Section 2
Description of the Project

Preamble

This section outlines the objectives and plans for the proposed development and operation of the Karuah South Quarry. The hard rock resource is described and the proposed extraction operation, its sequence and processing activities are outlined together with the planned product transportation. This section also describes the Project with respect to hours of operation, infrastructure and services, Site security, waste management and rehabilitation.

The Project is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of the activities proposed, how the various activities would be undertaken and to enable an assessment of the potential impacts of the Project on the surrounding environment.

Details of the safeguards and mitigation measures that the Operator would implement to protect and manage traffic, noise, groundwater, surface water, flora, fauna, air quality, visibility, Aboriginal cultural heritage, soils and other components of the local environment are presented in Section 5 of this document.

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2.1 INTRODUCTION

2.1.1 Objectives

The objectives in developing and operating the Karuah South Quarry are to:

1. secure access to a long-term hard rock resource that would provide a range of aggregates, pavement products and manufactured sand for use in the Hunter and Greater Sydney Regions;
2. produce up to 600 000 tonnes per annum (tpa) of aggregates, pavement products and manufactured sand to meet the increasing supply demands of these markets over the next 25 years;
3. maximise resource recovery within the defined extraction area;
4. undertake activities in an environmentally responsible manner to meet all relevant criteria and satisfy reasonable community expectations;
5. ensure its contribution to the cumulative impact of the quarries in the Karuah area is proportionate to the overall impacts of all quarries;
6. increase local employment levels; and
7. operate in a cost-efficient manner.

2.1.2 Overview of the Project

The proposed extraction area, as shown on **Figure 2.1**, has been defined based upon the occurrence of the underlying hard rock resource. An estimated 10 million tonnes of fresh rock and 1.25 million tonnes of weathered rock have been identified within the proposed extraction area.

The Project would utilise conventional drill and blast, load and haul and processing methods to produce up to 600 000tpa of quarry products. These products would include aggregates, pavement products, manufactured sand and select fill. Extraction would be undertaken in a staged manner, i.e. over two stages with each stage comprising three sub-stages. Production during the initial stages of extraction would be lower with production gradually ramped up in the years following site establishment. It is expected that extraction would continue for a period of approximately 25 years following Project commencement.

It is noted that both extraction and processing operations have been designed to optimise the recovery of resource whilst satisfying environmental and Site constraints.

Figure 2.1 displays the following principal components of the Project.

- Extraction Area - Stage 1
  The Stage 1 extraction area would cover approximately 4.9ha with its footprint typically between approximately 30m AHD and 75m AHD (to a floor with an elevation of 8m AHD).

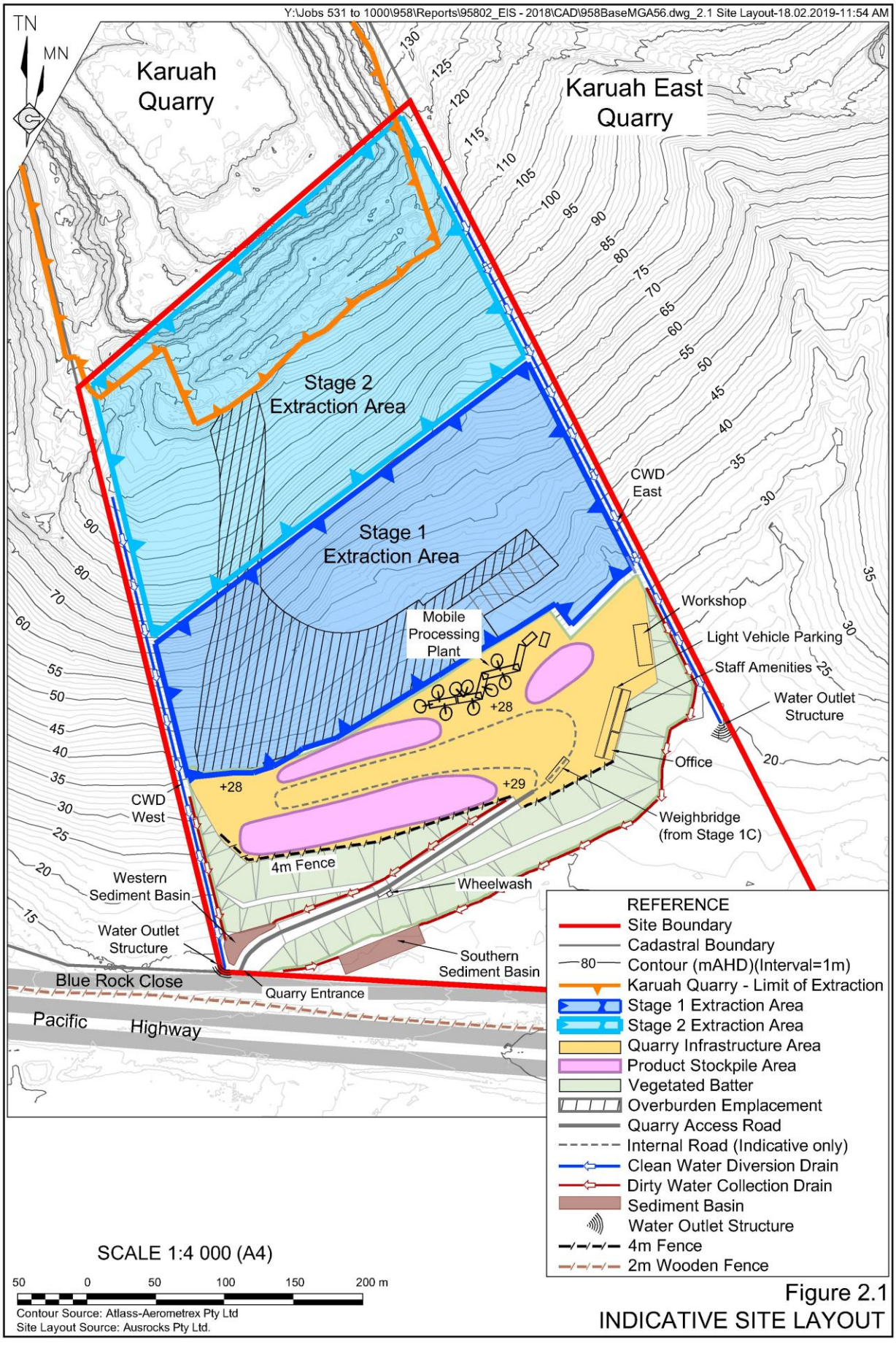


Figure 2.1
INDICATIVE SITE LAYOUT

- Extraction Area - Stage 2
  The Stage 2 extraction area would cover approximately 5.9ha with its footprint typically between 75m AHD and 120m AHD (to a sloping floor from an elevation of 8m to 12m AHD).

- Quarry Infrastructure Area
  The Quarry infrastructure area would be located on the southern side of the extraction area and would incorporate the product stockpiling area, mobile processing plant and ancillary components area.

- Product Stockpiling Area
  The product stockpiling area would be located within the Quarry infrastructure area and would be extended throughout the life of the Quarry onto areas backfilled with overburden (see **Figure 2.1**).

- Mobile Processing Plant
  The mobile processing plant would incorporate a range of crushers and screens and would be located on the western section of the quarry infrastructure area during Stage 1. During Stage 2 (see **Figure 2.1**), the mobile processing plant would be relocated to the eastern section of the Quarry infrastructure area to minimise product haulage distances.

- Internal Roads
  A network of roads to provide access for off-road haul trucks between the extraction and processing area.

- Quarry Access Road
  The inclined, sealed section of road extending from the Quarry entrance to the southern side of the Quarry infrastructure area.

- Sediment Basins
  Two sediment basins (Western and Southern), each with a with pre-treatment pond, would be constructed to collect sediment-laden runoff from the disturbed sections of the Quarry. The western sediment basin would be located at the southwestern toe of the Quarry infrastructure area pad, north of the Quarry access road, whilst the southern sediment basin would be situated along the southern toe of the Quarry infrastructure area pad / Quarry access road. Perimeter drains along the toe of the Quarry infrastructure area pad would collect runoff from the batter slopes of the pad and direct it to either of these sediment basins.

- Diversion Drains
  Two clean water diversion (CWD) drains (CWD East and CWD West) would be constructed to direct runoff from undisturbed areas upslope of the extraction area. Bunding and/or contour drains would intercept runoff from the upslope undisturbed catchments, preventing it from entering the extraction area and directing this runoff to either of the clean water diversion drains which in turn would flow towards Yalimbah Creek.

The overall footprint of the operation would be kept as small as possible during all stages of operation, with vegetation and soil removed immediately prior to the progressive extension of operations. Progressive rehabilitation would be undertaken as soon as practicable following disturbance.

Quarry products would be despatched by road using the existing road network with access to the Site via a new entrance to Lot 11 DP 1024564 from Blue Rock Close. The location of the Quarry entrance would be close to the existing entrance to the property and would be constructed to accommodate with quad-dog trailers and semi-trailers.

The following subsections present further information about the Project from site establishment and construction through to closure.

2.1.3 Approvals Required

Based upon the current design of the Project and understanding of the relevant environmental issues, the Project would require the following approvals to proceed.

- Development Consent from the Minister for Planning, his or her delegate, or the Independent Planning Commission as the Project has been classified as a "State Significant Development" under Schedule 1 (7(a)) of the *State Environmental Planning Policy (State and Regional Development) 2011*.
- An Environment Protection Licence from the Environment Protection Authority, under Section 47 of the *Protection of the Environment Operations Act 1997* for land-based extractive activities.

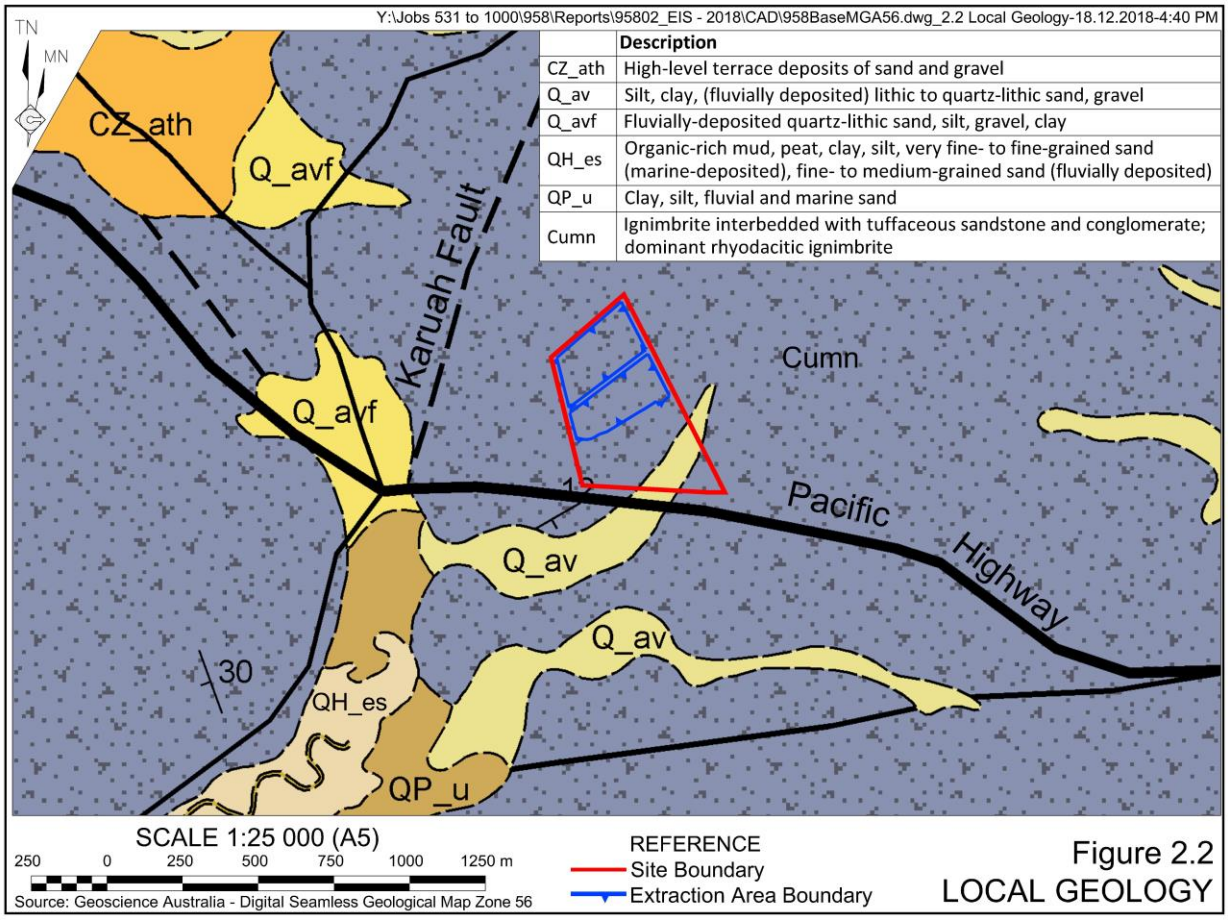
A water access licence may be required from the Department of Industry – Crown Lands and Water under the *Water Management Act 2000* to account for the small quantities of groundwater that may flow into the extraction during hard rock extraction. The need for this licence would be established during the life of the Quarry.

It is noted that an approval from the Commonwealth Minister for the Environment will not be required under the *Environment Protection and Biodiversity Conservation Act 1999.*

2.2 GEOLOGY AND RESOURCE ASSESSMENT

2.2.1 Regional Setting

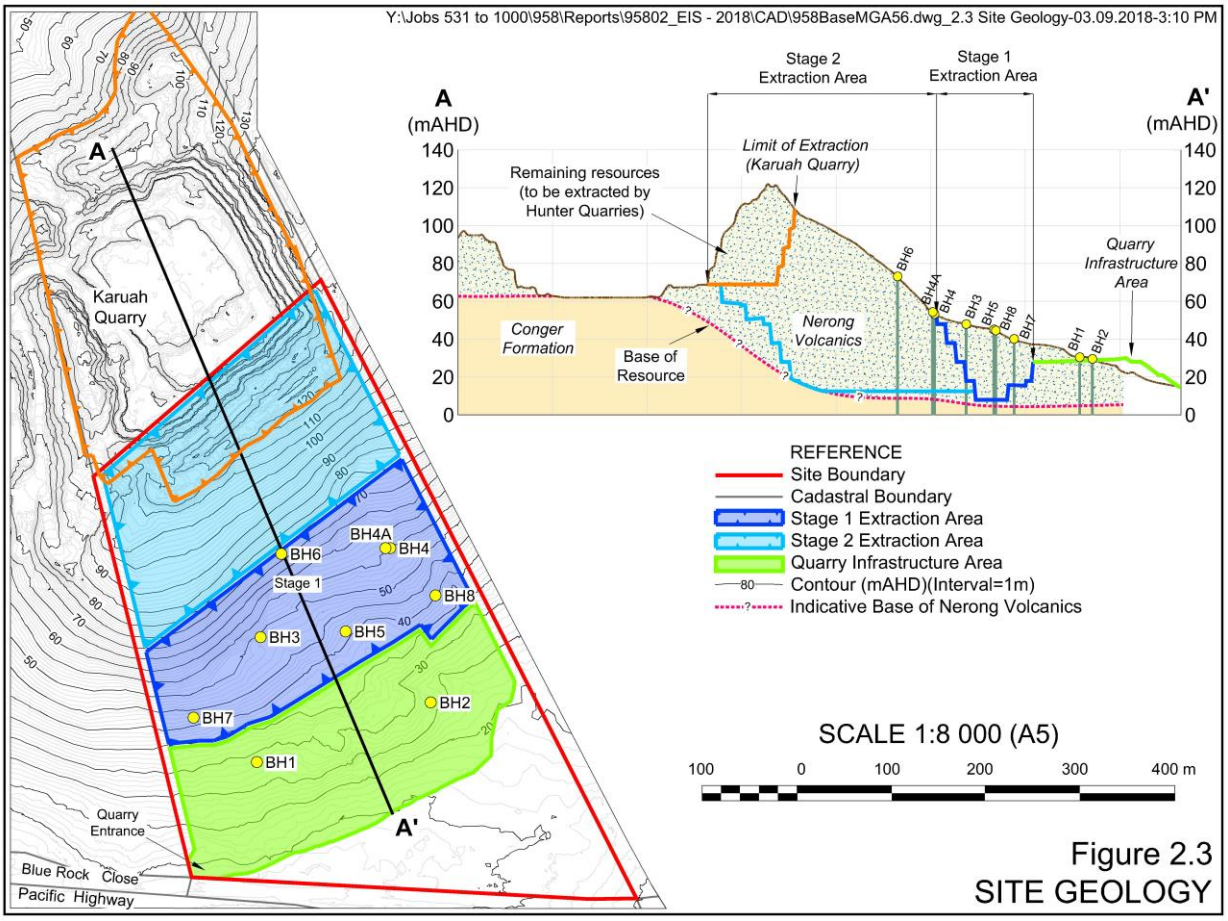
The Site is underlain by a sequence of volcanics and interbedded tuffaceous and clastic sedimentary rocks deposited during the Carboniferous Period (approximately 360 to 300 million years ago). The principal geological unit outcropping in the Karuah district is the Nerong Volcanics which is primarily comprised of rhyodacitic ignimbrite. Throughout this document, the rock type is referred to as "rhyodacite". The Nerong Volcanics are located in the Myall Structural Block which is a subdivision of the Tamworth Belt which in turn forms part of the southern New England Fold Belt. The Nerong Volcanics are disconformably overlain by the Karuah Formation and the Booti Booti Sandstone and conformably overlies the Conger Formation and the Boolambayte Formation. The stratigraphic sequence beneath the Site dips at various gradients to the south-southeast. The local geology is shown in **Figure 2.2**.



The Nerong Volcanics are extracted in the adjoining quarries to produce a range of aggregates and other construction materials. In the local area, the Nerong Volcanics occur in a broadly tabular shape which is consistent with its mode of formation, i.e. a really extensive, blanket-type ignimbrite-style eruption emanating from a nearby volcano or volcanoes. The relative homogeneity of the unit in the Karuah district supports its consideration as a regionally significant resource.

2.2.2 Site Geology

Based on the results of the resource drilling commissioned by the Applicant, the occurrence of the Nerong Volcanics in the Karuah Quarry and additional drilling conducted adjacent to the Site by Hunter Quarries Pty Ltd, a minimum 42m thickness of rhyodacite is present within the proposed extraction area. **Figure 2.3** displays the locations of the nine drill holes drilled to date which have been concentrated on the southern side of the Site as reliance has been placed upon the mapping of the exposures of the Nerong Volcanics in the Karuah Quarry to complete the depiction of the base of the Nerong Volcanics within the Site. It is noted from the north-south cross-section on **Figure 2.3** that the base of the Nerong Volcanics within the Karuah Quarry dips gradually to the south, however, then dips more steeply to the south beneath the northern section of the proposed Karuah South Quarry. Hence, the base of the resource is displayed as indicative on **Figure 2.3**.



The top 1m to 5m of this resource typically consists of highly weathered rock with the rock quality progressively improving with depth. The unweathered or fresh rhyodacite is typically massive and dark grey in colour (see **Plate 2.1**). Interbeds of sandstone, conglomerate and volcaniclastic (tuffaceous) siltstone between 3m to 5m in thickness have also been reported in the adjacent quarry operation, although no interbeds were intersected during resource drilling within the Site (Coffey Geotechnics, 2012). None of the weathered materials that would be retained on site are contaminated.

2.2.3 Resource Assessment

A resource assessment was undertaken by Ausrocks Pty Ltd in conjunction with Larry Cook Consulting Pty Ltd in February 2018 using historic data collected from the Site and data obtained during a site visit and further drilling undertaken in late 2017. The resource assessment relied upon drilling data obtained from nine drill holes drilled over a number of campaigns within the Site as well as observations at the adjacent Karuah Quarry. The resource was modelled using Surpac Software assuming standard pit design parameters (see Section 2.5). The quantities of resources that have been assessed as recoverable by extraction within the Site as at February 2018 are summarised in **Table 2.1**. It is noted that a proportion of the resource within Stage 2 overlays the southern part of the Karuah Quarry. It is understood that Hunter Quarries intends to extract a proportion of the area displayed as Stage 2 although the extent of material removed prior to the cessation of their extraction in 2023 is unknown. Whatever resource remains once Hunter Quarries is no longer operating on Lot 11 DP 1024564 would be extracted as part of Stage 2 of the Karuah South Quarry.

Plate 2.1 Drill Core displaying the dark natural colour of the rhyodacite within the Site (Ref: E958A_016)

Table 2.1
Estimated Resources within the Site

Stage/Phase	Fresh Rock (t)	Weathered Rock (t)	Overburden		Total (t)
			(t)	(m^3) *	
Stage 1A	118 000	263 000	197 000	90 000	**578 000**
Stage 1B	615 000	136 000	102 000	46 000	**853 000**
Stage 1C	490 000	99 000	74 000	33 000	**663 000**
Stage 1 Sub-Total	**1 223 000**	**498 000**	**373 000**	**169 000**	**2 094 000**
Stage 2A	1 580 000	254 000	190 000	87 000	**2 024 000**
Stage 2B	3 630 000	347 000	261 000	118 000	**4 238 000**
Stage 2C	3 707 000	157 000	117 000	53 000	**3 981 000**
Stage 2 Sub-Total	**8 917 000**	**758 000**	**568 000**	**258 000**	**10 243 000**
Total	**10 140 000**	**1 256 000**	**941 000**	**427 000**	**12 337 300**

* Densities have been based on 2.6 t/m^3 for fresh rock, 2.4 t/m^3 for weathered rock and 2.2 t/m^3 for overburden.

Source: Ausrocks Pty Ltd and Larry Cook Consulting Pty Ltd – Table 5.1

2.3 SITE LAYOUT AND DESIGN

2.3.1 Introduction

It is proposed that the Project would be developed in two stages.

Stage 1: would involve a site establishment and construction stage and the initial period of extraction and processing of the resource on the southern side of the Karuah South Quarry.

Stage 2: would involve the extraction of the remnant pillar of rock between the Stage 1 extraction area of the Karuah South Quarry and the southern limit of the floor of the Karuah Quarry[1].

2.3.2 Stage 1

The main components within Stage 1 are discussed below.

1. Extraction Area (4.9ha)
   The extraction area would be centred on the hard-rock resource defined through the resource assessment – see Section 2.5.2.1 for details of the design of the Stage 1 extraction area.

2. Internal Roads
   The internal haul roads would provide access for off-road haul trucks between the extraction area and processing area. The off-road haul trucks and road registered traffic would be kept in separate areas as much as possible to avoid interaction from the haul trucks transporting raw feed to the processing plant.

3. Quarry Access Road
   The Quarry access road would extend from the Quarry entrance to the southern boundary of the Quarry infrastructure area. The Quarry access road would be sealed prior to any products being transported from the Site and provide access to the Site for light and heavy road registered vehicles.

4. Mobile Processing Plant (0.5ha)
   The processing plant and related infrastructure would be located immediately south of the extraction area and comprise of mobile primary, secondary and tertiary crushers and screens. Section 2.6 provides details of the proposed processing operations.

5. Product Stockpiling Area (0.7ha)
   Products would be stockpiled principally on the northern section of the Quarry infrastructure area prior to despatch.

6. Ancillary Components Area (0.3ha)
   This area would be located at the southeastern corner of the Quarry infrastructure area and incorporate the quarry office, weighbridge (from Stage 1C onwards), workshop, staff amenities, and light vehicle parking.

[1] A small barrier of rock would remain between the Karuah Quarry and the Karuah South Quarry to enable the retention of the rehabilitated extraction floor within the Karuah Quarry (see Section 2.13)

Discussion regarding the environmental factors that were considered during the design of the Project are presented in Section 7.2.1.

2.3.3 Stage 2

By the commencement of Stage 2, the layout of the Quarry infrastructure area, including the processing and stockpiling areas, would be reconfigured to minimise haulage distances. This reconfiguration would involve the relocation of the mobile processing plant to the eastern section of the Quarry infrastructure area and an extension of product stockpiling areas within the northern and western sections of the Quarry infrastructure area.

2.4 SITE ESTABLISHMENT AND CONSTRUCTION STAGE

2.4.1 Introduction

During the first six months following Project commencement, a range of site establishment and construction activities would be undertaken within the Quarry infrastructure area to enable processing and product despatch to commence. The principal activities to be undertaken during this stage would be as follows. Details of each activity are provided in Section 2.4.2. **Figure 2.4** displays the locations of each of the component activities.

1. The marking out of all component areas to be disturbed during the site establishment and construction stage.
2. Removal of all stored materials and equipment on site not required for the proposed quarry operations.
3. Establishment of a temporary office and amenities within the existing large shed on site.
4. Construction of sediment basins and associated drainage infrastructure.
5. Progressive vegetation clearing and timber removal as well as the removal of soil and loose bush rock within the approved areas for the Quarry access road and Quarry infrastructure area, internal roads and the Stage 1A extraction area. Topsoil would be stockpiled in close proximity to the batters on the southern side of the Quarry infrastructure area.
6. Construction of an interim Quarry entrance and Quarry access road from Blue Rock Close, initially provided with an unsealed gravelled surface.
7. Removal of the existing smaller shed on site and related structures.
8. Construction of the eastern section of the Quarry infrastructure area pad for the Site offices and amenities, workshop and light vehicle car park. The larger existing shed would be retained on site during the site establishment and construction stage given it is currently located at an elevation comparable to the elevation of the Quarry infrastructure area.

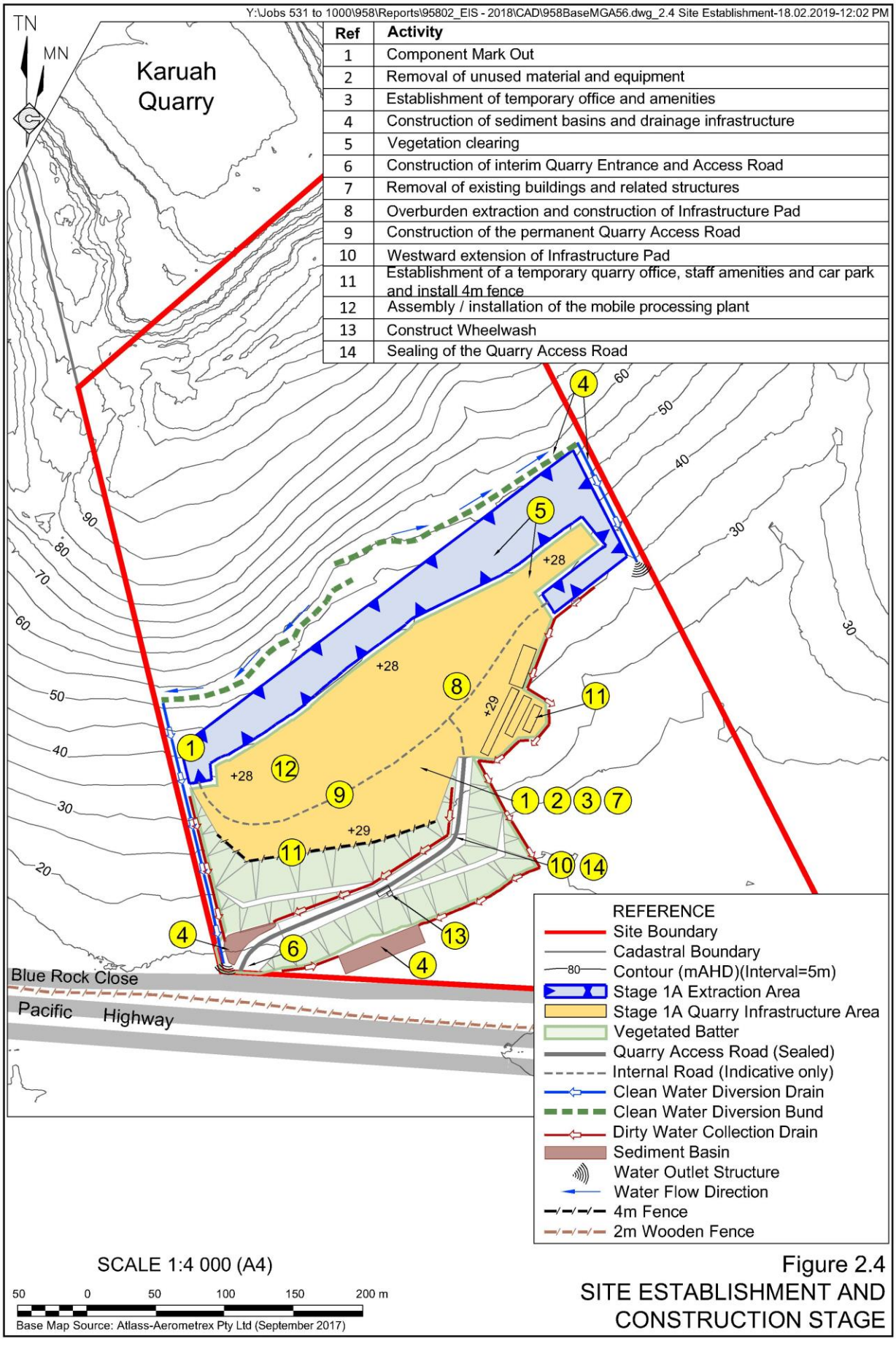


Figure 2.4
SITE ESTABLISHMENT AND CONSTRUCTION STAGE

9. Construction of the westward extension of the Quarry infrastructure area pad for the processing and product stockpiling areas using overburden from Stage 1A of the extraction area. This is to be built to an elevation of approximately 28m AHD to 29m AHD depending on the quantity of overburden available. A small drain would be excavated from the pad area to ensure the stormwater ultimately flows into the sump within the extraction area.
10. Construction of the permanent Quarry access road.
11. Construction/placement of the temporary quarry office, staff amenities, workshop and light vehicle parking and re-connection of existing electricity infrastructure.
12. Assembly/installation of the mobile processing plant and related infrastructure.
13. Installation of a wheelwash and related water treatment equipment.
14. Sealing of the Quarry access road on the inclined section of the road leading from the Quarry entrance to the Quarry infrastructure area.

Details of each activity are outlined in the following sections. **Table 2.2** displays the indicative schedule for all construction activities.

Table 2.2
Indicative Site Establishment and Construction Timetable

Construction Activity	Month					
	1	2	3	4	5	6
1. Component Mark Out						
2. Removal of unused material and equipment						
3. Establishment of temporary office and amenities						
4. Construction of sediment basins and drainage infrastructure						
5. Vegetation clearing						
6. Construction of interim Quarry entrance and access road						
7. Overburden extraction and construction of Infrastructure Pad						
8. Removal of existing buildings and related structures						
9. Westward extension of Infrastructure Pad						
10. Construction of the permanent Quarry access road						
11. Establishment of a temporary Quarry office, staff amenities and car park						
12. Assembly / installation of the mobile processing plant						
13. Construct Wheelwash						
14. Sealing of the Quarry access road						

2.4.2 Site Establishment and Construction Activities

Component Mark Out

Prior to the commencement of any vegetation clearing or earthworks, the Operator would commission a registered surveyor to survey and physically mark out the approved Stage 1 areas of disturbance using appropriately labelled and highly visible survey markers. Survey markers would be positioned at the corners of all component areas and along boundaries at distance / spacing that allows visibility of the next marker. Each of the surveyed locations would be displayed on all relevant plans / figures within the Environmental Management Plans and Sub-Plans prepared for the Project.

All Site personnel would be made aware of the approved areas of disturbance and the significance of not disturbing any area beyond the approved areas.

Equipment Deliveries

All earthmoving equipment, components of the processing plant, construction materials and consumables would be delivered to the Site by either low loader, trucks/semi-trailers or tankers.

Stored Materials and Equipment Removal

The Applicant has stored a range of materials and equipment on the property that will not be required for the operation of the Quarry. These materials and equipment would be removed from the Site early during the site establishment and construction stage.

Establishment of Temporary Office and Amenities

The Operator would establish a temporary office and amenities within the larger existing shed within the Site until the office and amenities are placed within the Quarry infrastructure area.

Water Management Infrastructure

Extraction Area – Sediment-laden Runoff

Runoff generated within the Stage 1A extraction area would be directed to a sump located in the western section of the southern limit of extraction adjacent to the product stockpiling area (see **Figure 2.4**). This sump would receive runoff from the entire Stage 1 extraction area and ultimately the product stockpile area and the Quarry infrastructure area.

Quarry Infrastructure Area – Sediment-laden Runoff

During the early stages of the site establishment and construction stage, two permanent sediment basins (Western Sediment Basin and Southern Sediment Basin) and ancillary perimeter drains would be constructed to collect and manage sediment-laden runoff. Each of the sediment basins would be equipped with a pre-treatment pond to assist with the management of the higher sediment loads anticipated in runoff during the site establishment and construction stage of the Project and to facilitate ongoing maintenance during the operational phase.

Undisturbed Areas – Clean Runoff

Two clean water diversions would be constructed to direct runoff from the undisturbed areas upslope of the extraction area, away from disturbed areas. The diversion drains would be situated east and west of the extraction area and would convey runoff downslope to receiving watercourses, either directly or via the roadside drainage of Blue Rock Close. Two clean water diversion bunds would be constructed at the northern edge of the Stage 1A extraction area to facilitate the re-direction of clean water runoff. These bunds would be constructed by pushing upslope to avoid disturbance on the upslope side of the bund.

Vegetation Clearing

Vegetation clearing in areas to be developed during the initial component of the site establishment and construction stage would be either chainsaw felled or cleared using a bulldozer or excavator. The initial area disturbed would be kept to a minimum to provide sufficient area for the progressive construction of each Quarry component.

Priority would be given to the initial removal of the lantana thickets and weeds prior to the removal of the native vegetation.

The opportunity for the collection of available seed for rehabilitation purposes would occur immediately after the native vegetation is felled. The bulk of the felled trees would either be removed for timber production or mulched with the mulch either used on site or any excess removed from Site. A number of larger tree trunks would be strategically placed to define the boundaries of operational areas whilst a number of small tree limbs and tree trunks would be set aside within designated areas within the southeastern corner of the Site for use in habitat improvement in that area.

Soil Removal

The soil in each area cleared of vegetation during the site establishment and construction stage would be stripped following the removal of the larger vegetation. The Operator would remove approximately 0.1m to 0.15m of topsoil, where present, focussing on the recovery of seed-bearing material. All topsoil recovered from the areas disturbed during the site establishment and construction stage will be pushed to either the edge of the extraction area boundary or southern extent of clearing for subsequent use in vegetation and stabilisation of the constructed batter slopes of the Quarry infrastructure area.

Stage 1A Extraction Area

Following the removal of the vegetation and soil within Stage 1A, the overburden materials would be selectively removed and relocated to create the initial pad for within the Quarry infrastructure area. Extraction of the overburden materials would continue until the weathered and fresh materials suitable for product manufacture are exposed.

The haul road from the extraction area would initially comprise a single lane, unsealed road.

Section 2.5.2 provides further details of the design of the extraction area and the internal road network between the extraction area and the Quarry infrastructure area.

Quarry Entrance Construction

The Quarry entrance and Quarry access road would be constructed to provide the long-term access to the Quarry from Blue Rock Close at the location near the existing vehicular access for Lot 11 DP1024564. The Quarry access road would be constructed using appropriate road pavement materials and retained with a gravelled unsealed surface until the end of the site establishment and construction stage. Ultimately, the Quarry entrance would be sealed with asphalt. A wheel wash would be constructed on a level section of the Quarry access road between the Quarry entrance and the Quarry infrastructure area to minimise the off-site dispersal of fine materials collected on vehicle tyres.

Section 2.7.1 provides further details of the design of the Quarry entrance and Quarry access road.

Ancillary Components Area Pad

The pad for the ancillary components would be constructed through the placement of overburden from the extraction area being placed in thin layers and compacted to achieve an elevation of approximately 28m AHD to 29m AHD and sloping towards the north towards the sump within the base of the extraction area.

On-site Building Removal

The larger existing shed being used as a temporary office and amenities would be dismantled and re-used in the construction of the on-site workshop towards the end of Stage 1A.

Ancillary Components Area

The Operator would utilise the area at the southeastern corner of the Quarry infrastructure area pad for placing ancillary quarry components, namely:

- quarry office;
- weighbridge (from Stage 1C onwards);
- staff amenities; and
- light vehicle parking.

This area would be configured in a manner that would limit potential interaction between Quarry internal haul road operations, expedite product transport operations and separate light and heavy vehicle traffic. This would be achieved by placing the ancillary quarry components east of the processing equipment and adjacent to the Quarry access road in the southeastern section of the Quarry infrastructure area.

Processing Area Pad

The Operator would utilise the northern section of the Quarry infrastructure area for product stockpiling and loading Quarry products for despatch. This area would limit any potential interaction between Quarry internal haul road operations. In addition, the topography of this area renders it suitable for the redirection, capture and management of sediment-laden runoff that may be generated from the stockpiles.

Processing Plant

All processing would be undertaken with mobile processing plant. The processing pad would be constructed to a level of approximately 28m AHD. The mobile processing plant would be located sufficiently close to the initial extraction area to lower transportation costs, fuel consumption, vehicle emissions and the overall disturbance footprint of the Project.

Sealing of the Quarry Access Road

The Quarry access road would be sealed prior to any products being transported from site.

2.5 EXTRACTION OPERATIONS

2.5.1 Introduction

Extraction operations would be undertaken using conventional extraction techniques involving drilling/blasting and load/haul. The proposed Stage 1 extraction area covers approximately 4.9ha. It is estimated that this area would yield approximately 1.7 million tonnes of saleable products[2] whilst the Stage 2 extraction area covers a further 5.9ha and would enable 9.6 million tonnes of saleable products to be produced.

[2] See Section 2.6.1

As discussed in Section 2.2.3, extraction operations in the Stage 2 extraction area would not commence until 24 August 2023, i.e. when the licence held by Hunter Quarries over the nominated area of Lot 11 DP 1024564 expires.

2.5.2 Stage 1

2.5.2.1 Extraction Area Design

The three sub-stages within the Stage 1 extraction area displayed in **Figure 2.5** have been designed using 3D Surpac software using the following specifications.

- Bench Height: 10m
- Operational Bench Width: 16m to 40m
- Terminal Bench Width: 8m
- Weathered Material Batter Angle: 45 Degrees
- Competent Material Batter Angle: 80 Degrees
- Haul Ramp Gradient: 1 in 8 (12.5%)
- Haul Ramp Width: 15m
- Property Boundary Buffer: 10m
- Overburden Material Swell Factor:15%
- Fresh Rock Density 2.6 t/m^3
- Weathered Rock Density 2.4 t/m^3
- Overburden Material Density 2.2 t/m^3

Elevations of benches in Stage 1 would be approximately 10m with benches positioned at approximately 18m, 28m, 38m, 48m and 58m AHD. The floor of the Stage 1C extraction area would be approximately 8m AHD.

2.5.2.2 Extraction Activities

Extraction would be undertaken in a staged manner commencing with vegetation and topsoil removal by bulldozer as described in Section 2.4 for the site establishment and construction stage. Topsoil would be stockpiled during each extraction stage for use during rehabilitation of the slopes created on the southern side of the Quarry infrastructure area pad. The weathered rock would then be extracted using a bulldozer rip method pushing material into stockpiles for truck and excavator removal. Weathered material would either be sold as low-grade fill or incorporated within road pavement products, used for rehabilitation or used for on-site earthworks. The competent rock (primary resource) would be extracted using a drill and blast method followed by load and haul. This method is consistent with the methods used within the adjoining Karuah and Karuah East Quarries.

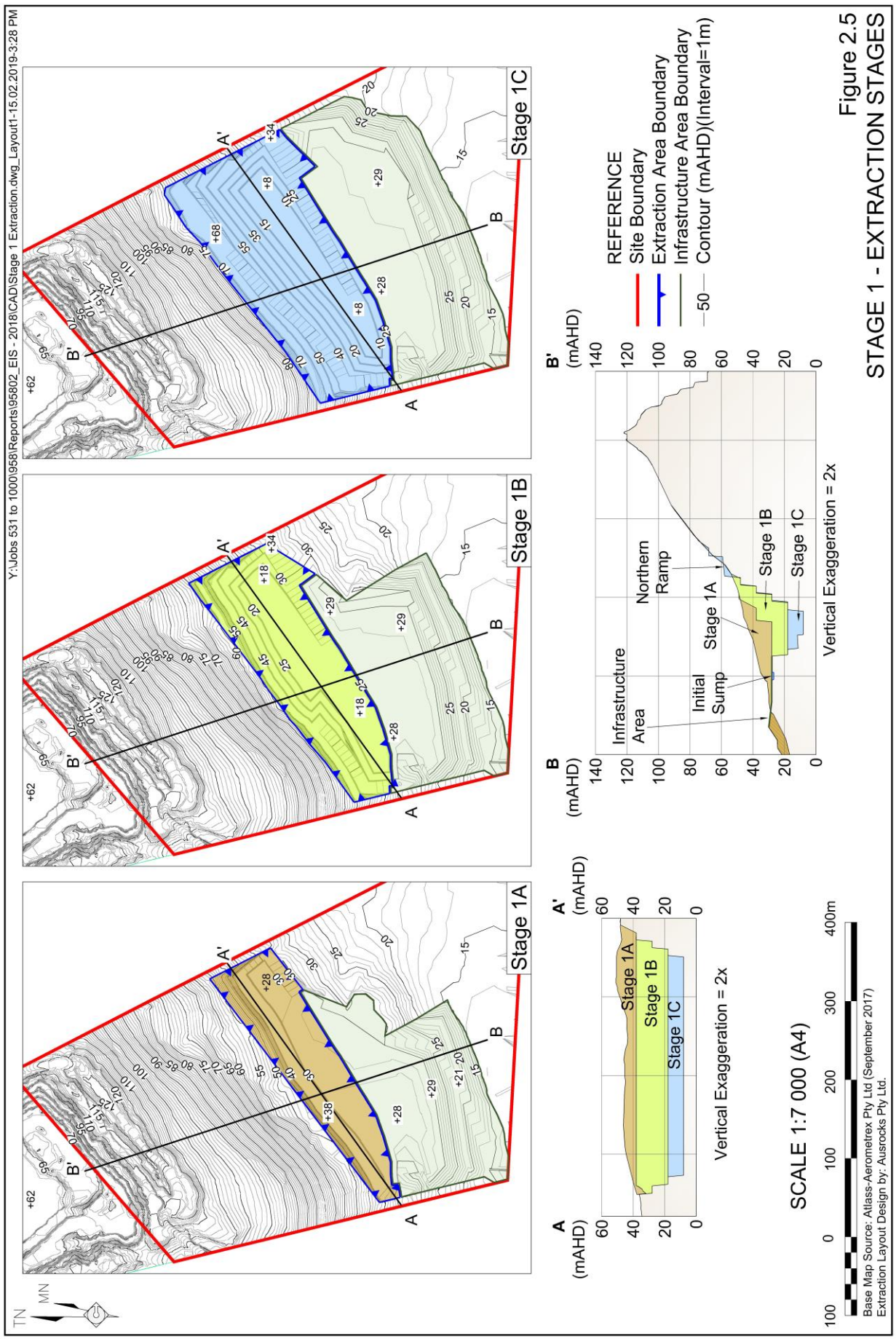


Figure 2.5
STAGE 1 - EXTRACTION STAGES

The approach to blasting within the extraction area would involve best practice design in conjunction with comprehensive risk assessments (see Section 5.2.5.3) undertaken by an experienced blasting technician.

Blasting would involve:

- The drilling of a pattern of regularly spaced holes using a hydraulic drill rig fitted with noise and dust suppression equipment;
- Placement of detonators, boosters and bulk explosives into all holes with crushed rock (stemming) in the top of approximately 2.5m to 3.0m of each hole; and
- Initiating the blast to fragment the in-situ rock.

It is proposed that the initial blast would be undertaken within Stage 1A of the extraction area approximately 430m from the Pacific Highway where impact risks are lowest. Subsequent blasts in Stage 1 would be undertaken closer to the highway, however, they would be designed and initiated with the benefit of monitoring of the initial blasts where the performance of initial blasts can assist to optimize the blast design and minimize the levels of airblast overpressure, ground vibration and fly rock. It is noted that the distance between each blast in Stage 2 and the Pacific Highway would vary from approximately 280m to 600m.

The initial blasts would involve the fragmentation of up to 20 000 tonnes of competent rock and involve a design with the direction of each blast to the west and not towards the Pacific Highway. Once a validated and demonstrated blast design is finalised, regular production blasts would be designed to fragment between approximately 20 000 tonnes and 40 000 tonnes of competent rock. The maximum quantity of rock fragmented in each blast would reflect the maximum quantity of ammonium nitrate that would be delivered to the Site in one (9t) truck load. There may be some occasions when some smaller blasts would be necessary during Stage 1. The design parameters for each blast are listed in **Table 2.3**.

Table 2.3
Indicative Blast Design Parameters

Parameter	20 000t Blast	40 000t Blast
Surface Area	800m^2	1,600m^2
Drillhole Diameter	89mm or 102mm	89mm or 102mm
Depth	10m	10m
Sub-drill	0.3m - 1.3m	0.3m - 1.3m
Stemming	>1.8m	>1.8m
Burden	2.5m -3.0m (dependent on blast design)	2.5m -3.0m (dependent on blast design)
Spacing	3.0m -3.5m (dependent on blast design)	3.0m -3.5m (dependent on blast design)
Maximum Instantaneous Charge	Approximately 60kg to 80kg dependent on blast design and the proximity to surrounding residences.	Approximately 60kg to 80kg dependent on blast design and the proximity to surrounding residences.

Drilling for each blast would be undertaken over a period of 2 to 3 days and blasts would typically occur every 2 to 4 weeks depending on the quantity to be blasted and its location within the extraction area.

Section 5.2.5.3 outlines the safeguards to be adopted to ensure safe and effective blasting practices are adopted and Section 5.2.7.2 reviews the predicted impacts of the proposed blasting.

2.5.2.3 Extraction Sequence

The extraction sequence within the Stage 1 extraction area would occur in three sub-stages, namely, Stages 1A, 1B and 1C. The sub-stages have been designed to optimise the ratio of weathered and competent material and enable the greatest range of products to be processed at the Quarry. The indicative timing for extraction sequencing is as follows.

- Stage 1A: Year 1
- Stage 1B: Year 2 to Year 3
- Stage 1C: Year 4 to Year 5.

Figure 2.6 displays an oblique view of the layout at the end of Stages 1A, 1B and 1C.

2.5.3 Stage 2

2.5.3.1 Extraction Area Design

The Stage 2 extraction area would also be developed in three stages.

The design of the sub-stages within the Stage 2 extraction area are displayed in **Figure 2.7**. This stage has been designed to progressively recover the weathered and competent rock remaining in the pillar between the Karuah South Quarry (Stage 1) and the Karuah Quarry. The same design specifications would be used as those used for the design of the Stage 1 extraction area.

Bench elevations throughout the Stage 2 extraction area would be positioned at approximately 68m, 78m, 88m, 98m, and possibly 108m AHD to pair with those in the adjoining Karuah Quarry extraction area.

2.5.3.2 Extraction Activities

Throughout Stage 2, the footprint of the processing and product stockpiling area would be progressively expanded to the north following overburden removal.

Overburden would be extracted from the northeastern corner of Stage 2A and placed on the floor of the Stage 1 extraction area to a level of approximately 12.5m AHD. Additional overburden from Stage 2A would be stockpiled at the southwestern extent of the Stage 1 extraction area to form a batter with an approximate slope of 1:1.5 (V:H). Overburden from Stage 2B would continue to be stockpiled within the former Stage 1 extraction area to an elevation of approximately 38m AHD. This would essentially expand the Quarry infrastructure area and provide additional capacity for product stockpiling during periods of peak production. Overburden from Stage 2C would be used to similarly expand the area available for surge stockpiling to the north and west. Small quantities of overburden would also be placed on terminal benches for their rehabilitation (see Section 2.12.4.3).

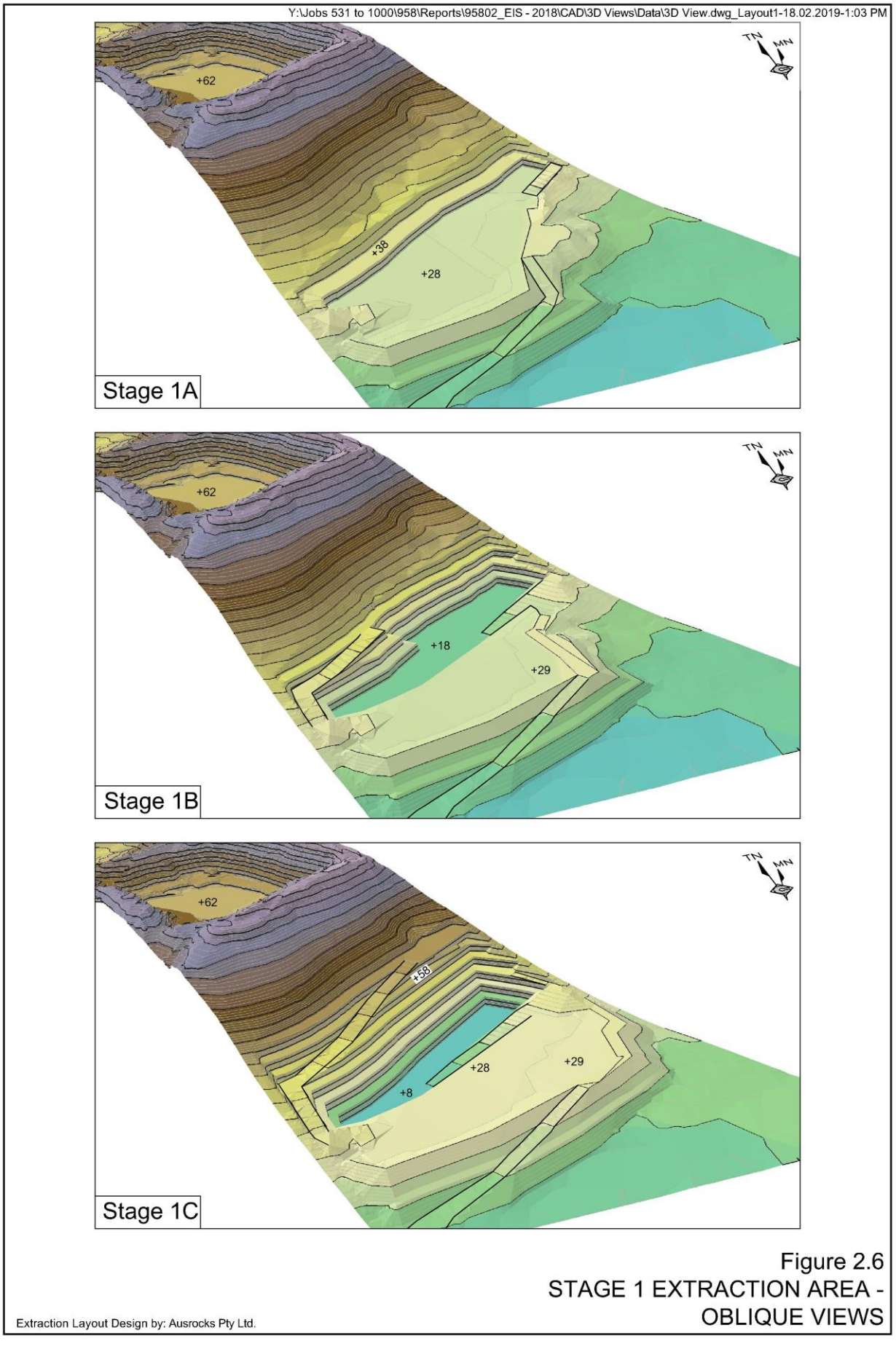
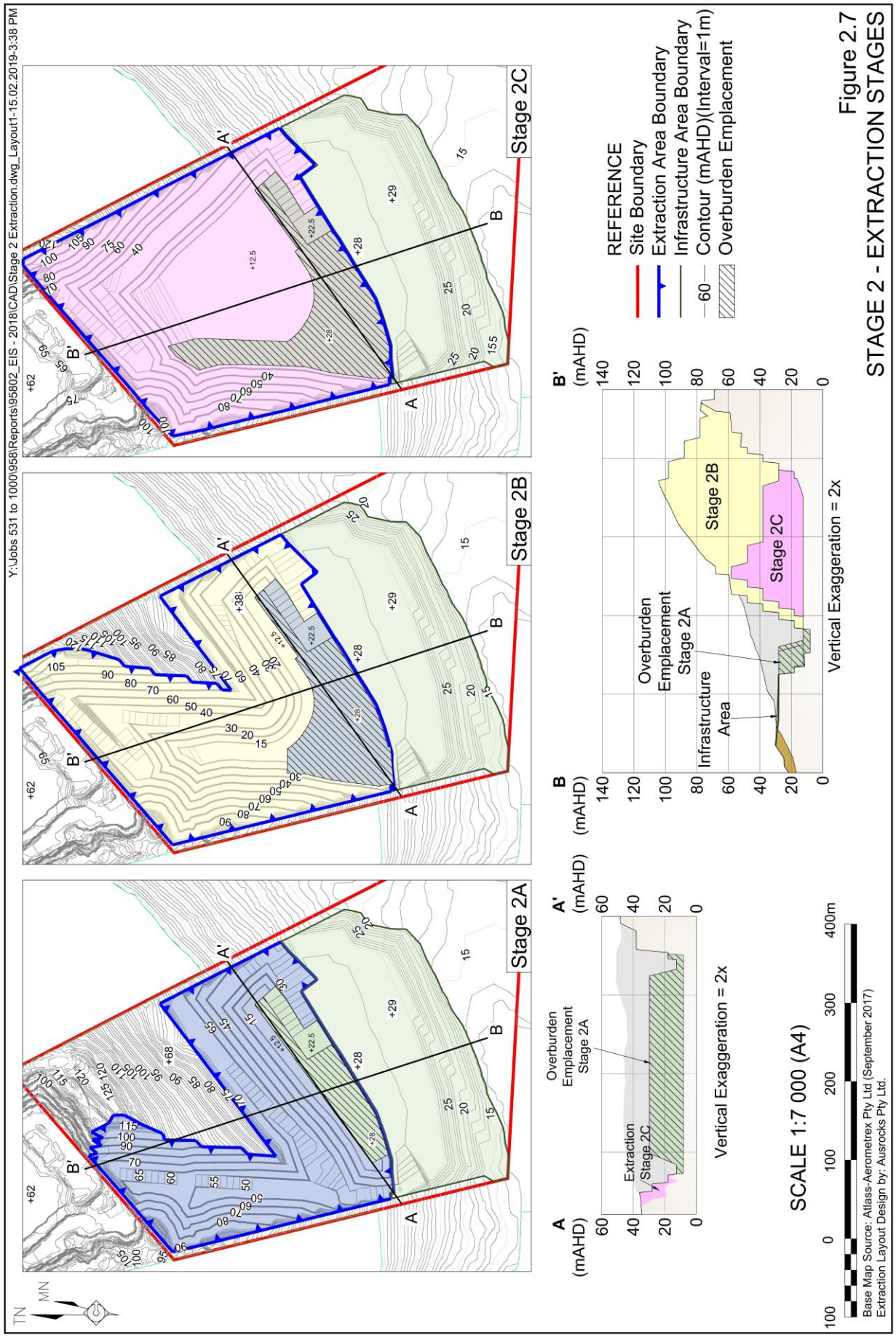


Figure 2.6
STAGE 1 EXTRACTION AREA - OBLIQUE VIEWS

Extraction Layout Design by: Ausrocks Pty Ltd.


Y:\Jobs 531 to 1000\958\Reports\95802_EIS - 2018\CAD\Stage 2 Extraction.dwg_Layout1-15.02.2019-3:38 PM
Stage 2A
Stage 2B
Stage 2C
REFERENCE
Site Boundary
Extraction Area Boundary
Infrastructure Area Boundary
Contour (mAHD)(Interval=1m)
Overburden Emplacement
Overburden Emplacement Stage 2A
Extraction Stage 2C
Infrastructure Area
Vertical Exaggeration = 2x
SCALE 1:7 000 (A4)
Base Map Source: Atlass-Aerometrex Pty Ltd (September 2017)
Extraction Layout Design by: Ausrocks Pty Ltd.
STAGE 2 - EXTRACTION STAGES
Figure 2.7

The haul ramp would extend to the base of the resource on the southern wall with the main access to the upper benches remaining along the western face throughout most of Stage 2.

It is proposed that blasts during Stage 2 would typically fragment approximately 40 000t per blast. These blasts would be designed with the same parameters as those for a 40 000t blast in Stage 1 (see **Table 2.3**).

2.5.3.3 Extraction Sequence

The extraction sequence within the Stage 2 extraction area would occur in three sub-stages, namely Stages 2A, 2B and 2C. The sub-stages have been designed to ensure that the extraction area can successfully break through into the previous Karuah Quarry extraction area in an appropriate area whilst optimising the ratio of weathered and competent material and enabling the greatest range of products to be produced at the Quarry. Indicative timing for extraction sequencing is as follows.

- Stage 2A: Year 6 to Year 8
- Stage 2B: Year 9 to Year 15
- Stage 2C: Year 16 onwards

Figure 2.8 displays an oblique aerial view of the layout at the end of Stages 2A, 2B and 2C.

2.5.3.4 Mobile Equipment

Table 2.4 lists the range of mobile equipment that would be used throughout Stages 1 and 2 of the Karuah South Quarry. Distinction is made between the planned maximum production level in Stage 1 (300 000tpa) and Stage 2 (600 000tpa). **Table 2.4** also displays the frequency of use of this equipment at both production levels.

Other similar equipment may be required from time to time for specific construction and ongoing operational tasks, however, they would only be brought to Site for short periods.

2.5.4 Extraction Rates

Indicative extraction rates for Stage 1 of the proposed operation, assuming a ramp-up period, would be approximately 200 000t in Year 1, 250 000t in Year 2 and possibly up to 300 000t in Years 3 to 5.

Throughout Stage 2, extraction rates would progressively increase from 300 000tpa to a maximum rate of 600 000tpa.

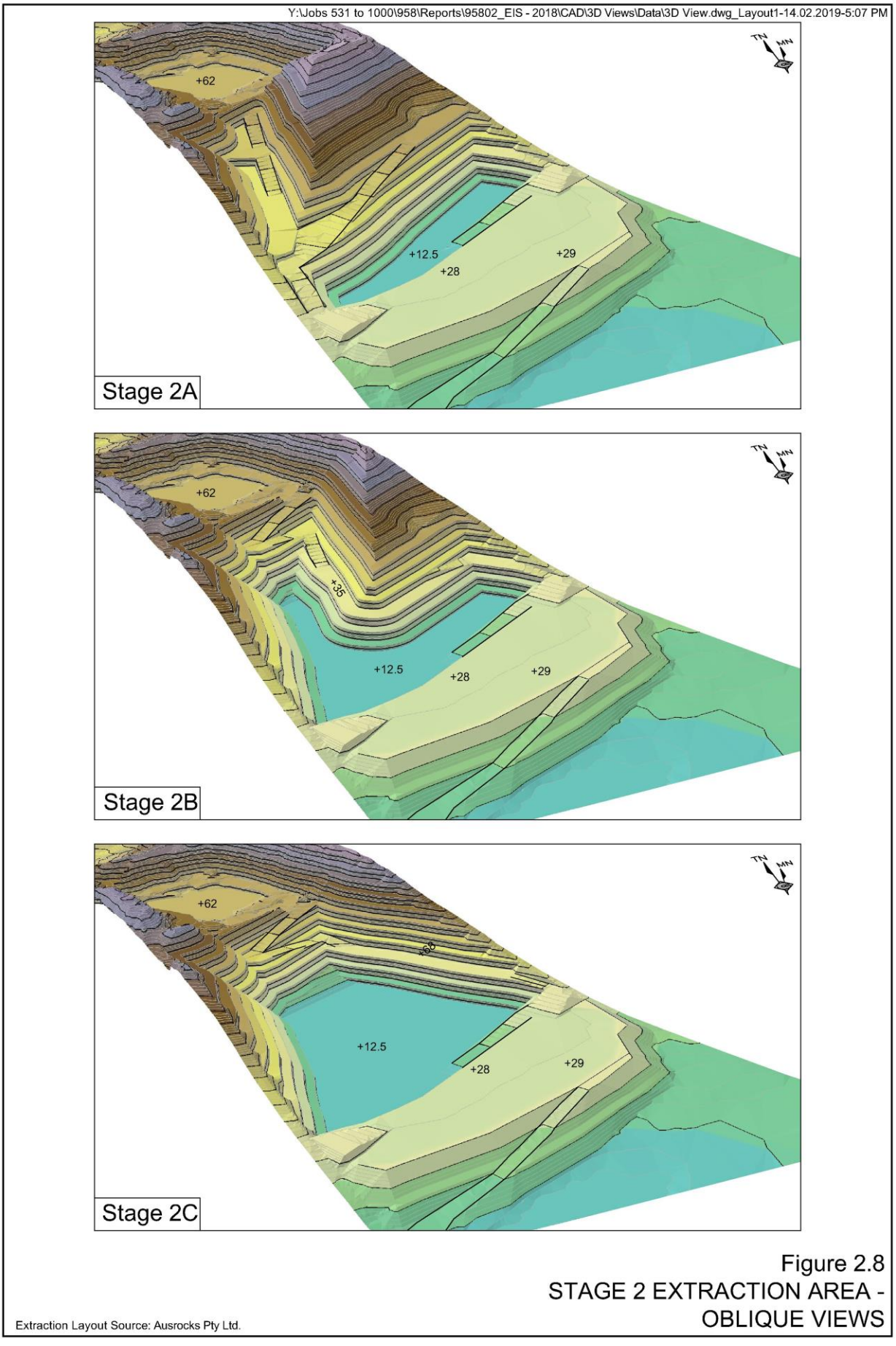


Figure 2.8
STAGE 2 EXTRACTION AREA - OBLIQUE VIEWS

Extraction Layout Source: Ausrocks Pty Ltd.

Table 2.4
Mobile Earthmoving Equipment Fleet

Equipment*	Number Annual Sales 300 000tpa	 600 000tpa	Use/Activity
Percussion Drill Rig (Atlas Copco T40 or similar)	1	1	Drilling blast holes (typically used 2-3 days every month)
Hydraulic Excavator 50t (Caterpillar 349F or similar)	1	1	Resource extraction and haul truck loading (daily use).
Hydraulic Excavator 26t (Caterpillar 325F or similar)	1	1	Resource extraction and haul truck loading (daily use).
Bulldozer (Caterpillar D9T Dozer or similar)	1	1	Resource extraction (ripping/pushing), site works (daily use).
Front-end Loader (Caterpillar 980K or similar)	1	2	Haul truck and product truck loading, blending road pavement materials (daily use).
Articulated Haul Truck (Caterpillar 730C Articulated haul trucks or similar)	1	3	Raw material haulage to processing area (daily use).
Service Truck (Fuso Canter (4.5t) or similar)	1	1	General operational use (daily use).
Bobcat (Caterpillar 289D Bobcat or similar)	1	1	Maintenance within product stockpile area, site works (daily use).
Water Truck (Minimum 12 000 L) (Caterpillar 720C Water Tanker or similar)	1	1	Dust suppression activities (daily use).
Utility Vehicle (Toyota Hilux Dual Cab or similar)	3	3	General operational use (daily use).
* Note: All equipment would be periodically replaced/refurbished with better equipment of a similar capacity and noise rating.			
Source: Ausrocks Pty Ltd			

2.5.5 Processing Plant Layout

Figures 2.9 and **2.10** display the indicative layout of the processing and product stockpiling area during Stages 1 and 2.

Figure 2.11 displays the indicative layout of the proposed mobile crushing plant although it is recognised that its configuration can be easily modified to suit local conditions. During Stage 1, the processing plant would be located on the western side of the Quarry infrastructure area and would be aligned generally west to east. The mobile processing plant would be re-located to the eastern side of the Quarry infrastructure area prior to the commencement of Stage 2 operations and would be aligned generally east to west. The processing plant would comprise primary, secondary and tertiary crushing units each with a companion set of screens and conveyors.

2.5.6 Products

The principal products produced at the Site would be hard rock aggregates, road pavement products and manufactured sand for use in construction and infrastructure projects. The key fresh hard rock products that would be produced by the Operator would include the following.

- Concrete/asphalt/drainage aggregates for use by construction companies, concrete suppliers, asphalt suppliers (typically 7mm to 20mm).

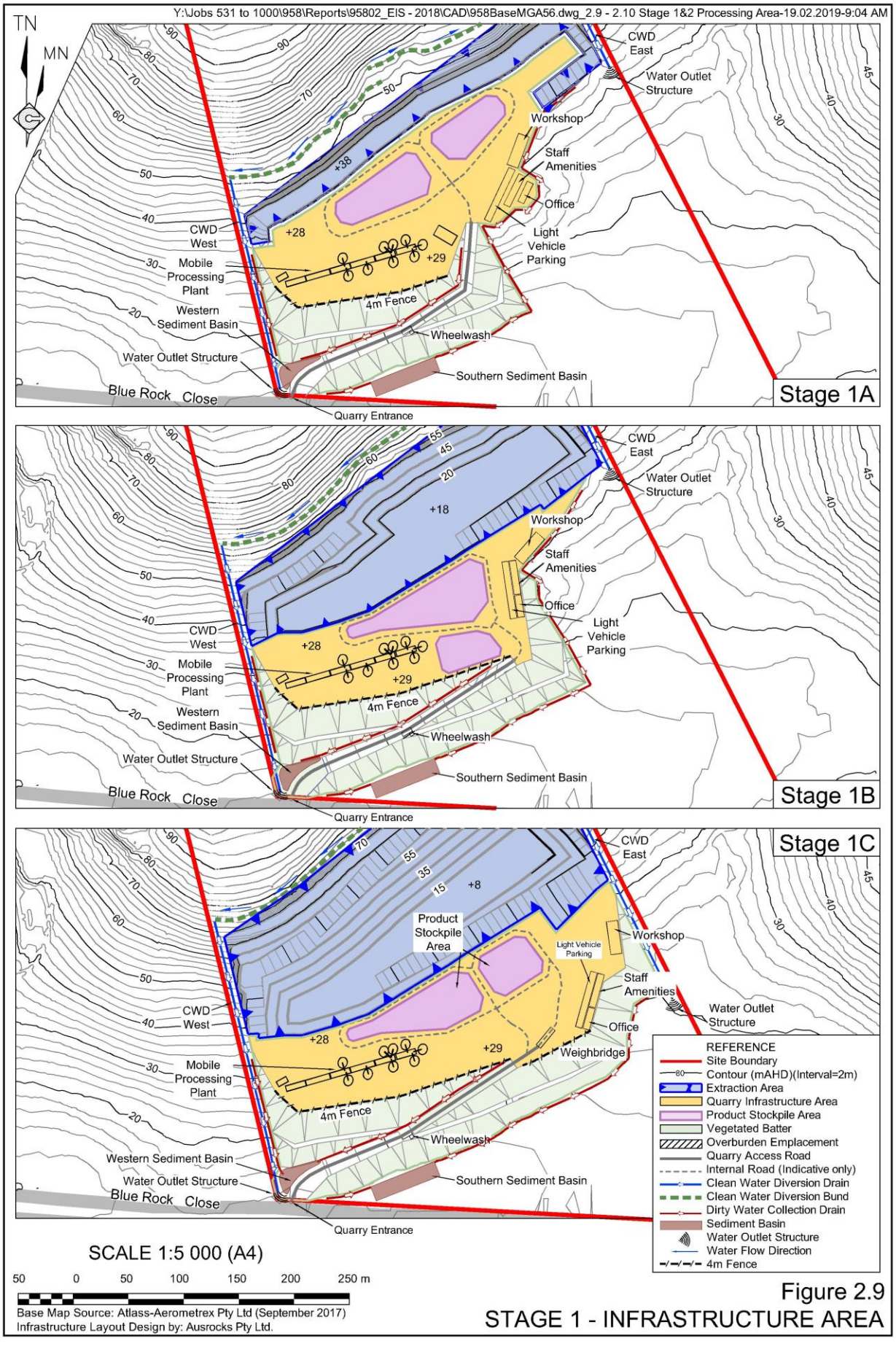


Figure 2.9
STAGE 1 - INFRASTRUCTURE AREA

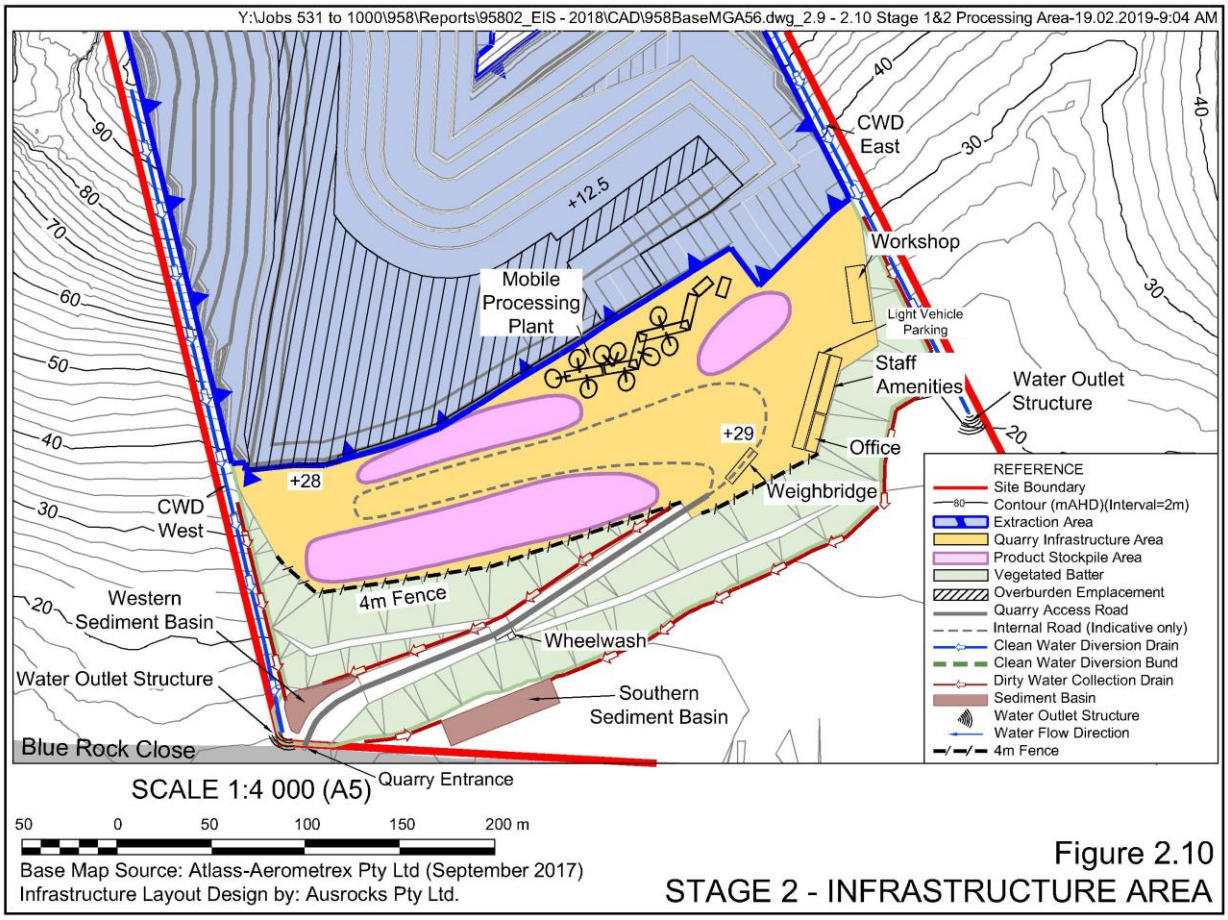


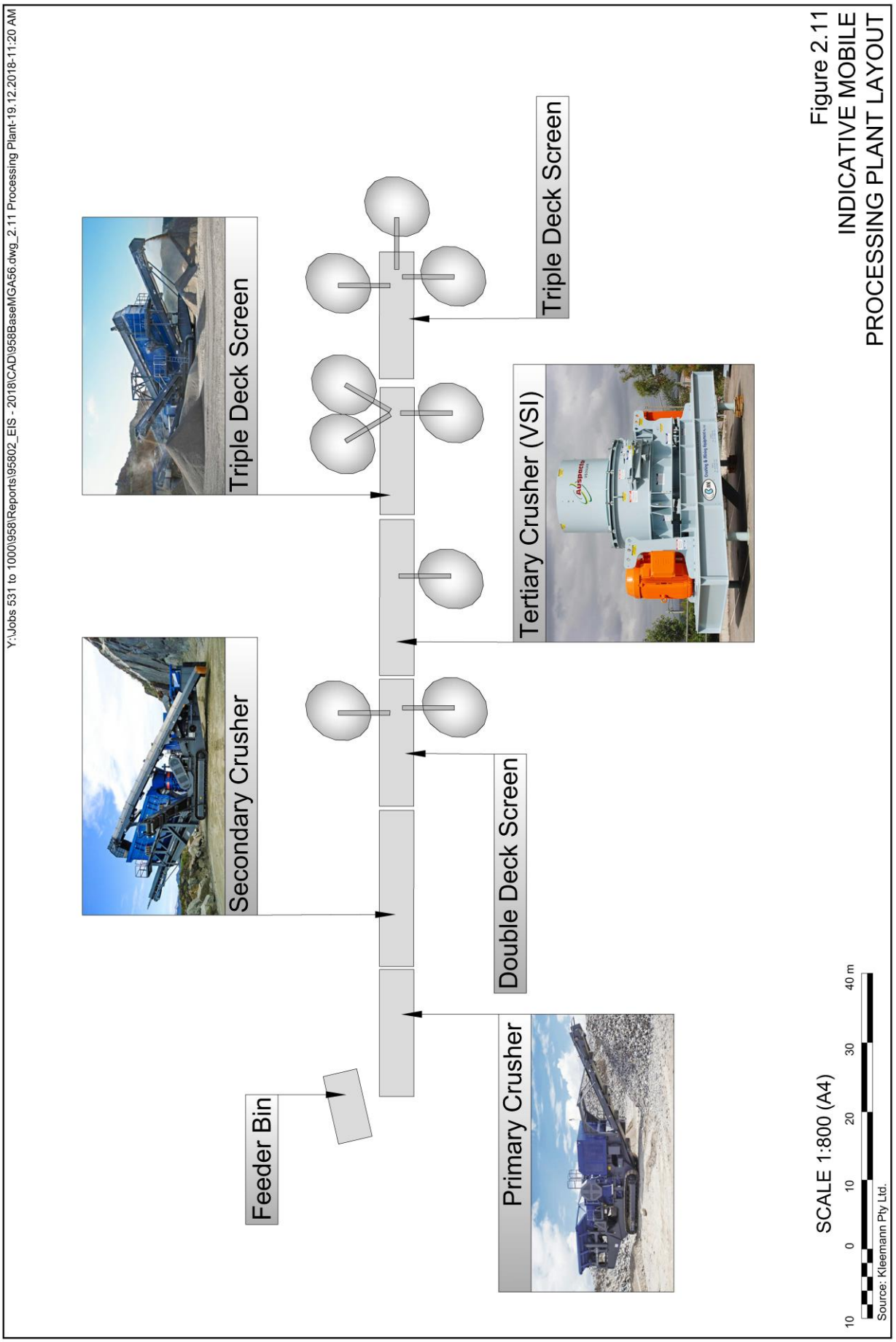
Figure 2.10
STAGE 2 - INFRASTRUCTURE AREA

- Decorative aggregates for use in paths, driveways and other open areas (typically 7mm to 40mm).
- Gabion rock for use in gabion baskets, retaining walls and drainage applications (typically 150mm to 300mm).
- Rocks for landscaping and other applications (from 300mm to >1m).
- Manufactured sand for use in the production of concrete.
- Crusher fines for use in various applications.

Weathered rock comprises approximately 11% of the total resource volume within the extraction area. This material, when blended with aggregates (7mm to 40mm) would produce a range of road pavement materials which would amount to approximately 15% to 30% of the products produced on site.

2.5.7 Processing Operations

Fragmented rock would be tipped into the hopper adjacent to the primary crusher and would progress through the sequence of equipment with the range of products outlined in Section 2.5.6 being produced.


Y:\Jobs 531 to 1000\958\Reports\95802_EIS - 2018\CAD\958BaseMGA56.dwg_2.11 Processing Plant-19.12.2018-11:20 AM
Figure 2.11
INDICATIVE MOBILE
PROCESSING PLANT LAYOUT
Feeder Bin
Primary Crusher
Double Deck Screen
Secondary Crusher
Triple Deck Screen
Tertiary Crusher (VSI)
Triple Deck Screen
SCALE 1:800 (A4)
10 0 10 20 30 40 m
Source: Kleemann Pty Ltd.

Weathered rock would also be processed through the processing plant and, where appropriate, would be blended with front-end loaders with selected coarse aggregates to meet customers' specifications for road pavement materials.

The mobile crushing and screening equipment would include the following. Examples of each item of equipment are provided to indicate their size and capacity which in turn is used in the Noise Assessment (see Section 5.2).

- 1 x Primary Jaw Crusher e.g. Kleemann Mobicat MC125Z K008;
- 1 x Secondary Cone Crusher e.g. Kleemann Mobicone MCO 13;
- 1 x Double Deck Screen e.g. Kleemann Mobiscreen MS 18 Z-AD;
- 1 x Tertiary VSI e.g. Auspactor VS300RR;
- 1 x Triple Deck Screens e.g. Kleemann Mobiscreen MS20D.

The mobile equipment would be set up in tandem with a series of mobile conveyors to reduce double handling. Various combinations of mobile crushers would be used to make specific products.

Although the plant would be mobile, the Operator would carry out processing operations generally in the same location throughout Stage 2 of the Project.

2.5.8 Operating Capacity and Production Rates

The mobile crushing and screening plant would be capable of producing up to a maximum of 450 tonnes of products per hour depending on the type(s) of products being produced. A number of operational constraints are likely to influence the hourly operating capacity. For the purposes of this document, the maximum daily production would be approximately 3 000 tonnes and the average daily production would be approximately 2 000tpd.

2.5.9 Product Stockpiling

Once processed, the products would be stockpiled in the designated product stockpile area adjacent to the processing area. Products would be stockpiled in nominal lots where material testing would be carried out prior to the material being loaded into trucks for despatch.

During periods of peak production (i.e. during Stages 2B and 2C), products stockpiles would also be located on the extended overburden emplacement to the north of the primary Quarry infrastructure area.

2.6 SITE WATER DEMAND

2.6.1 Water Sources

It is proposed that, for a normal rainfall year, the water storages on the Quarry would hold sufficient water to sustain the required production for that year taking into account rainfall, annual water use and losses due to evaporation. Water storage would be available within the

two sediment basins (Western and Southern Sediment Basins), the extraction area (sump). A sump would be maintained within the extraction area from the first day of operations and progressively deepened to ensure all runoff within the extraction area is collected within the sump.

The gains (inputs) and losses (outputs) for the Quarry water balance are summarised as follows.

- **Gains:** These include rainfall and associated runoff from the contributing Site catchments that would be captured in one of the sediment basins or the extraction area sump.
- **Losses:** These include evaporation, wheel-washing and water used in road watering as well as dust reduction in the crushing and screening process. In reality, not all of this water would be lost as some would be returned to the water management system (e.g. recirculated through wheel wash system).

Whilst groundwater was encountered in a number of exploration holes, this was assumed to hosted by fractures of limited extent and connectivity and hence groundwater is highly unlikely to be a reliable water supply and is not considered in the water balance.

2.6.2 Water Usage

Water usage at the Quarry has been calculated with the following outcomes.

- Construction phase demand: 7.8ML for the 6 month period.
- Operational phase demand.
  - 1.8ML/year for the wheel wash at maximum production (600 000tpa).
  - 3.1ML/year for crushing and screening operations at maximum production (600 000tpa).
  - Maximum 14ML/year for haul road watering and dust suppression in Stage 1A and Stage 1B increasing to 26ML/year in Stage 2A.
  - Maximum total site water demand would occur in Stage 1A (16ML/year) and Stage 2A (31ML/year).

Haul road watering and dust suppression activities are proposed during periods of dry weather or wind, however, the annual volumetric water requirement for these activities would be dependent upon the stage of the Quarry life as this will influence the area of application.

Section 5.6.4 presents the rainfall depths and the anticipated runoff volumes, site water demand and subsequent water balance for each stage of the Quarry. With the exception of four AEP / stages, annual rainfall and runoff volumes would be sufficient to meet the anticipated water demand of Quarry operations. Those AEP / stages which present exceptions to the above are as follows.

- Stage 1A – 99% AEP rainfall (634mm/year).
- Stage 2A – 99% AEP rainfall (634mm/year).
- Stage 2A – 95% AEP rainfall (784mm/year).
- Stage 2B – 99% AEP rainfall (634mm/year).

Subsequently, it is anticipated that, for a 50% AEP rainfall year (1 220mm/yr), the water storages on the Site would hold sufficient water to sustain the required production for that year taking into account rainfall and site water demand.

2.7 ACCESS, TRAFFIC AND PRODUCT TRANSPORTATION

2.7.1 Access

Access for all vehicles to the Site would be via a new entrance to Lot 11 DP 1024564 from Blue Rock Close. The location of the new entrance would be close to the existing entrance to the property. **Figure 2.12** displays the proposed layout of the new entrance to the Site. The Quarry entrance has been designed in accordance with Australian Standard AS2890.1 and provides for separate entry and exist lanes divided by a median barrier approximately 20m long. **Figure 2.12** also displays the swept path of a 19m semi-trailer, i.e. the largest vehicle with the widest turning circle to enter the Site. From the Quarry entrance, vehicles would travel up an inclined section of road for a distance of approximately 250m to the Quarry infrastructure area.

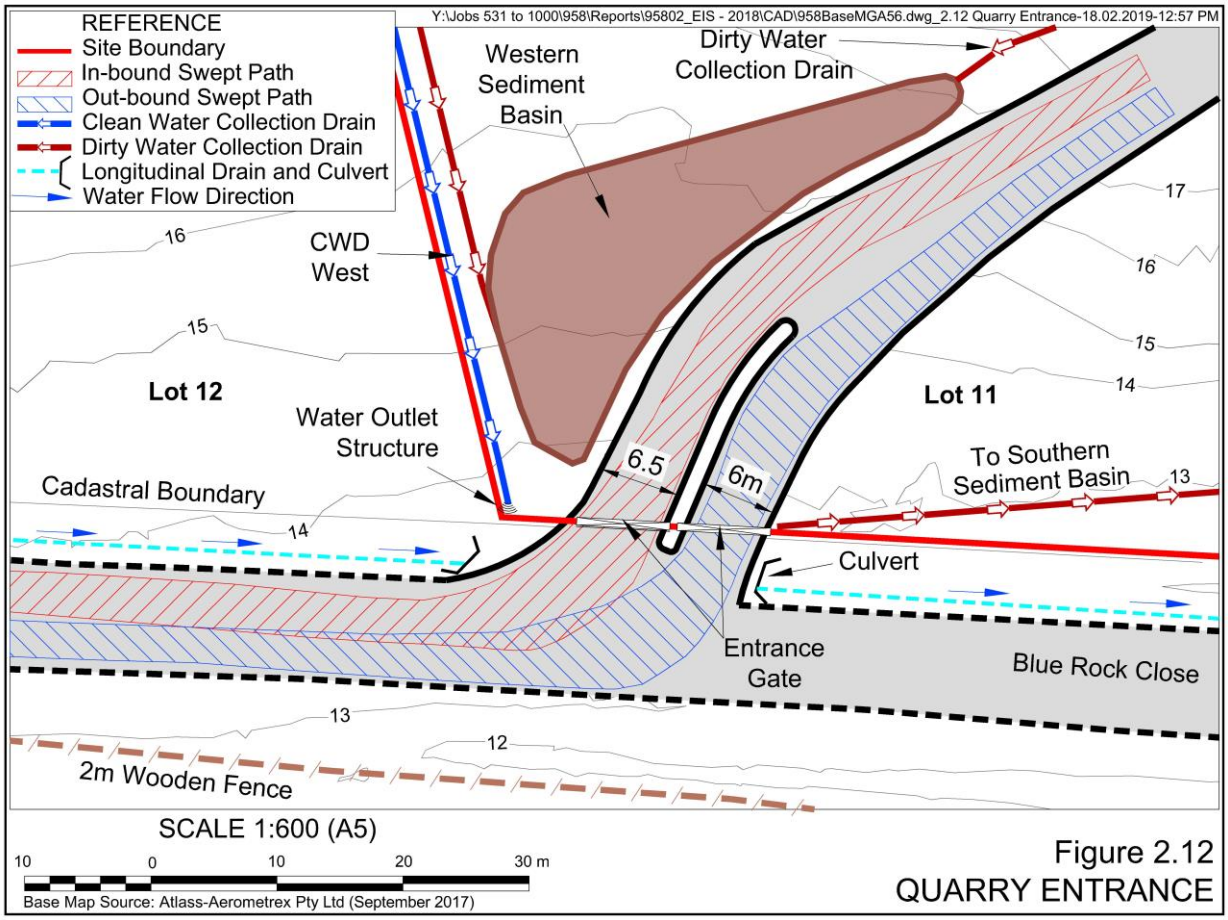


Figure 2.12
QUARRY ENTRANCE

2.7.2 On-Site Road Network

The Operator would separate road-registered trucks as much as possible from off-road haul trucks on site by restricting road-registered trucks to the product stockpiling area and ensuring all movement around the stockpiles is in a clockwise direction (see **Figures 2.9** and **2.10**).

All light vehicles arriving on site would be directed to the light vehicle parking area near the Quarry office.

2.7.3 Traffic Types and Levels

The bulk of the products would be despatched from the Site using truck and dog trailers of various configurations, i.e. with a capacity of between 32.5t and 37.5t, smaller quantities of products would be despatched by semi-trailers (27.5t to 30t capacity) or rigid trucks (12.5t to 18t capacity).

Traffic levels would vary substantially on a daily basis throughout the life of the Project. For the purposes of this assessment, daily loads despatched would vary from 12 to 72 and average 36 loads, i.e. when annual production is typically around 300 000tpa. When annual production levels of 600 000tpa are being achieved, the number of daily loads despatched would vary from approximately 20 to 120 and average approximately 72 loads.

2.7.4 Product Transport Routes

All laden trucks departing the Site would travel westwards on Blue Rock Close from the Quarry entrance. Blue Rock Close is a two-way, two-lane, sealed local road that is oriented generally east-west parallel to the Pacific Highway. Laden trucks would then enter Andersite Road which connects Blue Rock Close to The Branch Lane at its western extent. The Branch Lane is a two-lane, two-way local road which provides access to the Pacific Highway interchange for all northbound laden trucks. Southbound laden trucks would continue beneath the highway lanes prior to turning right and entering the southbound lanes of the Pacific Highway from the Pacific Highway interchange. It is proposed that, on average, 95% of laden trucks would travel to the south towards the Sydney and Newcastle markets with the remaining 5% of trucks destined towards Taree to the north.

Unladen trucks travelling to the Site from Sydney and Newcastle would approach the Pacific Highway interchange from the south prior to entering The Branch Lane. Unladen trucks travelling from the north would approach the Pacific Highway interchange from the north prior to entering Tarean Road.

The proposed transport routes are displayed in **Figure 2.13**.

2.8 INFRASTRUCTURE, UTILITIES AND SERVICES

2.8.1 Introduction

Quarrying operations would require a Site office, staff amenities, light-vehicle car park, weighbridge, wheelwash and workshop area. It is proposed to utilise loader scales for Stage 1A and 1B, with a fixed weighbridge to be installed in Stage 1C when the Quarry infrastructure pad reaches its final extent. The proposed services that would be used on site are outlined in this sub-section. Plans of buildings would be prepared and submitted to MidCoast Council with the applications for Construction Certificates.

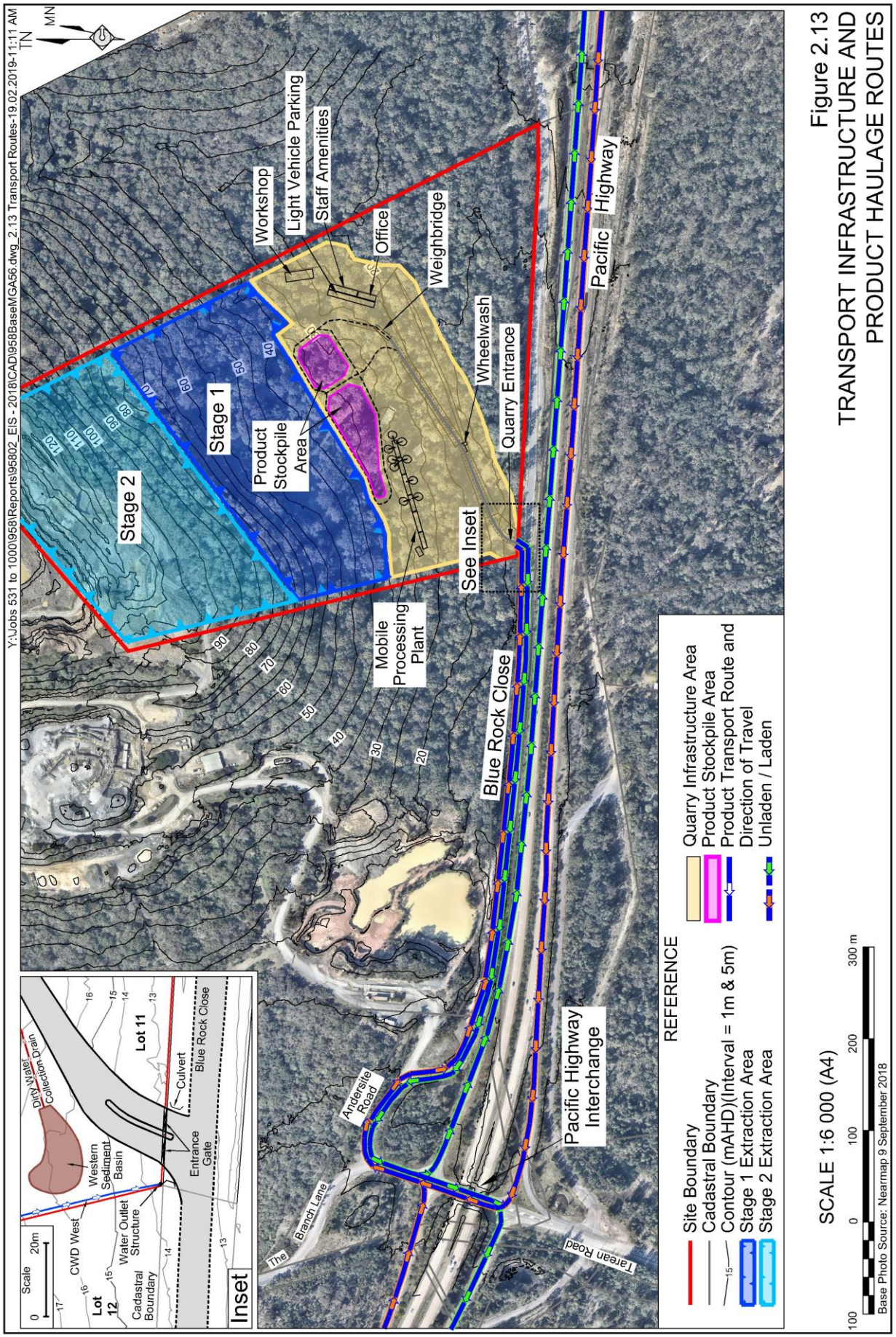


Figure 2.13
TRANSPORT INFRASTRUCTURE AND PRODUCT HAULAGE ROUTES

2.8.2 Power and Lighting

Three-phase power would be connected to the office, weighbridge, workshop and for lighting. This service is currently provided to the existing Site via buried cables, originating from an overhead supply and transformer located adjacent to Blue Rock Close. It is anticipated that some artificial lighting (other than mobile vehicle mounted lighting) would be required in work areas for security and efficiency of operations. Lighting would be appropriately shielded to prevent nuisance to occupants of surrounding properties.

2.8.3 Telephone

The Site would be serviced by telephone lines to the office. On-site communication would be undertaken by two-way radio and mobile phones.

2.8.4 Water Supply

Potable water would be supplied in bottles to the Site. Rainwater would be collected in tanks from all roofed areas within the Site for all other non-potable uses. The Site would not be connected to Council's reticulated water supply. If bulk water is required to supply the Project, particularly during the early periods of the site establishment and construction stage, it would be sourced via a licenced contractor and delivered by tanker to the on-site water tanks. Water for dust suppression would be sourced from the on-site sediment basins.

2.8.5 Fuels and Lubricants

Diesel fuel would be stored on site in self-bunded above-ground tanks (nominally 20 000L in capacity) located adjacent to the workshop (see **Figure 2.1**). All fuelling of mobile equipment would either be conducted within a bunded, concrete hardstand area or defined areas within the extraction or processing areas.

All lubricants and other small quantities of chemicals used on site would be stored in the on-site workshop.

2.8.6 Sewage and Effluent Disposal

Sewage and effluent disposal would be managed on location through a biocycle septic system, similar to the existing system currently utilised.

All hydrocarbons would be stored in accordance with Australian Standards AS 1940:2004 – The Storage and Handling of Flammable and Combustible Liquids.

2.9 HOURS OF OPERATION AND PROJECT LIFE

2.9.1 Hours of Operation

Table 2.5 lists the proposed hours of operation for the range of activities that would be undertaken at the Site throughout the life of the Project.

Table 2.5
Proposed Hours of Operation

Activity	Monday to Friday	Saturdays	Sundays or Public Holidays
Site establishment and construction	7:00am to 6:00pm	7:00am to 1:00pm	Nil
Extraction operations	7:00am to 6:00pm	7:00am to 1:00pm	Nil
Blasting operations	10:00am to 4:00pm	Nil	Nil
Processing operations	7:00am to 6:00pm	7:00am to 1:00pm	Nil
Product despatch	5:00am to 6:00pm	5:00am to 1:00pm	Nil
Maintenance	24 hours / day	24 hours / day	Nil

The hours nominated in **Table 2.5** are those that the Operator would operate within, not that they would be operating throughout the entire nominated periods. That is, the nominated hours would provide the flexibility needed to undertake all Project-related activities, when required. The flexibility achieved by the proposed operating hours would be important in order that the Operator can respond to large volume or urgent orders from its customers.

2.9.2 Life of the Project

At the proposed rate of extraction and processing, the overall operational life of Stage 1 of the Project would be approximately 5 years. It is proposed that Stage 2 extraction activities would be completed within a further 20 years. This would result in an overall Project life of approximately 25 years.

Final rehabilitation activities would require a further 1 to 2 year to complete beyond the cessation of extraction and processing activities.

2.10 WASTE MANAGEMENT

2.10.1 Introduction

The wastes generated from the Project would either be production by-products or non-production wastes.

2.10.2 Production By-products

The Project would produce process fines and highly weathered overburden both of which are saleable for a range of uses. It is proposed that most of the process fines would be sold, however, provision has been made for the on-site storage of excess fines in conjunction with the overburden within the completed sections of the extraction area. This material would be used to create an additional product stockpiling area near the processing plant area.

2.10.3 Non-Production Wastes

General domestic waste would be segregated into recyclable and non-recyclable materials and removed from Site by a licensed contractor. Any other waste generated would be removed to a facility licensed to receive these materials. No domestic wastes would be disposed of on site.

It is estimated that approximately 150m^3 of domestic mixed solid waste and recyclables would be produced annually with approximately one skip bin delivery/collection each fortnight. Recyclables would be collected less frequently or on an as needs basis.

2.11 EMPLOYMENT, SAFETY AND SECURITY

2.11.1 Employment

During the six month site establishment and construction stage, the Operator would employ a total of 10 fulltime equivalent positions.

The Operator would employ between approximately 14 and 20 persons fulltime during full-scale operations. This would increase to 16 to 20 when the Quarry is operating at maximum production levels. **Table 2.6** lists the likely employment position/function and the employment levels during years when annual sales are 300 000tpa and 600 000tpa respectively. A further 10 contractors and transport sub-contractors would be employed when production levels are approximately 300 000tpa.

Table 2.6
Indicative Project Employment

Position/Function	No. Employed	
	300 000tpa	**600 000tpa**
Direct Quarry Employment		
Quarry Manager	1	1
Administration	2	3
Weighbridge Officer	1	1
Sales	1	2
Mobile Equipment Operators	5	8
Mechanic/Fitter	4	5
Sub-total	**14**	**20**
Source: Wedgerock Pty Ltd		

2.11.2 Safety

It would be the Operator's objective that each person employed or visiting the Site is provided with a safe and healthy environment. The Operator would prepare a comprehensive Safety Management Plan for the Project to fully satisfy the statutory requirements of the Resource Regulator and WorkCover.

The Operator would progressively construct a series of safety bunds around the perimeter of the extraction area to prevent inadvertent access for mobile equipment over the perimeter extraction faces.

The Operator would ensure that operations within the Site are conducted in accordance with the requirements of the following.

- *Work Health and Safety Act 2011 No. 10.*
- *Work Health and Safety Regulation 2017.*
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013 No. 54.*
- *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.*

2.11.3 Security

Reliance would be placed upon the existing fencing around the boundary of Lot 11 DP1024564. A set of gates would be installed at the Quarry entrance to prevent unauthorised access to the Site. The Operator would also rely upon a network of CCTV cameras positioned at strategic locations around the Site for security purposes.

2.12 REHABILITATION

2.12.1 Introduction

An integrated approach would be adopted for rehabilitation of all areas to be disturbed within the Site. Progressive rehabilitation procedures would be adopted from the site establishment and construction stage and throughout the life of the Quarry, when required, all of which are described in the following subsections.

It is proposed to integrate the rehabilitation of the Site with that undertaken on the southern side of the Karuah Quarry. It is understood that Hunter Quarries is currently finalising its closure plan for the Quarry at the request of the DPE particularly with respect to the rehabilitation activities on Lot 11 DP1024564 that need to be finalised by 24 August 2023 when the licence to occupy the subject land expires. As such, the Operator would review the approach to the rehabilitation of the Site once that plan is approved. The post-approval rehabilitation plan for the Site would reflect the contents of this section and be varied, where appropriate, to integrate with the rehabilitation plan for the Karuah Quarry.

2.12.2 Rehabilitation and Final Land Use Objectives

The objectives for rehabilitation of the final landform are centred upon:

- the initial stabilisation of the areas to be disturbed during the site establishment and construction stage; and
- the progressive shaping and revegetation of the final or terminal extraction benches as they are completed.

The Operator would implement a program of interim rehabilitation of disturbed / constructed areas in order to:

- where possible, conserve all topsoil and if not immediately used in rehabilitation, stockpile in an appropriate manner and location;
- minimise the areas of exposed surfaces that would otherwise be potential sources of sediment-laden runoff; and
- ensure interim slopes are stable.

The specific objectives for the long term rehabilitation program are to:

- provide a low maintenance, geotechnically stable and safe landform with minimal erosion that would be suited for a subsequent land use; and
- ensure that the upper benches within the extraction area are well vegetated to minimise any visual contrasts and the visibility of the benches from the Pacific Highway and surrounding residences.

2.12.3 Initial Rehabilitation Activities

As discussed in Section 2.12.1 and 2.12.2, the areas disturbed during the site establishment and construction stage, and not required for the subsequent operational phase, would be progressively rehabilitated principally to stabilise those areas and minimise sediment-laden runoff.

The key project component requiring rehabilitation during the site establishment and construction stage would be the southern face of the Quarry infrastructure area. This area would be constructed and rehabilitated in stages.

When the embankment for the Quarry infrastructure area reaches an elevation of approximately 18m, the outer surface of the embankment would be shaped to the planned 14° to 16° slope and covered with topsoil. It is planned that given the considerable quantity of topsoil to be removed during the site establishment and construction stage, that at least 0.3m or more of topsoil would be placed on the outer slope to maximise the opportunity to successfully revegetate the slope. Once the topsoil is in place, the surface would be hydromulched with a mixture of pasture seed and shrubs endemic to the Site (see **Table 2.7**).

The hydromulch mix would also incorporate a binder and mulch to assist the stabilise the surface until pasture grasses are well established.

Emphasis would be placed throughout the construction of the embankment for the Quarry infrastructure area upon the development of the area in layers with the surface always sloping to the north and away from the batter slope, thereby ensuring that no upslope runoff is able to flow downslope across the constructed batter.

Once the 18m AHD level is reached, the construction of the next section could proceed in the same manner with the second program of soil placement and hydro mulching proposed when the embankment proposed when the embankment reaches an elevation of 23m AHD, i.e. a lift of 5m above the initial embankment level. The third and final 5m lift would occur to complete the construction and stabilisation of the embankment at an elevation of 28m AHD.

Table 2.7
Proposed Seeding Regime for Initial Revegetation

Pasture species	
Kangaroo Grass	*Themeda triandra* (syn. *Themeda australis*)
Weeping Grass	*Microlaena stipoides*
Barbed Wiregrass	*Cymbopogon refractus*
Tussock Grass	*Poa sieberiana*
Red Grass	*Bothriochloa macra*
Bushy Hedgehog Grass	*Echinopogon caespitosus*
Blady Grass	*Imperata cylindrica*
Bordered Panic	*Entolasia marginata*
Native shrubs for batter slopes	
White Sally Wattle	*Acacia floribunda*
Green Wattle	*Acacia irrorata*
Sydney Golden Wattle	*Acacia longifolia subsp. Longifolia*
Maiden's Wattle	*Acacia maidenii*
Hairy Bush Pea	*Pultenaea villosa*
Purple Coral Pea	*Hardenbergia violacea*
Australian Indigo	*Indigofera australis*
Trailing Guinea Flower	*Hibbertia dentata*
Climbing Guinea Flower	*Hibbertia scandens*
Tantoon	*Leptospermum polygalifolium*
Tick Bush	*Kunzea ambigua*
Wild Yellow Jasmine	*Pittosporum revolutum*
Coffee Bush	*Breynia oblongifolia*
Source: Ecoplanning Pty Ltd	

2.12.4 Long Term Rehabilitation

2.12.4.1 Introduction

The key rehabilitation activity for the long-term rehabilitation of the Quarry undertaken throughout the life of the Quarry would be the growth of a range of native shrubs and trees on the final or terminal benches within the extraction area. This subsection reviews the planned final landform and provides a description of the rehabilitation methods used both on the benches and ultimately the extraction floor.

2.12.4.2 Final Landform

Figure 2.14 displays the final landform following the cessation of extraction and processing operations. The three domains within the final landform would comprise:

i) the Quarry infrastructure area (with all mobile equipment removed);

ii) the stepped extraction benches on the eastern, northern and western side of the Site;

iii) the final floor.

It is noted that the exact form of the benches and internal haul roads at the northern side of the Site would reflect the integration of the Stage 2 extraction activities with the final landform left on the southern side of the Karuah Quarry when Hunter Quarries vacates that extraction area.

Quarry Infrastructure Area

The Quarry infrastructure area would be retained generally in its proposed form after the cessation of processing activities. A contamination assessment of the Quarry infrastructure area would be undertaken following the cessation of extraction and processing activities to identify any areas of contamination as a result of hydrocarbon or other material that remains in the landform. Any identified contaminated material would be remediated on site or removed to a suitable landfill facility.

This notwithstanding, the surface of the Quarry infrastructure area would continue to slope gradually to the north directing all runoff towards the former extraction area. Elevations would remain at approximately 28m AHD.

Final Floor

For the purposes of this application, a single gently sloping floor (covering approximately 5.3ha) would be created varying from approximately 19.0m AHD in the north to 17.5m AHD in the south. This area would be created by the recontouring of the residual overburden on the extraction floor. A suitable ramp would be retained between the final floor and the Quarry infrastructure area. A suitable sized sump or pond would be retained within the final floor as this domain would be internally draining. The configuration and drainage within the final floor would be determined in conjunction with the party(ies) likely to develop a subsequent business/enterprise within the Site. This is a common practice for the re-development of extraction sites.

2.12.4.3 Rehabilitation Methods

The main rehabilitation activities required would involve revegetating the extraction benches and constructing and preparing the final floor within the extraction area for a subsequent land use. No rehabilitation would be required for the Quarry infrastructure area.

Extraction Benches

All final or terminal benches within the extraction area would be progressively revegetated to minimise the visual impact of the exposed rock faces and to provide for the long-term re-establishment of a range of native vegetation on the extraction benches. Approximately 1m to 2m of overburden would be placed on the completed benches with emphasis placed on creating a roughened surface to locally contain the bulk of rain falling on the benches. Overburden would be placed on each bench once extraction and haulage activities cease in that area and prior to the creation of the adjoining extraction face. The overburden would form a substrate for the subsequent growth of trees and shrubs which would be planted either through direct seeding or tubestock.

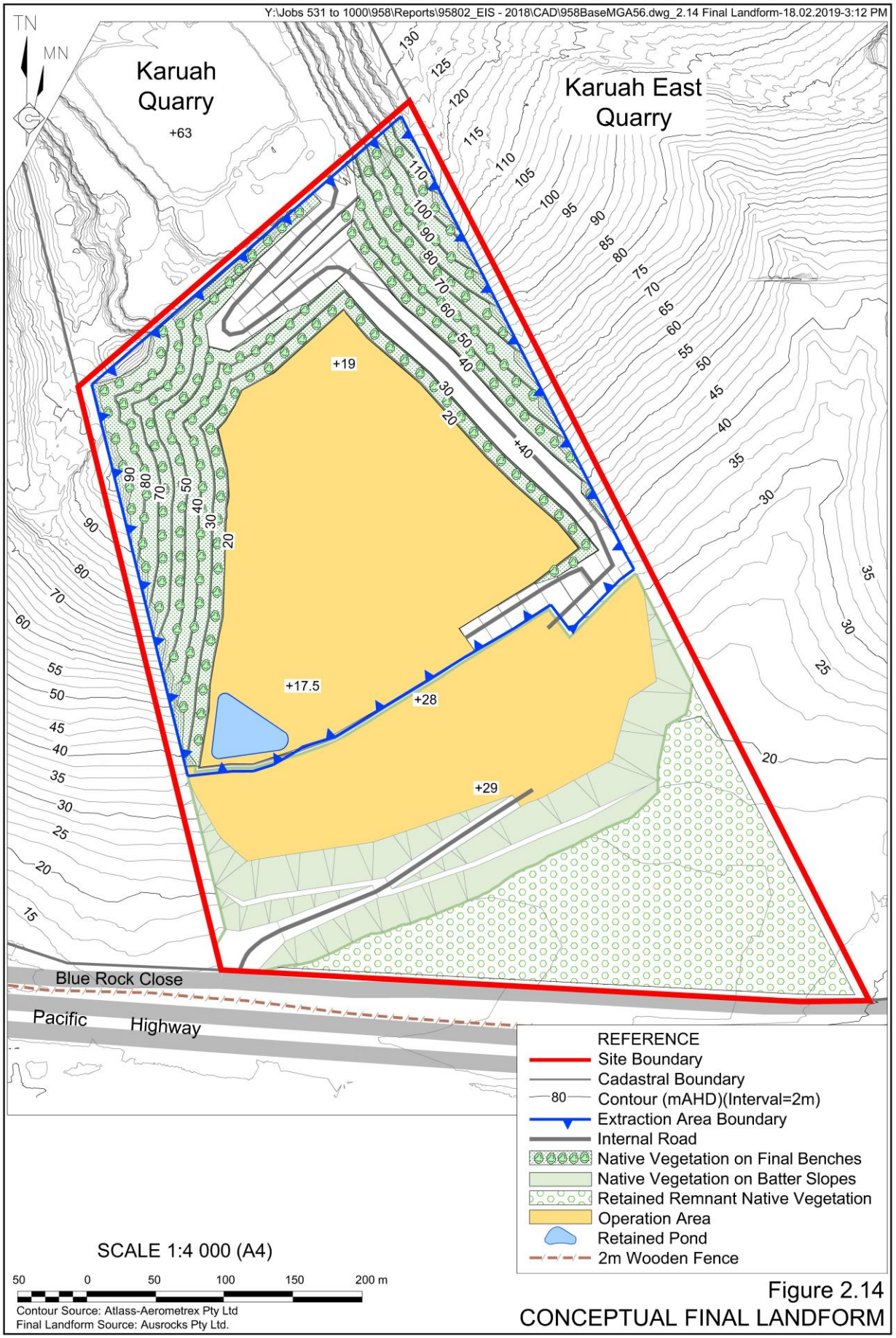
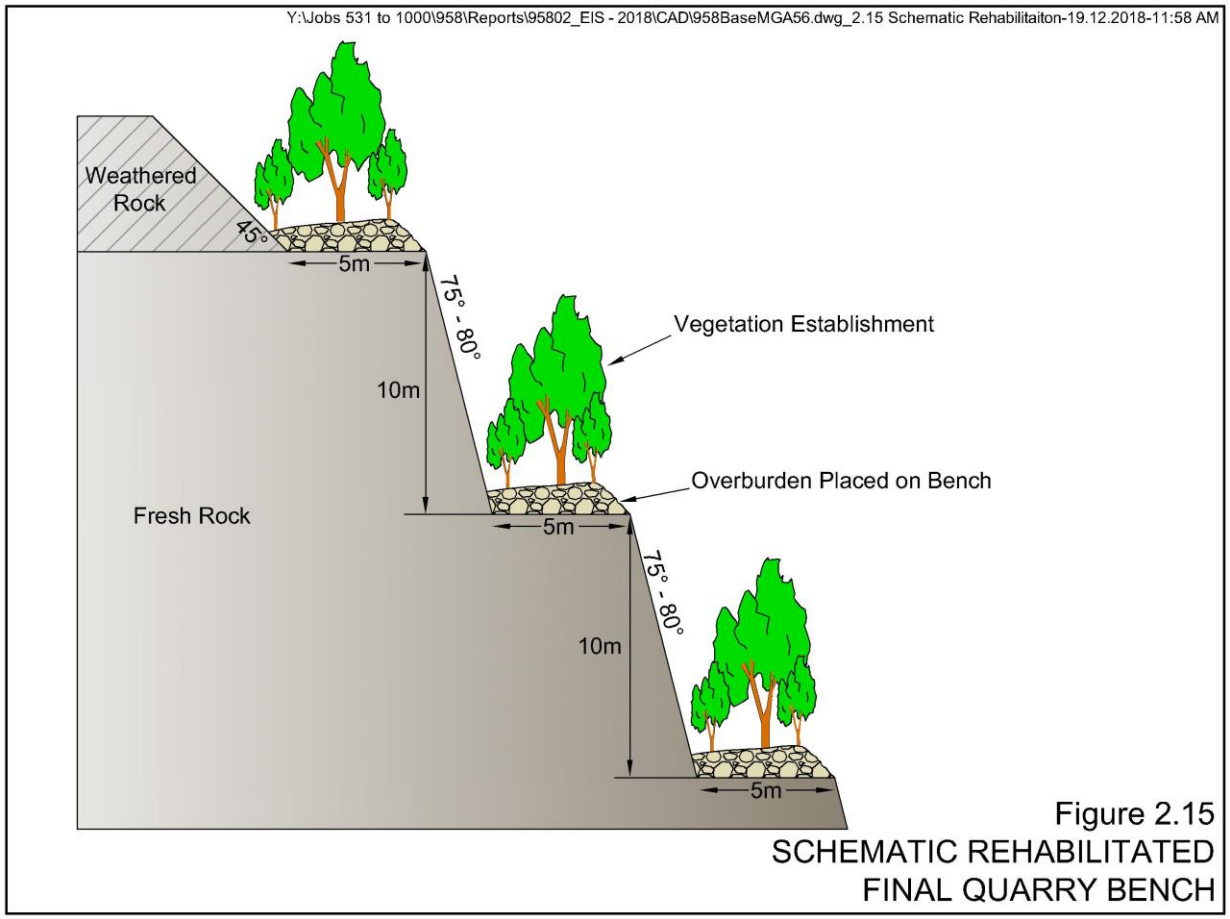


Figure 2.14
CONCEPTUAL FINAL LANDFORM

Figure 2.15 schematically displays the profile of two typical final or terminal benches below the top bench and the placement of the weathered rock and establishment of vegetation.



Up to eight extraction benches would remain within the final landform, i.e. approximately 10m high and 5m wide. These benches would be created progressively throughout the life of the Quarry with a series of ramps and internal haul roads traversing and joining a number of the benches. An internal road would be retained between the Site and the rehabilitated Karuah Quarry to the north as that Quarry and the Karuah South Quarry are both located on Lot 11 DP 1024564 owned by Mr Kiely of Wedgerock Pty Ltd. The exact location of the proposed internal road between the two quarries would be determined after Hunter Quarries vacates the Karuah Quarry.

Final Floor

As outlined in Section 2.12.4.2, it is envisaged that the final earthworks and shaping of the final floor would occur in conjunction with other parties who would want to take advantage of the Site's proximity to the Pacific Highway interchange, the large flat area of the Quarry infrastructure area and the sheltered final floor.

It is likely that during the creation of the final floor levels that some areas would be compacted to enable them to be used for buildings, if required. The remaining topsoil stockpiled from the Stage 2 extraction operations would be recovered to provide the substrate required for pasture growth in the defined areas of the final floor.

The final floor would effectively be an internally draining area with a catchment of approximately 12sha. One sump or pond would be constructed within the final floor providing a storage capacity not exceeding the harvestable right dam capacity for Lot 11, i.e. 4.3ML.

2.12.4.4 Final Land Use

Great Lakes LEP 2014 allows a considerable range of land uses that would be developed following the cessation of extraction and processing activities such as a range of industries, landscaping, material supplies, various storage establishment, e.g. boats/caravans; plant nurseries; or transport depots. Each of these land uses could be suitably established with the Site following its rehabilitation.

2.13 BIODIVERSITY OFFSETS

2.13.1 Introduction

The SEARs issued for the Project identified that EIS should include:

"a strategy to offset any residual impacts of the development in accordance with the NSW Biodiversity Offsets Policy for Major Projects, including evidence that the appropriate type and quantum of offsets will be available"

A Biodiversity Offset Assessment has been prepared by Ecoplanning Pty Ltd (Ecoplanning (2019)). The Ecoplanning (2019) assessment is included within the Biodiversity Development Assessment Report which is presented as Part 5 of the *Specialist Consultant Studies Compendium*.

2.13.2 Impacts Requiring Offsetting

Ecoplanning (2019) has identified that impacts to native vegetation would be expected through the direct clearing of the approximately 11.59ha of native vegetation, with a further 0.53ha of vegetation clearing impacting on areas identified as supporting exotic vegetation. The direct clearing and subsequent development of the proposed area of disturbance would represent a permanent impact, or loss, of this native vegetation and habitat.

Section 10.3.1 of the Biodiversity Assessment Method (BAM) outlines that the following vegetation zones would require offsets.

- Vegetation zones that have a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community.
- A vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat or is a vulnerable ecological community.
- A vegetation zone that has a vegetation integrity score ≥20.

All native vegetation zones within the Site have vegetation integrity scores of ≥15 and would require offsetting (**Table 2.8**).

Table 2.8
Summary Table – Existing Vegetation Ecosystem Credits

Vegetation zone	Vegetation integrity loss	Area*	Credits required
1590 - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest – Dense Lantana	52.6	0.6	11
1590 - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest – Low Lantana	61.5	0.6	13
1567 - Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast Lantana	63.2	7.5	176
1527 - Bangalow Palm - Coachwood - Sassafras gully warm temperate rainforest of the Central Coast Intact	64.9	0.5	15
1550 - Small-fruited Grey Gum - Turpentine - Tallowwood moist open forest on foothills of the lower North Coast Intact	62.1	2.5	59
Total		**11.7***	**274**
Note: * Rounding errors may apply			
Source: Modified after Ecoplanning (2019) – Table 20			

2.13.3 Impacts Not Requiring Offsetting

Impacts to those areas identified as "exotic vegetation" would not require offsetting.

2.13.4 Credit Calculations

2.13.4.1 Ecosystem Credits

Following the implementation of all practical measures to avoid or mitigate impacts to native vegetation, it is estimated that the proposal would result in the removal of approximately 11.59ha of native vegetation which is considered a residual impact of the Project. The ecosystem credits required to offset the residual impacts of the Project are provided in **Table 2.8**.

2.13.4.2 Species Credits

A total of 345 Koala (*Phascolarctos cinereus*) species credits would be required to offset the impacts of the Project on Koala habitat.

2.13.4.3 Securing Biodiversity Credits

The measures to address the offset obligation would be determined as the development consent assessment process progresses. Initial investigations have commenced to identify credits available for purchase, land available to purchase and enter into a Biodiversity Stewardship Agreement (BSA) and the costs of credits through payment into the Biodiversity Conservation Fund (BCF). It is likely that the Applicant would retire the required credits through payment into the BCF.

It is noted that the Applicant investigated the viability of establishing a BSA incorporating undisturbed vegetation within Lot 11 DP 1024564 to the southeast of the proposed area of disturbance and to the north of the existing Karuah Quarry. These investigations identified that the establishment of biodiversity offset areas within these areas would not generate sufficient credits to justify associated costs. Vegetation within these areas would remain undisturbed as part of this application and ongoing management of weeds and pests would be undertaken to maintain habitat health.

2.13.5 Conclusion

The biodiversity offset assessment prepared by Ecoplanning (2019) has identified and quantified the residual impacts to native vegetation as a result of the Project, in accordance with the BAM. It is considered that the impacts of the Project have been avoided, mitigated and offset to the greatest extent practicable.

2.14 FEASIBLE ALTERNATIVES CONSIDERED

2.14.1 Introduction

The Secretary's Environmental Assessment Requirements for the Project (see **Appendix 1**) contains a general requirement that the EIS describes the feasible alternatives considered for the Project and its key components.

Throughout the planning stages of the Project, a range of alternatives were considered with respect to the extraction area boundary, elevation of the Quarry infrastructure area, the type of processing equipment and the extraction sequence for Stage 2. All other components of the Quarry were decided upon/designed following the assembly and consideration of all relevant information and data without the consideration of alternatives. The following subsections outline the alternatives considered and the reasons for pursuing the preferred alternative described earlier in this section.

The alternative of not proceeding with the Project is discussed in Section 7.3.5.

2.14.2 Extraction Area Boundary

The northern boundary of the extraction area boundary displayed in **Figure 2.1** has been amended from the boundary displayed in the Preliminary Environmental Assessment, dated October 2017. The alternate proposed northern would enable the recovery of the recoverable rock remaining within the pillar between the Karuah Quarry and the Karuah South Quarry after Hunter Quarries vacates the Karuah Quarry in August 2023.

2.14.3 Elevation of the Quarry Infrastructure Area

A range of elevations was considered to establish the Quarry infrastructure area, namely 30m AHD, 28m AHD and 26m AHD.

The construction of the area with average elevations of 30m AHD would have required a greater volume of overburden materials than would be recoverable from the Stage 1 footprint. Hence, this alternative was not pursued. In order to construct the area to 26m AHD, it would have required some of the overburden materials to be transported off site which would incur unnecessary cost and hence was the basis of not pursuing that alternative. The third alternative, to construct the area to an average of 28m AHD was selected as the preferred elevation as the quantity of overburden recovered from Stage 1 would be sufficient to construct the area to 28m AHD.

A further reason for selecting the average elevation of 28m AHD was the fact that the existing large shed on the Site is located at an elevation of approximately 29m AHD with the top of the building at 33m AHD. The fact that the existing building cannot be observed from any location along with the southbound lanes of the Pacific Highway due to the shielding from the adjoining vegetation would mean that all mobile equipment and stockpiles of materials on the infrastructure area would be largely shielded from views from the highway, i.e. an important objective of the Quarry design. The selected elevation of the infrastructure area would also enable runoff from the area to drain towards and into the extraction area and away from the external batters of the area.

2.14.4 Use of Fixed or Mobile Processing Plant

A fixed crushing and screening plant was initially considered to produce the planned quarry products but this alternative was not pursed in favour of a mobile processing plant for the following reasons.

1. The use of mobile equipment allows considerable flexibility in operations, particularly during the initial years of operation when the area available for a fixed plant is limited.
2. The proposed annual production of 300 000tpa to 600 000tpa is well within the capacity of modern mobile equipment. Fixed plant is invariably more frequently used in quarries producing in excess of 600 000tpa.
3. Greater use is made of mobile equipment in quarries as their location can be easily adjusted to accommodate changes in the extraction area as it develops which in turn can reduce travel distances that need to be covered by on-site haul trucks.
4. The environmental controls able to be fitted on mobile processing equipment are effective in minimizing adverse effects, particularly dust impacts.

2.14.5 Stage 2 Extraction Sequence

During the initial design stage of the extraction area, the second stage of the extraction area involved extraction proceeding east to west, i.e. in the same manner as for Stage 1.

As a result of the preliminary visibility and air quality assessment, it was established that these aspects would benefit particularly from a visibility perspective if extraction in Stage 2 could proceed from west to east. This direction of extraction would allow each of the upper benches to be rehabilitated with trees and shrubs prior to the removal of vegetation and landform shielding those areas from the southbound lanes of the Pacific Highway.