario;
- any assumptions made in the predictions in terms of source heights, direct effects, shielding from topography, buildings or barriers etc.
- details of the expected noise level and noise character (e.g. tonality, impulsiveness, vibration etc.) likely to be generated from noise sources upon modification;
- details of the noise levels likely to be received at the most sensitive locations;
- methods used to predict noise impacts including identification of any noise models used;
- an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify assumed conditions;
- discussion of findings from the predictive modelling and where relevant noise criteria have not been met, recommend additional mitigation measures;
- details of the most appropriate mitigation measures and expected noise reduction including noise controls and management of impacts; and
- demonstration that the relevant noise criteria can be met, with the inclusion of mitigation measures in the project, if required.

Water

It is recommended that you undertake an assessment of the impacts on surface and groundwater, including:

- an outline of how the total water cycle considerations are to be addressed as a result of the modification;
- total water balances;
- demonstration of how the impact on water resources are minimised;
- the type, volume, proposed treatment and management and re-use methods for stormwater;
- the type, volume, proposed treatment, and management and re-use methods for wastewater; and

- identification of any impacts on and management of groundwater.

Should you have further questions in relation to this matter, please contact Lilian De Torres at 02 9995 5059 or by email at Lilian.DeTorres@epa.nsw.gov.au.

Yours sincerely



JACQUELINE INGHAM
Unit Head– Sydney Industry
Environment Protection Authority



Department of Industry

OUT19/4949

Alex Irwin
Principal Environmental Consultant
Umwelt (Australia) Pty Limited

airwin@umwelt.com.au

Dear Mr Irwin

**Roberts Road Quarry Modification 4 (DA 267-11-99)
Comment on the Secretary's Environmental Assessment Requirements (SEARs)**

I refer to your email of 10 April 2019 to the Department of Industry (DoI) about the above matter.

The following advice for you to consider is from relevant branches of DoI Lands & Water and the Department of Primary Industries. The SEARs should include:

DoI -- Water and Natural Resources Access Regulator

- The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.
- A detailed and consolidated site water balance.
- Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.
- Proposed surface and groundwater monitoring activities and methodologies.
- Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans (available at <https://www.industry.nsw.gov.au/water>).

DPI Agriculture

- A biosecurity (pests and weeds) risk assessment outlining the likely plant, animal and community risks from imported material.
- A biosecurity response plan to manage identified weed / pest animal risks.

Any further referrals to Department of Industry can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

Yours sincerely

Liz Rogers
Manager, Assessments
Lands and Water – Strategic Relations
29 April 2019



10 May 2019

Alex Irwin
Principal Environmental Consultant
Umwelt (Australia) Pty Limited
Office 1, 3 Hampden Avenue
Orange NSW 2800

Emailed: airwin@umwelt.com.au

Your Reference: DA 267-11-99
Our Reference: DOC19/345516

Dear Mr Irwin,

**Re: Request for Environmental Assessment Requirements
Roberts Road Quarry (DA 267-11-99) Modification 4.**

Thank you for the opportunity to provide advice on the Environmental Assessment Requirements (EARs) for the application to modify development consent for the Roberts Road Quarry operated by Hodgson Quarries and Plant Pty Ltd. This is a response from NSW Department of Planning & Environment – Division of Resources & Geoscience (the Division).

Sand is not a prescribed mineral under the *Mining Act 1992*. However, the Division 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.

All environmental reports (Statement of Environmental Effect (SEE) or similar) accompanying Development Applications for extractive industry lodged under the *Environmental Planning & Assessment Act 1979* should include a resource assessment which:

- Documents the size and quality of the resource and demonstrates that both have been adequately assessed; and
- Documents the methods used to assess the resource and its suitability for the intended applications.

The above information should be summarised in the SEE, with full documentation appended. If deemed commercial-in-confidence, the resource assessment summary included in the SEE should commit to providing the Division with full resource assessment documentation separately. Applications to modify, expand, extend or intensify an existing consent that has already been adequately reported using the above protocol in publicly available documents, may restrict detailed documentation to the additional resources to be used, if accompanied by a summary of past resource assessments and of past production.

NSW Department of Planning and Environment
DIVISION of RESOURCES & GEOSCIENCE
PO Box 344 Hunter Region Mail Centre NSW 2310
E: landuse.minerals@geoscience.nsw.gov.au
Tel: 02 4063 6500
ABN 38 755 709 681

The Division 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.

During the preparation of the SEE, the Division recommends that the proponent consult NSW Department of Planning & Environment's '*EIS Guideline - Extractive Industries – Quarries*'. This guideline is available from:

http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/~/_media/4A89C0947A8C4D70A983F8EE1D7B9790.ashx

Should any biodiversity conservation measures become necessary, the Division requests early consultation 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 Division of Resources & Geoscience - Land Use team at landuse.minerals@geoscience.nsw.gov.au.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Steven Palmer', with a stylized flourish at the end.

Steven Palmer
A/Manager - Land Use

From: [Greg Kininmonth](#)
To: [Alex Irwin](#)
Cc: [Hodgson Quarries and Plant Pty Ltd.](#); [Adam Banister](#); [DRG RO Assessment Coordination Mailbox](#)
Subject: RE: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99) - Resources Regulator Response
Date: Friday, 26 April 2019 5:23:35 PM
Attachments: [image001.png](#)
[image002.jpg](#)
[image003.png](#)
[image004.jpg](#)
[image005.jpg](#)
[image006.jpg](#)

Hi Alex

With reference to your email dated 10 April 2019, the Resources Regulator Compliance Operations section has reviewed the proposed Modification.

It is noted that there is no Mining Title covering the Roberts Road Quarry and it is understood, with reference to your email dated 17 April 2019 (below), that no Mining Title is required as operations do not involve the processing or sale of prescribed minerals, specifically Group 5 (Clay Minerals).

As such, the Resources Regulator, Compliance Operations section has no jurisdiction over this site and no comments to provide on the Proposed Modification to DA 267-11-99.

Mine Safety

It is relevant to note that the Resource Regulator Mine Safety Operations is responsible for ensuring mine operators manage the risk to worker health and safety through compliance with the Work Health and Safety (Mines and Petroleum Sites) Act 2013 and the subordinate mining legislation. In particular the effective management of risk associated with the principal hazards as specified in the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014. The Resource Regulator Mine Safety Operations have not identified any risk that would require comment in relation to this matter.

If you require further information with regard to this issue please feel free to contact me.

Regards

Greg Kininmonth

Manager Environmental Operations (Southern)
Compliance Operations
Resources Regulator
Level 3, Block F | 84 Crown Street | Wollongong NSW 2500
PO Box 674 | Wollongong NSW 2500
T 02 4276 7428 M 0429 168 021

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cid:image002.jpg@01D4F54E.64E41370



From: Alex Irwin <airwin@umwelt.com.au>

Sent: Wednesday, 17 April 2019 11:37 AM

To: Greg Kininmonth <greg.kininmonth@planning.nsw.gov.au>

Cc: Hodgson Quarries and Plant Pty Ltd . <hodgsonquarries@gmail.com>

Subject: RE: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

Gday Greg,

Hodgson's have confirmed that any clay extracted is stockpiled and used as a backfill material, on site construction works, e.g. bunds, or other rehabilitation activities. No processing or sale of clay is undertaken or planned.

Regards,

Alex Irwin
Principal Environmental Consultant

Umwelt (Australia) Pty Limited
Office 1, 3 Hampden Avenue
Orange, NSW 2800

Phone: (02) 4950 5322
Mobile: 0436 606 529

www.umwelt.com.au

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From: Greg Kininmonth <greg.kininmonth@planning.nsw.gov.au>

Sent: Tuesday, 16 April 2019 3:00 PM

To: Alex Irwin <airwin@umwelt.com.au>

Subject: RE: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

Hi Alex

Any update on your email below?

Regards

Greg Kininmonth

Manager Environmental Operations (Southern)
Compliance Operations
Resources Regulator
Level 3, Block F | 84 Crown Street | Wollongong NSW 2500
PO Box 674 | Wollongong NSW 2500
T 02 4276 7428 M 0429 168 021

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From: Alex Irwin <airwin@umwelt.com.au>

Sent: Monday, 15 April 2019 1:32 PM

To: Greg Kininmonth <greg.kininmonth@planning.nsw.gov.au>

Cc: 'Stuart Reed' <hodgsonquarries@gmail.com>

Subject: RE: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

Greg,

It is my understanding that the clay which occurs through the sand resource is only used for landform construction / rehabilitation purposes on the Quarry Site.

I will check with the operator and confirm.

Regards,

Alex Irwin

Principal Environmental Consultant

Umwelt (Australia) Pty Limited

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Orange, NSW 2800

Phone: (02) 4950 5322

Mobile: 0436 606 529

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From: Greg Kininmonth <greg.kininmonth@planning.nsw.gov.au>

Sent: Monday, 15 April 2019 1:02 PM

To: Alex Irwin <airwin@umwelt.com.au>

Subject: FW: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

Hi Alex

I note that there is some clay processing which occurs at this site.

Can you confirm whether or not this may fit in with the Prescribed Minerals referenced in the Mining Regulation 2016, specifically "Schedule 2 – Group of Minerals" which includes:

Group 5 (Clay minerals)

- bentonite (including fuller's earth)
- clay/shale
- kaolin
- structural clay

Link to Mining Regulation is below:

<https://www.legislation.nsw.gov.au/#/view/regulation/2016/498/sch2>

Regards

Greg Kininmonth

Manager Environmental Operations (Southern)

Compliance Operations

Resources Regulator

Level 3, Block F | 84 Crown Street | Wollongong NSW 2500

PO Box 674 | Wollongong NSW 2500

T 02 4276 7428 M 0429 168 021

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cid:image002.jpg@01D4F54E.64E41370



From: Adam Banister **On Behalf Of** DRG RO Assessment Coordination Mailbox
Sent: Wednesday, 10 April 2019 2:19 PM
To: RRD EO Resources Regulator Mailbox <resources.regulator@planning.nsw.gov.au>
Subject: FW: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

FYI.

Regards,

Assessment Coordination Unit

Resource Operations

Division of Resources & Geoscience

516 High Street Maitland NSW 2320 | PO Box 344 HRMC NSW 2310

T +61 2 4063 6534 | assessment.coordination@planning.nsw.gov.au

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Please contact the Assessment Coordination Unit for enquiries regarding development assessment, CPDP, project development, resource & economic assessments and engagement with operations

Visit the following links for further information about [ACU role](#) & [CPDP policy](#)

From: Alex Irwin <airwin@umwelt.com.au>
Sent: Wednesday, 10 April 2019 8:52 AM
To: DRG RO Assessment Coordination Mailbox <assessment.coordination@planning.nsw.gov.au>
Subject: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

Dear Sir/Madam,

Hodgson Quarries and Plant Pty Ltd are proposing to modify operations at the Roberts Road Quarry (the Quarry) located on Lots 1 and 2 DP 228308, and Lot 2 DP 312327, at Maroota within The Hills Shire Council Local Government Area (LGA). The Quarry has approval for the extraction and on-site processing of sand from the Maroota Sands geological formation under DA 267-11-99, a State Significant Development in accordance with State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP).

Environmental Assessment Requirements were sought from the NSW Department of Planning & Environment on 11 March 2019, with these provided in a letter from the DPE on 2 April 2019. In accordance with these EARs (which are attached), we are seeking from the Resources Regulator

any specific assessment requirements. To assist you in your consideration, please find attached correspondence summarising the proposed modification and a link to a Preliminary Environmental Assessment.

<https://umwelt.sharefile.com/d-s843ea16173946928>

If possible, we would appreciate your feedback and assessment requirements by 30 April 2019.

Regards,

Alex Irwin
Principal Environmental Consultant

Umwelt (Australia) Pty Limited
Office 1, 3 Hampden Avenue
Orange, NSW 2800

Phone: (02) 4950 5322
Mobile: 0436 606 529

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From: [Timothy Olliver](#)
To: [Alex Irwin](#); [OEHD Customer Strategies Mailbox](#)
Cc: [Adrian Hohenzollern](#)
Subject: RE: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)
Date: Tuesday, 23 April 2019 10:52:09 AM
Attachments: [image001.png](#)

Hi Alex,

Thanks for the referral, I've had a look at the documents. The Heritage Division has no issues or concerns in relation to State Heritage matters, and therefore are not a relevant stakeholder in this instance.

DPE does not need to refer this project, including any future modifications, to the Heritage Council (i.e Heritage Division of OEHD), however other Divisions of OEHD may respond separately in relation to Aboriginal Cultural Heritage.

Kind regards,



Tim Olliver

A/Senior Customer Strategies
Officer
Heritage Division

Locked Bag 5020, Parramatta 2150
T 02 4927 3203

From: Alex Irwin <airwin@umwelt.com.au>
Sent: Wednesday, 10 April 2019 9:01 AM
To: OEHD Customer Strategies Mailbox <customer.strategies@environment.nsw.gov.au>
Subject: 4465_Roberts Road Quarry_Proposed Modification to Operations (DA 267-11-99)

Dear Sir/Madam,

Hodgson Quarries and Plant Pty Ltd are proposing to modify operations at the Roberts Road Quarry (the Quarry) located on Lots 1 and 2 DP 228308, and Lot 2 DP 312327, at Maroota within The Hills Shire Council Local Government Area (LGA). The Quarry has approval for the extraction and on-site processing of sand from the Maroota Sands geological formation under DA 267-11-99, a State Significant Development in accordance with State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP).

Environmental Assessment Requirements were sought from the NSW Department of Planning & Environment on 11 March 2019, with these provided in a letter from the DPE on 2 April 2019. In accordance with these EARs (which are attached), we are seeking from the NSW Office of Environment and Heritage any specific assessment requirements. To assist you in your consideration, please find attached correspondence summarising the proposed modification and a link to a Preliminary Environmental Assessment.

<https://umwelt.sharefile.com/d-s843ea16173946928>

If possible, we would appreciate your feedback and assessment requirements by 30 April 2019.

Regards,

Alex Irwin

Principal Environmental Consultant

Umwelt (Australia) Pty Limited

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Orange, NSW 2800

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Mobile: 0436 606 529

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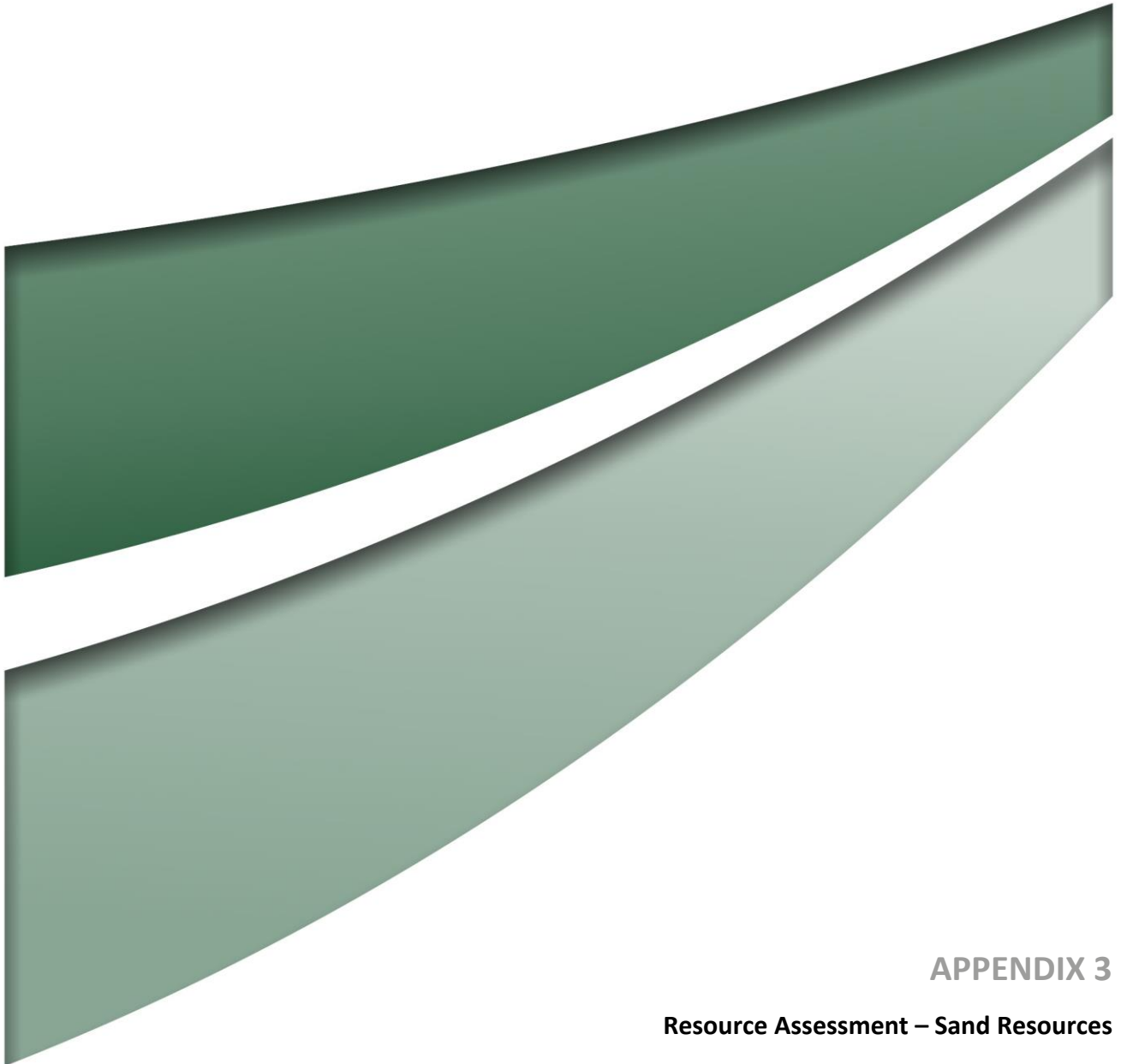
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APPENDIX 3

Resource Assessment – Sand Resources

18th May 2018

Hodgson Quarries and Plant Pty Limited

PO Box 1778

Gosford NSW 2250

Job No. 5910

Attention: Martin Hodgson

Dear Martin,

RE: Resource Calculation for Maroota Quarry

VGT has undertaken a resource calculation for your site at the corner of Northern Road and Roberts Road, Maroota.

The resource calculation has been based upon the following:

1. Survey obtained from Integral Survey on 9th May 2016 (see FS 1);
2. Utilization of SURPAC software;
3. 30 metre buffer from Northern and Roberts Road as specified in EIS Figure MP-05 B;
4. 10 metre buffer from the north boundary as specified in EIS Figure MP-05 B;
5. The quarry resource floor was identified as RL 187m (as specified by client) based upon an average of the current wet weather high groundwater levels as determined by Peter Dundon GWMP February 2018. As seen in attached Figures 19 and 21 from the Dundon report the ground water is not a horizontal plane, and this will change as the ground water levels change;
6. A single 1 horizontal: 1 vertical batter was used in consultation, pers. comm. 15th May 2018, with the client, Martin Hodgson;
7. Soil / overburden depth 0.5 metres; and
8. Statement of Accuracy see attached.

Table 1. Resource Table

Area to be extracted (m ²)	Overburden Volume (m ³)	Volume (m ³)
215,190	32,760	2,900,870

Discussion

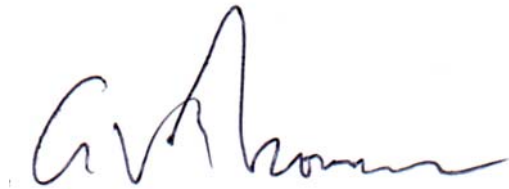
The landform presented in FS 1 is not the final landform. The final landform is the attached consented Figure MP-05.

The total volume described above is a combination of sand, sandstone and clay. Mining and processing of this resource involves crushing, screening and washing of most of the resource. Thicker clay bands are selectively mined out, but due to the lensing nature of these the amount of clay is not known. The overburden is topsoil.

The resource calculation is based upon 2016 survey, i.e. it is 2 years old, to achieve a more accurate resource volume, the author recommends either an updated survey or undertake a review of resources extracted from 9th May 2016.

I trust this meets with your expectations and if you have questions please do not hesitate to contact me.

Yours Sincerely

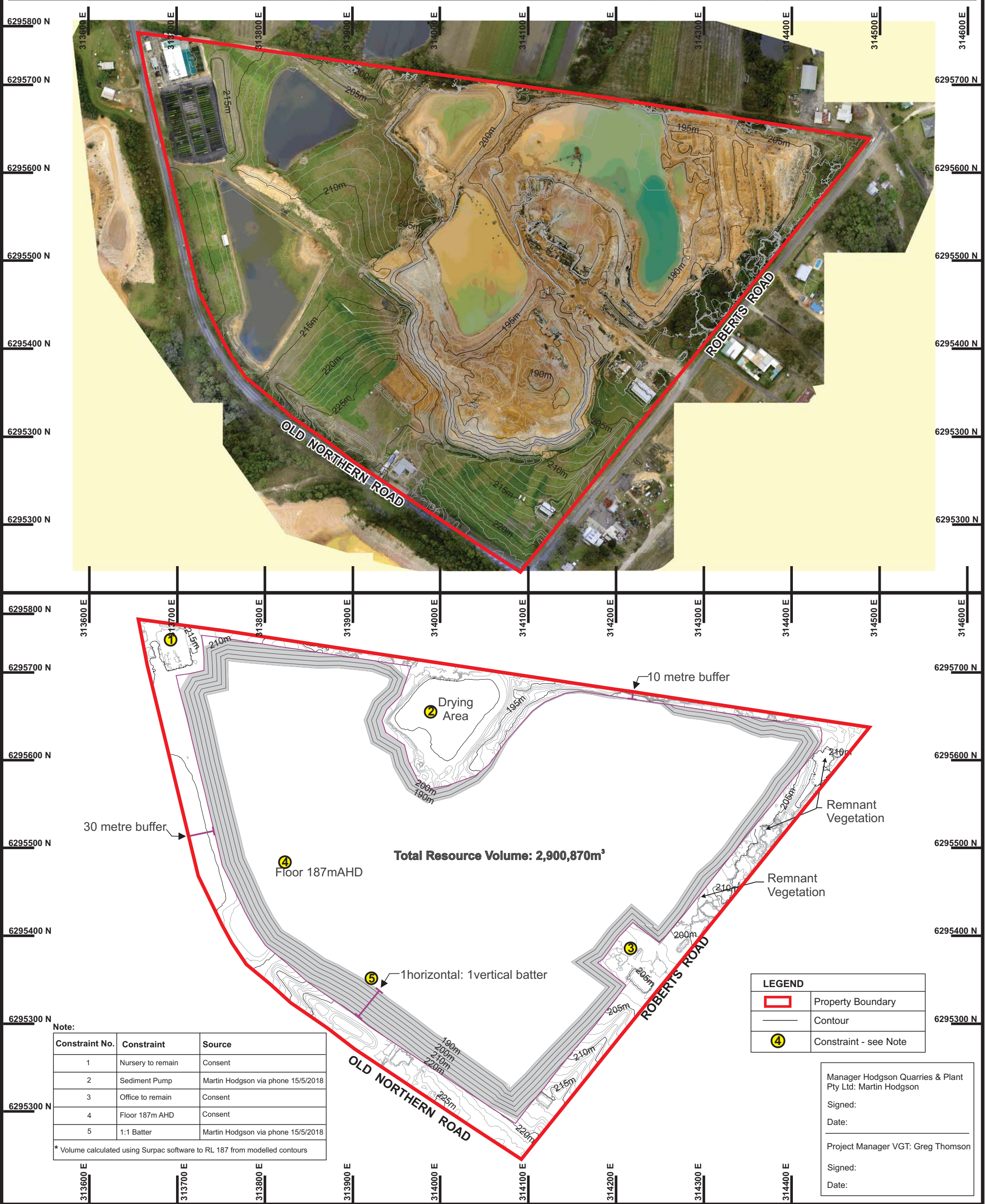
A handwritten signature in blue ink, appearing to read 'G Thomson'.

Greg Thomson

Director

Appendix A: Fieldsheet 1(FS1)

Plan of:	Field Sheet - Roberts Rd Maroota Sand Quarry Resource Calculation 2018	This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy. This figure is used as a working site plan and is not Quality Assured.			
Figure:	FS1				
Sheet:	1 of 1				
Version/Date:	V0 18/05/2018				
Location:	Maroota Quarry, Roberts Road, Maroota, NSW	Source:	Integral Surveys May 2016, Surpac, Consent documents and pers. comm MH May 2018	Our Ref:	5910_HMA_RC2018_FS01_V0_FS1.cdr
Council:	Hills Shire Council	Survey:	Integral Surveys May 2016	Plan By:	SK/GT
Tenures:	N/A	Projection:	MGA	Project Manager:	GVT
Client:	Hodgson Quarries & Plant Pty Ltd	Contour Interval:	1m	Office:	Thornton

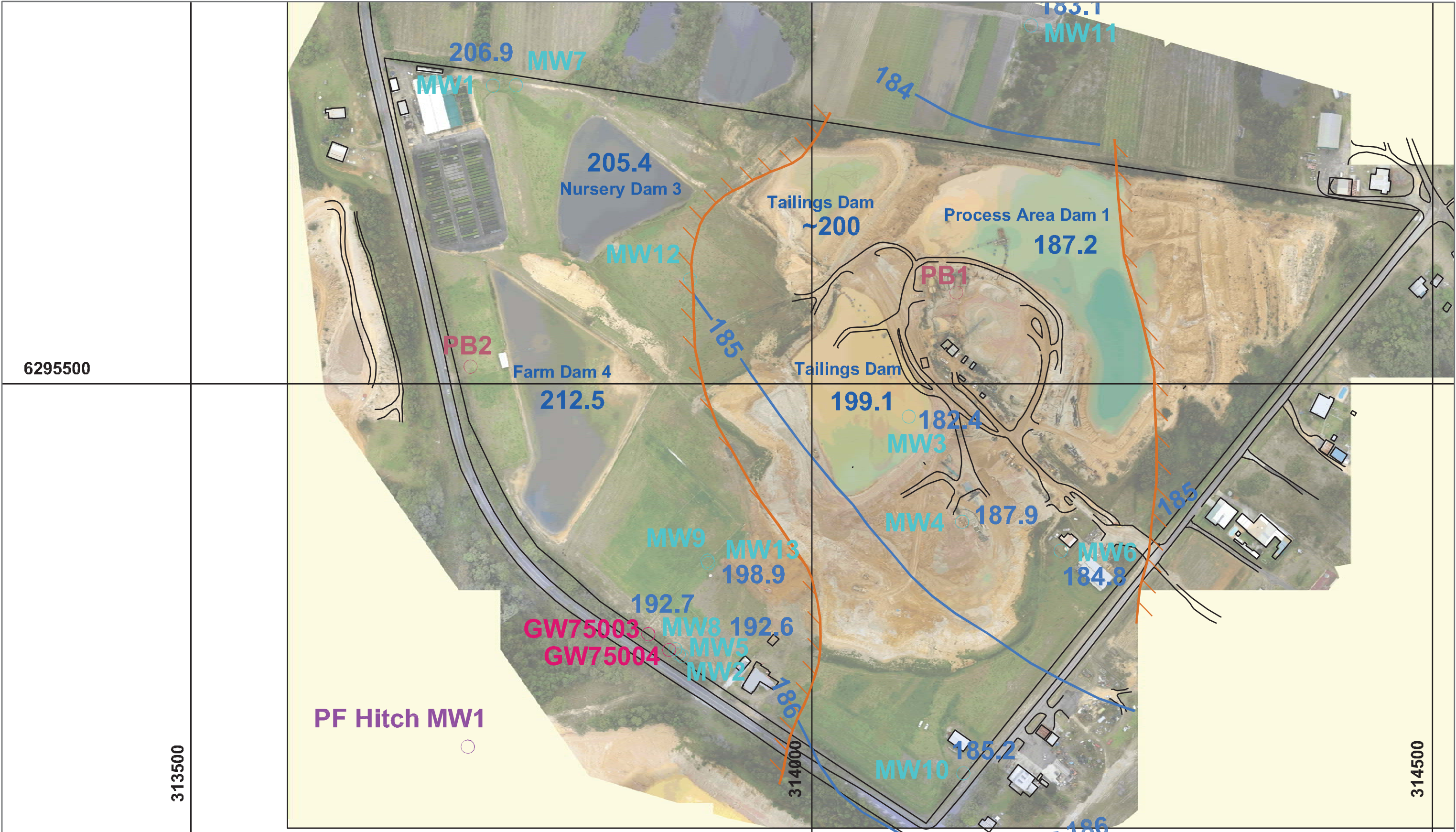




Appendix B: 1999 Rehabilitation Report Figure MP-05 B



Appendix C: Figures 19 & 21 from Peter Dundon GWMP February 2018



LEGEND:

-  Hodgson monitoring bore
-  Hodgson production bore
-  185.2 Maroota Sands WWHGWL (mAHD)
-  Contours of wet weather high GW level
-  Edge of saturated Maroota Sands

DATE:	8 March 2018	SCALE:	
PROJECT NO:	06-0318	AUTHOR:	PD
DRAWING NO:	06-0318-020d	REVISION:	D
Dundon Consulting Pty Ltd			

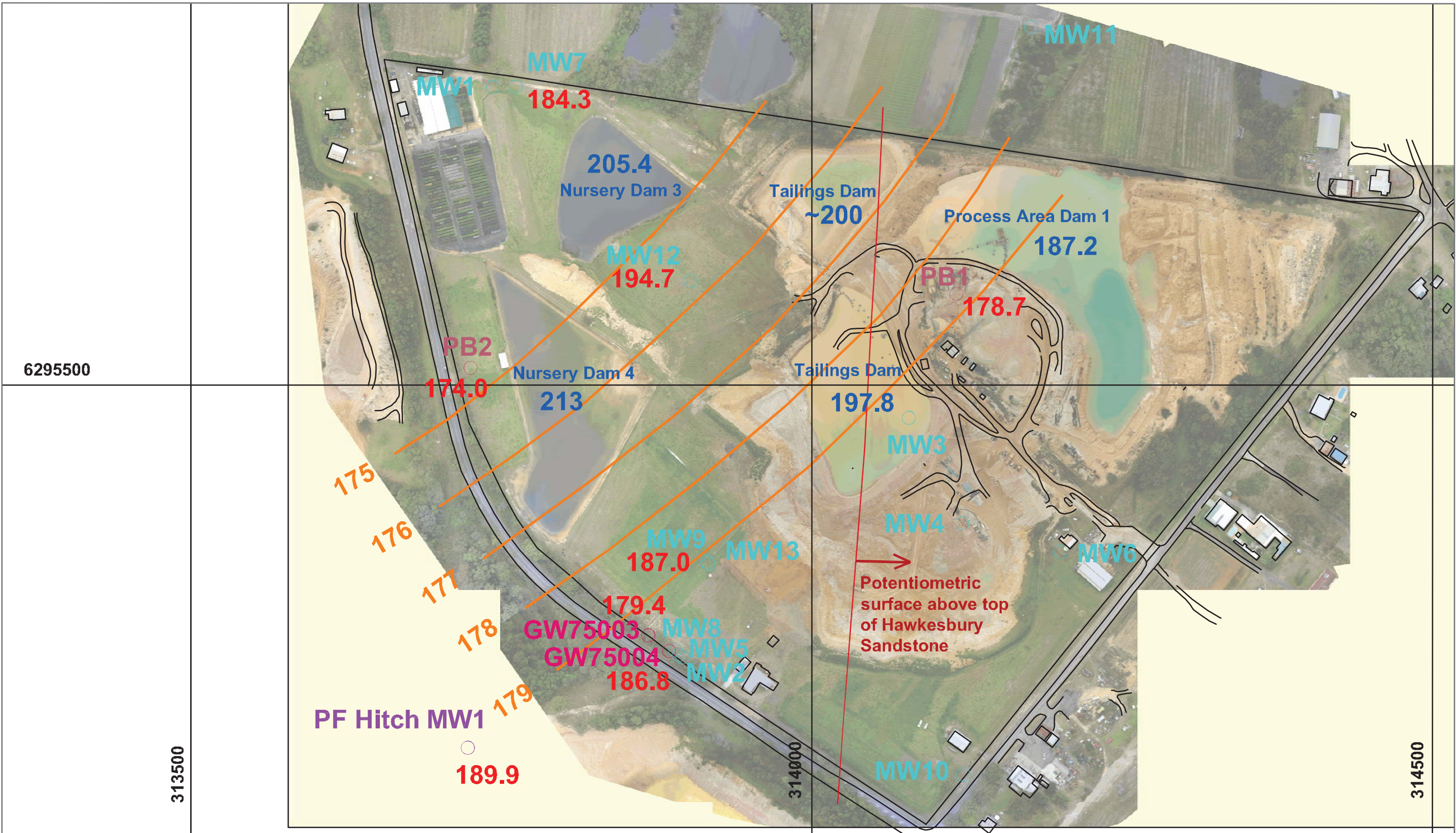
Hodgson Quarry and Plant Pty Ltd

ROBERTS ROAD MAROOTA SAND QUARRY

Wet Weather High Groundwater Level

Maroota Sands (February 2018)

Figure 19



LEGEND: Hodgson monitoring bore Hodgson production bore 174.0 Hawkesbury Sandstone water level Contours of wet weather high GW level Potentiometric surface above top of HS	DATE: 15 April 2018		SCALE:		Hodgson Quarry and Plant Pty Ltd	
	PROJECT NO: 06-0318		AUTHOR: PD		ROBERTS ROAD MAROOTA SAND QUARRY	
	DRAWING NO: 06-0318-021e		REVISION: E		Wet Weather High Groundwater Level	
	Dundon Consulting Pty Ltd		Hawkesbury Sandstone (February 2018)		Figure 21	

Appendix D: Statement of Accuracy

Statement of Accuracy Maroota Quarry– as of 17th May 2018

Table 1 Data Acquisition

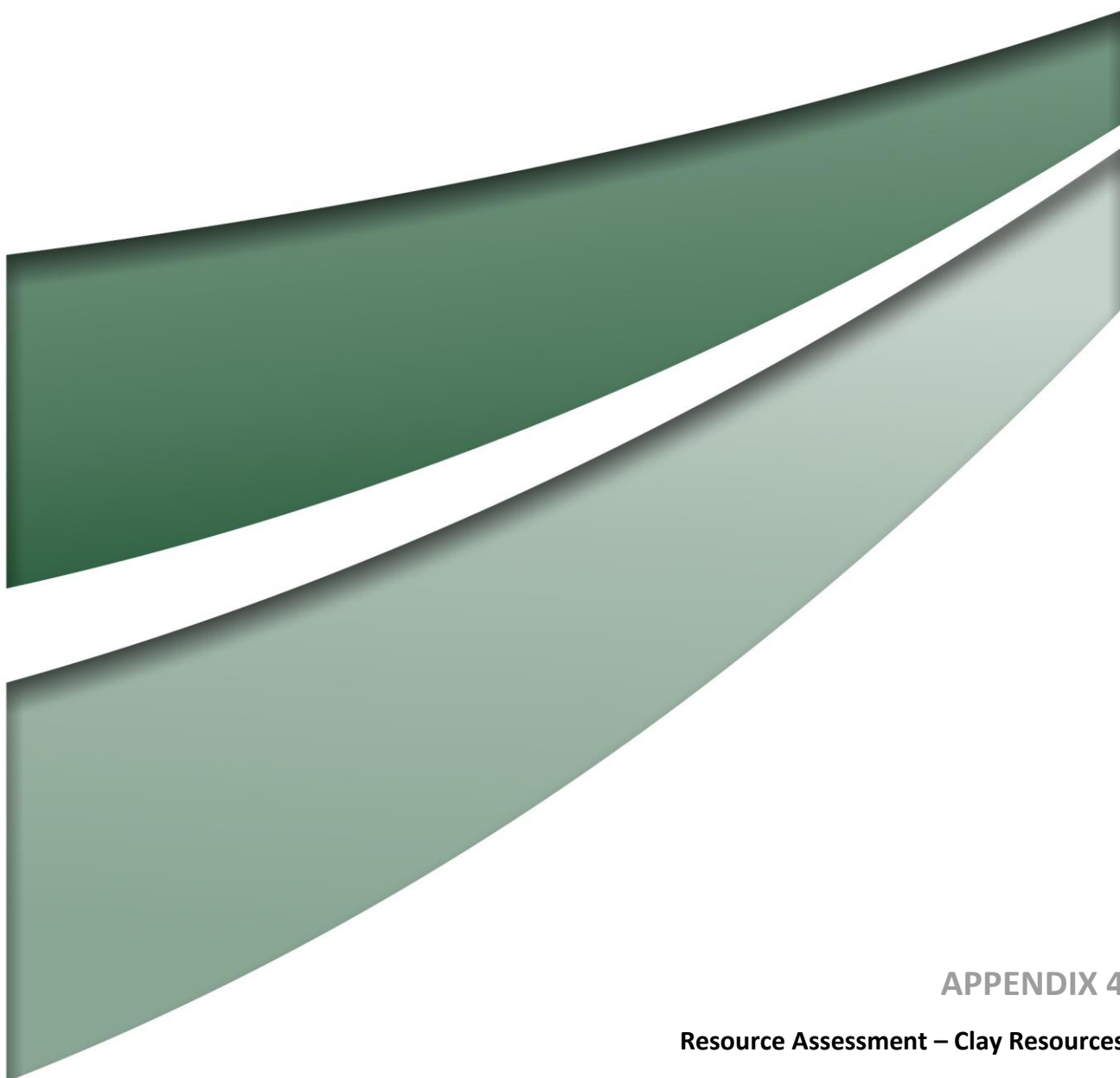
Item	Description
Source of survey	Integral Survey, Hugh Stephenson, 15 James Scott Crescent, Lemon Tree Passage, 2319. 0499 944 434
Date of Survey	9 th May 2016
Date files received	2 nd June 2016
File format	Geo referenced Ortho-photo and DXF
Ground control	Not supplied
Data Accuracy	Not supplied
Equipment	UAV
Software	12D
Property Boundary	Inferred, not verified.
Mine lease or Authority Boundary	Not required

Table 2 Processing and Manipulation

Item	Description
VGT Raw File location	V:\Jobs\ HMA Maroota\1 Base Boundary\surpac\Topo2016.dxf
VGT file import	Converted DXF to STR file using SURPAC
VGT manipulation	Erroneous heights were deleted, as the drone picked up trees, buildings etc that would provide false positives. 16 th May 2018 Now Topo2018.str and DTM. Both found in V:\Jobs\ HMA Maroota\1 Base Boundary\surpac
Ground truthing	Review topography visually and overly air photography (provided or nearmaps)
Conversion of data	String (str) file converted to Digital Terrain Model (DTM) using Surpac
Quarry Model Development	Top of cut was digitised using Surpac tool
Batter and Bench design	A 1 horizontal: 1 vertical single batter was adopted as defined by client. No benches.
Base of Resource	A base of resource is adopted via the latest groundwater high level (RL 185m) identified in GWMP and an additional consented 2 metres giving a base of RL 187m.
Verification	12D

Table 3 Attributes

Item	Description
Buffers	EIS Mod 2 Figure MP-05 B July 2000, Final Landform/Rehabilitation Plan, prepared by Nexus
Infrastructure	As identified in EIS Mod 2 Figure MP-05 B July 2000, Final Landform/Rehabilitation Plan, prepared by Nexus
Overburden	Site observations suggest and average topsoil thickness of 0.5 metres. This has been excluded from the calculations.
Resource Type	The lensing nature of sand, clay and sandstone is too difficult to predict amounts, therefore a total volume is presented.
Mining techniques	The mining procedure involves most of the resource to be processed.
Onsite Processing	The sand processing involves crushing, sorting and cleaning the sand. Reject fines are stored in ponds.
Verification	



APPENDIX 4

Resource Assessment – Clay Resources

10th January 2019

Hodgson Quarries and Plant Pty Limited

PO Box 1778

Gosford NSW 2250

Job No. 6920

Attention: Martin Hodgson

Dear Martin,

RE: Clay Calculation for Maroota Quarry

VGT Environmental Compliance Solutions Pty Limited (VGT) was engaged by Hodgson Quarries & Plant Pty Ltd to review the insitu remaining clays onsite.

Field Visit: A site visit was undertaken on the 7th January 2019 where photographs were taken and a hand held GPS was used to record some of the site.

Investigation Data: Presented in *Figure 1* are the photographs taken on the 7th January 2019. The black dashed line is the visual estimation of the contact between the clay and the underlying sands. The distances listed on *Figure 1* are also estimates based upon scaling from the house height estimation.

Drill holes MW 8, MW 9, MW 10 and MW 12 sunk in 2016 these were referenced to determine the clay base, logs are attached.

Table 1 Drill Hole Data

Drill Hole	Overburden Clay Thickness (m)
MW 8	16
MW 9	15
MW 10	10
MW 12	0

Maroota Geology: The Maroota sand and clay bands tend to vary in thickness over relatively short distances as seen in *Figure 1*. These are situated in a paleo channel of the older Hawkesbury Sandstone, as seen in *Figure 1*, out cropping to the west. Drill hole locations are found on *Figure 2*, the clay appears to be thickening to the south and disappears to the west.

Resource Calculation: has been based upon the following:

1. Survey obtained from NSW Spatial Services – DEM format May 2017;
2. Utilization of SURPAC software;
3. 30 metre buffer from Northern and Roberts Road as specified in EIS Figure MP-05 B;
4. The clay thickness has been estimated using visual review of photographs presented in *Figure 1* and drill hole data presented in Table 1;
5. A single 1 horizontal : 0.5 vertical batter was used, as similar batters were found on the May 2017 survey; and
6. Statement of Accuracy see attached.

Table 2 Clay Volume

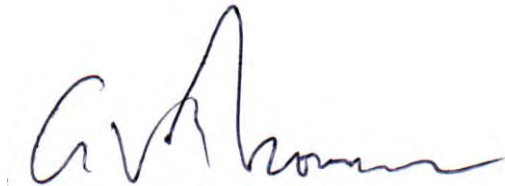
Estimated Area of Clay (m ²)	Clay Overburden Volume (m ³)
26,600	234,700

Discussion

The clay volume could significantly vary from the 234,700 cubic metres, as discussed previously due to the lateral variation in thickness in these units and the estimation of the thickness in the photography.

I trust this meets with your expectations and if you have questions please do not hesitate to contact me.

Yours Sincerely

A handwritten signature in blue ink, appearing to read 'G Thomson'.

Greg Thomson

Director



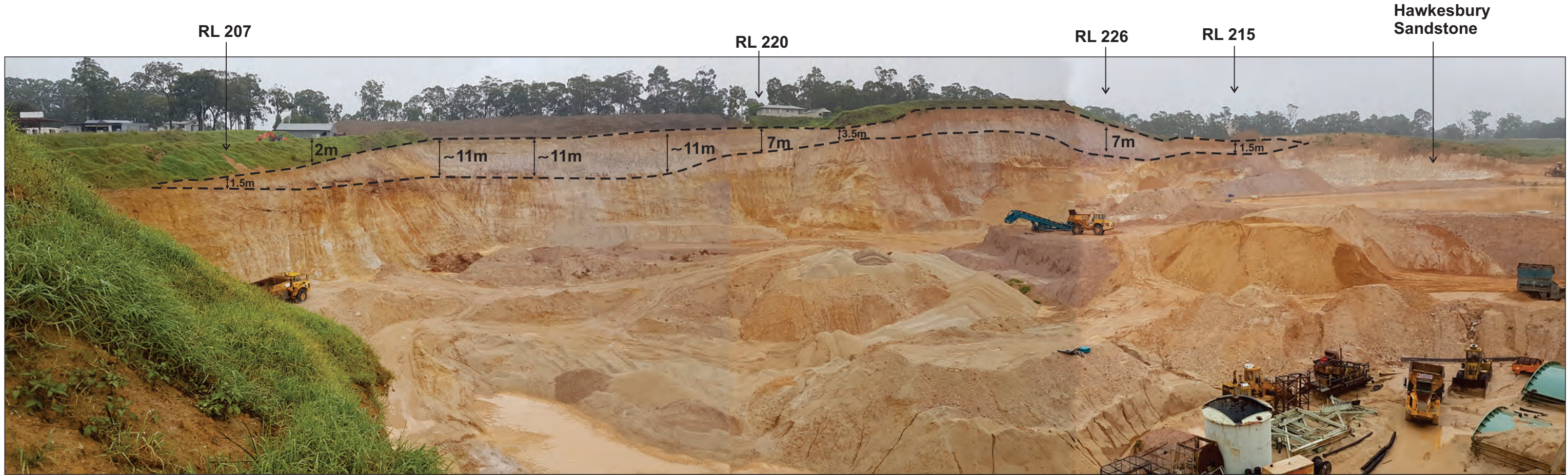
Appendix A: Figures

Plan of:	Roberts Rd Maroota Sand Quarry Clay Review 2019 - Clay Resource	Location:	Maroota Quarry, Roberts Road, Maroota, NSW	Source:	VGT - Image Dated 07/01/2019	Our Ref:	6920_HMA_CR2019_C003_V1_F31.cdr
Figure:	ONE	Council:	Hills Shire Council	Survey:	N/A	Plan By:	SC/JD
Sheet:	1 of 1	Tenures:	N/A	Projection:	N/A	Project Manager:	GVT
Version/Date:	V1 10/01/2019	Client:	Hodgson Quarries & Plant Pty Ltd	Contour Interval:	N/A	Office:	Thornton

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.



VIEW LOOKING SOUTH



Legend

Clay Overburden

Manager Hodgson Quarries & Plant Pty Ltd: Martin Hodgson

Signed:

Date:

Project Manager VGT: Greg Thomson

Signed:

Date:

Plan of:	Roberts Rd Maroota Sand Quarry Clay Review 2019 - Drill Hole & Clay Volume Plan	Location:	Maroota Quarry, Roberts Road, Maroota, NSW	Source:	N/A	Our Ref:	6920_HMA_CR2019_C003_V1_F31.cdr
Figure:	TWO	Council:	Hills Shire Council	Survey:	NSW Government Spatial Services, May 2017 Survey, Accessed Through ELVIS	Plan By:	SC/JD
Sheet:	1 of 1	Tenures:	N/A	Projection:	N/A	Project Manager:	GVT
Version/Date:	V0 10/01/2019	Client:	Hodgson Quarries & Plant Pty Ltd	Contour Interval:	N/A	Office:	Thornton

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.


0 20 40 60 80 100m


vgt
Environmental Compliance Solutions Pty Ltd



LEGEND	
	Property Boundary
	Water Management Area
	Building
	Drill Hole
	Existing Bund Wall
	Contour

Manager Hodgson Quarries & Plant Pty Ltd: Martin Hodgson

Signed:

Date:

Project Manager VGT: Greg Thomson

Signed:

Date:



Appendix B: Drill Holes

BOREHOLE LOG

Name of Hole: MW8

Project Number: 2801

Client: Hodgson Quarry Products and Plant

Project: Drilling Operations/ Groundwater Study

Location: Off Roberts Road, Maroota, NSW

Logged by: MA

MAROOTA

Date Commenced: 5/12/2016

Date Completed: 6/12/2016

Surface RL: 227.01m

Collar Height: 0.42m

Coordinates: 313889 6295287

Drilling Contractor: Ultra Drilling Waterbores



Page:1 of 4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Hammer Bit	227	0				Silty Sand- orange to light brown, fine to medium grained, subrounded to rounded grains	Feruginised fragments and some clay
	226	1				Silty Sand- orange, fine to medium grained, subrounded to rounded grains	Feruginised fragments and some clay
	225	2				Clayey Sand- orange to light orange, fine grained, subrounded to rounded	
	224	3				Silty Sand- light orange to orange, fine to coarse grained subrounded to rounded	Hammer bit not firing
	223	4				Silty Sand- orange, fine to coarse grained, subrounded to rounded grains	Hammer bit not firing
	222	5				Clay- white to light brown	Hammer bit not firing
	221	6				Clay- purple to pink	
	220	7				Clay- Deep purple	
	219	8				Clay-Purple to light brown	Water seepage @ 13m
	218	9				Clay- Deep purple	Hammer bit not firing
	217	10				Clay- light brown to purple	Hammer bit not firing
	216	11				Clay- dark brown to red	Hammer bit not firing
	215	12				Clayey Sand- cream to orange, fine grained, subrounded to rounded grains	Hammer bit not firing
	214	13					
	213	14					
	212	15					
	211	16					
	210	17					
	209	18					
	208	19					
	207	20					

Other Information:GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By: GT (12/01/2017)

2801_HMA_DO_LOG_MW8_V3

Name of Hole: MW8

Client: Hodgson Quarry Products and Plant

Project: Drilling Operations/ Groundwater Study

Location: Off Roberts Road, Maroota, NSW

Logged by: MA

Date Commenced: 5/12/2016

Date Completed: 6/12/2016

Surface RL: 227.01m

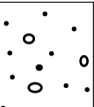
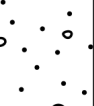
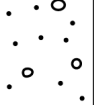
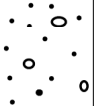
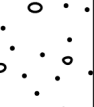
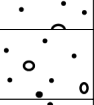
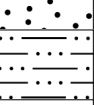
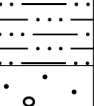
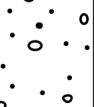
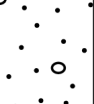
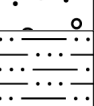
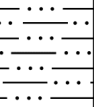
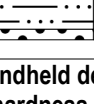
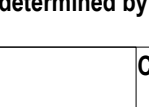
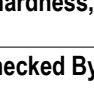
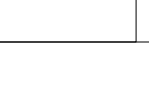
Collar Height: 0.42m

Coordinates: 313889 6295287

Drilling Contractor: Ultra Drilling Waterbores



Page:2of4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Hammer Bit	206	21				Pebbly Sand - orange to light brown, coarse to very coarse, rounded to subrounded	Hammer bit not firing to 20.5m, some clay
	205	22					
	204	23					
	203	24					
	202	25					
	201	26					
	200	27					
	199	28				Pebbly Sand- light brown, fine grained, subrounded to rounded grains	Some clay
	198	29				Sand- white to light brown, fine grained, subrounded to rounded	Some clay
	197	30				Sandy Clay- brown to light purple, fine grained, subrounded to rounded	Water injected
	196	31				Clayey Sand- brown to light brown, fine grained, subrounded to rounded	
	195	32				Pebbly Sand- brown to pink, very coarse to fine , subrounded to rounded	Feruginised fragments
	194	33					
	193	34					
	192	35					
	191	36				Clayey Sand- brown to purple, medium grained, subrounded to rounded grains	Hardness increasing
	190	37					
	189	38					
	188	39					
	187	40					

Other Information:GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA	Checked By: GT (12/01/2017)	2801_HMA_DO_LOG_MW8_V3
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BOREHOLE LOG

Name of Hole: MW8

Project Number: 2801

Client: Hodgson Quarry Products and Plant

Project: Drilling Operations/ Groundwater Study

Location: Off Roberts Road, Maroota, NSW

Logged by: MA

MAROOTA

Date Commenced: 5/12/2016

Date Completed: 6/12/2016

Surface RL: 227.01m

Collar Height: 0.42m

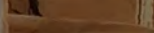
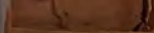
Coordinates: 313889 6295287

Drilling Contractor: Ultra Drilling Waterbores



Page:3of4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
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Hammer Bit	186	41				Sandstone - orange to brown	Interbedded shale laminations
	185	42					
	184	43					
	183	44					
	182	45					
	181	46					
	180	47					
	179	48					
	178	49					
	177	50	Hole Terminated in Hawkesbury Sandstone				

177	50
176	51
175	52

Piezo Legend

	2mm Gravel Pack
	Bentonite Seal
	Casing Blank
	Casing Slotted
	Fill
	Cap

Other Information:GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA	Checked By: GT (12/01/2017)	2801_HMA_DO_LOG_MW8_V3
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BOREHOLE LOG

Name of Hole: MW8

Project Number: 2801

Client: Hodgson Quarry Products and Plant

Project: Drilling Operations/ Groundwater Study

Location: Off Roberts Road, Maroota, NSW

Logged by: MA

MAROOTA

Date Commenced: 5/12/2016

Date Completed: 6/12/2016

Surface RL: 227.01m

Collar Height: 0.42m

Coordinates: 313889 6295287

Drilling Contractor: Ultra Drilling Waterbores



Page:4 of 4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
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Other Information:GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By: GT (12/01/2017)

2801_HMA_DO_LOG_MW8_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW9

Date Commenced: 19/12/2016

Date Completed: 19/12/2016

Project Number: 2801

Surface RL: 225.577 m

Client: Hodgson Quarry Products and Plant

Collar Height: 0.52m

Project: Drilling Operations/ Groundwater Study

Coordinates: 313916 6295355

Location: Off Roberts Road, Maroota, NSW

Drilling Contractor: Ultra Drilling Waterbores

Logged by: MA



Page 1 of 3

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Auger	225	0				Clayey Sand- orange to brown, fine to coarse grained, subrounded to rounded grains	Topsoil 0 - 0.3m
Blade Bit	224	1				Clayey sand- light brown to red, coarse grained, subrounded to rounded grains	Feruginised chips
	223	2				Clayey Sand- red to light orange, fine to coarse grained, subrounded to rounded grains	
	222	3				Clayey Sand- red to light brown, fine to coarse grained, rounded to subrounded grains	Feruginised Chips
	221	4				Clay- Pink to red	Some cream clay
	220	5				Clay- Pink to red	Some silt
	219	6					
	218	7					
	217	8					
	216	9				Clay- Cream to pink- silty	Water seepage @12m
	215	10					
	214	11					
	213	12					
	212	13				Clay- Red, no sand	
	211	14					
Hammer Bit	210	15				Pebbly Sand- light orange, fine to very coarse grained, subrounded to rounded grains	
	209	16					
	208	17				Pebbly Sand- orange to light orange, fine to very coarse grained, subrounded to rounded grains	
	207	18					
	206	19					
		20					

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.

Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By GT (12/01/2017)

Version: 2801_HMA_DO_LOG_MW9_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW9

Date Commenced: 19/12/2016

Project Number: 2801

Date Completed: 19/12/2016

Client: Hodgson Quarry Products and Plant

Surface RL: 225.577 m

Project: Drilling Operations/ Groundwater Study

Collar Height: 0.52m

Location: Off Roberts Road, Maroota, NSW

Coordinates: 313916 6295355

Logged by: MA

Drilling Contractor: Ultra Drilling Waterbores



Page 2 of 3

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Hammer Bit	205	21				Sand- orange to pink, fine to coarse grained, subrounded/subangular to rounded grains	
	204	22					
	203	23				Sand- light brown, fine to coarse grained, subrounded/subangular to rounded grains	Feruginised chips
	202	24					
	201	25					
	200	26					
	199	27					
	198	28				Sand- brown to orange, fine grained	Feruginised chips
	197	29					
	196	30					
	195	31					
	194	32					
	193	33					
	192	34					
	191	35				Sandstone- brown to light orange	Hardness progressively increasing
	190	36					
	189	37					
	188	38					
	187	39					
	186	40				Sandstone- light orange to red	

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.

Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By GT (12/01/2017)

Version: 2801_HMA_DO_LOG_MW9_V3

BOREHOLE LOG

MARROOTA

Name of Hole: MW9

Date Commenced: 19/12/2016

Project Number: 2801

Date Completed: 19/12/2016

Client: Hodgson Quarry Products and Plant

Surface RL: 225.577 m

Project: Drilling Operations/ Groundwater Study

Collar Height: 0.52m

Location: Off Roberts Road, Maroota, NSW

Coordinates: 313916 6295355

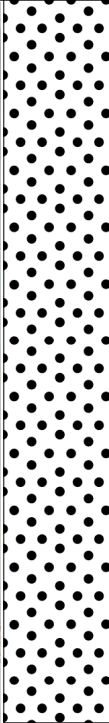
Logged by: MA

Drilling Contractor: Ultra Drilling Waterbores



Page 3 of 3

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
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Hammer Bit	185	41			Sandstone- light brown	Water injected @49m
	184	42				
	183	43				
	182	44				
	181	45				
	180	46				
	179	47				
	178	48				
	177	49				
	176	50				
175	51	Hole Terminated in Hawkesbury Sandstone				
174	52					

Piezo Legend

- 2mm Gravel Pack
- Bentonite Seal
- Casing Blank
- Casing Slotted
- Fill
- Cap

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By GT (12/01/2017)

Version: 2801_HMA_DO_LOG_MW9_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW10

Date Commenced: 12/12/2016

Date Completed: 14/12/2016

Project Number: 2801

Surface RL: 217.124m

Client: Hodgson Quarry Products and Plant

Collar Height: 0.49m

Project: Drilling Operations/ Groundwater Study Coordinates: 314122 6295186

Location: Off Roberts Road, Maroota, NSW

Drilling Contractor: Ultra Drilling Waterbores

Logged by: MA



Page: 1 of 4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Auger	217	0				Silty Clay - Orange to grey	Topsoil 0-0.2m
	216	1					
Blade Bit	215	2				Clay- red to cream, no sand	
	214	3					
	213	4				Clay- red, no sand	Some Silt
	212	5					
	211	6				Clay- cream to red, no sand	Some Silt
	210	7					
	209	8				Clay- red to orange, no sand	
	208	9				Clay- pink to cream, no sand	
	207	10				Clay- pink to purple, no sand	Some Silt
	206	11				Sand- light orange, fine grained, subrounded to rounded grains	Some Clay
	205	12					
	204	13					
	203	14					
	202	15				Sand- dark orange, fine to very coarse, grained, subrounded/subangular to rounded grains	Not hammering @ 18m
	201	16					
	200	17					
Hammer Bit	199	18					
	198	19					
	197	20					

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.

Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By: GT (12/01/2017)

Date: 2801_HMA_DO_LOG_MW10_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW10

Date Commenced: 12/12/2016

Project Number: 2801

Date Completed: 14/12/2016

Client: Hodgson Quarry Products and Plant

Surface RL: 217.124m

Project: Drilling Operations/ Groundwater Study

Collar Height: 0.49m

Location: Off Roberts Road, Maroota, NSW

Coordinates: 314122 6295186

Logged by: MA

Drilling Contractor: Ultra Drilling Waterbores



Page:2 of 4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Hammer Bit	196	21				Pebbly Sand- orange to red, coarse to very coarse, subrounded to rounded grains	Not hammering
	195	22					
	194	23					
	193	24				Sand- cream to light orange, fine to medium grained, subrounded/subangular to rounded grains	Not hammering
	192	25					
	191	26				Sand- orange, fine to coarse grained, subrounded/subangular to rounded	Not hammering
	190	27					
	189	28				Pebbly Sand- pink to orange, fine to very coarse grained, subangular to rounded grains	Not hammering, minor clay bands
	188	29				Pebbly Sand- pink to cream, coarse to very coarse, subrounded to rounded grains	Not hammering, minor clay bands
	187	30					
	186	31				Pebbly Sand- Pink to light brown, coarse to very coarse grained, subrounded to rounded grains	Hammering
	185	32				Pebbly Sand- pink to red, coarse to very coarse grained, subangular/subrounded to rounded grains	
	184	33					
	183	34					
	182	35				Pebbly Sand- pink to red, coarse to very coarse grained, subangular/subrounded to rounded grains	Water seepage
	181	36					
	180	37					
	179	38					
	178	39					
	177	40					

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.

Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By: GT (12/01/2017)

Date: 2801_HMA_DO_LOG_MW10_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW10

Date Commenced: 12/12/2016

Project Number: 2801

Date Completed: 14/12/2016

Client: Hodgson Quarry Products and Plant

Surface RL: 217.124m

Project: Drilling Operations/ Groundwater Study

Collar Height: 0.49m

Location: Off Roberts Road, Maroota, NSW

Coordinates: 314122 6295186

Logged by: MA

Drilling Contractor: Ultra Drilling Waterbores



Page:3 of 4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Hammer Bit	176	41				Pebbly Sand- brown, coarse to very coarse grained, subrounded to rounded grains	
	175	42					
	174	43					
	173	44					
	172	45					
	171	46				Pebbly Sand- red, coarse to very coarse grained, subangular/subrounded to rounded grains	
	170	47					
	169	48				Pebbly Sand- pink to orange, some very coarse to coarse grains, subrounded to rounded	
	168	49					
	167	50				Hole Terminated in Hawkesbury Sandstone as determined by drill penetration rates and colour change in drill water. No sample retained	
	166	51					
	165	52					

Piezo Legend

- 2mm Gravel Pack
- Bentonite Seal
- Casing Blank
- Casing Slotted
- Fill
- Cap

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.

Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By: GT (12/01/2017)

Date: 2801_HMA_DO_LOG_MW10_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW10

Date Commenced: 12/12/2016

Project Number: 2801

Date Completed: 14/12/2016

Client: Hodgson Quarry Products and Plant

Surface RL: 217.124m

Project: Drilling Operations/ Groundwater Study

Collar Height: 0.49m

Location: Off Roberts Road, Maroota, NSW

Coordinates: 314122 6295186

Logged by: MA

Drilling Contractor: Ultra Drilling Waterbores



Page:4 of 4

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
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Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By: GT (12/01/2017)

Date: 2801_HMA_DO_LOG_MW10_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW12

Date Commenced: 08/12/2016

Date Completed: 08/12/2016

Project Number: 2801

Surface RL: 210.275m

Client: Hodgson Quarry Products and Plant

Collar Height: 0.48m

Project: Drilling Operations/ Groundwater Study Coordinates: 313902 6295583

Location: Off Roberts Road, Maroota, NSW

Drilling Contractor: Ultra Drilling Waterbores

Logged by: MA



Page: 1 of 3

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Blade	210	0				Sand- orange to dark orange coarse to very coarse grained, subrounded to rounded grains	
	209	1				Sand- dark orange, fine to coarse grained, subrounded to rounded grains	Feruginised chips, some clay bands
	208	2				Sand- orange to red, fine to coarse grained, subrounded to rounded	Feruginised chips
	207	3				Sand- red to cream, fine to medium grained, subrounded to rounded grains	Feruginised chips
	206	4				Silty Sand- cream to light orange, fine to medium grained, subrounded to rounded grains	
	205	5				Sand- cream, fine to medium grained, rounded to subrounded grains	
	204	6					
	203	7					
	202	8					
	201	9					
Hammer Bit	200	10				Sand- cream to pink fine to medium grained, subrounded to rounded grains	Water seepage
	199	11				Sand- pink to light brown, fine grained, subrounded to rounded grains	
	198	12				Sand- cream to light brown, very coarse to coarse grained, subrounded to rounded grains	
	197	13					
	196	14					
	195	15				Sand- cream to light brown, coarse to very coarse, rounded to subrounded grains	
	194	16					
	193	17					
	192	18					
	191	19					
	190	20					

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.

Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By GT (12/01/2017)

Version: 2801_HMA_DO_LOG_MW12_V3

BOREHOLE LOG**MARROOTA**

Name of Hole: MW12

Date Commenced: 08/12/2016

Project Number: 2801

Date Completed: 08/12/2016

Client: Hodgson Quarry Products and Plant

Surface RL: 210.275m

Project: Drilling Operations/ Groundwater Study

Collar Height: 0.48m

Location: Off Roberts Road, Maroota, NSW

Coordinates: 313902 6295583

Logged by: MA

Drilling Contractor: Ultra Drilling Waterbores



Page: 2 of 3

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
------------	----------------	-----------	-------------------	-----------	-------------	-------------	------------------------

Hammer Bit	189	21				Sand- brown to light brown, fine to coarse, subrounded to rounded	Not Hammering
	188	22					
	187	23					
	186	24					
	185	25				Sandstone- grey to brown, fine to medium grained, subrounded to rounded grains	Shale laminations, hard
	184	26					
	183	27				Hole Terminated in Hawkesbury Sandstone	
	182	28					

Piezo Legend

- 2mm Gravel Pack
- Bentonite Seal
- Casing Blank
- Casing Slotted
- Fill
- Cap

Other Information: GPS Coordinates sourced from handheld devices. Survey conducted post exploration.
Stratum contacts determined by hardness, colour, sample recovery and lithological analysis.

Logged By: MA

Checked By GT (12/01/2017)

Version: 2801_HMA_DO_LOG_MW12_V3

Drill Type	Elevation (RL)	Depth (m)	Piezometer Design	Photo Log	Graphic Log	Description	Additional Information
Empty table body content							



Appendix C: Statement of Accuracy

Statement of Accuracy Maroota Quarry– as of 10th January 2019

Table 1 Data Acquisition

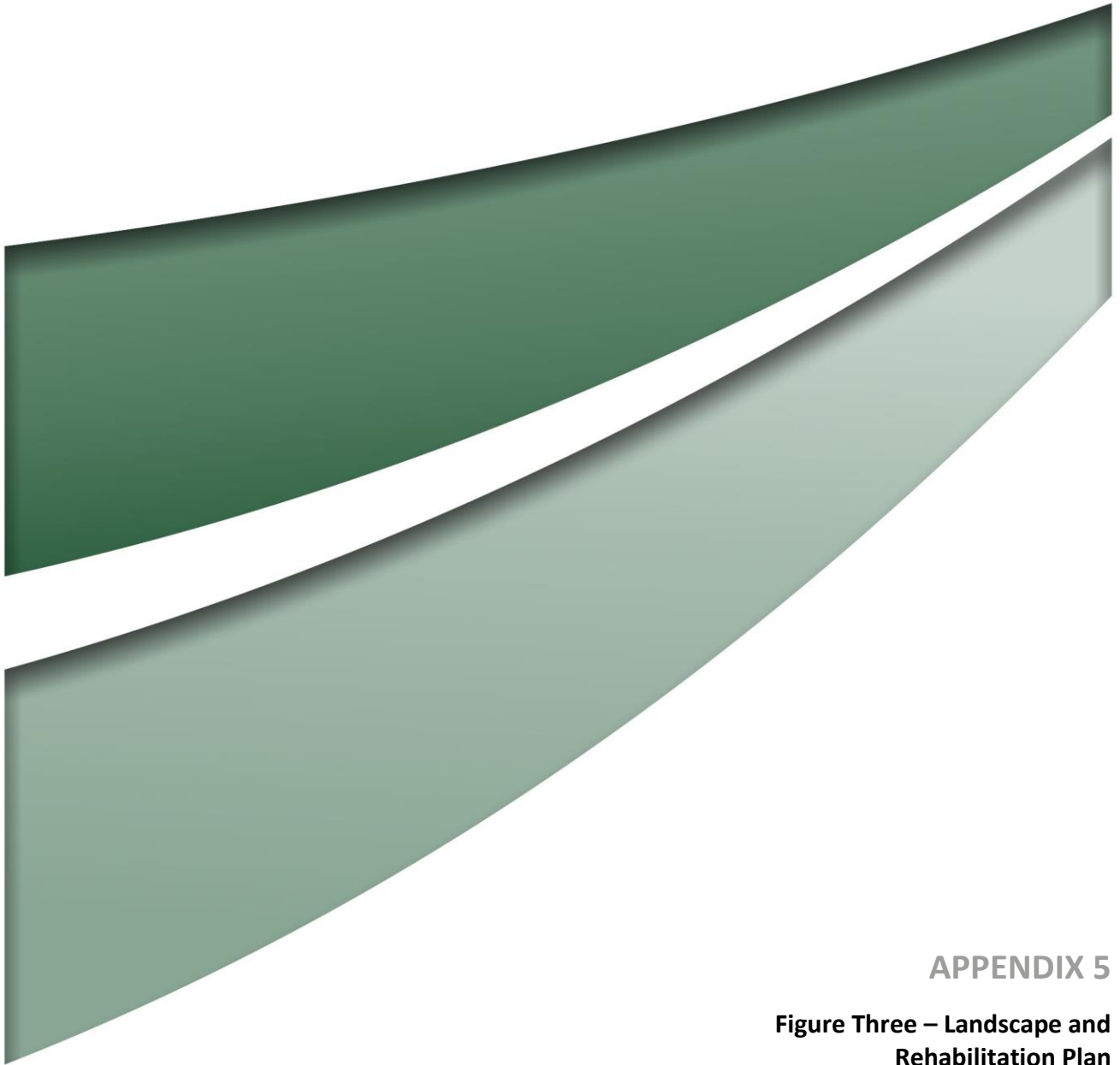
Item	Description
Source of survey	NSW Spatial Services – DEM format May 2017
Date of Survey	May 2017
Date files received	8 th January 2019
File format	Geo referenced Ortho-photo and DXF
Ground control	Not supplied
Data Accuracy	Not supplied
Equipment	Not supplied
Software	SURPAC
Property Boundary	Inferred, not verified.
Mine lease or Authority Boundary	Not required

Table 2 Processing and Manipulation

Item	Description
VGT Raw File location	V:\Jobs\ HMA Maroota\1_Base_Boundary\3D Survey\gov survey May 2017\DATA_6383\NSW Government\DEMs\1 Metre
VGT file import	Converted DXF to STR file using SURPAC
VGT manipulation	12d conversion from Digital Elevation Model (DEM) to Triangular Irregular Network (TIN) then contoured to produce DXF for surpac input.
Ground truthing	Review topography visually and overlay air photography (provided from nearmaps)
Conversion of data	String (str) file converted to Digital Terrain Model (DTM) using Surpac
Quarry Model Development	Top of cut was digitised using Surpac tool, utilised previous southern and eastern boundaries from resource review undertaken in May 2018
Batter and Bench design	A 1 horizontal: 0.5 vertical single batter was adopted, as similar batters were found in 2017 survey.
Base of Clay	A base of clay was determined using photography interpolation and drill holes.
Verification	None

Table 3 Attributes

Item	Description
Buffers	EIS Mod 2 Figure MP-05 B July 2000, Final Landform/Rehabilitation Plan, prepared by Nexus
Infrastructure	As identified in EIS Mod 2 Figure MP-05 B July 2000, Final Landform/Rehabilitation Plan, prepared by Nexus
Overburden	Site observations suggest and average topsoil thickness of 0.5 metres. This has been excluded from the calculations.
Resource Type	The lensing nature of sand, clay and sandstone is too difficult to predict amounts, therefore a total volume is presented.
Mining techniques	The mining procedure involves most of the resource to be processed.
Onsite Processing	The sand processing involves crushing, sorting and cleaning the sand. Reject fines are stored in ponds.
Verification	

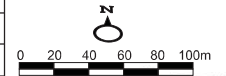


APPENDIX 5

**Figure Three – Landscape and
Rehabilitation Plan**

Plan of:	Roberts Rd Maroota Sand Quarry Rehabilitation Plan 2017 - Final Rehabilitation Plan (EA Plan LPDA 15-94/4)	Location:	Maroota Quarry, Roberts Road, Maroota, NSW	Source:	Concept Landscape Architects/Nexus Environmental Planning Pty Ltd Proposed Rehabilitation of Existing Sand Mine/Final Rehabilitation Details/Section 75W Modification 2 Dwg No:LPDA 15-94/4 Rev D 7/09/2015	Our Ref:	5072_HMA_EMP_RP17_C003_V2_F3.cdr
Figure:	THREE	Council:	Hills Shire Council	Survey:	N/A	Plan By:	LT/JD
Sheet:	1 of 1	Tenures:	N/A	Projection:	N/A	Project Manager:	LT
Version/Date:	V2 09/03/2018	Client:	Hodgson Quarries & Plant Pty Ltd	Contour Interval:	N/A	Office:	Thornton

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.



LEGEND

- FINAL DAM LOCATION AND EXTENTS - REFER ENGINEER'S PLANS
- EXISTING VEGETATION TO BE RETAINED AND PROTECTED
- STAGES 3, 4, 5 AND 6 BUND WALLS TO BE STABILISED WITH JUTE MATTING AND POCKET PLANTING - REFER DETAILS 4, 5 AND 6
- STAGES 3, 4, 5 AND 6 BUND WALLS TO BE REMOVED WHERE WITHIN FINAL EXCAVATION EXTENTS
- EXISTING VEGETATED BUND WALLS TO BE RETAINED
- EXISTING VEGETATED BUND WALLS TO BE REMOVED WHERE WITHIN FINAL EXCAVATION EXTENTS
- BOTTOM OF PIT TO BE HYDRO-MULCHED WITH NATIVE SEED MIX - REFER DETAIL 10
- 1V:3H GRADE EMBANKMENTS MASS PLANTED WITH ENDEMIC SPECIES - REFER DETAILS 07 AND 08
- EMBANKMENTS WITH FINAL SLOPES STEEPER THAN 1V:3H TO BE STABILISED WITH JUTE MATTING AND POCKET PLANTED WITH ENDEMIC SPECIES - REFER DETAILS 07 AND 11
- ENDEMIC SCREEN PLANTING WITHIN PERIMETER BUFFER SETBACKS - REFER DETAILS 07 AND 08
- STAGE 5B EXTRACTION ZONE TO BE USED FOR THE STOCKPILING OF SITE TOPSOIL AND SUBSOIL AND USED FOR FINAL REHABILITATION PLANTING PREPARATION WORKS - REFER DETAILS

THE FOLLOWING SHALL BE UNDERTAKEN TO ENSURE AVAILABLE MATERIAL FOR THE PLANTING PREPARATION OF THE FINAL REHABILITATED SITE - 300MM DEPTH TOPSOIL TO BE EXCAVATED AND STOCKPILED (WITHIN STAGE 5 EXCAVATION ZONE) - SUBSOIL TO BE TO BE EXCAVATED AND STOCKPILED (WITHIN STAGE 5 EXCAVATION ZONE)

THIS MATERIAL SHALL BE EXCAVATED AND STOCKPILED PRIOR TO COMMENCEMENT OF THE EXTRACTION WORKS FOR EACH STAGE, AND SHALL BE STORED SEPARATELY TO STOCKPILED MATERIAL FOR BUND WALL CONSTRUCTION.

STOCKPILED MATERIAL SHALL BE USED PROGRESSIVELY AS AREAS OF THE SITE ARE EXCAVATED AND FINISHED IN THEIR FINAL FORM AND READY FOR REHABILITATION PLANTING WORKS.

STOCKPILES MUST BE CLEARLY LABELLED AND IDENTIFIABLE TO ENSURE CORRECT FUTURE USE. APPROPRIATE SEDIMENT AND EROSION CONTROL MEASURES SHALL BE UNDERTAKEN TO ENSURE NO MIXING, LEACHING, RUN-OFF OR CONTAMINATION OF STOCKPILES.

CONSULTANTS INFORMATION

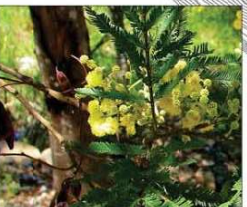
- REFER TO PLANS, DETAILS, SPECIFICATION AND REPORTS PREPARED BY OTHER CONSULTANTS FOR ALL INFORMATION RELATING TO THAT PRACTICE, INCLUDING:
- NEXUS ENVIRONMENTAL PLANNING: PROJECT MANAGEMENT AND PLANNING
 - LYLE MARSHALL & ASSOCIATES: TRAFFIC AND ACCESS
 - AUSTRALIAN GROUNDWATER TECHNOLOGIES: GROUNDWATER MONITORING & MANAGEMENT
 - PETER DUNDON & ASSOCIATES: GROUNDWATER
 - VGT ENVIRONMENTAL COMPLIANCE SOLUTIONS: SITE LAYOUT AND EXTRACTION PLANS, MODIFIED DAM DESIGN, MODIFIED RESOURCE VOLUMES
 - WILKINSON MURRAY: ACOUSTIC IMPACT ASSESSMENT AIR QUALITY ASSESSMENT



CANOPY TREE: ANGOPHORA COSTATA



CANOPY TREE: A. FLORIBUNDA



SMALL TREE: ACACIA PARRAMATTENSIS



SMALL TREE: ALLOCASUARINA LITTORALIS

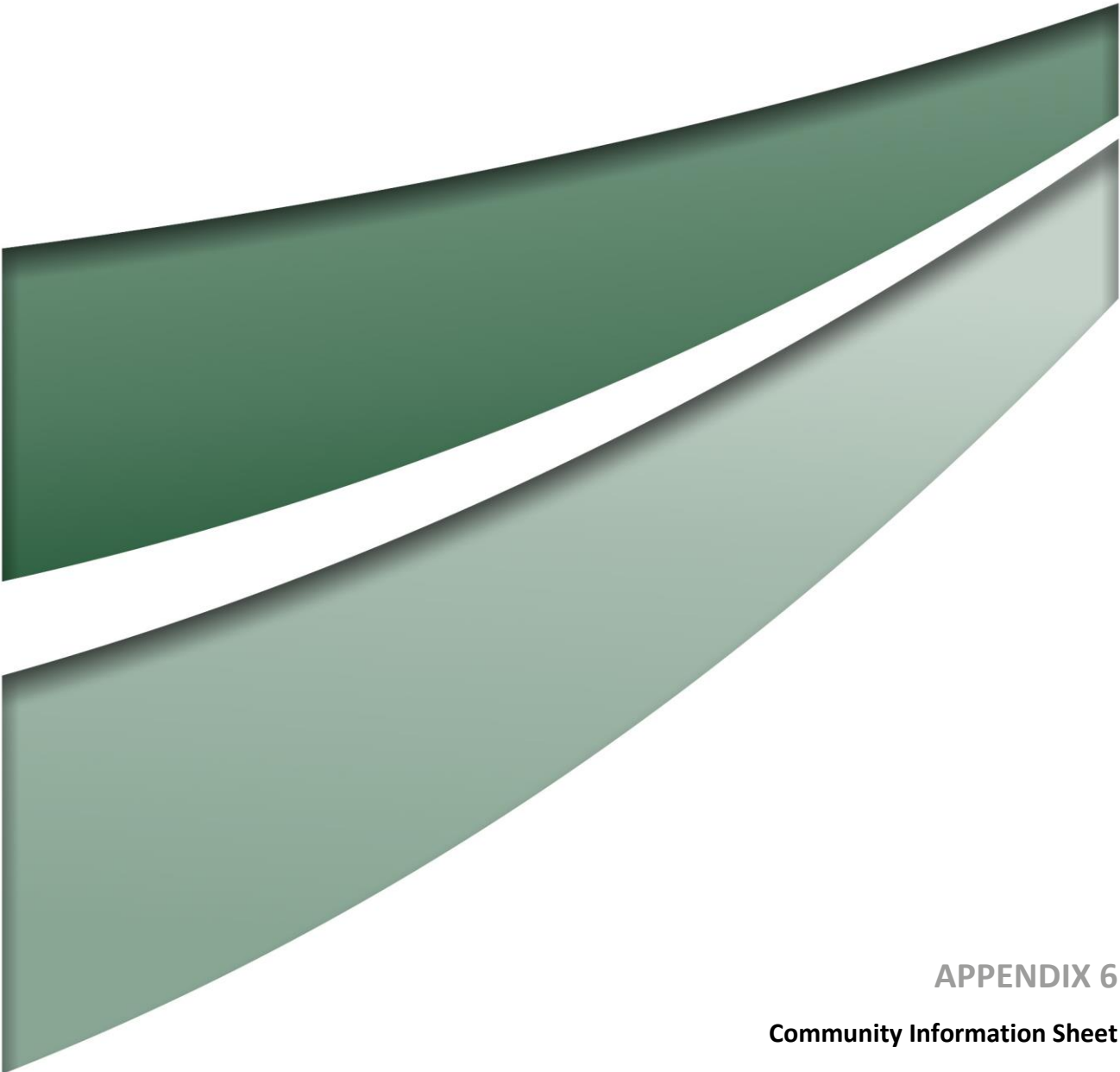


NATIVE GRASS: LOMANDRA LONGIFOLIA



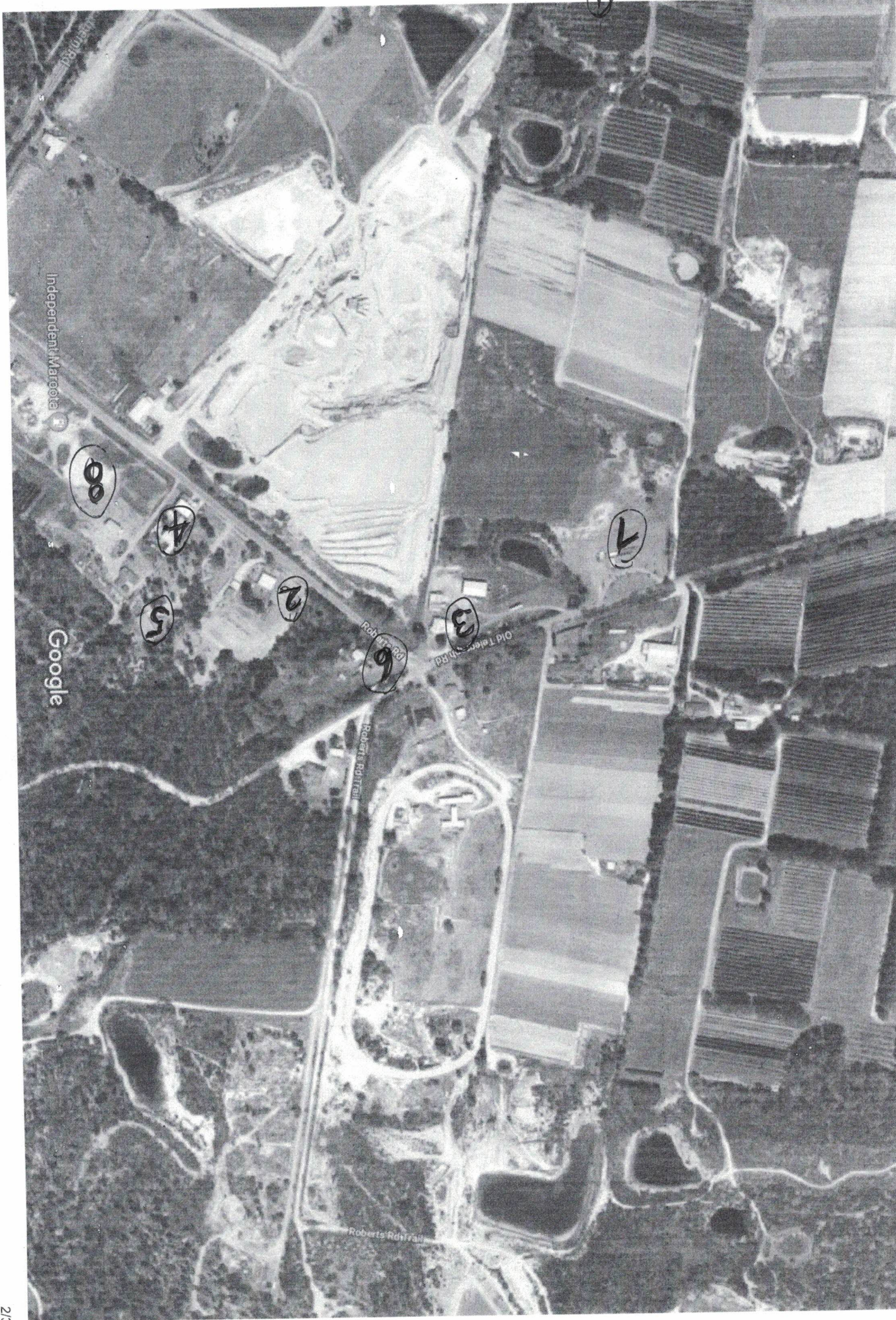
GROUNDCOVER: HARDENBERGIA

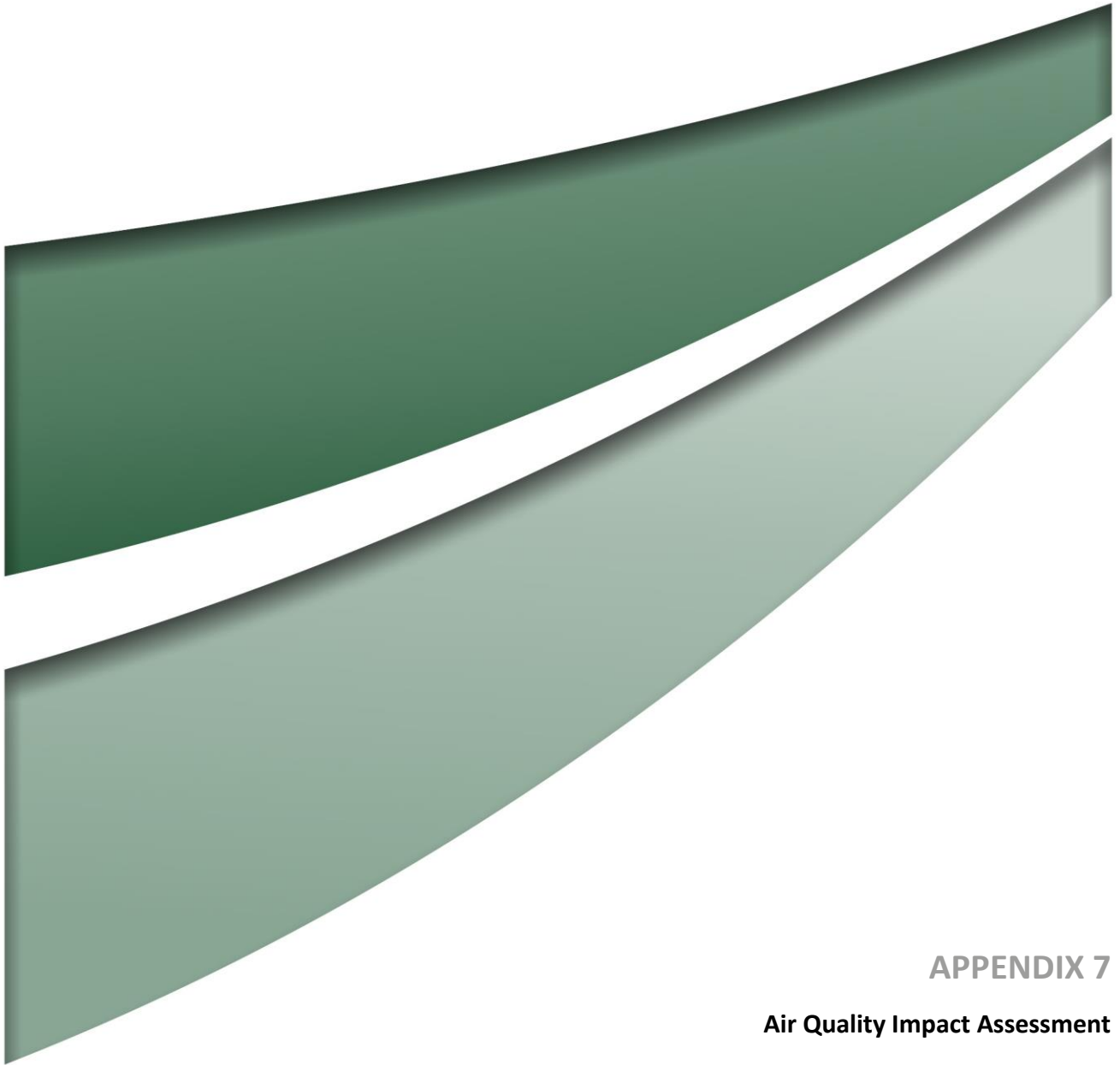
Manager Hodgson Quarries & Plant Pty Ltd: Martin Hodgson
Signed: *Martin R. Hodgson*
Date: 20/3/18
Project Manager VGT: Lisa Thomson
Signed: *Lisa Thomson*
Date: 16/3/18



APPENDIX 6

Community Information Sheet





APPENDIX 7

Air Quality Impact Assessment



Roberts Road Quarry

Umwelt Australia Pty Ltd

Air Quality Impact Assessment for Proposed Modification 4

F0 | v0

34 Jun 2019



Roberts Road Quarry

Project No: IA206300
Document Title: Air Quality Impact Assessment for Proposed Modification 4
Document No.: F0
Revision: v0
Date: 34 Jun 2019
Client Name: Umwelt Australia Pty Ltd

Project Manager: Luke Spencer
Author: Luke Spencer
File Name: J:\IE\Projects\04_Eastern\IA206300\21 Deliverables\11_Report\Roberts Road Quarry_AQIA_F0v0.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
D0v0	31/05/2019	Initial draft for internal technical review	LS	SL	SL
D0v1	03/06/2019	Second draft following initial client review	LS	SL	SL
F0v0	04/06/2019	Final	LS	SL	SL

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Executive Summary

This report provides an assessment of the air quality impacts of the proposed modification to allow VENM/ENM importation at Roberts Road Quarry. The air quality impact assessment has been carried out in accordance with the EPA's "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2016).

Identification of key risks

The primary air quality issue associated with the proposal was identified to be dust (that is, particulate matter in the form of TSP, deposited dust, PM₁₀ or PM_{2.5}) from continued quarrying operations, as well as planned VENM/ENM importation activities.

Existing environment

A detailed review of the existing environment was carried out to understand key features of the existing environment. Aerial imagery was reviewed to identify sensitive receivers around the Quarry. Meteorological observations from the on-site automatic weather station were analysed to identify a suitable meteorological year for the assessment. Air quality monitoring data collected from dust deposition gauges and a High-Volume Air Sampler at the Quarry were reviewed, as well as data from a nearby monitor operated at the Maroota Public School by Dixon Sands. These data were used to establish background conditions around the Quarry, identify any current air quality related issues and establish values to be applied as part of the assessment.

Assessment of impacts

The computer-based dispersion model known as CALPUFF was used to predict the potential air quality impacts of the proposed modification. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used dust emission estimates to predict the off-site air quality impacts. The focus of the assessment was on the potential change in air quality, noting that the Quarry already contributes to existing air quality.

The main conclusions of the assessment for each key pollutant and assessable averaging time were:

- Annually averaged TSP, annually averaged PM₁₀, and deposited dust: The proposed modification would not result in exceedances of the EPA's relevant impact assessment criteria at any of the nearest sensitive receivers.
- 24-hour averaged PM₁₀: The proposed modification has a potential to result in additional exceedances at the most-affected sensitive receivers.
- Annually averaged PM_{2.5}: Background concentrations already exceed the EPA's 8 µg/m³ criterion, however data from the nearest OEH station indicates that the monitored levels may be unexplainably higher than what could be expected. Still, the proposed modification was predicted to increase annual average PM_{2.5} concentrations by 0.5 µg/m³ (i.e. around 4 percent) and 0.4 µg/m³ (i.e. approximately 3 percent) at the most-affected sensitive receivers for VENM/ENM filling in the north and south of the Quarry respectively.
- 24-hour averaged PM_{2.5}: The proposed modification would not lead to any additional exceedances at the most-affected sensitive receivers.

The key matter identified was the potential for additional days exceeding the EPA's 50 µg/m³ 24-hour average PM₁₀ criteria at the nearest sensitive receivers. Further reviews of the circumstances leading to these additional exceedances were completed which identified that the main potential for exceedances was on days when PM₁₀ concentrations were already elevated.

Recommended safeguards

Safeguard measures have been recommended to proactively identify meteorological conditions that could lead to elevated background PM₁₀ concentrations, to assist with operations planning and management. Further visual verifications were recommended should conditions arise during operations, such that the level of activity,

location and controls would need to be reviewed. Review of the siting of the on-site meteorological station was also recommended, to improve the usefulness of data collected.

With respect to Voluntary Land Acquisition and Mitigation Policy (VLAMP), which is applicable to the Quarry as a State Significant Development, the conservative, potential predictions of the assessment indicate that the provisions of this guideline could apply. To ascertain whether operations present an actual rather than potential risk, it was recommended that future monitoring be considered with the EPA.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to quantify the potential air quality impacts of the proposed VENM/ENM importation modification at Roberts Road Quarry in accordance with the scope of services set out in the contract between Jacobs and Umwelt Australia Pty Ltd (Umwelt). That scope of services, as described in this report, was developed with Umwelt.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Umwelt and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Umwelt (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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1. Introduction

Roberts Road Quarry (the Quarry) is operated by Hodgson Quarries and Plant Pty Ltd (Hodgson Quarries) on Lots 1 and 2, DP 228308; and Lot 2, DP 312327, within the Hills Shire Council Local Government Area (LGA) (see to **Figure 1-1** below). The Quarry operates in accordance with Development Consent DA 267-11-99 which permits the extraction and on-site processing of sand, clay and pebble. DA 267-11-99 has been modified three times, with the most recent update allowing an amendment to the dam construction process from stages two and three, modification to the sequence and process of extraction, and extension of the approved life until 2026, granted 18 March 2016.

Hodgson Quarries is proposing a fourth modification to DA 267-11-99 to allow the importation of clean fill material generated from Sydney construction projects, increase the number of truck movements generated by the Quarry, and extend the life of the Quarry (beyond 2026). Umwelt (Australia) Pty Ltd (Umwelt) is assisting Hodgson Quarries with the environmental approval process for this modification and has engaged Jacobs Group Australia Pty Ltd (Jacobs) to prepare an Air Quality Impact Assessment (AQIA) to assess the potential for air quality impacts as a result of the proposed modification. A Preliminary Environmental Assessment (PEA) prepared by Umwelt to support an application for Environmental Assessment Requirements from the Department of Planning & Environment (DPE) (Umwelt, 2019) identified the need for

“further review of potential sources of dust emissions will be undertaken and dispersion modelling undertaken to demonstrate that the minor modifications to operations will not result in exceedance of the nominated air quality criteria”.

Additionally, the NSW Environment Protection Authority (NSW EPA) requested an air quality assessment be completed for the modification. Their requirements and where they are addressed in this report as listed in **Table 1-1**.

Table 1-1 NSW EPA air quality assessment requirements for the modification

Environmental aspect	Requirement	Where addressed in this report
Air quality	The additional processing of some VENM and ENM materials, increase in daily truck movements and additional area exposure has the potential to increase the generation of dust (PM ₁₀ and PM _{2.5}) and other pollutant emission beyond the boundary of the premises. It is therefore recommended that you undertake an air assessment in accordance with the Approved Methods for the Modelling and assessment of Air Pollutants in NSW and Approved Methods for the Sampling and Analysis of Air Pollutants in NSW, including:	This report
	- a description of the existing air quality and meteorology using existing information and site representative ambient monitoring data;	Section 5
	- an outline of the point and fugitive sources of all pollutant emissions and the resulting ground level concentrations of all pollutants at all sensitive receivers;	Section 6 and Section 7
	- a description of the effects and significance of resulting pollutant concentrations on the environment, human health, amenity and regional ambient air quality standard and goals; and	Section 8
	- details of the mitigation measures proposed in managing the any additional impacts of air emission from the proposed modification.	Section 9

In achieving the assessment objectives identified in the PEA and assessment requirements of the NSW EPA, the objectives of this report were to:

- Outline existing and proposed Quarry operations, and the wider local setting (**Section 2**);
- Identify key air quality risks associated with the proposed modifications (**Section 3**);
- Establish suitable assessment criteria (**Section 4**);

- Describe existing local meteorological and background air quality conditions (**Section 5**);
- Estimate changes in emissions to air as a result of the proposed modification (**Section 6**);
- Explain the methods used to predict potential air quality impacts (**Section 7**);
- Present potential air quality impacts, as determined by the comparison of results from dispersion modelling with criteria, and results for existing operations (**Section 8**); and
- Recommend suitable mitigation, management and monitoring measures to address any predicted increases in impacts (**Section 9**).

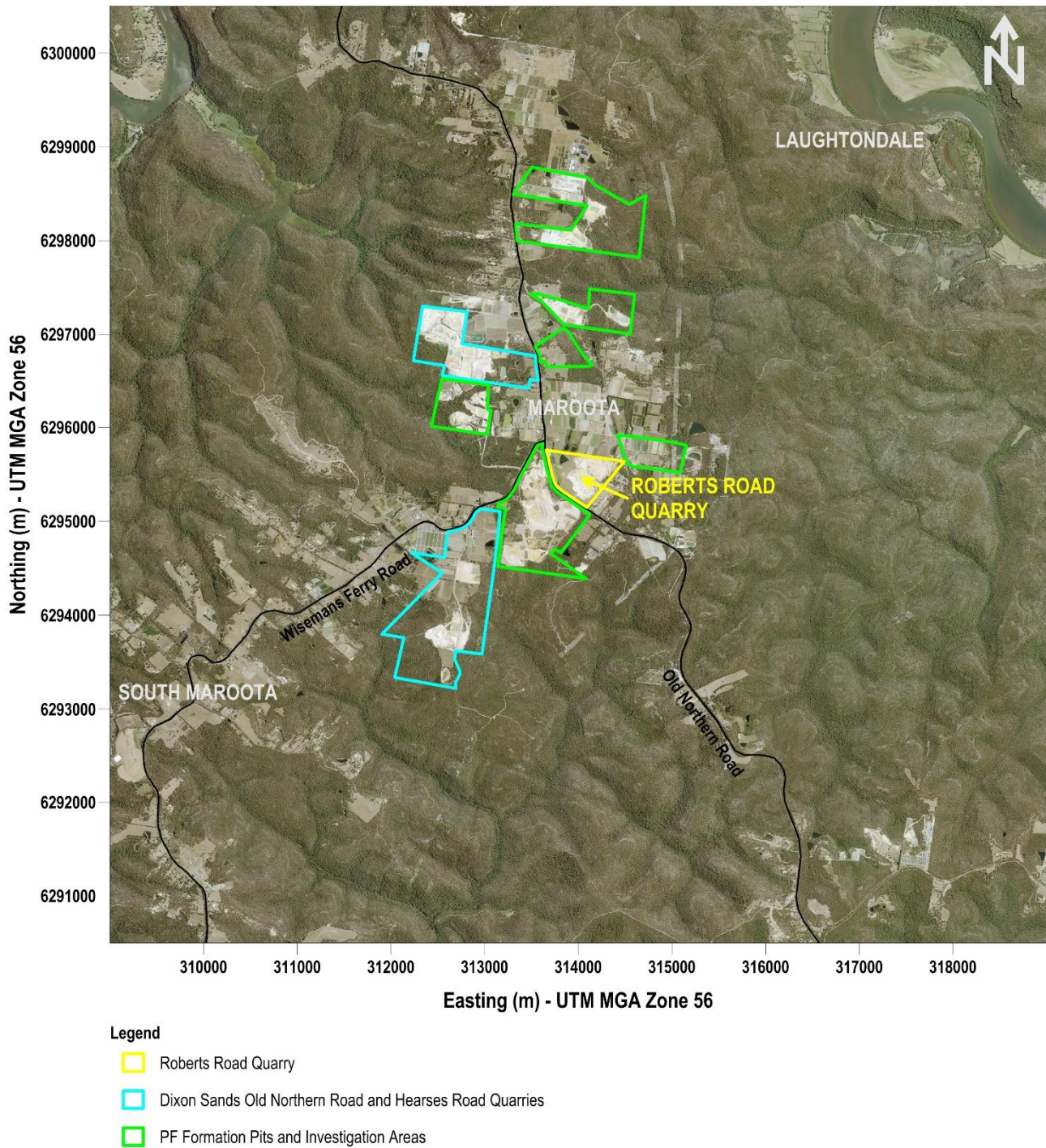


Figure 1-1 Location of Roberts Road Quarry

2. Project description

The Quarry is currently approved to produce a range of coarse, fine and ultra-fine sand, clay and pebble products. Although DA 267-11-99 does not include a limit on annual extraction, production is limited by the number of truck movements allowed from the Quarry. This limit is presently 50 laden trucks (i.e. 100 movements) per day and a maximum of 20 movements per hour; equating to a theoretical maximum of around 480,000 tonnes per annum (tpa). Extraction and processing of these products are undertaken at the Quarry, with most products transported to Sydney construction projects. The proposed modification seeks to change operations at the Quarry in the following ways:

- Up to 300,000 t of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) would be imported to the Quarry annually.
- The VENM and ENM would be primarily used to backfill the completed sections of the extraction area and recreate a final landform which more closely reflects the pre-Quarry topography. A portion of the imported VENM and ENM, containing sufficiently high proportion of sandstone or sand, would be blended with existing resources at the Quarry to extend its operational life. Based on an analysis of the remaining resources of the Quarry and selective blending with the imported VENM/ENM, a further increase in the life of the Quarry of around 5 years to 2030 is proposed.
- To accommodate the importation of VENM and ENM, the number of daily truck movements to and from the Quarry would need to increase from 100 to 140 movements per day.
- To accommodate the additional activities associated with the importation, placement and profiling of the VENM and ENM, Condition 29 (c) of DA 267-11-99 which restricts the extent of the 'exposed and active' working areas to 3 hectares would also need to be amended.

Figure 2-1 below shows the approximate boundary of the Quarry, and the nearest surrounding sensitive receiver locations. It is noted that the Quarry boundary would not change as a result of the proposed modification. As **Figure 2-1** displays, the nearest residential receivers are located to the east of the site off Roberts Road, to the south and west off the Old Northern Road and northwest off Old Telegraph Road.

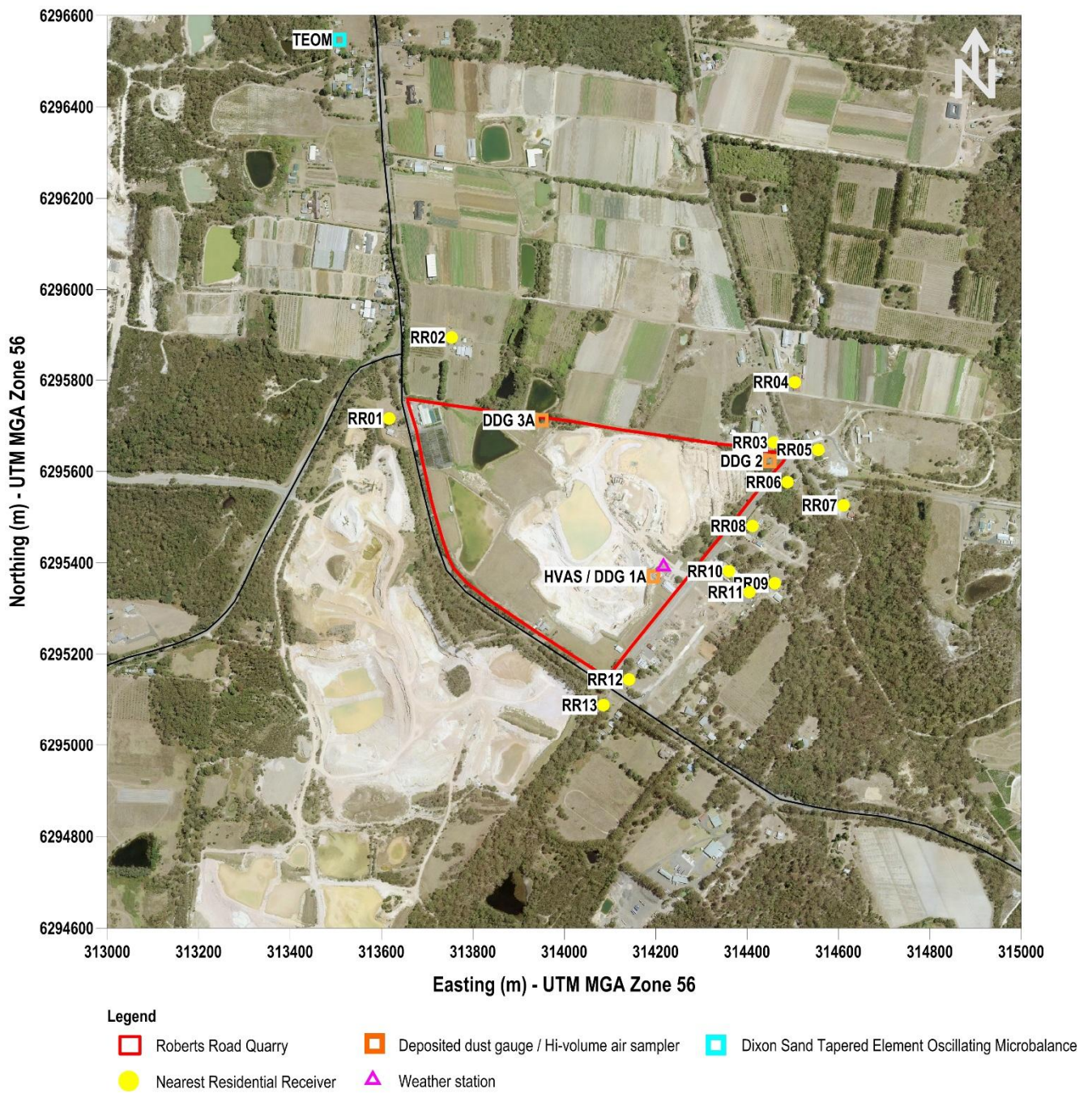


Figure 2-1 Roberts Road Quarry and surrounding residential receivers and monitoring stations

3. Air quality risks

Air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. Potential air quality issues have been identified from a review of the proposed modification and its associated activities. This identification process has considered the types of emissions to air and proximity of these emission sources to sensitive receptors.

Emissions to air will occur from a variety of activities including material extraction, material handling, material transport, processing, and wind erosion of stored materials and exposed surfaces. These emissions would mainly comprise of particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM₁₀) and particulate matter with equivalent aerodynamic diameter of 2.5 microns or less (PM_{2.5}). There would also be relatively minor emissions from machinery exhausts such as carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter.

The primary air quality issue associated with the proposed modification was identified to be dust (that is, particulate matter in the form of TSP, deposited dust, PM₁₀ or PM_{2.5}) from existing quarrying and planned VENM/ENM importation activities. The focus of this assessment was to predict how concentrations of dust generated by the modified operations at surrounding residential receivers would compare against existing (unmodified) operations and assessment criteria from applicable guidelines (refer to **Section 4** below).

4. Policy setting and assessment criteria

Typically, air quality is quantified by the concentrations of air pollutants in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the air pollutants most relevant to the Quarry are particulate matter emissions from, excavation works and material handling, transport and processing activities; as well as from wind erosion of stored materials and exposed surfaces (see **Section 3**).

There are various classifications of particulate matter and the EPA has developed assessment criteria for:

- TSP, to protect against nuisance amenity impacts;
- PM₁₀, to protect against health impacts;
- PM_{2.5}, to protect against health impacts; and
- Deposited dust, to protect against nuisance amenity impacts.

Most of the EPA criteria are drawn from national standards for air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPM). To measure compliance with ambient air quality criteria, the Office of Environment and Heritage (OEH) has established a network of monitoring stations across the State and up-to-date records are published on the OEH website.

Air quality impacts from a project are determined by the level of compliance with the air quality criteria set by the EPA as part of their 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (Approved Methods), (EPA, 2016). These criteria are outlined in **Table 4-1** and apply to existing and potential sensitive receptors such as residences, schools and hospitals.

Table 4-1 EPA Impact assessment criteria

Substance	Averaging time	Criterion	Source
Particulate matter (PM ₁₀)	24-hour	50 µg/m ³	EPA (2016) / DoE (2016)
	Annual	25 µg/m ³	EPA (2016) / DoE (2016)
Particulate matter (PM _{2.5})	24-hour	25 µg/m ³	EPA (2016) / DoE (2016)
	Annual	8 µg/m ³	EPA (2016) / DoE (2016)
Particulate matter (TSP)	Annual	90 µg/m ³	EPA (2016) / NHMRC (1996)
Deposited dust	Annual (maximum increase)	2 g/m ² /month	EPA (2016) / NERDDC (1998)
	Annual (maximum total)	4 g/m ² /month	EPA (2016) / NERDDC (1998)
Nitrogen dioxide (NO ₂)	1-hour	246 µg/m ³	EPA (2016) / NEPC (1998)
	Annual	62 µg/m ³	EPA (2016) / NEPC (1998)

The EPA air quality assessment criteria relate to the total concentration of air pollutant in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. Further discussion of background levels around the proposal is provided in **Section 5**.

In situations where background levels are elevated, the proponent must "demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical" (EPA, 2016).

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) includes the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state

significant mining, petroleum and extractive industry developments. The VLAMP (2018) brings the air quality criteria in line with the NEPM standards and EPA criteria. From this Policy, voluntary mitigation or acquisition rights may apply where, even with best practice management, the development contributes to exceedances of the criteria specified in VLAMP 2018. The applicability of the VLAMP has been reviewed in the context of the certainty of potential air quality risks of the proposed modification.

5. Existing environment

5.1 Meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature, and atmospheric stability. For air quality assessments, a minimum one year of hourly data is usually required, which means that almost all possible meteorological conditions, including seasonal variations, are considered in the model simulations.

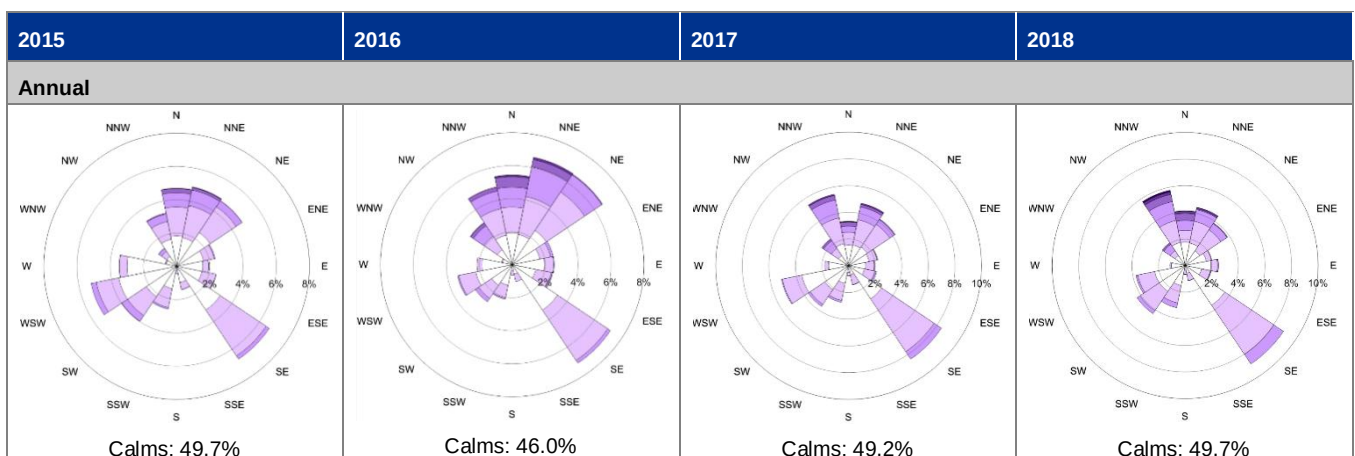
Hodgson Quarries operates a meteorological station on-site at Roberts Road Quarry. As **Figure 2-1** shows, the meteorological station is located near the southwestern boundary of the site, adjacent to the main site access point off Roberts Road. Data from the station for the period from 28 December 2013 to 7 February 2019 were provided by VGT Environmental Compliance Solutions who provide environmental monitoring and management services to the Quarry.

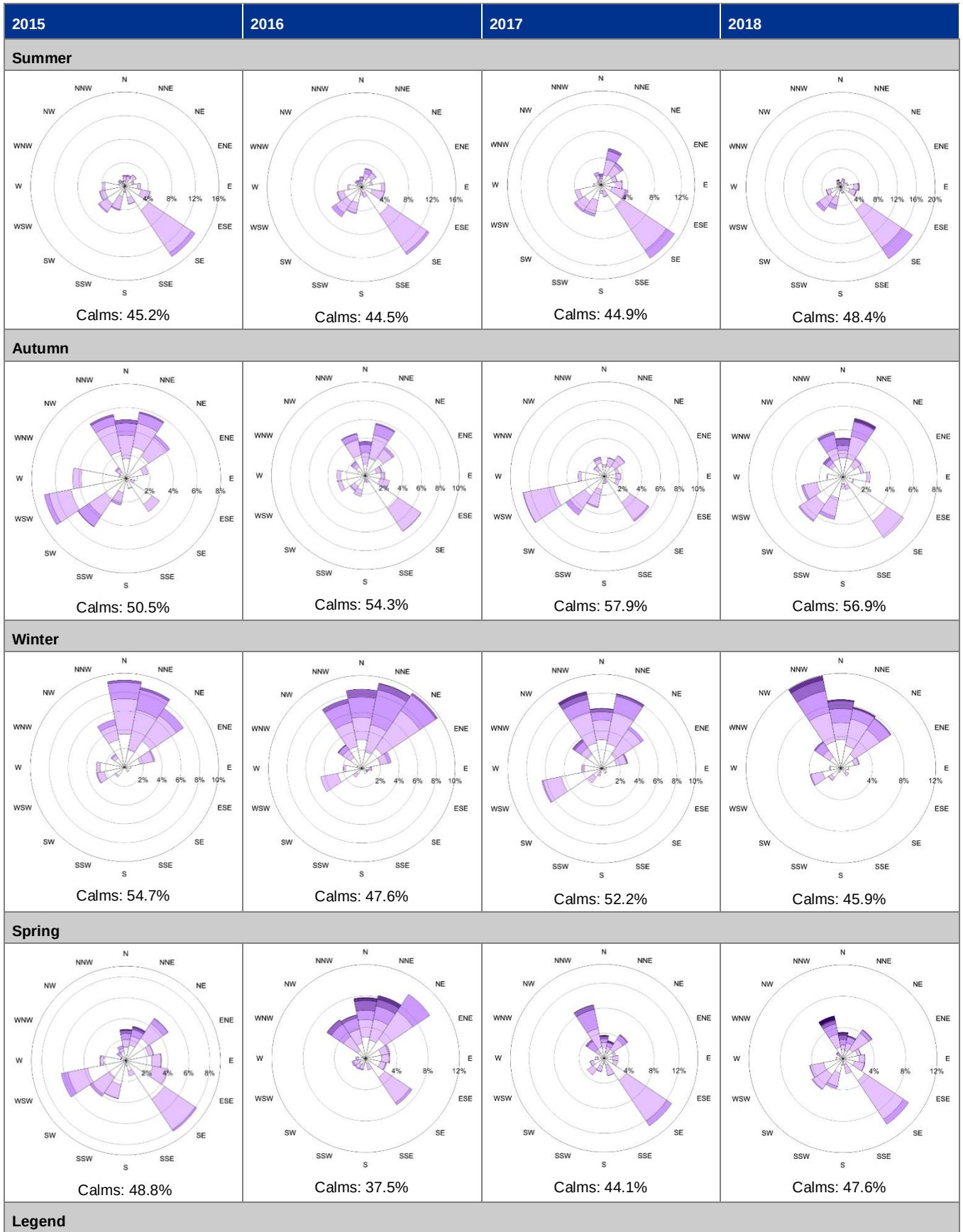
As outlined above, a minimum of one year of data is generally required for dispersion modelling assessments, and so data from the years' 2014 to 2018 were reviewed to determine a suitable year for the assessment. **Table 5-1** shows the statistics reviewed as part of this analysis.

Table 5-1 Annual statistics from meteorological data collected at Roberts Road Quarry meteorological station (2014 to 2018)

Statistic	2014	2015	2016	2017	2018
Percent complete (%)	85.1	97.6	99.9	91.6	99.9
Mean wind speed (m/s)	1.0	0.9	1.1	1.0	1.1
99 th percentile wind speed (m/s)	4.9	4.0	5.4	4.9	5.8
Percentage of calms (%)	46.0	49.7	46.0	49.2	49.9
Percentage of winds >6 m/s (%)	0.3	0.1	0.3	0.3	0.6

As displayed in **Table 5-1**, mean wind speeds were generally of the order of 1.0 m/s. 99th percentile wind speeds (i.e. wind speeds only exceeded one percent of the time) were also consistent, ranging between 4.0 and 5.8 m/s. The percentage occurrence of calm conditions (i.e. when wind speeds were recorded less than 0.5 m/s) was also consistent, ranging from 46 to 50 percent. The EPA requires that, for "Level 2" assessments based on site-specific information, the meteorological data should be derived from a site-specific source and at least 90 percent complete. The 2015, 2016, 2017 and 2018 datasets meet the EPA's site-specific data capture rate requirements. With 2014 excluded owing to insufficient dataset completion; meteorological conditions in 2015, 2016, 2017 and 2018 were further analysed to identify representative year for modelling. Annual and seasonal wind roses were developed for these years. These are displayed below in **Figure 5-1**.





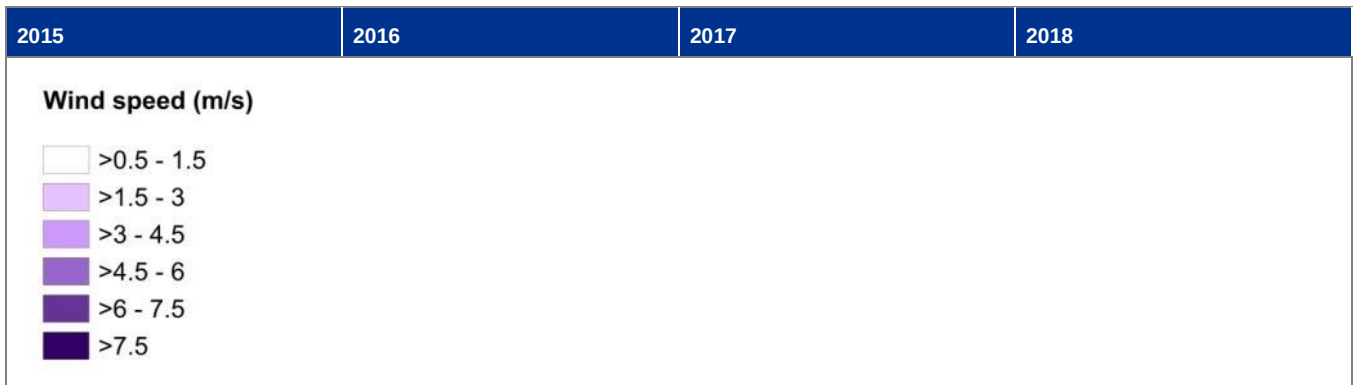


Figure 5-1 Annual and seasonal wind roses 2015 to 2018

The 2018 calendar year was selected as the meteorological modelling year. The reasoning for this selection was as follows:

- 2018 had a higher data capture rate compared with 2017, 2016 and 2015.
- A higher frequency of calm conditions was recorded in 2018. Calm conditions typically lead to higher predictions of ground-level concentrations as these conditions are often associated with poor dispersion whereby any dust emissions disperse more slowly and allow higher concentrations to exist for extended periods of time.
- Contemporaneous background data is available for 2018, to allow a more detailed review of changes in the number of exceedances. Further detail of this is provided below in **Section 5.2**.

5.2 Air quality conditions

The EPA air quality criteria refer to levels of substances which generally include the contribution from the project of interest as well as the contribution from existing sources. To fully assess impacts against all the relevant air quality criteria (see **Section 4**) it is necessary to have information or estimates of the existing air quality conditions. This section provides a description of the existing air quality.

Air quality around Roberts Road Quarry is monitored by VGT Environmental Compliance Solutions (VGT). This monitoring includes the measurement of:

- Total suspended particulates (TSP);
- Particulate matter (as PM₁₀ and PM_{2.5}); and
- Dust deposition.

As displayed above in **Figure 2-1**, deposited dust is measured at three deposited dust gauges (DDGs) 1A, 2 and 3A located towards the eastern, north-eastern and northern boundaries of the site respectively. As shown, a high-volume air sampler (HVAS) measuring TSP, PM₁₀ and PM_{2.5} is also located near the eastern boundary adjacent to DDG 1A. Data collected from these locations from 15 January 2016 to 7 March 2019 reported on Hodgson Quarries website were reviewed to identify existing conditions around the Quarry.

As displayed in **Figure 1-1** there are several other quarries and extractive operations located near Roberts Road Quarry. Dixon Sand Penrith Pty Ltd (Dixon Sand) conduct quarrying operations at the Old Northern Road (one kilometre to the northwest of the Roberts Road Quarry) and Haerses Road (around one and a half kilometres to the southwest). Dixon Sand operate a tapered element oscillating microbalance (TEOM) at the Maroota Public School just to the southeast of their operations at the Old Northern Road Quarry. The indicative location of the TEOM in relation to Roberts Road Quarry is displayed above in **Figure 2-1**. Daily PM₁₀ concentrations are measured at the TEOM, with data available on the website for 2017 and 2018 calendar years.

5.2.1 Total suspended particulates (TSP)

TSP data are collected every six days from the HVAS near DDG 1A. TSP concentration measurements were available from 18 August 2016 to 16 April 2018. The daily concentrations measured are summarised below in **Figure 5-2**.

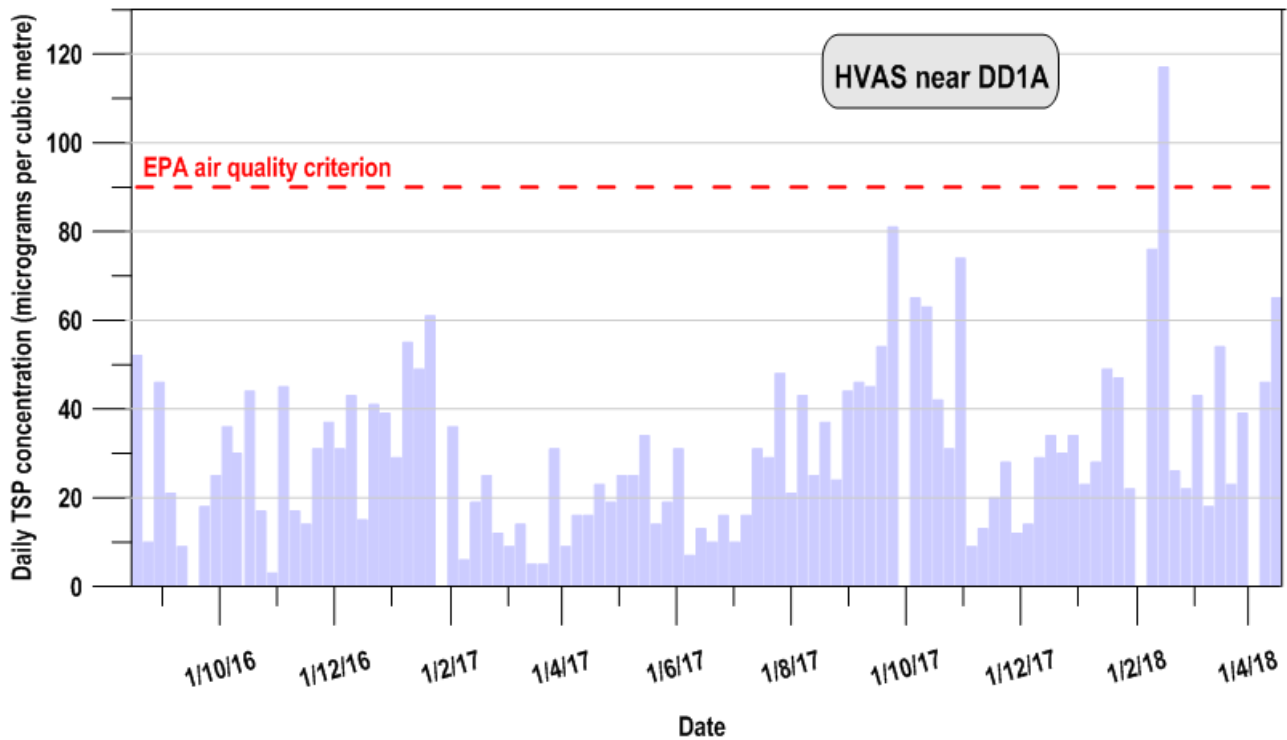


Figure 5-2 Measured 24-hour averaged TSP concentrations measured at Roberts Road Quarry HVAS

As displayed, annual TSP concentrations from this monitor were only able to be estimated from these data from one calendar year (2017), noting that the data for 2016 and 2018 were incomplete. For 2017, an annual TSP average of 29 µg/m³ was measured, well below the EPA's 90 µg/m³ assessment criteria.

5.2.2 Particulate matter (PM₁₀)

Roberts Road Quarry HVAS

PM₁₀ concentrations were also collected every 6 days from the Roberts Road Quarry HVAS. The data collected are displayed below in **Figure 5-3**.

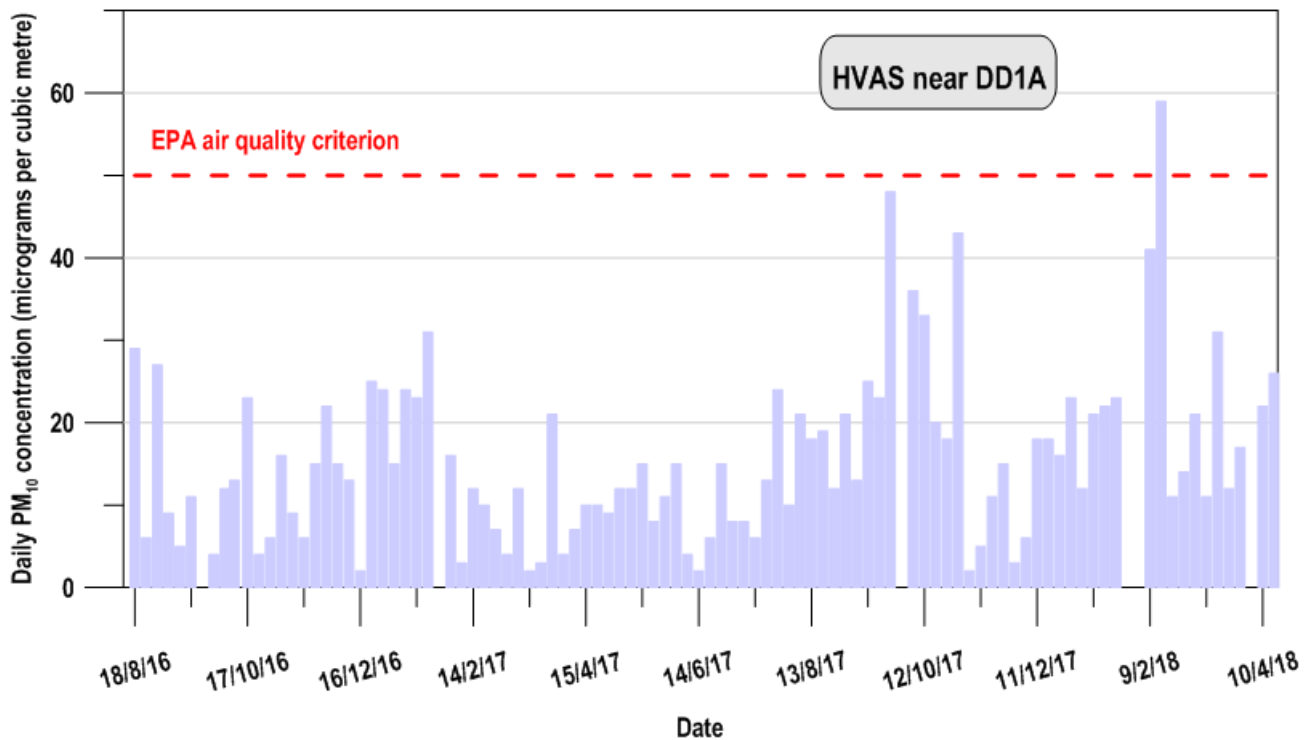


Figure 5-3 Measured 24-hour averaged PM₁₀ concentrations measured at Roberts Road Quarry HVAS

Over the approximately 20 months of measurements between August 2016 and April 2018 the EPA's 24-hour averaged assessment criteria of 50 µg/m³ was recorded to have been exceeded once. There may have been further exceedances over the period of available data, noting the six-day sampling frequency of the HVAS. For the only full calendar year (2017), the maximum recorded 24-hour average was 48 µg/m³, with the maximum value over the 20-month period being 59 µg/m³. The annually averaged PM₁₀ concentration in 2017 was 15 µg/m³, 10 µg/m³ below the EPA's 25 µg/m³ annual PM₁₀ impact assessment criteria.

Dixon Sand TEOM

Daily measurements of PM₁₀ are collected at the TEOM run by Dixon Sand near their Old Northern Road quarrying operations. These data are displayed below in **Figure 5-4**.

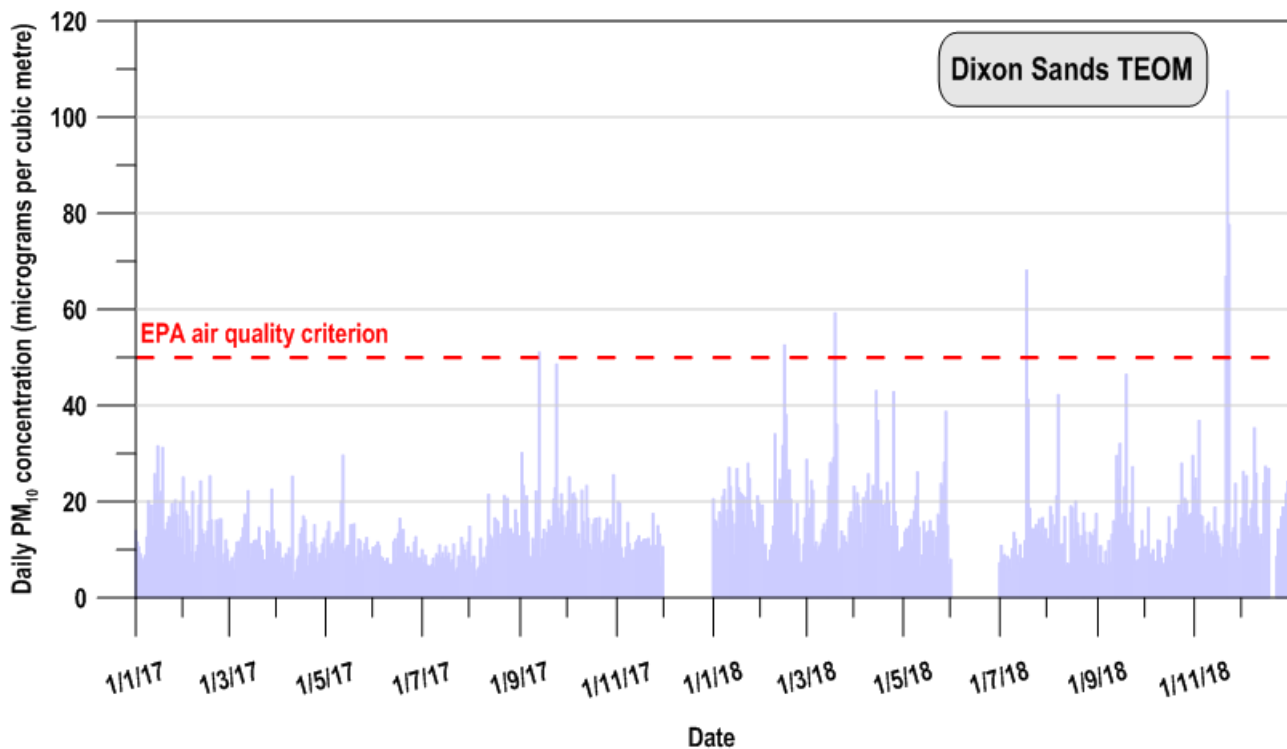


Figure 5-4 Measured 24-hour averaged PM₁₀ concentrations measured at Dixon Sand Quarry TEOM

For the 2017 and 2018 period reviewed there were seven instances when 24-hour-averaged PM₁₀ exceeded 50 µg/m³. Each instance was investigated in their monitoring log, with six of the seven instances of exceedances having been in some way attributed to Dixon Sand's operations. Noting the data gaps in December 2017, June 2018 and 19 to 22 December 2018, annually averaged PM₁₀ concentrations of 13 µg/m³ and 17 µg/m³ were measured in 2017 and 2018 respectively.

5.2.3 Particulate matter (PM_{2.5})

The Roberts Road Quarry HVAS also measured PM_{2.5} on a six-day cycle between August 2016 and April 2018. **Figure 5-5** below shows the 24-hour averaged PM_{2.5} monitoring values.

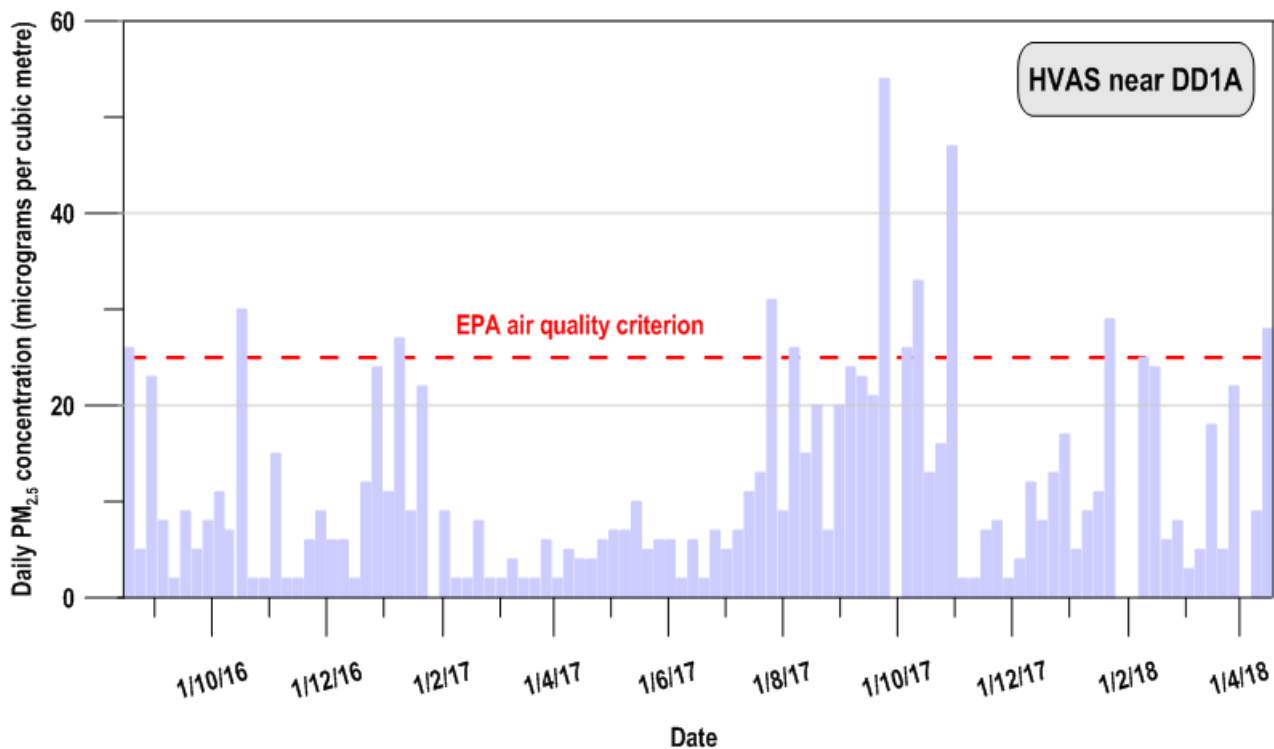


Figure 5-5 Measured 24-hour averaged PM_{2.5} concentrations measured at Roberts Road Quarry HVAS

As displayed, there were 11 instances where the EPA's 24-hour averaged PM_{2.5} assessment criteria of 25 µg/m³ was exceeded, with seven of these instances recorded during the 2017 calendar year. There may have been further exceedances over the period of available data, noting the six-day sampling frequency of the HVAS.

For the 2017 calendar year, the maximum 24-hour averaged PM_{2.5} concentration was 54 µg/m³; that is, above the EPA's 25 µg/m³ assessment criteria from the Approved Methods. The annual average in 2017 was 11.6 µg/m³, 3.6 µg/m³ above the 8 µg/m³ EPA assessment criteria. It is noted that these values are high compared with the measured PM₁₀ concentrations. It is generally common that PM_{2.5} concentrations are around 50% or less than PM₁₀, although at the Quarry's HVAS they have been reported as being around 77%. The measured annual average of 11.6 µg/m³ at the Quarry is also well above the values measured over the last five calendar years (2014 to 2018 inclusive) at the nearest air quality monitoring station operated by the Office of Environment and Heritage (OEH) at Richmond. Over these five years' annual averages of 6.7, 7.7, 7.9, 7.0, and 8.1 µg/m³ were measured.

5.2.4 Deposited dust

Table 5-2 shows the annual average deposited dust levels for each gauge from data collected between 2016 and 2017.

Table 5-2 Summary of measured deposited dust levels near Roberts Road Quarry

Year	Annual average expressed as g/m ² /month			
	DDG 1A	DDG 2	DDG 3A	EPA criteria
2016	1.9	1.2	1.3	4
2017	1.9	1.8	1.9	

As displayed, deposited dust levels remained less than 50% of the EPA's 4 g/m²/month at all three deposited dust gauges over 2016 and 2017.

5.3 Adopted background levels

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to model predictions for the assessment of potential cumulative impacts, that is, Project contribution plus other sources. The establishment of background levels also needs to consider that there is an existing Quarry that is likely to contribute to measured levels. The estimated background levels that apply at sensitive receptors are shown below in **Table 5-3**.

Table 5-3 Assumed background levels that apply at sensitive receptors

Substance	Averaging time	Assumed background level that applies at sensitive receptors	Notes
Particulate matter (PM ₁₀)	24-hour	Daily PM ₁₀ measured values from Dixon Sand TEOM	Time-varying data collected at Dixon Sand TEOM for year of modelling (2018)
	Annual	17 µg/m ³	Annual average of data collected at Dixon Sand TEOM for year of modelling (2018)
Particulate matter (PM _{2.5})	24-hour	Daily values based on measurements from Dixon Sand TEOM	Time-varying data collected at Dixon Sand TEOM for year of modelling (2018) with scaling applied based on the ratio of PM ₁₀ to PM _{2.5} measured at Roberts Road HVAS. This ratio was 0.73.
	Annual	13 µg/m ³	Annual average of data collected at Dixon Sand TEOM for year of modelling (2018) with scaling applied based on the ratio of PM ₁₀ to PM _{2.5} measured at Roberts Road HVAS. The measured on-site annual average in 2017 was 12 µg/m ³ , so the value adopted is considered to be conservative.
Particulate matter (TSP)	Annual	32 µg/m ³	Annual average of data collected at Dixon Sand TEOM for year of modelling (2018) with scaling applied based on the ratio of PM ₁₀ to TSP measured at Roberts Road HVAS. It should be noted that the assumed level of 32 µg/m ³ is higher than the on-site measurement of 29 µg/m ³ . This is a conservative approach.
Deposited dust	Annual	1.9 g/m ² /month	Highest value measured at DDG 1A, DDG 2 and DDG 3A for available 2016 and 2017 monitoring data

6. Emissions to air

6.1 Roberts Road Quarry

The most significant emission to air from the Quarry will be dust (particulate matter) due to material handling, material transport, processing, and wind erosion of stored and exposed surfaces. Estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing the material handling schedule, equipment listing and Quarry plans and identifying the location and intensity of dust generating activities. Operations have been combined with emissions factors developed both locally and by the US EPA.

The emission factors used for this assessment have been drawn largely from the following sources:

- *Emission Estimation Technique Manual for Mining* (NPI, 2012); and
- AP 42 (US EPA, 1985 and updates).

Dust emission inventories have been developed for each of the modelled scenarios, namely:

- Existing operations, at the approved extraction rate, for comparison with future operations;
- Proposed Modification with VENM/ENM filling at northeast corner of the Quarry; and
- Proposed Modification with VENM/ENM filling at southeast corner of the Quarry.

The inventories applied in the assessment for each of these scenarios are summarised below in **Table 6-1** (existing), **Table 6-2** (proposed modification with VENM/ENM filling in the north) and **Table 6-3** (proposed modification with VENM/ENM filling in the south). The key change in these inventories between the assessment scenarios for the two modification options and existing operations are additional emissions associated with the hauling, unloading, and placement of VENM/ENM materials.

Table 6-1 Estimated TSP emissions from the Quarry

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Dozers ripping materials	2,775	2,775	2,775
Excavators loading raw product to trucks	274	274	274
Hauling raw product to Screening 1	3,183	1,591	1,591
Unloading raw product to Screens 1	864	864	864
Screening 1	3,000	7,200	7,200
Loading product stockpiles	15	69	69
Excavators loading screened product to trucks	137	137	137
Hauling raw product to Screening 2	1,910	1,910	1,910
Unloading raw product to Screens 2	864	864	864
Screening 2	3,000	7,200	7,200
Loading product stockpiles	29	137	137
Excavators loading screened product to trucks	274	274	274
Hauling product off-site	1,715	1715	1715
Wind erosion from exposed areas, inactive	5,396	5,396	5,396
Wind erosion from exposed areas, active	4,906	4,906	4,906
Wind erosion from rehabilitation area (VENM/ENM placement), inactive in existing and	4,415	3,154	3,154

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
active in proposed options			
Wind erosion from product stockpiles	3,854	3,854	3,854
Hauling VENM/ENM to site	0	3,809	4,353
Unloading VENM/ENM	0	1,152	1,152
Dozers placing materials	0	2,775	2,775
Total	36,612	47,282	47,826

Table 6-2 Estimated PM₁₀ emissions from the Quarry

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Dozers ripping materials	417	417	417
Excavators loading raw product to trucks	130	130	130
Hauling raw product to Screening 1	681	340	340
Unloading raw product to Screens 1	310	310	310
Screening 1	1,032	2,400	2,400
Loading product stockpiles	7	32	32
Excavators loading screened product to trucks	65	65	65
Hauling raw product to Screening 2	409	409	409
Unloading raw product to Screens 2	310	310	310
Screening 2	1,032	2,400	2,400
Loading product stockpiles	14	65	65
Excavators loading screened product to trucks	130	130	130
Hauling product off-site	367	367	367
Wind erosion from exposed areas, inactive	2,698	2,698	2,698
Wind erosion from exposed areas, active	2,453	2,453	2,453
Wind erosion from rehabilitation area (VENM/ENM placement), inactive in existing and active in proposed options	2,208	1,577	1,577
Wind erosion from product stockpiles	1,927	1,927	1,927
Hauling VENM/ENM to site	0	815	931
Unloading VENM/ENM	0	413	413
Dozers placing materials	0	417	417
Total	13,770	17,256	17,373

Table 6-3 Estimated PM_{2.5} emissions from the Quarry

Activity	Estimated annual emissions (kg/y)		
	Existing	Proposed Modification, North	Proposed Modification, South
Dozers ripping materials	21	21	21
Excavators loading raw product to trucks	14	14	14
Hauling raw product to Screening 1	34	17	17
Unloading raw product to Screens 1	43	43	43
Screening 1	150	360	360
Loading product stockpiles	1	3	3
Excavators loading screened product to trucks	7	7	7
Hauling raw product to Screening 2	20	20	20
Unloading raw product to Screens 2	43	43	43
Screening 2	150	360	360
Loading product stockpiles	1	7	7
Excavators loading screened product to trucks	14	14	14
Hauling product off-site	18	18	18
Wind erosion from exposed areas, inactive	135	135	135
Wind erosion from exposed areas, active	123	123	123
Wind erosion from rehabilitation area (VENM/ENM placement), inactive in existing and active in proposed options	110	79	79
Wind erosion from product stockpiles	96	96	96
Hauling VENM/ENM to site	0	41	47
Unloading VENM/ENM	0	58	58
Dozers placing materials	0	21	21
Total	960	1,459	1,465

It should be noted that the main intent of the inventories is to capture the most significant emission sources that may affect off-site air quality. Not every source will be captured, however, the contribution of emissions from sources not identified will be captured in the assumed background levels and these data have been added to the predicted Project contributions.

The following emission controls have been assumed to be applicable to the Project:

- Watering of unsealed access roads (leading to a 50% control on emissions);
- Watering during unloading of materials to screens (leading to a 70% control of emissions);
- Water sprays during loading of materials to stockpiles (leading to a 50% control of emissions);
- Water sprays on inactive (leading to a 30% control on emissions) and active extraction (leading to a 50% control on emissions) areas; and
- Partial rehabilitation in-place for the proposed northern VENM/ENM filling area for the existing scenario (leading to a 30% control on emissions).

6.2 Other local sources

As identified above in **Figure 1-1**, several other quarries are located in close proximity to the Quarry. It is expected that the same types of activities are taking place at these locations and that these operations would also contribute to local particulate matter air quality conditions.

7. Approach to assessment

7.1 Overview

This assessment has followed the EPA's Approved Methods which specifies how assessments based on the use of air dispersion models should be undertaken. The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources, and the model predictions have been compared with relevant air quality criteria. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions.

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model. The model comprises meteorological modelling as well as dispersion modelling, both of which are described below.

7.2 Meteorological modelling

The air dispersion model used for this assessment, CALPUFF, requires information on the meteorological conditions in the modelled region. This information is typically generated by the meteorological pre-processor, CALMET, using surface observation data from local weather stations and upper air data from radio-sondes or numerical models, such as the CSIRO's prognostic model known as TAPM (The Air Pollution Model). CALMET also requires information on the local land-use and terrain. The result of a CALMET simulation is a year-long, three-dimensional output of meteorological conditions that can be used as input to the CALPUFF air dispersion model.

There are no known meteorological stations in the Roberts Road Quarry area that collect suitable surface or upper air data for CALMET. The closest station with suitable data is operated by the Bureau of Meteorology at Richmond, approximately 30 km to the southwest. The necessary surface and upper air data were therefore generated by TAPM, using influence from the surface observations at the Roberts Road Quarry meteorological station. Key setup details for TAPM are listed in **Table 7-1**.

Table 7-1 TAPM setup details

Parameter	Value(s)
Model version	4.0.5
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	35 x 35 x 25
Year(s) of analysis	2018, with one "spin-up" day.
Centre of analysis	Roberts Road Quarry (33°27.5' S, 151°0' E)
Terrain data source	Shuttle Research Topography Mission (SRTM), 30 m resolution
Land use data source	Default
Meteorological data assimilation	Roberts Road Quarry meteorological station. Radius of influence = 10 km. Number of vertical levels for assimilation = 4. Quality factor = 0.1. This quality factor value was adopted so that the observation data were considered in the meteorological assimilation in TAPM, with appropriate adjustments made for potential uncertainties around these data.

CALTAPM was used to process the outputs from TAPM into a suitable format for CALMET. Meteorological modelling in CALMET was completed in 'no observations' mode. This setting was applied rather than 'observations' mode using the surface observation data from the monitoring station at Roberts Road Quarry as there was some uncertainty of observations from the privately-operated station. This was primarily due to the frequency of calm conditions measured (refer to Table 5-1) being higher than might be expected for this location. This might suggest some localised screening around the station. The approach adopted allowed these data to be considered, with weighting also given to synoptic data from TAPM. **Table 7-2** lists the key settings that were applied in CALMET.

Table 7-2 CALMET setup details

Parameter	Value(s)
Model version	6.334
Run mode	No-observations mode
Terrain data source(s)	NASA SRTM1 30 metre resolution dataset
Land-use data source(s)	Digitized from aerial imagery and classified as 'forest', 'water', 'barren' or 'agricultural' categories specified in "CALPUFF Modeling System Version 6 User Instructions", (TRC, 2011). This is displayed below in Figure 7-1 .
Meteorological grid domain	10 kilometres x 10 kilometres x 0 to 3 kilometres depth spread over 11 vertical layers
Meteorological grid resolution	0.1 km
Meteorological grid dimensions	100 x 100 x 11
Meteorological grid origin	309000 mE, 6290500 mN. MGA Zone 56
Surface meteorological inputs	Wind speed, wind direction, ceiling height, cloud cover, temperature, relative humidity and air pressure for the site location from TAPM.
Upper air meteorological inputs	Wind speed, wind direction, ceiling height, cloud cover, temperature, relative humidity and air pressure for the site location from TAPM.
Simulation length	8760 hours (1 Jan 2018 to 31 Dec 2018)

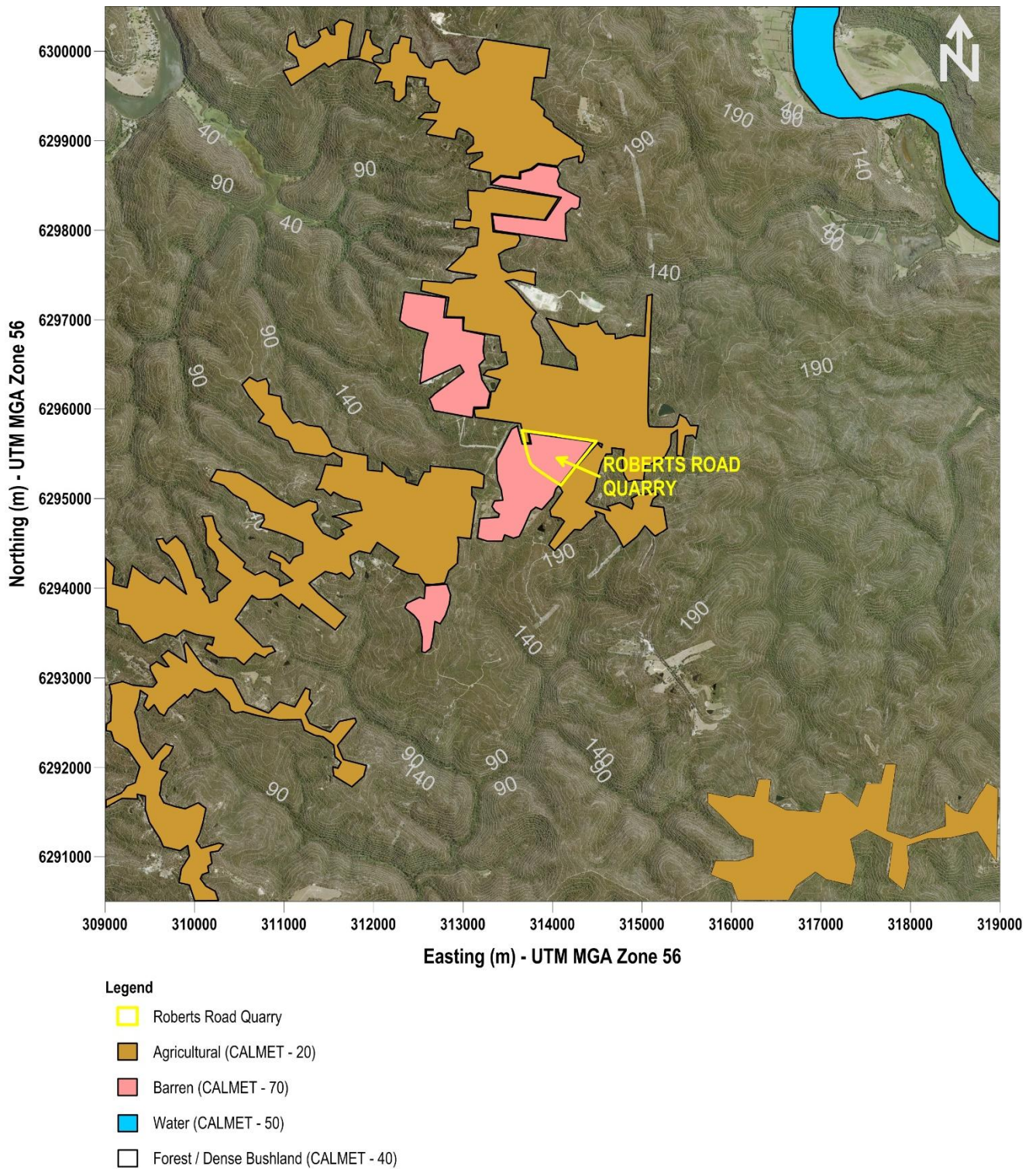


Figure 7-1 CALMET land use classifications

7.3 Dispersion modelling

Ground-level concentration and deposition levels due to the identified emission sources have been predicted using the air dispersion model known as CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap, and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME and ISCST3) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long-range transport and near calm conditions. It is the preferred model of the United States Environmental Protection Agency for the long-range transport of pollutants and for complex terrain (TRC, 2007). CALPUFF has the ability to model the effect of emissions entrained into the thermal internal boundary layer that forms over land, both through fumigation and plume trapping. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments (EPA, 2016).

The modelling was performed using the emission estimates from **Section 6** and using the meteorological information provided by the CALMET model, described in **Section 7.2**. Predictions were made at 481 discrete receptors (including the 13 nearby sensitive receptors shown in **Figure 2-1**) to allow for contouring of results. The locations of the model receptors are shown in **Figure 7-2**.

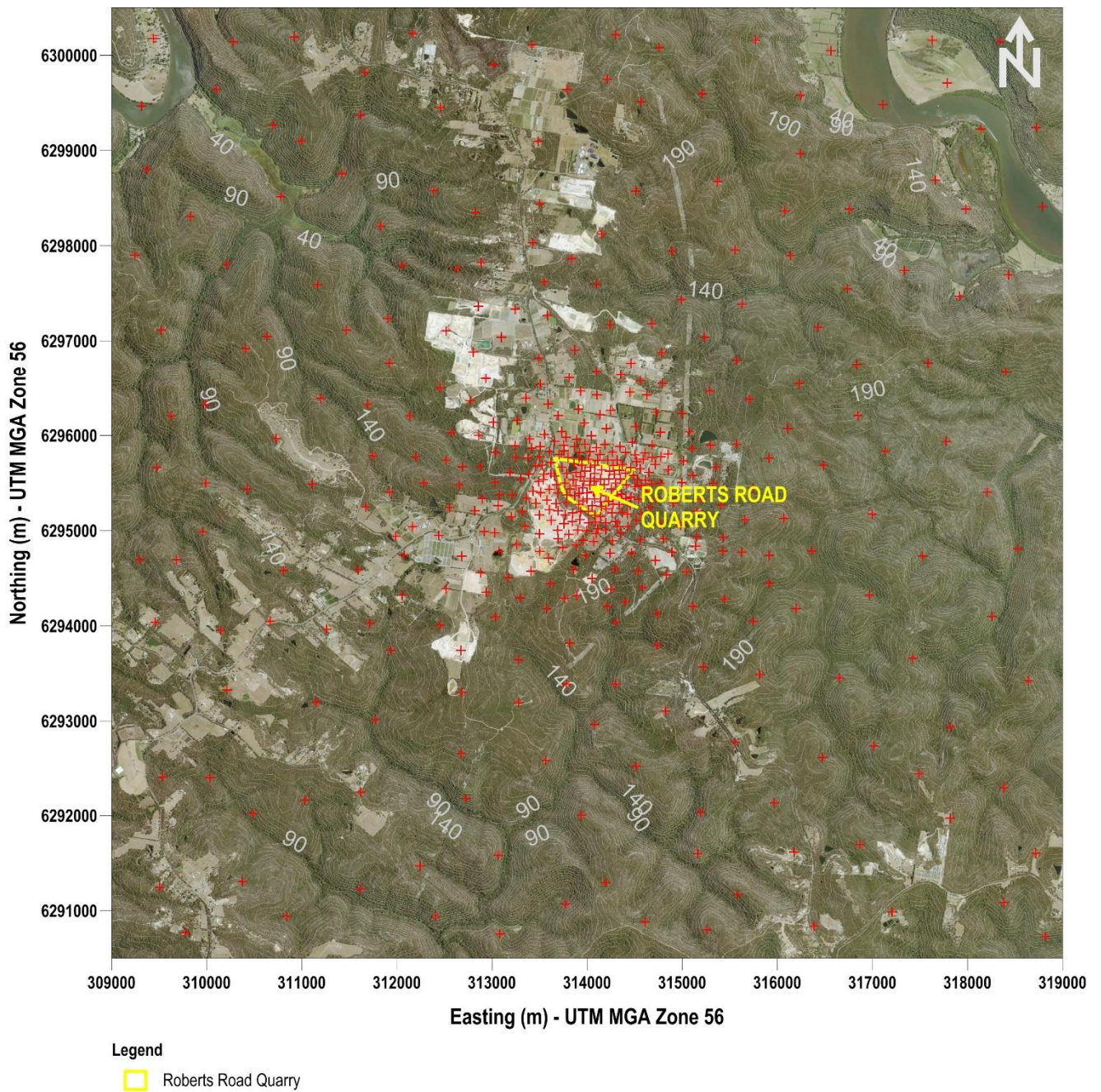


Figure 7-2 CALPUFF discrete receiver locations

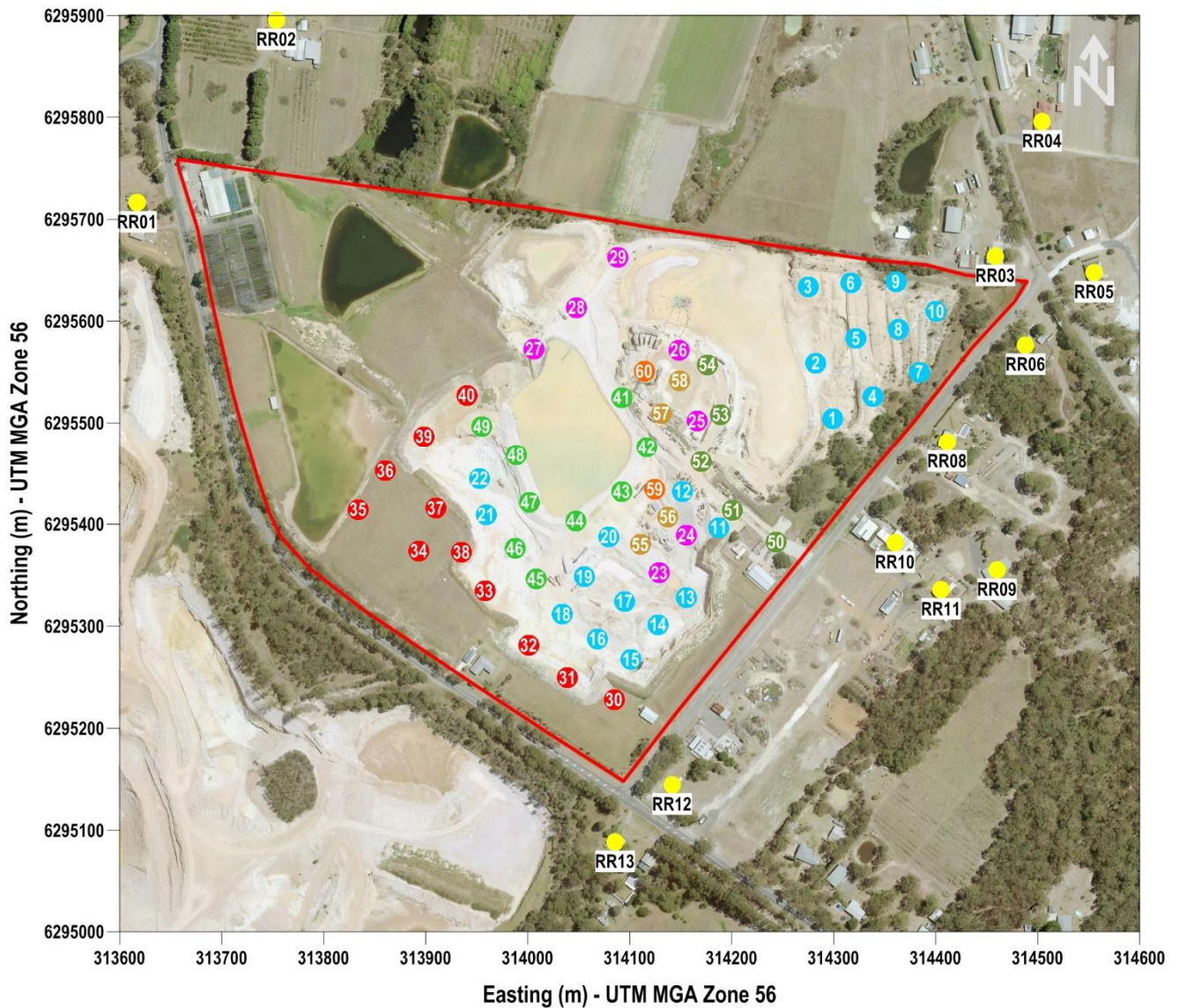
Quarry operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. TSP, PM₁₀ and PM_{2.5} emissions for existing operations listed in **Table 6-1**, **Table 6-2** and **Table 6-3** were applied as displayed **Figure 7-3**. For the proposed modification with VENM/ENM placement in the north of the Quarry, emissions outlined in these tables were modelled as shown in **Figure 7-4**. Finally, for the modification option where VENM/ENM filling would take place in the south of the site, the location where different dust generating sources were modelled is shown in **Figure 7-5**.

Dust emissions for all modelled Quarry-related sources have been considered to fit in one of three categories, as follows:

- Wind insensitive sources, where emissions are relatively insensitive to wind speed (for example, dozers).
- Wind sensitive sources, where emissions vary with the hourly wind speed, raised to the power of 1.3, a generic relationship published by the US EPA (1987). This relationship has been applied to sources such as loading and unloading of materials to/from trucks and results in increased emissions with increased wind speed.
- Wind sensitive sources, where emissions also vary with the hourly wind speed, but raised to the power of 3, a generic relationship published by Skidmore (1998). This relationship has been applied to sources including wind erosion from stockpiles, exposed areas or active pits, and results in increased emissions with increased wind speed.

Emissions from each volume source were developed on an hourly time step, taking into account the level of activity at that location and, in some cases, the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

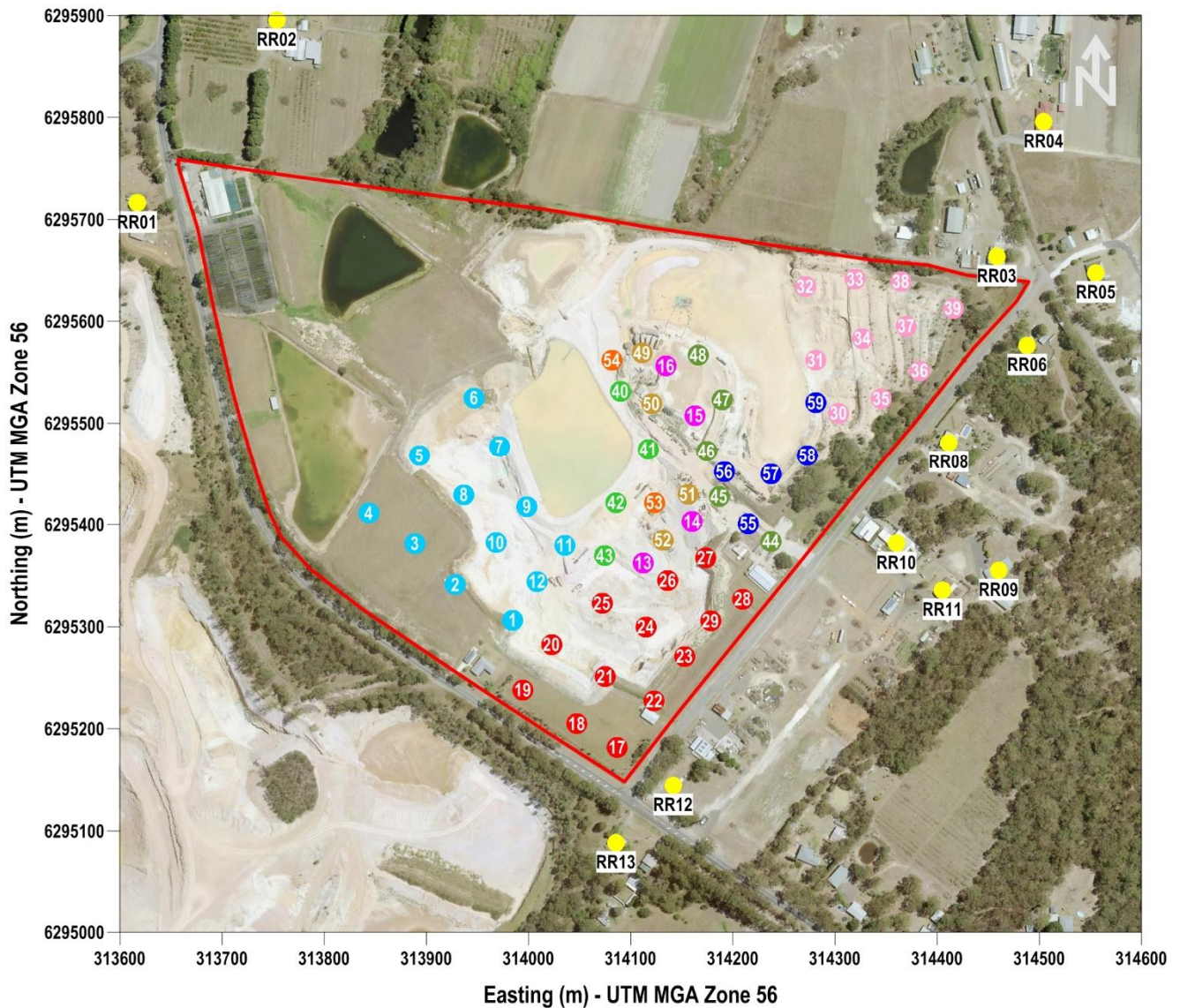
All site activities have been modelled for the hours of day proposed under the proposed modification, for every day of the year. Further, the model considers these activities occurring at all locations displayed in **Figure 7-3**, **Figure 7-4** and **Figure 7-5** which is not likely to be the case for extraction, loading and VENM/ENM placement activities. Also, the model assumes the maximum rate of activity which in practice is not expected to be achieved. These assumptions were necessary to ensure that all source and meteorological interactions are considered although these aspects of the model result in predictions where the quarries likely contribution to local air quality is over-estimated.



Legend

- | | |
|---|---|
| ● Residential Receiver | ● Export Transport / Wind Erosion |
| ● Extraction: Dozers / Excavators / Wind Erosion | ● Screening / Processing |
| ● Wind Erosion (Exposed Surface) | ● Materials Unloading / Loading / Wind Erosion |
| ● Wind Erosion (Stockpiles) | |
| ● Internal Transport / Wind Erosion | |

Figure 7-3 Location of modelled sources – Existing operations (no VENM/ENM placement)



Legend

- | | |
|---|---|
| ● Residential Receiver | ● Internal Transport / Wind Erosion |
| ● Extraction: Dozers / Excavators / Wind Erosion | ● Export Transport / Wind Erosion |
| ● VENM/ENM Import: Dozers / Excavators / Wind Erosion | ● Screening / Processing |
| ● Wind Erosion (Exposed Surface) | ● Materials Unloading / Loading / Wind Erosion |
| ● Wind Erosion (Stockpiles) | ● Internal Transport VENM/ENM / Wind Erosion |

Figure 7-4 Location of modelled sources – Proposed operations, VENM/ENM placement at northeast of the Quarry

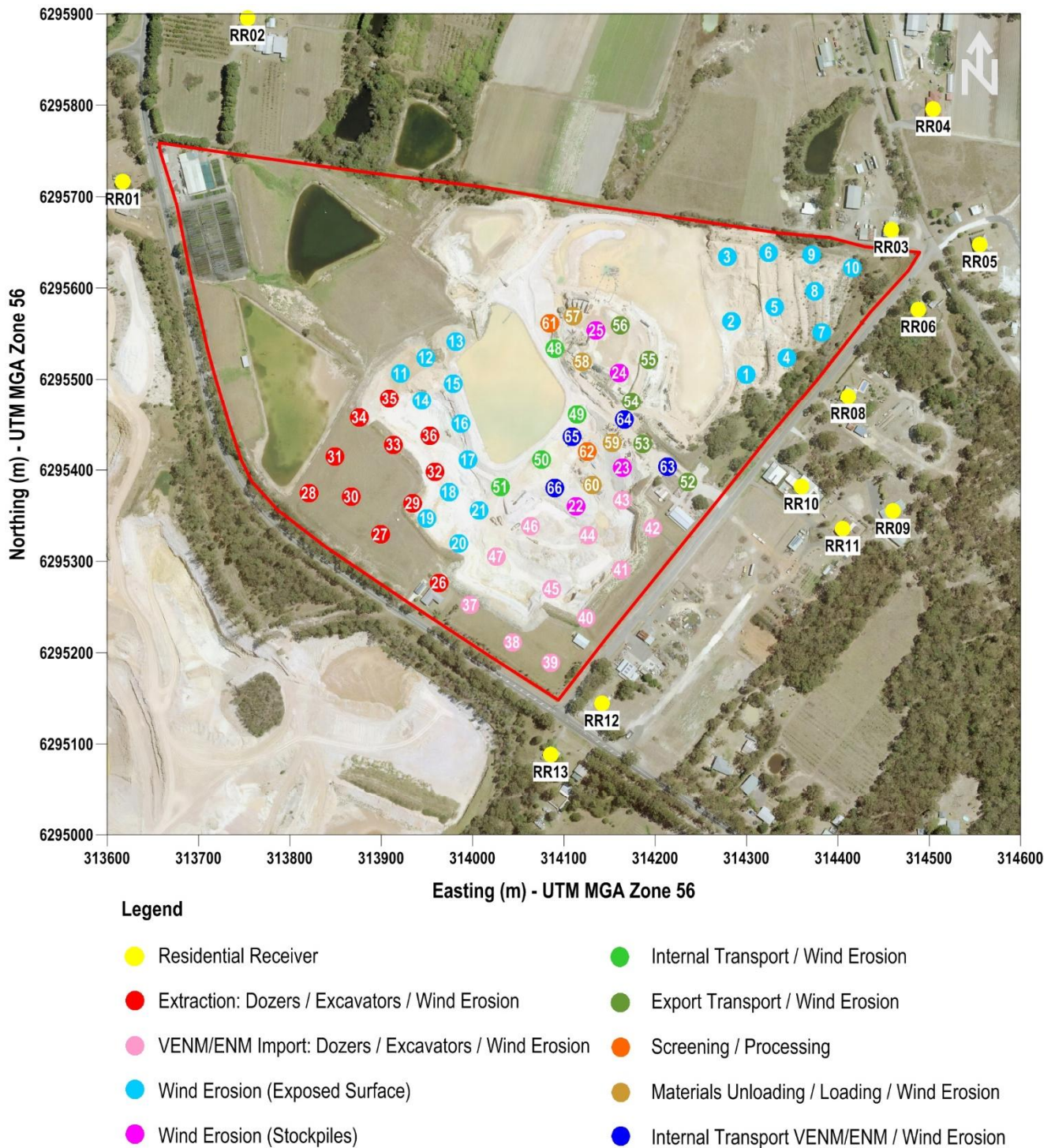


Figure 7-5 Location of modelled sources – Proposed operations, VENM/ENM placement at southeast of the Quarry

8. Assessment of impacts

This section provides an assessment of the key air quality issues associated with the proposed modification, primarily based on model predictions and comparisons to air quality criteria. One objective of this study was to predict the extent of air quality impacts due to the proposed modification, and to identify the potential changes in air quality over existing levels, recognising that the Quarry currently exists and that the proposed modification represents the continuation of quarrying activities up to the same maximum approved rate of extraction, albeit with an increase in activity arising from the importation of VENM/ENM products. For this objective, examination of the predicted incremental change from existing to proposed operations is useful. Therefore “Cumulative” has been defined as the “Project” (as modelled) minus “Existing” (as modelled) plus “Background”. This approach also addressed potential cumulative impacts with neighbouring quarries as the contributions from these quarries will be contained in the assumed background levels.

Results are presented and discussed by pollutant in the sub-sections below.

8.1 Total suspended particulates (TSP)

Table 8-1 shows the predicted annually averaged TSP concentrations at the nearest sensitive receiver locations (refer to **Figure 2-1**), in tabular form. Compliance with the EPA’s assessment criterion for annual average TSP ($90 \mu\text{g}/\text{m}^3$) is predicted at all locations.

Table 8-1 Predicted annual average TSP concentrations ($\mu\text{g}/\text{m}^3$)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	3	3	4	32	32	33	90
2	2	3	3	32	33	33	90
3	10	19	10	32	41	32	90
4	4	7	5	32	35	33	90
5	5	9	5	32	36	32	90
6	9	17	9	32	40	32	90
7	3	6	4	32	35	33	90
8	16	27	15	32	43	31	90
9	7	11	8	32	36	33	90
10	13	24	18	32	43	37	90
11	8	14	11	32	38	35	90
12	14	22	22	32	40	40	90
13	9	14	15	32	37	38	90

Changes in TSP concentrations as a result of the proposal operations are displayed as contour plots in **Appendix B**.

8.2 Particulate matter (PM₁₀)

Table 8-2 shows the predicted annually averaged PM₁₀ concentrations at the nearest sensitive receiver locations (refer to **Figure 2-1**), in tabular form. Compliance with the EPA’s assessment criterion for annual average PM₁₀ ($25 \mu\text{g}/\text{m}^3$) was predicted at all locations.

Table 8-2 Predicted annual average PM₁₀ concentrations (µg/m³)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	3	3	3	17	17	18	25
2	3	3	3	17	17	17	25
3	9	13	9	17	20	17	25
4	5	7	5	17	18	17	25
5	6	8	6	17	19	17	25
6	9	12	8	17	20	17	25
7	4	6	5	17	18	17	25
8	12	16	12	17	21	16	25
9	7	9	7	17	19	18	25
10	10	15	13	17	22	19	25
11	8	11	9	17	20	19	25
12	10	14	14	17	21	21	25
13	7	9	10	17	19	20	25

Changes in annually averaged PM₁₀ concentrations as a result of the modification are also displayed as contour plots in **Appendix B**.

Regarding 24-hour averaged PM₁₀, the 2018 (year of assessment) background air quality data from Dixon Sand's TEOM presented above in **Section 5.2.2** shows how daily background PM₁₀ concentrations already exceeded the EPA's 50 µg/m³ assessment criteria on up to six days per year. For these types of situations where background concentrations are already elevated, the Approved Methods requires the determination of whether "additional exceedances of the impact assessment criteria will occur as a result of the proposed activity". This analysis was performed at the four nearest receivers in different directions from the site (RR01, RR03, RR08 and RR12). Gaps in Dixon Sand's 2018 daily PM₁₀ 2018 dataset (June 2018 and 19 to 22 December 2018) with filled using data collected from the HVAS at Roberts Road Quarry, with averaged values applied for days where no data were available, noting the 6-day sampling frequency of the HVAS. **Figure 8-1** and **Figure 8-2** display the results of this review for the proposed modification with VENM/ENM filling at the north and south of the site respectively.

As **Figure 8-1** shows, with VENM/ENM importation taking place at the northeast corner of the site no additional exceedances were predicted to occur at RR01. One additional exceedance per year was predicted at RR03 and RR08. Four additional days where concentrations exceeded 50 µg/m³ in the year were predicted at RR12.

For the alternative option involving VENM/ENM importation occurring in the southeast corner, **Figure 8-2** shows how no additional instances of daily PM₁₀ concentrations above 50 µg/m³ were predicted at RR01, RR03 and RR08. One additional exceedance per year was predicted at RR12. On this day it is noted that the background concentration was 47 µg/m³ and contributions from the site were 5 µg/m³.

These results are discussed further, below in **Section 8.5**.

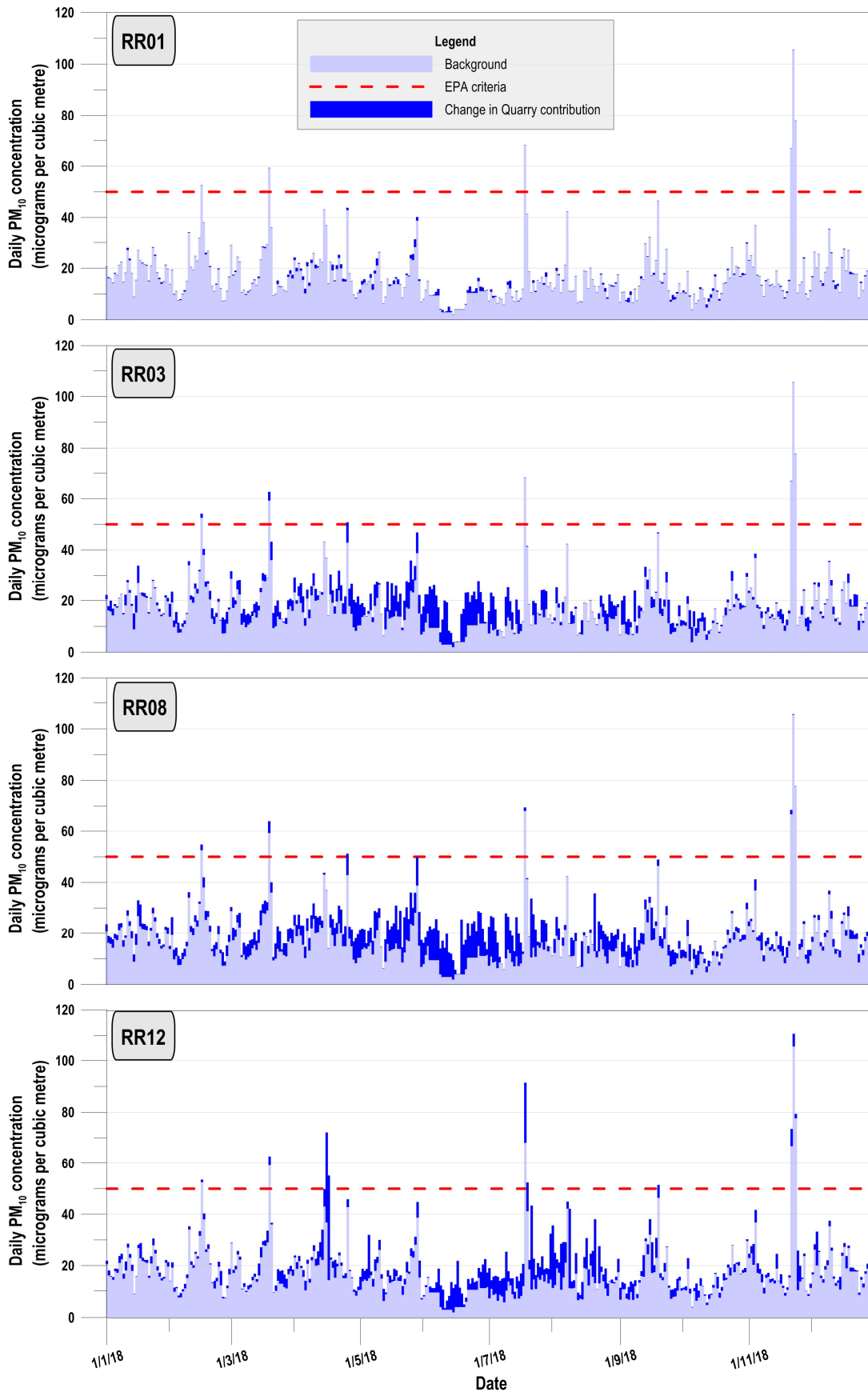


Figure 8-1 Change in 24-hour averaged PM₁₀ at RR01, RR03, RR08 and RR12 – Proposed modification (north)

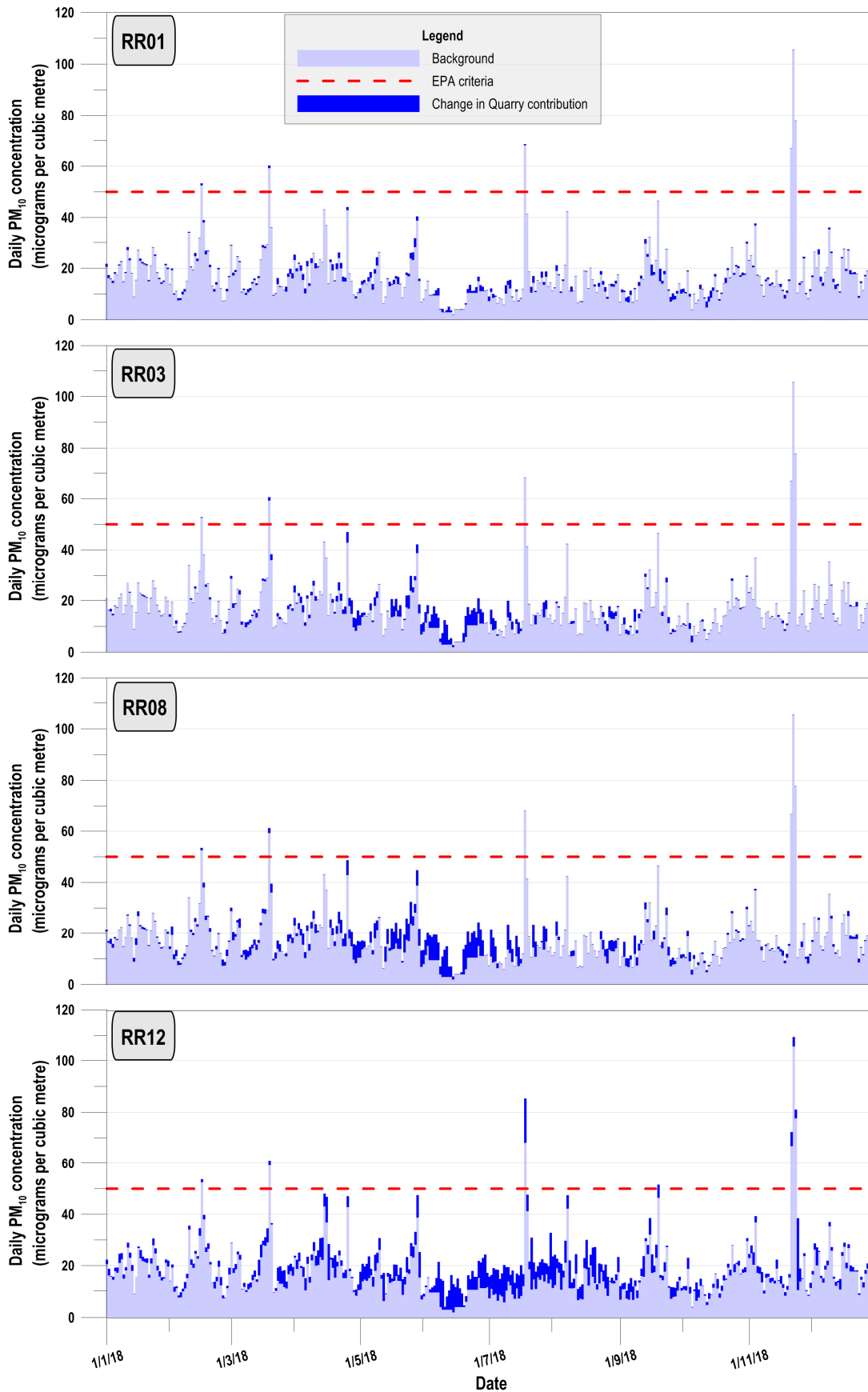


Figure 8-2 Change in 24-hour averaged PM₁₀ at RR01, RR03, RR08 and RR12 – Proposed modification (South)

8.3 Particulate matter (PM_{2.5})

Table 8-3 lists the predicted annually averaged PM_{2.5} concentrations at the nearby sensitive receiver locations displayed in **Figure 2-1**. As shown, annually the averaged PM_{2.5} background concentration in 2018 (13.5 µg/m³ inferred from PM₁₀ measurements at Dixon Sand's TEOM and the relationship between PM₁₀ and PM_{2.5} at the HVAS located at Roberts Road Quarry)) already exceeded the 8 µg/m³ assessment criteria in the Approved Methods. Increases of up to 0.5 µg/m³ (i.e. around 4 percent) and 0.4 µg/m³ (i.e. approximately 3 percent) were predicted for the proposed modification with VENM/ENM filling in the north and south of the site respectively. It can also be seen from **Table 8-3** that the contribution of the existing Quarry to PM_{2.5} concentrations is less than 1 µg/m³ at all nearest receivers. This means that the existing (and proposed) Quarry operation is not likely to be the cause of background annual average PM_{2.5} concentrations which exceed the 8 µg/m³ criterion. The assumed background level of 13.5 µg/m³ is taken to be conservatively high.

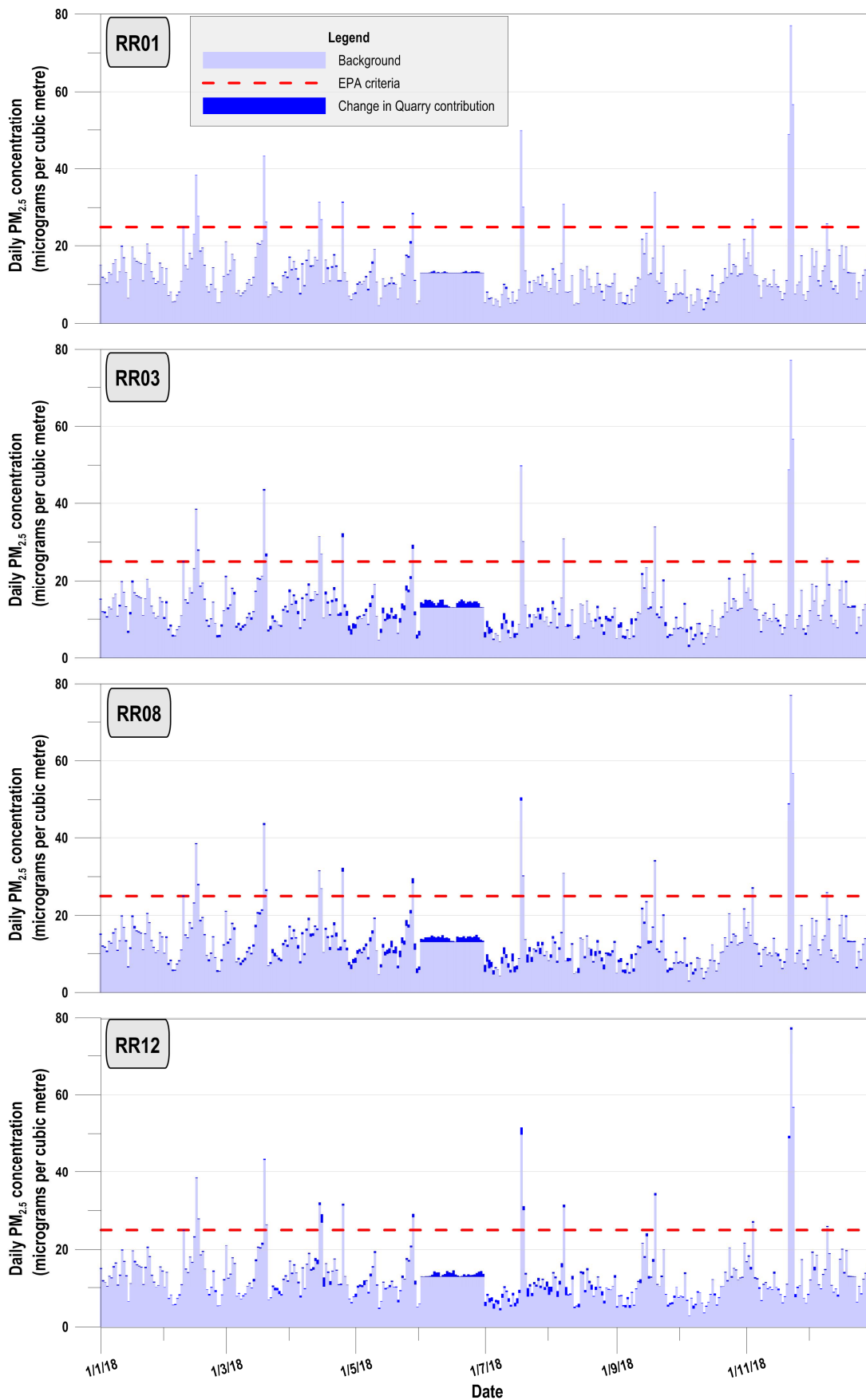
Table 8-3 Predicted annual average PM_{2.5} concentrations (µg/m³)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	0.2	0.3	0.3	13.5	13.6	13.6	8
2	0.2	0.3	0.3	13.5	13.6	13.6	8
3	0.6	1.0	0.8	13.5	13.9	13.6	8
4	0.4	0.6	0.5	13.5	13.7	13.6	8
5	0.4	0.7	0.5	13.5	13.8	13.6	8
6	0.6	1.0	0.7	13.5	13.9	13.6	8
7	0.3	0.5	0.4	13.5	13.7	13.6	8
8	0.8	1.3	1.0	13.5	14.0	13.7	8
9	0.5	0.7	0.7	13.5	13.8	13.7	8
10	0.7	1.2	1.1	13.5	14.0	13.9	8
11	0.5	0.9	0.8	13.5	13.8	13.8	8
12	0.7	1.0	1.1	13.5	13.9	13.9	8
13	0.5	0.7	0.8	13.5	13.7	13.8	8

As for PM₁₀, daily background PM_{2.5} concentrations in 2018 were also measured to occasionally exceed the 25 µg/m³ impact assessment criteria. The same assessment approach was applied, with the average ratio of PM₁₀ to PM_{2.5} measured at the Roberts Road HVAS used to scale the daily PM₁₀ to estimate daily PM_{2.5} at Dixon Sand's TEOM. Since PM_{2.5} data from the HVAS were only available to April 2018, the June and December 2018 gaps in the Dixon Sand TEOM dataset were filled using the annually averaged PM_{2.5} concentration (13 µg/m³). **Figure 8-3** and **Figure 8-4** display the results of this review for the proposed modification with VENM/ENM filling at the north and south of the site respectively.

As **Figure 8-3** displays, with VENM/ENM importation taking place at the northeast corner of the site no additional exceedances were predicted to occur at RR01, RR03, RR08 and RR12. For the alternative option involving VENM/ENM importation occurring in the southeast corner, **Figure 8-4** shows how no additional instances of daily PM_{2.5} concentrations above 25 µg/m³ were predicted at RR01, RR03, RR08 and RR12.

These results are discussed further, below in **Section 8.5**.

Figure 8-3 Change in 24-hour averaged $PM_{2.5}$ at RR01, RR03, RR08 and RR12 – Proposed modification (north)

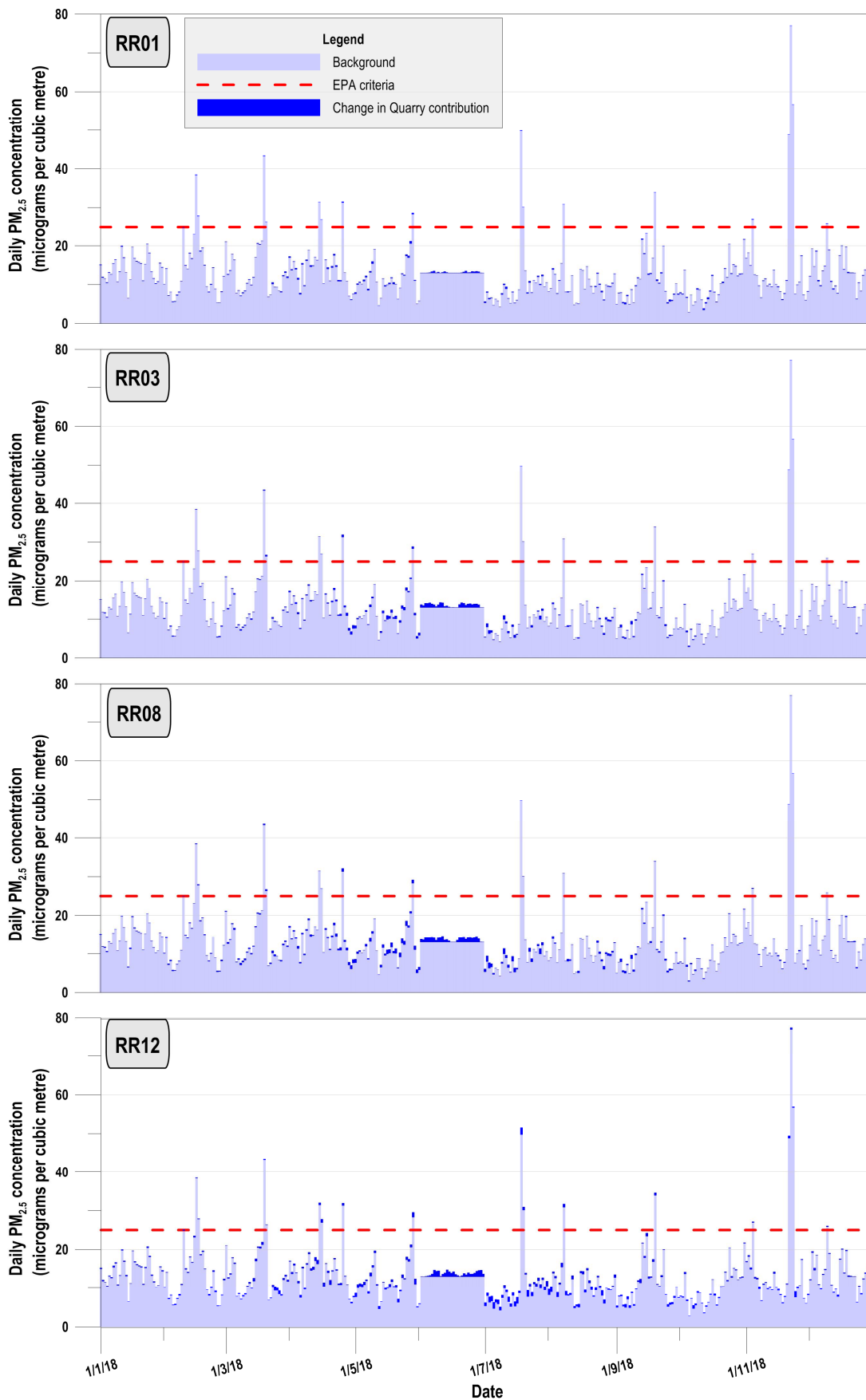


Figure 8-4 Change in 24-hour averaged PM_{2.5} at RR01, RR03, RR08 and RR12 – Proposed modification (south)

8.4 Deposited dust

Table 8-4 shows the predicted deposited dust levels at the nearest sensitive receiver locations (refer to **Figure 2-1**), in tabular form. Compliance with the EPA's assessment criterion for annual average criterion of 4 g/m²/month was predicted at all locations.

Table 8-4 Predicted dust deposition (g/m²/month)

ID	Due to Quarry			Background	Cumulative		Criteria
	Existing	Proposed Modification (North)	Proposed Modification (South)		Proposed Modification (North)	Proposed Modification (South)	
1	0.3	0.3	0.3	1.9	1.9	2.0	4
2	0.2	0.2	0.3	1.9	1.9	2.0	4
3	0.8	1.5	0.8	1.9	2.6	1.9	4
4	0.4	0.6	0.4	1.9	2.1	1.9	4
5	0.4	0.7	0.4	1.9	2.2	1.9	4
6	0.8	1.4	0.8	1.9	2.5	1.9	4
7	0.3	0.5	0.3	1.9	2.1	1.9	4
8	1.3	2.2	1.2	1.9	2.7	1.8	4
9	0.6	1.0	0.7	1.9	2.2	2.0	4
10	1.1	2.0	1.5	1.9	2.8	2.3	4
11	0.7	1.2	1.0	1.9	2.4	2.1	4
12	1.2	1.8	1.8	1.9	2.5	2.5	4
13	0.8	1.1	1.2	1.9	2.3	2.4	4

Changes in deposited dust due resulting from the modification are also displayed as contour plots in **Appendix B**.

8.5 Summary and interpretation

8.5.1 Summary

In summary, the following changes in local air quality as a result of the proposed modification were predicted:

- TSP, annually averaged PM₁₀, and deposited dust: Changes would not result in exceedance of the EPA's relevant impact assessment criteria at any of the nearest sensitive receivers.
- Daily PM₁₀: The potential for additional exceedances at the most-affected sensitive receivers under both scenarios modelled.
- Annually averaged PM_{2.5}: Background concentrations already exceed the EPA's 8 µg/m³ criterion, with increases of 0.5 µg/m³ (i.e. around 4 percent) and 0.4 µg/m³ (i.e. approximately 3 percent) predicted at the most-affected sensitive receivers for VENM/ENM filling in the north and south of the site respectively.
- Daily PM_{2.5}: No additional exceedances at the most-affected sensitive receivers for VENM/ENM filling in the north or south of the site.

8.5.2 Interpretation

Changes in the frequency of 24-hour averaged PM₁₀ concentrations exceeding 50 µg/m³ at the nearest, most-affected sensitive receivers around the Quarry was the only potential air quality risk identified for the proposed modification. The following factors should be considered in the interpretation of this result:

- **Conservatism of modelling:** As discussed above in **Section 7.3**, the site activities were modelled for the hours of day proposed under the proposed modification, for every day of the year. In reality the Quarry will not operate for every day of the year. Further, the model considers these activities occurring at all locations

displayed in **Figure 7-3**, **Figure 7-4** and **Figure 7-5** which is not likely to be the case for extraction, loading and VENM/ENM placement activities. Also, the model assumes the maximum rate of activity which in practice is not expected to be achieved. These assumptions were necessary to ensure that all source and meteorological interactions are considered. However, these assumptions of the model result in predictions where the contribution of the Quarry to local air quality is over-estimated.

- **Complaints:** No dust-related complaints have been received from the nearest sensitive receivers around the site (Umwelt, 2019). This suggests that dust from existing operations are not presently an issue for surrounding nearby residents.
- **Meteorological sensitivity review:** Sensitivity runs were performed noting that the reliability value was scaled back for the on-site meteorological station that was assimilated into TAPM. Consistent with the previous air quality impact assessment completed at the site (Wilkinson Murray, 2015), predictions were also reviewed without the influence of measurements from the on-site meteorological station in TAPM. Regarding 24-hour averaged PM₁₀, the number of additional exceedances decreased compared with the results presented in **Section 8**, although there was still one additional exceedance predicted for the option of VENM/ENM filling in the south. As the sensitivity review confirmed the potential for additional daily averaged PM₁₀ exceedances at the nearest receivers as a result of the proposed modification, the potential for such exceedances would need to be managed by Hodgson Quarries.
- **Review of exceedances:** As discussed in **Section 8.2**, the following additional daily averaged PM₁₀ exceedances were predicted:
 - VENM/ENM importation taking place at the northeast corner of the site: No additional exceedances were predicted at RR01; one additional exceedance at RR03 and RR08; and four additional exceedances at RR12.
 - VENM/ENM importation taking place at the southeast corner of the site: No additional exceedances at RR01, RR03 and RR08; with one additional exceedance predicted at RR12.

Each exceedance was reviewed to confirm the relative contributions of background concentrations and contributions from the site:

- VENM/ENM importation taking place at the northeast corner of the site:
 - RR03: Background was 43 µg/m³, site additional contribution 8 µg/m³ (16% of total).
 - RR08: Background was 43 µg/m³, site additional contribution 8 µg/m³ (16% of total).
 - RR12: Background was 37 µg/m³, 14 µg/m³, 41 µg/m³ and 47 µg/m³, and site additional contributions were 35 µg/m³ (49% of total), 41 µg/m³ (75% of total), 11 µg/m³ (21% of total) and 5 µg/m³ (10% of total) respectively.
- VENM/ENM importation taking place at the southeast corner of the site:
 - RR12: Background was 47 µg/m³, site additional contribution 5 µg/m³ (10% of total).

In most cases, these additional exceedances were primarily the result of elevated background concentrations. There was once instance for the scenario involving VENM/ENM importation taking place at the northeast corner at RR12 where background concentrations were low (14 µg/m³), and the primary contributor to the exceedance was Quarry operations. It should be noted that for this scenario, VENM/ENM importation and placement activities were taking place away from RR12 and that the activity most proximal was existing extraction operations.

These results suggest the need for additional measures to 1) minimise site contributions during days of elevated background PM₁₀ concentrations, and 2) review the conditions when extractive and emplacement activities take place towards the perimeter of the site. Safeguards to address these two requirements are recommended in **Section 9** below.

9. Safeguards and monitoring

As outlined above in **Section 6**, several operational control measures are already implemented at the Quarry including watering at extraction areas, haulage routes, during stockpiling and of inactive areas. This assessment has considered the application of these measures to VENM/ENM importation and placement activities. This will involve:

- Watering of unsealed roads used for importation of VENM/ENM;
- Water sprays during unloading of VENM/ENM; and
- Watering during placement of VENM/ENM.

To address the potential for additional daily averaged PM₁₀ exceedances at nearby residential receivers, there is a need for mechanisms to identify conditions that could lead to these instances. As identified above, exceedances would be more likely when background concentrations are elevated (that is, around 40 µg/m³ or more). Regional PM₁₀ concentrations are highest during hot, dry and windy conditions. To proactively identify and appropriately plan for these conditions before they occur, local meteorological forecasts should be reviewed each day. Where unfavourable meteorological conditions are forecast, the intensity (including number of trucks), types and location of activities and the controls to be implemented should be reviewed and adjusted.

A second trigger involving visual inspections should also be implemented. This would involve routine inspections to review whether the planned intensity, types, location and level of activities and the levels of controls in place remain adequate, or whether operations need to be scaled back or temporarily suspended. Metrics for making this determination would include whether:

- Dust is emanating from Quarry operations;
- The efficacy of control measures is observable as being impaired; and
- Meteorological conditions have changed so that wind is blowing dust in the direction from the site to the nearest surrounding receivers.

To improve the level of understanding of meteorological conditions at the Quarry, the location of the on-site meteorological station should be reviewed against the siting requirements detailed in Section 2.6.1 of Australian/New Zealand Standard AS/NZS 3580.14:2014 Methods for sampling and analysis of ambient air - Part 14: Meteorological monitoring for ambient air quality monitoring applications. PM_{2.5} measurement at the on-site HVAS should also be reviewed, noting the potential issues outlined above in **Section 5.2.3**.

In respect of the VLAMP, the conservative, potential predictions of the assessment indicate that the provisions of this guideline could apply. To ascertain whether operations present an actual rather than potential risk, future monitoring should be considered as appropriate, in consultation with the EPA.

10. Conclusion

This report has assessed the potential for adverse changes in local air quality from a proposed modification to operations at Roberts Road Quarry. The proposed modification would involve the importation and placement of VENM/ENM at the Quarry, an increase in the number of daily truck movements and removal of a restrictive condition associated with the area of 'active and exposed' areas at the Quarry.

The primary air quality issue associated with the proposed modification was identified to be dust (that is, particulate matter in the form of TSP, deposited dust, PM₁₀ or PM_{2.5}) from existing Quarrying and planned VENM/ENM importation activities.

Statutes, policies and guidelines were reviewed to identify a suitable approach and criteria for assessing potential impacts from the modification. From the EPA's Approved Methods and consistent with the EPA's specific assessment requirements for the proposal it was confirmed that impacts were to be assessed quantitatively, and suitable criteria were established.

The assessment required an understanding of key features of the existing environment including the presence and location of sensitive receivers; local meteorological conditions; and existing background pollutant concentrations. Nearby sensitive receivers around the site were identified by reviewing aerial imagery.

Consistent with EPA guidance, the last 5 calendar years of meteorological data collected at the Roberts Road Quarry automatic weather station were reviewed to identify a representative year for the purpose of the assessment. Based on this review, 2018 was confirmed as a suitable year for the purpose of the assessment. For 2018, as for the other years reviewed, winds were measured predominantly blowing from the southeast annually, with winds from the north-northwest also common.

The EPA's impact assessment criteria are based on the total concentration of these pollutants, that is the existing background concentrations as well as any changes as a result of the modification. Data collected from the on-site dust deposition gauges and a High-Volume Air Sampler at the Quarry were reviewed, as well as data from a nearby TEOM operated by Dixon Sands at the Maroota Public School to establish background conditions around the Quarry.

The computer-based dispersion model known as CALPUFF was used to predict the potential air quality impacts of the existing and proposed modified Quarry operations. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used dust emission estimates to predict the off-site air quality impacts. The focus of the assessment was on the potential change in air quality, noting that the Quarry already contributes to existing air quality.

The main conclusions of the assessment for each key pollutant and assessable averaging time were:

- Annually averaged TSP, annually averaged PM₁₀, and deposited dust: The proposed modification would not result in exceedances of the EPA's relevant impact assessment criteria at any of the nearest sensitive receivers.
- 24-hour averaged PM₁₀: The proposed modification has a potential to result in additional exceedances at the most-affected sensitive receivers.
- Annually averaged PM_{2.5}: Background concentrations already exceed the EPA's 8 µg/m³ criterion, however data from the nearest OEH station indicates that the monitored levels may be unexplainably higher than what could be expected. Still, the proposed modification was predicted to increase annual average PM_{2.5} concentrations by 0.5 µg/m³ (i.e. around 4 percent) and 0.4 µg/m³ (i.e. approximately 3 percent) at the most-affected sensitive receivers for VENM/ENM filling in the north and south of the Quarry respectively.
- 24-hour averaged PM_{2.5}: The proposed modification would not lead to any additional exceedances at the most-affected sensitive receivers for VENM/ENM filling in the north or south of the Quarry.

The key matter identified was the potential for additional days exceeding the EPA's 50 µg/m³ daily PM₁₀ criteria at the nearest sensitive receivers. Further reviews of the circumstances leading to these additional

exceedances were completed which identified that most occurred on days where daily PM₁₀ concentrations were already elevated. Safeguard measures to proactively identify meteorological conditions that could lead to elevated background PM₁₀ concentrations so that they could be planned for and effectively managed were recommended. Further visual verifications were recommended should conditions arise during operations, such that the level of activity, location and controls would need to be reviewed. Review of the siting of the on-site meteorological station and PM_{2.5} monitoring at the HVAS was also recommended, to improve the usefulness of data collected.

Regarding the VLAMP, the conservative, potential predictions of the assessment indicate that the provisions of this guideline could apply. To ascertain whether operations present an actual rather than potential risk, it was recommended that future monitoring be considered with the EPA.

11. References

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Appendix A. Emissions Calculations

Emission estimates, controls factors, emission factors and input variables

Emission calculations															
Roberts Road Quarry Existing															
Annual emissions (kg/y)															
Activity	TSP			Control (%)	Intensity	Units	TSP		PM10		PM2.5		Variables		
	Factor	Units	Factor	Units	Factor	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2) ^{1.3}	Moisture (%)	Silt (%)
Dozers ripping materials	2775	417	21	50	2288 h/y		2.42589 kg/h/v	0.3644 kg/h/v	0.01822 kg/h/v				0.48	2	2
Excavators loading raw product to trucks	274	130	14	0	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	2
Hauling raw product to Screening 1	3183	681	34	50	4364 VKT/y		1.45876 kg/VKT	0.31207 kg/VKT	0.016 kg/VKT					55	0.5
Unloading raw product to Screens 1	864	310	43	70	240000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Screening 1	3000	1032	150	0	240000 t/y		0.0125 kg/t	0.0043 kg/t	0.001 kg/t						
Loading product stockpiles	15	7	1	50	240000 t/y		0.00012 kg/t	5.8E-05 kg/t	0.000 kg/t				0.48	6	
Excavators loading screened product to trucks	137	65	7	0	240000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling raw product to Screening 2	1910	409	20	50	2618 VKT/y		1.45876 kg/VKT	0.31207 kg/VKT	0.016 kg/VKT					55	0.3
Unloading raw product to Screens 2	864	310	43	70	240000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Screening 2	3000	1032	150	0	240000 t/y		0.0125 kg/t	0.0043 kg/t	0.001 kg/t						
Loading product stockpiles	29	14	1	50	480000 t/y		0.00012 kg/t	5.8E-05 kg/t	0.000 kg/t				0.48	6	
Excavators loading screened product to trucks	274	130	14	0	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling product off-site	1715	367	18	75	5000 VKT/y		1.37208 kg/VKT	0.29353 kg/VKT	0.015 kg/VKT					48	0.5
Wind erosion from exposed areas, inactive	5396	2698	135	30	2.2 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from exposed areas, active	4906	2453	123	50	2.8 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from rehabilitation area, inactive	4415	2208	110	30	1.8 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from product stockpiles	3854	1927	96	0	1.1 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
kg/yr	36612	13770	960												

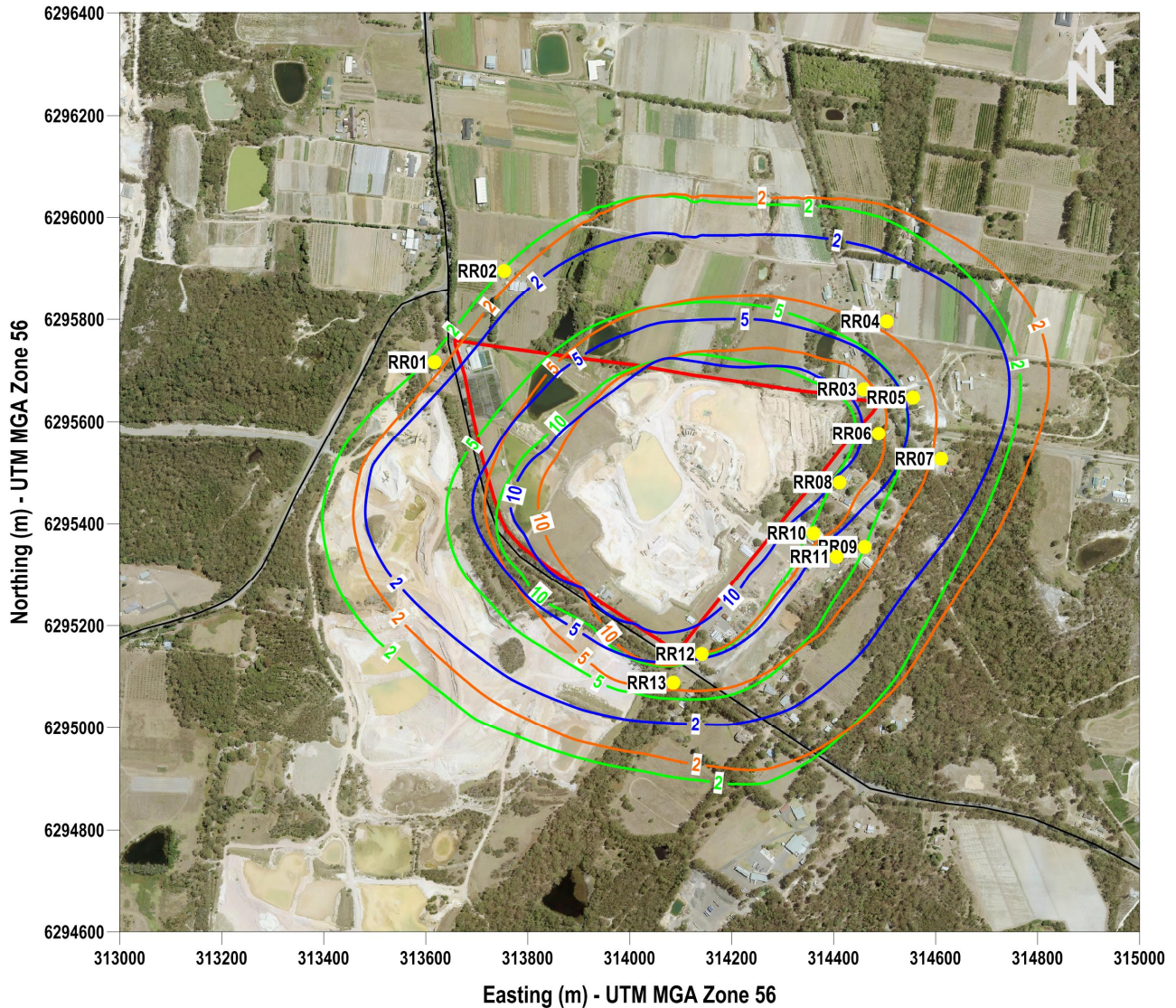
Emission calculations															
Roberts Road Quarry Proposed, VENM/ENM filling North															
Annual emissions (kg/y)															
Activity	TSP			Control (%)	Intensity	Units	TSP		PM10		PM2.5		Variables		
	Factor	Units	Factor	Units	Factor	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2) ^{1.3}	Moisture (%)	Silt (%)
Dozers ripping materials	2775	417	21	50	2288 h/y		2.42589 kg/h/v	0.3644 kg/h/v	0.01822 kg/h/v				0.48	2	2
Excavators loading raw product to trucks	274	130	14	0	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling raw product to Screening 1	1591	340	17	50	2182 VKT/y		1.45876 kg/VKT	0.31207 kg/VKT	0.016 kg/VKT					55	0.25
Unloading raw product to Screens 1	864	310	43	70	240000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Screening 1	7200	2400	360	0	240000 t/y		0.03 kg/t	0.01 kg/t	0.002 kg/t						
Loading product stockpiles	69	32	3	50	240000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Excavators loading screened product to trucks	137	65	7	0	240000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling raw product to Screening 2	1910	409	20	50	2618 VKT/y		1.45876 kg/VKT	0.31207 kg/VKT	0.016 kg/VKT					55	0.3
Unloading raw product to Screens 2	864	310	43	70	240000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Screening 2	7200	2400	360	0	240000 t/y		0.03 kg/t	0.01 kg/t	0.002 kg/t						
Loading product stockpiles	137	65	7	50	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Excavators loading screened product to trucks	274	130	14	0	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling product off-site	1715	367	18	75	5000 VKT/y		1.37208 kg/VKT	0.29353 kg/VKT	0.015 kg/VKT					48	0.5
Wind erosion from exposed areas, inactive	5396	2698	135	30	2.2 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from exposed areas, active	4906	2453	123	50	2.8 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from rehabilitation area (VENM/ENM), active	3154	1577	79	50	1.8 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from product stockpiles	3854	1927	96	0	1.1 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Hauling ENM/VENM to site	3809	815	41	50	6400 VKT/y		1.19029 kg/VKT	0.25463 kg/VKT	0.013 kg/VKT					35	0.7
Unloading ENM/VENM	1152	413	58	70	320000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Dozers placing materials	2775	417	21	50	2288 h/y		2.42589 kg/h/v	0.3644 kg/h/v	0.01822 kg/h/v				2		2
kg/yr	47282	17256	1459												

Emission calculations															
Roberts Road Quarry, Proposed South															
Annual emissions (kg/y)															
Activity	TSP			Control (%)	Intensity	Units	TSP		PM10		PM2.5		Variables		
	Factor	Units	Factor	Units	Factor	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2) ^{1.3}	Moisture (%)	Silt (%)
Dozers ripping materials	2775	417	21	50	2288 h/y		2.42589 kg/h/v	0.3644 kg/h/v	0.01822 kg/h/v				0.48	2	2
Excavators loading raw product to trucks	274	130	14	0	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling raw product to Screening 1	1591	340	17	50	2182 VKT/y		1.45876 kg/VKT	0.31207 kg/VKT	0.016 kg/VKT					55	0.25
Unloading raw product to Screens 1	864	310	43	70	240000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Screening 1	7200	2400	360	0	240000 t/y		0.03 kg/t	0.01 kg/t	0.002 kg/t						
Loading product stockpiles	69	32	3	50	240000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Excavators loading screened product to trucks	137	65	7	0	240000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling raw product to Screening 2	1910	409	20	50	2618 VKT/y		1.45876 kg/VKT	0.31207 kg/VKT	0.016 kg/VKT					55	0.3
Unloading raw product to Screens 2	864	310	43	70	240000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Screening 2	7200	2400	360	0	240000 t/y		0.03 kg/t	0.01 kg/t	0.002 kg/t						
Loading product stockpiles	137	65	7	50	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Excavators loading screened product to trucks	274	130	14	0	480000 t/y		0.00057 kg/t	0.00027 kg/t	0.000 kg/t				0.48	2	
Hauling product off-site	1715	367	18	75	5000 VKT/y		1.37208 kg/VKT	0.29353 kg/VKT	0.015 kg/VKT					48	0.5
Wind erosion from exposed areas, inactive	5396	2698	135	30	2.2 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from exposed areas, active	4906	2453	123	50	2.8 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from VENM/ENM area, active	3154	1577	79	50	1.8 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Wind erosion from product stockpiles	3854	1927	96	0	1.1 ha		3504.0 kg/ha/y	1752.0 kg/ha/y	87.6 kg/ha/y						
Hauling ENM/VENM to site	4353	931	47	50	7314 VKT/y		1.19029 kg/VKT	0.25463 kg/VKT	0.013 kg/VKT					35	0.8
Unloading ENM/VENM	1152	413	58	70	320000 t/y		0.01200 kg/t	0.0043 kg/t	0.001 kg/t						
Dozers placing materials	2775	417	21	50	2288 h/y		2.42589 kg/h/v	0.3644 kg/h/v	0.01822 kg/h/v				2		2
kg/yr	47826	17373	1465												

Appendix B. Contour plots

B.1 Total suspended particulates (TSP)

Annually averaged TSP, $\mu\text{g}/\text{m}^3$, site contribution only

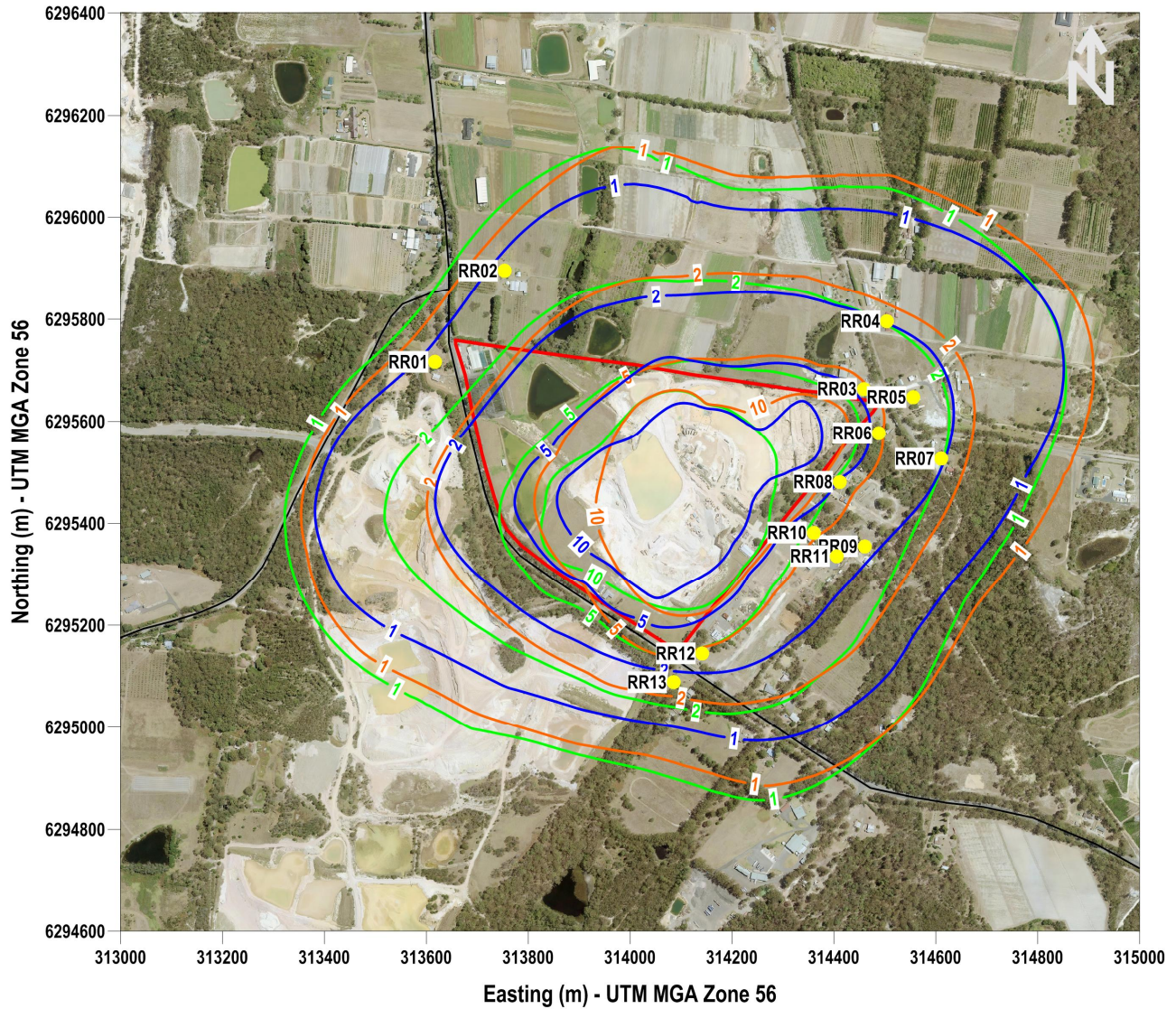


Legend

- Roberts Road Quarry
- Nearest Residential Receiver
- Existing operations
- Proposed modification; VENM/ENM filling in north
- Proposed modification; VENM/ENM filling in south

B.2 Particulate matter (PM₁₀)

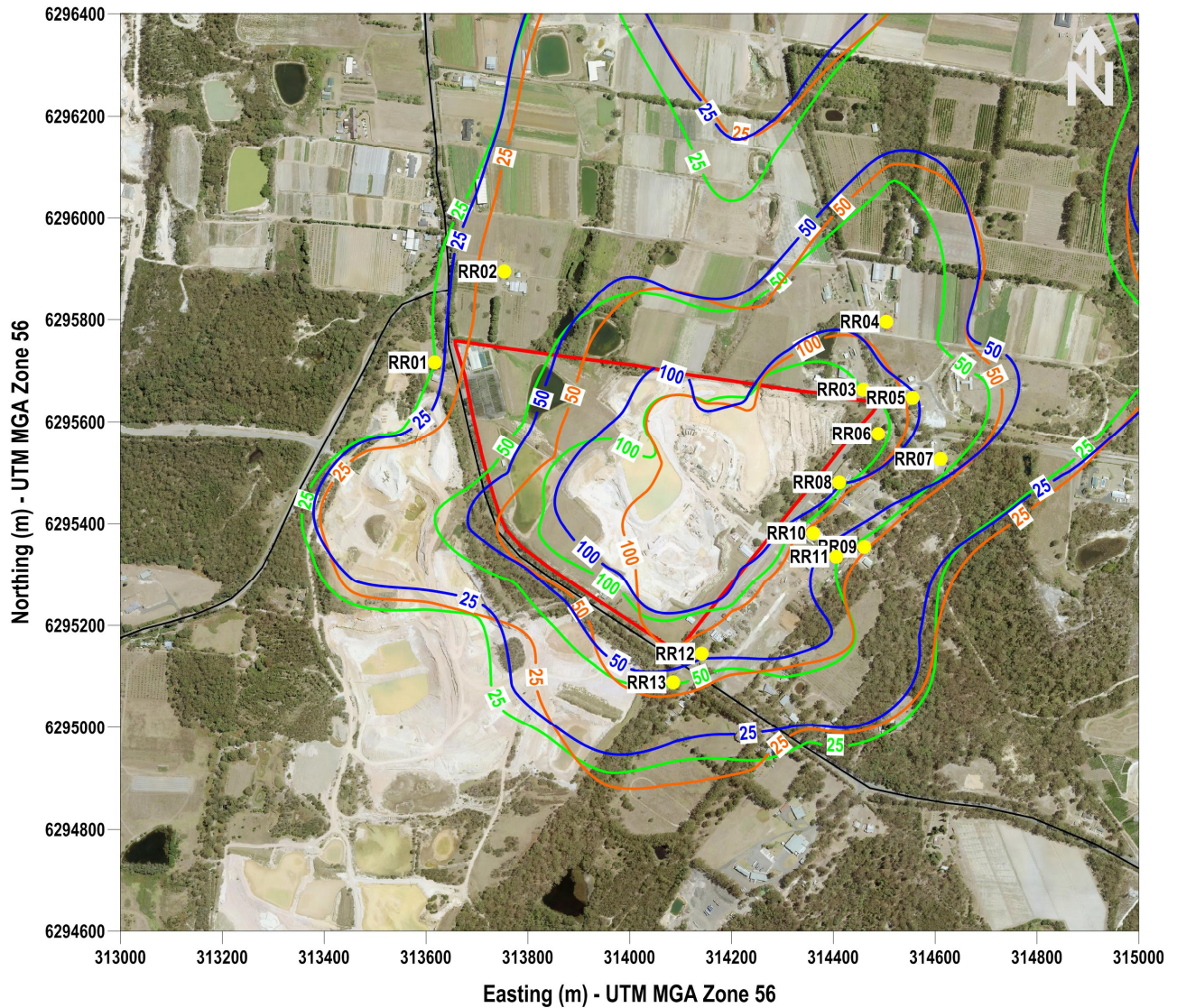
Annually averaged PM₁₀, µg/m³, site contribution only



Legend

- Roberts Road Quarry
- Nearest Residential Receiver
- Existing operations
- Proposed modification; VENM/ENM filling in north
- Proposed modification; VENM/ENM filling in south

Maximum 24-hour averaged PM_{10} , $\mu g/m^3$, site contribution only

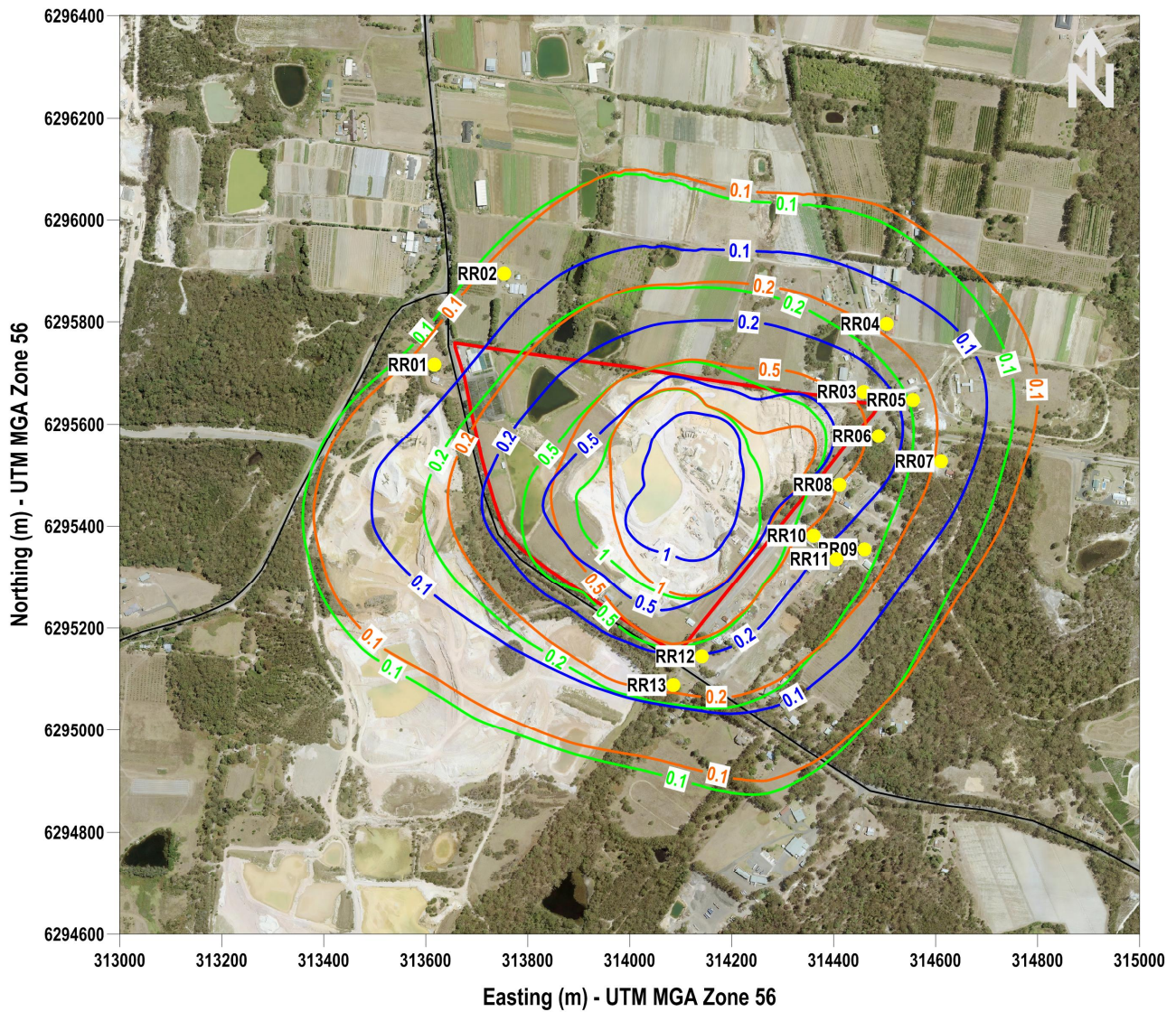


Legend

- Roberts Road Quarry
- Nearest Residential Receiver
- Existing operations
- Proposed modification; VENM/ENM filling in north
- Proposed modification; VENM/ENM filling in south

B.3 Particulate matter (PM_{2.5})

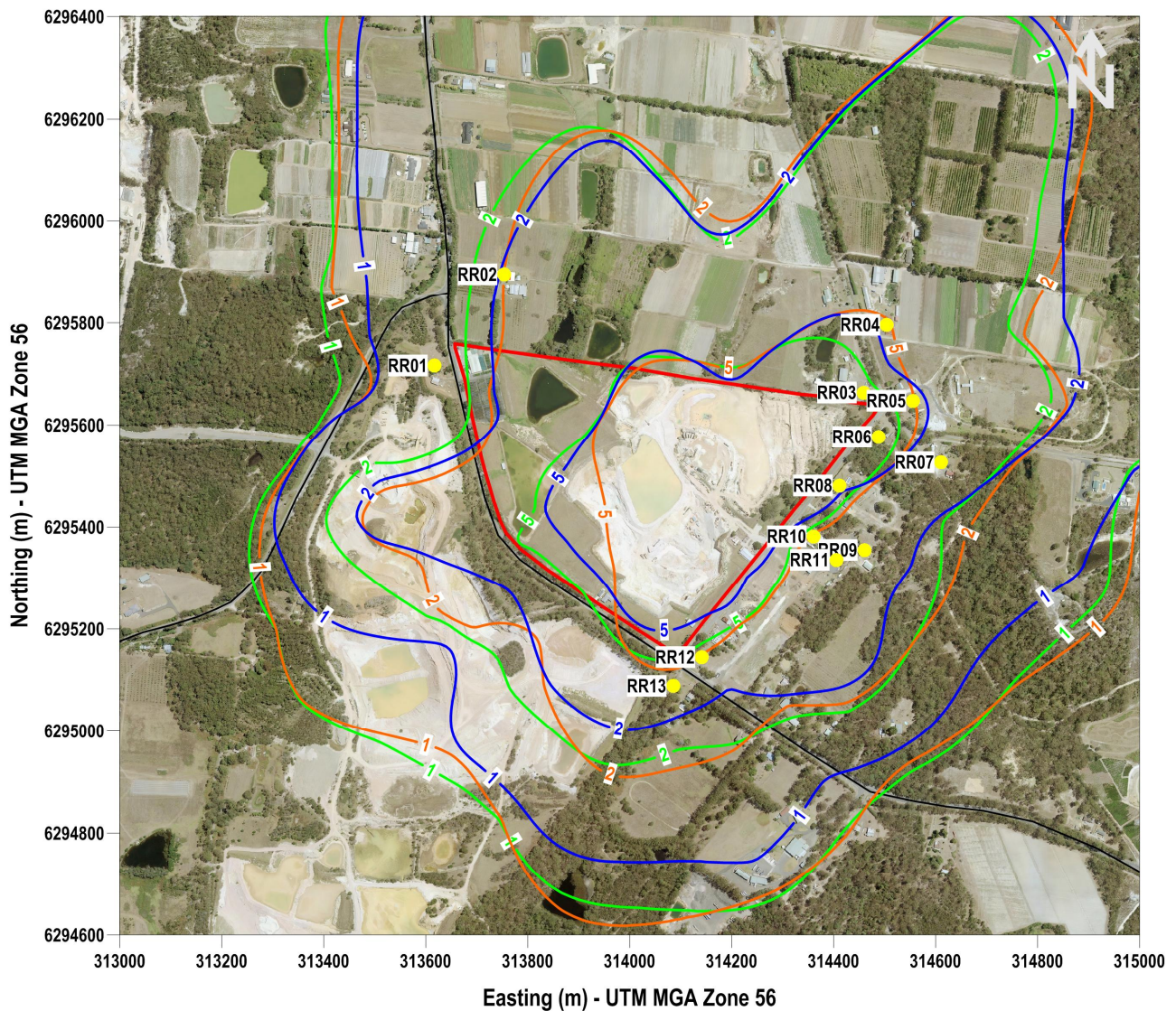
Annually averaged PM_{2.5}, µg/m³, site contribution only



Legend

- Roberts Road Quarry
- Nearest Residential Receiver
- Existing operations
- Proposed modification; VENM/ENM filling in north
- Proposed modification; VENM/ENM filling in south

Maximum 24-hour averaged PM_{2.5}, µg/m³, site contribution only

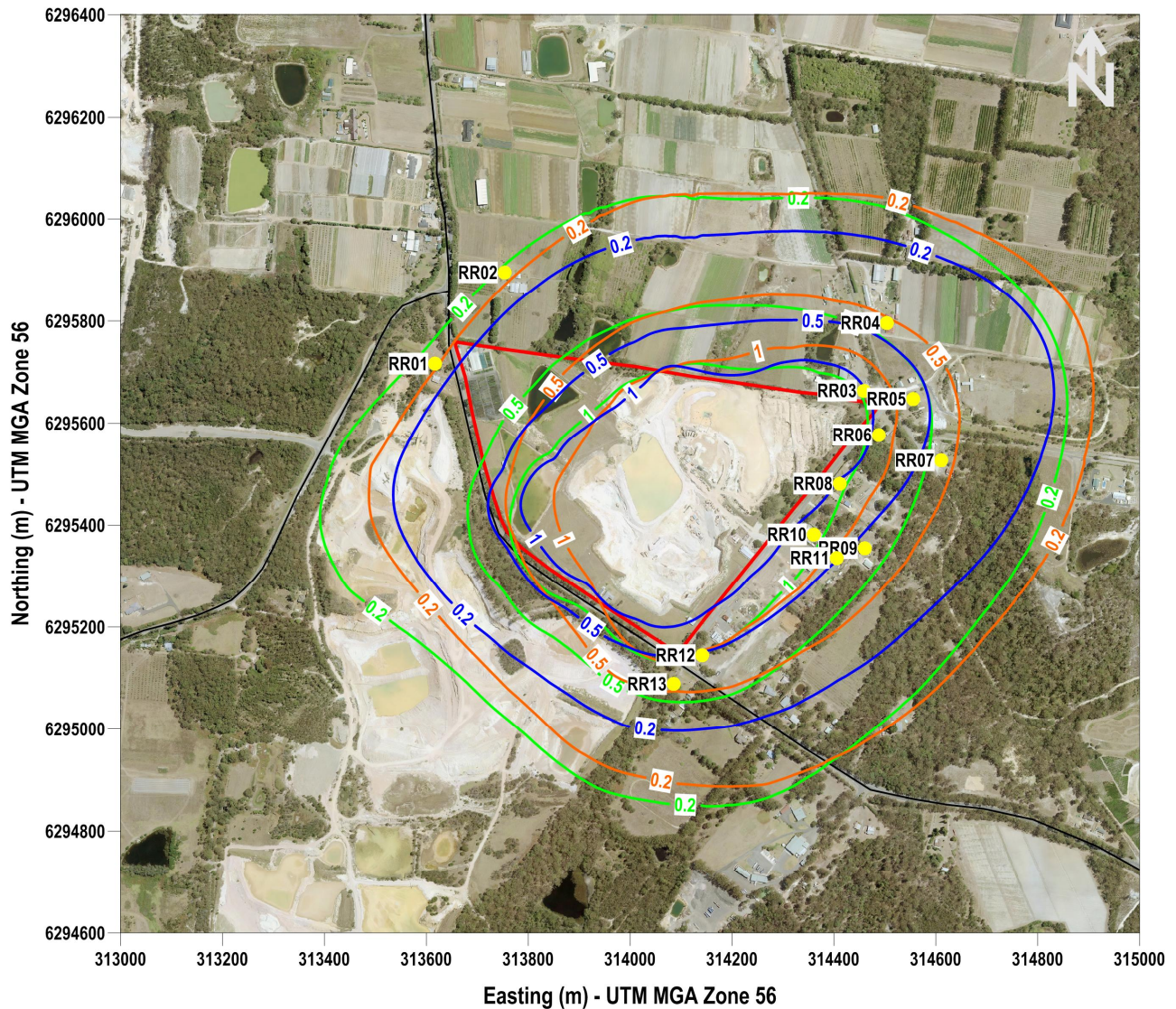


Legend

- Roberts Road Quarry
- Nearest Residential Receiver
- Existing operations
- Proposed modification; VENM/ENM filling in north
- Proposed modification; VENM/ENM filling in south

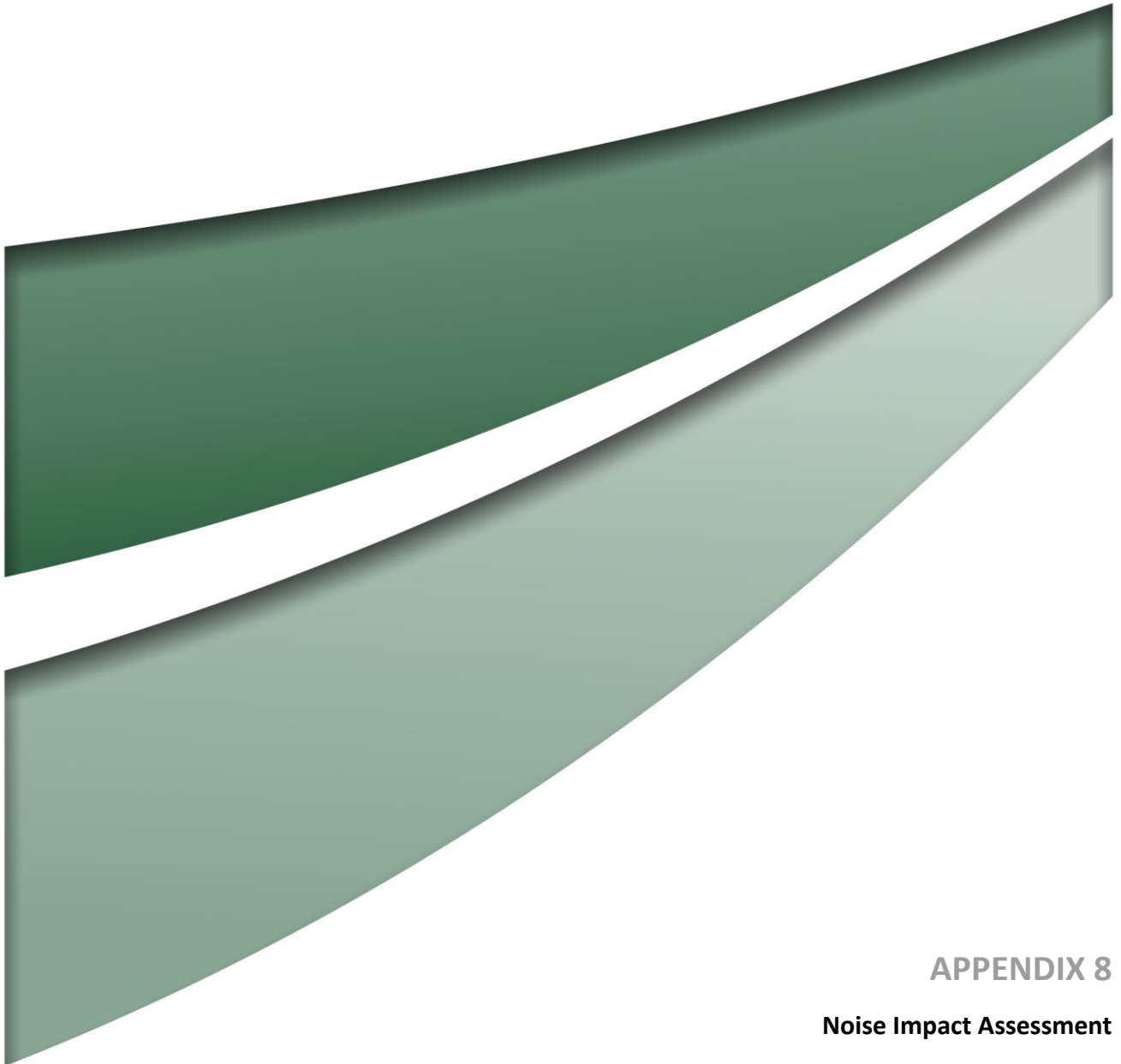
B.4 Deposited dust

Annually averaged maximum deposited dust (g/m²/month), site contribution only



Legend

- ▭ Roberts Road Quarry
- Nearest Residential Receiver
- Existing operations
- Proposed modification; VENM/ENM filling in north
- Proposed modification; VENM/ENM filling in south



APPENDIX 8

Noise Impact Assessment



**Hodgson Quarries
and Plant Pty Ltd**

NOISE IMPACT ASSESSMENT

Roberts Road Quarry – Modification 4

FINAL

November 2019

Hodgson Quarries and Plant Pty Ltd

NOISE IMPACT ASSESSMENT

Roberts Road Quarry – Modification 4

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Hodgson Quarries and Plant Pty Ltd

Project Director: Gabrielle Allan
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Report No. 4465/R04
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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Alex Irwin	12 November 2019	Dave Davis	12 November 2019

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1.0 Introduction

1.1 Scope

Umwelt (Australia) Pty Limited (Umwelt) has undertaken an assessment of the potential noise impacts from the proposed modification of the Roberts Road Quarry (the Quarry) located at Maroota, New South Wales (NSW), across Lots 1 and 2, DP 228308 and Lot 2, DP 312327. The location of the Quarry can be seen in **Figure 1.1**.

The potential noise impacts have been assessed by comparison of predicted noise levels against the applicable noise impact assessment levels. The applicable noise impact assessment levels are the noise limits in the existing Development Consent (DA 267-11-99) and Environmental Protection License (EPL) 6535.

This Noise Impact Assessment (NIA) has been undertaken in accordance with the requirements of the NSW *Noise Policy for Industry* (Environment Protection Authority (EPA), 2017) (NPfI) and the NSW *Road Noise Policy* (Department of Environment and Climate Change (DECC), 2011) (RNP). Any variance from either Policy in the assessment has been justified.

1.2 Description of the Proposed Modification

Hodgson Quarry Products Pty Limited (Hodgson Quarry Products) is proposing to modify DA 267-11-99 to permit the importation of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to the Quarry. The imported VENM and ENM would be used to facilitate rehabilitation of the Quarry void to create a final landform that is free-draining, thereby reinstating pre-Quarry drainage, with reduced slopes that will be more sympathetic to the and surrounding topography and more amenable to future use of the land for agricultural or horticultural purposes. A dam would be retained within the final landform to provide for erosion and sediment control during the landform construction and rehabilitation phase, and storage and retention of water in accordance with the licensed allocation of the landholding following rehabilitation. While the management of VENM and ENM on the Quarry site is likely to be completed using existing Quarry mobile equipment, the noise assessment considers the operation of the Quarry dozer and front-end loader (FEL) as a separate noise source.

Imported VENM or ENM with high sand content may be processed, along with the sand excavated from the extraction area, and blended to produce sand products for sale. The proposed processing of the imported VENM and ENM would not require any additional processing infrastructure or noise sources. Blending of material would prolong the life of the extractable resource within the Quarry and as such, the proposed modification includes a five year extension of the operational life of the Quarry, out to 2030.

To accommodate the importation of VENM/ENM, the proposed modification is to include an increase to the approved daily truck movements from 100 movements (50 laden trucks) to 140 movements (70 laden trucks). Where possible, Hodgson Quarry Products will undertake 'double trucking' whereby an inbound laden truck (VENM/ENM) would unload and then be loaded with quarry product and become an outbound laden truck.



Legend

Roberts Road Quarry Boundary



FIGURE 1.1
Location of Roberts Road Quarry

2.0 Existing Noise Environment

The area around the Quarry is predominantly rural and rural residential, and there are several other operating sand quarries in the area.

2.1 Receivers

Noise levels have been assessed at the same receivers where noise levels were predicted for the noise assessment that was undertaken for the MOD 2 application (refer *Hodgson Quarry Products Sand Extraction Roberts Road, Maroota - Operational Noise Assessment*, Wilkinson Murray Report No. 14229-B, May 2015) (the MOD 2 noise assessment). The assessed noise receivers are shown in **Table 2.1** and **Figure 2.1**. As the assessment of noise relies upon the previous modelling of the MOD 2 noise assessment, the receiver references of this assessment have been retained. For clarity, the corresponding receiver references used in the Statement of Environmental Effects (SEE) are presented in **Table 2.1**.

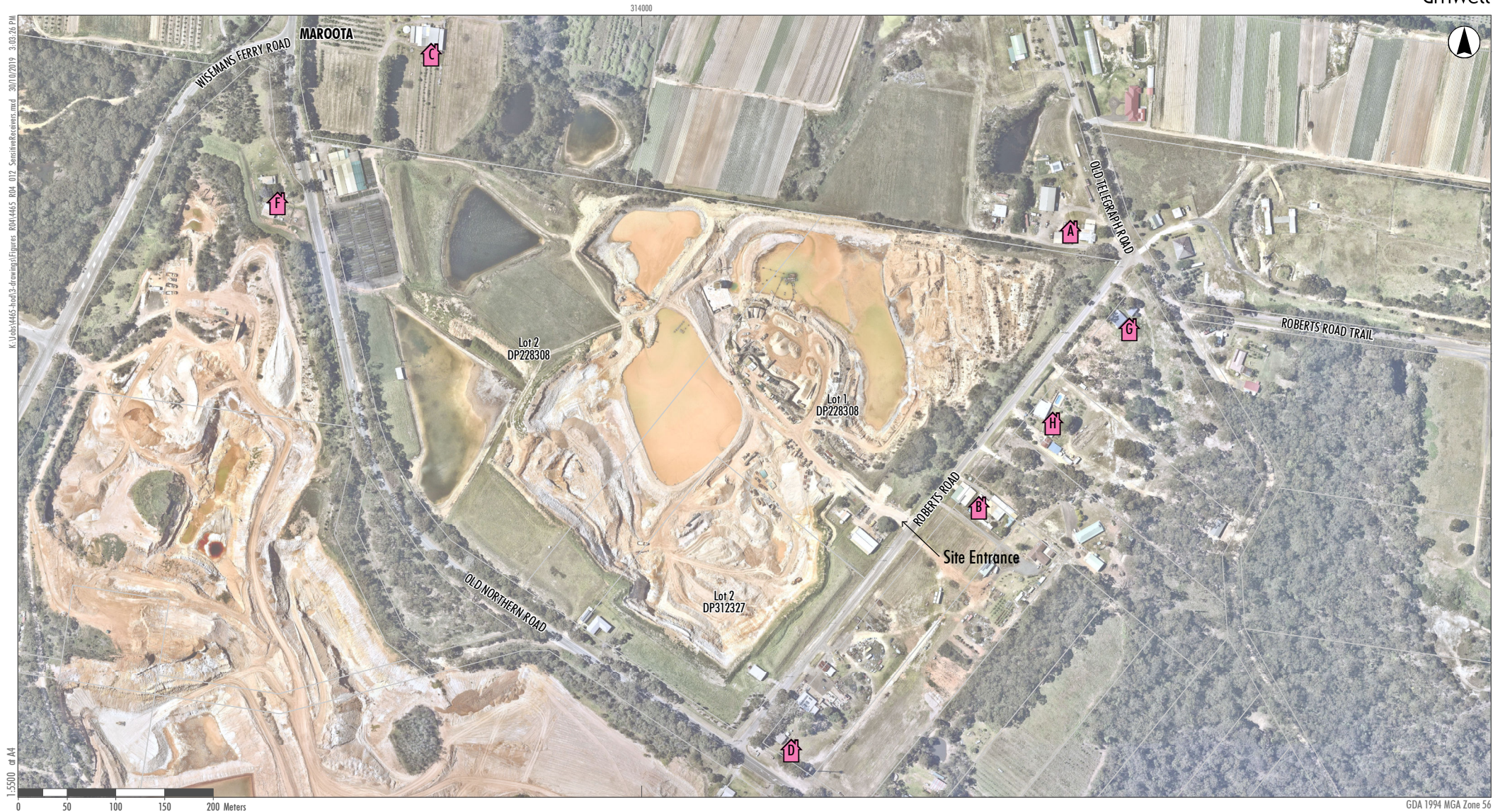
Table 2.1 Noise receivers

Receiver ID		Address	Approximate distance to Quarry boundary	Direction from Quarry	MGA Coordinates (m)	
NIA	SEE				Easting	Northing
A	RR03	100 Old Telegraph Road, Maroota	12 m	N	314418	6295660
B	RR10	35 Roberts Road, Maroota	16 m	E	314332	6295397
C	RR02	4471 Old Northern Road, Maroota	109 m	N	313781	6295850
D	RR12	11 Roberts Road, Maroota	29 m	E	314156	6295190
E ¹	-	1700 Wisemans Ferry Road, Maroota	1000 m	WSW	312820	6295008
F	RR01	4460 Old Northern Road, Maroota	46 m	W	313617	6295687
G	RR06	59 Roberts Road, Maroota	27 m	E	314489	6295576
H	RR08	45 Roberts Road, Maroota	25 m	E	314412	6295483

Notes: 1. Only road traffic noise has been assessed at Receiver E. Quarry noise has not been assessed at Receiver E, which is consistent with the MOD 2 noise assessment

2.2 Noise limits

This NIA has been undertaken by comparing the predicted noise levels from the Proposed Modification against the Quarry's existing noise limits. Roberts Road Quarry does not seek a modification of noise limits as the Quarry is confident that continued compliance with existing noise limits can be maintained.



Legend

- Roberts Road Quarry Boundary
- Cadastral boundary
- 🏠 Receivers

FIGURE 2.1
Noise Assessment Receivers

2.2.1 Operational noise limits

The noise limits of EPL 6535 are as follows.

L2 Noise limits

L2.1 Noise from the premises must not exceed the sound pressure level expressed as LA10(15 minute) of 45 dB(A), except as expressly provided by this licence.

L2.2 Noise from the premises is to be measured or computed at any point within one metre of any residential boundary, or at any point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in Condition L2.1.

The noise limits in the development consent conditions for DA 267-11-99 (as Modified) are:

For typical operations, noise from the premises must not exceed:

- *an LAeq,15 min noise emission criterion of 43 dB(A) (7.00 am to 6.00 pm) Monday to Saturday;*
- *an LAeq,15 min noise emission criterion of 40 dB(A) (6.00 am to 7.00 am) Monday to Saturday; and*
- *an LA1,1 minute noise emission criterion of 50 dB(A) (6.00 am to 7.00 am) Monday to Saturday.*

The MOD 2 noise assessment discusses that the LAeq,15 min noise limit of 43 dB(A) in the development consent is equivalent to the LA10(15 minute) noise limit of 45 dB(A) in the EPL. Consistent with the approach adopted in the MOD 2 noise assessment, this noise impact assessment has been undertaken under the assumption that demonstration of compliance with the development consent condition will also demonstrate that compliance with the noise limit of EPL 6535 has been achieved, for typical daytime operations (7.00 am to 6.00 pm) Monday to Saturday.

2.2.2 Road traffic noise criteria

Traffic noise limits are provided by Condition 48 of DA 267-11-99 MOD 3. Traffic noise from the development is not to exceed the following noise limits at any affected residence on minor roads:

- *an LAeq, 1 hour of 55 dB(A) between 7.00 am and 10.00 pm, and*
- *an LAeq, 1 hour of 50 dB(A) between 10.00 pm and 7.00 am.*

Where existing LAeq traffic noise levels already exceed these criteria, the development is to ensure that traffic noise from the development does not result in an increase of more than 2 dB(A).

In addition to the above, road noise criteria are also provided in the RNP (DECC, 2011) as follows:

*For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use developments**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*

The NSW EPA Application Note "Applying the NSW Road Noise Policy" further states:

The 2 dB increase applies to both the relevant day and night assessment criteria.

The time periods for the day and night assessment criteria are defined in the RNP as:

- LAeq, (15 hour) represents the LAeq noise level for the period 7.00 am to 10.00 pm.
- LAeq, (9 hour) represents the LAeq noise level for the period 10.00 pm to 7.00 am.

2.3 Measured Noise Levels

Noise monitoring is undertaken annually to confirm noise levels of the Quarry against the limits imposed by DA 267-11-99 and EPL 6535. Noise levels have been measured in accordance with an Operational and Road Noise Management Plan (ORNMP) (MAC, 2016), prepared and implemented in accordance with Condition 46 of DA 267-11-99 in 2016, 2017, 2018 and 2019. All noise measurements have confirmed compliance of Quarry operations with the operational and road traffic noise limits in the conditions of DA 267-11-99 and the EPL 6535.

3.0 Methodology

3.1 Modified Operations

The proposed modified Quarry operations will remain substantially the same as those currently approved, the noise impacts of which were comprehensively assessed for the MOD 2 Application. The only relevant acoustic differences between the Quarry, as assessed by the MOD 2 noise assessment (Wilkinson Murray Pty Ltd [WMPL], 2015), and the proposed modification are:

- the increased use of the Quarry dozer and FELs to profile the VENM and ENM imported to the Quarry (currently these plant are utilised only occasionally for landform construction and profiling activities when sufficient clay waste or consolidated silt is available), and
- an increase in the number of trucks accessing the site per day.

3.2 Operational Noise Assessment

The noise assessment has been undertaken by quantifying the difference in noise levels at receivers between the proposed MOD 4 operations and the currently approved operations (as modelled and predicted by WMPL, 2015). WMPL (2015) predicted the noise levels received at surrounding residences for 3 cases.

1. Typical activities, where typical noise sources (Case 1) modelled for the MOD 2 noise assessment were:
 - 1 × Excavator at base of excavation
 - 2 × dump trucks continuously between face and processing area
 - 1 × FEL feeding processing plant managing stockpiles
 - 1 × Diesel Screen/Conveyers
 - 1 × Processing and Washing Plant/Conveyers
 - 1 × FEL loading haul trucks/managing stockpiles
 - 3 × Haul trucks in 15 minutes taking product off site.
2. Typical activities with Dozer (located at the highest RL within the Extraction or Emplacement area).
3. Typical activities with surface operations behind bund (Extraction or Emplacement).

It is noted that both the dozer and FEL to be used for VENM and ENM management would be effectively repurposed/redeployed and do not represent additional noise sources to those previously assessed and modelled to establish Quarry noise criteria (WMPL, 2015). The potential impact on received noise levels would be as a result of the more frequent operation of the dozer and FEL managing VENM and ENM as part of Quarry backfill, landform construction and rehabilitation operations. The dozer and FEL have therefore been considered as a separate noise source for the purpose of this noise assessment.

The proposed modification has been assessed by combining the predicted noise from the operation of the dozer and FEL in this area to the previously predicted MOD 2 noise levels at receivers (of WMPL, 2015). This has allowed for conservative predictions of the total noise levels from the Quarry (as modified), noting that on the basis of the redeployment of the dozer and FEL, the predicted noise levels of WMPL (2015) are likely to be conservatively high.

Noise levels generated by the dozer/FEL VENM/ENM management activities have been predicted with the same modelling software and the same prediction method used in the MOD 2 noise assessment (WMPL, 2015), that is the Cadna/A proprietary noise modelling software using the ISO 9613 noise prediction method. The ISO 9613 noise prediction method (using the default parameters) calculates the long-term average noise levels from noise sources under moderate noise-enhancing meteorological conditions. For the current proposed modification, the noise modelling was undertaken using the default meteorological parameters.

For the purpose of assessment, the predicted noise levels from Case 1 in the MOD 2 noise assessment (of WMPL, 2015) have been used. Cases 1 and 2 of the MOD 2 noise assessment are not considered representative of future operations as these involve around the redeployment of existing equipment to specific activities/operations on the Quarry site. That is, the proposed modification effectively represents a Case 4 if considered in the context of the MOD 2 assessment. The proposed dozer/FEL operations proposed would be instead of, as opposed to in addition to the Case 2 and 3 scenarios.

3.3 Road Traffic Noise Assessment Method

In regards to the increase in the number of trucks accessing the Quarry per day, there is no proposed increase to the number of trucks that will access the site in any single 15-minute period, consequently there will be no net change in noise from the Quarry site due to the number of trucks on site at any time. As the MOD 2 noise assessment modelled the worst case of the maximum number of trucks on site at any time in order to predict the highest $L_{Aeq}(15 \text{ minute})$ noise level, the noise from all trucks on site for the proposed modification have already been predicted. Therefore the net effect of the proposed modification only relates to the road traffic noise levels of trucks on the public roads which are described as an acoustic average over the time period (either Day 7.00 am to 10.00 pm or Night 10.00 pm to 7.00 am).

The modification proposes an increase from a maximum of 100 to 140 truck movements per day. The modification does not propose to increase the maximum number of truck movements per hour of operation. Consequently the only impact will be the change in the total number of truck movements during the daytime period (7.00 am to 10.00 pm).

As Roberts Road is a local road, the noise level criteria in the RNP is given in terms of $L_{Aeq}(1 \text{ hour})$ (refer to **Section 2.2.2**). Notably, the proposed modification would not change the maximum number of truck movements in any hour. As a result no increase in the maximum $L_{Aeq}(1 \text{ hour})$ from quarry trucks would occur as a result of the proposed modification.

The potential road traffic noise impact of the proposed modification has been assessed by estimating the relative increase in $L_{Aeq}(15 \text{ hour})$ traffic noise levels during the daytime period 7.00 am to 10.00 pm as a result of the increased numbers of truck movements in and out of the quarry during the hours of operation 7.00 am to 6.00 pm.

The Traffic Impact Assessment (TIA) (Seca Solution, 2019) describes the proposed increase in the number of trucks as follows:

The subject site has an approved haulage rate of 100 trucks per day (50 laden/50 unladen), which allows for inbound and outbound truck movements with the daily total two-way flows not to exceed 100 per day. The project seeks to increase the daily approval to 140 trucks per day, with no increase proposed for the existing hourly maximum of 20 trucks per hour. Instead the project shall see the additional heavy vehicle movements spread over the course of the day during periods of high demand.

All truck access will remain via the existing site access direct onto Roberts Road, with the existing distribution onto Old Northern Road to be maintained.

- 80% to/from the north, turning right onto Old Northern Road and the reverse left turn in.
- 20% to/from the south, being left turns onto Old Northern Road and right turns in.

Contemporary road traffic volumes data were not available for this NIA, which was also the case for the MOD 2 NIA. The specialist reports including the Acoustic Impact Assessment and the Traffic and Transport Study by Lyle Marshall & Associates that was prepared for the Environmental Impact Statement (EIS) (Appendices 11 and 15 of the EIS respectively) were also not available.

For this NIA, the current daily traffic volumes have been estimated from the traffic volumes presented in the EIS (Nexus, 1999), indexed by an annual growth factor of 2% as nominated in the TIA (Seca Solution, 2019), as shown in **Table 3.1**.

Table 3.1 Average Two-Way Traffic Volumes (derived from EIS (Nexus, 1999) Table 3.10)

Average Daily Vehicles (7 days)	Old Northern Road (Location D)		Wisemans Ferry Road (Location E)	
	1999	2020	1999	2020
Total Vehicles	2026	3071	1769	2681
Light Vehicles	1844	2795	1589	2408
Heavy Vehicles	183	277	180	273

In order to estimate the increase in the daytime 7.00 am to 10.00 pm period noise levels $L_{Aeq}(15 \text{ hour})$ it is necessary to estimate the proportion of 24-hour traffic that occurs between 7.00 am and 10.00 pm. For the purposes of this assessment, it is considered that a conservatively low estimate of the traffic volumes between 7.00 am and 10.00 pm on Old Northern Road and Wisemans Ferry Road is 75% of total 24-hour volumes.

As described in the TIA, the existing distribution of Quarry trucks will be maintained for the proposed modification, where 80% of trucks will access the Quarry from the north, turning left onto Roberts Road from Old Northern Road, and 20% from the south, turning right onto Roberts Road from Old Northern Road.

4.0 Noise Sources

4.1 Quarry Site Noise Sources

4.1.1 Plant and equipment sound power levels

As noted in **Section 3.2**, the noise sources associated with the proposed modification have been identified as a Dozer and a FEL operating to manage VENM and ENM. As these items of equipment are to be the same as those currently used at the Quarry, the sound power levels used in the modelling are based on the values given in the MOD 2 noise assessment, shown in **Table 4.1**.

Table 4.1 Dozer and FEL sound power levels

Plant Item	Sound Power Level L_w dB(A) re $10^{-12}W$
Volvo L180G Front End Loader (based on Volvo L150 dynamic)	105
Komatsu D375A Dozer (pushing sand)	110

4.1.2 Noise emitting source locations

The previous modelling for the MOD 2 noise assessment placed noise sources in the approved extraction area, the Infrastructure area and the haul/access roads. **Table 4.2** provides the activities modelled by the MOD 2 noise assessment.

Table 4.2 MOD 2 noise assessment scenarios and equipment

Scenario	Operating Equipment
Core Activities	1 Excavator at base of excavation 2 dump trucks continuously between face and processing area 1 FEL feeding processing plant managing stockpiles 1 Diesel Screen/Conveyers 1 Processing and Washing Plant/Conveyers 1 FEL loading haul trucks/managing stockpiles 3 Haul trucks in 15 minutes taking product off site
Dozer Extraction/Emplacement	Dozer at highest RL within extraction or emplacement area
Surface Extraction	1 Excavator (from base) repositioned at surface behind bund
Bund Construction	1 Excavator (from base) repositioned at surface building bund

The dozer extraction /emplacement scenarios considered activities in each of the extraction areas shown in **Figure 4.1**. For the purpose of the MOD 2 noise assessment, extraction operations were modelled in each of the identified extraction stages to ensure the worst-case noise levels were identified at each of the receivers surrounding the Quarry.

The dozer and FEL noise sources were located in the proposed MOD 4 VENM/ENM Placement and Profiling area, as shown in **Figure 4.2**. These locations reflect the fact that backfill and landform construction activities at the very north-eastern extent of the extraction area has been completed. These locations represent the most exposed locations of these noise sources to the nearest receivers.



Legend

- Quarry Site
- Approved Extraction Area
- Processing Plant and Product Stockpile
- Land Being Prepared for Rehabilitation
- Water Management
- Nursery
- Bundwalls (including topsoil)
- Extraction Sequence Stages
- Production Bores

Image Source: Neermag (2019) Data source: Umwelt (2019), NSW LPI DTDB/DCOB (2018)

FIGURE 4.1
Approved Extraction Area and Sequence

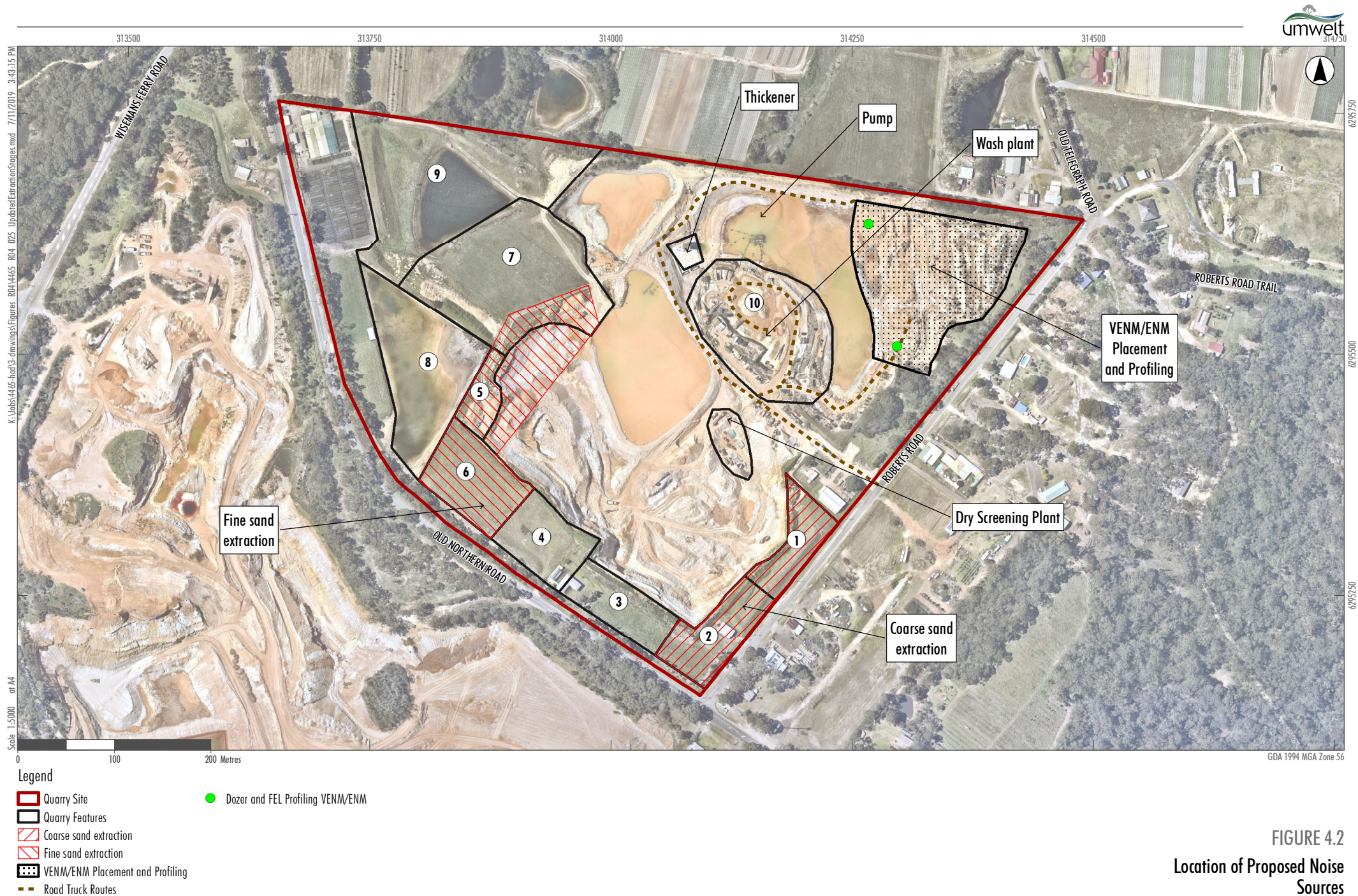


FIGURE 4.2
Location of Proposed Noise
Sources

4.2 Traffic noise sources

The current approved daily truck movements for the quarry is 100 total truck movements (50 laden trucks). The modification is seeking approval for up to 140 movements per day (70 laden trucks). Based on the expected distribution of 80% of trucks to/from the north, and 20% to/from the south, the maximum increase in the number of quarry trucks during the daytime period is:

- 8 trucks per day on Old Northern Road south of Roberts Road, and
- 32 trucks per day on Old Northern Road north of Roberts Road and Wisemans Ferry Road.

The posted speed limits at the locations where traffic volumes were previously measured (Nexus, 1999) and where traffic noise levels have been previously assessed are 90 km/hr on Old Northern Road and 80 km/hr on Wisemans Ferry Road. **Table 4.3** summarises the additional noise sources.

Table 4.3 Quarry truck traffic noise sources

Road	Speed km/h	Number of additional quarry trucks per day 7 am to 10 pm
Old Northern Road, south of Roberts Road	90	8
Old Northern Road, north of Roberts Road	90	32
Wisemans Ferry Road, south of Old Northern Road	80	32

Based on the methodology described in **Section 3.3**, the existing and proposed traffic volumes for Old Northern Road and Wisemans Ferry Road between 7.00 am to 10.00 pm are shown in **Table 4.4**. Traffic projections were based on the traffic volumes used in the EIS (Nexus Environmental Planning, 1999) and indexed by a growth rate of 2% as advised by traffic consultants SECA Solution (email: 30 May 2019).

Table 4.4 Estimated traffic volumes on Old Northern Road and Wisemans Ferry Road 7.00 am to 10.00 pm (Year 2020)

Road	Existing LV ¹	Existing HV ¹	Proposed Additional Quarry Trucks	Proposed Total HV
Old Northern Road (south of Roberts Road)	2096	208	8	216
Old Northern Road (north of Roberts Road)	2096	208	32	240
Wisemans Ferry Road	1806	205	32	237

Note 1: LV = Light Vehicles (Class 2 and below); HV = Heavy Vehicles (Class 3 and above)

5.0 Predicted Noise Levels

5.1 Operational noise

The predicted noise levels at receivers are presented in **Table 5.1**. These consider the worst-case noise levels predicted by WMPL (2015) (Case 1 operations), noise received as a result of the VENM/ENM management activities (FEL/Dozer operation) and combined noise predictions.

Table 5.1 Predicted noise levels at receivers LAeq,15 min dB(A)

Receiver		MOD 2 Assessment (Location of Typical activities) ¹	MOD 2 noise assessment ¹	Noise from FEL/Dozer ²	Combined noise
NIA ³	SEE ⁴				
A	RR03	1A	37	35	39
B	RR10	1A	42	39	44
		5A	43	39	44
C	RR02	6B	38	38	41
D	RR12	5A	40	39	43
F	RR01	6B	35	35	38
G	RR06	1A	38	32	39
H	RR08	1A	41	38	43

Note 1: Refer to Figure 4.1

Note 2: Refer to Figure 4.2

Note 3: Noise receivers identified in the MOD 2 noise assessment and this MOD4 noise impact assessment (refer **Table 2.1**)

Note 4: Noise receivers reference as identified in the SEE (refer **Table 2.1**)

5.2 Road traffic noise

The predicted change in road traffic noise LAeq(15 hour) due to the addition of 40 trucks between 7.00 am and 6.00 pm is shown in **Table 5.2**.

Table 5.2 Predicted increase in road traffic noise due to the proposed modification (Year 2020)

Road	Speed km/hr	Existing Total Traffic Volume 7.00 am-10.00 pm	Existing %HV	Proposed Total Traffic Volume 7.00 am-10.00 pm	Proposed %HV	Increase in noise level LAeq(15 hour) dB(A)
Old Northern Road (south of Roberts Road)	90	2304	9.0	2312	9.3	0.1
Old Northern Road (north of Roberts Road)	90	2304	9.0	2336	10.3	0.3
Wisemans Ferry Road	80	2011	10.2	2043	11.6	0.3

As shown in **Table 5.2** the maximum increase in LAeq(15 hour) road traffic noise levels is predicted to be 0.3 dB(A) due to the proposed modification.

6.0 Impact Assessment

6.1 Operational noise assessment

As shown in **Table 5.1**, the predicted noise levels from the proposed modification would comply with the noise limit of 43 dB(A) LAeq(15 minute) at all receivers, except for minor 1 dB(A) exceedances at Receiver B (Receiver RR10).

As previously noted in the MOD 2 noise assessment, the plant on site is considered to be modern and well maintained, and the site is already protected by acoustic bunds at the site perimeter.

However, as the noise predictions undertaken for the MOD 2 noise assessment and the noise predictions for the proposed modification shown in **Table 5.1** are based on worst-case site noise emissions, it is expected that compliance with noise limits will be achievable by adherence to the ongoing noise control strategies in the Quarry ORNMP (MAC, 2016). The most relevant of these, with modifications recommended to reflect the VENM and ENM management identified in underlined italics.

“... use overburden to establish perimeter bunds to shield mobile plant from surrounding receivers as much as possible. As works progress, plant work below the surface and hence noise attenuation is increased.

In addition to the above controls, ... implement temporary noise shielding such as temporary bunds when extraction or VENM and ENM placement and profiling occurs in close proximity to the property boundary of neighbouring receivers. Prior to constructing the bunds, consultation with the neighbouring residence is sought which provided clear lines of communication between the quarry and community.”

6.2 Road traffic noise assessment

As seen in **Table 5.2**, the predicted worst-case increase in road traffic noise due to the proposed maximum number of quarry trucks along Old Northern Road and Wisemans Ferry Road is below 2dB(A). This increase in road traffic noise complies with the RNP criteria for the increase in noise levels due to the proposed modification.

7.0 References

Hodgson Quarry Products Sand Extraction Roberts Road, Maroota - Operational Noise Assessment, Wilkinson Murray Report No. 14229-B, May 2015

Nexus Environmental Planning Pty Ltd, 1999. *Environmental Impact Statement Sand, Clay & Pebble Extraction, Lot 1 & 2 DP 228308, Lot 2, DP 312327 Maroota. Volume I – Text.*

ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation, International Organization for Standardization

Development Consent for DA-267-11-99 (as Modified 18 March 2016)

New South Wales Environmental Protection Licence 6535

New South Wales *Noise Policy for Industry*, Environmental Protection Authority, 2017

New South Wales *Road Noise Policy*, Department of Environment and Climate Change, 2011

Traffic impact assessment letter report, Seca Solution Project Reference P1340, 1 February 2019

Noise Monitoring Assessment, Muller Acoustic Consulting Report MAC160257PR1, 2 June 2016

Noise Monitoring Assessment, Muller Acoustic Consulting Report MAC160257RP1, 15 May 2017

Noise Monitoring Assessment, Muller Acoustic Consulting Report MAC160257RP3, 31 May 2018

Noise Monitoring Assessment, Muller Acoustic Consulting Report MAC160257RP4, 20 June 2019

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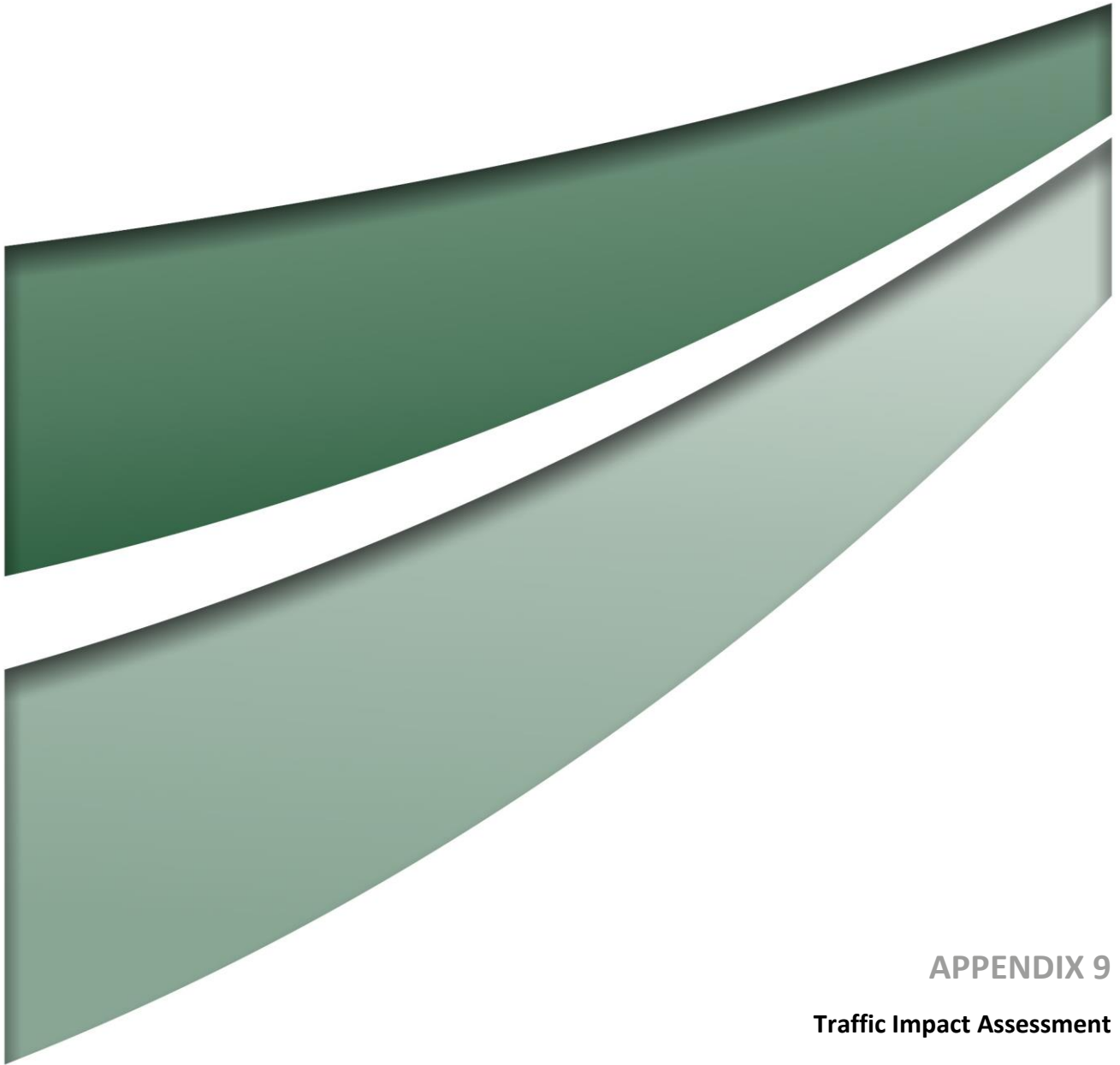
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APPENDIX 9

Traffic Impact Assessment

1 February 2019

P1340 Umwelt Roberts Road Quarry

Umwelt (Australia) Pty Ltd
75 York Street
Teralba NSW 2284

Attn: Alex Irwin

Dear Alex,

Proposed modification to Roberts Road Quarry, Maroota, NSW

Further to our recent correspondence, we have reviewed the previous traffic assessment completed by Lyle Marshall and Associates (May 2015) and have discussed the proposed modifications to consent for the existing Roberts Road Quarry to obtain an understanding of the project requirements. We have completed a site visit and collected traffic data via traffic surveys in the surrounding area to obtain the current traffic flows.

Hodgson Quarry Products Pty Ltd operates the Roberts Road Quarry, a sand extraction and processing operation, located at the corner of Roberts Road and Old Northern Road, Maroota. The quarry obtained original consent in 2000, with this being modified three times to accommodate change to the extraction process, sequence of extraction and to extend the life of the quarry.

The existing consent allows for operation until 2025 for the extraction and processing of up to 480,000 tonnes of quarry products per annum and up to 100 truck movements per day, with a maximum of 20 truck movements per hour. This proposal seeks to increase the truck movements to 140 per day, including 30-40 movements associated with the importation of Excavated Natural Material (ENM) and Virgin Excavated Natural Material (VENM), and extend the quarry life by 5 years to 2030. No change to the existing quarry hours of operation are proposed.

The following assessment has been undertaken to determine the traffic impacts of the proposed increase in daily truck movements. This assessment has taken into consideration the Austroads Guidelines and Section 2.3 of the RMS Guide to Traffic Generating Developments, which provides the structure for the reporting of key issues to be addressed when determining the impacts of traffic associated with a development.

Existing situation

The subject site is located at the corner of Roberts Road and Old Northern Road, Maroota incorporating Lots 1 and 2 DP228308 and Lot 2 DP 312327 (Figure 1). Access is available via a single vehicle access direct off Roberts Road. Roberts Road is a local rural road which provides access to the subject site, an additional quarry and several land holdings. Roberts Road intersects with Old Telegraph Road to the east, which provides access to further landholdings.

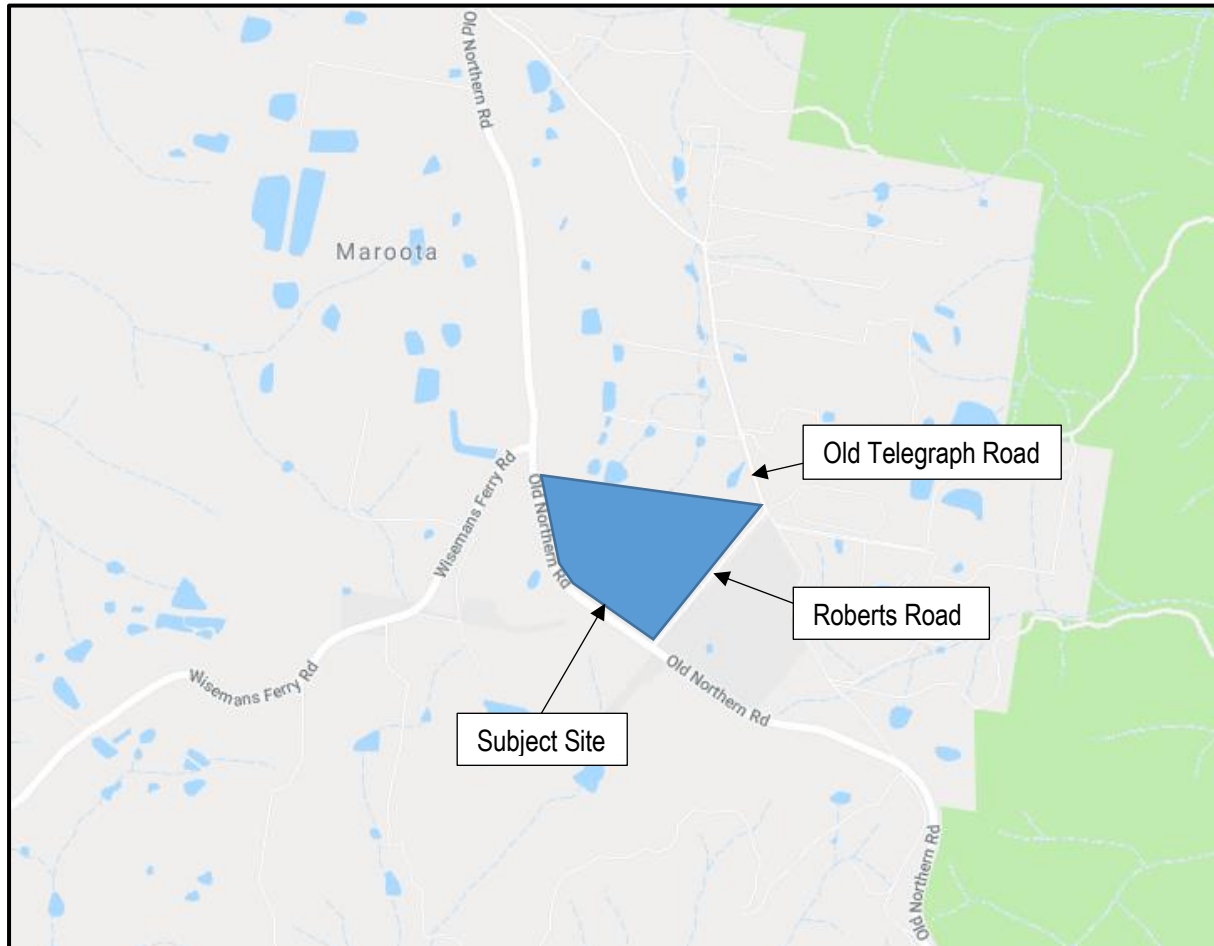


Figure 1 - Subject site in the context of the local road network

Access

There are no proposed changes to the existing access to the quarry. The site access is located on the northern side of Roberts Road, approximately 290 metres east of the intersection with Old Northern Road. Roberts Road in this location offers a straight horizontal alignment allowing for good visibility in each direction along its length. Sight distance to the right (south-west) is 290 metres with clear visibility to sight Old Northern Road as shown in Figure 2, whilst sight distance to the left (north-east) is 220 metres as shown in Figure 3.

Sight distance requirements for access driveways to commercial vehicle facilities are outlined in AS2890.2. For the speed limit of 60km/hr along Roberts Road a minimum sight distance of 83 metres is required (5 second gap), with 133 metres specified for an 8 second gap. As noted above sight distance in both directions out of the site access is well in excess of the required 83 metres and also satisfies the higher requirement. Therefore, the site access provides sight distance in accordance with AS2890.2.



Figure 2 - Visibility to the right (south-west) out of the existing site access



Figure 3 - Visibility to the left (north-east) out of the existing site access

The intersection of Old Northern Road and Roberts Road has also been assessed. Sight distance requirements at intersections are outlined in the Austroads Guide to Road Design Part 4A, with safe intersection sight distance (SISD) being the critical requirement. For the posted speed limit of 90km/hr along Old Northern Road a SISD of 214 metres is required.

Sight distances were measured on site, with visibility to the left out of Roberts Road being 300 metres, whilst visibility to the right is 278 metres. As such, the intersection satisfies Austroads requirements in regard to sight distance. The layout of this intersection also includes a channelised right turn lane for turning movements into Roberts Road, which has a storage length of approximately 35 metres with approximately 20 metres of additional storage available within the painted median. This allows storage for at least two quarry trucks with through traffic still able to pass along Old Northern Road. Given the relatively low traffic flows and minimal delays for turning movements observed during the site work this turn lane has sufficient capacity.

Traffic Flows

As part of the project work Seca Solution completed a traffic survey at the intersection of Old Northern Road and Roberts Road to determine the current peak hour traffic flows in this location. This survey was completed on the 4th December 2018 between 7am to 9am, with the peak hour determined as 7:15am to 8:15am. The distribution of traffic during the morning peak hour is shown in Figure 4 following, with the raw survey data provided in **Attachment A**.

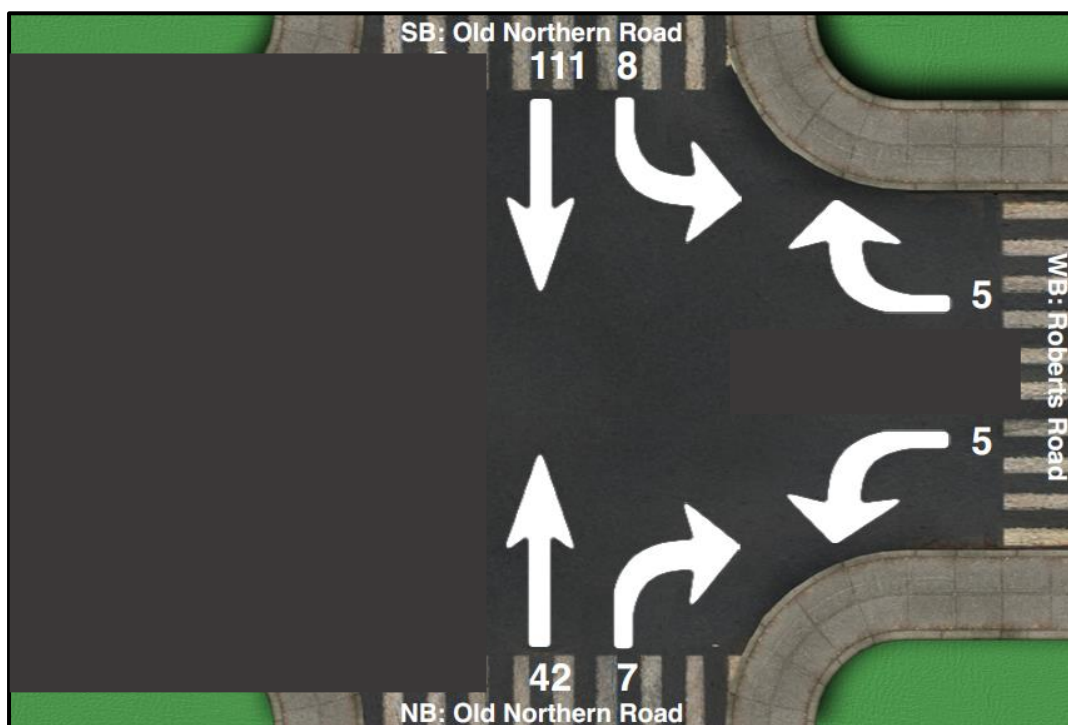


Figure 4 - Morning peak hour flows at the intersection of Old Northern Road / Roberts Road

- The two-way movements along Roberts Road during the intersection AM peak hour were 25 vehicles.
- The two-way flows along Old Northern Road (to the north of Roberts Road) were 166 vehicles.

The RMS Guide to Traffic Generating Developments states peak hourly flows typically represent 8-12% of daily flows. Based on the average of 10% the daily flows on Old Northern Road would be in the order of 1,660 vehicles per day whilst Roberts Road would be in the order of 250 vehicles per day.

Current Road Network Operation

Heavy vehicles represent 18% (32 vehicles) of the total flows recorded through the intersection. It is noted that the truck movements associated with the quarry operations were observed and noted as part of this survey.

The intersection of Old Northern Road and Roberts Road was modelled using Sidra Intersection 8, with the results outlined in Table 1.

Table 1 – 2018 AM Sidra results for the intersection of Old Northern Road/Roberts Road

Movement	Level of Service	Average Delay (seconds)	Back of Queue (m)
Right turn into Roberts Road	A	5.9	0.1
Left turn out of Roberts Road	A	6.2	0.4
Right turn out of Roberts Road	A	7.3	0.4
Left turn into Roberts Road	A	6.2	0.0

It can be seen from the above that the intersection currently operates well, operating at LoS A with minimal delays for all turning movements. The Sidra outputs are provided in **Attachment B**.

Proposed Development

Site operations

The subject site has an approved haulage rate of 100 trucks per day (50 laden/50 unladen), which allows for inbound and outbound truck movements with the daily total two-way flows not to exceed 100 per day. The project seeks to increase the daily approval to 140 trucks per day, with no increase proposed for the existing hourly maximum of 20 trucks per hour. Instead the project shall see the additional heavy vehicle movements spread over the course of the day during periods of high demand.

All truck access will remain via the existing site access direct onto Roberts Road, with the existing distribution onto Old Northern Road to be maintained.

- 80% to/from the north, turning right onto Old Northern Road and the reverse left turn in.
- 20% to/from the south, being left turns onto Old Northern Road and right turns in.

Quarry generated truck movements for the site currently have significant hourly and day to day variation, depending on market demands. During the survey the quarry was not operating at its highest capacity of 20 vehicles per hour. To assess the operation of the Old Northern Road/Roberts Road intersection for the Quarry operating at its maximum approval (up to 20 truck movements) during the peak hour, an allowance for an additional 10 inbound and 10 outbound trucks has been made (per the distributions outlined above). This is on top of the truck flows already recorded during the traffic survey which accounted for the movements of trucks associated with the quarry operating on that day but also included other background traffic. As such this assessment provides a robust assessment of the intersection.

As the increase in daily movements does not increase the hourly trucks the above was modelled using Sidra with the results outlined in Table 2.

Table 2 – 2018 AM Sidra results for the intersection of Old Northern Road/Roberts Road with maximum quarry trucks per hour

Movement	Level of Service	Average Delay (seconds)	Back of Queue (m)
Right turn into Roberts Road	A	6.3	0.2
Left turn out of Roberts Road	A	6.6	1.2
Right turn out of Roberts Road	A	8.4	1.2
Left turn into Roberts Road	A	6.4	0.0

It can be seen from the above that the intersection will continue to operate at the highest LoS allowing for the maximum hourly truck movements for the site. The Sidra outputs are provided in **Attachment B**.

Impact of operations to 2030

As well as the increase to daily movements, the quarry operations are seeking to operate for 5 years beyond the approval life of the existing consent, which is 2025.

To allow for assessment of the potential daily traffic flows in 2030, an annual increase of 2.0% per annum has been applied for through movements along Old Northern Road. This rate accounts for increased flows associated with the growth of other quarry operations in the area. Along Roberts Road an allowance for growth of 1% per annum has been applied to cater for other quarry operations, including the quarry located on Old Telegraph Road off Roberts Road, which recently began operation. The above growth rates were applied to the intersection flows through to 2030 with the results outlined in Table 3.

Table 3 – 2030 AM Sidra results for the intersection of Old Northern Road/Roberts Road with maximum quarry trucks per hour

Movement	Level of Service	Average Delay (seconds)	Back of Queue (m)
Right turn into Roberts Road	A	6.4	0.3
Left turn out of Roberts Road	A	6.7	1.4
Right turn out of Roberts Road	A	9.0	1.4
Left turn into Roberts Road	A	6.4	0.0

It can be seen from the above that the intersection will continue to operate at the highest LoS allowing for the maximum hourly truck movements and background growth through to 2030. The Sidra outputs are provided in **Attachment B**.

Impact on Daily Traffic flows

Based on the traffic survey completed, the current two-way daily traffic flows along Old Northern Road (to the north of Roberts Road) are in the order of 1,660 vpd. It is known that the quarry was operating on this day with some of these movements therefore relating to the existing quarry operations. In order to ensure a worst case assessment of the impact on daily traffic flows, an allowance for an additional 140 vpd associated with the quarry has been allowed for on top of the surveyed flows, therefore assuming the recorded flows accounted for no quarry traffic.

Based on the 80/20 (north/south) distribution of quarry traffic to the north/south there shall be:

- 112 vehicles to/from the north along Old Northern Road
- 28 vehicles to/from the south along Old Northern Road

The above shall see daily flows shall increase from 1,660 to 1,772 vpd along Old Northern Road to the north of Roberts Road. This represents an increase of 32 vpd of the current 1,740 in this direction for the existing approval of 100 trucks per day (80 vehicles northbound / 20 vehicles southbound). This increase is less than 2% and well within the capacity of the road network.

Allowing for the background growth to 2030 flows on Old Northern Road (north of Roberts Road) could be in the order of 2,200 including the quarry expansion associated with the subject site. This is still well within the capacity of the road.

Impact on Road Safety

It is noted that there is an existing school bus stop along Roberts Road. During the morning survey two buses were observed with one at approximately 7:15am and the other at 8:30am. Both turned left in and left out of the intersection of Old Northern Road and Roberts Road.

Given the low traffic flows along Roberts Road and the good visibility for Quarry trucks, it is considered the proposed increase in daily truck movements will not impact upon the operation of these buses. The hourly approval for the site will not change and as such the existing situation will remain with no identifiable safety issues for the current Roberts Road and quarry access layout. Similarly as there is no proposed change to hourly operations there shall be no impact on school bus operations.

Conclusion

The development traffic will remain consistent with its current hourly level with daily capacity increasing by an additional 40 truck movements per day.

It can thus be seen that the impact of the trucks in the future design year of 2030 is acceptable with the intersection of Roberts Road and Old Northern Road continuing to operate at a high level of service (LoS A).

Overall it is concluded that the on-going use of the site as a quarry operation with 140 truck movements per day and 20 truck movements per hour, can continue to occur in a safe and appropriate manner with an acceptable impact upon the local road network to the future design year of 2030.

Please feel free to contact me on 4032 7979, should you have any queries.

Yours sincerely



Sean Morgan

Director

Attachment A

Turn Count Summary

Location: Old Northern Road at Roberts Road , Maroota

GPS Coordinates: Lat=-33.467309, Lon=150.999862

Date: 2018-12-04

Day of week: Tuesday

Weather:

Analyst: SL

Total vehicle traffic

Interval starts	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
06:52	2	12	0	0	0	1	0	3	0	0	0	0	18
07:00	1	21	0	2	0	2	0	6	1	0	0	0	33
07:15	0	37	0	2	0	0	0	14	1	0	0	0	54
07:30	1	23	0	3	0	1	0	9	1	0	0	0	38
07:45	3	21	0	0	0	2	0	13	2	0	0	0	41
08:00	4	30	0	0	0	2	0	6	3	0	0	0	45
08:15	4	21	0	1	0	1	0	8	0	0	0	0	35
08:30	3	26	0	5	0	4	0	6	4	0	0	0	48
08:45	1	21	0	0	0	4	0	7	1	0	0	0	34
09:00	3	24	0	3	0	1	0	10	0	0	0	0	41
09:15	0	10	0	0	0	1	0	8	0	0	0	0	19
09:30	1	17	0	0	0	1	0	16	0	0	0	0	35
09:45	2	10	0	0	0	2	0	14	6	0	0	0	34

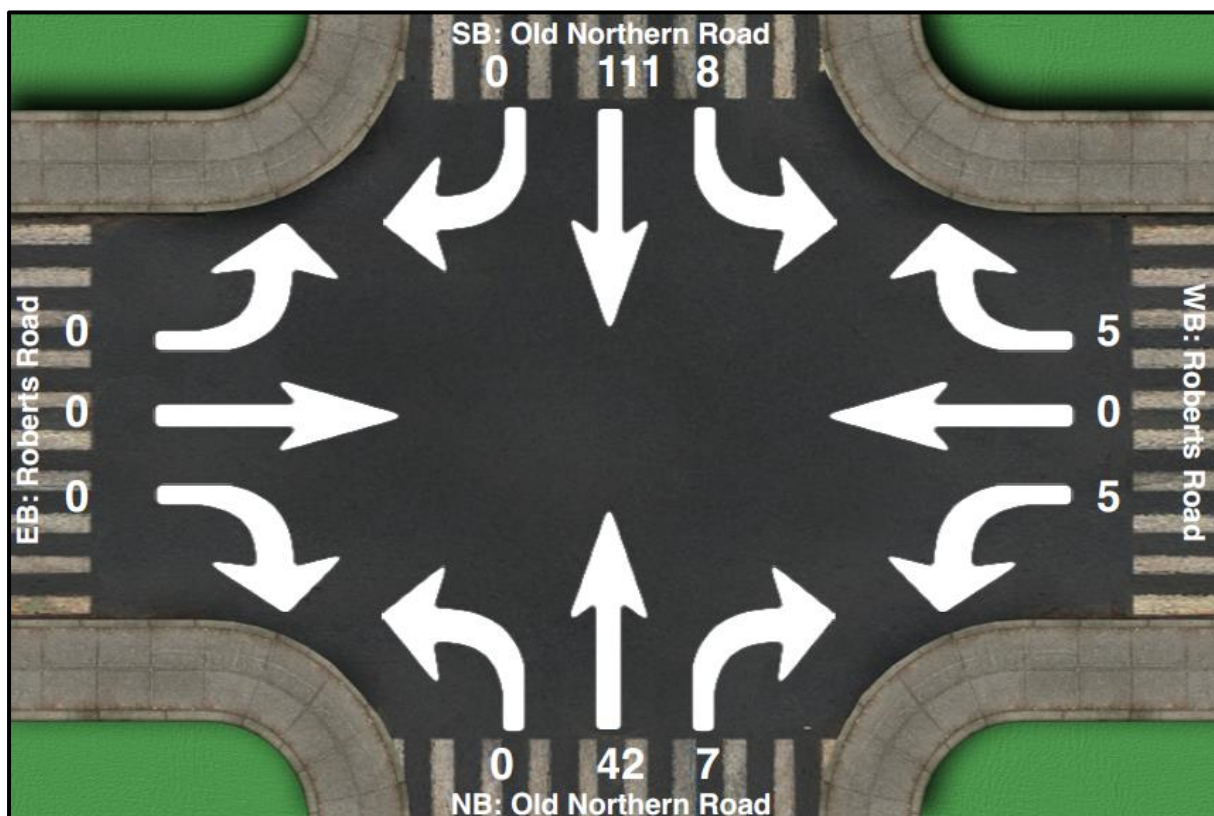
Intersection Peak Hour

07:15 - 08:15

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	8	111	0	5	0	5	0	42	7	0	0	0	178
Factor	0.50	0.75	0.00	0.42	0.00	0.62	0.00	0.75	0.58	0.00	0.00	0.00	0.82
Approach Factor	0.80			0.62			0.82			0.00			

Peak Hour Vehicle Summary

Vehicle	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Car	4	99	0	4	0	3	0	29	7	0	0	0	146
Truck	4	12	0	1	0	2	0	13	0	0	0	0	32



Sidra Outputs

MOVEMENT SUMMARY

▽ Site: 101 [2018 AM Existing]

Old Northern Road / Roberts Road
 Site Category: (None)
 Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
2	T1	44	31.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	7	0.0	0.005	5.9	LOS A	0.0	0.1	0.23	0.53	0.23	54.2
Approach		52	26.5	0.027	0.8	NA	0.0	0.1	0.03	0.08	0.03	59.3
East: Roberts Road												
4	L2	5	20.0	0.011	6.2	LOS A	0.0	0.4	0.27	0.55	0.27	53.6
6	R2	5	40.0	0.011	7.3	LOS A	0.0	0.4	0.27	0.55	0.27	51.9
Approach		11	30.0	0.011	6.7	LOS A	0.0	0.4	0.27	0.55	0.27	52.8
North: Old Northern Road												
7	L2	8	50.0	0.070	6.1	LOS A	0.0	0.0	0.00	0.04	0.00	52.2
8	T1	117	10.8	0.070	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.9
Approach		125	13.4	0.070	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.5
All Vehicles		187	18.0	0.070	0.9	NA	0.0	0.4	0.02	0.08	0.02	59.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [2018 AM Max truck movements]

Old Site: Northern Road Category: / Roberts Road (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
2	T1	44	31.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	9	22.2	0.007	6.3	LOS A	0.0	0.2	0.26	0.53	0.26	51.7
Approach		54	29.4	0.027	1.1	NA	0.0	0.2	0.05	0.09	0.05	58.8
East: Roberts Road												
4	L2	7	42.9	0.028	6.6	LOS A	0.1	1.2	0.32	0.57	0.32	52.6
6	R2	14	76.9	0.028	8.4	LOS A	0.1	1.2	0.32	0.57	0.32	50.3
Approach		21	65.0	0.028	7.8	LOS A	0.1	1.2	0.32	0.57	0.32	51.1
North: Old Northern Road												
7	L2	17	75.0	0.078	6.4	LOS A	0.0	0.0	0.00	0.07	0.00	49.5
8	T1	117	10.8	0.078	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.9
Approach		134	18.9	0.078	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles		208	26.3	0.078	1.6	NA	0.1	1.2	0.04	0.13	0.04	58.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: 101 [2030 AM with Max truck movements]**

Old Site: Northern Road / Roberts Road (None)
 Giveway: / Category: Yield (Two-Way)
 Design Life Analysis (Final Year): Results for 12 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Old Northern Road												
2	T1	55	31.0	0.034	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	11	22.2	0.008	6.4	LOS A	0.0	0.3	0.29	0.54	0.29	51.7
Approach		65	29.5	0.034	1.0	NA	0.0	0.3	0.05	0.09	0.05	58.9
East: Roberts Road												
4	L2	8	42.9	0.033	6.7	LOS A	0.1	1.4	0.36	0.59	0.36	52.3
6	R2	15	76.9	0.033	9.0	LOS A	0.1	1.4	0.36	0.59	0.36	50.0
Approach		24	65.0	0.033	8.2	LOS A	0.1	1.4	0.36	0.59	0.36	50.9
North: Old Northern Road												
7	L2	19	75.0	0.095	6.4	LOS A	0.0	0.0	0.00	0.07	0.00	49.5
8	T1	145	10.8	0.095	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.9
Approach		164	18.2	0.095	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles		253	25.5	0.095	1.5	NA	0.1	1.4	0.05	0.12	0.05	58.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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