Section 2

Description of the Proposal

PREAMBLE

This section describes the proposed Austen Quarry Stage 2 Extension Project ("the Proposal") including:

- *the objectives and need for the Proposal;*
- *a review of local geology, resources and quarry products;*
- *a description of the proposed activities to be undertaken at the quarry, including both the proposed extensions to the Stage 1 extraction area and overburden emplacement, as well as those components or operations that would be retained or continue if the Stage 2 Extension Project is approved;*
- *the proposed ongoing product transportation regime for the delivery of the products from the quarry;*
- *the proposed rehabilitation of the areas that would be disturbed throughout the life of the Proposal;*
- *development and implementation of a Biodiversity Offset Strategy; and*
- *a consideration of feasible alternatives to the Proposal.*

The Applicant proposes throughout the Stage 2 Extension Project to maintain the currently approved maximum annual sales level of 1.1Mtpa.

The Proposal is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of all activities proposed throughout the life of the Proposal, how the various activities would continue to be undertaken and to enable an assessment of the potential impacts on the surrounding environment. Where existing activities would continue in the same manner beyond 2020, the description of the activities is duplicated from Section 1.5 and adjusted, where necessary, to relate to the maximum approved (and proposed) annual sales level. It is noted that the boundaries and dimensions of the various components described throughout this section are indicative only.

Details of the safeguards and management measures that the Applicant proposes to implement to minimise or negate the potential impacts on components of the surrounding environment are provided in Section 4 of this document.

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2.1 OBJECTIVES

The principal objectives of the Proposal are to:

- secure access to the proven rhyolite resource, through an extension to the current approved extraction footprint, for the ongoing and long term operation of the quarry;
- extend the existing overburden emplacement for the long-term storage of unsaleable overburden;
- supply up to 1.1 million (M) tpa of quarry products to the Applicant's concrete batching plants and external markets;
- continue the extraction, processing, handling and delivery of quarry products in a safe, efficient and environmentally responsible manner.
- progressively rehabilitate the disturbance areas beyond the extraction area to provide for long-term nature conservation with minor grazing following completion of operations;
- develop and implement a biodiversity offset plan which, in conjunction with Site rehabilitation, would ensure no net loss of biodiversity values as a consequence of the Proposal;
- achieve the above objectives in a cost-effective manner to ensure the Proposal is viable.

2.2 NEED FOR THE PROPOSAL

The Austen Quarry is currently despatching up to approximately 750 000t of coarse aggregates, sand and other specialty products annually to supply the building and construction market requirements within the greater Sydney metropolitan area, Blue Mountains and surrounding regions. The demand for these products, used in the manufacture of concrete, road construction and rail works is likely to increase over the next 35 years in response to the projected population growth for Sydney. The key material required to underpin Sydney's growth throughout this period will be concrete for which coarse aggregates account for approximately 70% of the raw materials requirements. Current demand for coarse aggregates within the Greater Sydney region is estimated by the Institute of Quarrying Australia (IQA)[1] to be 23Mtpa, of which 17Mt is crushed rock such as that produced by Austen Quarry and 6Mt is processed river gravel such as that produced by the Penrith Lakes Scheme.

Based on the baseline assessment work of Pienmunne (2000), reflected in the 'Sydney Construction Materials Strategy' commenced by the then NSW Department of Planning, Infrastructure & Natural Resources (DIPNR) for the management of construction materials in the Greater Sydney region (Francis, 2011), it has been estimated that by 2040 between 650Mt and 700Mt of coarse aggregates (rising from the current average of 23Mtpa to at least 30Mtpa by 2040) will be required to meet this demand (Geos Mining, undated).

[1] https://www.quarry.com.au/ConstructionMaterials/GravelCrushedRock.aspx

The NSW Industry Profile 2013 (DTIRIS, 2013) identifies that the main sources of coarse aggregates for the Greater Sydney region are currently river gravel produced from the Penrith Lakes Scheme, basalt in the Peats Ridge-Kulnura area, and latite in the Kiama–Shellharbour region. As the quarry operations within these areas exhaust current resources, the Penrith Lakes Development Corporation extraction operations at Penrith Lakes is due for cessation by 2016, the need for these materials from quarries with long-term resources will increase substantially. As noted in DTIRIS (2013) and the IQA[2], while production from the Kiama–Shellharbour area is expected to increase, the Sydney region will be increasingly reliant on external sources such as those identified around Wingecarribee/Mulwaree, lower Hunter and Lithgow (which includes the Austen Quarry) regions. Any shortfall in the production of coarse aggregates to meet the anticipated demand would have negative impact on the NSW economy as follows.

- A reduction in the direct contribution of coarse aggregate production to the NSW economy, which is currently estimated to be $310Mpa by the IQA[2] and $366Mpa by the Department of Trade & Investment, Regional Infrastructure & Service (DTIRIS, 2013).
- Increased costs of concrete production as a result of either reduced supply, or the requirement of concrete producers to source coarse aggregates from sources further from the Greater Sydney region.
- Potential indirect impacts on the NSW economy as a result of reduced construction activity in response to either increased cost, or reduced supply of concrete.

As a concrete manufacturer with significant and growing market share, the Applicant requires at least 600 000tpa of aggregates and sand from Austen Quarry to supply Hy-Tec concrete plants to meet forecast demand (the balance of the 1.1Mtpa to be produced by Austen Quarry is budgeted to external customers for aggregates, sand, road base and specialty products). The cessation of production from Austen Quarry would obviously require this shortfall to be sourced from elsewhere, more than likely from locations more distant to the Sydney market, leading to an increase in transport and therefore manufacture costs which would ultimately be borne by the construction industry and therefore the NSW public.

As discussed in Section 1.4, approximately 44 million tonnes of recoverable rhyolite has been defined within the remaining sections in Stage 1 and proposed Stage 2 extraction areas at the quarry. Considering this, and the fact that extraction and processing operations are already well established, the quarry is located with direct access to the Great Western Highway (providing a distribution route to Sydney), and is relatively isolated from surrounding residential development, the quarry provides a key supply point for construction materials to the Sydney metropolitan area for at least the next 35 years.

Conversely, should the Proposal not proceed, and the defined resources are not recovered to supply Sydney metropolitan area with construction materials, the demand would still remain. This would necessitate the development of other greenfield sites, or the extension of other quarries which may have greater (or less certain) environmental or social impacts than the Austen Quarry. Failure to develop the resources within the footprint of the Austen Quarry would require the Applicant to source materials from external sources for its concrete manufacturing business. Ultimately, this would make the Applicant less competitive and potentially lead to reduced competition (and therefore higher prices) within Sydney's concrete industry.

[2] https://www.quarry.com.au/ConstructionMaterials/GravelCrushedRock.aspx

The need for the Proposal is therefore demonstrated both by the ongoing demand for the high quality products produced within the quarry and the opportunity to produce and deliver the quarry's products in an environmentally responsible manner.

2.3 OVERVIEW OF THE PROPOSAL

2.3.1 Introduction

For the purposes of this document and the application for development consent, reference is made to existing approved components or activities as "Stage 1" and new or extended components or activities as "Stage 2". **Table 2.1** lists each of the existing components or activities and the extent to which they are proposed to change, where relevant. The locations of all components are displayed on **Figure 2.1**.

It is noted that should development consent be granted for the Stage 2 Extension Project, the Stage 2 extraction area would incorporate the existing Stage 1 extraction area and likewise, the Stage 2 Overburden Emplacement would incorporate the Stage 1 Overburden Emplacement. The Stage 1 component areas and activities, which are detailed in Section 1.5.2 and displayed on **Figure 1.3,** are also outlined in this section for the purposes of describing the extent of the proposed extension within the Site.

2.3.2 Stage 1 Components

Existing Stage 1 Extraction Area

The Stage 1 extraction area, as presented on **Figure 2.1**, covers 12.1ha and encompasses the currently approved extraction limit. **Figure 2.2** illustrates the remaining area to be developed. A ridge on the northern side of the Stage 1 extraction area provides a visual barrier across much of the extraction area for viewers at Hassans Walls. While this ridge is within the approved Stage 1 extraction area, it would only be quarried if the Stage 2 Extension is not approved. Extraction has progressed within the Stage 1 extraction area to an elevation of 750m AHD, 20m above the current approved extraction depth of 730m AHD. The loading hopper of the primary crushing station is located at the northwestern corner of the Stage 1 extraction area at approximately 750m AHD (the footings are at an elevation of approximately 735m AHD).

Existing Stage 1 Overburden Emplacement

The existing Stage 1 overburden emplacement covers approximately 6.6ha (see **Figure 2.1**), and has been developed immediately adjacent to the Stage 1 extraction area. Overburden emplacement in this area has involved the partial in-filling of the head of a gully between 730m AHD and 780m AHD.

Secondary Processing Area

The secondary processing area encompasses the area from the surge stockpile at the end of the conveyor from the primary crushing station to the site office. This area covers approximately 6.1ha and incorporates three crushers, six screens, 17 conveyors and the air separation unit. Aggregates of various sizes are separated or blended to produce customised products and temporarily stockpiled before transportation to their destination or to the Yorkeys Creek stockpile area. This area varies in elevation from 668m AHD (west) to 664m AHD (east) and is bounded to the north by the setback from the Coxs River (see **Figure 2.1**).

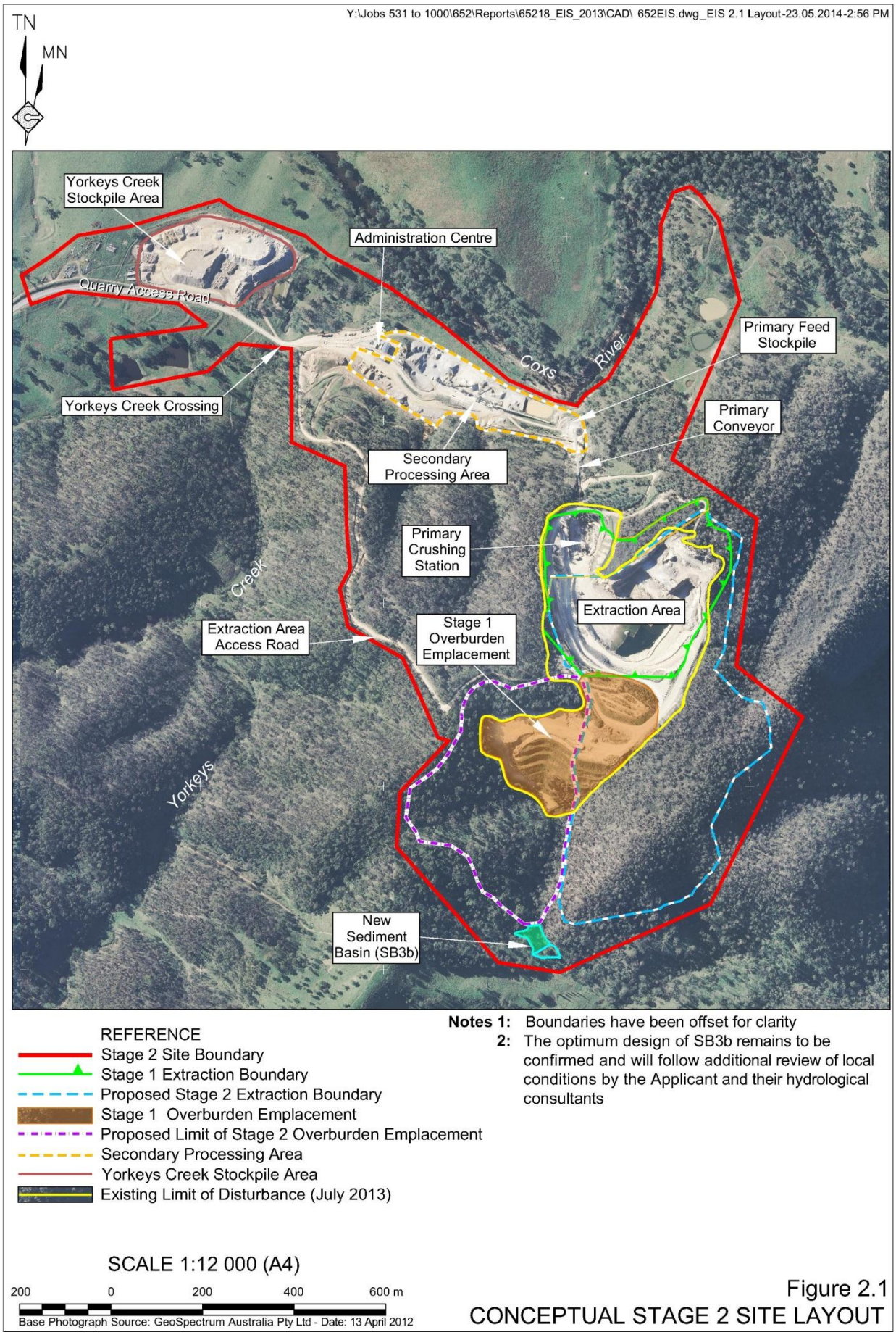


Figure 2.1
CONCEPTUAL STAGE 2 SITE LAYOUT

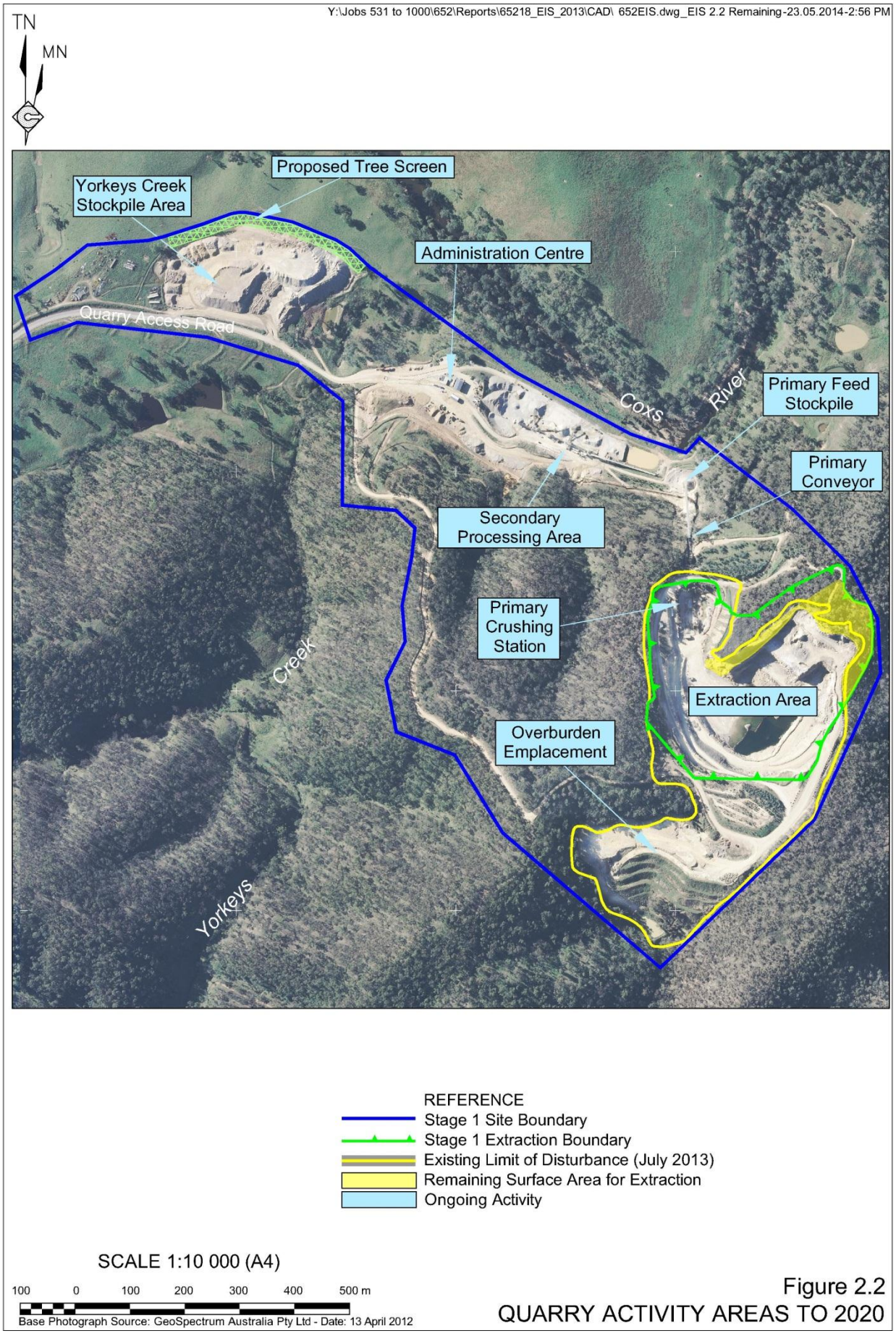


Figure 2.2
QUARRY ACTIVITY AREAS TO 2020

Table 2.1
Overview of Proposal Components and Activities

Component or Activity	Approved Stage 1 Site	Proposed Stage 2 Site	Relevant EIS Section
Area	79ha	Covers 103ha (a 30% increase)	1.3.2
Duration of Approval	Approved to March 2020	Approval sought to March 2050 (an increase of 30 years)	2.11
Maximum Annual Sales Level	1.1 Million tpa	No Change	2.7.2
Extraction Area	Approximately 12.1ha to an elevation of 730m AHD	Extension of approximately 16.1ha to an elevation of 685m AHD	2.5.2
Overburden Emplacement	Approximately 6.1ha to an elevation of 780m AHD	Extension of approximately 9.9ha to an elevation of 810m AHD	2.6
Method of Extraction	Drilling / blasting and load and haul to Primary Crushing Station	No Change	2.5.3
Mobile Equipment Fleet in Extraction Area	1 x Bulldozer 1 x Excavator (85t) 2 x Haul Trucks (40t) 1 x Water Truck (15 000L)	1 x Bulldozer 1 x Excavator (85t) 3 x Haul Trucks (60t) 1 x Water Truck (15 000L)	2.5.5
Secondary Processing Operations	Four Stage Crushing and Screening Plant and air separator - throughput 400tph	No Change	2.7
Product Stockpiling surrounding Plant	Stockpile capacity = 80 000t	No Change	2.7.3
Hours of Operations for the Extraction and Processing	Mon-Fri: 6:00am-6:00pm Saturday: 7:00am-3:00pm	Mon-Fri: 6:00am-10:00pm Saturday: 7:00am-3:00pm	2.11.1
Blasting	Mon-Fri: 10:00am-3:00pm	No Change	2.11.1
Yorkeys Creek stockpile area	Area = 4.4ha Capacity = 750 000 tonnes	No Change	2.7.3
Quarry Access Road	3.1km in length sealed	No Change	2.8.1
Maximum Product Transportation	1.1 Million tpa	No Change	2.8.3
Daily Truck Loads to Sydney Customers	Average 125[@] Maximum 180[#]	No Change	2.8.3
Daily Truck Loads to local and Sydney Customers	Average 150^ Maximum 250[#]	No Change	2.8.3
Loading Product Trucks and Despatch Hours of Operation	Mon-Fri: 5:00am-10:00pm Saturday: 5:00am-3:00pm	No Change	2.11.1
On-site Administration and Amenities	Site Office, two weighbridges, workshops, stores and amenities	No Change	2.10.2

@ Current Average = 83 per day # Current Maximum = 150 per day ^ Current Average = 87 per day

Table 2.1 (Cont'd)
Overview of Proposal Components and Activities

Component or Activity	Approved Stage 1	Proposed Stage 2	Relevant EIS Section
Services			
Diesel	Annual Usage* = 0.95 million litres	Annual Usage** = 1.4 million litres	2.10.7
Telecommunications	1 line	No Change	2.10.6
Sewerage	Biocycle Unit (30 persons)	No change	2.9.2
Rehabilitation	Peripheral rehabilitation only during quarry operational life.	Revegetation of terminal extraction benches.	2.13
	Temporary measures to ensure erosion and sediment control. Monitoring for the success of revegetation and erosion control. Final landform suitable for passive biodiversity conservation (woodland / forest vegetation) and minor grazing[ø]. Removal of all buildings, infrastructure and stockpiles[ø].	No changes to other components	

Note * Based upon 750 000tpa Note ** Based upon 1.1 million tpa [ø] Unless a further stage of operations is approved

Yorkeys Creek Stockpile Area

The bulk of the road pavement materials, manufactured sands, select fills, drainage materials and road construction materials are stockpiled within the Yorkeys Creek stockpile area to the northwest of the secondary processing area on the northern side of the Quarry Access Road (see **Figure 2.1**).

This area is defined by the area between the Quarry Access Road, Yorkeys Creek and the northern boundary of the Application Area, covers approximately 4.4ha and has a total estimated capacity of 750 000t. The Applicant estimates between 600 000t and 700 000t of products are currently retained within the Yorkeys Creek stockpile area.

Quarry Access Road

The sealed private Quarry Access Road from the Jenolan Caves Road to the quarry weighbridge provides the only access to the Site (see **Figure 2.1**). The road has centre and edge line markings the full length of the road between the intersection with Jenolan Caves Road and the substantial culvert crossing of Yorkeys Creek to the west of the outgoing weighbridge.

Other Areas

The Site also incorporates additional existing infrastructure and services including:

- the on-site road network;
- the administration building, amenities, laboratory and other structures;

- water management structures;
- the hydrocarbon storage area;
- two weighbridges; and
- facilities to house services such as power and communications.

These are discussed further in Section 2.10.

2.3.3 Proposed Stage 2 Components

Proposed Stage 2 Extraction Area

The proposed Stage 2 extraction area would incorporate an increase in depth to and lateral extension of the Stage 1 extraction area along an adjacent southwest-northwest trending ridge. Should the Proposal be approved, the northern side of the ridge within in the existing Stage 1 extraction area would remain as a visual barrier to views from the north.

The area of the extension covers approximately 15.8ha and lies immediately to the southeast and east of the Stage 1 extraction area (see **Figure 2.1**). The combined area of the Stage 1 and Stage 2 extraction areas would be 28.2ha. The proposed extension comprises the southern section of a north/south ridge that traverses the land owned by the HPC. The Stage 2 extraction area has been designed largely on the top of a ridge with minimal or no impacts upon the surrounding watercourses.

Proposed Stage 2 Overburden Emplacement

The proposed overburden emplacement would laterally extend (9.9ha) and increase the elevation of the existing Stage 1 overburden emplacement to 810m AHD. The combined area of the Stage 1 and Stage 2 overburden emplacement would be 13.5ha, noting that 3.0ha of the existing Stage 1 overburden emplacement would be incorporated into the Stage 2 extraction area. The Stage 2 overburden emplacement would continue to in-fill the small valley to the southwest of the Stage 2 extraction area (see **Figure 2.1**).

2.4 RESOURCES AND PRODUCTS

2.4.1 Geological Setting and Resources

The hard rock resource being quarried at the quarry is most accurately described as a series of steeply dipping sequences of 'metamorphosed, tuffaceous, acid igneous rocks'. **Figure 2.3** displays the surface geology within and immediately surrounding the Stage 1 and Stage 2 extraction areas. The rock was originally identified as a 'metamorphosed rhyolitic rock' and subsequently described as **'**rhyolite'. The 'rhyolite' and related igneous rock types within the Site are Lower to Middle Devonian in age (approximately 390 million years old). These volcanic rocks are underlain by granitic rocks types and interbedded with a range of metasediments of the Lambie Group that outcrop to both the east and west of the Site.

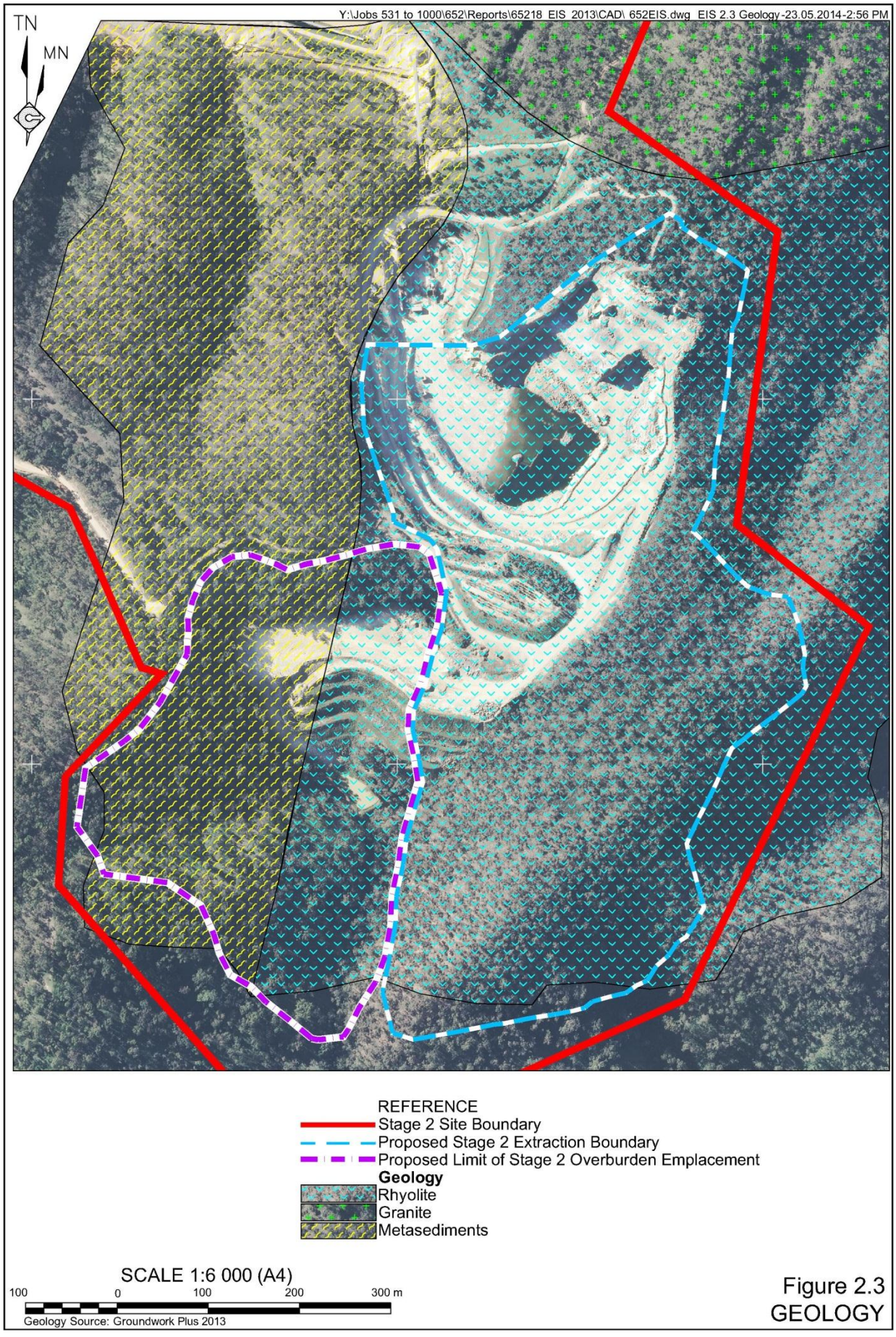


Figure 2.3
GEOLOGY

The Stage 1 extraction area was first drilled in 1991 with second, third and fourth stage exploration programs undertaken in 1994, 1995 and 2003 prior to commencement of continuous extraction activities in 2004. Geological exploration included diamond and percussion drill programs, trial blasting, representative sampling and testing. Since 2004, extraction has exposed the hard rock resource from original hilltop at an elevation of 810m AHD down to the current extraction floor at 750m AHD.

Although being overlain by variable depths of overburden and intruded by two dyke systems, the rock extracted in the Stage 1 extraction area has proven to be strong, durable, sound and of excellent quality for production of a full range of premium quality, hard rock quarry products. The original development consent (DA 103/94) of 1995 allowed for the extraction of 12.5Mt of rock and overburden to yield 9.6Mt of saleable product down to 730m AHD. Approximately 4Mt of rock suited to the production of high quality quarry products remains within the Stage 1 extraction area.

Since 2011, geological exploration of underlying and adjacent hard rock resources has been supervised and reported by industry specialists, Don Reed & Associates (exploration geology and conceptual quarry planning) and Groundwork Plus (geological modelling and detailed quarry planning). Geological exploration has incorporated programs of surface geological mapping, diamond and percussion drill programs, representative sampling of core and lump samples, expanded geological modelling and detailed extraction planning.

The above exploration has confirmed the presence of an additional Indicated Resource of 44Mt of recoverable rhyolite within the extended ridgeline trending from south through to the northeast of the existing Stage 1 extraction area. The rock drilled and tested both laterally and at depth has been petrographically described as the same suite of rock types extracted and processed from the Stage 1 extraction area. Initial indications are that product yields from the newly defined resource would be higher than those from the Stage 1 extraction area. An estimated 4.4Mt of overburden is present within the Stage 2 extraction area.

2.4.2 Quarry Products

Quarry products would remain the same as those of the existing operations, i.e. aggregates typically 20mm, 14mm, 10mm and 7mm, as well as rail ballast, gabion material, blended road pavement products, manufactured sand, select fill, and drainage materials. A number of products are customised to meet the customers' individual specifications. Approximately 50% to 75% of the quarry's products are aggregates destined for the Applicant's seven concrete batching plants in the Sydney Metropolitan Area. The Applicant's seven concrete batch plants in the Sydney metropolitan area and one regional plant located at Wallerawang.

2.5 EXTRACTION OPERATIONS

2.5.1 Introduction

The extraction operations would continue to be undertaken in a similar manner to existing operations i.e. using conventional drill and blast, load and haul methods. This would involve a sequence of activities commencing with vegetation clearing and soil removal, and where necessary stockpiling this for future rehabilitation, followed by overburden removal (where present) and finally extraction of the rhyolite.

This subsection presents information relating to the proposed extended extraction operations including vegetation clearing, soil removal, overburden removal, extraction methods, extraction rates and the mobile equipment fleet.

2.5.2 Design Features

The extraction footprint for the proposed Stage 2 development is presented on **Figure 2.4** together with a typical cross-section. The proposed Stage 2 extraction area encompasses the approved Stage 1 extraction area and extends approximately 100m to the east and 500m to the south. Extraction is proposed to a depth of 685m AHD, approximately 60m deeper than the current extraction area floor (745m AHD) and 50m deeper than the footings of the primary crushing station (735m AHD).

Although subject to modifications based on localised geological conditions or the optimal locations of quarry ramps or sumps, the following general design criteria of the Stage 2 extraction area would be adopted.

- Operational Face Height: 15m.
- Operational Bench Width: 20-100m.
- Terminal Bench Width: 5m-10m.
- Face Angle: 70° (approximate).

The proposed maximum 70° face angle would be subject to further geotechnical investigation throughout the life of the quarry to ensure a safe and stable landform is achieved within the extraction area.

2.5.3 Extraction Method

2.5.3.1 Vegetation Clearing

Vegetation would continue to be cleared by bulldozer and/or hydraulic excavator on steeper slopes or more densely vegetated areas. The cleared vegetation would be stockpiled for future placement, mulched and/or immediately placed on prepared sections of the overburden emplacement (see Section 2.6). Selected material may be made available for use by the landowner or sale for the purposes of fencing materials or firewood. **Figure 2.5** displays the areas to be sequentially cleared of vegetation throughout the life of the quarry. The extent of clearing would be typically between 1.1ha to 6.6ha during each stage with between 1.0 and 2.0ha cleared at one time.

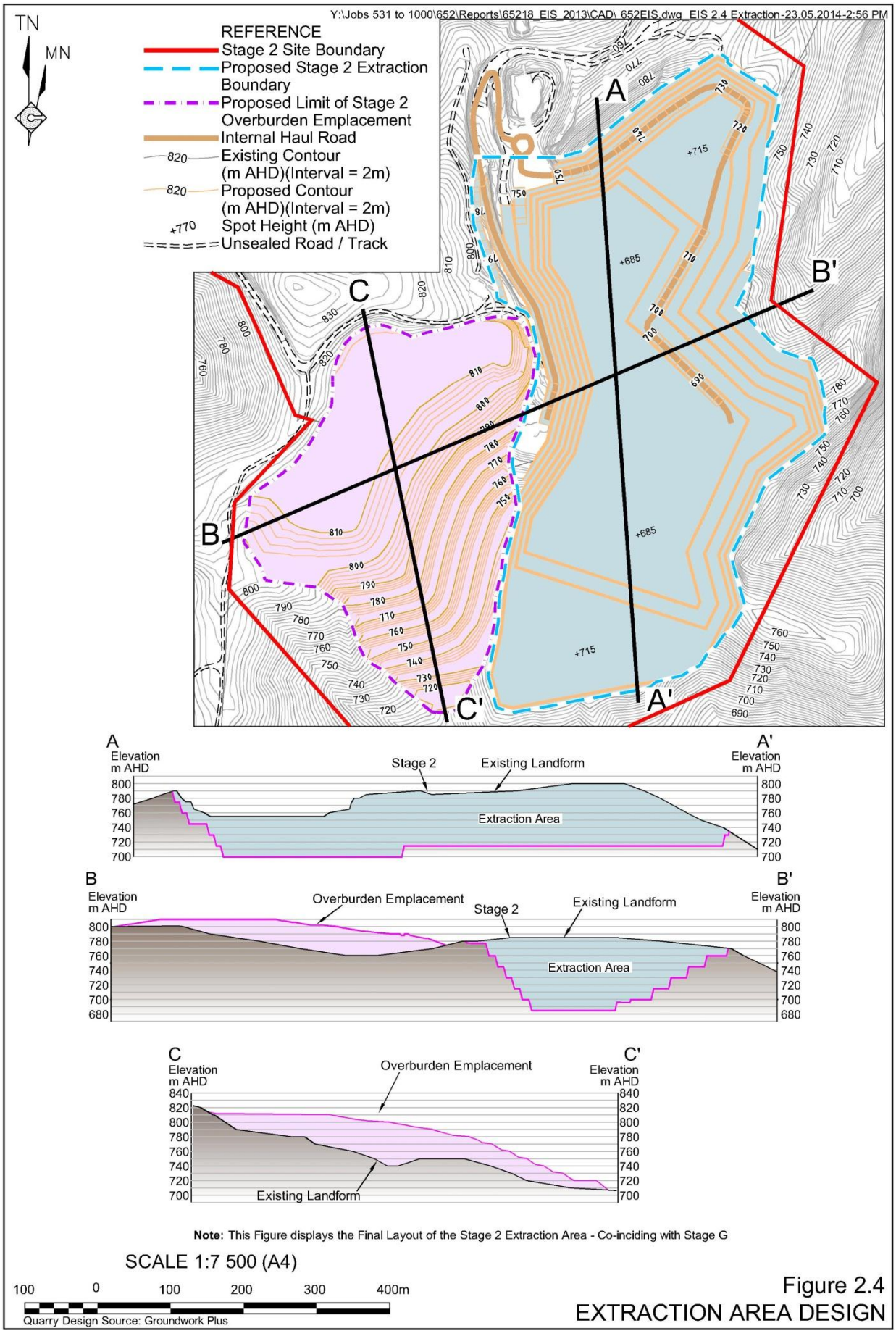


Figure 2.4
EXTRACTION AREA DESIGN

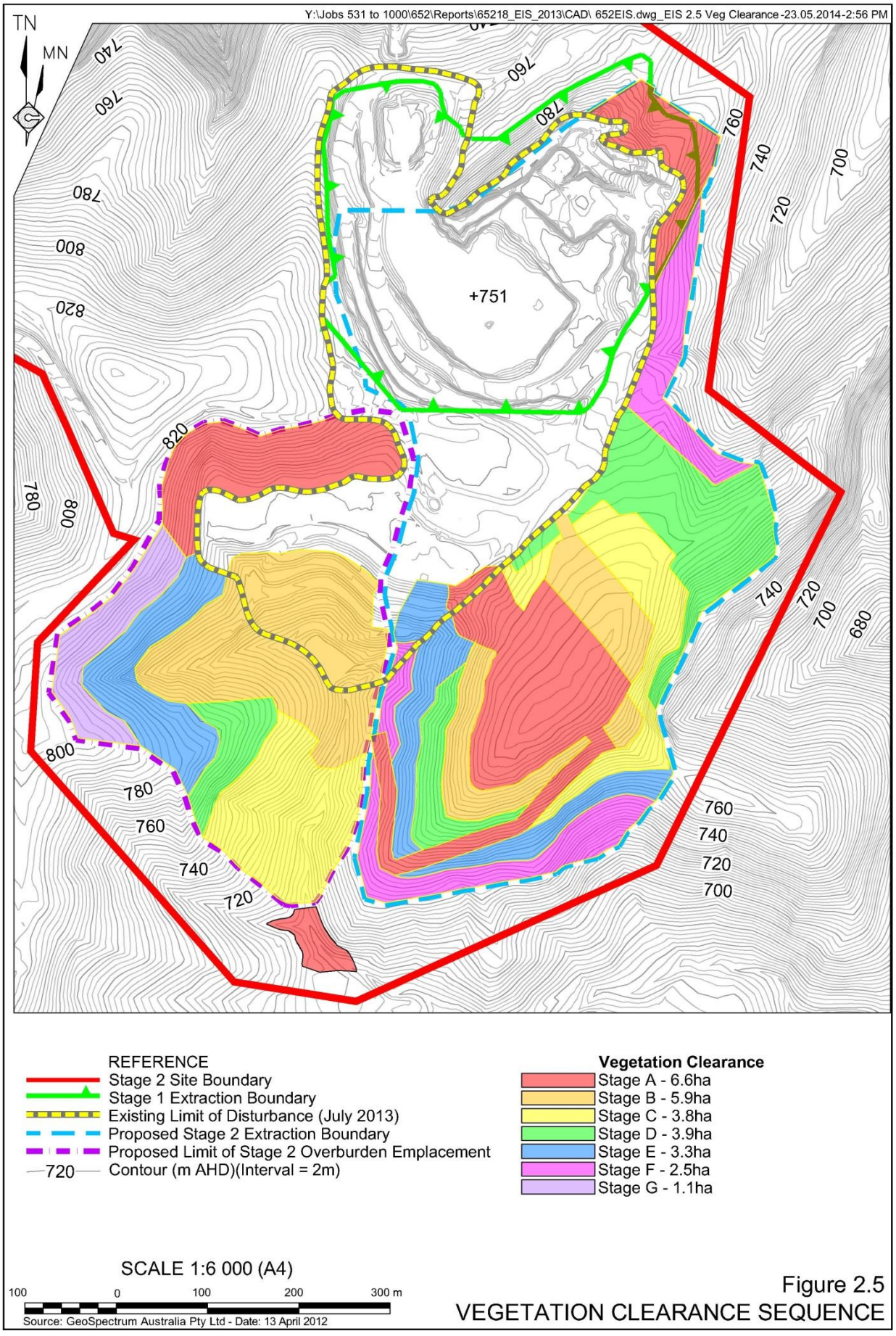


Figure 2.5
VEGETATION CLEARANCE SEQUENCE

2.5.3.2 Soil Removal

As noted in SEEC (2014), the topsoil of the Site is thin (50mm to 100mm) and poorly defined above a moderate subsoil layer (600mm). Bedrock occurs immediately below the subsoil and outcrops in various areas across the Site. SEEC (2014) notes that the topsoil and subsoil are sufficiently similar so as to be stripped, blended and managed as a single unit. The soil would be stripped (to an average depth of 600mm) using a bulldozer and/or excavator loaded into trucks and either stockpiled within an interim area within the overburden emplacement for future placement, or immediately placed on prepared sections of the overburden emplacement. The act of stripping, stockpiling and respreading would provide for adequate blending of the topsoil and subsoil. Furthermore, more active blending could destroy the limited structure of the subsoil.

The area of land cleared at any one time would be confined to an area that can be shaped and profiled on a daily basis such that all runoff from the cleared area is directed back into the active extraction area. As far as practicable, soil stripping would avoid the December to February period given the predicted annual soil loss using the Revised Universal Soil Loss Equation (RUSLE) (Landcom, 2004) indicates the soil loss class for the Site would be Class 5 (high) (SEEC, 2014). If clearing during these months is unavoidable, additional practices would be undertaken to reduce the erosion risk, such as immediate application of ground cover, e.g. mulch, or reduction in the slope length to half by using mulch berms, contour banks, etc.

2.5.3.3 Overburden Removal

Following the removal of recoverable soil, any rippable rock that is not suitable for processing would be ripped by bulldozer or hydraulically excavated and loaded into haul trucks and placed within the overburden emplacement. Overburden above the rhyolite which is too hard to be ripped would be drilled and blasted before the material is loaded and hauled to the overburden emplacement. These development blasts would generally be smaller than production blasts due to the proximity to surface and associated potential for noise and fly-rock impacts.

Current quarry planning indicates approximately 2 200 000m^3 (4.4Mt) of overburden and interburden (including dyke material and weathered rock) would be removed throughout the life of the Proposal. It is anticipated that the quantity of overburden removed each year would vary depending on the development activities undertaken during that year. It would generally be between 100 000t and 400 000t annually although negligible quantities could be extracted during some years.

2.5.3.4 Rhyolite Extraction

The exposed rhyolite would be drilled and blasted with the fractured rock loaded into haul trucks and tipped into the hopper at the primary crushing station. On average, each production blast would remove approximately 60 000t, although larger blasts of up to 100 000t or more may be planned whilst maintaining compliance with noise and vibration criteria. A blast yielding 60 000t would cover a surface area of approximately 1 600m^2, i.e. based upon a 15m high bench.

2.5.4 Extraction Sequence

Figure 2.6 provides a conceptual illustration of the extraction sequence, i.e. based upon six intermediate stages. The final stage is represented in **Figure 2.4**. **Table 2.2** provides the volume of overburden to be removed at each stage.

Table 2.2
Extraction Sequence

Extraction Stage	Total (bcm)	Rhyolite [2]		Overburden [3]	
		bcm	t	bcm	t
Stage 1[1]	*1 992 000*	*1 594 000*	*4 144 500*	*398 000*	*796 000*
A	465 000	372 000	967 000	93 000	186 000
B	344 000	275 000	715 000	69 000	137 500
C	1 234 000	987 000	2 566 500	247 000	493 500
D	1 810 500	1 448 500	3 766 500	362 000	724 500
E	4 029 000	3 626 000	9 427 000	403 000	805 500
F	3 846 000	3 461 500	8 999 500	384 500	769 000
G	2 659 500	2 393 500	6 223 500	266 000	533 000
Total	**16 380 000**	**14 157 500**	**36 809 000**	**2 222 500**	**4 445 000**

Note 1: Remaining in approved Stage 1 extraction area bcm = bank cubic metres
Note 2: In situ density = 2.6t/m^3
Note 3: In situ density = 2.0t/m^3
Source: Groundwork Plus

Notably, the ridge retained to the north of the Stage 1 extraction area would remain undisturbed for the life of the Stage 2 Extension to maintain a visual barrier to vantage points to the north and northwest. It is recognised that this action would sterilize in excess of 2Mt of high quality rhyolite.

2.5.5 Extraction Equipment

With the addition of one further haul truck and the increased capacity of the haul trucks from 40t to 60t to account for the increased overburden movement and production up to the maximum approved limit, the Applicant would continue to operate the same or equivalent mobile equipment throughout the life of the Proposal. The Applicant would also continue to operate one water truck between the Stage 2 extraction area and the secondary processing area and a fleet of light and maintenance vehicles. A drill rig would continue to be brought in on a contract basis for drilling blast holes. **Table 2.3** lists the proposed mobile equipment fleet, including the number and frequency of use of each fleet item. The number of items of mobile equipment is based upon the extraction of 1.1Mtpa of rhyolite and a maximum quantity of overburden of 0.4Mtpa. Details of the locations and elevations of the various items of equipment in the respective years are included in the noise and air quality assessments.

Table 2.3
Mobile Equipment Fleet

Type	Model	No.	Function	Frequency of Use
Drill	AC 1152	1	Drilling blast holes	Continuous
Excavator	PC 850	1	Loading blasted rock into haul trucks	Continuous
Haul truck – 750 000tpa	HD405	2	Transporting blasted rock to primary crushing station or overburden emplacement	Continuous
Haul Truck – 1.1 million tpa	HD605	3		Continuous
Grader	G16	1	Grading roads	2 days every 2 months
Bulldozer	D10	1	Stripping vegetation and ripping/pushing weathered overburden	3 hours per day
Water Cart	15 000L	1	Dust suppression	8 hours per day
Fuel Truck	5 000L	1	Fuelling mobile fleet	1 hour per day

2.6 OVERBURDEN MANAGEMENT

2.6.1 Introduction

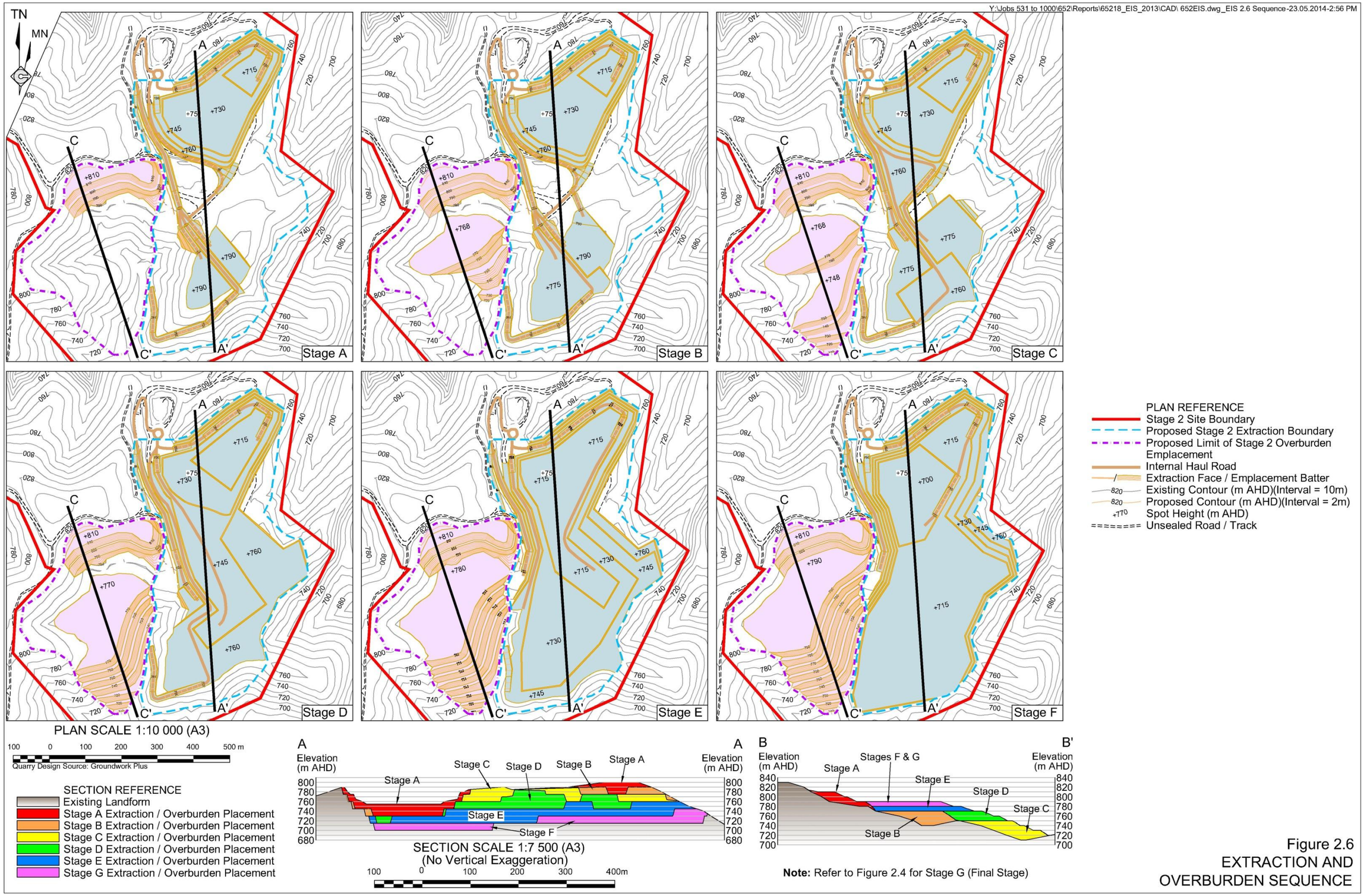
Over the remaining life of Stage 1 and proposed Stage 2 Extension, approximately 2 200 000m^3 (4 400 000t) of overburden would be removed from the extraction area. Applying a swell factor of 1.3, this equates to a volume of 2 860 000m^3 requiring placement within an extended overburden emplacement.

The following subsections describe the design and construction sequence of the overburden emplacement prepared by PSM Consult Pty Limited (PSM). A complete copy of this report (PSM, 2013) is included as **Appendix 4** to the EIS.

2.6.2 Overburden Emplacement Design

Figure 2.4 presents the indicative layout and typical sections through the overburden emplacement, the primary features of which are as follows.

- Storage for the placement of 3Mm^3 of overburden, exceeding the anticipated volume of overburden to be generated over the life of the Proposal (see Section 2.6.1).
- Extension of the toe of the overburden emplacement to 710m AHD, lateral extension to the southwest and complete infill of the valley.
- Extension to the north, by way of three additional 10m lifts, to the 'skyline' section of the Extraction Area Access Road.
- Phased construction to enable the 'bottom-up' development of the emplacement, i.e. establishment of lower sections of each phase and subsequent placement over these as a series of 10m lifts.
- The outer slope of each lift would be profiled on completion to provide for a 26° slope.



Note: Refer to Figure 2.4 for Stage G (Final Stage)

Figure 2.6
EXTRACTION AND OVERBURDEN SEQUENCE

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Clean water diversion banks or channels would be constructed up-slope of the extended overburden emplacement and each bench would be contoured to retain run-off, i.e. the cross-fall of each bench would be back towards the slope of the emplacement. A sediment basin, designed to accommodate sediment-laden runoff from a 5-day 95th percentile rainfall event, would be constructed at the base of the overburden emplacement (see Section 4.5.4 for details).

2.6.3 Construction Sequence

Prior to the placement of overburden within the Stage 2 overburden emplacement, the vegetation and soil resources contained within the impact footprint of each stage would be cleared, stripped and managed as described in Sections 2.5.3.1 and 2.5.3.2. This would include the vegetation and soil contained within those areas of rehabilitation to be disturbed by the Stage 2 overburden emplacement.

Figure 2.6 provides an illustration of the proposed construction sequence of the overburden emplacement to approximate the seven extraction stages (A to G) for the Proposal.

On initial development of the Stage 2 extraction area (Stage A), overburden would be placed between the 780m AHD level of the existing overburden emplacement and the Extraction Area Access Road, at an elevation of 810m AHD. This would allow for the placement of overburden prior to the completion of a haul road between the initial Stage 2 extraction area and the 730m AHD contour (which would provide access to the lower elevation sections of the overburden emplacement). A bulldozer would be used to push and profile the material which would be constructed from east to west for both lifts. On reaching the final extent, the material would be compacted and the outer batter slope profiled in preparation for rehabilitation.

Following completion of an access road from the Stage 2 extraction area to the 730m AHD, the Stage 1 overburden emplacement would be extended laterally (to the west) and vertically (to 740m AHD). This would be followed by a series of up-slope emplacement phases as follows.

- Stage C: from the toe of the emplacement at 710m AHD to an elevation of approximately 750m AHD.
- Stage D: completion of the emplacement from the toe (710m AHD) to an elevation of 770m AHD.
- Stage E: completion of the emplacement from 770m AHD to an elevation of 780m AHD.
- Stage F: completion of the emplacement from 780m AHD to an elevation of 790m AHD.
- Stage G: completion of the emplacement from 790m AHD to an elevation of 810m AHD.

In developing the overburden emplacement through Stages E, F and G, the outer (exposed) perimeter of each successive lift would be constructed and profiled first. This would allow for the rehabilitation of this exposed slope, whilst overburden is placed behind.

The overburden emplacement would be progressively constructed in this manner until the volume of overburden generated by the extraction area is exhausted or the extent of the emplacement as presented on **Figure 2.4** is reached. **Table 2.2** provides the approximate volume of overburden to be placed within each stage of the overburden emplacement.

2.7 CRUSHING, SCREENING AND STOCKPILING OPERATIONS

2.7.1 Processing Plant Design and Operations

Processing operations would continue as described in Section 1.5.3 and in the processing flow sheet displayed on **Figure 1.5** for the secondary processing operations. This includes a fixed processing plant that incorporates a combination of primary followed by a further three stages of crushing, a series of screens are utilised as well as an air separation unit to produce manufactured sand. **Table 2.4** lists the main components of primary crushing station and the secondary processing plant.

Table 2.4
Existing Processing Plant Components

Equipment*	Number of Items	Use
Primary Crusher (Vickers Rv holt 60” x 48” (DT))	1	Primary crushing of materials
Secondary Crusher (MVP450)	1	Secondary crushing of materials
Tertiary Crusher (MVP550)	1	Tertiary crushing of materials
Quaternary Crusher (Canica VS1)	1	Predominantly product shaping
Air Separation Unit (Fisher (13’))	1	Manufactured sand
Screens (various sizes)	6	Size screening of materials
Conveyors	17	Movement of materials around processing plant
* These items would require regular maintenance and periodic refurbishment/replacement throughout the life of the plant.		

The degree of processing is dependent on the size or other characteristics of the final product(s) required.

The Applicant proposes to install a mobile pugmill within the Yorkeys Creek stockpile area to produce a range of road pavement materials from the products stockpiled within the area.

2.7.2 Production Rates

The rate of production from the quarry would be controlled by the demand for building and construction materials from the Sydney metropolitan area and regional markets while maintaining the 1.1Mtpa limit for product sales of DA 103/94. It is anticipated that sales from the quarry would reach the approved level of 1.1Mtpa by about 2015 or 2016. It is noted that the rate of production through the processing plant may periodically exceed 1.1Mtpa as it will be necessary to maintain production stocks, as well as the products despatched. In any one year, when 1.1Mt of products are sold, the processing plant throughput could be expected to be in the order of 1.15 to 1.25Mtpa.

Products would continue to be produced through the secondary processing plant on each operational day with the plant operating at approximately 400tph. The quantity of products produced daily would reflect the number of hours the processing plant operates within.

2.7.3 Product Stockpiling

Product stockpiles would also be utilised in a similar manner to existing operations (see Section 1.5.3.2).

2.7.4 Processing Plant Fines and Other By-Products

Processing plant fines and other by-products produced in processing operations would be temporarily stockpiled in the secondary processing area before being despatched from the quarry or stockpiled in the Yorkeys Creek stockpile area until they are blended within the proposed pug mill to manufacture a range of road pavement materials.

2.8 PRODUCT TRANSPORTATION

2.8.1 Site Access and Transport Routes

Product transportation would be undertaken in a manner consistent with current practices. All trucks would continue to access the quarry only via the existing entrance from Jenolan Caves Road. This entrance and the associated intersection with Jenolan Caves Road have been upgraded to accommodate the approved level of truck transportation.

All products would be loaded into road registered trucks within either the secondary processing area or the Yorkeys Creek stockpile area. Trucks would exit the quarry via the departure weighbridge and Quarry Access Road, with virtually all of the trucks turning right onto Jenolan Caves Road and continuing northwards to the intersection with the Great Western Highway. The majority of movements would then be to the right or in an easterly direction towards the Blue Mountains and the Sydney metropolitan area.

Depending on demand for construction materials for local projects between Hartley and Lithgow, there are likely to be periods when more trucks (typically rigid trucks) turn left or in a westerly direction at the Jenolan Caves Road – Great Western Highway intersection to supply those projects or other destinations beyond Lithgow. Aggregates from the Austen Quarry are also delivered to the Hy-Tec concrete batching plant at Wallerawang. The existing transport routes to and from the quarry are displayed on **Figure 2.7**.

All product trucks would be initially weighed using the on-site incoming weighbridge and then at the departure weighbridge prior to exiting the quarry. No overweight vehicles are, or would be permitted to leave the quarry.

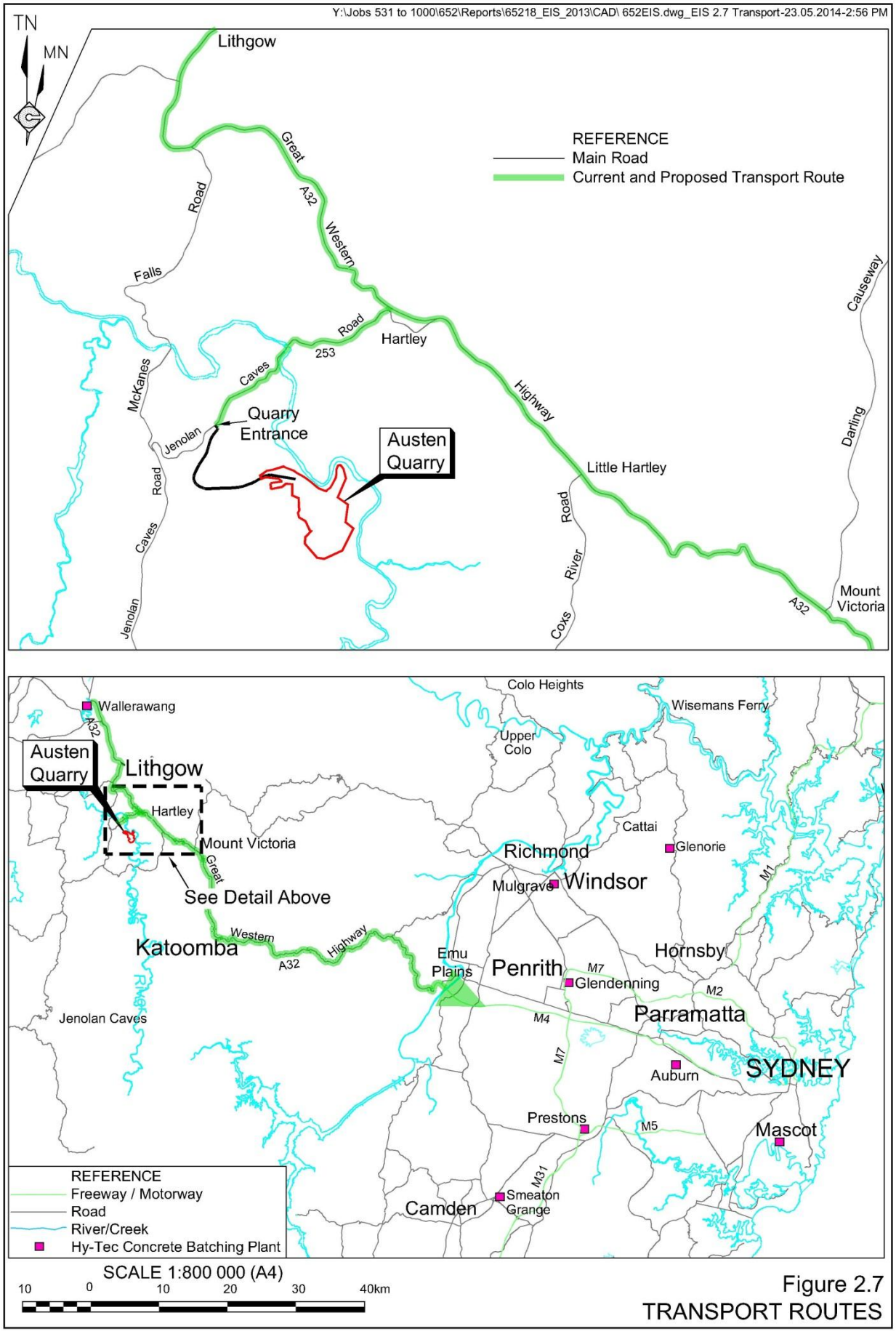


Figure 2.7
TRANSPORT ROUTES

2.8.2 Heavy Vehicle Types

Product trucks entering and leaving the quarry are typically truck and dog trailer combinations or less commonly 19m B-Doubles. Other trucks such as smaller rigid vehicles also make up a small proportion of quarry traffic. The average pay load capacity for all trucks would be approximately 30t taking into account the capacity of smaller rigid vehicles carrying material from the quarry.

Currently, approximately 80% to 90% of the trucks that travel eastwards travel the full length of the Great Western Highway and continue on the M4 Motorway before travelling to their specific destinations. The only trucks that do not travel the full length of the Great Western Highway to Emu Plains are those delivering quarry products to the highway upgrade projects and those destined for the Lawson and Springwood concrete batching plants operated by Hanson.

2.8.3 Product Distribution and Traffic Levels

For the production of approximately 750 000tpa, the quarry currently generates an average of approximately 83 truck loads or 166 trips or movements per day, up to a maximum of approximately 150 truck loads or 300 trips or movements per day (where one load generates two trips or movements). These average and maximum vehicle trips or movements assume operations 6 days per week (and excluding public holidays), i.e. 302 days per year.

As discussed in Section 1.5.4, the despatch of 1.1 million tpa would involve one of two scenarios on weekdays.

Scenario 1: **Predominantly Sydney Customers** (95% to Sydney / 5% local).
Average: 125 loads / 250 trips or movements.
Maximum: 180 loads / 360 trips or movements.

Scenario 2: **Sydney Customers and Local Road Works** (70% to Sydney / 30% local).
Average: 150 loads / 300 trips or movements.
Maximum: 250 loads / 500 trips or movements.

It is most likely that Scenario 1 would be the most common occurrence, except for those days when local projects are supplied, e.g. to supply RMS road works between Lithgow and Mount Victoria. In reality, there may only be two or three periods until 2050 when this level of local traffic would occur. On the days when local RMS road works are being supplied, it is highly unlikely that maximum traffic levels through the Blue Mountains would be achieved.

During the short-term campaigns to supply local RMS road works, when smaller capacity rigid trucks of (average) 15t capacity dominate trips or movements to and from the quarry, a maximum of 25 truck loads or 50 trips or movements per hour could occur. For deliveries to the Sydney metropolitan area, when the dominant vehicle types entering and exiting the quarry are truck and dog trailer combinations or 19m B-Doubles, a maximum of 20 truck loads or 40 trips or movements per hour could occur.

The proposed average product transport distribution is indicated on **Figure 2.7,** i.e. approximately 95% of despatched products would be transported along the Great Western Highway to the east of Jenolan Caves Road, and 5% transported along the Great Western

Highway to the west of Jenolan Caves Road. This distribution would vary when RMS road works or other local projects are being undertaken to the west of Jenolan Caves Road. It is anticipated that during these periods the proportion of product trucks from the quarry may reach approximately 30% to the west and 70% to the east. When RMS local road works are being undertaken between Hartley and Mount Victoria the higher levels of product truck movements may also occur over that section of the Great Western Highway. As noted above, these deliveries use smaller capacity rigid trucks and would generally be completed by early afternoon.

2.9 WASTE MANAGEMENT

2.9.1 Introduction

The DGRs issued for the Proposal identified "*Waste*" as a key issue requiring that the "*EIS include:*

- *accurate estimates of the quantity and nature of the potential waste streams of the development;*
- *a waste disposal strategy;*
- *details of the importation of materials onto the site; and*
- *a description of measures that would be implemented to minimise production of other waste, and ensure that that waste is appropriately managed.*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the EPA and Lithgow City Council which request that the EIS record all wastes to be generated, mitigation and management plans and that the waste be dealt with in accordance with relevant guidelines and legislation.

The following provides an overview of waste streams that would be generated by the Proposal, approximate volumes and methods of disposal. It is noted that the Applicant would not import any waste materials onto the Stage 2 Site.

2.9.2 Production Waste

Production waste generated by the Proposal can be classified as either the overburden waste, i.e. non-rhyolitic rock to be extracted over the life of the Proposal, and processing by-product, i.e. the crusher oversize, fines and scalps removed prior to sale of the various products.

Overburden

As noted in Section 2.6.1, approximately 2 200 000m^3 (4 400 000t) of overburden would be removed from the extraction area throughout the life of the Proposal. Applying a swell factor of 1.3, this equates to a volume of approximately 2 860 000m^3 requiring placement within an extended overburden emplacement. PSM (2013) confirms that the proposed overburden emplacement provides sufficient capacity and would be structurally stable (see **Appendix 4**).

Process By-product

The objective of the Applicant is to incorporate all crushed components of the rhyolite into aggregate, road pavement, select fill and other manufactured sand and soil products. In doing so, the volume of 'waste' requiring long-term management on the Stage 2 Site would be minimised.

Currently between 15% and 20% of the rhyolite crushed at the primary crushing station is removed as fines or scalps and transferred to the Yorkeys Creek stockpile area. A much smaller proportion of the crushed rhyolite would be separated from the final products on the secondary processing area. Taking into consideration improvements to in-pit screening, it is anticipated that as quarry operations approach the maximum production rate, the combined primary and secondary process by-product would approximate 100 000tpa to 150 000tpa.

The Applicant has identified that these by-products can be reprocessed, sold and used as valuable road construction materials, either as sub-base material, blending material for road base aggregates or in some cases as road base to RMS specifications. As road construction projects within the Lithgow City, Blue Mountains City and other LGAs are commenced, the Applicant expects the demand for these materials will increase. As an initial target, the Applicant is aiming to reprocess and sell 100 000tpa of by-product, with periodically larger campaigns to supply specific road or other infrastructure projects to result in a gradual reduction in the Yorkeys Creek stockpile area.

2.9.3 Non-production Waste

A number of solid and liquid wastes would continue to be produced on site. The Applicant proposes to continue to manage the wastes in the manner adopted as detailed below.

Sewage

An on-site sewage treatment biocycle unit capable of managing sewage for 30 persons is maintained on site. This unit would be able to manage the sewage generated throughout the Stage 2 operations.

Waste Oil

Waste oil is collected from the workshop sump and other locations and is regularly removed on a monthly or as needs basis for recycling.

General Solid Wastes

All general solid wastes are currently collected in waste skips and removed on a weekly basis. Separate bins are provided for recyclable materials such as paper, cardboard, plastic and metal. Greater emphasis would be placed upon measuring the proportion of wastes separated for recycling throughout Stage 2.

Scrap Metal

A small amount of scrap metal is produced at the quarry, primarily as a result of plant maintenance and parts replacement. Scrap metal bins are provided and removed on an as needs basis by a licenced metal recycler. The volume of this waste generated each year varies and cannot be accurately estimated.

2.10 INFRASTRUCTURE AND SERVICES

2.10.1 On-Site Road Network

Existing haul roads and internal access roads would be extended into the Stage 2 extraction and overburden emplacement areas to allow transportation of the blasted rock to the primary crusher and for the emplacement of overburden and general access to approved personnel.

Vehicle access to the Stage 2 extraction area would continue on the unsealed road that enters from the western side of the Stage 1 extraction area (see **Figure 2.1**).

Existing internal access roads would continue to provide access to the processing area, administration and services areas and to the weighbridge for road registered product despatch trucks.

The road network within the Stage 2 extraction area would be modified, as required, throughout the life of the Proposal to provide access from the active extraction area to the primary crushing station.

2.10.2 Buildings and Structures

The principal buildings on the Site are the existing office, weighbridge offices and maintenance workshop. Each of these buildings would remain and be used in a similar manner to existing operations.

The existing smaller structures and buildings on site would be retained throughout the remaining life.

2.10.3 Weighbridges

The Quarry operates with two weighbridges, one for incoming trucks and one for outgoing trucks (see **Figure 2.1**). Trucks are not issued with a transport docket in the event a truck is overloaded.

2.10.4 Water Use

The Applicant sources its water requirements for the Stage 1 operations from three sources, namely:

- a series of storage and sediment dams located across the Site, interconnected by a series of pipes and pumps to two water storage tanks with capacities of 100KL and 30kL (see **Figure 2.8**);
- sump(s) maintained on the floor of the primary crushing station and active extraction area where surface runoff occasionally and groundwater seepage collects (and is pumped either to the storage tank located to the west of the extraction area or SD1); and
- surface water from the Coxs River should the quarry exhaust water available or the licensed allocation from the dams specified above.

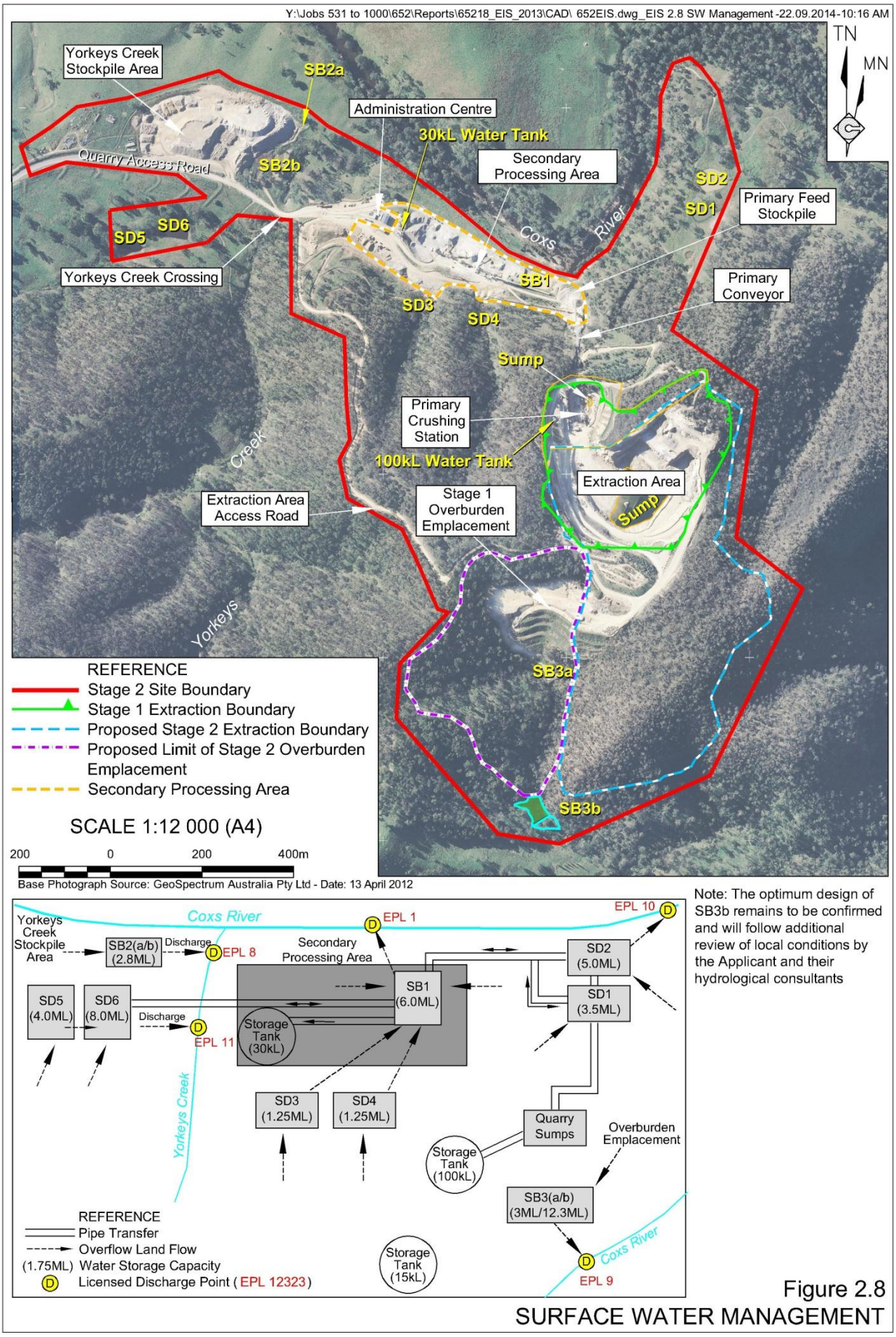


Figure 2.8
SURFACE WATER MANAGEMENT

Dust suppression is the major on-site requirement for water using a maximum of 31.5ML annually. On the basis of information provided by quarry personnel, it is estimated 21.1ML is drawn from the sediment basin within the secondary processing area (SB1)[3] and 10.4ML from the extraction area sump[4]. An estimated 11.7ML/year would continue to be lost as a result of evaporation, based on annual evaporation rate of 975mm/year[5] and an effective surface area[6] of water storages of 12 000m^2.

Water sourced from the on-site water storages, extraction area sumps or extracted from the Coxs River is and would be continue to be used at the quarry for the following.

- Truck washing and routine maintenance.
- Irrigation of rehabilitation and other vegetation plantings.
- Dust suppression.

While the volume of water used each year, and within each year would vary depending weather conditions, production levels and specific operating conditions on the Site, annual water requirements have not, and are not expected to exceed 35MLpa. Considering the annual evaporation expected from the exposed water storages noted above, the total water requirement for the quarry is approximately 45ML/year.

The surface water to be captured and used on the Site would be undertaken with recognition of the Maximum Harvestable Rights Dam Capacity (MHRDC) for the landholding on which the Site is located. Using the calculator available on the NOW website, the MHRDC would be 16.5ML for the 200ha of land that the Applicant leases form HPC[7]. The storage capacity of the dams and sediment basins of the Site is as follows.

- SD1 – 3.5ML*
- SD2 – 5.0ML*
- SD3 – 1.25ML*
- SD4 – 1.25ML*
- SD5 – 4.0ML
- SD6 – 8.0ML
- SB1 – 6.0ML*
- SB2a/b – 2.8ML
- SB3a/b – 3ML / 12.3ML

Those storages marked with an asterisk (*) form part of the MHRDC for the Site. Notably, as these provide 17ML of storage, only 5.5ML would be drawn from SB1 for the purpose of on-site water use. Storage dams SD5 and SD6 are excluded from the MHRDC for the Site as these are incorporated into the MHRDC for the larger property of HPC. Water from these dams is available to Hy-Tec through negotiation with HPC.

[3] The estimate is based on the 13kL water truck being refilled six times Monday to Friday and four times on Saturdays, 52 weeks a year (23ML). Dust suppression is not undertaken on days when rainfall of (approximately 10mm) is received and a review of rainfall data for the years 2009, 2011, 2012 and 2013 indicates this occurs on an average of 24 days a year (2010 data was not included given this was an exceptionally high rainfall year and skews the average) (-1.9ML).

[4] The estimate is based on refilling of the 100kL storage tank twice per week (200kL).

[5] Pan evaporation rate of 1 341mm/year (see **Table 4.1**) x correction factor (0.75).

[6] Assumes the sumps of the extraction area are maintained at the maximum surface area while the various water storages and sediment dams are maintained at an average of 75% capacity.

[7] The multiplier value for the Stage 2 Site obtained from the farm dams calculator of the NSW Office of Water (http://www.farmdamscalculator.dnr.nsw.gov.au/cgi-bin/ws_zoom_6.epl) is 0.0825ML/ha.

The Applicant also purchases potable water, stored in 10kL tanks of the administration area and primary crushing station, for the purpose of drinking, ablutions and dust suppression (on the conveyors and screens when surface runoff may have a high concentration of suspended sediment which could clog spray nozzles).

The Applicant[8] holds the following licence, issued under Section 87B of the *Water Management Act 2000*, which provides access to water in addition to that purchased or harvested on the Site.

- WAL 25616: allows for 20 units (of 2ML/unit in the first year reverting to 1ML/unit thereafter[9]) to be extracted from the Upper Nepean and Upstream Warragamba Water Source (Coxs River) of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* annually.

A small amount of groundwater is expected to be removed ('taken') from the local aquifer (~8MLpa – refer to Section 4.6.5.2), either as a component of the rhyolite and overburden excavated or drainage of the adjoining rock within the cone of depression to the extraction areas from where it either evaporates, is dewatered, or used for dust suppression. To account for this 'take' of groundwater, the Applicant has lodged an application for a zero allocation WAL. On receipt of this, an allocation for the annual volume of groundwater to be taken would be obtained in one of two ways.

1. By temporary or permanent transfer of existing WALs (or part of) within the Coxs River Fractured Rock Aquifer Groundwater Source of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* (WSP, 2011). A search of publically available records has identified that there are only eight WALs for this Groundwater Source with allocations of between 0.5 and 21 units. The Applicant has made initial investigations as to the possibility of temporary or permanent transfer of these WALs.
2. As part of a controlled allocation of groundwater from the Minister for Natural Resources, Lands and Water. It is noted that a controlled allocation order, including the additional allocation of up to 327 units within the Coxs River Fractured Rock groundwater management unit, was issued on 9 September 2014 (NSW Government, 2014). This represents approximately 5% of the long-term average annual extraction limit (LTAAEL) for the Coxs River Fractured Rock management unit (6 806ML/yr) identified in the WSP (2011). The Applicant intends on applying for 20 units (20MLpa) of this controlled allocation by the deadline of 20 October 2014.

The removal of groundwater would be approved for commercial or industrial use by virtue of the development consent issued under Division 4.1 of the EP&A Act (for State Significant Development).

Section 4.5.5 provides a detailed assessment of the Site Water Balance for the Proposal which demonstrates sufficient water will be available for use.

[8] As Aus - 10 Rhyolite Pty Limited.

[9] In accordance with the rules of the water sharing plan, up to 20ML can be carried over until used.

2.10.5 Power

No mains power is connected to the Quarry. All electrical power is generated by three diesel-powered generators. Three 1000kVA generators are used to supply power for the primary crushing station and the secondary processing plant. A third, smaller 35kVA generator provides power to the administration area, workshop and weighbridges.

2.10.6 Communications

The administration office operates with one communications line for both telephone and data transfer. Either UHF two-way or mobile telephones are used throughout the quarry for on-site communication.

2.10.7 Hydrocarbon Storage

The existing fuel bay incorporating one 31 400L diesel tank and one 10 000L diesel fuel truck tank would be retained. All oils, greases etc. are stored in a concrete-bunded facility within a building adjacent to the workshop.

2.11 HOURS OF OPERATION AND QUARRY LIFE

2.11.1 Hours of Operation

Blasting and product despatch would continue to be undertaken within the current approved hours of operation. The Applicant does, however, propose to increase the period during which extraction and processing would be undertaken. **Table 2.5** lists the overall proposed hours of operation for the Proposal.

Table 2.5
Proposed Hours of Operation

	Monday to Friday	Saturday	Sundays / Public Holidays
Blasting*	10:00am to 3:00pm	No Activity	No Activity
Extraction and Processing	6:00am to 10:00pm	6:00am to 3:00pm	No Activity
Loading Trucks and Product Despatch*	5:00am to 10:00pm	5:00am to 3:00pm	No Activity
Maintenance	24 hours/day – Any day		
* No change			

The increase to the hours of extraction and processing operations are required as relatively constant extraction, crushing and processing operations are required between 6:00am and 6:00pm to produce the approved 1.1Mtpa. By increasing the available hours for extraction and, more importantly, processing until 10:00pm, the following benefits would be derived.

- Greater operational flexibility would be provided such that general maintenance work, shut-downs and other enforced stoppages can be accommodated without compromising either safe operations or the ability to produce the approved 1.1Mtpa.

- A later start-up time during the winter months, when inversion conditions are prevalent, could be accommodated. Inversion conditions enhance noise dispersal and cause frosts which reduce operating efficiency.
- The viability of reprocessing the process by-products within the Yorkeys Creek stockpile area to produce specialty aggregates and other products would be improved. Scalped materials from the primary crushing circuit are currently stockpiled within an area referred to as the 'reclaim boot'. There is the potential to deliver these scalps to the secondary and tertiary screening circuit to produce specialty aggregates and other products, however, as the crushing and screening circuit must be operated close to full time to produce sufficient coarse aggregates, sands and road base products, these scalps are generally transferred to the Yorkeys Creek stockpile area. There are limited markets for the scalped material in the unprocessed form and it is impractical to return the scalps to the secondary processing area as:
  - periods when the use of crushing and screening infrastructure for scalps reprocessing are limited and infrequent;
  - the double handling of scalps reduces the efficiency (and therefore cost-effectiveness) of production; and
  - there is limited scope within the Stage 2 Site for stockpiling the value-added products.

  However, if an additional 3 to 4 hours operation were available, this could be devoted to the processing of scalped material direct from the reclaim boot to supply customer demand as it arises.

2.11.2 Quarry Life

The Stage 2 Extension would increase the available recoverable rhyolite resources to approximately 44Mt. At the maximum sales rate of 1.1Mtpa, this would extend the approved quarry life beyond 2020 by at least 30 years, i.e. until at least 2050. As discussed in Section 1.4, the overall rhyolite resource within the Site is estimated to approach 100Mt. It is conceivable that prior to 2050, an application for a third stage of development would be lodged for the ongoing operation of the quarry to recover further rhyolite hard rock resource.

2.12 EMPLOYMENT

The Applicant proposes that direct employment at the quarry would increase from 16 to approximately 20 persons based on the requirement for additional truck and mobile equipment operators and potentially additional operators within the secondary processing area to account for the extension of planned increase in production (up to the current approved maximum level).

2.13 REHABILITATION

2.13.1 Introduction

Rehabilitation of the Site would continue to be a progressive activity that requires the Applicant to undertake a planned program of decommissioning, final landform construction and revegetation focused upon achieving an acceptable final land use.

Emphasis has been placed on designing, implementing and managing the rehabilitation of the Site in accordance with the key principles identified within *Strategic Framework for Mine Closure*, prepared by the Australian and New Zealand Minerals and Energy Council (ANZMEC) and Minerals Council of Australia (MCA) (ANZMEC / MCA, 2000). Although not strictly a mining project, reference has also been made to relevant guidelines provided by the DRE prepared guideline, *ESG3: Mining Operations Plan (MOP) Guideline* (DRE, 2013), as it includes useful guidance on the establishment of rehabilitation objectives, performance standards and completion criteria.

The following subsections describe the Applicant's proposed approach to Site decommissioning and rehabilitation.

- Section 2.13.2 provides a summary of the stakeholder identification and consultation undertaken in order to establish the proposed final landform and land use(s) for the Site.
- Section 2.13.3 describes the proposed landform and final land uses, including details on the integration of biodiversity conservation and agricultural activities. Consideration is given to the strategic land use planning completed for the Lithgow City LGA (LCC, 2011).
- Section 2.13.4 provide an overview of the strategic management of rehabilitation, which includes:
  - the rehabilitation objectives of the Applicant with respect to the rehabilitation of the Site;
  - the establishment of a rehabilitation hierarchy;
  - the establishment of specific rehabilitation 'domains'; and
  - the establishment of completion criteria, performance indicators and monitoring programs.
- Section 2.13.5 describes the methods and procedures for rehabilitation including decommissioning activities, the specific rehabilitation procedures to be applied to each domain, and a site revegetation strategy.
- Section 2.13.6 describes the proposed implementation of Site decommissioning and rehabilitation including:
  - the establishment of key responsibilities and accountabilities for implementation;
  - the allocation of resources for the purposes of rehabilitation;

- a description of monitoring and maintenance procedures to assess success against objectives and criteria; and
- closure planning and long-term management.

2.13.2 Stakeholder Identification and Consultation

Stakeholders in the rehabilitation of the Site are those parties with the potential to be affected by the act of rehabilitation itself or as a result of the final land use. The stakeholders identified and consulted are broadly defined in the following categories.

The Landowner

As identified in Sections 1.1 and 1.3.2, the Austen Quarry is located on land owned by HPC which operates an ongoing agricultural enterprise on surrounding land. Consultation with the landowner has been ongoing since the Applicant commenced the construction of the Austen Quarry in 2002.

The principal concerns of the landowner with respect to the rehabilitation of the quarry are as follows.

- To ensure compliance with the conditions of the development consent initially issued for the quarry (DA 103/94).
- To not restrict, or create hazards incompatible with, ongoing and continued agricultural operations of the property.
- To minimise the impact of the final landform on the visual amenity of the property by creating a final landform and community structure compatible with the surrounding topography and vegetation.

The Community

Section 3.2.2 summarises the consultation undertaken with adjoining landowners and the local community, i.e. those community stakeholders considered most likely to be affected by the proposed final land use and landform of the Site. The only issue raised relevant to rehabilitation refers to the management of the visual impact of the Site.

Government Stakeholders

Section 3.2.2 summarises the consultation undertaken with the various government agencies and regulatory authorities with an interest in the Proposal. Those government stakeholders considered as having a specific interest in the final land use and rehabilitation of the Site, and the key issues and requests of each, are summarised as follows.

- Department of Planning & Environment.

  DP&E (formerly DP&I) has placed emphasis on the key principles of *Strategic Framework for Mine Closure* (ANZMEC, 2000) and as noted in Section 1.1, Section 2.13 has been structured to address these. In addition, the DGRs issued by DP&E require that with respect to rehabilitation, the EIS include a detailed description of the likely components and staging of rehabilitation.

- Department of Trade & Investment, Regional Infrastructure & Services – Division of Resources & Energy.

  While the Site will not require a lease under the *Mining Act 1992*, requiring the Applicant to plan and report rehabilitation progress and planning in accordance with DRE guidelines, DRE has requested that the proposed final land use of the Site be nominated and that the EIS document the proposed rehabilitation procedures during, and after completion of, extraction operations.

- Lithgow City Council.

  Lithgow City Council has requested that estimated costs for the rehabilitation of the Site be nominated and that a bond be lodged to provide for this rehabilitation. Council has also requested that a proposed timeline for Site landscaping be provided.

  It is also acknowledged that while not explicitly stated by Council personnel as part of the consultation undertaken, the final and land use and landform should conform with the Lithgow Land Use Strategy 2010-2030 (LCC, 2011) with specific reference to the objectives of the relevant zoning.

- Blue Mountains City Council.

  Discussions with BMCC established that Councils' key area of interest with the rehabilitation of the quarry is the reduction and ultimate elimination of any adverse visual impacts when viewed from key vantage points in the Blue Mountains.

- Sydney Catchment Authority.

  The SCA's primary area of concern with respect to the final land use and rehabilitation of the Site is ensuring that this landform and land use provides for a neutral or beneficial effect on water quality and does not hinder the achievement of water quality objectives for the Sydney drinking water catchment. In correspondence provided to the DP&I with respect to the requirements of the EIS, the SCA makes specific reference to the preparation of a conceptual Rehabilitation Plan.

- Department of Primary Industries – NSW Office of Water (NOW).

  The NOW requires that the rehabilitated landform does not impact on local surface or groundwater resources. In correspondence provided to the DP&I with respect to the requirements of the EIS, NOW requests that rehabilitation and final land use:

  – justify the proposed final landform with regard to minimising impacts on local and regional surface and groundwater sources, floodplains, dependent ecosystems, basic landholder rights to water and adjacent/downstream licensed water users;

  – provide details of the proposed rehabilitation measures to restore any land, water sources and dependent ecosystems which are degraded by the Proposal;

- establish and justify criteria regarding completion of rehabilitation and details of management arrangements for post-operational phases of the Site;
- include contingency strategies aligned to rehabilitation monitoring; and
- demonstrate of surety of rehabilitation funding.

- Department of Primary Industries – NSW Fisheries.

  NSW Fisheries' interest in the final land use and rehabilitation of the Site is to ensure that adverse impacts on the aquatic environment and fish habitat of the Coxs River are minimised. NSW Fisheries has requested that site rehabilitation takes into account impact minimisation on aquatic habitat.

- Department of Primary Industries – NSW Agriculture.

  NSW Agriculture requires that in rehabilitating the Site, any impact on the agricultural production on the Site, and within the local area and region, is quantified, minimised and where unavoidable, justified.

- NSW Office of Environment and Heritage, (OEH)

  OEH is primarily interested in maximising the biodiversity benefits that may be provided by the final landform through retention of key habitat features, re-establishment of native vegetation communities and fauna habitat, creation of linkages to remnant habitat and establishment of compensatory habitat. OEH also requires that a detailed list of the plant species to be used during rehabilitation be provided along with details as to how the rehabilitation would be appropriately managed and funded.

2.13.3 Final Land Use and Landform

2.13.3.1 Final Land Use

Considering the concerns and priorities of the various stakeholders (see Section 2.13.2), the priorities for final land uses are identified as follows.

- Minimising the visual impact of the Stage 2 Site. A key issue for stakeholders, both community and government, is the impact of the Site on local visual amenity.
- Passive biodiversity conservation. The Stage 2 Site provides connectivity between remnant vegetation and fauna habitat of the Coxs River and Yorkeys Creek with that of the uncleared ridges. Maintaining and improving the biodiversity value of the local setting, as well as conserving threatened flora and fauna species has been identified as an important land use by both community and regulatory stakeholders.

- Low intensity agriculture. The property on which the Site is located is operated as an agricultural enterprise. Notably, the majority of the land to be developed for the purpose of the Stage 2 Extension is of low land capability and of limited agricultural production value. This notwithstanding, the landowner and Department of Primary Industries are interested in maximising the potential use of the rehabilitated Site for future agricultural production.

On the basis of these stakeholder identified priorities, the primary land use for the Site would be passive biodiversity conservation, revegetated to minimise the future visibility of extraction, overburden management and processing operations. This land use would focus on areas of the Site exposed to local and regional vantage points, adjoining remnant native vegetation and which have impacted on threatened flora and fauna habitat.

A secondary land use, to be integrated with the primary biodiversity land use on land with a higher land capability, would be agricultural grazing. The existing internal road network and Extraction Area Access Road would be retained to provide access to that area of the HPC property and for other existing road users in the vicinity.

2.13.3.2 Final Landform

Figure 2.9 presents the proposed final landform and identifies the selected cross-sections presented on **Figure 2.10**. In summary, the final landform would include the following components.

- Removal of all processing plant, office and ancillary infrastructure, including concrete pads (unless required for a future land use) with the remaining landform profiled to approximate that which existed prior to the establishment of the infrastructure. The vegetated bund along Coxs Creek and storage and sediment dams would be retained.
- A single appropriately bunded, fenced and signed final void. Terminal faces would be retained at 70° with overburden and previously cleared vegetation spread over the final benches where safe to do so and in a manner that ensures structural integrity.

  It is expected that water would accumulate within the void, primarily in response to local rainfall conditions with some minor contribution (<4MLpa) from groundwater (refer to Section 4.6.5.2). The retention of a small void with a fluctuating depth of water would provide habitat for native flora and fauna. On the basis that the majority of the water accumulating within the final void would be surface runoff, the potential for the accumulation of salt or other contaminants is considered very low. Furthermore, the lack of acid generating material reduces the potential for the mobilisation of any trace metals which might be present in the in situ rock.
- A shaped and revegetated overburden emplacement with the following design parameters.
  - An overall landform shape that blends with the surrounding landforms.

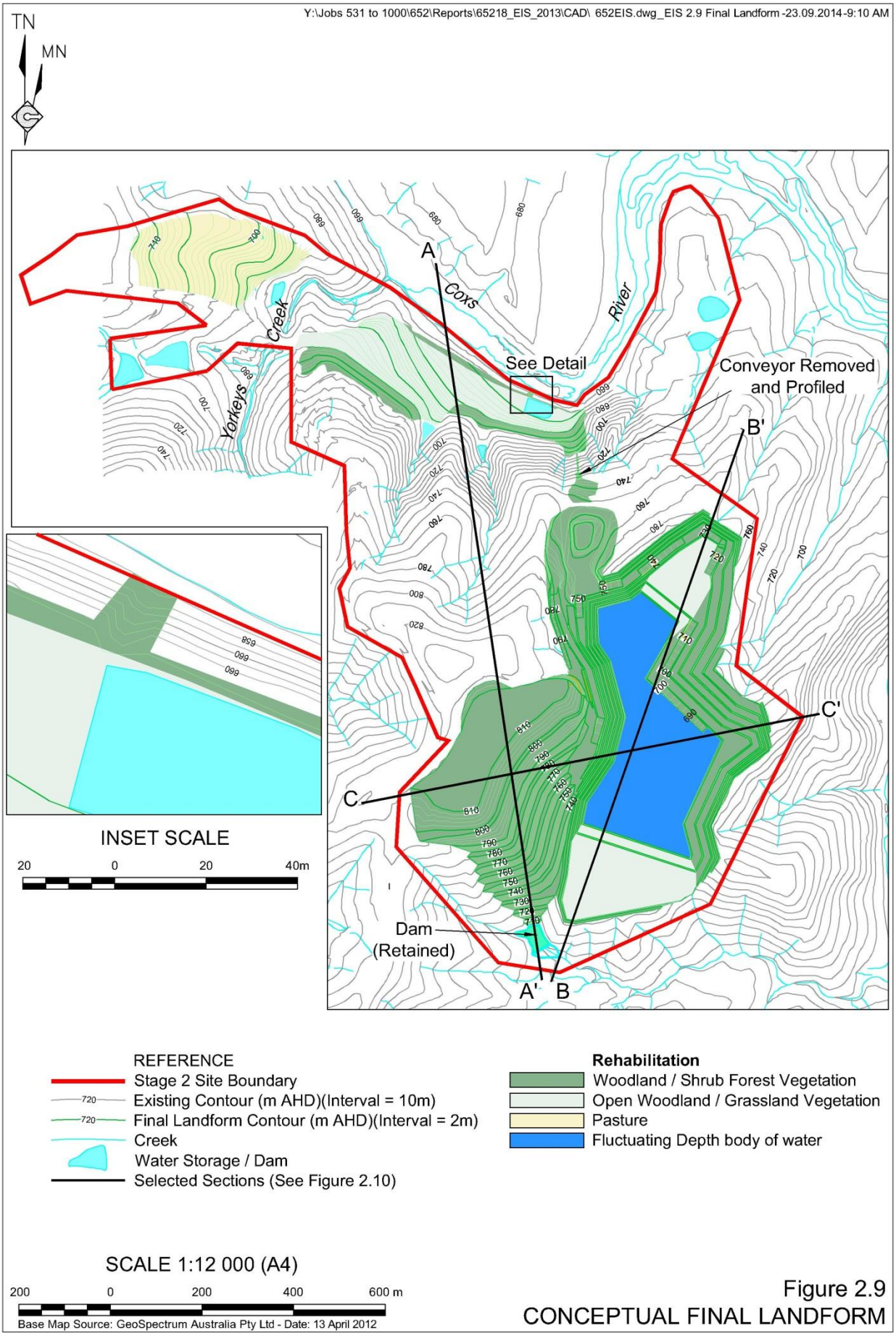
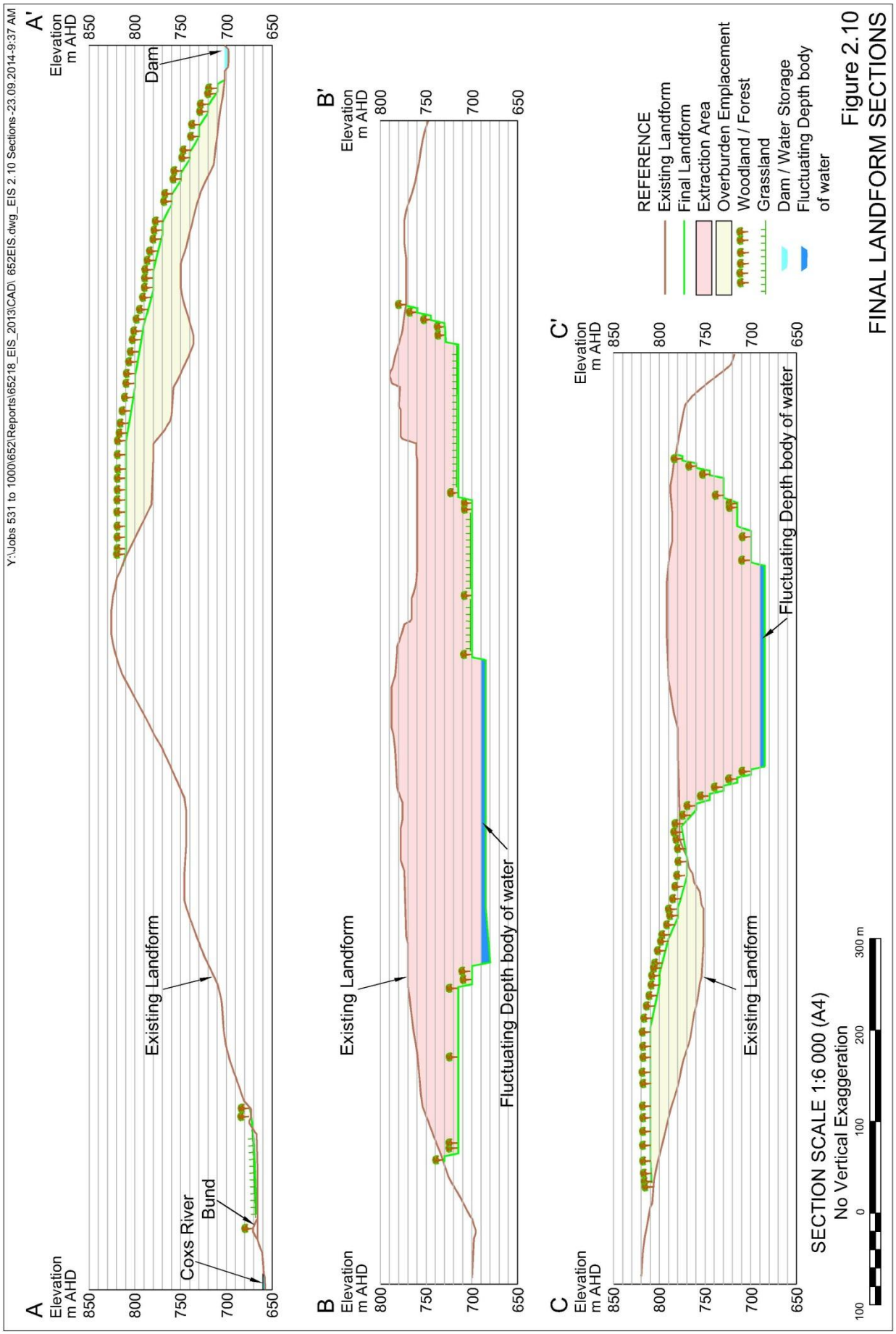


Figure 2.9
CONCEPTUAL FINAL LANDFORM


Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\ 652EIS.dwg_EIS 2.10 Sections -23.09.2014-9:37 AM
A
A'
B
B'
C
C'
Elevation m AHD
850
800
750
700
650
Dam
Existing Landform
Coxs River
Bund
Fluctuating Depth body of water
REFERENCE
Existing Landform
Final Landform
Extraction Area
Overburden Emplacement
Woodland / Forest
Grassland
Dam / Water Storage
Fluctuating Depth body of water
SECTION SCALE 1:6 000 (A4)
No Vertical Exaggeration
100
0
100
200
300 m
Figure 2.10
FINAL LANDFORM SECTIONS

- Side slopes of approximately 26° with 5m wide, back-sloped benches every 10m vertically.
- An upper surface with a maximum elevation of 810m AHD which provides a very gentle concave profile to allow runoff to drain off the landform.
- Appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.

Noting the shallow nature of existing and pre-disturbance soils within the Site boundary, the land would be revegetated with native vegetation suitable to pre-disturbance conditions. The Applicant has previously had great success in planting the threatened plant *Eucalyptus pulverulenta* (silver-leaved mountain gum) in nursery areas on the Site, with in excess of 3 000 plants successfully grown as part of the existing biodiversity offset strategy.

Landform ultimately influences land use, and vice versa, consequently the landform concept presented by **Figure 2.9** could be modified during the life of the Proposal to reflect any changes to the intended final use of the land.

2.13.4 Planning and Strategic Management of Rehabilitation

2.13.4.1 Rehabilitation Objectives

In the short to medium term, the Applicant's rehabilitation objectives would be to stabilise all earthworks, drainage lines and disturbed areas no longer required for Proposal-related activities. The Applicant would also implement a program of interim rehabilitation of disturbed/constructed areas in order to:

- reduce the visibility of extraction and overburden emplacement activities from surrounding properties, lookouts, roads and other vantage points;
- where possible, conserve all soil resources 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 windblown dust; and
- ensure interim slopes are stable.

Over the long-term, rehabilitation of the Site would involve the progressive re-establishment of areas of disturbance through the creation of a final landform, soil substrate and vegetative cover suitable for a predominantly passive biodiversity conservation land use with some integrated agricultural productivity. The objectives for the long term rehabilitation program are to:

- blend the created landforms and vegetation established with that of the surrounding topography;

- provide a low maintenance, geotechnically stable and safe landform with minimal erosion, particularly within the Stage 2 extraction area and overburden emplacement; and
- re-instate the pre-disturbance soil and land capability in the area used for the secondary processing area and Yorkeys Creek stockpile area.

More detailed objectives relevant to each phase of rehabilitation are described in Section 2.13.4.3.

2.13.4.2 Rehabilitation Domains

Rehabilitation domains refer to areas of related disturbance based on processes and use prior to rehabilitation and for which decommissioning and rehabilitation activities would be similar. Five rehabilitation domains have been nominated for the Stage 2 Site and a description of each is as follows.

Domain 1 – Extraction Area (D1)

The extraction area includes both the Stage 1 and Stage 2 areas, Primary Crushing Station, earth embankment constructed to screen the Stage 1 extraction area from the north and associated roads and ramps.

Domain 2 – Overburden Emplacement Areas (D2)

This domain includes the main and ancillary overburden emplacement areas and soil stockpile locations.

Domain 3 – Processing Area, Quarry Infrastructure and Services (D3)

This domain would include the secondary processing area, main administration area, Quarry Access Road and any other miscellaneous buildings or roads.

Domain 4 – Surface Water Management Structures (D4)

This domain includes all clean and dirty water dams, diversion drains and associated infrastructure.

Domain 5 – Yorkeys Creek Stockpile Area (D5)

This domain includes the stockpile area located to the north of Yorkeys Creek where the bulk of the road pavement materials, manufactured sands, select fills, drainage materials and road construction materials are stockpiled prior to sale. It is noted that on completion of the Proposal, any remaining product would be profiled, covered with soil and revegetated to pasture or fodder crop as requested by the landowner at the time to provide a low maintenance, geotechnically stable and safe landform with minimal erosion.

The rehabilitation objectives described in Section 2.13.4.1 relate to all rehabilitation domains.

2.13.4.3 Phases of Rehabilitation

The Applicant has adopted a hierarchical approach to the rehabilitation of the Site, modelled on the approach recommended by DRE (2013), whereby the rehabilitation is considered as progressive phases, each with its own objectives, criteria for completion and indicators of performance against these criteria.

A summary of each phase of the rehabilitation hierarchy is as follows.

Decommissioning

Specific details of decommissioning completion criteria would be confirmed closer to completion of activities. In general, however, the decommissioning phase involves the cessation of infrastructure usage, dismantling or demolition, removal and remediation of the land on which the infrastructure was located. Specific decommissioning activities that relate to completion criteria at this stage in the rehabilitation hierarchy are outlined in Section 2.13.6.2.

The objectives associated with this phase of rehabilitation are as follows.

- To maximise the re-use or recycling of materials.
- To stabilise the area surrounding the infrastructure to be decommissioned in order to prevent pollution to air, land or water.
- To remediate any contamination and ensure the area is non-polluting prior to commencement of the landform establishment phase.

Landform Establishment

The landform establishment phase involves the earthworks required to create a landform suitable for the proposed final land use and which blends with the adjacent topography. This stage would also include the construction of any drainage structures needed for the area.

The objectives associated with this phase of rehabilitation are as follows.

- To stabilise all disturbed areas and minimise erosion and dust generation.
- To provide a low maintenance, geotechnically stable and safe landform suitable for the intended final land use.
- To achieve the nominated design for each landform.
- To blend the created landform with the surrounding topography.

Growth Media Development

The growth media development phase of the rehabilitation hierarchy involves the replacement of soil over disturbed areas and preparation of the soil for revegetation including fertiliser or ameliorant application, and ripping or scarifying the soil.

The objectives associated with this phase of rehabilitation are as follows.

- To achieve a soil profile capable of sustaining the specified final land use.
- To minimise the potential for erosion, sedimentation and dust generation prior to establishment of vegetation.

Ecosystem and Land Use Establishment

The ecosystem and land use establishment phase of the rehabilitation hierarchy involves the revegetation of the rehabilitated landform with species commensurate with the targeted final land use.

The objectives associated with this phase of rehabilitation are as follows.

- To reduce the visual impact upon surrounding residents by early establishment of vegetation in areas where operations have been completed, i.e. on the external face of visibility bunds, exposed terminal faces of the extraction area and completed lifts of the overburden emplacement.
- To select and establish vegetation with the species diversity commensurate to the relevant ecological community or agricultural land use.

Ecosystem and Land Use Sustainability

The ecosystem and land use sustainability phase of rehabilitation involves the management and maintenance of the revegetated landform whilst completion criteria for the nominated landform and land use are achieved. This phase may be ongoing for a long period of time, depending on what the final land use outcome is, and will include any remedial works or revegetation deemed necessary to achieve the final completion criteria.

The objectives associated with this phase of rehabilitation are as follows.

- To re-instate ecological communities with biodiversity commensurate with or greater than those communities disturbed by the Proposal and previous quarry operations.
- To ensure that the ongoing viability of these ecological communities are sustainable following the active management by the Applicant.
- To integrate the rehabilitated ecological communities with those incorporated into and protected by a Biodiversity Offset Strategy for the Proposal (refer to Section 2.14).
- To retain areas on the Site amenable to future agricultural activities.

2.13.4.4 Completion Criteria, Performance Indicators and Monitoring Strategy

The strategic rehabilitation completion criteria, associated performance indicators and monitoring strategy for the Proposal are summarised in **Table 2.6** to align with the rehabilitation hierarchy and objectives outlined in Section 2.13.4.1.

Table 2.6
Completion Criteria, Performance Indicators and Monitoring Strategy

Objectives	Completion Criteria	Domain	Performance Indicator	Monitoring Strategy
Decommissioning				
• To maximise the re-use or recycling of materials. • To stabilise the area surrounding the infrastructure to be decommissioned in order to prevent pollution to air, land or water.	Final land use is defined and agreed by relevant stakeholders	1 to 5	Final land use agreed and formalised in Rehabilitation Plan.	-
	Services are isolated, disconnected, removed and terminated.	3	Completed to the satisfaction of Council.	Survey of services to be completed.
	Infrastructure and associated buildings not required are demolished and removed.	3	Completed to the satisfaction of Council.	Survey of infrastructure to be completed.
	All internal roads, car parks and hardstands not required for the end land use/user are ripped and profiled.	3	Completed to the satisfaction of Council.	Survey of infrastructure to be completed.
• To remediate any contamination and ensure the area is non-polluting prior to commencement of the landform establishment phase.	Contaminated sites are identified for remediation.	1 to 5	Contaminated Sites Report (or equivalent) completed.	Soils tested and analysed as part of Contaminated Sites Report (or equivalent)
	Contaminated land is remediated.	1 to 5	Site free of contaminants.	
	Identified heritage sites are retained	1 to 5	No damage to known sites.	Sites resurveyed prior to relocation of previously removed artefacts.
Landform Establishment				
• To stabilise all disturbed areas and minimise erosion and dust generation. • To provide a low maintenance, geotechnically stable and safe landform suitable for the intended final land use. • To achieve the nominated design for each landform. • To blend the created landform with the surrounding topography, where practicable.	The final landform achieves the nominated design of the EIS or subsequent Rehabilitation Plan.	1	Terminal faces and benches are geotechnically stable.	Survey following completion of landform establishment activities.
			Bitumen application complete.	
		2	Slopes approximate 26°.	
		3, 5	Ripped and profiled surface accommodates surrounding topography	
		4	Water diversion structures retained.	
	Final landform does not pose a security or safety risk	1	Safety bund is extended across entry ramps.	Inspection by Site Manager
			Signage erected identifying 'deep void – no access'.	
	The rehabilitated area does not represent an erosion hazard.	1 to 5	Erosion does not exceed 0.3m (gully) deep.	Visual inspection.
		2	Banks are constructed at 10m vertical intervals with a back-slope of <5% (3º) and longitudinal slope of <2% (1.5º).	Survey following completion of landform establishment activities.

Table 2.6 (Cont'd)
Completion Criteria, Performance Indicators and Monitoring Strategy

Objectives	Completion Criteria	Domain	Performance Indicator	Monitoring Strategy
Growth Medium Development				
• To achieve a soil profile capable of sustaining the specified final land use.	Soil is appropriately stockpiled	1, 2	Soil stockpiles do not exceed 2m in height.	Survey of stockpiles completed.
	Soil is spread to a depth of 30cm on sloped surfaces (≥10º) and 60cm on flat surfaces (<10º).	1-3 & 5	Soil depths as nominated.	Maintenance of soil inventory (comparison of soil excavated from stockpile to that spread over landform). Survey of treated areas completed annually and included in AEMR.
	Soil is appropriately prepared prior to seeding	1, 3-5	pH levels are equivalent to that of the local setting (4.5 to 6.0).	Soil analyses.
• To minimise the potential for erosion, sedimentation and dust generation prior to establishment of vegetation.	Erosion of soil is minimised.	1 to 5	Erosion does not exceed 0.3m (gully) deep.	Visual inspection.
		1 to 5	Average soil loss per annum is <40 tonnes/ha/year	Inspection of sediment basins and calculation of sedimentation.
	Placement of mulch of woody debris on rehabilitated areas.	1-3, 5	Native fauna observed utilising habitat provided by woody debris.	General observation.
Ecosystem and Land Use Development				
• To reduce the visual impact upon surrounding residents by early establishment of vegetation in areas where operations have been completed, i.e. on the external face of visibility bunds, exposed terminal faces of the extraction area and completed lifts of the overburden emplacement. • To select and establish vegetation with the species diversity commensurate to the relevant ecological community or agricultural land use.	Appropriate native plant species used in rehabilitation.	1-3	Species used are consistent with those of the disturbed vegetation communities.	Review against species list provided by ecologist or rehabilitation specialist.
		1-3	*E. pulverulenta* included in revegetation	
	Appropriate pasture species used in rehabilitation.	5	Species used are consistent with those nominated by landowner.	
	Appropriate native plant species richness is present for the restored ecological community.	1-3	Native plant species density to approximate density of relevant community (pre-disturbance) (refer to Section 4.7.3.1.1).	Monitoring by ecologist or rehabilitation specialist.
	Appropriate density/structure of native overstorey species.	1-3	Overstorey projected foliage cover (PFC) approximates that of target community[1].	
	Appropriate density/structure of native lower or mid storey.	1-3	Lower or mid storey PFC approximates that of relevant community[1] (pre-disturbance).	
	Appropriate native groundcover coverage.	1-3	Groundcover PFC approximates that of target community[1].	

Table 2.6 (Cont'd)
Completion Criteria, Performance Indicators and Monitoring Strategy

Objectives	Completion Criteria	Domain	Performance Indicator	Monitoring Strategy
Ecosystem and Land Use Sustainability				
• To re-instate ecological communities with biodiversity commensurate with or greater than those communities disturbed by the Proposal and previous quarry operations.	The established land form and vegetation is sustainable and consistent with the intended land use.	1 to 5	Establish areas of rehabilitation consistent approval conditions. Land use classifications to include: • Rehabilitation of Woodland Ecological Communities; • Agricultural land; and • Biodiversity Offset Area.	Monitoring by ecologist or rehabilitation specialist.
• To ensure that the ongoing viability of these ecological communities are sustainable following the active management by the Applicant.	There are no potential hazards that are not consistent with the intended land use.	1 to 5	The site is free of safety or environmental hazards including: • holes, tunnels or unstable areas; • quarry infrastructure or debris; or • hazardous materials.	Visual inspection.
	The soil pH is representative of the intended land use.	1 to 5	pH levels are equivalent to that of the local setting (4.5 to 6.0).	Soil analyses.
• To integrate the rehabilitated ecological communities with those incorporated into and protected by a Biodiversity Offset Strategy for the Proposal (refer to Section 2.14). • To retain areas on the Site amenable to future agricultural or industrial activities.	Surface runoff from rehabilitated areas does not result in downstream pollution.	1 to 5	Receiving waters affected by surface water runoff from rehabilitated areas have EC<1500µS/cm and a pH between 5.5 and 8.5.	Regular monitoring of water quality contained with sediment basins and receiving waters.
	Exotic weeds or vegetation is not competing or impacting on the intended land use.	1 to 5	Noxious weeds are not present within rehabilitation or biodiversity offset areas until data from analogue sites is available.	Monitoring by ecologist or rehabilitation specialist.
	Feral pests are not competing or impacting on the intended land use.	1 to 5	Feral pests are not present within rehabilitation or biodiversity offset areas until data from analogue sites is available.	Inspection by local personnel.
Note 1: Based on pre-disturbance communities for the Site described by Niche (2014a)				

Specific rehabilitation criteria and a monitoring program would be outlined in a relevant management plan to be submitted and approved following receipt of development consent. The rehabilitation criteria would be continually refined through monitoring and revised through a relevant updated management plan to be approved by DP&I.

The objective of the monitoring program would be to evaluate the restoration progress of the Site rehabilitation towards fulfilling ecological community land use objectives and closure criteria. The purpose of monitoring activities would be to ensure the sustainable re-colonisation and ongoing management of native flora and fauna, and to guide continual improvement of rehabilitation practices.

2.13.5 Rehabilitation Methods and Procedures

2.13.5.1 Introduction

The following subsection details the rehabilitation methods and procedures that would be utilised in each of the rehabilitation domains.

2.13.5.2 Decommissioning Activities

Following the completion of all production activities, the Applicant would commence a program to decommission the site, i.e. removing all items of plant and equipment (and buildings) not required for a subsequent land use.

The processing plant would be dismantled and useful components sold for re-use whilst all remaining steel would be removed for recycling. All pumps and pipelines not required would be removed and the ground level contoured. All mobile equipment would be progressively removed from site as it is no longer required.

It is proposed to retain all surface water dams that the Applicant has been responsible for given they are likely to be of use for the subsequent land use. All power infrastructure would also be removed given this is not required for the planned future use.

Following the removal of all equipment and unwanted materials, all concrete foundations would be broken up and removed from site for recycling. Any areas that display an accumulation of hydrocarbons would be remediated and all final surfaces would be shaped and revegetated.

2.13.5.3 Domain Specific Rehabilitation

Rehabilitation domains refer to areas of related disturbance based on processes and use prior to rehabilitation and for which decommissioning and rehabilitation activities would be similar. A description of each domain and proposed methods and procedures for rehabilitation is given below.

Domain 1 – Extraction Area

Terminal faces of the Stage 2 extraction area would be retained at 70° with a coating of bitumen spayed over the faces visible from vantage points to the north and northeast. The effectiveness of the bitumen spray in reducing the visual intrusion of the extraction area wall is illustrated by **Plates 1.9** and **1.10**, which presents photos of the completed western limit of the Stage 1 extraction area prior to (**Plate 1.9**) and following (**Plate 1.10**) the re-application of the bitumen. The application of a bitumen coating is intended only as an interim or short-term measure to reduce adverse visual impacts until the longer term measures become effective.

The long-term visual impact of the terminal faces would be progressively reduced by the establishment of vegetation on the final benches. This would be achieved by spreading a layer of weathered overburden and previously cleared vegetation over the bench prior to the removal of the last material creating the terminal face. A seed mix of locally endemic trees and shrubs would be used with further details on the Site revegetation strategy provided in Section 2.13.5.4.

In the event extraction does not continue into Stage 3, a layer of weathered overburden would be placed over the final extraction area floor to create a water holding substrate. Previously excavated and stockpiled soil would then be placed on the shaped landform in accordance with the following procedures.

- Prior to respreading, the soil would be sprayed with a herbicide to prevent the relocation of weed species from stockpile to rehabilitation.
- Sampling and analysis of the soil would be completed (for selected campaigns) to assess potential constraints on revegetation (e.g. low pH, low organic concentration, high dispersibility) and identify soil ameliorants. As recommended by SEEC (2014), only slow-release fertilisers would be used but in conjunction with organic matter (mulch from previously cleared vegetation). Using organic matter would increase the Cation Exchange Capacity (CEC) of the soil to enable longer retention of nutrients. Modifications to the low pH of the soil may be made through addition of lime or gypsum, however, any such modifications to soil pH would only follow consultation with an appropriately qualified ecologist or revegetation specialist to ensure this does not preclude the reinstatement of the preferred vegetation communities on the final landform (see Section 2.13.5.4).
- The soil resources would be replaced as a single blended topsoil / subsoil unit with the depth of respread soil to vary between 300mm and 600mm in depth (deeper on flatter areas and shallower on steeper areas).
- The surface of the shaped landform would be left even but slightly scarified. This would assist in maintaining soil stability, maximising seed retention and germination and minimising erosion.
- If required, artificial covers such as bitumen impregnated straw or mulches would be used to stabilise the soils on the shaped landform.

If retained, the final sump within the extraction area would likely accumulate rainfall runoff and some inflowing groundwater (refer to Section 4.6.3). As the proposed final land use is for passive biodiversity conservation, there is no need to retain a water holding / watering point within the extraction area domain and overburden would be used to backfill the sump before soil is respread and revegetation with endemic grass and tree species is undertaken.

A seed mix of locally endemic native grasses and tree species would be sown or planted as tubestock to establish a grassy woodland setting. Noting the microclimate conditions likely to be created by the retained void (increased shading, restricted drainage and reduced evaporation), species would be carefully selected and likely include those capable of tolerating increased shade, damper and possible cooler conditions. Section 2.13.5.4 provides further detail on the proposed revegetation of the terminal extraction area benches, including a preliminary species list.

Should some low intensity grazing of this domain form a component of the final land use, following discussion and negotiation with the landowner, the proposed revegetation strategy is unlikely to differ significantly, however, the sump may be retained to provide a water source for stock.

Domain 2 – Overburden Emplacement Areas

The outer batters of the overburden emplacement would be profiled to create a slope of approximately 1:3(V:H) (~18°) with the surface ripped to allow for the keying of soil spread over the slopes. In sympathy to the surrounding topography, the upper lifts of the overburden emplacement may have slopes slightly exceeding 18°, with those of the lower lifts slightly less than 18° to create a slightly concave landform. A concave landform is preferable to a flat or convex slope as it provides for the retarding of flow velocity and therefore erosive force of water flowing over the final landform.

During shaping operations, contour banks would be constructed as benches at 10m vertical intervals. These structures would direct water at non-erosive velocities from the emplacement to the adjacent natural landform into which the emplacement is blended or to high-slope, drop-down structures such as flumes. These drop-down structures would direct the surface water flows collected by the contour banks initially to the dirty water management system and then, following completion of rehabilitation operations, to natural drainage lines. The indicative locations of the drop-down structures are presented on **Figure 2.9**, however, illustrating horizontal intervals of no more than 200m to reduce the volume and erosive velocity of flow to each. Thee drop-down structures would also be spaced such that following discharge from one structure, the flow would then be horizontal along the contour bank again to reduce the erosive force of the flow.

Soil would then be placed on the shaped landform in accordance with the procedures described for Domain 1. Soil would either be directly stripped from the footprint of the Stage 2 extraction area or recovered from stockpiles and spread over the profiled slopes, and seeded with a locally endemic native seed mix and allowed to revegetate. It is noted, however, that the thickness of the soil layers may be slightly reduced on the slopes and slightly increased on the upper (flat) of the overburden emplacement.

The entire overburden emplacement would be returned for a passive biodiversity conservation land use.

Domain 3 – Processing Area, Quarry Infrastructure and Services

All infrastructure associated with the processing plant would be removed in accordance with the decommissioning phase of rehabilitation described in Section 2.13.5.2.

It is considered likely that by 2055, the vegetation of the bund wall within the riparian zone of the Coxs River would be well established as a viable riparian community providing habitat to a variety of fauna. As a consequence, it is proposed that the bund be retained in the final landform with a small channel excavated from the sediment basin (following rehabilitation of the remaining Processing area) to allow for natural drainage of water to the Coxs River.

It is proposed that the hardstand surface be ripped and covered with a layer of weathered overburden followed by available soil (in accordance with the procedures described for Domain 1) and previously cleared vegetation. The final landform would then be seeded with endemic grass, shrub and tree species (predominantly those associated with the Coxs River riparian zone). Once a cover of grass has been established over the former hardstand, drainage to the Coxs River would be reinstated by removing a small section of the bund wall at the eastern end, the created spillway or channel to be provided with appropriate erosion protection.

The Site Access Road and Yorkeys Creek Crossing would be retained to allow for continued access to this part of the property.

Domain 4 – Surface Water Management Structures

All infrastructure associated with water management would be removed at the end of quarry life. Where useable, pumps and drain pipes would either be relocated to an alternate site or removed to landfill. The storage and sediment dams would remain in place as their use is consistent with the final land use described in Section 2.13.3.1.

Domain 5 – Yorkeys Creek Stockpile Area

The Yorkeys Creek stockpile area would also be profiled in sympathy with the surrounding paddocks. A 300mm to 600mm layer of blended soil would be spread over the re-profiled landform. Gypsum or lime would be added to this soil to increase the pH to >6.0 before being reseeded with pasture species and fertilised (with slow-release fertiliser) in consultation with the landowner.

Sediment fencing would be retained down-slope of the area under rehabilitation until such time as a 70% groundcover has been established. At this time, the sediment fencing would be removed.

The success of rehabilitation and revegetation of each domain would be reviewed progressively, in accordance with the completion criteria and performance indicators nominated or modified after Section 2.13.4.4, with additional soil, seed or tube stock added as required..

2.13.5.4 Indicative Site Revegetation Strategy

The approach to the revegetation strategy would vary depending on the intended final land use, i.e. either low intensity agricultural production or passive biodiversity conservation (see **Figure 2.9**). The following provides a summary of the revegetation strategy in each case.

Agricultural Production

Limited to Domain 5 (Yorkeys Creek stockpile area), restricted areas of Domain 3 (Processing Area, Quarry Infrastructure and Services) and those surface water management structures (Domain 4) associated with these areas, the revegetation strategy of these sections of the final landform would be sown with a mixture of pasture species appropriate to the season. The seed mixture would be determined, in consultation with the landowner, by the intended crop or agricultural activities proposed for the land.

Fertiliser may be applied depending on soil conditions (as determined following soil sampling and analysis – see Section 2.13.5.3) and intended crop or pasture. Contour banks may be constructed as required over this landform, in particular the profiled paddocks of Domain 5, to assist in surface runoff retention and prevention of erosion.

Passive Biodiversity Conservation

Over the remaining areas of the final landform (Domains 1, 2, the remaining area of 3 and relevant structures of 4) a mixture of native and introduced species of grasses and legumes would be used for rapid stabilisation of batters. On the upper batters of the overburden emplacement (between 780m and 810m AHD), the seed mix would include fast growing native shrubs to reduce the visual impact of this component of the Stage 2 Site. This component of the

rehabilitation is considered 'sacrificial', as it will eventually be disturbed to enable the southerly extension of the upper overburden emplacement lifts (compare the final panel on **Figure 2.6** to **Figure 2.4**).

Following stabilisation (on all but the sacrificial rehabilitation areas), the Applicant would commence a program of revegetation, using both tubestock planting and direct seeding techniques, to create native open forest and grassy woodland communities across the Site. The species to be used as part of this revegetation program would vary dependent on the final landform, i.e. hill top, slopes or drainage line / riparian zone, however, the objective would be to create open forest and grassy woodland communities equivalent to those disturbed and/or occurring on the Site structured approximately as follows.

- Canopy (tree height of 10m to 25m): 10% - 20% Project Foliage Cover (PFC).
- Mid-storey (tree height 3m to 10m): 5% PFC.
- Lower stratum (shrub layer of 1m to 3m): 10% - 20% PFC.
- Grassy ground cover: 55% - 65% PFC.

The indicative species list would include tree, shrub and grass species and would be refined with experience and the actual species used would be presented in annual reports to be prepared for the Site. Acknowledging the conservation status of *Eucalyptus pulverulenta* (Silver leaved Mountain Gum), the propagation and re-establishment of this threatened tree species on the slopes of the final landform would be prioritised.

2.13.6 Implementation

2.13.6.1 Rehabilitation Management Plan

Following the issue of development consent, the Applicant would prepare and implement a *Rehabilitation Management Plan* for the Proposal based on the final landform and land use, strategic rehabilitation management and proposed methods and procedures nominated throughout this section.

The *Rehabilitation Management Plan* would be prepared following further consultation with DRE, DPI, NOW, SCA and Lithgow City Council and reference relevant government and industry guidelines including the Leading Practice Sustainable Development Program for the Mining Industry series produced by the Commonwealth of Australia (Commonwealth of Australia, 2006a,b). In summary, the *Rehabilitation Management Plan* would:

- confirm details of the conceptual final landform and associated land uses;
- describe the short, medium and long term measures that would be implemented to:
  - manage remnant vegetation and habitat of the Site; and
  - ensure compliance with the rehabilitation obligations and commitments included in the development consent;
- include performance and completion criteria for evaluating the performance of the rehabilitation, including those triggering remedial action (if necessary);

- include a detailed description of the measures that would be implemented over the initial 3 years, including procedures for:
  - ensuring compliance with the rehabilitation objectives and obligations;
  - enhancing the quality of remnant vegetation and fauna habitat;
  - establishing and maintaining vegetation screens to minimise the visual impacts of the Site;
  - restoring native vegetation communities and fauna habitat on the final landform;
  - salvaging of important environmental resources including tree hollows, vegetative and soil resources, for replacement on the final landform or enhancement surrounding areas within a biodiversity area (refer to Section 2.14);
  - collection and propagation of native, provenance, seed;
  - minimising impacts on native fauna and native fauna habitats on the Site;
  - integrating and managing the alternative land use of the Site, low intensity agriculture;
  - controlling weeds and feral pests;
  - controlling access; and
  - bushfire management;
- include performance indicators and completion criteria for each phase of rehabilitation;
- include a program to monitor and report on the effectiveness of rehabilitation against these performance indicators and completion criteria;
- nominate the responsible personnel for monitoring, reviewing, and implementing the plan; and
- provide for periodic review and update.

The *Rehabilitation Management Plan* would be provided to the DP&I for review and approval within 12 months of the issue date of the development consent.

2.13.6.2 Responsibility and Accountability

Responsibility for the implementation of rehabilitation, as documented in the *Rehabilitation Management Plan*, would be shared by Hy-Tec's NSW Environment and Safety Manager, the Quarry Manager, nominated environmental representative and various quarry personnel. These responsibilities would be formalised within the *Rehabilitation Management Plan*, however, **Table 2.7** provides an overview of the various tasks and likely allocation of responsibilities.

Table 2.7
Accountable Positions and Tasks (Rehabilitation)

Position	Accountable Task
Environment and Safety Manager (NSW)	• Ensure that the development and operation of Austen Quarry comply with the conditions of development consent, all NSW Acts and Regulations, and issued approvals, permits and licences. • Ensure funds required for rehabilitation of the Site are provided for. • Ensure all Corporate Policies and Procedures pertaining to the promotion and implementation of responsible Health, Safety and Environmental practices. • Ensure the *Rehabilitation Management Plan* is prepared, understood, implemented, reviewed and updated as required.
Quarry Manager	• Ensure compliance with all NSW Acts and Regulations pertaining to the operation of the Mine. • Ensure that the extraction area and overburden emplacement remains within the approved limits and conditions of development consent. • Understand the commitments made in this EIS and the *Rehabilitation Management Plan* with respect to rehabilitation. • Ensure rehabilitation monitoring obligations are adhered to. • Provide clear, unambiguous instruction to mobile equipment operators as to requirements of final landform.
Nominated Environmental Representative	• Understand the commitments made in this EIS and the *Rehabilitation Management Plan* with respect to rehabilitation. • Maintain and regularly update a register of disturbance & rehabilitation on the Site, nominating active quarry and rehabilitation areas including relevant phase of rehabilitation (see Section 2.13.4.3). • Ensure soil and cleared vegetation stockpiles are managed appropriately and as nominated in the *Rehabilitation Management Plan*. • Document rehabilitation as completed and make data available for annual reporting. • Complete, or manage, rehabilitation monitoring as nominated in the *Rehabilitation Management Plan*. • Take soil samples, review analysis and provide for soil ameliorants for selected soil respreading campaigns each year.
Mobile Equipment Operators	• Understand approved limits of disturbance (do not clear vegetation or strip soil unless under clear instruction). • Ensure overburden is transferred to the location specified by quarry management. • Construct land forms as nominated in the *Rehabilitation Management Plan* and instructed by quarry management. • Replace overburden and soil in reverse order to stripping, i.e. weathered overburden then soil.

2.13.6.3 Rehabilitation Funding

On approval of the proposed rehabilitation of the Site, and in conjunction with the completion of the *Rehabilitation Management Plan*, the Applicant would calculate the likely cost to complete the proposed rehabilitation (in 2014 dollar value). Rehabilitation bonds currently lodged with the LCC and SCA would be supplemented so that the total amount would be

available for the rehabilitation of the Site in the unlikely event that rehabilitation is not completed satisfactorily (when considered against the nominated completion criteria) and the Applicant is not able to contribute further to rehabilitation.

The Applicant, as part of normal budgeting process, allocates a value to be spent each year for the purposes of rehabilitation. The cost to rehabilitate the Site would be reviewed periodically (to coincide with an independent environmental audit of the Proposal to be undertaken every three years) to assess rehabilitation completed, costs to complete rehabilitation and likely allocation of funds over the ensuing years to rehabilitation.

2.13.6.4 Rehabilitation Monitoring and Management

The Applicant's commitment to effective rehabilitation would involve an ongoing monitoring and maintenance program following completion of quarry-related operations. Areas being progressively rehabilitated would be regularly inspected, during which the following would be noted.

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover.
- Success of initial cover crop or grass cover establishment.
- Success of tree and shrub plantings.
- Natural regeneration of native species.
- Adequacy of drainage controls.
- General stability of the rehabilitated areas.

Remediation and enhancement activities would include but not be limited to the following.

- Where rehabilitation success appears limited, maintenance activities would be initiated. These may include re-seeding and where necessary, reapplication of soil and/or specialised treatments.
- If drainage controls are found to be inadequate for their intended purpose, or compromised by wildlife or native vegetation, these would be replaced.
- Temporary fences would be installed to exclude native fauna, if grazing appears to be excessive.
- In the event areas of excessive erosion and sedimentation are identified, remedial works such as importation of additional fill, soil material, or redesigning of water management structures would be undertaken.
- Appropriate noxious weed control or eradication methods and programs would be undertaken in consultation with the Department of Primary Industries – NSW Agriculture (DPI-Ag) and / or the local Noxious Weeds Inspector.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Rather, maintenance would continue until such time as the objectives outlined in Section 2.13.4 are achieved to the satisfaction of the relevant government agencies.

2.13.6.5 Site Closure Planning

As operations at the Austen Quarry approach completion, the Applicant would prepare the Site for closure. The general approach to Site closure would reflect that provided by *Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion* (Commonwealth, 2006b) as follows.

1. **Identify and engage with relevant stakeholders.**

   The objective of this stakeholder identification and engagement would be to ensure that the rehabilitation and final land use objectives remain the most appropriate. It is noted these may be different from the current stakeholders.

2. **Review, confirm or modify final land use and rehabilitation objectives and completion criteria.**

   Following the stakeholder consultation, the preferred final land use and therefore rehabilitation of the Site may have changed. The rehabilitation and final land use objectives and completion criteria would be reviewed and confirmed or modified in this context.

3. **Complete a risk and opportunity assessment for Site closure.**

   The risk assessment would be completed to evaluate the risks posed by the proposed final land use and rehabilitation, thereby allowing for appropriate mitigation strategies to be implemented proactively, and opportunities that Site closure could offer.

4. **Review final rehabilitation costs.**

   A rehabilitation cost estimate would be prepared accounting for any modifications to proposed methods or preferred outcomes on the basis of 1 to 3 above.

5. **Prepare a detailed final rehabilitation and Site closure plan.**

   This plan, which would be prepared internally, would document the remaining features of the Site to be decommissioned and rehabilitated, procedures for competing this and schedule for completion.

6. **Reporting against Completion Criteria.**

   Commission independent monitoring of the Site against the completion criteria confirmed or modified by Step 2. It is likely that this monitoring would be undertaken over several years (up to 5 years), with supplementary rehabilitation works undertaken in response to recommendations provided at the completion of each monitoring campaign.

It is noted that Site closure would not require commencement for at least 30 years, during which there may be significant changes to the local setting or planning framework. As such, while the general approach as nominated above is considered unlikely to change significantly, some modification to approach will almost certainly be required.

2.14 BIODIVERSITY OFFSET STRATEGY

2.14.1 Introduction

The DGRs issued on 3 September 2013 required that the Applicant provide:

> *"a detailed description of the measures that would be implemented to avoid, reduce or mitigate impacts on biodiversity, including an appropriate biodiversity offset strategy."*

Notably, as the Proposal requires disturbance to a species listed under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act), the *Biodiversity Offset Strategy* has been developed to account for the requirements of both NSW Office of Environment & Heritage (OEH) and Commonwealth Department of the Environment (DoE). Further discussion on the application of the EPBC Act to the Proposal is provided in Sections 3.2.2.4.2 and 3.2.3.2.

The following subsections provide a summary of:

- the critical features of a *Biodiversity Offset Strategy* (BOS) as required by OEH and DoE;
- residual impacts on native vegetation as a result of the Proposal and the credits required to offset the impact;
- the proposed Biodiversity Offset Area (BOA) and credits available within that area;
- credit calculation results; and
- proposed strategies.

Following receipt of development consent, the Applicant would prepare a detailed *Biodiversity Management Plan* in consultation with the DP&I, OEH and DoE that would provide further details on the implementation of the Plan. It is proposed that the Plan would be prepared within 12 months of receipt of development consent.

2.14.2 Biodiversity Offset Requirements

2.14.2.1 NSW Requirements

In June 2011, the NSW Office of Environment & Heritage (OEH) issued an interim policy for assessing and offsetting biodiversity impacts of 'State Significant Development' (OEH, 2011[10]). This policy seeks to provide a consistent and transparent approach to impact assessment and offsetting for projects assessed under Division 4.1 of the EP&A Act.

[10] It is noted that the nominated expiry date for the interim policy, June 2012, has passed. No formal policy position from the OEH has been subsequently provided.

Under OEH (2011), the Applicant is required to:

- describe, quantify and categorise the biodiversity values and impacts of a proposal;
- identify, for benchmarking purposes, the offsetting that would be required to meet, improve or maintain the standard; and
- provide the information for calculating offsets under this policy.

OEH (2011) relies on the ability of an assessment to categorise and quantify the biodiversity values of land to be impacted and that to be used to offset the impacts. The BioBanking Assessment Methodology (BBAM) provides an approved method of completing such categorisation and quantification, establishing benchmark requirements for offsets based on the type, condition and quantum of the biodiversity to be disturbed. BBAM considers biodiversity at both the 'ecosystem' or 'species' level. OEH (2011) requires that the nominated offset strategy be considered against benchmark requirements (generated by BBAM) to determine whether it meets one of the following biodiversity outcomes.

- Tier 1: Improve or maintain. The benchmark offsets nominated by BBAM are achieved.
- Tier 2: No net loss. With the exception that 'red flag' areas, e.g. EECs or threatened flora, are not protected, the benchmark offsets nominated by BBAM are achieved.
- Tier 3: Mitigated net loss. The nominated offset does achieve the benchmark nominated by BBAM, however, a lesser quantum is justified on the basis of other factors.

In addition to OEH (2011), the NSW Government recently released (NSW Government, 2013)[11] the following seven principles for the assessment of impacts to biodiversity and determination of acceptable offsets for State significant development and State significant infrastructure projects ("the New Offset Principles").

1. **Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.**

   Before an offset is considered for a proposed development, it must be demonstrated that any unnecessary impact to biodiversity has been avoided. Where impacts cannot be avoided, measures to minimise the impact must be identified. Offsets should only be used to compensate for those impacts that cannot be avoided or minimised.

2. **Offset requirements should be based on a reliable and transparent assessment of losses and gains.**

   Offsetting decisions should be based on a reliable and transparent assessment of the loss in biodiversity due to the proposal and the likely gain in biodiversity through the offset. The BBAM is considered best practice.

[11] http://www.environment.nsw.gov.au/biocertification/offsets.htm (posted 17 July 2013)

3. Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.

Offsets should reflect the biodiversity values, including threatened species and their habitat, that are being lost.

Like-for-like is preferable for NSW-listed EECs, threatened species and their habitat, however, vegetation communities of equivalent type or higher conservation priority and threatened species of a higher conservation priority will be considered where like-for-like offset sites are not reasonably available.

The offsetting of Commonwealth-listed species and ecological communities still requires the establishment of like-for-like offset sites (see Section 2.14.2.2).

4. Offsets must be additional to other legal requirements.

The biodiversity protection and management requirements of an offset must be in addition to any legal requirements already in place for biodiversity on that land. Improvements in the condition of native vegetation not currently required by other legislation would count as an offset.

5. Offsets must be enduring, enforceable and auditable.

Offset sites must be subject to good governance arrangements to ensure they are not inadvertently developed in the future. This includes having an appropriate plan of management, resourcing for management, legal security and accountability mechanisms. BioBanking Agreements or addition to the NSW national parks system are the preferred mechanisms for securing an offset site. The purchase and retirement of biodiversity credits under the BioBanking Scheme, where appropriate credits are available, also meets the requirement for good governance arrangements.

Suitable offsets must be determined prior to approval, however, the offset does not need to be finalized prior to approval (providing it is subject to a suitable mechanism that will remain enforceable after the project has been completed).

6. Supplementary measures can be used in lieu of offsets.

Supplementary measures can be used in lieu of offsets in situations where land based offsetting is not feasible or practical. The supplementary measure must be relevant to the biodiversity value being impacted and the monetary value of a supplementary measure is to be determined by an appropriate method that is repeatable and transparent.

Examples of supplementary measures include the provision of funds for:

– biodiversity research or surveys;

– recovery of threatened species; or

– community education and awareness programs.

7. Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.[12]

While an outcome in which biodiversity values are improved or maintained is preferred, it is acknowledged that in some circumstances flexibility may be required, especially in the context of a project providing significant social or economic benefits to NSW.

The New Offset Principles, while reinforcing the existing hierarchy of 'avoid, minimise, offset' and continuing to emphasise BBAM as the preferred offset assessment tool, offer greater flexibility. In particular, the New Offset Principles provide:

- for the discounting of offset requirements where significant social and economic benefits can be demonstrated;
- for the use of supplementary measures as offsets in situations where land-based offsetting is not feasible or practical; and
- greater flexibility to the 'like-for-like' approach to offsetting.

2.14.2.2 Commonwealth Requirements

The *EPBC Act Offset Assessment Guide* (DSEWPaC, 2012) provides the requirements of biodiversity offsets required of proposals determined controlled actions and requiring approval under the EPBC Act. DSEWPaC (2012) states that impacts should first be avoided and mitigated and that while both direct and indirect impacts are considered, direct offsets should meet at least 90% of the measureable conservation gain by:

- improving existing habitat;
- creating new habitat;
- reducing threats; and/or
- averting the loss of individuals or its habitat.

DSEWPaC (2012) notes that a range of considerations at both the impact and proposed offset site(s) are to be taken into account as follows.

- Matters to be considered at the impact site.
    1. Presence and conservation status of protected matters likely to be impacted by the proposed action.
    2. Specific attributes of the protected matter being impacted at a site, for example: the type of threatened species or ecological community habitat, the quality of habitat, population attributes such as recruitment or mortality, landscape attributes such as habitat connectivity, or heritage values.

[12] It is noted that this principle has been removed from the latest draft Biodiversity Offset Policy (NSW Government, 2014).

3. Scale and nature of the impacts of the proposed action – including direct and indirect impacts.
4. Duration of the impact (not of the action).

- Matters to be considered at the offset site.
  1. Extent to which the proposed offset actions correlate to, and adequately compensate for, the impacts on the attributes for the protected matter.
  2. Conservation gain to be achieved by the offset. This may be through positive management activities that improve the viability of the protected matter or averting the future loss, degradation or damage of the protected matter.
  3. Current land tenure of the offset and the proposed method of securing and managing the offset for the life of the impact.
  4. Time it will take to achieve the proposed conservation gain.
  5. Level of certainty that the proposed offset will be successful. In the case of uncertainty, such as using a previously untested conservation technique, a greater variety and/or quantity of offsets may be required to minimise risk.
  6. Suitability of the location of the offset site. In most cases, this will be as close to the impact site as possible. However, if it can be shown that a greater conservation benefit for the impacted protected matter can be achieved by providing an offset further away, then this will be considered.

2.14.3 Summary of Impacts

2.14.3.1 Ecosystems

As is discussed in Section 4.7.3.1.1, six native vegetation communities have been mapped within the Stage 2 Site. Three of these vegetation communities, aligned to four Revised Biometric Vegetation Types (RBVT) of the Hawkesbury Nepean (HN) CMA region in accordance with BBAM (see **Table 4.23**). Of the six vegetation communities within the Stage 2 Site, only three would be directly impacted by the Proposal and **Table 2.8** identifies these communities, the area of disturbance and number of ecosystem credits generated following the application of BBAM by Niche (2014a). The impacted area has been further refined as 'direct', i.e. areas within the nominated impact footprint of the Stage 2 Extension, and 'indirect', i.e. those within a 10m buffer zone from the directly impacted areas which could be subject to minor levels of disturbance such as access tracks or indirect impacts such as edge effects.

Table 2.8
Summary Table – Existing Vegetation Ecosystem Credits

Vegetation Community	Revised Biometric Vegetation Type	Area of Impact (ha)		Ecosystem Credits Required
		Direct	Indirect	
C1: Brittle Gum – Broad-leaved Peppermint open forest	HN570: Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands	17.3	1.3	620
C3: Forest Red Gum grassy open forest	HN527: Forest Red Gum - Yellow Box woodland of dry gorge slopes, southern Sydney Basin and South Eastern Highlands	4.4	0.8	134
C5: Stringybark – Apple Box open forest	HN501: Apple Box - Broad-leaved Peppermint dry open forest of the Abercrombie-Tarlo area, South Eastern Highlands	4.8	0.4	148
	Total	**26.5**	**2.5**	**902**
Source: Niche (2014a) – Modified after Tables 12 and 13				

2.14.3.2 Species

Under BBAM, species credits are created or required for impacts on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. No threatened fauna as listed within the TSC Act, that require the retirement of species credits, were detected during the field surveys (Niche (2014a). No threatened fauna species listed under the EPBC Act would be significantly impacted and therefore no specific offset is required by DSEWPaC (2012).

As is discussed in further detail in Section 4.7.3.1.2, 721 individual Silver-leaved mountain gum plants occur within the impact footprint of the Proposal. Species credits are required in order to offset this impact under BBAM which Niche (2014a) calculated equals 11 092 credits. As a species listed under the EPBC Act which would be significantly impacted by the Proposal, an offset is required for this species in accordance with DSEWPaC (2012).

2.14.4 Proposed Offsets

2.14.4.1 Biodiversity Offset Area

During the development of the Proposal, the likely requirement for a Biodiversity Offset Area (BOA) was identified and vegetation surveys extended to include potential areas for this purpose between the Stage 2 Site and the Coxs River. Following establishment of a defined impact footprint, and initial calculations of BBAM ecosystem credit requirements, a proposed BOA area was defined.

Figure 2.11 illustrates the proposed BOA which is focussed on the conservation of the remnant vegetation of which links the undisturbed vegetation of the ridges and gullies to the west of the Stage 2 Site with the Coxs River. The proposed BOA, as presented on **Figure 2.11**, covers 94.3ha and comprises the following vegetation communities (as mapped by Niche, (2014a), and described in Section 4.7.3.1.1) and RBVT's (pre-fixed with HN) to which each is aligned.

- C1: Brittle Gum – Broad-leaved Peppermint open forest (HN570) – 46.3ha*;
- C2: Silver-leaved Mountain Gum mallee woodland (HN570) – 1.9ha*;

- C3: Forest Red Gum grassy open forest (HN527) – 22.8ha;
- C3a: Forest Red Gum native grassland (HN527) – 0.8ha;
- C3b: Forest Red Gum exotic grassland (HN527) – 9.7ha;
- C4: Rough-barked Apple gully forest (HN527) – 2.4ha;
- C6: River Oak riparian open forest (HN574) – 10.4ha*.

The vegetation communities demoted by an * represent those communities which would be disturbed by the Proposal (see **Table 2.9**).

Table 2.9
Summary Table – Biodiversity Offset Area Ecosystem Credits

Vegetation Community		**Area (ha)**	**Ecosystem Credits Generated**
C1: Brittle Gum – Broad-leaved Peppermint open forest	HN570 – Red Stringybark - Brittle Gum - Brittle Gum dry open forest of the tablelands, South Eastern Highlands	46.3	446
C2: Silver-leaved Mountain Gum mallee woodland		1.9	15
C3: Forest Red Gum grassy open forest	HN527 – Forest Red Gum - Yellow Box woodland of dry gorge slopes, southern Sydney Basin and South Eastern Highlands	22.8	299
C3a: Forest Red Gum native grassland		0.8	9
C3b: Forest Red Gum exotic grassland		9.7	110
C4: Rough-barked Apple gully forest		2.4	21
C6: River Oak riparian open forest	HN574 – River Oak open forest of major streams, Sydney Basin and South East Corner	10.4	103
Total		**94.3**	**1 003**
Source: Modified after Niche (2014a) – *Table 17*			

The polygon excluded from the proposed BOA (see **Figure 2.11**) represents an easement for the purpose of Conservation Maintenance Work established to comply with Condition 7b) of DA 103/94 (see **Box 2.1**).

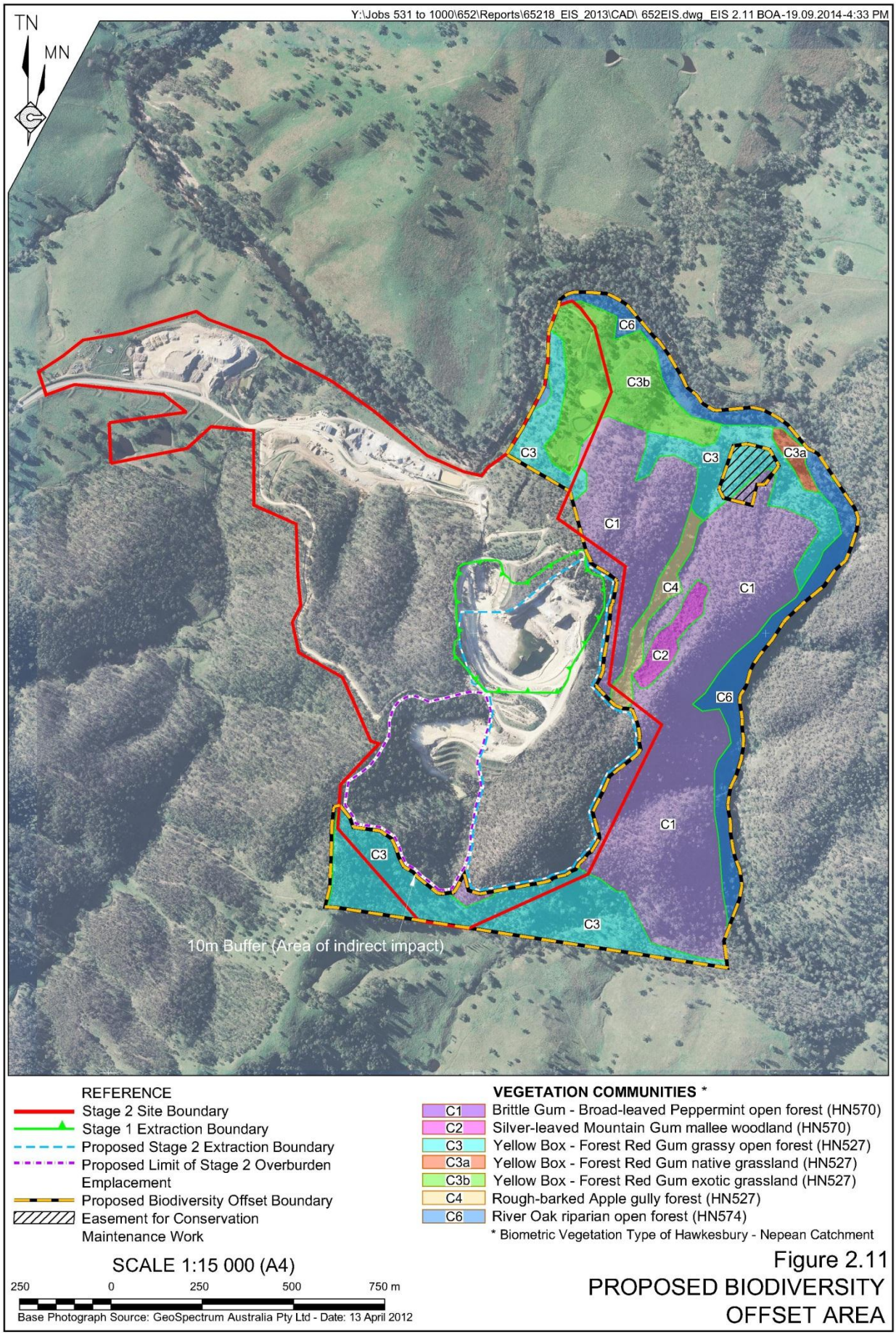
In accordance with Principle 4 of the New Offset Principles, this has been excluded from the proposal BOA and calculations completed in accordance with BBAM.

It is noted that the final BOA may vary slightly from that presented on **Figure 2.11** to account for specific ecological or other features identified during final survey of the areas. Any modification is unlikely to increase or decrease the size of the BOA as proposed by more than 1ha (1%) and therefore not impact on the suitability or function of the offset.

2.14.4.2 Ecosystem Offsets

Once the field survey was completed and the impact footprint finalised, the BBAM was applied to the communities within the proposed BOA to objectively quantify the ecosystem credits acquired. **Table 2.9** provides a summary of the communities and the BBAM results.

A comparison of the ecosystem credits provided for each of the impacted vegetation communities is provided by Section 4.7.5.2.


Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\ 652EIS.dwg_EIS 2.11 BOA-19.09.2014-4:33 PM
TN
MN
C6
C3b
C3
C3
C3a
C1
C4
C1
C2
C6
C1
C3
C3
10m Buffer (Area of indirect impact)
REFERENCE
Stage 2 Site Boundary
Stage 1 Extraction Boundary
Proposed Stage 2 Extraction Boundary
Proposed Limit of Stage 2 Overburden Emplacement
Proposed Biodiversity Offset Boundary
Easement for Conservation Maintenance Work
VEGETATION COMMUNITIES *
C1 Brittle Gum - Broad-leaved Peppermint open forest (HN570)
C2 Silver-leaved Mountain Gum mallee woodland (HN570)
C3 Yellow Box - Forest Red Gum grassy open forest (HN527)
C3a Yellow Box - Forest Red Gum native grassland (HN527)
C3b Yellow Box - Forest Red Gum exotic grassland (HN527)
C4 Rough-barked Apple gully forest (HN574)
C6 River Oak riparian open forest (HN574)
* Biometric Vegetation Type of Hawkesbury - Nepean Catchment
SCALE 1:15 000 (A4)
250 0 250 500 750 m
Base Photograph Source: GeoSpectrum Australia Pty Ltd - Date: 13 April 2012
Figure 2.11
PROPOSED BIODIVERSITY OFFSET AREA

Flora and Fauna

7. a) The developer to undertake a program of annual monitoring of fauna and fauna habitats in the vicinity of the quarry and stockpile areas, to monitor any indirect impacts from the operation. Such to be included in the annual report to be submitted to Council.

b) The developer is to pursue the attainment and fund implementation of a Conservation Agreement or flora preservation conditions over suitable E Pulvurulenta habitat identified by the National Parks and Wildlife Service of N.S.W., within the Hartley area.

c) The developer is to provide funding for the ex-situ growing of the species, E Pulverulenta, under the supervision of the National Parks and Wildlife Service and in conjunction with the Mt Tomah annex of the Royal Botanic Gardens, or other appropriately qualified organisation acceptable to the Service.

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Box 2.1
CONDITION 7(a) TO (c) OF DA 103/94

2.14.4.3 Species Offsets

The proposed BOA would incorporate 1 850 individual Silver-leaved mountain gum plants (Niche, 2014a). BBAM attributes 6 species credits per plant conserved, and therefore the proposed BOA would generate 11 100 species credits.

A review of the proposed BOA against the requirement of DSEWPaC (2012), i.e. the EPBC Act, is provided by Section 4.7.5.2.

2.15 CONSIDERATION OF ALTERNATIVES

2.15.1 Introduction

The Applicant has examined a range of alternatives before deciding upon the Proposal as presented within this document.

2.15.2 Alternative Method of Extraction

Given the nature and location of the rhyolite resource at or near the surface, open cut methods were determined to be the only feasible means of extracting the identified resource.

2.15.3 Limit of Extraction

The extraction area could be reduced in size and still provide for an increase in the life of the quarry. However, given the resource is now well understood, its quality recognised and the Applicant's experience in the current setting, there is little to be gained by progressively

extending the quarry in smaller increments until 2050. By presenting the larger extension, certainty can be provided to the local community, Council, DP&I and the construction industry as to the ultimate extent and life of operation at the quarry.

The proposed limit of extraction presented in the EIS has also been modified following consideration of potential impacts. The initial limit of extraction extended further to the north and east and would have provided a slightly larger quarry resource (see **Figure 2.12**). However, this larger extraction area was rejected on the basis of visual and biodiversity impacts.

By excluding the northerly and easterly extraction area extension, the visual exposure of the quarry to the northeast would be minimised while still providing sufficient volume of extractable material for the proposed 30 year life of quarry (at the currently approved maximum production rate).

The modified extraction area extension also minimises to the greatest extent feasible, disturbance to the NSW and Commonwealth listed Silver-leafed Mountain Gum. The identified occurrences of this species and residual impacts are discussed in Sections 4.7.4.2 and 4.7.5.7.

2.15.4 Extraction Sequence

The initial proposed sequence for extraction (**Alternative 1**) would have involved a direct continuation of the Stage 1 extraction area to the northeast, east and south (see **Figure 2.12**). This alternative would be the most cost-effective as it would not require the splitting of mobile equipment between two extraction areas and provide for more streamlined progression from development areas (for land preparation and removal of overburden) to extraction area (for excavation of rhyolite).

Following a review of the likely area of exposure from public vantage points to the north and the northeast the Stage 2 Site, it was identified that this sequence of extraction would result in the maximum area of the Stage 2 Site being exposed to north, northeast and east for the maximum period over the life of the Proposal. An assessment of constraints determined this to be unacceptable and two alternative extraction sequences were considered.

Alternative 2: South-to-North Sequence

This sequence would involve the commencement of the extraction area extension at or towards the southern limit of extraction, with the extraction face developed to the north on an east-west orientation.

This sequence would ensure that the north-south oriented ridges through the Stage 2 Site would be retained between the extraction area and vantage points to the northeast. The east-west oriented extraction face would also ensure that the extraction face would be on the reverse side of the advancing extraction area and therefore screened from vantage points to the north.

This alternative, while providing for a reduction in the likely impact on visual amenity, would be impractical for operational reasons and less cost-effective than other alternatives due to the separation distance between the initial development and overburden emplacement.

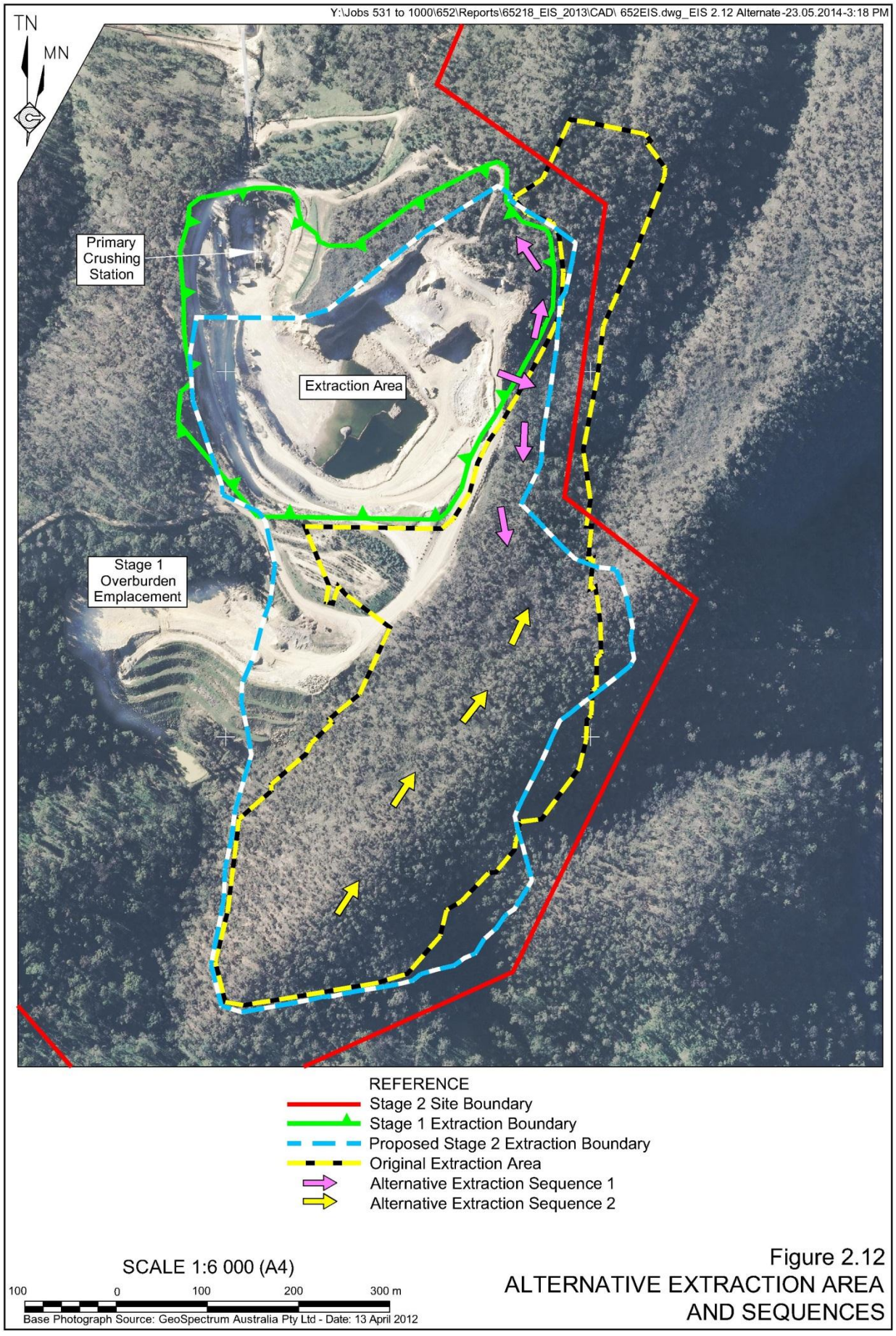

Figure 2.12
ALTERNATIVE EXTRACTION AREA AND SEQUENCES

Alternative 3: Central Expansion Sequence

This sequence, which now forms part of the Proposal (see **Figure 2.6**), provides for the commencement of the extraction area extension to the immediate south of the larger, more southern ridge through the Stage 2 Site. The extraction area is then developed initially to the south, and then to the north to ensure that an active extraction face is effectively screened by the retained ridge.

The extraction faces are oriented northwest-southeast, which provides for more effective management of non-rhyolitic material within the extraction area, which still allowing for the screening of the active extraction areas from the north.

As noted above, Alternative 3 has been incorporated as the proposed extraction sequence for the Stage 2 Extension.

2.15.5 Overburden Disposal

Backfilling of completed sections of the final extraction area remains a feasible option for placement of some of the overburden, however, is less favoured than the option to extend the existing overburden emplacement for the following reasons.

- The total volume of overburden requiring disposal is not large (4.4Mt – 11% of the total volume to be extracted) and would have little influence on the final landform within the extraction area or disturbance associated with the overburden emplacement (an increase of approximately 5.8ha).
- Backfilling would only be practical after many years of operation, when the overburden emplacement would already have been extended to (or close to) its maximum footprint.
- Any backfilling operations would need to take into account the presence of the primary crushing station and potential to damage or impact on the operation of this facility.

Alternatives to the location of the proposed out-of-pit overburden emplacement were not considered as the proposed location allows for the extension of the existing emplacement where surrounding topography provides for the maximum visual screening of the structure. As no endangered ecological communities (EECs), threatened species nor sites of heritage significance occur in this location (refer to **Figures 4.23** and Section 4.11.3), the relative impact of this location is considered appropriate.

It is possible that the area of impact associated with the overburden emplacement could have been slightly reduced by increasing the elevation of the structure, i.e. above an elevation of 810m AHD. This alternative design was ultimately rejected, however, on the grounds that:

a) this would increase the visual exposure of activities associated with the Proposal from public vantage points particularly to the northeast surrounding the Site; and

b) this would increase the cost to transfer the overburden material.

An alternative overburden placement sequence was considered which involved construction in a more directly bottom-up sequence. This sequence of overburden emplacement was ultimately rejected for the following reasons.

1. Before overburden could be placed at the lower levels of the emplacement, an access road down to these levels requires construction. Based on the extraction sequence, designed to minimise impacts on visual amenity of the local setting (refer to Section 4.4), construction of such an access road would not be practical until Stage A is largely complete.
2. Placement of the initial overburden to be generated by the Stage 2 Extension above the 780m AHD level of the existing overburden emplacement minimises the maximum visual exposure of the activities of the Stage 2 Site over the life of the Proposal. That is, the upper visually exposed lifts of the overburden emplacement would be completed and rehabilitated prior to the main exposure of the extraction area extension. This approach is discussed in more detail in Section 4.4.4.2.

2.15.6 Product Despatch

2.15.6.1 Rail Transportation

The use of rail to transport quarry products has been considered by the Applicant, however, there is considered to be little benefit to pursuing this option for the following reasons.

- Quarry products would have to be delivered by road to a rail siding, possibly at Lithgow or Lidsdale or Mount Victoria, negating the benefit of using the rail.
- The Applicant does not have access to a rail facility within the Sydney metropolitan area capable of loading the aggregate products. The cost of acquiring and constructing such a facility would be prohibitive.
- The Applicant's concrete batching plants throughout Sydney are strategically located near the M4 and M7 motorways and not near rail sidings. Furthermore, the locations of its customers are not static. Consequently, even if products could be placed on rail, there would be added cost and road transport necessary to deliver to the final destination and would place the company at an uneconomical disadvantage to its competitors

Road transportation is the only feasible alternative for transportation of quarry products from the quarry.

2.15.6.2 Alternative Access to the Great Western Highway

Consideration has been given to the construction and use of a new access road to provide direct access from the Stage 2 Site to the Great Western Highway, either via a new intersection or via the Carroll Drive intersection with the Great Western Highway at Hartley.

The primary advantage of constructing a private road between the Stage 2 Site and the Great Western Highway would be to reduce the volume of traffic on Jenolan Caves Road. However, as is discussed in Section 4.3.6, even considering the proposed maximum traffic levels and increase in background traffic volume over the life of the Proposal, the level of service experienced on Jenolan Caves Road would not change.

Notwithstanding the complexity and high cost associated with the option of constructing a new access road between the Stage 2 Site and Great Western Highway, the potential disadvantages or constraints on this alternative are significant.

- An additional crossing of the Coxs River would be required, either as a bridge or via a conveyor to a new stockpile and loading area.
  - The construction of a bridge would require disturbance to remnant riparian vegetation and create a new environmental hazard, i.e. disturbance during construction and the potential for spillage of fuel of product into the river during operation.
  - The construction of a conveyor to a stockpile and loading point on the northern side of the river would similarly require additional disturbance, in the form of the conveyor itself and stockpile area, and create an even more significant pollution hazard, i.e. potential spillage from the conveyor into the river.
- The construction of another road suitable for the heavy vehicles travelling to and from the Stage 2 Site would require significant additional disturbance. While some farm tracks exist between Carroll Drive, Hartley and the Coxs River, disturbance over the estimated 4.5km route would be between 3ha and 4.5ha. Almost certainly, this would include native vegetation communities, species and habitat.
- Historically, the NSW Roads and Maritime Services have opposed the creation of new intersections onto the State highway network. This would suggest an upgrade to Carroll Drive and its intersection with the highway as the only realistic option. A number of residences are located on Carroll Drive, with the residents of these then exposed to significant heavy vehicle traffic and noise.

Further to the above, the quarry currently operates with a purpose constructed, high quality access road and intersection with Jenolan Caves Road. As is discussed further in Section 4.3.2.6, the Applicant has maintained records of accidents/incidents involving heavy vehicles travelling to and from the Austen Quarry since 2005. Over that period, only one accident has occurred involving a truck travelling from the quarry, with the accident attributed to the car involved travelling on the wrong side of the road. This illustrates that the safe use of Jenolan Caves Road can be achieved.

Through an objective assessment of the alternative access to the Great Western Highway, it is concluded that this would provide a marginal benefit to the traffic conditions of Jenolan Caves Road, but with significant risks to or impacts on biodiversity, water quality and the residents of Hartley (Carroll Drive), at very high cost making existing infrastructure redundant. On the basis of this assessment, the alternative has been discounted.

2.15.7 Electrical Power

The option of mains power has been explored by the Applicant with Integral Energy. The minimum requirement of Integral Energy is to construct a 66kV power connection from Lithgow to the Austen Quarry location. This would involve some 15km of power line construction and the construction for a sole connection is considered to be uneconomical.

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