

**WALLERAWANG QUARRY
MODIFICATION 3**

Statement of Environmental Effects

FINAL

June 2019



WALLERAWANG QUARRY MODIFICATION 3

Statement of Environmental Effects

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Walker Quarries Pty Ltd

Report No. 4433/R01
Date: June 2019



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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Alex Irwin	19/6/2019	Alex Irwin	20/6/2019

Executive Summary

The Wallerawang Quarry (“the Quarry”) is located on land adjoining the Great Western Highway to the south of Wallerawang, approximately 8 kilometres (km) northwest of Lithgow. Development Approval DA 344-11-2001 for the Quarry was issued to Sitegoal Pty Ltd by the then Minister for Planning and Infrastructure on 19 October 2004. No activities were undertaken under DA 344-11-2001 until 2014 when an intersection with the Great Western Highway was constructed. Mining activities commenced in late 2014 with the Quarry now producing a range of quartzite aggregates, pebbles and sand. Notably, the range of products now produced at the Quarry is more extensive than envisaged by the original development application which nominated quartzite and rock aggregates only.

DA 344-11-2001 limits Quarry operations to a period of 10 years from the date of granting of a mining lease. ML 1633 was granted in July 2009, initially limiting quarry operations to July 2019, with this recently modified to extend the period to 15 July 2040. The 10 year limit on operations is understood to have been imposed as a result of concerns held by Lithgow City Council over the impact of the Quarry on the visual amenity of existing and future residential development to the north of the Great Western Highway. Notably, the visual impacts on residential vantage points to the north of the Quarry have been minimised and managed over the 5 years of operation at the Quarry.

Due to the delayed commencement of the Quarry operations, extraction has not reached the approved limits of DA 344-11-2001. Furthermore, recently completed drilling and resource assessment has also confirmed that the quartzite resource which is currently being extracted extends to depths at least 70 metres (m) below the currently approved extraction area, as well as further to the south. The Proposed Modification to approved Quarry operations seeks to provide for an increase in the quartzite resource to be extracted along with an increase to the period of approved operations. The Proposed Modification involves the following key components.

- Extension of the approved extraction area to increase the quartzite which can be recovered and incorporate additional resources to quartzite, namely, hornfels, sandstone and cobble conglomerate from which a wider variety of products can be produced. The extension involves both an increase in surface area and depth.
- Extension to the stockpiling areas on the Quarry Site to accommodate both an increase in overburden materials generated by the increased extraction area and additional Quarry products.
- Modifications to water diversion, capture and storage on the Quarry Site to accommodate the extended stockpile areas and improve the water security of the Quarry.
- Extension to the current limit on Quarry operations from July 2020 to July 2050.

This Statement of Environmental Effects (SEE) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) to support an application to modify DA 344-11-2001 pursuant to Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Key Design Considerations

The overall disturbance footprint of the Quarry would increase, however, there would be no change to annual production, transportation operations or hours of operation is proposed. Noting impacts of the Quarry on residential receivers to the north of the Quarry as a result of changes to visibility, noise levels and air emissions remains of key concern to the local community and Lithgow City Council, and the Proposed Modification has been planned to avoid or mitigate any additional impacts to these residences.

In particular, the design and sequencing of the extraction area has taken into account the line of sight from residential receivers to the north and northeast of the Quarry Site, with northerly extension of the extraction area beyond the current limit to only proceed after the elevation of the extraction area to the south has been developed below the line of sight. The vegetated hill slope to the north and east of the extraction area would be retained to screen view of the extraction area and other Quarry operations from these vantage points.

Other key design features of the Proposed Modification proposed to avoid, minimise or mitigate impacts are as follows:

- The stockpile area extensions would be undertaken in a staged manner, with the Western Stockpile Area extension only undertaken if markets for fill and low grade quartzite cannot be identified.
- The extraction area has been limited in depth to remain above the bank level, and greater than 40 m from the bank of the Coxs River.
- Clean water diversions would be constructed to minimise any reductions in environmental flows to the Coxs River.
- Crushing would continue to be undertaken within the extraction area, to reduce noise and air emissions received beyond the Project Site, unless a fixed plant with emissions sources covered is constructed.
- Impacts on biodiversity would be offset in accordance with the NSW Biodiversity Offsets Policy and impact on heritage undertaken in accordance with management measures agreed to be the Registered Aboriginal parties for the Proposed Modification.

Key benefits of the Proposed Modification include the following.

- Maximisation of the recovery of the quartzite resource.
- Provision of the ongoing employment of Quarry workforce and continued contribution to the local and regional economy.
- Maintenance and, where relevant, strengthening of the existing environmental mitigation and management strategies to minimise impacts associated with the Proposed Modification.

Broad Overview of Environmental and Socio-economic Outcomes

This SEE includes a detailed assessment of the potential environmental and socio-economic outcomes of the Proposed Modification and identifies the management, mitigation and offset measures that will be implemented as part of the Proposed Modification. A summary of the key findings of the assessment process is provided in **Table 1**.

Table 1 Summary of the Key Environmental, Social and Economic Impact Assessment Findings

Environmental/Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
<p>Ecology</p>	<p>The Biodiversity Assessment for the Proposed Modification was undertaken in accordance with the <i>Biodiversity Conservation Act 2017</i> and the Biodiversity Assessment Methodology.</p> <p>The Proposed Modification would directly impact biodiversity values through the clearing of up to 14.1 ha of native vegetation with biodiversity ecosystem credits required to offset the impacts as follows:</p> <ul style="list-style-type: none"> • 214 credits for the disturbance of 5.5 ha of PCT 732 (Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion). • 273 credits for the disturbance of 8.6 ha of PCT 1093 (Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion). <p>No additional species credits were generated by the proposed disturbance.</p> <p>The clearing of native vegetation would be staged over the life of the Quarry with credits for each stage calculated such that these can be retired progressively. majority of the Proposed Disturbance Area comprises disturbed and low quality vegetation in the form of derived native grasslands and an olive plantation.</p> <p>The measures to address the offset obligation of the Proposed Modification are to be documented in an updated Biodiversity Offset Strategy (BOS) for the Quarry and may include securing a land based offset, securing credits through the open credit market or paying into the Biodiversity Conservation Fund (or a combination of these measures). Investigations of the native vegetation on land owned by the Proponent has identified that a proportion of the required credits could be provided through a Biodiversity Stewardship Agreement over this land.</p>
<p>Aboriginal Heritage</p>	<p>A detailed Aboriginal Cultural Heritage Assessment (ACHA) has been undertaken in consultation with the Registered Aboriginal Parties (RAPs) identified for the Proposed Modification.</p> <p>No new sites were found during survey works, however, one known site (with high cultural value and low-moderate archaeological/aesthetic value) would be directly impacted by the Proposed Modification resulting in a medium loss of heritage value from the regional context.</p> <p>Salvage of the artefacts contained within the impacted site has been proposed with the final management measures to be documented in an Aboriginal Cultural Heritage Management Plan (ACHMP) to be prepared for the Quarry.</p>
<p>Groundwater</p>	<p>A conceptual hydrogeological model was established for the Quarry and surrounds following the construction and testing of three bores on the Quarry Site. Groundwater modelling indicated that the drawdown of the groundwater table is predicted to be approximately 35 to 40 m immediately surrounding the extraction area but reducing to less than 1 m within 1 km to the west, <750 m to the north and southwest. To the east and south, drawdown did not extend beyond the Coxs River.</p> <p>This drawdown would not exceed the minimal impact thresholds of the NSW Aquifer Interference Policy and is unlikely to result in any adverse impact on the availability of water to surrounding groundwater bores or on groundwater dependent ecosystems.</p> <p>A small reduction in recharge to the Coxs River is predicted once the extraction area is developed to its maximum extent, however, this reduction represents <0.05% of the main daily discharge of groundwater to the Coxs River in the vicinity of the Quarry.</p>

Environmental/Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Surface Water	<p>The Proposed Modification would require diversion of ephemeral tributaries of the Coxs River to accommodate the extended stockpile areas. These diversions have been designed as high flow diversion channels to ensure erosion and sedimentation of the modified drainage lines is avoided. Erosion and sediment control measures would be implemented in accordance with an updated Soil and Water Management Plan to prevent erosion or pollution of local drainage lines and the Coxs River catchment during construction of the extended stockpile areas or extension of the extraction area.</p> <p>The water use requirements of the modified Quarry operations have been reviewed and a site water balance prepared which confirms sufficient water would be available, either as surface water harvest or from local groundwater sources to supply the modified operations.</p>
Visual Amenity	<p>Line of sight sections and bare earth visual analyses were completed at residential vantage points (both existing and possible future) to the north and northeast, and from the Great Western Highway to the southwest.</p> <p>This analysis illustrates that with the implementation of the proposed extraction plan and sequence, the extraction area and other components of the Quarry would remain screened by topography and vegetation for the life of the Quarry. The Quarry operations would continue to be visible from the Great Western Highway, however, progressive establishment of vegetation along the western perimeter of the Quarry would gradually reduce the available views of the Quarry.</p>
Noise	<p>Modelling results indicate that through the proposed design and sequence of the extraction area, and the implementation of the proposed operational safeguards and controls, compliance with the Project Noise Trigger Levels would be achieved.</p>
Blasting	<p>Modelling results indicate that the potential impacts resulting from blasting activities can be managed effectively under the existing Blast Management Plan to ensure no exceedance of the relevant criteria.</p>
Air Quality	<p>Modelling results indicate that through the proposed design and sequence of the extraction area, and the implementation of the proposed operational safeguards and controls, compliance with air quality criteria for deposited dust and airborne particulate matter would be achieved.</p>
Rehabilitation	<p>The proposed final landform and land use considers requests and recommendations made by Forestry Corporation NSW and the Department of Industry – Crown Lands, owners of the land on which the Proposed Modification occurs.</p> <p>In keeping with these requests and recommendations, all infrastructure (including roads and water storages) would be decommissioned and removed, and the landform return to a moderately undulating one, with micro-relief, to achieve a natural landform design in keeping with the surrounding topography. These landforms would be vegetated to return a native woodland equivalent to that of the surrounding vegetation.</p> <p>The retention of a final void is unavoidable, however, to reduce the risk of landform contamination the void would be drained to prevent accumulation of groundwater and surface water runoff.</p>

Environmental/Social Issue	Overview of Key Outcomes (after proposed Management, Mitigation, Offsets)
Socio-economic Impact	<p>Through consultation with the local community and key government agencies and public authorities, an understanding of the key issues likely to impact on the social setting were identified. Through the implementation of key design and operational controls and safeguards, the predicted impacts on these matters can be addressed such that changes to local amenity can be minimised.</p> <p>The Proposed Modification would secure the ongoing contribution of the Applicant to the local and regional economy through employment, purchase of goods and services and payment of royalties and taxes for the next 25 to 30 years. Land use on surrounding properties would remain unaffected.</p> <p>After considering the possible of the Proposed Modification on the socio-economic environment and proposed management strategies to address these, the residual adverse and beneficial impacts are considered as follows:</p> <p>Adverse Impacts</p> <ul style="list-style-type: none"> (i) The Quarry would remain a feature of the local setting for the extended life of the Quarry. (ii) The rehabilitation of the Quarry, and mitigation of the visual impact of the Quarry when viewed from the Great Western Highway, would be delayed. <p>Beneficial/Positive Impacts</p> <ul style="list-style-type: none"> (i) Investment of an estimated \$1.1 million for additional and upgraded equipment and works associated with extraction area extension. (ii) Sustainment and future increase in employment opportunities within the Lithgow LGA. (iii) Flow-on benefits to the economy through the expenditure of wages paid to employees, sale of quarry profits and purchase of goods and services. (iv) Continued supply of important construction and landscaping materials to local and regional industry. <p>As a consequence of the Applicant’s commitment to employ and utilise local resources where practicable, there would be a direct economic benefit to the Lithgow LGA. It is also assessed that as a result of the proposed design features, operational safeguards, controls and management measures, any the impacts on local amenity associated with the Proposed Modification have been appropriately considered and addressed.</p>

Further details of the predicted environmental and social impacts of the Proposed Modification are provided in the main text of this SEE and associated technical reports in the appendices.

Through the implementation of the management, mitigation and offset measures proposed by the Applicant, it is considered that the Proposed Modification will result in a significant net benefit at a local, regional and NSW level relative to the Approved Operations.

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1.0 Introduction and Overview of the Proposed Modification

1.1 Scope

This Statement of Environmental Effects (SEE) has been prepared by Umwelt (Australia) Pty Ltd (Umwelt) to support an application of Walker Quarries Pty Ltd (“the Applicant”), a subsidiary company of Sitegoal Pty Ltd, to modify development consent DA 344-11-2001 for the Wallerawang Quarry (“the Quarry”). The Quarry is located at 963 Great Western Highway, to the south of Wallerawang and approximately 8 km north-west of Lithgow (see **Figure 1.1**).

Development consent for the Quarry was originally issued to Sitegoal Pty Ltd by the then Minister for Planning and Infrastructure on 19 October 2004 and has been subsequently been modified twice. On 25 August 2017, a modification to approve extension of stockpile areas and production of sand and other small diameter aggregates was issued. More recently on 7 December 2018, DA 344-11-2001 was modified to provide a short-term extension to the approved period of Quarry operations to 15 July 2020.

The Proposed Modification to approved operations, hereafter referred to as the Proposed Modification, involves the following key components:

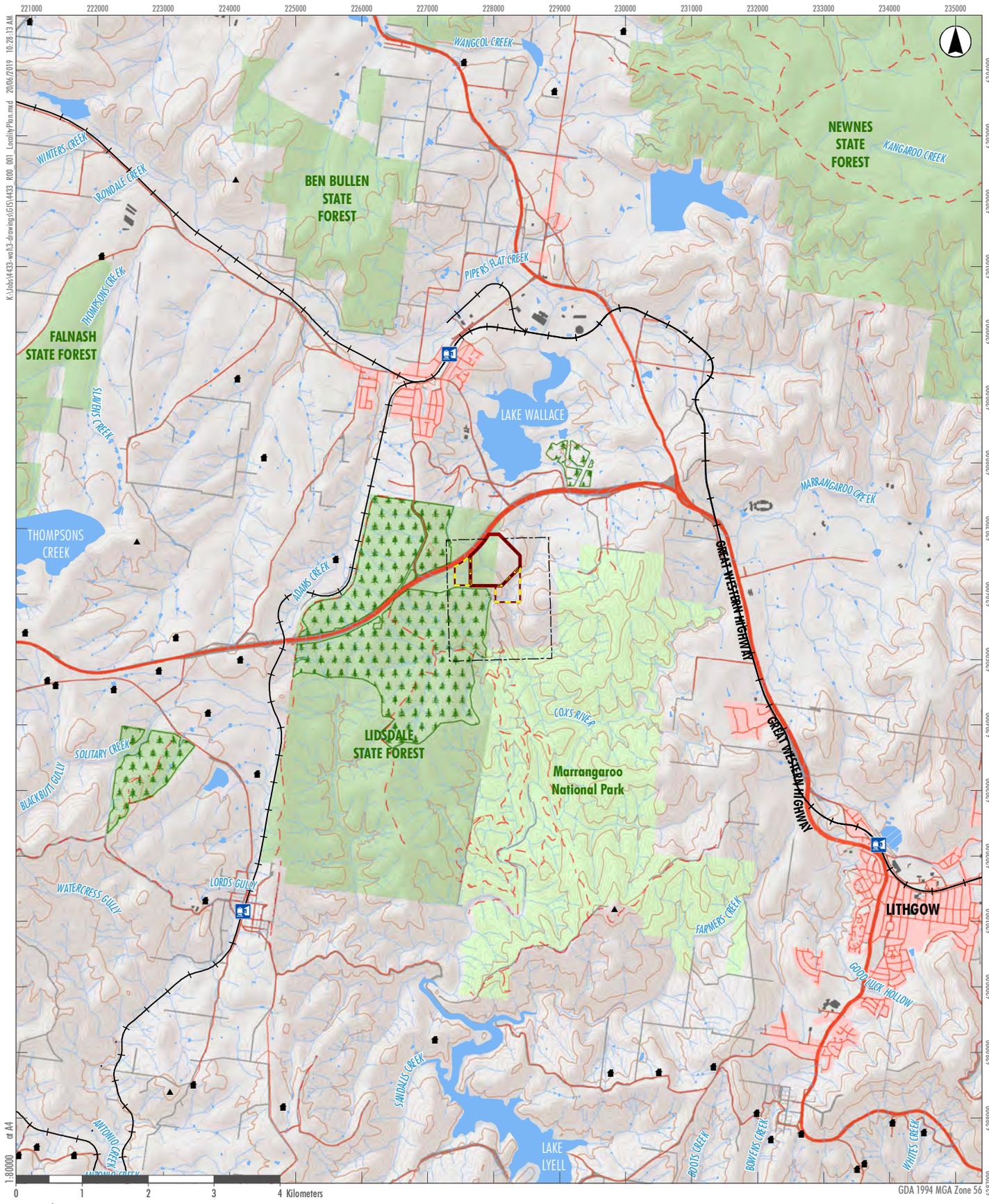
- Extension of the approved extraction area to increase the quartzite which can be recovered and incorporate additional resources to quartzite, namely, hornfels, sandstone and cobble conglomerate from which a wider variety of products can be produced. The extension involves both an increase in surface area and depth.
- Extension to the stockpiling areas on the Quarry Site to accommodate both an increase in overburden materials generated by the increased extraction area and additional Quarry products.
- Modifications to water diversion, capture and storage on the Quarry Site to accommodate the extended stockpile areas and improve the water security of the Quarry.
- Extension to the current limit on Quarry operations from July 2020 to July 2050.

The overall disturbance footprint of the Quarry Site would increase, however, there would be no change to annual production, transportation operations or hours of operation is proposed. The Applicant acknowledges that the visibility of the Quarry to the residential development to the north of the Quarry is of key concern to the local community and Lithgow City Council, and the Proposed Modification has therefore been planned to avoid or mitigate any additional impacts on visual amenity to these residences.

The information contained in this document relates only to those components of the Quarry that would be the subject of the Proposed Modification. Aspects of the Quarry that would not be modified would continue to be undertaken in accordance with the following:

- The conditions of DA 344-11-2001.
- The commitments made in the following documents:
 - Environmental Assessment for Modification to Operations at the Wallerawang Quarry (DA 344-11-2001) (RWC, 2017)

- Wallerawang Quarry Mining Operations Plan (incorporating a Rehabilitation Management Plan) (MOP), for the period 15 May 2018 to 14 December 2020 (RWC, 2018).
- The Wallerawang Quarry Environmental Management Strategy and various management plans, most recently reviewed and updated in February 2019, namely:
 - Noise Management Plan
 - Blast Management and Explosives Control Plan
 - Air Quality Management Plan
 - Soil and Water Management Plan (incorporating an Erosion and Sediment Control Plan)
 - Bushfire Management Plan
 - Biodiversity Management Plan.



- Legend**
- Quarry Site - ML1633
 - Proposed Quarry Site Extension
 - EL 4473
 - State Forest
 - NPWS Estate

FIGURE 1.1
Locality Plan

1.2 Format

The format of the SEE has been prepared to ensure the requirements of Section 4.15 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), *Environmental Planning and Assessment Regulation 2000* (EP&A Reg) and the environmental assessment requirements nominated by the Department of Planning and Environment (DPE) and consulted government agencies (refer also to **Section 3.2.1**). The format of the SEE is as follows:

The **Executive Summary** provides a brief overview of the Proposed Modification and summarises the key assessment outcomes.

Section 1.0 introduces the Proposed Modification, the Applicant and Application Area, provides an overview of the approved and current Quarry operations, relevant background to the Proposed Modification and a discussion on the need for the modification. Information on the format of the document and management of investigations is also included.

Section 2.0 provides a description of the Proposed Modification, focusing on those aspects of Quarry likely to be affected by the modified operations. The approvals, permits and other authorisations required are also described, and the section concludes with a review of alternatives considered in the development of the Proposed Modification.

Section 3.0 describes the approach taken to issue identification and prioritisation. This includes:

- a review of the stakeholder consultation undertaken, relevant legislation and planning instruments identification, and environmental performance
- identification of the key environmental and community issues
- analysis and assessment of these issues relevant to the Proposed Modification.

Section 4.0 identifies those components of the local environment which could be impacted by the Proposed Modification, outlines management and mitigation measures and provides an assessment of the residual impacts that may be associated with the Proposed Modification.

Section 5.0 sets out a summary of the environmental management measures (including monitoring) proposed to be adopted throughout the life of the Modification in order to mitigate potential impacts.

Section 6.0 summarises the key conclusions arising from the detailed environmental assessment, discusses the justification for the Modification and sets out how it is consistent with the principles of ecologically sustainable development.

Section 7.0 lists references cited in the SEE.

1.3 The Applicant and Application Area

1.3.1 The Applicant

Walker Quarries Pty Ltd is a subsidiary of Sitegoal Pty Ltd, to whom the original development consent was granted in 2004, created to carry out mining, processing, transport and other ancillary activities at the Quarry. Sitegoal Pty Ltd was formed in 1994 to identify and develop mineral resources in New South Wales. The Company Directors maintain a hands-on management style and are either Lithgow or Sydney-based.

In 2017, Walker Quarries Pty Ltd took over all operational and quarrying responsibilities which had previously been under contract to a local earthmoving contractor. Since taking on this operational responsibility, the compliance and environmental performance of the Quarry has improved significantly illustrating the Applicant's commitment to operating the Quarry in a manner that complies with all conditional requirements of the development consent and other approval, relevant environmental legislation and is environmentally responsible.

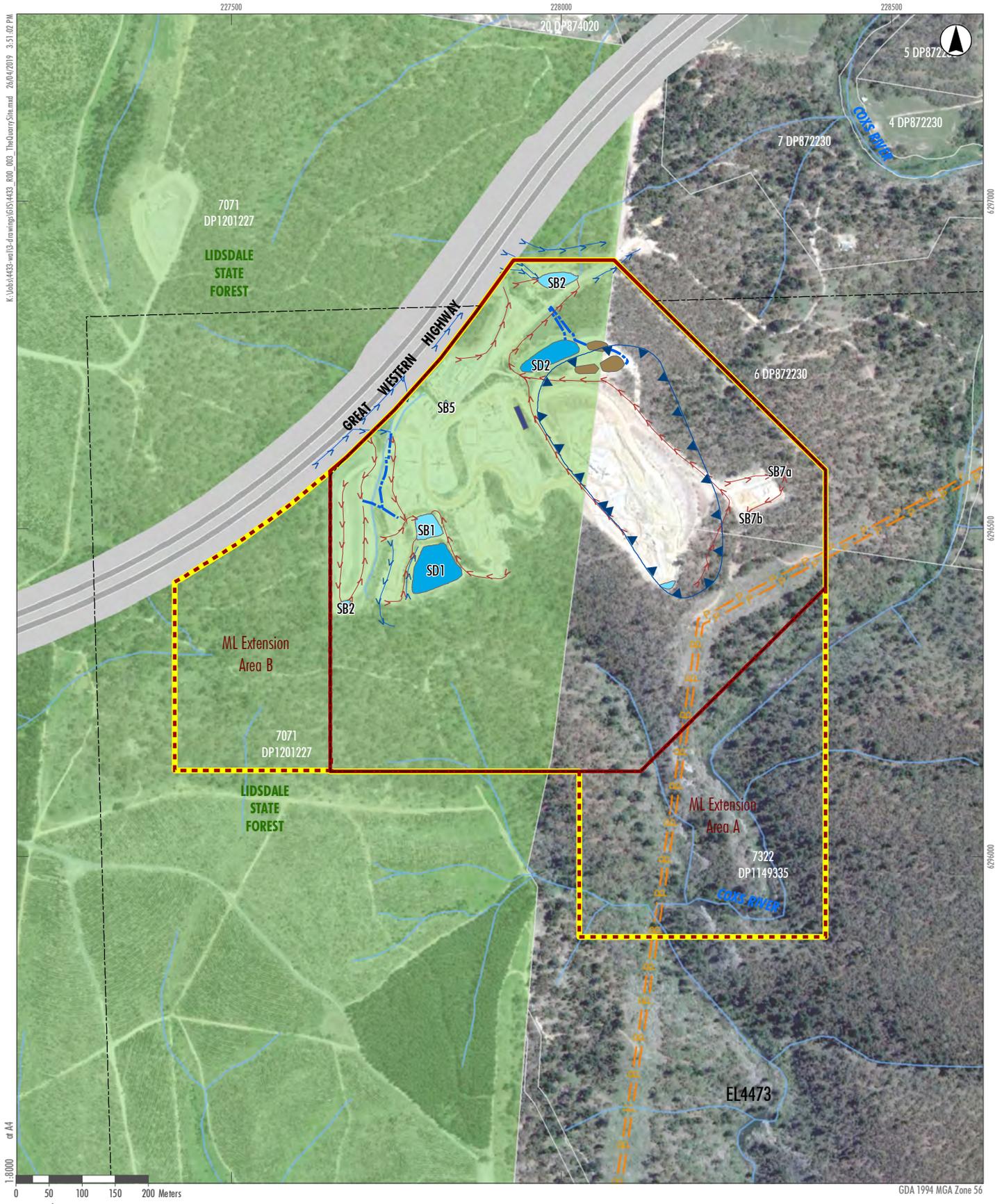
1.3.2 The Application Area

The approved Quarry Site, which coincides with the boundary of Mining Lease (ML) 1633, covers an area of 44 hectares (ha) and is located over three parcels of land adjoining the Great Western Highway to the south of Wallerawang (see **Figure 1.2**).

- Lot 6 DP872230: freehold title owned by Sitegoal Pty Ltd
- Lot 7322 DP1149335: Crown Land which is managed by the Department of Industry – Crown Lands and Water Division (DI-CLWD)
- Lot 7071 DP1201227: Crown Land which forms part of Lidsdale State Forest managed by Forestry Corporation of NSW (FC NSW).

The Proposed Modification requires an extension of ML 1633 to the south and west on Lots 7322 and 7071 respectively. These extension areas are identified on **Figure 1.2** as ML Extension Area A and B respectively. Significant features of the existing and extended Quarry Site identified on **Figure 1.2** are as follows:

- The additional portion of Lidsdale State Forest (Lot 7322) included in the Application Area contains native, not plantation, forest.
- The western extension to the Quarry Site includes the confluence of three ephemeral drainage lines which flow in an easterly then southerly direction to the Coxs River.
- The southern extension to the Quarry Sites incorporates a portion of the Coxs River and includes land which overlies the southerly continuation of the quartzite resource. A transmission line traverses the Quarry Site with all activities have been designed to remain at least 30 m from the stanchion located to the south of the existing extraction area.
- Some drainage from and to the north of the Great Western Highway discharges onto the Quarry Site.



- Legend**
- Project Site
 - Quarry Site - ML1633
 - Quarry Site Extension
 - EL 4473
 - ▼ Approved Extraction Area
 - State Forest
 - Sediment Basin
 - Silt Cell
 - Storage Dam
 - Water Storage Sumps
 - Clean Water Drain
 - Dirty water drain
 - Water Pipeline
 - P — Electricity Transmission Lines

FIGURE 1.2
The Project Site

1.4 Approved and Ongoing Operations

1.4.1 Limits

DA 344-11-2004 provides for the annual production of up to 500,000 tonnes (t) of quarry products from an open cut area of approximately 6.5 ha in surface area and with quarrying operations not permitted below a level of 930 m AHD. **Figure 1.3** presents the layout of the Quarry Site as approved by the modification to the development consent issued on 25 August 2017.

Operations at the Quarry commenced in 2014 with the construction of a new intersection with the Great Western Highway. Quarrying activities commenced in late 2014 with the Quarry now producing a range of aggregates, pebbles and sand. At the time of writing, the disturbance footprint of the Quarry was 14 ha which represents approximately 85% of the approved 16.5 ha disturbance area of DA 344-11-2004. The floor of the extraction area rises from approximately 950 to 955 m AHD, remaining 20 to 25 m above the approved maximum depth.

The following provides an overview of the activities undertaken on the Quarry Site.

1.4.2 Extraction Operations

Extraction of the quartzite is undertaken using conventional drill and blast, load and haul methods. Surface vegetation is first cleared by bulldozer and/or hydraulic excavator and placed in stockpiles. This stockpiled vegetation is retained for reapplication to landforms of the Quarry Site to be rehabilitated. Where this cleared vegetation is retained in stockpiles for in excess of three months it is mulched prior to future application to landforms under rehabilitation or dispatch from the Quarry in accordance with the Resource Recovery Order for mulch issued under Part 9 of the *Protection of the Environment Operation (Waste) Regulation 2014* in 2016. Where it is present in sufficient thickness, soil is stripped and stockpiled for use in rehabilitation activities.

A thin strip of clay and weathered quartzite occurs below the soil. This overburden is excavated, loaded to haul trucks and either used in the construction of bunds, maintenance of internal roads or temporarily stockpiled within the extraction area prior to use as described.

The quartzite is generally non-rippable, i.e. too hard to be fragmented by a ripper blade attached to a dozer and is blasted to fragment the material. The blasted quartzite is currently loaded to haul trucks for delivery to a primary crusher which is located at an elevation of approximately 960 m AHD at the southern end of the extraction area. A small ROM stockpile of several thousand tonnes is maintained adjacent to the crusher. Current blast sizes vary according to the location within the extraction area but generally vary from 15,000 bank cubic metres (bcm) (40,000 t) to 35,000 bcm (95,000 t).

1.4.3 Processing Operations

The processing operations involve the use of a series of crushers and screens to crush, separate and wash the quartzite into various size aggregates and sands. Customised road pavement, construction and landscaping products are also produced through blending of the various raw materials and products.

The development consent does not impose restrictions on the crushing equipment which may be used as long as noise and air emission criteria are complied with. It is also noted that the nominated size fractions represent those of the current processing arrangement and these may be subject to change over the life of the Quarry.

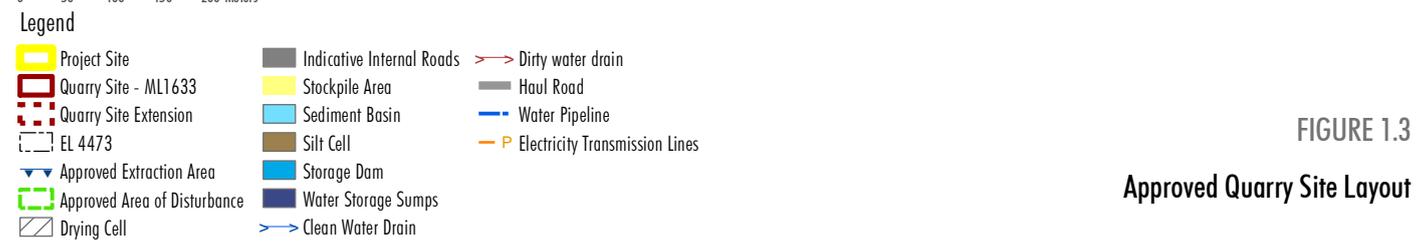
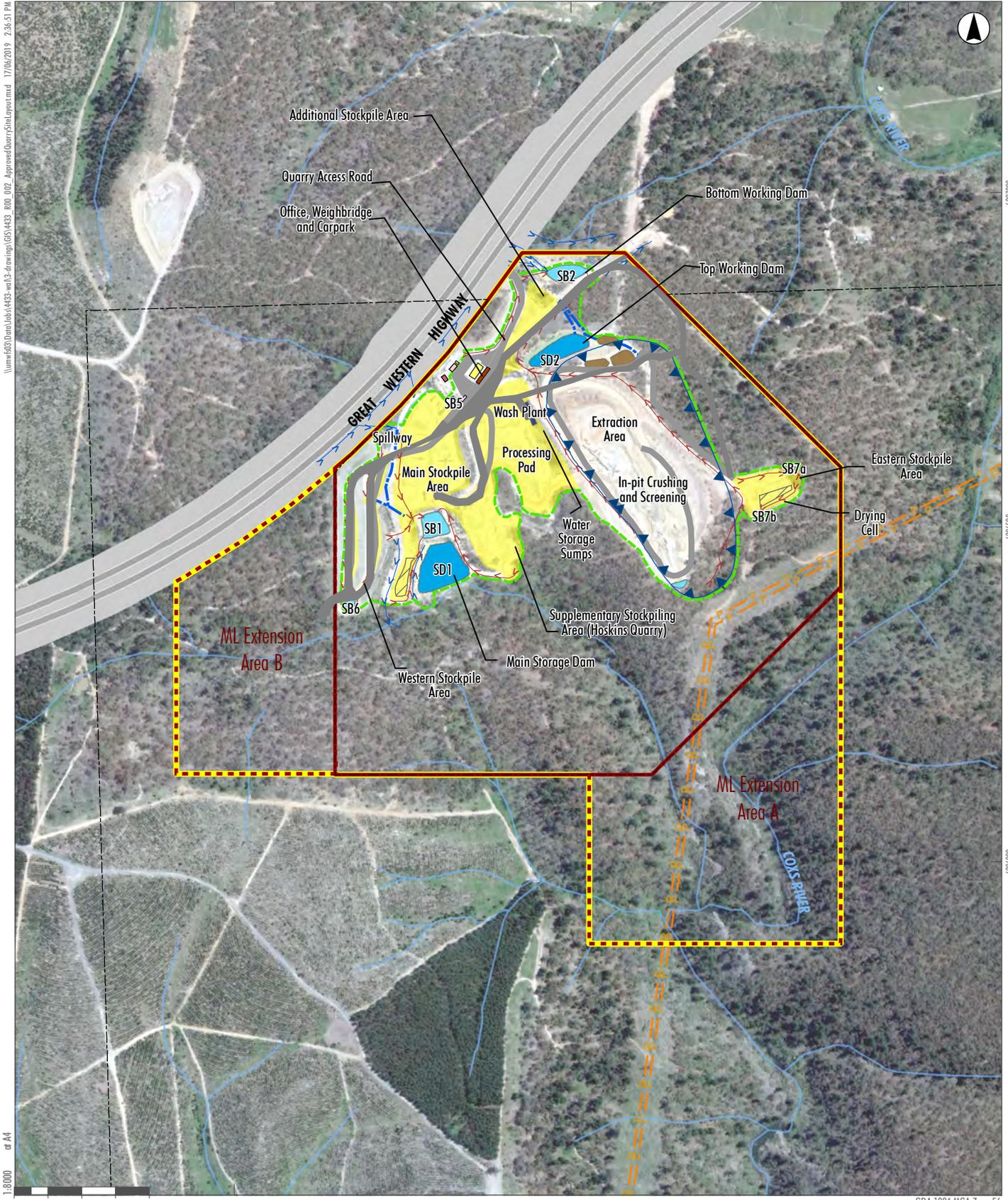


FIGURE 1.3

Approved Quarry Site Layout

Crushing and Screening Circuits

There are currently two crushing and screening circuits operating, one producing road base materials and the second aggregates of various sizes. However, it is noted that the number of crushing trains and arrangement of the crushing and screening equipment may be modified in accordance with DA 344-11-2001 subject to meeting noise and air emission criteria.

Blasted rock is either loaded by excavator to the primary jaw crusher where it is crushed to reduce its size (to <100 mm). Oversized materials and dust are screened before the rock is conveyed to a secondary crusher which reduces the size of the quartzite again (to <40 mm) for delivery by conveyor for screening into various size fractions (>40 mm, <40 mm and fines). The >40 mm and fines components are either returned to the primary crusher or stockpiled for future blending or use in rehabilitation. The targeted size fraction (<40 mm) is delivered by conveyor to a tertiary crusher for further size reduction and size grading, as described below.

- Oversize materials (>20 mm) are either delivered to stockpile for sale or returned along with other oversize material to the primary jaw crusher for re-crushing.
- Select diameter aggregates (14 to 20 mm and 7 to 14 mm) are delivered to stockpile for sale.
- The <7 mm fraction from the tertiary crusher are either delivered to stockpile for sale or further screened and separated into smaller sized (currently <7 mm and <5 mm) aggregates.
- The graded <7 mm and <5 mm aggregates are either stockpiled for sale or sent to the washing circuit to create washed aggregate and sand products.

Washing Circuit

Water is added to the <7 mm material over a variable sized vibrating screen (mesh sizes of 7 mm or 5 mm). This initial mixing of water and rock, along with the vibrating nature of the screen, allows for the removal of fine clay and silt particles. Water sprays are also used to remove additional clays and silts with the heavier and washed aggregates moving to the bottom of the tanks and the silt containing water drawn off the top and pumped initially to a water storage sump to the immediate east of the processing plant for initial settlement. The <7 mm or <5 mm quartzite aggregate collected at the base of the tank is then dewatered with the aggregates stacked before being loaded to trucks and delivered to stockpile.

The washing circuit is also used periodically to wash and grade any cobble conglomerate which is extracted and produces decorative pebble products for landscaping.

The silty water drawn from the wash tank is initially pumped to a water storage sump on the main stockpile area for settlement of the coarser (heavier) sediments. The water is then pumped and discharged via a 300 mm HDPE pipeline to the first of three silt cells operated in sequence (refer to **Figure 1.3**). To avoid potential damage, the pipeline is buried below the surface of the main haul ramp to the open cut.

The silt cells have been designed as rectangular structures (length : width ratio of between 2 : 1 and 3 : 1) to extend the flow through time and therefore promote the settlement and collection of silts within each cell. Gabion basket walls are placed across the middle of each cell to further assist in the collection and settlement of silts and clays. A concrete weir is designed at the discharge point of the first two cells, again to assist in the retention of silt in the cell, with flow between each cell via a concrete culvert, to prevent the collection of additional silt during transfer between cells.

As the silt accumulates in the cells, it is periodically removed (by excavation or pumping) and transferred to drying cells constructed on the stockpile areas of the Quarry Site.

As required, the water within the silt cells is dosed with an anionic acrylamide-based copolymer flocculent to accelerate the settlement of silts. As the silt dries sufficiently to be shovelled, it is excavated, loaded

to trucks and used either as a blending material for specialty aggregate or fill materials, in ongoing rehabilitation activities or stockpiled for future used in rehabilitation.

1.4.4 Stockpile Management

As identified in **Section 1.4.3**, the Applicant produces a wide range of aggregate, sand and other products (ranging in size from 40 mm, 20 mm, 14 mm, 10 mm, 7 mm through to 5 mm), gabion material, blended road pavement products, select fill, landscaping and drainage materials. A number of these products are customised to meet the customers' individual specifications. Hence, a number of smaller stockpiles are maintained for these products.

The Applicant maintains an area of approximately 3.5 ha for stockpiling materials as described below (see **Figure 1.3**).

- Main Stockpile Area and Processing Pad: operated as the principal stockpiling areas for high volume quarry products.
- Additional Stockpile Area: located to the immediate south of the Quarry Entrance and used as a temporary surge stockpile area.
- Supplementary Stockpile Area: located in the former Hoskins Quarry and which has been used for the stockpiling of crushing and screening reject material prior to sale.
- Western Stockpile Area: located on the western side of a small drainage line, this area is used for the stockpiling of smaller volume and specialty products.
- Eastern Stockpile Area: located to the east of the extraction area, this stockpile is currently being used for the drying of silts removed from the sand washing plant silt cells prior to use in rehabilitation.

1.4.5 Quarry Site Water Management

The diversion, collection, settlement, harvesting, and discharge of water are undertaken in accordance with the Quarry's Soil and Water Management Plan (Umwelt, 2019a). The Soil and Water Management Plan is regularly reviewed and the most recent version (last updated in April 2019) is available on the Applicant's website (<https://walkerquarries.com.au/statutory-information/>).

1.4.6 Transport Operations

All trucks enter and exit the Quarry via the existing entrance at the intersection with the Great Western Highway (see **Figure 1.3**). Constructed in 2014, this intersection provides a channelized entrance and exit to the Quarry Site from the Great Western Highway, which is a dual lane, 110 km/hr road at this point. The internal access road is sealed from the Quarry Site entrance to just beyond the Quarry office and weighbridge.

Within the Quarry Site, haul trucks, road registered trucks and light vehicles share the roads. As far as practical, one way routes would be maintained to avoid conflict between vehicles as well as maximise the available space for stockpiling.

The Quarry is not restricted as to the size or configuration of road-registered trucks entering and leaving the Quarry. Typically, 19 m truck and dog, larger (B-Double) or smaller rigid configurations are used to deliver quarry products. At the approved maximum production rate of 500,000 tpa, the Quarry would generate between 90 and 110 truck movements per day. The daily number would fluctuate depending on customer demand, however, the total number of movement in any one day is unlikely to exceed 150.

1.4.7 Hours of Operation

The Quarry is approved for operation in accordance with the hours of operation presented in **Table 1.1**.

Table 1.1 Approved Hours of Quarry Operation

Activity	Permissible Hours
<ul style="list-style-type: none"> • Drilling and Blasting • Mining operations • Processing operations • Overburden Management • Stockpile Management 	<ul style="list-style-type: none"> • 7:00am to 6:00pm Monday to Friday; • 8:00am to 1:00pm Saturday; and • At no time on Sundays or public holidays.
<ul style="list-style-type: none"> • Loading and Despatch 	<ul style="list-style-type: none"> • Any time provided it meets the noise criteria set out in <i>Table 2.1</i> of DA 344-11-2001.
<ul style="list-style-type: none"> • Maintenance 	<ul style="list-style-type: none"> • Any time provided it is inaudible at all residential premises surrounding the Quarry Site.

1.4.8 Infrastructure and Services

The key infrastructure and services of the Quarry includes the following:

1. A sealed Quarry Access Road between the Great Western Highway and main stockpile area (providing access to the Quarry administration area and weighbridge).
2. Two demountable site office buildings¹ constructed on concrete footings, including offices, kitchen, ablution, storage and training facilities. Parking facilities for employees and visitors are provided in accordance with Lithgow City Council planning provisions.
3. Self-bunded diesel fuel storage tank.
4. A meteorological station located at the north-western corner of the Quarry Site.
5. Various hardstand surfaces for product stockpiling and a network of unsealed roads for internal vehicle movements.
6. Six sediment basins and two water storage dams (and associated pumping and water transfer infrastructure).
7. Electrical power for all quarry operations and the administration centre is supplied by diesel-powered generators.

1.4.9 Quarry Site Rehabilitation

The Applicant is undertaking rehabilitation in accordance with an approved MOP (incorporating a Rehabilitation Plan) (RWC, 2018). As far as practical, a progressive approach to rehabilitation is adopted for areas not required for ongoing operations, such as amenity bunds, batter slopes and closed roads/tracks. These areas are progressively profiled and vegetated to provide a stable landform. The nature of Quarry operations, which requires the ongoing use of the majority of disturbed areas for the life of the Quarry, reduces opportunities for progressive rehabilitation with most rehabilitation scheduled to be completed much closer to the exhaustion of the resource.

¹ One of these structures was approved by Lithgow City Council in February 2018 as DA 019/18.

In accordance with the MOP, the Applicant intends on creating a final landform which includes:

- a final void (down to a maximum elevation of 930 m AHD and stable walls of between 55° and 70°)
- retention of the two water storage dams and major drainage lines
- retention of the Quarry Site entrance, sealed access road and access roads to the water storages
- profiling of the remaining surfaces to create a gently undulating landform, vegetated as open forest, sympathetic to the surrounding environment.

1.5 Background to the Proposed Modification

On the initial issue of DA 344-11-2001 in 2004, the development consent limited operations to 10 years from the date of granting of a mining lease. ML 1633 was granted in July 2009, initially limiting quarry operations to July 2019. As noted in **Section 1.1**, a recent modification extended the period of approved quarrying operations to 15 July 2020. From the initial issue of DA 344-11-2001, no activities had been undertaken on the site, until 2014 when an intersection with the Great Western Highway was constructed. Mining activities then commenced in late 2014, with the Quarry producing a range of quartzite aggregates, pebbles and sand. Notably, the range of products now produced at the Quarry is more extensive than envisaged by the original development application which nominated quartzite and rock aggregates only.

The original 10 year limit imposed on quarrying operations was conditioned as a result of concerns held by Lithgow City Council over the impact of the Quarry on the visual amenity of existing and future residential development to the north of the Great Western Highway. Considering the 10 year limit on quarrying operations and the maximum proposed production of 500 000 tpa, the extraction area as currently approved was designed to provide for approximately 3.5 Million tonnes (Mt) of quartzite resource.

Recognising the likely continuation of the quartzite resource, both laterally and at depth, the Applicant engaged Rangott Mineral Exploration Pty Ltd (RME), initially in 2014 and again in 2017, to complete exploration drilling, geological mapping and resource calculations of the quartzite and other hard rock resources contained within ML 1633. **Figure 1.4** identifies the exploration completed between 2014 and 2017 and geological mapping generated as a result.

Most recently (in 2017), eight diamond drill holes were completed with the results, as summarised by RME (2018), confirming the occurrence of four key resource types:

- Quartzite. The high silica, high purity metamorphosed (indurated) quartzose sandstone which is currently exposed and extracted from the open cut.
- Sandstone. Less indurated than the quartzite and containing less silica, this is currently sold as road base and could potentially be processed to produce sand.
- Hornfels. A field term for the metamorphosed volcanoclastic, sedimentary and limey rocks that were historically extracted at the Hoskins Quarry. The hornfels, which is strongly indurated due to the intrusion of a granite nearby, could potentially be used as concrete aggregate, ballast and gabion rock. While bands containing deleterious minerals were identified, these may only be a minor component of this rock unit.
- Cobble conglomerate. Well-rounded, 'flattened egg' ovoid cobbles of up to 20 cm in length, of a variety of basement rock types but mainly of quartzite composition, in a clayey matrix. The cobbles could be sold as landscaping material and as architectural aggregate.

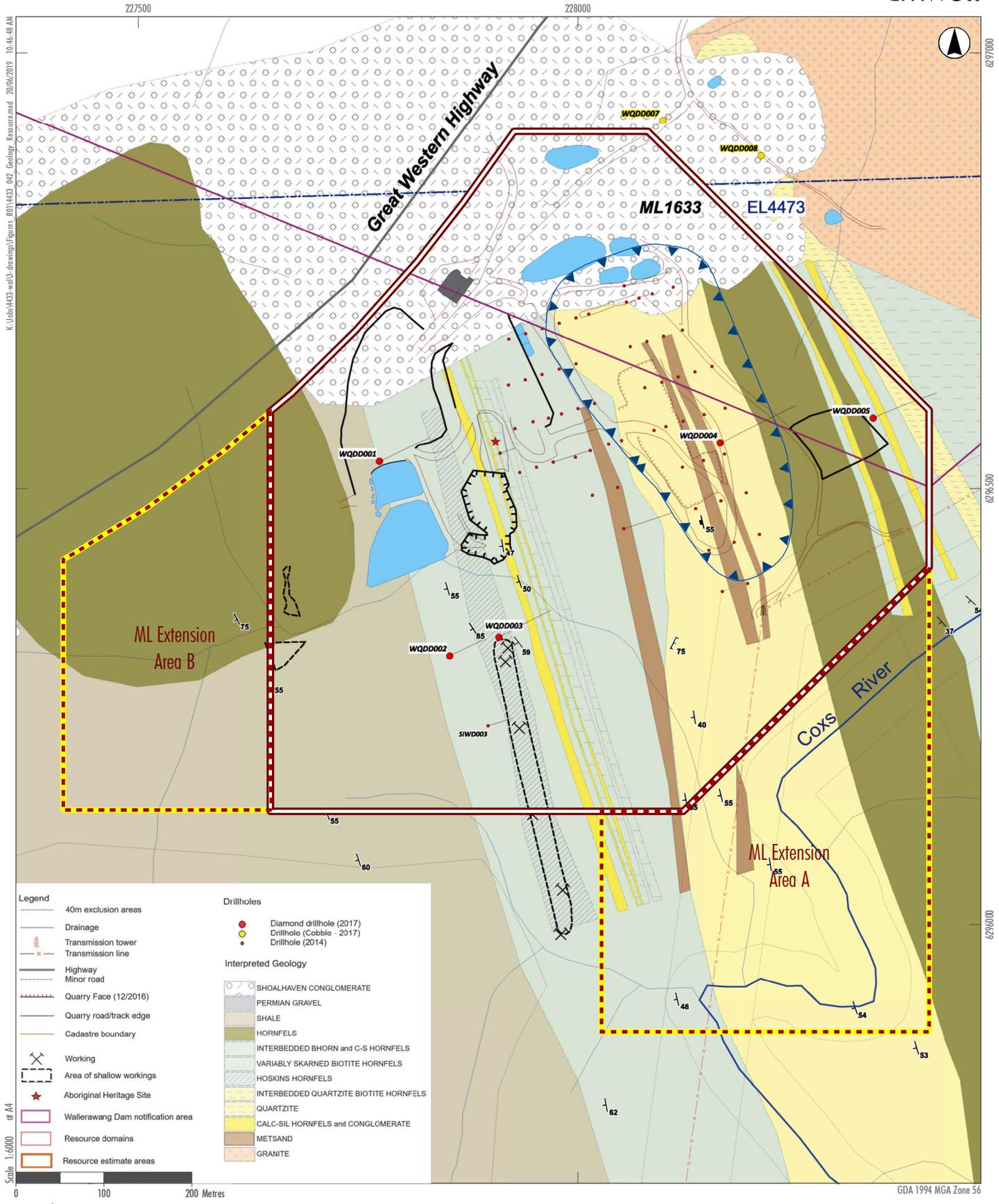


FIGURE 1.4

Quarry Geology & Resource Assessment

Following the instruction of the Applicant, RME (2018) identified an additional resource of 12.4 Mt of quartzite which was reported to JORC standard to 860 m AHD within the resource assessment area identified on **Figure 1.4**. While not calculated to JORC standard, RME (2018) also estimated the sandstone, hornfels (excluding scapolite zones) and cobble conglomerate on ML 1633 as follows:

- Hornfels: 28.8 Mt
- Sandstone: 3.7 Mt
- Cobble conglomerate: 0.185 Mt.

On identification of these significant resources within and to the south of ML 1633, the Applicant commenced further assessment to define an extended extraction area. Key parameters considered in the design of the extraction area were as follows:

- Maximising the recovery of quartzite (in preference to hornfels and sandstone).
- Minimising the extraction of overburden and other non-economic rock types, e.g. shale and scapolite hornfels. Scapolite is considered a deleterious element for aggregates as it weathers easily to clay.
- Remaining above the channel of the Coxs River (which is between 850 and 855 m AHD adjacent to the Quarry Site).
- Avoiding or restricting as far as practical additional visual exposure of operations to residences to the north and northeast of the Quarry.

The extended extraction area, which is identified on **Figure 1.4**, and further discussed in **Section 2.0**, provides for the addition of approximately 12 Mt of quartzite material. The extension retains the existing approved eastern perimeter of the extraction area as this represents the boundary between the quartzite and eastern hornfels resources. The westerly extension allows for the intersection of the quartzite layer at the 860 m elevation at its western most extent, thereby allowing for the recovery of the full extent of the westerly dipping quartzite. If developed to its full westerly extent, approximately 1.5 M³ of predominantly hornfels and sandstone material would be recovered for sale or on-site disposal. A small extension to the north has been proposed to allow for the extraction and recovery of the cobble conglomerate to a depth of approximately 915 m AHD.

Recognising the importance of managing visual amenity, especially to the north of the Quarry Site, the Applicant has identified that managing the sequence of extraction is critical to demonstrate that the visibility of the Quarry Site from vantage points to the north and northeast can be managed and mitigated. **Plates 1.1 to 1.4** present photos taken from residential properties to the north and northeast of the Quarry, as well as views for eastbound traffic on the Great Western highway. It is important to note that the visible elements of the Quarry presented in these photos represent the most that the Quarry will ever be seen over the life of the Quarry.



Plate 1.1 View from 42 Rocky Waterhole Drive toward the Quarry Site



Plate 1.2 View from elevated point on Lot 104 toward the Quarry Site



Plate 1.3 View from 4 Cypress Place toward the Quarry Site



Plate 1.4 View of the Quarry Site for eastbound traffic on the Great Western Highway

1.6 Need for the Modification

As identified in **Sections 1.1** and **1.5**, the limits on DA 344-11-2001 restrict quarrying operations to July 2020. As a result of the delay in the commencement of quarrying operations, an annual production rate (<100 000 tpa) well below the nominated maximum, and a period of care and maintenance between November 2016 and August 2018, a significant proportion of the originally identified 3.5 Mt of quartzite would remain unrecovered. The intended final landform identified in the original development application and presented (as modified) in the MOP could not be completed which would impact on the integration of the final landform with the surrounding environment and negatively impact on the visual amenity of the Quarry Site (which includes State Forest and Crown land). On the basis of ensuring that the Quarry can be completed as originally intended, an extension to the period of quarrying operations is needed.

As quarrying operations have progressed since 2014, the Applicant has identified key markets both locally and regionally for the high quality road construction aggregates produced by the Quarry. The Quarry also produces a wide range of other fine and coarse aggregates which are likely to increase in demand as in local and regional markets for concrete manufacture, construction materials, select fills, drainage and

landscaping products. The cobble conglomerate resource which occurs as white to cream coloured pebbles is also particularly sought after as a decorative landscaping product.

The Department of Planning and Environment (DPE) is currently undertaking an assessment of the current and future availability of construction materials (sand and hard rock aggregates) for Sydney and wider NSW. Figures obtained from the Institute of Quarrying Australia (IQA)² identify the current demand for crushed rock and sand in NSW as being 23 Mt and 11 Mt respectively. Previous assessments of supply requirements for the Sydney and wider NSW construction markets (Pienmunne, 2000, Francis, 2011, DTIRIS, 2013, Goes Mining, undated) have all identified that the demand for coarse and fine aggregates and sand will increase significantly as population and the subsequent demand for concrete and other construction materials grows. Sand in particular has been identified as limited in current availability and supply with developments such as the Quarry likely to become important suppliers into the future.

As noted in DTIRIS (2013), the larger Sydney market for construction materials is likely to become increasingly reliant on sources from around Wingecaribee/Mulwaree, Lower Hunter and Lithgow (which includes Wallerawang) regions. Any shortfall in the production of coarse aggregates and sand to meet the anticipated demand would have a negative impact on the NSW economy as follows:

- A reduction in the direct contribution of production to the NSW economy, which was estimated to be \$366 Million by DTIRIS (2013) and \$405 Million by the IQA.
- Increased supply costs as a result of reduced availability (supply) or requirement to source from locations more distant to markets (in particular the Greater Sydney metropolitan area).
- Indirect impacts on the NSW economy as a result of reduced construction activity in response to either increased cost or reduced supply of concrete and other construction materials.

The Quarry has the potential to be a significant local and regional supplier of coarse aggregates and sand through the crushing, screening and washing of quartzite, hornfels and sandstone. If approved to expand and continue beyond July 2020, the Quarry would contribute to the long-term supply of sand to local, regional and Sydney markets. It is also relevant that as a smaller independent operator, the Applicant would retain greater flexibility to supply a range of large and small customers and would not be subject to internal demands for concrete as the larger construction materials companies may be.

Since commencing operations in 2014, the Applicant has identified that an advantage held by the Quarry is the wide range of products which can be produced and sold. Not being tied to supply any one concrete manufacturer, the scope for producing specialised or customised products provides a competitive advantage. The Applicant has identified, however, that maintaining adequate stockpile area to management the wide range of quarry products is important. The current Quarry Site provides sufficient stockpile area for the current range of quarry products and production volumes. However, with the potential to include hornfels, sandstone and cobble conglomerate in the production of quarry products, and increase production up to the approved maximum (500 000 tpa), there is a need for additional stockpile area.

On the basis of the confirmed resource and growing demand for the products produced at the Quarry, the Applicant considers that there is a demonstrated need for an extension to the Quarry, both in terms of the period of operation, resource to be extracted and area of disturbance. The Proposed Modification would allow for a significant increase in the operational life of the Quarry and provide for continued supply of construction materials and other products to local, regional and Sydney markets.

² <https://www.quarry.com.au/ConstructionMaterials/Sand.aspx>, <https://www.quarry.com.au/ConstructionMaterials/GravelCrushedRock.aspx>

1.7 Management of Investigations

The preparation of this document has been managed by Mr Alex Irwin, B.Sc. (Hons), Principal Environmental Consultant, Umwelt, assisted by Ms Kate Everding, B.App.Sc., and Ms Chelsea Balcomb, B.Env.Sc., Environmental Scientist, Umwelt.

Geological and resource information has been sourced from documents produced by RME, with additional information and descriptions provided by Ms Anne Eastwood (formerly) and Mr Dean Brownlee of that company. Information on current and future operations at the Quarry was provided by the Applicant, in particular, by Mr Kerry Burke (Managing Director), Mr Paul Hensley (Director), Mr Trevor Hoffman (Operations Manager) and Mr Ray Sharwood (Quarry Manager).

A range of environmental investigations have been undertaken to assess the potential environmental impacts and identify operational safeguards and measures. The surface water impact assessment was managed by Ms Melissa Swan of Umwelt under the direction of Mr Irwin. The remaining studies were undertaken by a team of specialist consultants managed by Umwelt, including the following key individuals and companies:

- Air Quality – Ramboll Pty Ltd (Ramboll).
Mr Ronan Kellaghan.
- Noise and Vibration – Muller Acoustic Consulting Pty Ltd (MAC).
Mr Oliver Muller.
Mr Rod Linnett.
- Biodiversity – Ecoplaning Pty Ltd (Ecoplaning).
Mr Lucas McKinnon.
Mr Brian Towle.
- Heritage – OzArk Environmental & Heritage Management Pty Ltd (OzArk).
Dr Jodie Benton.
Ms Philippa Sokol.
- Groundwater – Jacobs Australia Pty Ltd (Jacobs).
Mr Sean Daykin.
Mr Ben Rose.

Section 4.0 of this document incorporates a summary of the technical assessments undertaken by the above consultants in order to satisfy the requirements of the assessment requirements of the DPE and consulted government agencies, and the issues identified during consultation. The impact assessment reports prepared by these consultants are provided as appendices to the SEE.

2.0 Description of the Proposed Modification

2.1 Overview of the Proposed Modification

2.1.1 Objectives

The Proponent's objectives in modifying DA 344-11-2001 are as follows:

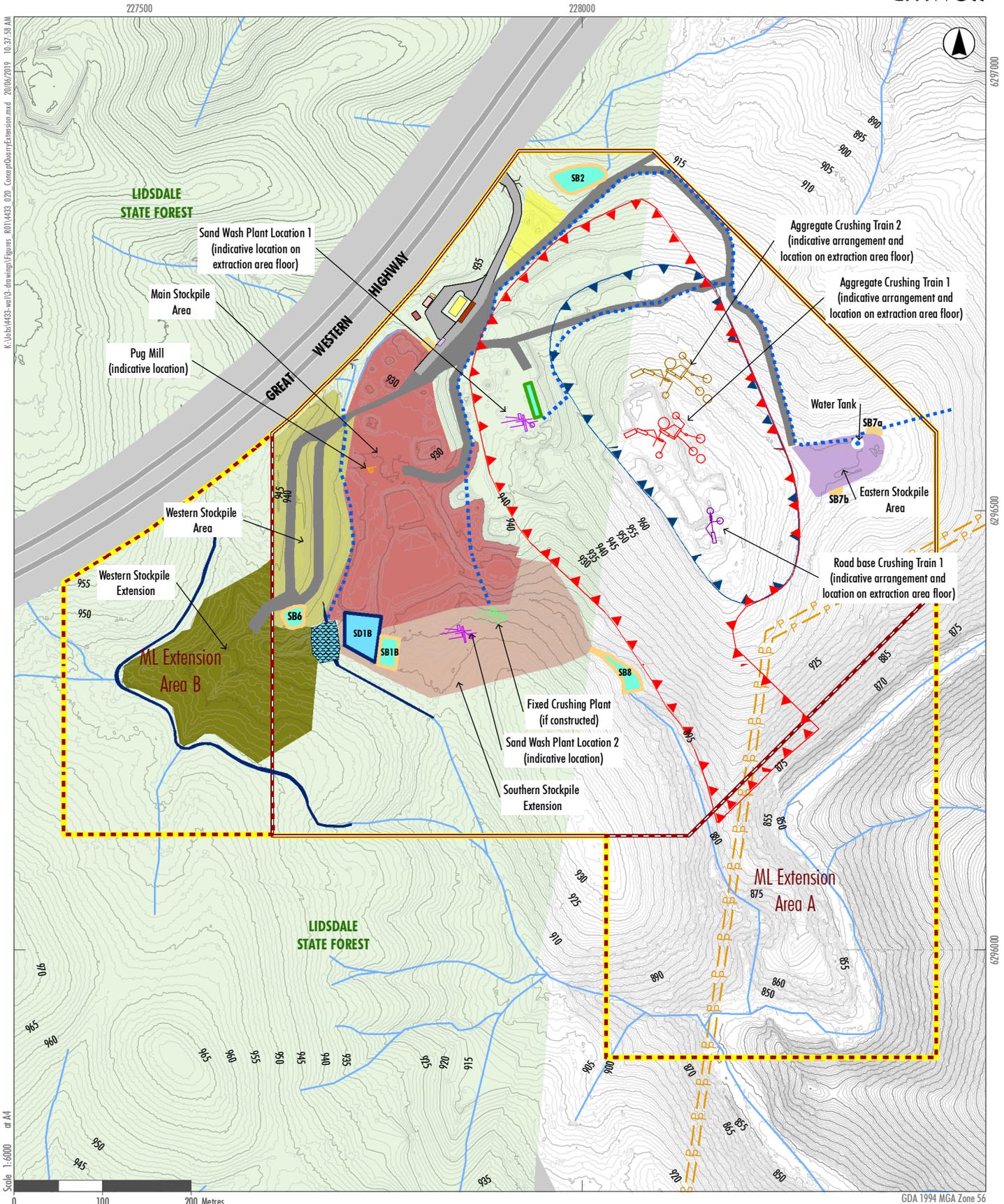
- To access additional resources and extend the life of the Quarry by 25 to 30 years.
- To maximise the recovery of the identified quartzite and other hard rock resources to increase the range of products produced by the Quarry.
- To improve the efficiency of storage and supply of Quarry products through an extension to available stockpiling areas.
- To improve the water security of Quarry operations.
- To ensure the modified Quarry operations remain compliant with all conditions of DA 344-11-2001 and commitments of environmental management plans, unless modified by this Proposed Modification.
- To minimise, to the maximum extent practicable, the impact on the local environment, including community and other stakeholders.
- To ensure that the ongoing operation of the Quarry can continue in a safe and reliable manner.
- To ensure contribution to the local, regional and NSW economies through continued employment, payment of wages and taxes, purchase of goods and services and payment of royalties is continued beyond July 2020.

2.1.2 Summary of Key Modifications

Figure 2.1 illustrates the key features of the Proposed Modification as follows:

1. An extension to the period of consent from July 2020 to July 2050 is proposed to allow for the recovery of the remaining resource currently approved by DA 344-11-2001, as well as that identified to access additional resources identified below and adjacent to the approved extraction area. Based on an additional 12 to 15 Mt of extractable resource (including quartzite, hornfels, sandstone and conglomerate pebbles), and the current approved extraction rate of 500,000 tpa, an extension of 30 years (to July 2050) is sought.
2. An extension to the extraction area is proposed. The extension would increase the surface area of extraction from 6.5 to 13.3 ha, the depth from 930 m AHD to 860 m AHD, and would allow for the extraction of non-quartzite materials including hornfels and sandstone (to the east of the approved extraction area) and cobble conglomerate (to the north of the approved extraction area). Extraction would continue to be by standard drill and blast methods.

It is noted that the 13.3 ha extraction area represents the maximum extent of the proposed extraction operations. Should markets for the hornfels and sandstone resources not be identified, the Proponent would restrict the westerly extension of the extraction area to limit the volume of overburden required to be removed to access the quartzite.



Legend		Indicative Plant Infrastructure Locations		Approved & Proposed Quarry Layout		Water Management Infrastructure (Proposed)	
	Project Site		Aggregate Crushing Train 1		Approved Extraction Area		Clean Water Diversion
	Quarry Site (ML1633)		Aggregate Crushing Train 2		Proposed Extraction Area		Sediment Basins
	Quarry Site Extension		Fixed Crushing Plant (if constructed)		Main Stockpile Area (935m AHD)		Settlement Ponds
	Clean Water Drainage		Pug Mill		Southern Stockpile Area (935m AHD)		Water Tank
	State Forest		Road base Crushing Train 1		Western Stockpile Area		Water Pipeline (Indicative)
			Sand Wash Plant		Western Stockpile Extension (940m AHD)		Clean Water Drainage
					ML Extension Area B		
					ML Extension Area A		
					Eastern Stockpile Area		

FIGURE 2.1
Modified Quarry Site Layout

Data source: Walker Quarries (2019) ; NSW LPI DTDB (2019)

3. An extension to the stockpile areas of the Quarry Site, using the overburden removed from the extraction area, is proposed to allow for the maintenance of the increased type and volume of Quarry products.
4. Modification to the approved water management system of the Quarry would be required as a result of the modified stockpile area construction. This would include:
 - the extension and burial of the central pipeline to transfer clean water runoff from the Great Western Highway to the south of the Main Stockpile Area
 - the diversion of ephemeral, second order drainage lines around the extended stockpile areas
 - the construction of an additional water storage dam for the harvesting and storage of water (required for processing and dust suppression).

The modified Quarry Site Layout, identifying these key modifications, is provided as **Figure 2.1**. **Table 2.1** provides a comparison between the approved and proposed Quarry operations.

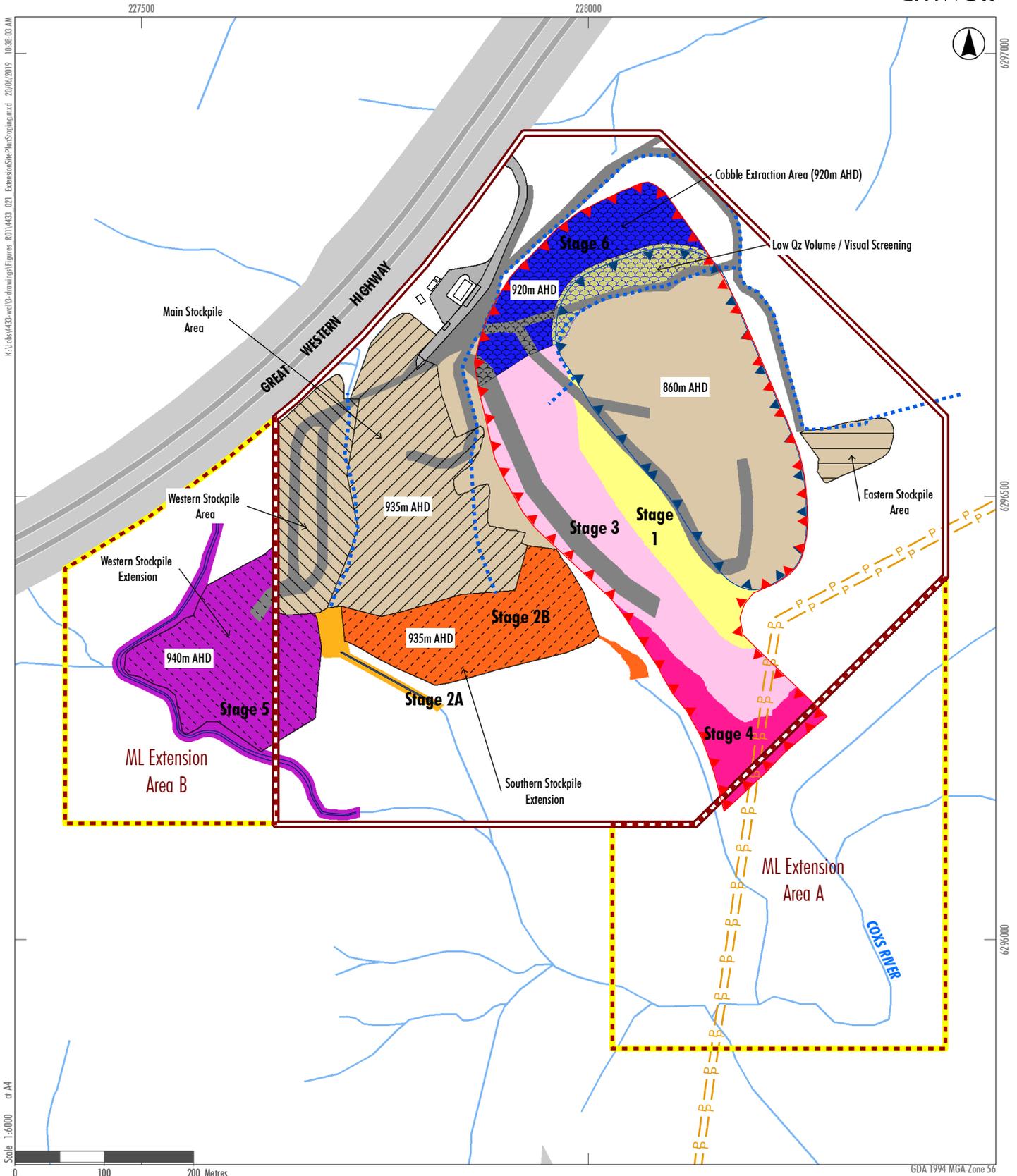
Table 2.1 Comparison of the Approved and Proposed Modified Quarry Operations

Quarry Components	Currently Approved	Proposed Modifications
Quarry life	Quarry operations to cease 15 July 2020	Additional 30 years. Quarry operations to cease July 2050
Limit on production	500,000 tpa	No change
Limit on extraction	Maximum surface area extent of 6.5 ha (Figure 1.3)	Maximum surface area extent of 13.3 ha (Figure 2.1)
Extraction operations	Drill and blast	No change
	Overburden used for internal bund construction and road maintenance	Overburden to be used in the construction of the stockpile area extension
Processing operations	Primary and secondary crushing and screening (in-pit) Tertiary crushing and washing with water recycled through three silt cells	Allowance has been made for the construction of a fixed crushing plant on the Southern Stockpile Area Relocation of the sand washing plant and silt cells Campaign operation of a mobile Pug Mill
Stockpile management	Five stockpile areas maintained with a combined surface area of 3.5 ha	Construction of the following stockpile areas: <ul style="list-style-type: none"> • Western Stockpile Area Extension (2.8 ha) to the southwest • Southern Stockpile Area (2.5 ha) to the south of the Main Stockpile Area
Water management	Harvesting of runoff from disturbed areas for settlement in six sediment basins and storage in two storage dams (in accordance with the Quarry's Soil and Water Management Plan)	Diversion of runoff around the proposed extension to the Western Stockpile Area Diversion of discharge from the central clean water drain to the south of the Southern Stockpile Area
	Diversion of clean water runoff (including from the Great Western Highway)	In-fill and relocation of the Main Water Storage Dam (SD1) and sediment basin (SB1) to the Southern Stockpile Area Construction and maintenance of additional sediment basins

Quarry Components	Currently Approved	Proposed Modifications
Transport	Delivery of quarry products via the Great Western Highway without restriction on number or size, subject to compliance with noise criteria, RMS requirements and operating conditions of <i>Condition 3(20)</i>	No change
Quarry infrastructure	Site office, weighbridge, car park and sealed entrance road	No change (other than to water management infrastructure)
Hours of operation	Quarrying operations <ul style="list-style-type: none"> Monday to Friday 7am to 6pm. Saturday 8am to 1pm Product loading and dispatch <ul style="list-style-type: none"> Any time, subject to compliance with noise criteria Blasting <ul style="list-style-type: none"> Monday to Friday 9am to 5pm. Saturday 9am to 1pm 	No change
Employment	10 operational, 3 office/administration and 2 management staff	No change
Rehabilitation	Extraction Area: Retained closed system void Other Areas: Return to undulating landform with ongoing land use of passive biodiversity conservation or forestry	Extraction Area: Void extents to be increased but free-draining through boring of a drainage hole from the 860 m floor Other Areas: No change to intended final landform and land use objectives

The proposed extensions to the extraction area and stockpile areas, and associated water management infrastructure modifications would be undertaken over the extended life of the Quarry. The disturbance associated with these modifications would only be undertaken as required, and the Applicant has developed a staged disturbance sequence to assist in quarry planning and management of environmental impacts over the life of the Quarry. **Figure 2.2** identifies the Quarry Site disturbance into six stages which are briefly described below:

- Stage 1. The initial extension of the extraction area to the west, down to the 950 m AHD contour. This initial extension will target the outcropping quartzite and would allow for the immediate deepening of the quarry floor.
- Stage 2. This stage comprises two components: the construction of a diversion of the second order drainage line, which originates within Lidsdale State Forest to the west, into a natural gully discharging into the Coxs River (Stage 2A); and once this drainage line has been diverted, the construction of the Southern Stockpile Area may commence (Stage 2B).
- Stage 3. Further extension of the extraction area to the west (to the 920 m AHD contour), where increased volumes of non-saleable hornfels, shale and other non-quartzite materials would be encountered (refer to **Section 2.2**) and disposed of to the Southern Stockpile Area.
- Stage 4. Extension of the extraction area to its southern and south-western perimeter, allowing for development of the Quarry down to the proposed maximum elevation of 860 m AHD. As overburden is encountered it would be disposed of within the Southern Stockpile Extension, which includes a 5 m lift of the Main Stockpile Area (to 935 m AHD) and integration with the lower tier of the Western Stockpile Area.



Legend

- | | | |
|---|---|--|
| <ul style="list-style-type: none"> Project Site Quarry Site (ML) Potential Quarry Extension Areas Watercourses Electricity Transmission Lines Site Infrastructure Sealed Internal Roads Water Management Infrastructure Clean Water Diversion Buried Pipe Culvert | <p>Approved & Proposed Quarry Layout</p> <ul style="list-style-type: none"> Approved Extraction Area Proposed Extraction Area Main Stockpile Area (935m AHD) Southern Stockpile Area (935m AHD) Western Stockpile Area Western Stockpile Extension (940m AHD) Eastern Stockpile Area Cobble Extraction Area (920m AHD) Indicative Internal Roads | <p>Quarry Extension Staging</p> <ul style="list-style-type: none"> Stage 1 - Extraction Stage A Stage 2A - Flow Through Dam & Cleanwater Diversion Stage 2B - Southern Stockpile Extension & Sediment Basin Stage 3 - Extraction Stage B Stage 4 - Extraction Stage C Stage 5 - Western Stockpile Extension & Sediment Basin Stage 6 - Extraction Stage D (Cobble Extraction Area) Stage 6 - Extraction Stage D (Low Qz Volume & Visual Screening) Continued Operations |
|---|---|--|

FIGURE 2.2

Quarry Disturbance Sequence

- Stage 5. In the event that markets for non-quartzite materials are not confirmed, and the total volume of overburden to be removed exceeds the capacity of the combined Main Stockpile Area/Southern Stockpile Area, the Western Stockpile Extension would be prepared and constructed. A clean water drain would be constructed upstream to divert clean water from the second order drainage line originating within the Lidsdale State Forest to the south. Once the diversion is in place, the Western Stockpile Extension would be constructed to an elevation of 940 m AHD.
- Stage 6. Is a northerly extension of the extraction area (also referred to as the Cobble Extraction Area) to recover the quartzite cobbles/pebbles which occur in seams within 5 to 20 m of the surface. While nominally identified as the last stage of disturbance, periodic excavation and extraction from this area could occur earlier in the life of the Quarry subject to market demand for the cobbles/pebbles, compliance with noise and air quality criteria, and the activities being effectively visually screened by vegetation and topography from residential vantage points to the north.

2.1.3 Approvals and Other Authorisations Required

Based upon the current design and understanding of relevant environmental issues, the Proposed Modification would require the following approvals (or modifications, variations or amendments).

1. Modification to DA 344-11-2001 under Section 4.55(2) of the EP&A Act.
2. Extension to ML 1633 to enable the westerly extension of the Western Stockpile and southerly extension of the extraction area.
3. Variation to Environment Protection Licence (EPL) 13172 under the *Protection of the Environment Operations Act 1997*. The issuing authority would be the EPA.

The variation would relate only to the modification of the development consent or changes to monitoring locations as no change to the type or scale of scheduled activities is proposed.

4. A Water Access Licence (WAL) is required for any extraction of groundwater or capture and use of surface water above that to which the Applicant is entitled under maximum harvestable rights.

The Applicant holds the following two Water Access Licences (WALs) issued by the NSW Department of Industry in accordance with Part 2 of the WM Act.

- WAL 42081 for the Coxs River Fractured Rock Groundwater Source of the Water Sharing Plan (WSP) for the Greater Metropolitan Region Groundwater Sources. The Applicant was recently issued with approval for a water access licence dealing (Ref 10AL123089) under the *Water Management Act 2000* (WM Act) for a 100 unit (ML) share for extraction of water from Coxs River Fractured Rock Groundwater Source of the Water Sharing Plan (WSP) for the Greater Metropolitan Region Groundwater Sources.
- WAL 41884 for the Upper Nepean and Upstream Warragamba Water Source of the WSP for the Greater Metropolitan Region Unregulated River Water Sources. This is currently a zero share WAL and the Applicant intends on trading for a permanent or temporary transfer of water allocation from an existing WAL holders within the water source.

2.2 Local Geology and Resources

2.2.1 Geology

RME (2018) describes the basement geology of the Quarry Site and surrounds as being of the Carboniferous Bathurst Batholith with the granite of this basement formation outcropping to the east of the Quarry Site. Overlying the Bathurst Batholith are variably metamorphosed and silicified sandstones, siltstones, limestones and volcanoclastic rocks of the Late Devonian Lambie Group. These rocks, which include interbedded quartzite, hornfels and sandstone, dip to the west at an angle of between 50° and 60° and outcrop across the Quarry Site. They have been subject to metamorphism as a result of contact with the underlying granite (which also intrudes the Lambie Group metasedimentary units) and it is the contact metamorphism which produces the physical properties of these rocks which makes the quartzite and, to a lesser extent the hornfels, potentially suitable as hard rock aggregates for concrete. The proposed extraction area continues to target the quartzite resource, however, extends to the west to include the interbedded hornfels, sandstone and other metasediment rock layers.

Unconformably overlying the Lambie Group and the Carboniferous granite are the irregular and discontinuous deposits of relatively flat-lying pebble to cobble conglomerates of the Permian Shoalhaven Group (Snapper Point Formation – formerly Megalong Conglomerate), the lowest part of the Sydney Basin sequence. The Snapper Point Formation is well exposed in a roadside cutting of the Great Western Highway adjacent to the quarry and has been mapped in the north-eastern section of the Quarry Site (refer to **Figure 1.4**).

2.2.2 Resources

As discussed in **Section 1.5**, RME (2018) have produced resource estimates for the Quarry Site down to an elevation of 860 m AHD. **Table 2.2** summarises these resource estimates which exclude those resources considered to be non-economic in terms of extraction and recovery.

Based on the proposed extraction area extension (see **Figure 2.1**), which is described in further detail in **Section 2.3**, the additional resource available for extraction would be up to approximately 15 Mt. The relative proportions of the key resources approximate to the following:

- Quartzite: 80%
- Hornfels/Sandstone: 15%
- Cobble Conglomerate: <1%.

The remainder represents overburden, i.e. clay, shale, scapolite hornfels, predominantly from the western perimeter of the extraction area.

Table 2.2 Quarry Site Resource Evaluation

Resource	Estimate (t)		
	Indicated (JORC)	Inferred (JORC)	Inferred (Non-JORC)
Quartzite	6,450,000	5,950,000	4,100,000
Interbedded Quartzite (metasediments)			2,080,000
	Total		18,580,000
Hornfels			
• Main			9,150,000
• Hoskins			3,200,000
• Eastern			16,380,000

Resource	Estimate (t)		
	Indicated (JORC)	Inferred (JORC)	Inferred (Non-JORC)
	Total		28,730,000
Sandstone			3,730,000
Cobble Conglomerate			185,000
<i>Source: RME (2018)</i>			

2.3 Extraction Area Extension

2.3.1 Overview

The extraction operations would continue to be undertaken in a similar manner to the current operations as described in **Section 1.4.2**, i.e. using conventional drill and blast, load and haul methods. The following sub-sections present information relating to the proposed extended extraction operations including design features, sequence, methods (including overburden management) and equipment.

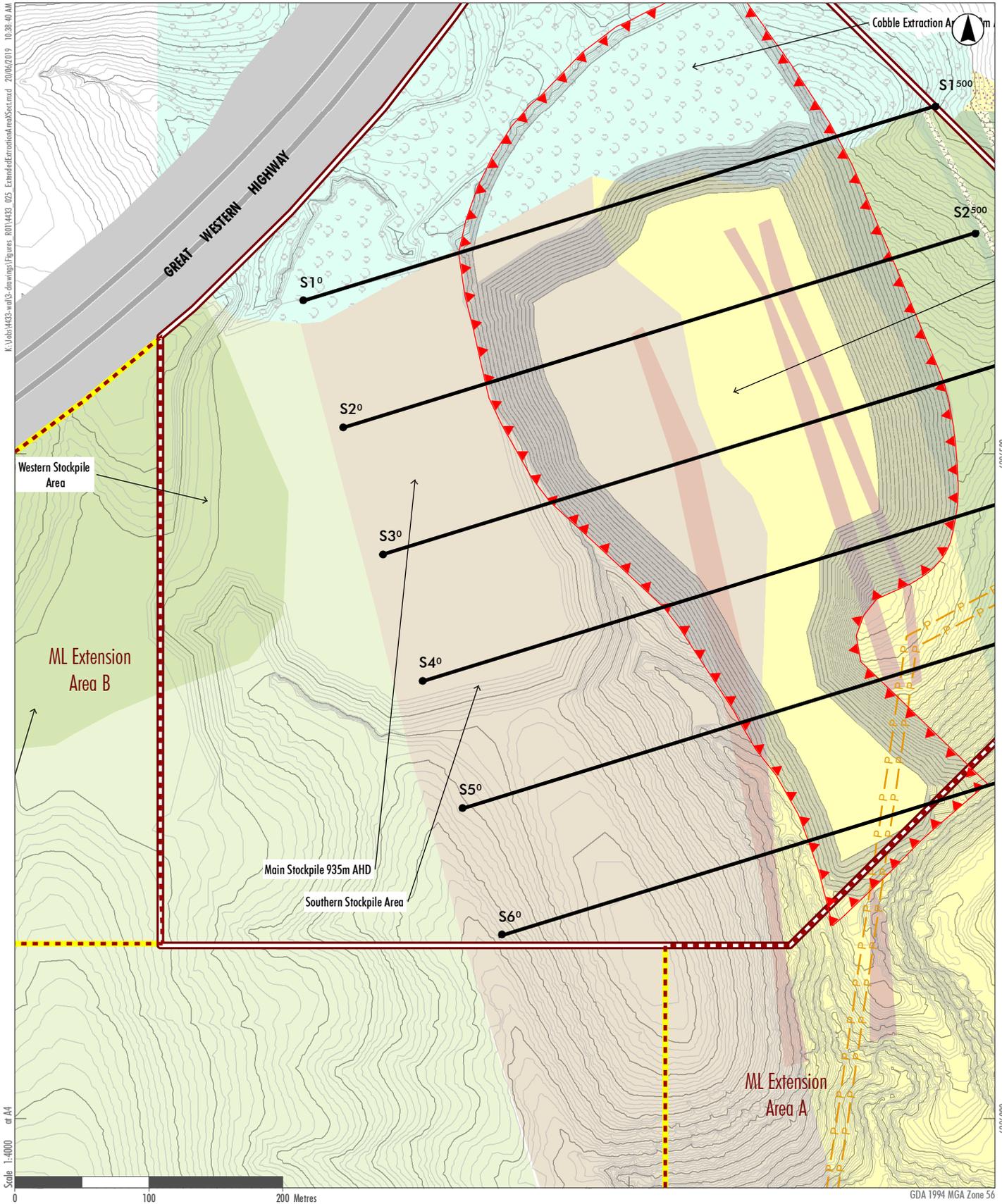
2.3.2 Design Features

A more detailed illustration of the modified extraction area is provided by **Figure 2.3**, together with typical cross-sections (**Figures 2.4** and **2.5**).

At its maximum extent, the proposed extraction area would be constrained as follows:

- An extension of between 50 m and 70 m to the west, to maximise the recovery of the quartzite which dips at an angle of approximately 55° to the west at the 860 m AHD elevation and remains at least 10 m from the bank of a tributary of the Coxs River. On review of the hydro line spatial dataset maintained by the NSW Department of Industry – Lands and Water³, this tributary is mapped as a 3rd Order Stream. It is noted however, that the 2nd order drainage line from the north has been highly modified by the drainage of the Great Western Highway and Quarry operations.
- An extension of approximately 150 m to the south to remain at least 40 m from the Coxs River. This extension area includes an existing 330 kV powerline and easement. Subject to concurrence by the easement owner (Transgrid), the southern extension would include an extraction area immediately below the powerline, while remaining at least 30 m from the powerline footings.
- The eastern perimeter of the extraction area would follow a 30 m arc around the powerline footings before extending to the eastern limit of the quartzite resource at the southern perimeter.
- The extraction area would be extended a maximum of 70 m to the north, targeting the recovery of the cobble conglomerate (as described by RME, 2018). **Figure 2.3** identifies this northerly extension area separately as the Cobble Extraction Area, to reflect the fact that extraction sequence and methods will be different to the larger Quartzite Extraction Area.

³ The stream order is based on the hydro line spatial dataset maintained by the NSW Department of Industry – Lands and Water, which maps watercourses and waterbodies in NSW and is based on the Spatial Services (Department of Finance, Services & Innovation) NSW Hydro Line dataset.

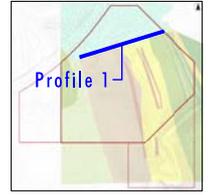
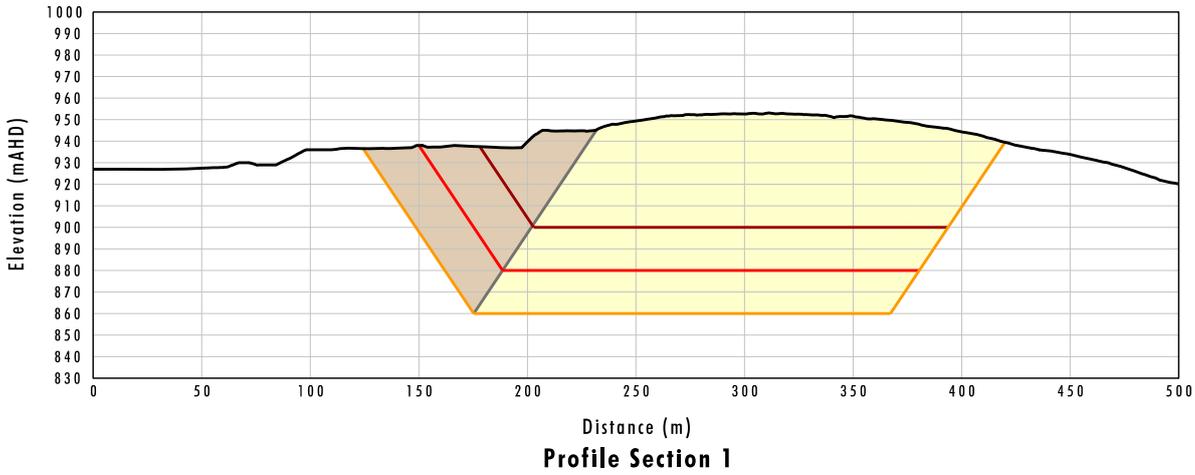


Legend

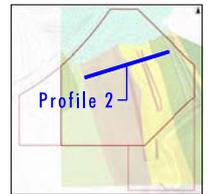
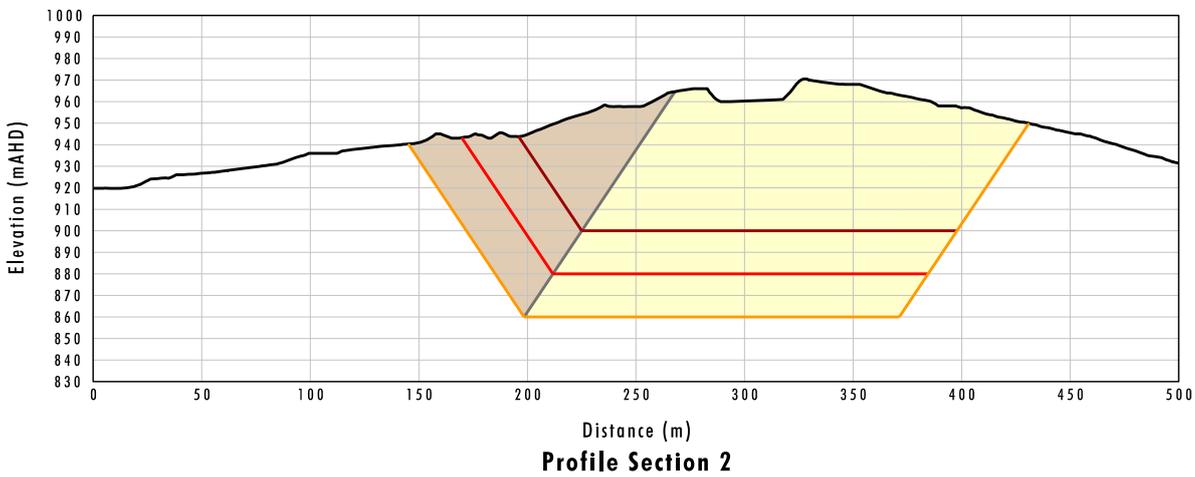
- | | | |
|--|-------------------------------|----------------------------|
| Project Site | Indicative Geology | METSAND |
| Quarry Site (ML) | BHORN HORNFELS | QUARTZITE |
| Potential Quarry Extension Areas | BIOTITE HORNFELS | QUARTZITE BIOTITE HORNFELS |
| Electricity Transmission Lines | CAL-SIL HORNFELS CONGLOMERATE | SHALE |
| Proposed Extraction Area | HORNFELS | SHOALHAVEN CONGLOMERATE |
| Section Profiles (See Figures 2.4 & 2.5) | | |

FIGURE 2.3

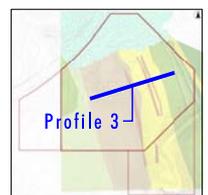
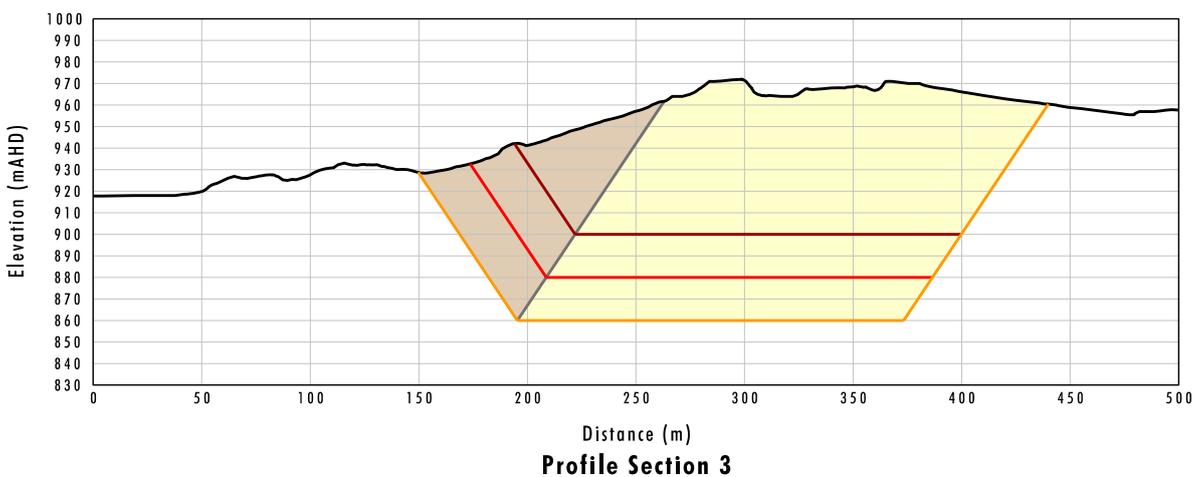
Extended Extraction Area & Cross Section Locations



Plan View



Plan View

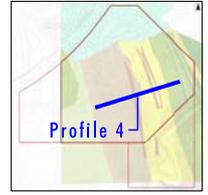
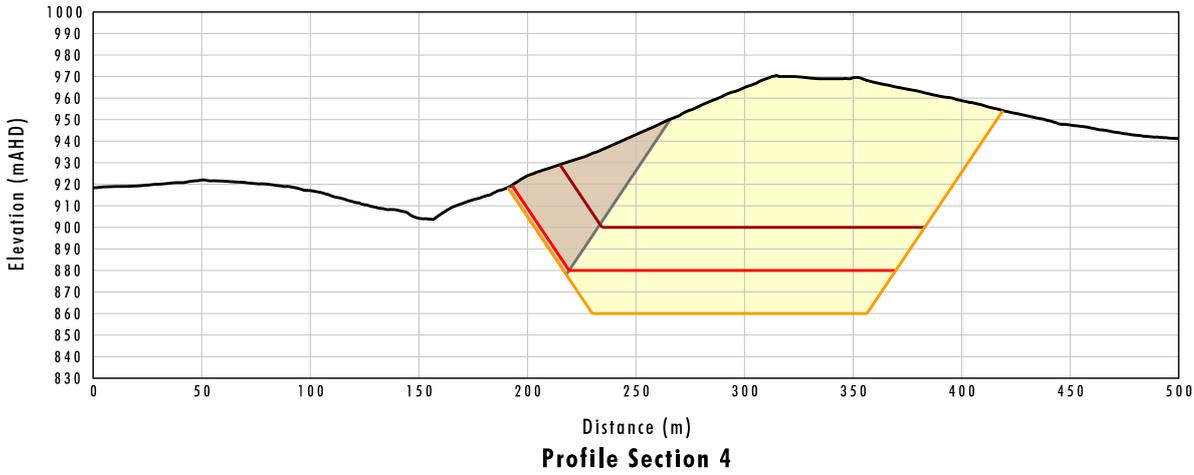


Plan View

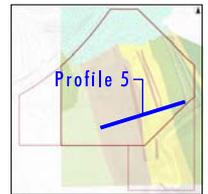
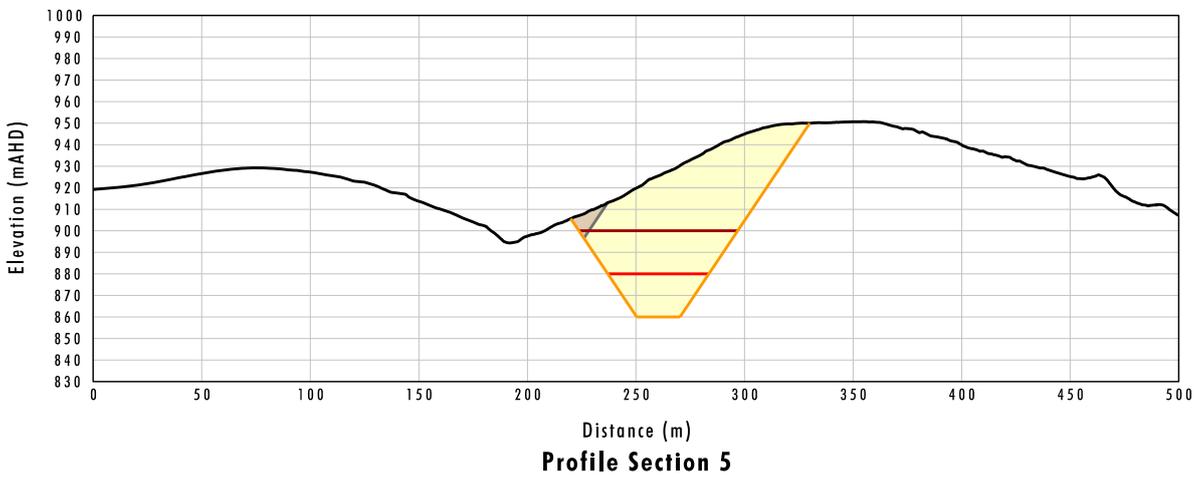
Legend

- Area of Quartzite
- Area of Overburden
- Existing Surface
- Extraction Profile 1 (860m RL)
- Extraction Profile 2 (880m RL)
- Extraction Profile 3 (900m RL)

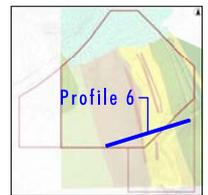
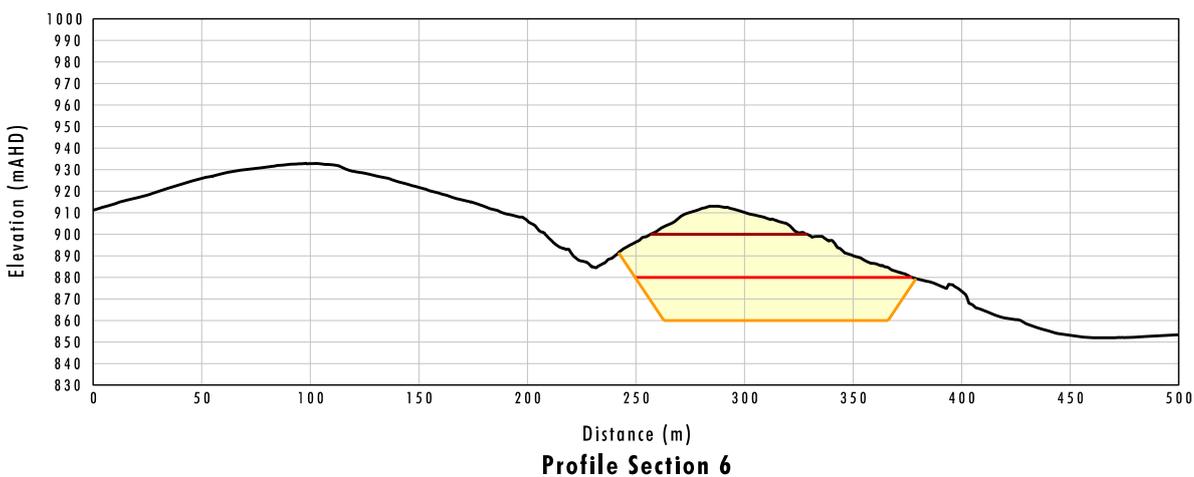
FIGURE 2.4
Profile Sections 1 - 3



Plan View



Plan View



Plan View

Legend

- Area of Quartzite
- Area of Overburden
- Existing Surface
- Extraction Profile 1 (860m RL)
- Extraction Profile 2 (880m RL)
- Extraction Profile 3 (900m RL)

FIGURE 2.5
Profile Sections 4 - 6

Extraction in the majority of proposed areas would be down to a maximum elevation of 860 m AHD, with the exception of the Cobble Extraction Area, which would be developed down to a maximum elevation of approximately 920 m AHD. This is up to 70 m deeper than the current limits of DA 344-1-2001 but would remain 10 m above the bank of the Coxs River.

Although subject to modifications based on localised geological conditions or the optimal location of internal quarry infrastructure such as roads, ramps and sumps, the following general design criteria would be adopted.

- Operational face height: 10 m to 15 m.
- Minimum operational bench width: 50 m.
- Terminal bench width: 5 m to 10 m.
- Face angle:
 - Eastern perimeter: 55° (to follow the dipping quartzite/eastern hornfels boundary)
 - Other faces: 70° to 75°.

The proposed maximum face angle would be subject to review over the life of the Quarry to ensure this provides for a geotechnically stable angle (i.e. at an appropriate factor of safety).

2.3.3 Sequence

In keeping with the current approach to extraction sequencing, the Main Extraction Area would be initially developed to the west and south of a southerly rising forested slope which provides a visual barrier to vantage points to the north and northeast. Given the westerly dipping geology, there is no requirement to extract from varying depths to target particular materials and maintain a constant proportion of quartzite : sandstone : hornfels : overburden. As a result, the extraction area would simply be developed as a series of progressive 10 to 15 m strips.

Following progression of the extraction area to the eastern perimeter of the currently approved extraction area, which represents the easterly extent of the quartzite resource, the Main Extraction Area would be extended in a staged manner, reflecting the disturbance stages identified on **Figure 2.2**. For each stage of extraction area development, the approach would involve the progressive clearing of vegetation, stripping of soil and excavation of overburden (hornfels and sandstone) to daylight the extraction area to the nominated elevation. The exposed quartzite would then be mined to at least 15 m below the daylight elevation before the next strip of vegetation, soil and overburden would be removed.

It is noted that clearing and stripping ahead of extraction would only be undertaken to allow for the following 12 months activities and generally commencing in the southern portion of each stage before being developed to the north.

Figures 2.6, 2.7 and 2.8 present an indicative extraction area development sequence based on the progressive extraction and overburden management (stockpile construction) sequence. It is noted that this sequence may be subject to variation over the life of the Quarry, for example if demand for significant volume of low grade or non-quartzite materials as a select fill or specialised construction/aggregate product is identified. This could promote the earlier development and extension of the northern section of the extraction area where the proportion of these overburden materials is much greater (see **Figure 2.3**).

Subject to compliance with noise and air quality criteria (refer to **Sections 4.9.3** and **4.10.3**) and adequate visual screening being available, the Applicant may complete small extraction campaigns within the Cobble Extraction Area separately and concurrently with development within the Main Extraction Area. In order to minimise the potential impact of these activities on the visual amenity of vantage points to the north and northeast, the area of excavation would be limited to one hectare at a time. That is, these restricted excavation areas would be developed to maximum depth before a new area is stripped of vegetation and developed. This would allow for effective progressive rehabilitation of the completed areas of cobble extraction.

2.3.4 Methods

2.3.4.1 Main Extraction Area

Methods of extraction would be the conventional drill and blast, load and haul methods currently implemented. The following provides a general overview of these activities.

Site Pegging and Clearance Surveys

Prior to the commencement of any ground-disturbing activities, the Applicant would survey all areas of proposed disturbance and physically mark out approved areas of disturbance using appropriately labelled survey markers. All site personnel would be made aware of the approved areas of disturbance and the significance of not disturbing areas outside the approved areas.

Where the disturbance involves the disturbance to native vegetation, the area will be inspected by a qualified professional to assess the area for the presence of threatened native flora or fauna. If identified, the procedures nominated in the Quarry Biodiversity Management Plan would be followed prior to commencement of disturbance.

Erosion and Sediment Control

Prior to the commencement of any surface disturbance, appropriate erosion and sediment controls would be installed or constructed to either divert clean water flows from the area of disturbance, divert and capture runoff from significant areas of disturbance or provide for secondary control of runoff from areas likely to generate only low volumes of sediment containing runoff. The installation or construction of any structures would follow the guidance provided by the relevant standard drawing of Managing Urban Stormwater: Soils and Construction Vol. 1 ("the Blue Book") (Landcom, 2004), the Quarry Soil and Water Management Plan and recommendations contained in this SEE. The Surface Water Impact Assessment (SWIA) of **Appendix 9** describes the recommendations for the management of surface water on the Quarry Site in more detail. **Section 4.5** provides a summary of the SWIA.

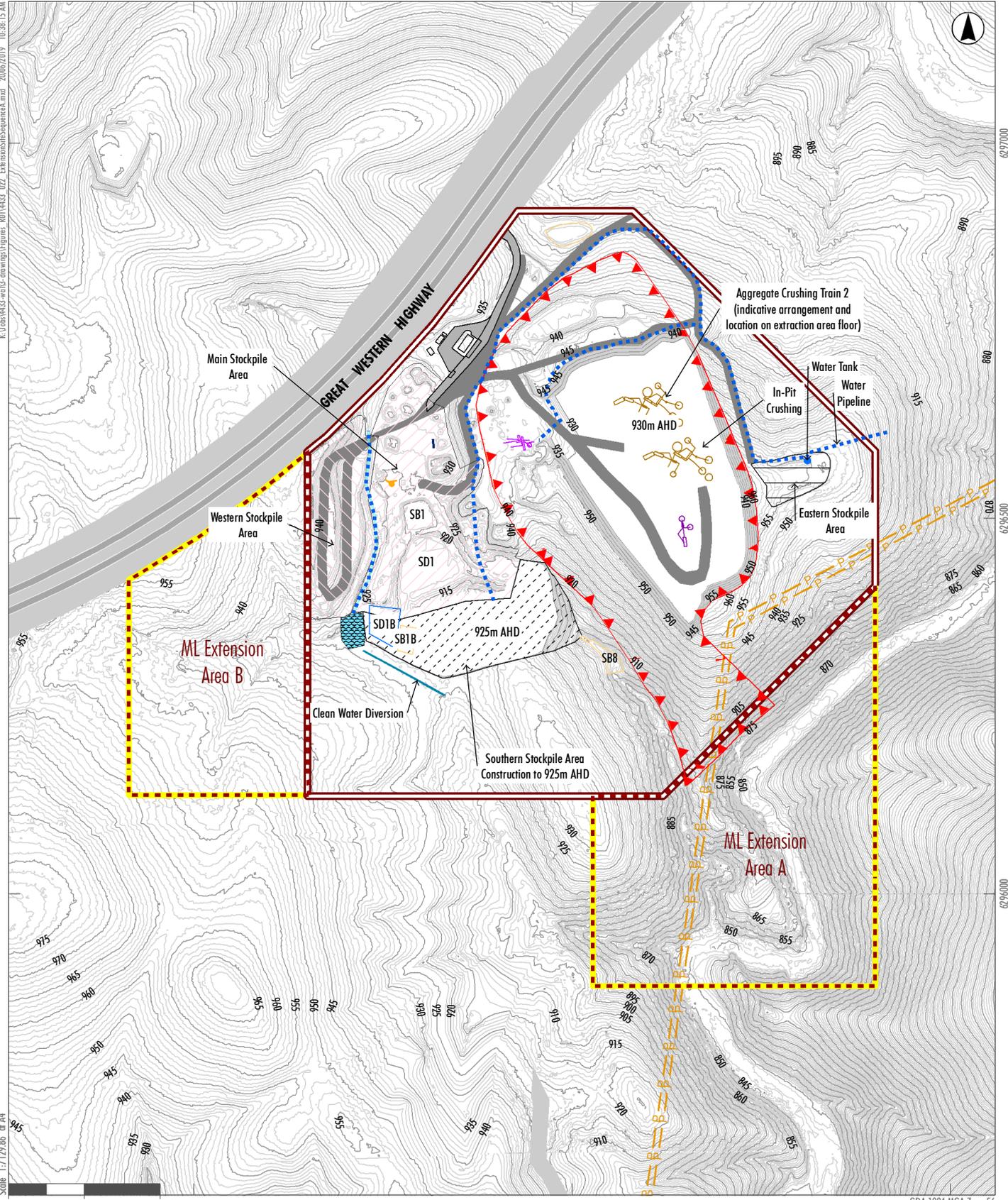
Vegetation Clearing

The preferred method of clearing would be by dozer, however, chainsaw felling may be required for the largest trees. Any hollows identified during the pre-clearance survey would be collected and retained, where practical, for use in habitat recreation on any final landforms to be rehabilitated.

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Legend

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|--------------------------------|------------------------------------|--|--|
| Project Site | Proposed Extraction Area | Water Management Infrastructure | Indicative Plant Infrastructure Locations |
| Quarry Site (ML) | Main Stockpile Area (935m AHD) | Buried Pipe Culvert | Aggregate Crushing Train |
| Quarry Site Extension | Western Stockpile Area | Clean Water Diversion | Road base Crushing Train |
| Electricity Transmission Lines | Eastern Stockpile Area | Sediment Basins | Sand Wash Plant |
| Sealed Internal Roads | Southern Stockpile Area (935m AHD) | Water Storage Sump | Pug Mill |
| Indicative Internal Roads | | Water Tank | |
| | | Water Pipeline (Indicative) | |

FIGURE 2.6

Quarry Extension Sequence (2025)

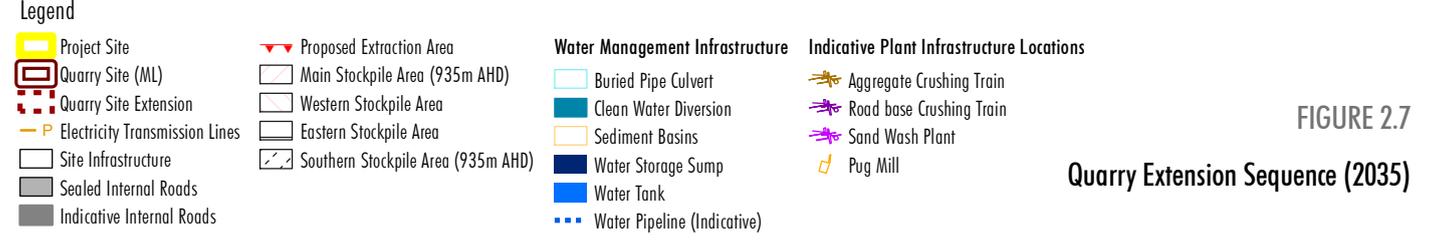
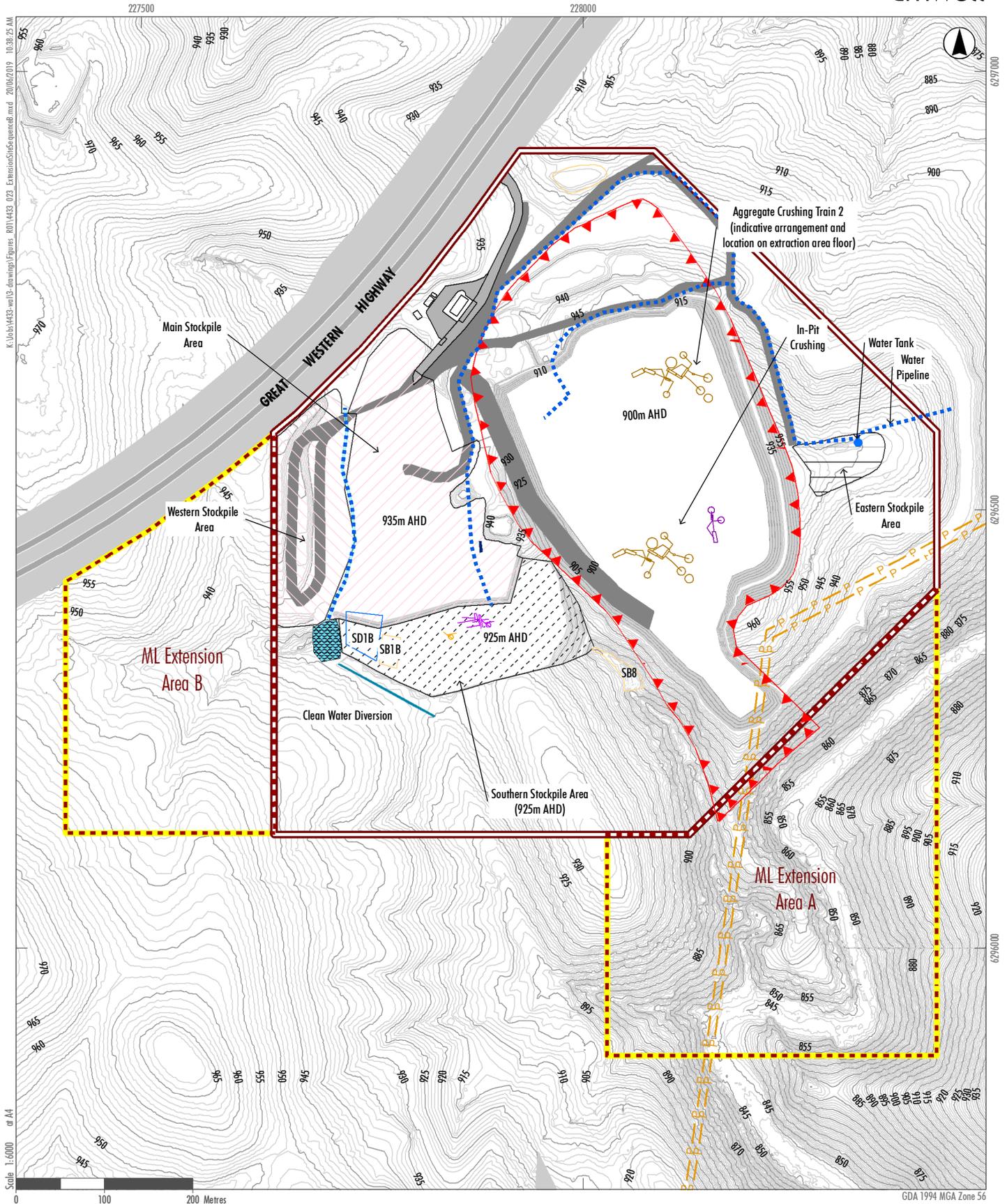


FIGURE 2.7

Quarry Extension Sequence (2035)

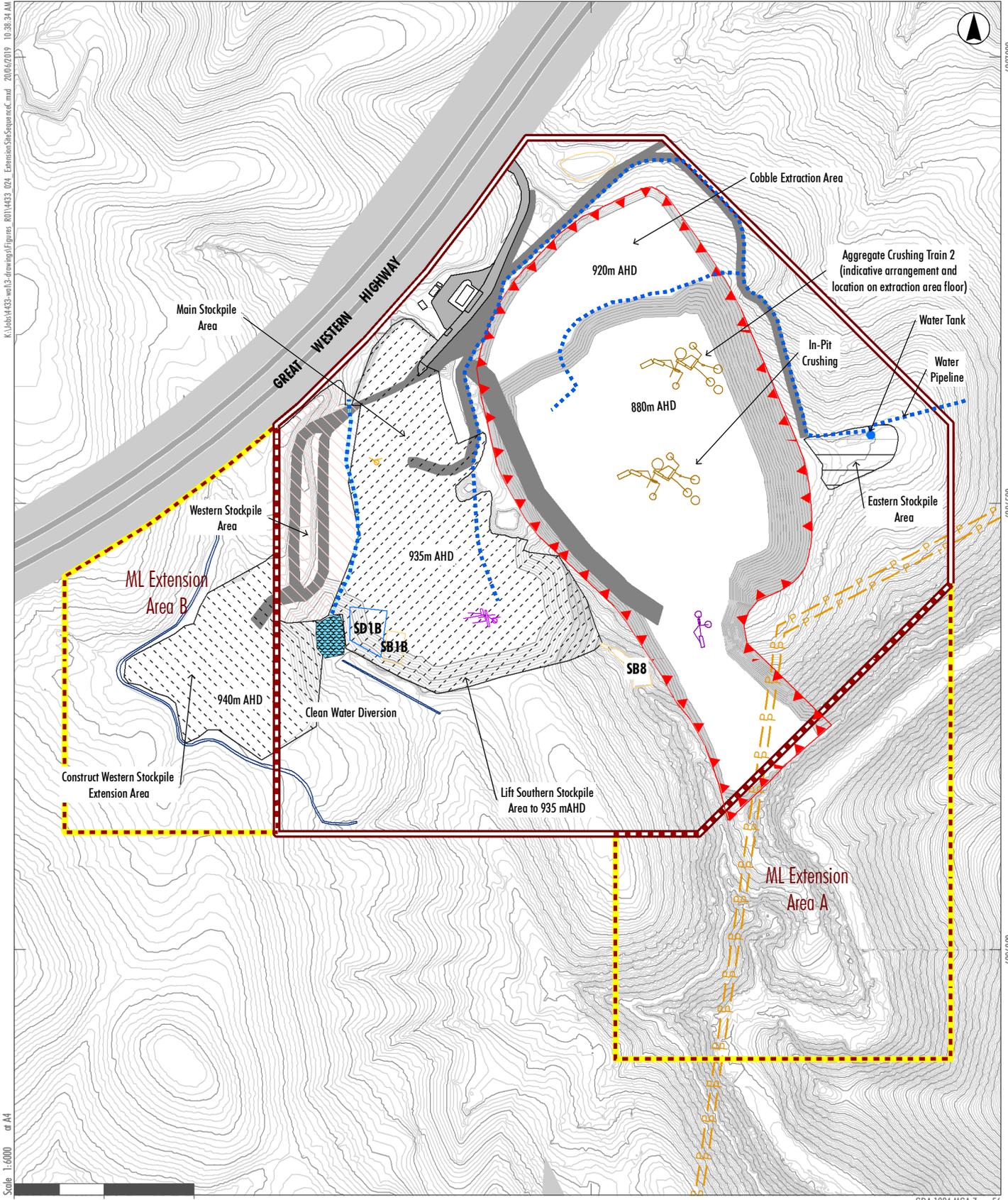
Data source: Walker Quarries (2019) ; NSW LPI DTDB (2019)

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Legend		Water Management Infrastructure	Indicative Plant Infrastructure Locations
Project Site	Proposed Extraction Area	Buried Pipe Culvert	Aggregate Crushing Train
Quarry Site (ML)	Western Stockpile Area	Clean Water Diversion	Road base Crushing Train
Quarry Site Extension	Western Stockpile Extension (940m AHD)	Sediment Basins	Sand Wash Plant
Electricity Transmission Lines	Eastern Stockpile Area	Water Tank	Pug Mill
Site Infrastructure	Extended Main Stockpile Area (935m AHD)	Water Pipeline (Indicative)	
Sealed Internal Roads			
Indicative Internal Roads			

FIGURE 2.8

Quarry Extension Sequence (2045)

Following the clearing of vegetation, selected timber may be made available for use on the freehold land of the Applicant, e.g. fencing materials or firewood. Cypress pine would be separated from the remaining vegetation for individual management as this could negatively impact on the value of track rolled or mulched vegetation for rehabilitation. Cypress pine would be preferentially used for on property management purposes, i.e. as firewood or fencing material. The remaining non-cypress vegetation would be stockpiled downslope of the disturbance area and either track-rolled by bulldozer prior to placement on final landforms to be rehabilitated or mulched. Sufficient mulched vegetation would be retained in stockpile for future application use in rehabilitation (in accordance with the MOP - see also **Section 2.10**) with surplus mulched vegetation sold and dispatched from the Quarry Site under the control of the 2016 Mulch Resource Recovery Order (EPA, 2016).

Soil Stripping and Management

Any soil, where present and recoverable, would be stripped and either stockpiled for future use in rehabilitation activities or directly transferred to an area to be revegetated. The act of stripping the shallow, skeletal soil, stockpiling and respreading would provide for adequate blending of the topsoil and subsoil recovered. Stockpiles of soil would be constructed and maintained in accordance with Standard Drawing (SD) 4-1 of the Blue Book, as close as possible to where the soils would be reused as part of rehabilitation activities.

In order to reduce the potential of soil loss due to erosion and degradation of soil structure, as far as practicable, soil stripping would be undertaken during periods that avoid forecast rainfall. If clearing during these periods is unavoidable, additional practices would be undertaken to reduce the erosion risk, such as placement of silt-stop fencing at a location downslope that allows the installation of the fencing, and minimisation of handling.

Overburden Management

Following the removal of the recoverable soil, any rippable clay or weathered rock that cannot be processed into saleable products would be ripped by bulldozer and loaded into haul trucks for disposal. Where the thickness of overburden increases, in particular along the western edge of the extraction area where the majority of the hornfels material would be extracted, the material would be drilled and blasted before being loaded to haul trucks for disposal. These development blasts would generally be smaller than production blasts due to the more targeted nature of the material to be fragmented. Interburden, i.e. bands of non-sealable material identified between bands of quartzite, sandstone or hornfels would be managed in the same way as the overburden.

The volume of overburden to be managed would be dependent on what proportion of the hornfels, sandstone and other non-quartzite rock can be marketed and sold as select fill or specialised aggregate products. Development of the extraction area to the 860m AHD elevation would generate approximately 1,400,000 m³ of overburden, however, based on market analysis undertaken by the Applicant at least 50% and as much as 75% of this material could be marketed and sold. Based on current this analysis, the Applicant has accounted for the management of between 350,000 m³ and 700,000 m³ of overburden. This material would be used in the construction of the two stockpile area extensions, described in greater detail in **Section 2.5**, an indicative sequence of construction of which is provided in **Figures 2.6 to 2.8**.

Once the construction of the stockpile areas are complete, any additional overburden would either be used in the construction or maintenance of bunds and roads within the Quarry Site, or stockpiled on the extended stockpile areas for future on-site use or replacement over the final landform at the cessation of quarrying activities (refer to **Section 2.10.2**). In the event that sufficient storage is not available on the Quarry Site for the overburden generated, the extraction area perimeter would not be extended to its full extent, reducing the volume of overburden required to be extracted in order for the Quarry to reach the 860m AHD elevation (noting that this would also reduce the extractable quartzite resource).

Hard Rock Extraction

Once exposed, the quartzite, hornfels and harder sandstone would be drilled and blasted to fragment the rock before this is loaded to trucks for delivery to the processing circuit (refer to **Section 2.4**). All blasting operations would be supervised by a suitably qualified and experienced blasting engineer or shot-firer. Blast holes would be drilled using a hydraulic drill rig equipped with dust and noise suppression equipment. These holes would then be filled with explosives and the blast initiated, fragmenting the in situ basalt.

The approach to blast notification, management and monitoring would remain as described in the Quarry Blast Management Plan. While subject to review and modification over the life of the Quarry, **Table 2.3** outlines the indicative blast design parameters to be applied.

Table 2.3 Indicative Blast Design Parameters

Parameter	Scale
Blast hole Diameter	89 mm
Blast hole Depth	5.5 to 11 m
Blast hole Spacing	Approximately 3 x 3 m
Depth of Stemming	1 to 2 m
Size of Blast	2 000 bcm – 10 000 bcm ¹
Area of Blast	500 m – 1 500 m ²
Bulk Explosive Type/Initiation System	ANFO/None
Powder Factor	0.60 kg/bcm ²
Maximum Instantaneous Charge (MIC)	<60 kg (approximate)

Notes:

¹ bcm = bank cubic metre

² To be confirmed by blast contractor

Bulk explosives, detonators and boosters would not be stored within the Quarry Site, rather they would be bought to the Quarry on the day of the blast.

The fragmented rock would be loaded to haul truck for delivery to the processing circuit.

2.3.4.2 Cobble Extraction Area

The same procedures relevant to site marking and pegging, vegetation clearing and soil stripping would be implemented as for the Main Extraction Area.

Drill and blast would not be required within this area with the exposed cobble conglomerate ripped to loosen the cobbles from the clay/sand matrix. Once ripped, the material would be loaded through a dry screen to further separate the cobbles from the sand and clay. The separated cobbles would be transferred to the main stockpile area where this material would be stockpiled prior to washing.

The remaining sand/clay matrix would be retained within the excavation cell and used respread within the cell once all cobble has been removed as part of rehabilitation. Based on the cobble within the abundant cobble conglomerate area representing 60% of the total material by weight, it is expected that the completed cell would be backfilled to approximately 50 to 60% of initial volume (accounting for the conglomerate having a higher density than the sand/clay matrix and swelling of the separated matrix material).

2.3.5 Rate

In order to produce 500 000 t of quarry products annually, and accounting for the increased initial volumes of overburden contained within the initial development of the extended extraction area, up to 250 000 m³ of material would be extracted annually. This represents approximately 200 000 m³ of quartzite, hornfels and sandstone (with an average density of 2.5 t/m³) and 50 000 m³ of overburden and interburden. The Applicant anticipates it will take several years for quarry production to approach 500 000 tpa and so it is unlikely this maximum extraction rate will ever be achieved. This notwithstanding, the assessment of noise and air emissions account for this maximum extraction rate.

2.3.6 Equipment

Table 2.4 presents the indicative list of mobile equipment that would be used during the life of the Proposed Modification. This may change to reflect demand and market requirements.

Table 2.4 Mobile Equipment

Equipment	No.	Model/Capacity (indicative)	Use	Indicative Usage (hr/day)
Dozer	1	CA D8T	Vegetation clearing and soil stripping Ripping of friable overburden and cobble conglomerate. Landform profiling and miscellaneous rehabilitation works.	9 ¹
Excavator	2	Komatsu PC450 / 48t	Loading of fragmented rock.	8-10
Drill Rig	1-2		Drilling of quartzite for blasting.	8 ²
Haul truck	2	Komatsu HM400/40t	Miscellaneous movement of soil, overburden, oversize rock and Quarry products.	10
Front-end loader	3	2 x Komatsu WA480 1 x Komatsu WA500	Raw and processed stockpile management. Loading product.	8-10
Water Cart	1	14kL	Watering of roads and trafficked surfaces.	8-10
Fuel/Service Truck	1	4kL	Refuel all crushers, screens and pumps	4
Tool Carrier/ ForkLift	1	Manitou 1700	Load/unloading of trucks Miscellaneous activities	4

Source: Walker Quarries Pty Ltd

Notes:

¹ Machine is hired on a need to basis, generally for one month each campaign

² Campaign operations only

2.4 Processing Operations

2.4.1 Hard Rock Crushing and Screening

Two operational crushing scenarios may be implemented.

Mobile Crushing Operations

No change to the current mobile crushing operations are proposed with a road base crushing trains and one or more aggregate crushing trains to be operated within the extraction area (or on the stockpile area subject to compliance with noise criteria).

Fixed Plant Crushing Operations

The Applicant currently retains approval for the construction and operation of fixed plant crushing operations. Whilst the in-pit mobile crushing operation is the current preferred approach, transition to a fixed plant crushing operation may occur in the future.

Fixed plant crushing would include the primary and secondary crushing described in **Section 1.4.3**, however, would also include a tertiary crushing station (cone or VSI). DA 344-11-2001 currently provides for the fixed crushing operations to the immediate west of the extraction area on the Main Stockpile Area. Given this area would be incorporated into the extended extraction area, the Application has identified the Southern Stockpile Area, adjacent to the location of the Washing Plant on relocation, as the preferred location (See **Figure 2.8**). Noise and air emission modelling considers the operation of fixed plant crushing in this location (refer to **Section 4.9** and **4.10**).

2.4.2 Washing Plant

The current washing plant, or equivalent unit, would continue to be operated, however, relocated initially to the south where the loading hopper would be located against an existing tip-head to the upper tier of the Main Stockpile Area. A rotating log washing unit, or equivalent, would be added to the washing circuit to which the cobbles would be loaded. The existing settlement ponds on the stockpile area and silt cells to the north of the extraction area would continue to be used until replaced by a new set of silt cells (see discussion below) which would allow for the decommissioning and extraction of the silt cells located within the Cobble Extraction Area.

Eventually, and following the construction of the Southern Stockpile Extension, the washing plant would be relocated on to this area of the Quarry Site. **Figures 2.7** and **2.8** identify an indicative relocated position adjoining the old Hoskins Quarry, however, the location may be subject to further relocation over the life of the Quarry.

An equivalent approach to the management of the water used to wash the silt from the fine aggregates, pebbles and sand would be implemented where this water is discharged to a series of cells which promote the settlement of silt from the water before it is returned to the wash plant. On relocation of the wash plant, the Applicant intends on constructing and operating two banks of three silt cells at each new location. The silt cells would be constructed as rectangular structures (length : width ratio of between 2 : 1 and 3 : 1) to extend the flow through time and therefore promote the settlement and collection of silts within each cell. Similar to the design of the existing silt cells, flow between each cell would be protected from erosion to prevent the collection of additional silt during transfer between cells and a concrete weir would be constructed at the discharge point of the silt cells to assist in the retention of silt. By operating two banks of silt cells, whilst one is in operation, the other can be dewatered and the silts allowed time to dry and consolidate. Once sufficiently dry as to be spadeable, the consolidated silt would be removed and either used as a rehabilitation material or sold as a soil conditioning agent.

2.4.3 Pug Mill

A Pug Mill would be operated to add moisture and blend cement, fly ash or materials to produce a homogenous road base material for the roads and other infrastructure. While the specific design features of the Pug Mill would be subject to the particular brand purchased or leased at the time, it would be operated generally in accordance with the following method:

- Crushed aggregate would be loaded to a hopper and transported by conveyor to a mixing tank.
- Cement, fly ash or other binding material would be added from a tank next to or above the mixing tank.
- Water would also be added as required to achieve the required moisture content (generally around 8% but subject to specific customer requirements).
- The aggregate, binding material and water would be mixed before being discharged to stockpile or directly to truck from a conveyor and stacker.

The specific mix of aggregate/binding material/water will vary depending on customer requirements, with most modern pug mills allowing for digital control over material addition and mixing.

The Pug Mill would be mobile with the location on the Quarry Site likely to vary over the life of the Quarry to reflect development stage. However, in most cases, the Pug Mill is likely to remain in close proximity to the sand washing plant or water storage dam (for access to water supply).

2.5 Stockpile Area Extension

2.5.1 Design Features

The modified stockpile areas would be constructed as extensions to the Main Stockpile Area (including the infill of a gully to the south and lifting of the combined stockpile area to 935 m AHD) and Western Stockpile Area (from the upper 940 m AHD tier to the southwest). Key design features of the stockpile areas are nominated below.

2.5.1.1 Southern Stockpile Extension

The Southern Stockpile Extension has been designed to be constructed in three stages.

Stage 1: Southern Extension

Stage 1 provides for the construction as a southerly extension of the 925m AHD hardstand of the Main Stockpile Area which would effectively infill the drainage line which carries runoff from the Lidsdale State Forest to the Coxs River to the southeast (see **Figure 2.6**). Prior to commencement of overburden placement within the stockpile extension area, the following water management and pollution control works would be required:

- The watercourse which directs runoff from the west to the Coxs River would be diverted and discharged into a gully and ephemeral drainage line approximately 250 m to the west of the diverted drainage line.
- A sediment basin would be constructed within the watercourse immediately downstream of the stockpile extension area to prevent pollution of this tributary of the Coxs River (SB 10).

Initial placement of overburden would be immediately upstream of the sediment basin such that any runoff is either to the sediment basin or to the dammed (nil discharge) section of the catchment. While only required for pollution control during the initial phase of stockpile construction, this sediment basin (SB 10) would be retained as a secondary control and water storage dam for any overflow or runoff from the completed Southern Stockpile Extension.

The slopes of the stockpile area would be constructed at an angle equivalent to the surrounding topography, with a temporary sediment basin constructed down slope of the final western batter (SB 8) to prevent discharge of sediment laden water into a clean water flow through dam to be constructed between the Southern and Western Stockpile Area (refer also to **Section 2.6.1**). Once the western slope of the stockpile area is stabilised, this sediment basin would be decommissioned and removed. This initial southerly extension of the Main Stockpile Area would provide for storage of up to 185,000 m³ of overburden.

As part of Stage 1, a water storage dam and sediment basin would be constructed at the south-western perimeter of the stockpile area in a similar arrangement to SB 1 and SD 2 on the current main stockpile area. The capacity of the combined structures (identified as SD1B and SB1B) would be sufficient to manage runoff from a five day, 95th percentile rainfall off the Southern Stockpile Area and Main Stockpile Area, i.e. in accordance with the Blue Book (Landcom, 2004).

Stage 2: Main Stockpile Area Lift

Stage 2 of the Southern Stockpile Extension would involve the decommissioning and backfill of the Main Water Storage Dam (SD1) and sediment basin (SB1), and raising of the Main Stockpile Area to an elevation of 935m AHD. This would involve the backfill of the remaining section of the central clean water drain to the east of the western stockpile area with the pipe culvert which carries runoff from the north of the Quarry Site continued to a discharge point immediately upstream of the stage 1 extension of the Southern Stockpile Area and into the Central Clean Water Diversion constructed prior to Stage 1.

This lifting of the Main Stockpile Area would effectively join the main and lower tier of the Western Stockpile Area and provide access to the Western Stockpile Extension should this be constructed and provide for storage of up to 250,000 m³ of overburden.

Runoff from the combined Stage 1/Stage 2 stockpile area would be to SD1B and SB1B constructed at the south-western perimeter of the 925 m AHD level of the stockpile.

Stage 3: Southern Extension Lift

Stage 3 would involve the raising the southern portion of the Southern Stockpile Area (south of SD 1) to an elevation of 935 m AHD (see **Figure 2.8**). Placement of overburden would commence against the western perimeter of the stockpile area with runoff from this slope directed to the sediment basin previously constructed down slope of the western limit of the Southern Stockpile Area (SB 8). SD1B and SB1B would be retained or reconstructed at the western perimeter of the Southern Stockpile Area. Stage 3 of the Southern Stockpile Area would provide for storage of (up to) an additional 140,000 m³ of overburden.

2.5.1.2 Western Stockpile Extension

Constructed as an extension from the 940 m AHD level of the upper tier of the Western Stockpile Area, the area would require a small amount of cut (along the northern perimeter of the area). This initial cut material, along with initial overburden excavated from the extended extraction area would be used to construct and stabilised an initial flat hardstand along the northern perimeter of the area. As more overburden is excavated from the extraction area, this hardstand surface would be extended to the south and south-east maintaining the 940 m AHD level and effectively in-filling a drainage line which flows from the Lidsdale State Forest to the west to the Coxs River to the south (see **Figure 2.8**).

Prior to commencement of overburden placement within the stockpile extension area, the following water management and pollution control works (refer also to **Section 2.6.3**) would be required:

- A clean water diversion drain would be constructed to collect runoff from the north and west and divert this to a first order ephemeral drainage gully which is aligned along the southern perimeter of ML 1633.
- A sediment basin would be constructed immediately downstream of the stockpile extension area (SB 9) to prevent pollution of the clean water drainage which would be piped from the north of the Main Stockpile Area and discharged into the new clean water diversion drain constructed prior to the commencement of the Southern Stockpile Area.

At its completed extent, the Western Stockpile Extension (WSE) would incorporate approximately 130 000m³ of material. The eastern batter of the WSE would be developed with a 3:1 (H:V) slope to integrate with the existing inter-tier batter slope (930m to 940m AHD) of the Western Stockpile Area.

2.5.2 Product Storage and Loading Operations

The crushed, screened and washed products would be loaded and transferred to larger stockpiles on the existing and extended stockpile areas. The higher volume, higher turnover products would continue to be maintained on the Main Stockpile Area. As capacity of the Main Stockpile Area is reached, excess product would be delivered to the western stockpile area, Southern Stockpile Area and eventually Western Stockpile Area Extension for placement in individual stockpiles. These stockpile areas would also be utilised for the storage of the many specialized products such as decorative pebble/cobble, quarry fines, gabion and other ballast, with lower demand and turnover.

Material to be transported from the Quarry would be loaded into road registered trucks by front-end loader. Care would be taken to ensure that trucks are not overloaded, with reliance placed on the drivers to inform the Applicant of the relevant load limits for each vehicle. During loading operations, care would also be taken to ensure that product is not deposited on running boards or elsewhere where it may be spilled on public roads. All vehicles transporting products off site would be required to be covered prior to leaving the Quarry Site. The loaded trucks would pass over the Quarry weighbridge prior to departure to ensure that they are not overloaded. The trucks would be sent back to the stockpile area for unloading if overweight on initial pass over the weigh bridge.

The stockpiles and stockpile areas would be watered as required to reduce the potential for dust lift-off during hot, dry and windy conditions.

2.6 Quarry Water Management

2.6.1 Modified Water Management Infrastructure

To accommodate the modified extraction and stockpile areas, a number of modifications to the surface water management system of the Quarry Site would be required (see **Figure 2.1**).

2.6.1.1 Central Clean Water Diversion

Prior to the commencement of the Southern Stockpile Area, a clean water diversion would be constructed in accordance with SD 5-6 of the Blue Book (Landcom, 2004) to divert the discharge from the Central Drainage Line of the Quarry Site and drainage line from Lidsdale State Forest to the west into a southerly aligned tributary of the Coxs River.

Should the Western Stockpile Area Extension proceed, the runoff from the Lidsdale State Forest would eventually be diverted further upstream (to the west of the Western Stockpile Area Extension, refer to **Section 2.6.1.2**).

2.6.1.2 Western Clean Water Diversion

Prior to the commencement of the Western Stockpile Area Extension, a clean water diversion would be constructed to collect runoff from the following drainage lines to the north, west and south-west of the Quarry Site.

A high flow diversion drain constructed in accordance Standard Drawing (SD) 5-6 of the Blue Book (Landcom, 2004) would be constructed to drain this runoff to the south and east of the proposed Western Stockpile Extension and discharge into a natural southerly aligned tributary of the Coxs River.

2.6.1.3 Water Storage Infrastructure

As discussed in **Section 2.5.1.1**, with the progressive extension and lifting of the main stockpile area, i.e. the Southern Stockpile Extension, progressive decommissioning and commissioning of sediment basins and storage dams would be undertaken to prevent pollution of the downstream catchment and provide storage for water for operational and pollution control purposes (refer to **Section 2.6.1**).

Figures 2.6 to 2.8 identifies the sequential development of the stockpile extensions, along with indicative locations of the sediment basin / storage dam arrangement nominated for each stage.

A 500,000L water tank is maintained by the landowner on the Eastern Stockpile Area and leased to the Applicant. Water is pumped to this water storage, either from the water storages of the Quarry Site as these are filled following high rainfall events or from a groundwater bore operated on the property to the north. A water pipeline is maintained between this water tank and the washing plant where the Applicant would install a standpipe.

2.6.2 Water Requirements and Losses

Water is required at the Quarry for four principal purposes:

1. Dust suppression of active and exposed areas, e.g. internal roads, hardstand surface and stockpile areas.
2. Dust suppression of crushing operations.
3. Sand and cobble washing.
4. Evaporative losses.

The following provides information on the anticipated water use for each of these activities.

2.6.2.1 Dust Suppression – General

Exposed and trafficked areas of the Quarry Site are watered as required using a 14 kL water truck to reduce the potential for wind or wheel generated dust. The volume of water used for this purpose varies significantly from day to day and month to month based on seasonal and meteorological conditions.

The following provides an indication of water use under various meteorological conditions:

- rainfall conditions: no applications

- temperature $\leq 15^\circ$: 1 to 2 applications
- temperature $> 15^\circ \leq 25^\circ$: 2 to 3 applications
- temperature $> 25^\circ \leq 30^\circ$: 3 to 4 applications
- temperature $> 30^\circ$: 5 to 6 applications.

Between 14 ML and 16 ML is estimated to be used for general dust suppression, with approximately 70% of this volume required during the period of October to March (inclusive). This could increase by 50% to 21 to 24 ML as the area of disturbance increases over the life of the Quarry.

2.6.2.2 Dust Suppression - Crushing

Based on historic dust suppression rates to the road base and aggregate crushing trains, the Applicant applies water at the following rates:

- 20 L/t of crushed aggregate
- 7 L/t of crushed road base.

At a production rate of 350,000 tpa, which reflects the likely maximum sand production rate of 150,000 tpa, the following water usage is anticipated:

- 40 kL per day (when crushing) and up to 5ML per year to produce 250,000 t of aggregates
- 10 kL per day (when crushing) and up to 1ML per year to produce 100,000 t of road base.

2.6.2.3 Sand Washing

An estimated 1ML of water is used per day (8 hours) to wash 650 t of sand. This equates to approximately 1,500 L/t of sand washed.

A large proportion of the water used to wash the sand is recycled with losses estimated as follows:

- approximately 5% (75 L/t) is lost as moisture content of the final sand product
- approximately 10% (150 L/t) is lost as evaporation or seepage on the processing and stockpile area.

At a maximum sand production rate, it is estimated that 34 ML per year would be lost.

2.6.2.4 Evaporative Losses

Evaporative losses are based on average monthly evaporation at the BoM Bathurst Agricultural Station (Station 63005), a pan factor of 0.8 and water storage surface areas calculated using area-volume relationships at each Model time step.

2.6.3 Water Sources

The Applicant proposes to source water from the following sources. Water would be drawn from these sources in the priority order that they are described below.

1. Rainfall and runoff collected from hardstand surfaces, stockpile areas and other disturbed areas directed to sediment basins, as well as clean water harvest collected in accordance with harvestable rights.

2. Incidental groundwater inflow seepage to the Quarry Pit of up to 25.55 ML/year (Jacobs, 2019).
3. Groundwater extracted from the Cox's River Fractured Rock Groundwater Source from an approved bore (Approval No. 10CA123169) under WAL 42081 which provides an entitlement of up to 100 ML/year.

2.6.4 Erosion and Sediment Control

With the increased disturbance footprint of the Quarry Site, several additional sediment basins would be constructed downslope of the new disturbance.

- Sediment Basin (SB) 8. Constructed to capture runoff from the western batter slope of the Southern Stockpile Area (during the construction phase of this stockpile) (refer to **Figure 2.6**).
- SB 9. Constructed to capture runoff from the eastern batter slope of the Western Stockpile Extension Area (during the construction phase of this stockpile) (refer to **Figure 2.8**).
- SB 10. Constructed to capture runoff from the western batter slope of the Southern Stockpile Area (refer to **Figure 2.6**).

Runoff would be directed to each sediment basin by a low flow diversion drain constructed in accordance with SD 5-5 of the Blue Book.

In addition, the catchment areas of a number of the existing sediment basins would be modified as the stockpile areas of the Quarry are extended and increased in elevation. Several of these sediment basins would be enlarged over the life of the Quarry to account for the modified catchments, whilst others may retain surplus storage due to a reduction in the relevant catchment.

Further detail on the proposed Water Management System (WMS) for the Quarry, including detail on the minimum storage requirements of the Quarry sediment basins, is provided in **Section 4.7.4**.

2.7 Transport Operations

2.7.1 Quarry Site Access

Entrance and exit to the Quarry Site would continue to be via the existing entrance and intersection with the Great Western Highway, which is a dual lane, 110 km/hr road at this point. This entrance and intersection was constructed in 2014, in accordance with RMS requirements, to accommodate the product transportation approved by DA 344-11-2001.

The internal access road is sealed from the Quarry Site entrance to the Main Stockpile Area just beyond the Quarry office and weighbridge.

2.7.2 Internal Traffic Movement

Within the Quarry Site, haul trucks, road registered trucks and light vehicles share roads. As far as practical, one way routes would be maintained to avoid conflict between vehicles as well as maximise the available space for stockpiling.

A front-end loader would be used to load the road trucks which would then pass over a weighbridge prior to exit, to ensure load limits are adhered to.

2.7.3 Product Distribution

As is currently the case, road-registered trucks entering and leaving the Quarry would vary in configuration but would be typically 19 m truck and dog or B-Double configurations. Other trucks such as smaller rigid vehicles also make up a small proportion of quarry traffic.

At the approved production rate of 500 000 tpa, the Quarry would generate between 90 and 110 truck movements per day. The daily number would fluctuate depending on customer demand, however, the total number of movement in any one day is unlikely to exceed 150.

The distribution of trucks from the Quarry, eastbound to Lithgow, the Blue Mountains and Sydney, or westbound is likely to vary dependent on market demand. It is anticipated, however, that except during periods when the Quarry supplies significant regional roadwork or infrastructure projects, the majority of truck movements will be to the east.

2.8 Hours of Operation and Quarry Life

No change to the approved hours of operation (as presented in **Table 1.1**) is proposed.

Based on a combined resource of approximately 12 Mt and production rate of up to 500 000 tpa, the remaining Quarry life would exceed 25 years. Approval for an additional 30 years quarry operations is sought which would extend the limits on the consent to July 2050.

2.9 Employment, Capital Cost and Economic Contributions

15 full-time equivalent personnel are currently employed at the Quarry with increases possible should production rates increase towards the maximum approved rate (500,000 tpa). The Applicant employs:

- 10 operational staff, of which eight reside in the City Local Government Area (LGA)
- three administrative staff, all of which reside in the Lithgow LGA
- two management staff, who travel to the Lithgow LGA.

As illustrated above, the Applicant has committed to employing locally, with the majority of the workforce residing in the Lithgow City LGA.

The Applicant contributes to the local economy of the Lithgow City LGA through the payment of wages and the purchase of goods and services. The Applicant is committed to purchasing locally where a reasonable alternative is available. The flow-on benefits of these contributions is felt in the local economy through expenditure of these wages and payments. The Applicant also contributes to the NSW and Australian economies through the payment of royalties on the quartzite mined, rates, payroll and other taxes.

Table 2.5 provides information on current and future contributions of the Quarry to the local and NSW economy.

Table 2.5 Economic Contributions of the Quarry

Contribution	Value	
	2017/2018	Future (annual)
Payment of wages	\$1,025,000	\$1,650,000
Purchase of Consumables, goods and services		
• Fuel	\$190,000	\$330,000
• Other	\$185,000	\$485,000
Payments to contractors and suppliers	\$205,000	\$360,000
Other local payments/contributions	\$320,000	\$510,000
Rates payments/other payments to Lithgow City Council	\$7,500	\$7,500
Royalty payments	\$49,000	\$105,000
Compensation payments (e.g. FC NSW)	\$47,000	\$30,000 (variable)
Biodiversity Offset	-	\$298,000 (2018/2019)
Total	\$1,003,500	\$1,827,500

Source: Walker Quarries Pty Ltd

2.10 Quarry Site Decommissioning and Rehabilitation

The Applicant would continue to implement a progressive approach to the rehabilitation of disturbed areas at the Quarry and incorporate the additional areas of disturbance, namely the extraction area and stockpile area extensions, into the overall rehabilitation plan as nominated in the Quarry MOP (RWC, 2018). As far as practical, a progressive approach to rehabilitation would be adopted with areas not required for ongoing operations decommissioned, profiled and vegetated to provide a stable landform. The nature of Quarry operations, which requires the ongoing use of the majority of disturbed areas for the life of the Quarry, reduces opportunities for progressive rehabilitation with most rehabilitation to be completed much closer to the exhaustion of the quartzite resource.

The following rehabilitation strategy has been prepared with reference to the existing and approved MOP, which follows *ESG3: Mining Operations Plan (MOP) Guidelines September 2013* (MOP Guidelines) (DTIRIS, 2013) and provides for the definition of performance targets and measurement over the life of the Quarry. It is noted that rehabilitation is described for the Quarry Site in its totality, noting that only those aspects relevant to the extraction and stockpile area extensions, and modified water management, are modifications from the approved rehabilitation activities described in the MOP.

2.10.1 Land Use Goals and Rehabilitation Objectives

2.10.1.1 Land Use Goals

The nominated post mining land use goals for the Quarry are:

- to implement successful design and rehabilitation of landforms to ensure structural stability, revegetation success and prevention of pollution
- to ensure rehabilitation and revegetation is self-sustaining and follows the principles of sustainable development
- to return the Quarry Site to an area of passive conservation, i.e. sustainable native woodland with management requirements no greater than the surrounding landforms.

2.10.1.2 Rehabilitation Objectives

In the short to medium term, the Applicant’s rehabilitation objectives would be to stabilise all earthworks, drainage lines and disturbed areas not actively included in Quarry operations. The long term rehabilitation objective remains to restore the Quarry Site to resemble the surrounding bushland and to not require maintenance in addition to what may be required in the surrounding bushland. In order to achieve the nominated post mining land use goals, the objectives of rehabilitation activities are as presented in **Table 2.6**.

Table 2.6 Rehabilitation Objectives and Targets

Feature	Objective	Target
Land Use	Produce a sustainable native woodland community.	Landform management requirements no greater than the surrounding landforms.
	Minimise adverse socio-economic outcomes following mine closure.	Preferred final land use determined in consultation with landowners, Council and relevant government agencies. No ongoing economic costs to the community.
Landform	Provide a low maintenance, geotechnically stable and safe, non-polluting landform and provides land suitable for the proposed final land use.	Geotechnical results show the landform is stable.
	Construct the final landform such that it is self-sustaining.	Maintenance requirements consistent with the agreed post mining land use(s).
	Establish and sustain woodland communities adjoining conserved native vegetation remnants to create a contiguous corridor of woodland vegetation.	Woodland vegetation is confirmed (by monitoring) to be sustainable and contiguous.
Biodiversity	Establish and sustain low maintenance vegetation communities which support habitat for native fauna.	Self-sustaining vegetation communities established.
Infrastructure	Decommission and remove all infrastructure (unless required for a lawful post mining land use).	All infrastructure removed.
Final Void	Ensure the final void are safe, stable and secure.	Safety bund constructed and non-eroding. Internal walls confirmed as geotechnically stable

Further consideration and assessment of the proposed rehabilitation of the Quarry is provided in **Section 4.11**.

2.10.2 Final Landform and Land Use

Figure 2.9 presents the proposed modified final landform. In summary, the modified final landform would comprise the following components.

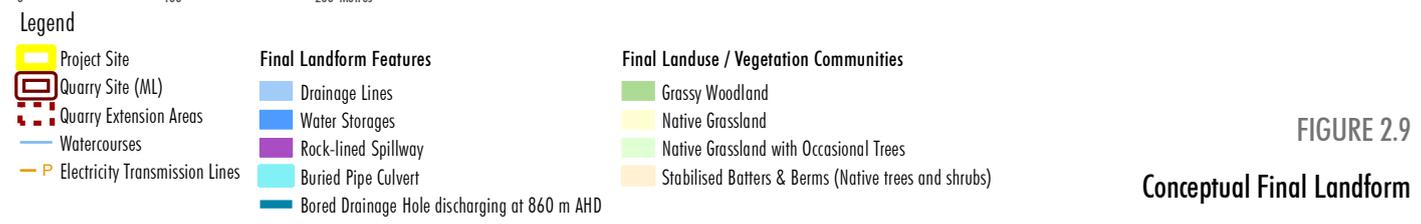
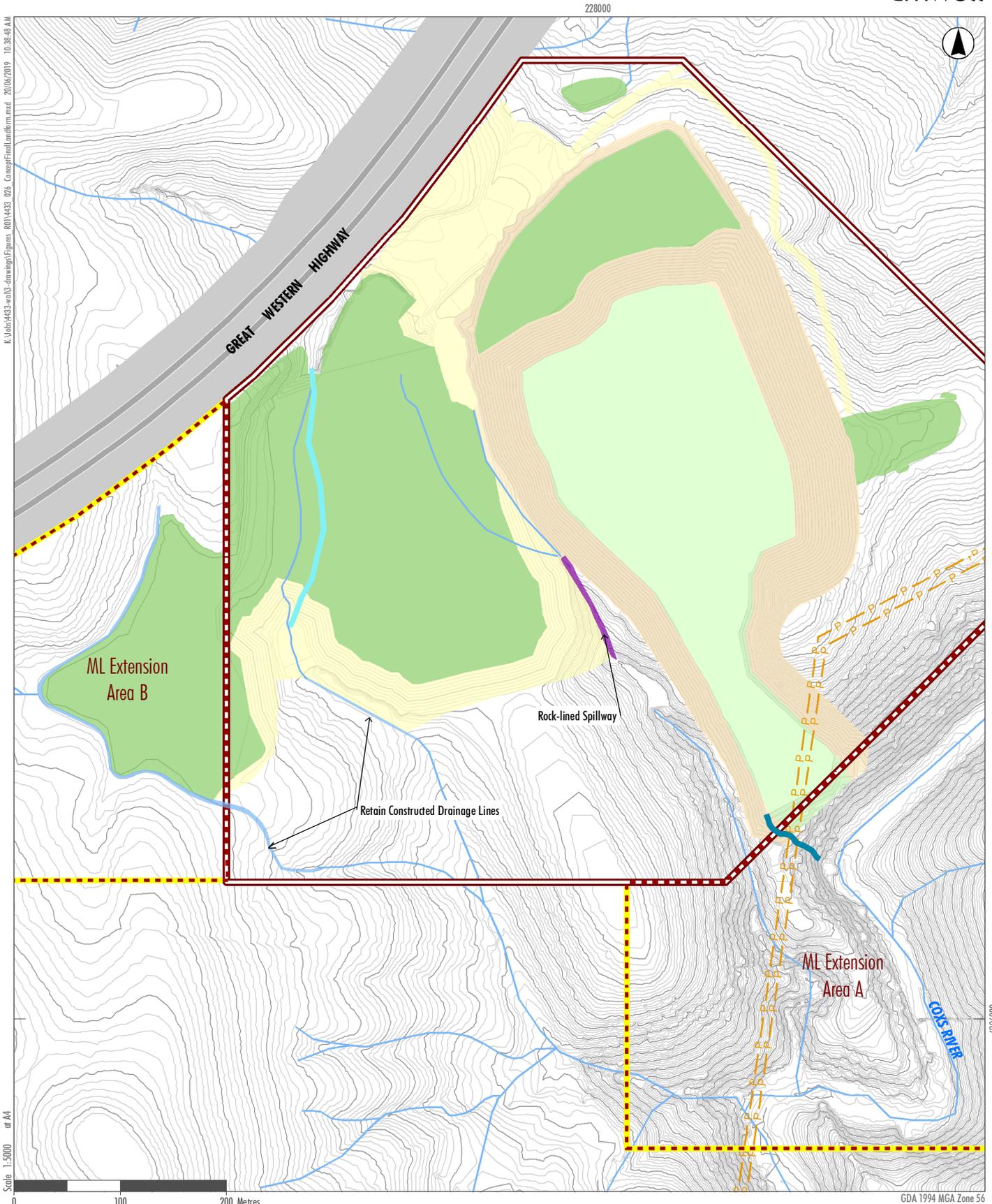


FIGURE 2.9
Conceptual Final Landform

Domain 1 – Infrastructure Areas

- All buildings and other structures, including concrete foundations and slabs would be removed from the Quarry Site (unless these are requested to be retained by the current or future landowner).
- Unless retained for a suitable and lawful use, the Quarry Site Entrance and Access Road would be decommissioned and removed.

Domain 2 – Surface Water Management Structures

- Unless requested to be retained by the current or future landowner, the water storages of the Quarry Site would be decommissioned and removed.
- The clean water diversions are expected to be well established at the completion of quarrying operations and the Applicant proposes to retain these.
- The approach to rehabilitation of the buried central clean water pipeline would be dependent on whether the lift of the Main Stockpile Area is required.
 - If sales for overburden materials are identified such that the Stage 2 and 3 lifts of the Main Stockpile Area and Southern Stockpile Area are not required, the Applicant would remove the pipeline and reinstate the central drainage line which would discharge to the new clean water channel to the south.
 - If the lift of the Main Stockpile Area proceeds (Stage 2), the Applicant would retain the pipeline (below 5 to 10 m of overburden) with discharge to the new clean water channel to the south.

Domain 3 – Processing and Stockpile Areas

- It is expected that the batters of the stockpile extensions would be well vegetated at the cessation of mining and so landform modification would be restricted to minor reprofiling of the hardstand surfaces to create an undulating and free draining surface.

Domain 4 – Void Areas

- An open cut void (to a depth of 860 m AHD) would be retained. At the completion of extraction, a drainage point would be bored from the base of the extraction area to allow any water which flows into the void (groundwater seepage or rainfall/runoff) to be discharged to the Coxs River to the south.
- After removal of the material currently stockpiled, the site of the former Hoskins Quarry (Supplementary Stockpile Area) would be profiled and integrated with the surrounding landform.

In keeping with the commitments made in the MOP (RWC, 2018), the proposed final land use for the Quarry Site, including the rehabilitated stockpile extension areas would be nature conservation. Specifically, the Quarry Site would be revegetated to re-establish the native open forest community which previously occurred across the areas disturbed (refer to **Section 2.10.4**).

2.10.3 Strategic Rehabilitation Management

2.10.3.1 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. A description of each domain, and specific rehabilitation objectives (as taken from the MOP), is as follows:

Domain 1 – Infrastructure Areas

This domain would include the Quarry Site Entrance and Access Road, offices and car park, weighbridge and miscellaneous surrounding hardstand surfaces.

The rehabilitation objectives for this domain are as follows:

- The landform is to be safe and free from contamination.
- Unless retained for a suitable and lawful use, Quarry Site entrance and sealed access road, as well as all buildings and infrastructure are to be decommissioned and removed.
- The remaining landform is to be profiled, respread with soil or available growth medium and revegetated as a self-sustaining native open forest community.

Domain 2 – Surface Water Management Structures

This domain includes all water storages, diversion drains and associated infrastructure.

The rehabilitation objectives for this domain are as follows:

- Water diversions are to be retained with all other water infrastructure including water storage dams, sediment basins, silt cells and sumps backfilled and profiled.
- The retained dams and drains, and profiled backfilled landforms, respread are to be stabilised and revegetated as a self-sustaining open forest community.

Domain 3 – Processing and Stockpile Areas

This domain includes the ROM and all product stockpile areas with the rehabilitation objectives as follows:

- All plant is to be decommissioned and surplus stock removed.
- The landform is to be safe and free from contamination.
- The landform is to be profiled, respread with soil or available growth medium and revegetated as a self-sustaining open forest community.

Domain 4 – Void Areas

This domain includes the final open cut void with the rehabilitation objectives as follows:

- The landform is geotechnically stable, safe and free from contamination.
- The landform will not accumulate water.
- A perimeter bund is to be retained for public safety.
- Surfaces are to be respread with soil or available growth medium and allowed to revegetate naturally.

2.10.3.2 Rehabilitation Phases

The Applicant would continue to adopt a hierarchical approach to the rehabilitation of the Quarry 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

The decommissioning phase involves the dismantling or demolition and removal of infrastructure from the Quarry Site, and remediation of the land on which the infrastructure was located. 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 phase 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 involves the replacement of soil over disturbed areas and preparation 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 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 mining 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 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.
- 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 surrounding the disturbed areas.

2.10.4 Rehabilitation Methods and Procedures

Rehabilitation methods and procedures would be consistent with the methods described in the MOP (RWC, 2018). In summary, rehabilitation of the Quarry Site would comprise the following activities.

2.10.4.1 Decommissioning

On completion of quarrying activities, the Applicant would either sell or scrap the surface infrastructure of the Project Site. This would include removal of the following:

- All processing infrastructure, including ancillary equipment.
- All buildings, including the office, crib room, ablutions and workshop.
- The weighbridge.
- Fuel storage facilities.

All concrete footings and foundations of buildings or structures would be broken up and removed. The materials used to form roads and hardstands would be removed and/or the areas ripped.

The areas of the Quarry Site surrounding hydrocarbon storage areas would be inspected for hydrocarbon contamination. In the event contamination is identified, the area would be segregated, the contaminated material excavated and transferred to a facility licensed to accept hydrocarbon contaminated material.

Unless retention is requested by the landowner, the Quarry Entrance, internal roads and water storages would be decommissioned and removed or remediated.

2.10.4.2 Landform Establishment

Extraction Area

Prior to extraction from the terminal faces of the extraction area, a geotechnical review of the final faces would be completed to confirm the slope that would provide for a safe and stable landform.

The water balance prepared for the Quarry suggests that up to 50% of the 25.5ML of groundwater seepage (refer to **Section 4.6.5.5**) would accumulate within the void. While average evaporative rates generally exceed rainfall rates (refer to Chart 2.1 of the SWIA), it is expected that some additional accumulation of water could occur. To provide for removal of water which accumulates under high rainfall conditions is drained from the void, the Applicant proposes to bore a hole with a diameter of 150 mm to 300 mm from the base of the void to allow for water to discharge to the Coxs River to the south.

Remaining Areas

The outer batters of the stockpile areas would be inspected to confirm the slope is no greater than the surrounding landforms and final profiling completed prior to create, where possible, a concave slope. 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. The final slope would be lightly ripped parallel with the contour. Where the slope exceeds 10m, contour banks would be constructed to divert runoff off the landform and discharge to natural drainage at a non-erosive velocity.

Following the removal of all infrastructure and product stockpiles (see **Section 2.10.4.1**), the surface of these areas would be ripped to break-up the compacted hardstand surface. Any remaining overburden or unsold products would be spread over the surface of the completed landform to create minor undulations. The profiled landform would then be lightly ripped again or scarified in preparation for the application of growth media.

2.10.4.3 Growth Media Development

The profiled landform would be ripped parallel to the contour to assist in future water infiltration and keying of soil. 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.
- The soil would be replaced as a single blended topsoil/subsoil unit with the depth of respread soil to vary between 300 mm and 600 mm 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.
- A slow-release fertiliser may be used, as required, in conjunction with organic matter (mulch from previously cleared vegetation) to improve the Cation Exchange Capacity (CEC) of the soil to enable longer retention of nutrients.

2.10.4.4 Ecosystem and Land Use Establishment

A seed mix of locally endemic native grass, shrub and tree species would be sown or planted as tubestock to establish a grassy woodland setting.

Any tubestock would be watered on initial planting, however, future watering would only be in response to signs of stress (to avoid habituation to watering).

2.10.4.5 Ecosystem and Land Use Sustainability

Ongoing monitoring of the success of rehabilitation would be undertaken in accordance with the procedures outlined in the MOP, and remedial action would be implemented should the progression of rehabilitation not be satisfactory.

2.10.5 Implementation

2.10.5.1 Responsibility and Accountability

Responsibility for the implementation of rehabilitation would fall to the Quarry Manager, supported by Quarry operators. **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
Quarry Manager	<p>Ensure that the development and operation of Quarry complies with the conditions of development consent, all NSW Acts and Regulations, and issued approvals, permits and licences.</p> <p>Ensure funds required for rehabilitation of the Quarry are provided for.</p> <p>Ensure that the mining area remains within the approved limits and conditions of development consent.</p> <p>Understand the commitments made in this document with respect to rehabilitation.</p> <p>Ensure rehabilitation monitoring obligations are adhered to.</p> <p>Provide clear, unambiguous instruction to mobile equipment operators as to requirements of final landform.</p> <p>Ensure soil and cleared vegetation stockpiles are managed appropriately.</p> <p>Document rehabilitation as completed and make data available for annual reporting.</p>
Operators	<p>Understand approved limits of disturbance (do not clear vegetation or strip soil unless under clear instruction).</p> <p>Construct landforms as nominated in this Environmental Assessment or as instructed by quarry management.</p>

2.10.5.2 Rehabilitation Funding

On approval, the Applicant would recalculate the cost to complete the proposed rehabilitation (in 2019 dollar value) using the resource Regulator's rehabilitation security calculator. Concurrently with an application to amend the MOP, the Applicant would provide for an increase in the rehabilitation security held by the DRE for the rehabilitation of the Quarry on ML 1633.

The Applicant, as part of normal budgeting process, would allocate a value to be spent each year for the purposes of rehabilitation. The cost to rehabilitate the Quarry Site would be reviewed periodically to assess rehabilitation completed, costs to complete rehabilitation and likely allocation of funds over the ensuing years to rehabilitation.

2.11 Alternatives Considered

2.11.1 Alternative Extraction Area

The detailed geological and resource modelling produced by RME (2018) indicates that the quartzite continues at greater depth and further to the south when compared to the extent of the proposed open cut (refer to **Figure 2.3**).

The Applicant considered a number of different open cut designs which either developed the open cut to increased depth (with a reduced southerly extent) or extended the surface area of the open cut further south.

- A deeper extraction area (with reduced surface disturbance footprint) was rejected as the working area at the base of the open cut would not be sufficiently large enough to allow for safe working conditions (based on the recovery of the same amount of quartzite).
- While the overburden to quartzite ratio reduces significantly to the south, extending the extraction area further south was rejected given this would require further impact on the Coxs River and the tributary which provide the western perimeter of the current extraction area. As the current extraction area design provides for 15 Mt of quartzite, the Applicant determined there was no need (at this time) to extend the area further.

2.11.2 Alternative Stockpile Areas

Increasing the area available for product stockpiling is identified in **Section 1.6** as important in securing the future for the Quarry. That is, in order to carry sufficient stocks of a variety of aggregate products, an increase in the total area available for stockpiling is required.

Initially, the Applicant considered a much larger Western Stockpile Extension which involved cut and fill operations to create an extended stockpile area at an elevation of approximately 940 m AHD. Following a review of the likely volumes of overburden which could be generated by the extended extraction area, the Applicant identified that the extended stockpile areas should also provide for the placement and storage of this non-saleable material.

The western area was first considered for extension to the 950 m AHD contour level within Lidsdale State Forest. However, due to the sloping nature of the area to the west of the Quarry Site, the volume of material which could be stored was less than 300,000 m³ and unlikely to provide sufficient storage for the non-saleable overburden to be generated by the extended extraction area.

The Southern Stockpile Area offers a much greater volume to surface area ratio for overburden placement and therefore provides for a reduction in the disturbance footprint necessary to manage the overburden. The impact on the local environment of the completed clearing and proposed ongoing use is assessed in **Section 4.0**.

2.11.3 Increased Production Rate

The Applicant considered the possibility of increasing the production rate and therefore increasing the maximum allowable production from the Quarry Site. However, based on market analysis, the Applicant determined that 500,000 tpa was more than sufficient in the short to medium term. Should market demand increase significantly, the Applicant would consider a further modification to increase the maximum allowable annual production.

3.0 Issue Identification and Prioritisation

3.1 Introduction

In order to undertake a comprehensive environmental assessment of the Proposed Modification, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community. Issue identification was completed through a combination of the following methods:

- Notification and consultation of local community stakeholders and key government agencies in order to identify environmental issues of concern or relevance.
- A review of environmental planning documentation in order to identify relevant environmental constraints and/or issues.
- A review of the environmental performance at the Quarry in order to identify those aspects of the environment that are, have been or are likely to be affected by mining operations.
- The experience of the Proponent and the author of this SEE in relation to the likely impacts.

A summary of the issue identification process undertaken is provided by **Section 3.2**.

On identification of those environmental issues that could be affected by the Proposed Modification, an analysis of the potential for impact on each of these has been undertaken in order to identify the priority and scale of assessment required (see **Section 3.3**).

3.2 Issue Identification

3.2.1 Consultation

3.2.1.1 Community Consultation

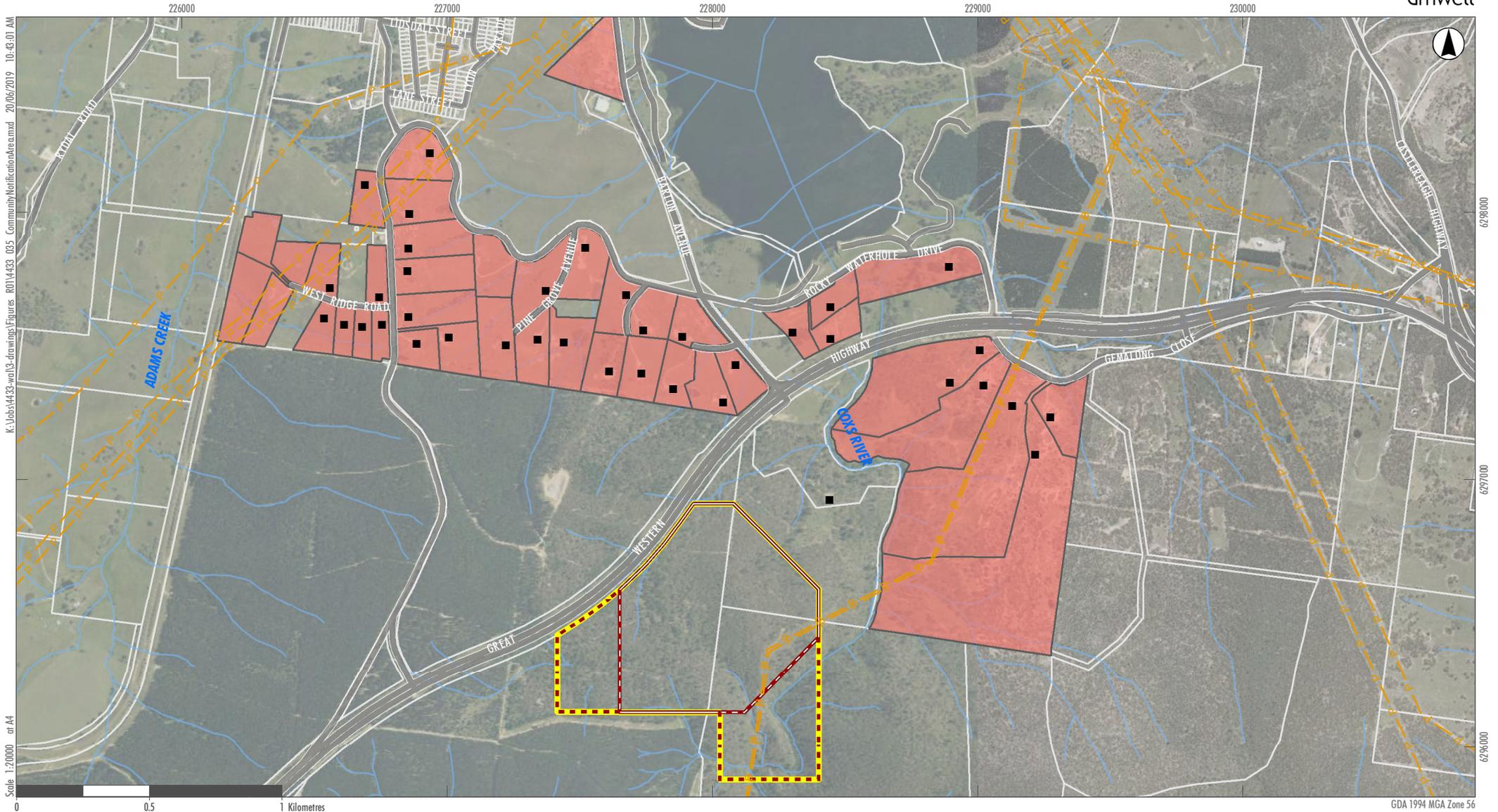
The Applicant's Community Engagement Strategy (CES) has been developed to include three phases as follows:

Notification

Initial notification of the Proposed Modification to the community was provided by the Proponent at the Community Consultative Committee (CCC) meetings of 10 April and 8 November 2018. The Applicant encouraged the CCC to discuss the Proposed Modification with local community members and to contact the Proponent with any concerns or questions.

A Community Information Sheet (CIS) was prepared and distributed to landowners and residents to the north and east of the Quarry Site, i.e. those with the potential to be impacted by Quarry operations (see **Figure 3.1**). The CIS (which is reproduced as **Appendix 2**) provided an overview of the Proposed Modification, a summary of the development assessment process and an invitation to comment on matters of concern or take part in further consultation.

Lithgow City Council was also contacted and invited to provide details of any community groups deemed as having an interest in the Proposed Modification. While Council did not provide any advice on potentially interested community groups, the Wallerawang and Lidsdale Progress Association and Lithgow Chamber of Commerce were notified and invited to provide input.



Legend

- Quarry Site (ML1633)
- Project Site
- Community Notification Delivered
- Residence
- P Electricity Transmission Lines
- Cadastre

Image Source: Data source:

FIGURE 3.1
Community Notification Area

Consultation

A community register was created where the responses to the initial notification were recorded. Each of these respondents were then contacted to obtain preliminary information on their social values, view on current Quarry operations, the Proposed Modification and concerns held. Where the details of other potentially interested community members were provided, these stakeholders were also contacted.

In response to the CIS, the Applicant received correspondence from the owners of five properties on Rocky Waterhole Drive to the north of the Quarry and the Great Western Highway. Contact was made with each of these residents (by email and phone) to obtain preliminary information on their view of current Quarry operations, the Proposed Modification and concerns held.

Based on the responses to the CIS received, a meeting was subsequently scheduled and held at the residence of 42 Rocky Waterhole Drive on Friday 7 December 2018. The objective of this meeting was to establish the social values of these stakeholders, discuss the potential impact of the Proposed Modification on these and consider mitigation or management measures as relevant. The meeting was attended by the five property owners on Rocky Waterhole Drive who were provided with a summary of the Proposed Modification and asked questions regarding the proposed operation and potential impacts. Following the meeting, the Applicant agreed to undertake blast monitoring at 42 Rocky Waterhole Drive to provide additional information on vibration levels received.

Following this consultation where key issues of concern were identified, additional impact mitigation and management measures were identified before technical assessment of impacts on environmental parameters. On completion of these technical studies, the residents of Rocky Waterhole Drive were emailed an updated overview (with figures) of the Proposed Modification along with a summary of the key findings of visual, noise and blasting impact assessments on 7 May 2019.

Evaluation and Response

The response to the Proposed Modification at the two CCC meetings where the matter was raised was generally positive and supportive. The Council representative requesting that issues related to traffic and visual amenity be properly assessed.

No responses have been received to invitation to provide feedback from the Wallerawang and Lidsdale Progress Association or Lithgow Chamber of Commerce.

At the meeting with the local community (residents of Rocky Waterhole Drive) in December 2018, and in email and phone consultation following this, the primary issues of concern were identified as follows:

- Visual impact, being the potential for the quarry operations to become more visible from private (existing or future residential) vantage points.
- Property damage and reduced amenity as a result of blasting.
- Poor driver behaviour (although it was noted that this applied to all truck drivers on the Great Western highway and not necessarily those servicing the Quarry).
- Potential pollution of the Coxs River.
- Reduced local (rural) amenity as a result of greater intrusion of the Quarry (views, noise, vibration).
- The potential for a reduction in property values.

As noted above, the Applicant subsequently provided these residents with an updated summary of the proposed Quarry operations along with the results of technical assessments of visual, noise and blasting impacts. Feedback from the residents was invited, however, none has been received to date.

3.2.1.2 Government Agency and Public Authority Consultation

The following provides a summary of consultation undertaken with relevant government agencies and public authorities in relation to the Proposed Modification. Any formal correspondence provided by these agencies which nominates specific assessment requirements or recommendations are included in **Appendix 3**.

It is noted that the Applicant, their consultants or legal representatives may have undertaken other consultation with government agencies in relation to the operations of the Quarry. This summary has been restricted to consultation with direct relevance to the Proposed Modification.

Department of Planning and Environment

On 8 June 2018, a Preliminary Environmental Assessment (PEA) was submitted to the DPE seeking environmental assessment requirements for the Proposed Modification. On 18 June 2018, the DPE provided Environmental Assessment Requirements requiring that:

- the Air Quality Impact Assessment be prepared in accordance with the *Approved Methods for Modelling and Assessment of Air Pollutants in NSW* (EPA, 2017a)
- the Noise Impact Assessment be prepared in accordance with the *NSW Noise Policy for Industry* (EPA, 2017b)
- the Biodiversity Assessment be prepared in accordance with the *Biodiversity Assessment Methodology* (OEH, 2017).

The nominated assessments have been prepared in accordance with the nominated documents, with full versions of each assessment provided as **Appendices 6, 10 and 11**.

The DPE also requested the SEE consult with the Resources Regulator and Forestry Corporation of NSW (FC NSW) in the preparation of the final landform and emphasised the importance of consultation with relevant community and government stakeholders. To ensure the requirements and/or preferences of the Resources Regulator and FC NSW were considered, a copy of the PEA was provided to both along with an invitation to provide comments on key assessment requirement. In addition, the PEA was provided to the following government agencies with an invitation to provide assessment requirements:

- Lithgow City Council (LCC): as the Quarry is located within this LGA.
- WaterNSW: as the Proposed Modification has the potential to impact on the Sydney Drinking Water Catchment.
- Office of Environment and Heritage (OEH): given the potential occurrence of threatened species within and adjoining the area of direct impact.
- Environment Protection Authority (EPA): for consideration of any potential changes to polluting emissions.
- Department of Industry – Crown lands (DI-Crown Lands): given the Quarry Site occupies Crown land Lot 7322 DP 1149335.

- Department of Industry – Water (DI-Water) (now identified as the Natural Resources Assessment Regulator): for consideration of water licensing matters associated with the use of water.

The key responses and assessment requirements of the DPE and consulted government agencies, which can be reviewed in full as **Appendix 3**, are summarised as follows. Where relevant, additional consultation undertaken either prior to or following the distribution of the PEA is referenced and summarised.

Lithgow City Council

The Applicant maintains regular contact with Lithgow City Council with representatives of Council being members of the Quarry Community Consultative Committee. Council is well informed of operations being undertaken at the Quarry and of the Proposed Modification.

On 11 September 2018, Council provided a formal response to the request for assessment requirements and identified the continued management of visual impacts as the primary issue.

Resources Regulator

On 10 August 2018, the Resources Regulator responded to the invitation to provide assessment requirements and referred the Applicant to the “*Mining Development - Rehabilitation Standard Assessment Requirements*”. The Resources Regulator identified the Proposed Modification as an opportunity to re-assess existing approved post mining rehabilitation outcomes and ensure they are modified to meet contemporary standards and expectations. Specifically, the Resources Regulator noted the following:

- Avoiding or minimising the size and batter steepness of any final void should be a key consideration when determining the post mining landform.
- The outcomes of consultation with FC NSW with respect to rehabilitation should be identified.

Following a review of the extent of the quartzite resource, the Applicant updated the proposed layout of the Project Site to account. Noting this involved changes to final landforms and rehabilitation, an updated Project Site Layout (**Figure 2.1**), Quarry development sequence (**Figures 2.6 to 2.8**) and final landform (**Figure 2.9**) was provide to the Resources Regulator for review and comment on 23 April 2019. In reply (4 June 2019), the Resources Regulator reiterated their previous comments regarding rehabilitation requirements.

NSW Environment Protection Authority

On 8 August 2018, the EPA responded to the invitation to provide assessment requirements. The primary matter of interest to the EPA was the construction of the additional stockpile areas, with a request made to explore all options to minimise the area of disturbance outside the footprint of the existing stockpile areas and to avoid creating steep unvegetated, and erodible batters.

The EPA also requested consideration be given to the potential for overburden materials to be disposed of at other sites in the local areas which may be seeking clean fill for rehabilitation purposes.

It is noted that both these requests have been considered as part of the development of the Proposed Modification and are discussed in **Sections 2.5** and **2.11**. As noted in **Section 2.5**, the proposed areas of stockpile extension have been nominated as the maximum area and the Applicant intends on sourcing markets for this material to reduce the final impact footprint. The Applicant has recently sold significant volumes of clean fill to Energy Australia and is aware of other developments within the Lithgow LGA which either require clean fill for rehabilitation purposes or could in the future. The requirement for these sites to obtain development consent to import VENM or ENM, over and above exclusions from licensing offered by clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014, remains a constraint on future sales.

The Applicant will continue to seek and take-up opportunities for such sales, noting that where the non-quartzite material is to be taken from Lot 7322 DP1201227, this would be undertaken in accordance with a Forest Materials Licence (FML) currently being negotiated with FC NSW.

NSW Office of Environment and Heritage

OEH provided correspondence requesting that the Applicant consider, assess, quantify and report on the likely environmental impacts of the Proposed Modification, with specific reference to the following.

- Biodiversity.
- Aboriginal cultural heritage.
- Historic heritage.
- Water and soils.
- Flooding and coastal hazards.

Specific guidance on the assessment requirements for each of the parameters noted above was provided and can be viewed in **Appendix 3**.

Department of Industry – Water

On 21 February 2018, an email was sent to the Department of Industry – Water (DI Water) by Jacobs Pty Ltd (Jacobs), on behalf of the Applicant, outlining the proposed extension to the extraction area and suggesting an analytical assessment of the potential impacts would be sufficient. In responding on 24 February 2018, DI Water did not comment on the proposed approach to assessment, rather provided recommended groundwater related assessment requirements for any updated Environmental Assessment of the Quarry.

In June 2018, Jacobs prepared a memorandum that was issued to DI Water. The memorandum detailed the local geological and hydrogeological setting, documented a preliminary quantitative assessment of the potential impacts of an extension to the Quarry extraction area and documented the intended application of a 2D analytical groundwater model for impact assessment purposes. The purpose of the memorandum was to inform discussions regarding the groundwater assessment approach prior to a meeting between the Applicant and NSW DI Water that took place on 27 June 2018 at Parramatta office of DI Water. The key outcome from the meeting was that DI Water recommended three site groundwater monitoring bores be installed to underpin the groundwater assessment and provide certainty with regards to water table levels.

The Applicant subsequently engaged Jacobs to undertake the recommended drilling and hydrogeological test program following which, on 12 September 2018, an email was sent to NSW DI requesting comment in relation to assessment requirements for the Proposed Modification. On 24 October 2018, DI Water provided a letter outlining assessment requirements. The three key requirements for assessment were identified as follows:

- Water Supply and Licensing: including:
 - annual volumes of surface water and groundwater proposed to be taken
 - assessment of any volumetric water licensing requirements
 - the identification of an adequate and secure water supply for the life of the project
 - a detailed and consolidated site water balance.

- Water impact assessment, monitoring and management, including:
 - assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems
 - assessment of any potential cumulative impacts on water resources;
 - details of the final landform of the site, including final void management and rehabilitation measures
 - full technical details and data of all surface and groundwater modelling
 - proposed surface and groundwater monitoring activities and methodologies
 - proposed management and disposal of produced or incidental water.
- Assessment against the Aquifer Interference Policy (2012).

Further discussion on the initial consultation with DI Water, along with a summary of the groundwater testing is provided in the Groundwater Impact Assessment of Jacobs Pty Ltd (refer to **Appendix 8**).

Department of Industry – Crown lands

Following the preparation of PEA, DI-Crown Lands provided advice on key assessment requirements (2 July 2018). In summary, the requirements of DI-Crown Lands nominated the following:

- No work may be undertaken on Crown land cannot without a current tenure from the Department authorising such work or occupation.
- Consideration of Aboriginal Land Claim No. 44317 which applies to Lot 7322 DP1149335 is required.
- The development should avoid where appropriate, the removal or damage of any native vegetation located within Crown lands.
- The development should ensure no pollution as a result of overflow or contaminated waste (contaminated runoff) to Crown land or waterway. Any such events should be notified to DI-Crown Lands.
- The final landform should be rehabilitated to a standard that will ensure there is no ongoing maintenance requirement greater than the surrounding bushland.

Following receipt of these assessment requirements, the Applicant and their consultant met with Messrs Daryl Lawrence and Steve Pearson, and Ms Kay Oxley to further discuss the Proposed Modification, potential impacts and procedure for obtaining appropriate approval to operate on the Crown land. At the meeting, it was noted that advice received from Hetherington Exploration and Mining Title Services and Hicksons Lawyers indicated that Native Title was extinguished on Lot 7322 DP1149335 by virtue of Section 23A(2) of the Commonwealth *Native Title Act* (1993) (refer to **Section 3.2.2.1** and **Appendix 4**).

Following the meeting, where it was identified that the Applicant requires a licence to occupy and use Crown land, the Applicant submitted an application on 18 July 2018. The Applicant is awaiting determination of the application.

On 23 April 2019, an email was sent to DI-Crown Lands which provided an update on the Proposed Modifications to the Quarry operations on Lot 7322 DP1149335 inviting feedback on the proposed operations and approach to quarry development and rehabilitation, and requesting consent to the

lodgement of the application to modify DA 344-11-2001. A formal application to provide consent to lodge was subsequently prepared and submitted to DI Crown Lands by the Applicant on 26 April 2019. The matter was further discussed in a phone call between DI-Crown Lands and Umwelt on 7 May 2019, where the principal matter of discussion was the consent to lodgement. Consent to lodge was provided on 10 May 2019.

Forestry Corporation NSW

The Applicant has maintained ongoing dialogue with FC NSW over a number of matters related to the Wallerawang Quarry and proposed extension. A compensation agreement with respect to operations on Lidsdale State Forest has been prepared and implemented. Negotiations with respect to a Forest Materials Licence are ongoing with a key issue for negotiation being the relative royalty to be applied to non-mineral resources removed from the extraction area.

The Applicant has also made enquiries over the possible purchase of that section of Lidsdale State Forest which is currently and proposed to be impacted by the Quarry. In correspondence received on 22 November 2018, FC NSW noted that sale of the land was not feasible but that other arrangements could be entered between the parties which would enable transfer of the land from FC NSW to the Applicant. In subsequent meetings between the Applicant and FC NSW, it was identified that should alternative land be identified, obtained and provided to FC NSW, the area in question of Lidsdale SF could be transferred to the Applicant.

With respect to the proposed extension, FC NSW was originally provided with conceptual Quarry extension plans in March and April 2018. Following the distribution of PEA, a representative of FC NSW emailed a response on 9 August 2018 identifying their primary interest as the rehabilitation of the Quarry Site following completion.

As noted in **Section 1.1**, a decision was made by the Applicant to make a minor modification to the development consent in September 2018 to extend the limits on the consent by 12 months (to July 2020). Once this application was made, an update to the proposed Quarry Site layout was provided to FC NSW in November 2018 with an invitation to discuss this or meet with the Applicant. The Applicant was not contacted at this time by FC NSW.

A copy of the proposed Quarry Site layout, development sequence and rehabilitation of the Quarry Site was supplied to FC NSW on 23 April 2019 with a request to provide feedback on the proposed final landform objectives and approach to rehabilitation management, as well as consent to lodge the application to modify DA 344-11-2001. FC NSW responded on 7 May 2019 providing some comments on the proposed rehabilitation strategy and requesting a meeting to further discuss the intentions and objective of the Applicant to the rehabilitation of the Quarry Site and land managed by FC NSW.

On 15 May 2019, representative of the Applicant and Umwelt met with FC NSW personnel to further discuss the Proposed Modification, effects on FC NSW land and the preferences of FC NSW in relation to rehabilitation. As a result of the meeting, the Applicant agreed to decommission and rehabilitate all surface infrastructure (including water storages) unless agreement with FC NSW or a future landholder is reached to retain this. While noting a preference for the final void to be backfilled, FC NSW acknowledged this as not feasible. On 3 June 2019, FC NSW issued a letter providing landowner consent to lodge the application to modify the development consent.

NSW Roads and Maritime Services

On 23 July 2018, the RMS noted that on the basis that the Proposed Modification would not result in any change to existing peak traffic volumes, it had no specific assessment requirements.

TransGrid Pty Ltd

Following a detailed review of the quartzite resource, the Applicant has proposed to extend the extraction area below the 330kV powerline which traverses ML 1633 and is owned and operated by TransGrid Pty Ltd. Noting the potential impact of the Proposed Modification on the TransGrid asset, namely High Tension Pylon Number 7715 and the aerial powerlines (with a span of 657 m), the Applicant arranged and attended a meeting with TransGrid on 27 February 2019.

At the meeting, the Applicant committed to maintaining an offset distance of 30 m from the pylon (in accordance with current plans) and discussed the potential effects of blasting. The issue of primary interest to TransGrid was conveyed as wind loading on the Aerial powerlines which could occur as a result of any change in the cross-section of the valley directly below the aerial wires. TransGrid noted that should the shape/cross-sectional area of the valley shape/contours be modified significantly, then modelling of this change would be required by TransGrid.

The Applicant has subsequently provided the relevant cross-section of the valley walls beneath the aerial powerlines. At the time of writing TransGrid had not provided any further advice as to the requirement for additional modelling of wind loading.

3.2.2 Review of Planning Issues

The following sections identify relevant legislation and planning controls to operations at the Quarry and discuss the application of these planning provisions to the Modification.

3.2.2.1 Commonwealth Legislation

Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the primary environmental and planning regulatory instrument relevant to the Modification at a Commonwealth level.

Under the EPBC Act, approval by the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World Heritage properties
- National Heritage Places
- Wetlands of international importance (Ramsar wetlands)
- migratory species, threatened species, critical habitats or ecological communities listed in the EPBC Act
- Commonwealth land, marine areas or reserves
- nuclear actions
- a water resource in relation to coal seam gas development and large coal mining development.

The Modification does not interact with any Commonwealth land, Commonwealth marine areas, the Great Barrier Reef Marine Park and is not a nuclear action, coal seam gas development or large coal mining development. Following a review of potential habitat and field survey in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia, 2013), Ecoplanning Pty Ltd has concluded that the Proposed Modification would not exceed the significant impact criteria identified in these guidelines. As such, the Proposed Modification is considered unlikely to represent a controlled action and

therefore approval of the Commonwealth Minister for the Environment is not required. Further discussion is provided in **Section 4.3.3.7**.

Native Title Act 1993

The *Native Title Act 1993* (NT Act) is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. The NT Act prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land.

An assessment of the land parcels contained within the Application Area (see **Section 1.3.2** and **Figure 1.2**) by Hetherington Exploration and Mining Title Services (Hetherington, 2018) identified one determined native title claim which has been accepted for registration (Warrabinga-Wiradjuri #7). Hetherington (2018) has determined that native title rights have been extinguished on the Lots 7071 DP1201227 and Lot 7322 DP1149225 by virtue of the reservation of this land as a stock route under the *Crown Lands Alienation Act 1861 (NSW)*. This constitutes a reservation for ‘public works’ in satisfaction of Section 23A of the NT Act, and therefore an act of previous exclusive possession, which extinguishes native title under Section 23B(7) of the NT Act. This interpretation of the application of Sections 23A and 23B of the NT Act has been reviewed and supported by legal opinion provided by Hicksons Lawyers. A copy of Hetherington (2018) and legal opinion of Hicksons Lawyers is provided in **Appendix 4**.

3.2.2.2 State Legislation

Environmental Planning and Assessment Act 1979

The EP&A Act is the primary legislation governing environmental planning and assessment for NSW. DP&E is responsible for State Significant Development which includes the Quarry and is therefore the consent authority for the Proposed Modification.

The objectives of the EP&A Act relevant to the Proposed Modification encourage:

- the proper management, development and conservation of natural and artificial resources
- the promotion and co-ordination of the orderly and economic use and development of land
- the protection of the environment
- ecologically sustainable development.

DA 344-11-2001 was originally granted under Part 4 of the EP&A Act on 19 October 2004 and classified as State Significant Development (SSD). On the basis that the development as modified remains substantially the same to the development for which consent was originally granted, DA 344-11-2001 may be modified under Section 4.55 of the EPA& Act. The proposed modified operations are considered substantially the same on the basis that the type of development remains the same, the production level (scale) remains the same and the level of impact (considered in Section 4) remains equivalent. **Section 6.3.3** provides further justification for the proposed modified Quarry as substantially the same as that approved by DA 344-11-2001.

This SEE has been prepared in consideration of the factors identified in Section 4.55 of the EP&A Act, clause 115 of the EP&A Regulation and in accordance with advice provided by DPE on 18 June 2018 confirming the approval pathway under Section 4.55(2) of the EP&A Act (refer to **Appendix 1**).

Section 4.0 includes an assessment of relevant environmental impacts associated with the Proposed Modification to determine the level of assessment completed to support the SEE. This has been completed to satisfy the relevant requirements of Section 4.15 of the EP&A Act and also the assessment guidance provided by DPE dated 18 June 2018 (refer to **Appendix 3**).

Other State Legislation

A summary of the NSW legislation potentially applicable to the Modification is included in **Table 3.1**, along with an indication of which additional approvals will be required.

Table 3.1 Summary of Other Potentially Relevant State Legislation

Act	Comments	Approval Required
<i>Protection of the Environment Operations Act 1997</i>	The Applicant holds an Environment Protection Licence (EPL No. 13172) for the Quarry. While no change to the type or scale of activities is proposed, the EPL will need to be varied to reflect any updated development consent.	Yes
<i>National Parks & Wildlife Act 1974</i>	In accordance with Section 4.41 of the EP&A Act an Aboriginal Heritage Impact Permits (AHIPs) is not required under Section 90 of the <i>National Parks & Wildlife Act 1974</i> for Aboriginal sites proposed to be impacted by development where authorisation is provided by the development consent. An Aboriginal site (AHIMS Site #45-1-2802 ⁴) would be disturbed by the Proposed Modification and while an AHIP is not required, the consent authority must be satisfied that the site will be appropriately managed, after consultation with the Registered Aboriginal Parties to the Proposed Modification prior to consent being issued.	No ⁵
<i>Water Act 1912</i>	This Act has been repealed by the <i>Water Management Act 2000</i> ; however, some of the licensing provisions remain in force where the water source is not covered by a water sharing plan. The Quarry is within an area covered by a water sharing plan.	No
<i>Water Management Act 2000</i>	The Application Area falls within the following Water Sharing Plans for groundwater and surface water respectively: <ul style="list-style-type: none"> <i>Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources</i> which commenced on 1 July 2011. <i>Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources</i> which commenced on 2 March 2011. As such, surface water within the catchment is managed under the <i>Water Management Act 2000</i> . All water extraction from water sources (surface and groundwater) regulated by a Water Sharing Plan will require licensing under the <i>Water Management Act 2000</i> where they are in addition to extractions permitted under harvestable rights.	Yes

⁴ Identified in previous environmental documentation as Site WQ1

⁵ Authorisation for disturbance is still required but provided by the development consent.

Act	Comments	Approval Required
<i>Mining Act 1992</i>	<p>Quartzite is a prescribed mineral under Schedule 2 of the Mining Regulation 2016. A mining lease is required prior to development for the purpose of mining being undertaken. The Applicant holds Mining Lease (ML) 1633 for the approved Quarry operations.</p> <p>An extension to the ML 1633 has been lodged with the Division of Resources & Geoscience with a preliminary decision approving the extension issued in July 2018. An application to extend the area covered by ML 1633 is required as the disturbance footprint of the Proposed Modification extends beyond the extents of ML 1633.</p>	Yes
<i>Biodiversity Conservation Act 2017</i>	A licence under this Act is not required for any activity undertaken in accordance with a development consent granted under the EP&A Act and therefore no approvals are required.	No
<i>Heritage Act 1912</i>	No heritage sites will be affected and no s140 or s60 excavation permits are required under this Act for works associated with the Proposed Modification.	No
<i>Roads Act 1993</i>	<p>The <i>Roads Act 1993</i> determines the rights of the public and adjacent landowners to use public roads and establishes procedures for the opening and closing of public roads. Under the Act applications are required to be made for the closure of roads and for works in road reserves.</p> <p>No road closures or road works are proposed.</p>	No
<i>Crown Lands Act 1989</i>	<p>The <i>Crown Lands Act 1989</i> provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the <i>Crown Land (Continued Tenures) Act 1989</i>.</p> <p>The Applicant lodged an application for a licence to occupy Lot 7322 DP1149335 in July 2018 and is awaiting confirmation.</p>	Yes
<i>Local Land Services Act 2013</i>	The provisions of this Act do not apply to any activity undertaken in accordance with a development application granted for designated development under the EP&A Act and therefore do not apply to the Proposed Modification.	No
<i>Environmentally Hazardous Chemicals Act 1985</i>	<p>Under the <i>Environmentally Hazardous Chemicals Act 1985</i> a licence is required for any storage, transport or use of prescribed chemicals.</p> <p>The Applicant does not propose to store, transport or use any chemicals currently subject to a Chemical Control Order (CCO) under this Act.</p>	No

3.2.2.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments created by the State government. The SEPPs that are potentially relevant to the Modification are discussed in the following section.

State Environmental Planning Policies (State and Regional Development) 2011 (SRD SEPP)

The State and Regional Development SEPP defines development of State Significance which requires Ministerial approval under the provisions of the EP&A Act. As discussed in **Section 3.3.1**, the original development application was deemed a State Significant Development and granted under Part 4 of the EP&A Act. As this application seeks to modify DA 344-11-2001, the requirements for assessment nominated by the SRD SEPP apply.

In assessing the Proposed Modification, it is noted that in the event of any inconsistency between the SRD SEPP and other planning instruments, the provisions of the SRD SEPP prevail. Of particular note, Clause 11 confirms that planning provisions nominated in local development control plans do not apply to State Significant Development.

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

The Extractive Industries SEPP regulates the permissibility and assessment requirements for mining, petroleum production and extractive industries and related development. The SEPP outlines where various extractive industry activities are permissible both with and without development consent. The SEPP also defines mining, petroleum production and extractive industries developments that are prohibited, exempt or complying developments.

Table 3.2 presents a summary of the matters that the Minister or his/her delegate needs to consider when assessing a new or modified Proposed Modification (Part 3 – Clauses 12 to 17 of the SEPP) and a reference to the section(s) in this SEE where each relevant element of the Extractive Industries SEPP is addressed.

Table 3.2 Application of the Extractive Industries SEPP

Clause	Description	Section
12AB: Non-discretionary development standards for mining	1. The object of this clause is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with).	Noted
	2. The matters set out in this clause are identified as non-discretionary development standards for the purposes of Section 4.15 (2) and (3) of the Act in relation to the carrying out of development for the purposes of mining. Note: The development standards do not prevent a consent authority from imposing conditions to regulate project-related noise, air quality, blasting or ground vibration impacts that are not the subject of the development standards.	Noted
	3. Cumulative noise level. The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.2 of the <i>Noise Policy for Industry</i> , for residences that are private dwellings.	4.9
	4. Cumulative air quality level. The development does not result in a cumulative annual average level greater than 25µg/m ³ of PM ₁₀ or 8µg/m ³ of PM _{2.5} for private dwellings.	4.10
	5. Airblast overpressure. Airblast overpressure caused by the development does not exceed: (a) 120 dB (Lin Peak) at any time, and (b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	4.9

Clause	Description	Section
	<p>6. Ground vibration.</p> <p>Ground vibration caused by the development does not exceed:</p> <p>(a) 10mm/sec (peak particle velocity) at any time, and</p> <p>(b) 5mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.</p>	4.9
	<p>7. Aquifer interference.</p> <p>Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table.</p> <p>Note: The taking of water from all water sources must be authorised by way of licences or exemptions under the relevant water legislation.</p>	4.6
	<p>8. The Minister is to review a non-discretionary development standard under this clause if a government policy on which the standard is based is changed.</p>	Noted
<p>12: Compatibility with other land uses</p>	<p>Consideration is given to:</p> <ul style="list-style-type: none"> the existing uses and approved uses of land in the vicinity of the development; the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and any ways in which the development may be incompatible with any of those existing, approved or preferred land uses. <p>The respective public benefits of the development and the existing, approved or preferred land uses are evaluated and compared.</p> <p>Measures proposed to avoid or minimise any incompatibility are considered.</p>	<p>4.11, 4.13</p> <p>4.13</p>
<p>12A: Consideration of voluntary land acquisition and mitigation policy</p>	<p>Consideration is given to any applicable provisions of the voluntary land acquisition and mitigation policy and, in particular:</p> <p>a) any applicable provisions of the policy for the mitigation or avoidance of noise or particulate matter impacts outside the land on which the development is to be carried out, and</p> <p>b) any applicable provisions of the policy relating to the developer making an offer to acquire land affected by those impacts.</p>	3.2.2.4
<p>13: Compatibility with mining, petroleum production or extractive industry</p>	<p>Consideration is given to whether the development is likely to have a significant impact on current or future mining, petroleum production or extractive industry and ways in which the development may be incompatible.</p> <p>Measures taken by the Proponent to avoid or minimise any incompatibility are considered.</p> <p>The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared.</p>	NR ¹

Clause	Description	Section
14: Natural resource and environmental management	<p>Consideration is given to ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure:</p> <ul style="list-style-type: none"> impacts on significant water resources, including surface and groundwater resources, are avoided or minimised; impacts on threatened species and biodiversity are avoided or minimised; and greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided. 	<p>4.6.5, 4.7.6</p> <p>4.3.5</p> <p>Appendix 11</p>
15: Resource recovery	The efficiency of resource recovery, including the reuse or recycling of material and minimisation of the creation of waste, is considered.	2.5
16: Transportation	<p>The following transport related issued are considered.</p> <ul style="list-style-type: none"> The transport of some or all of the materials from the site by means other than public road. Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools. The preparation of a code of conduct for the transport of materials on public roads. 	2.7, 3.3
17: Rehabilitation	<p>The rehabilitation of the land affected by the development is considered including:</p> <ul style="list-style-type: none"> the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated; the appropriate management of development generated waste; remediation of any soil contaminated by the development; and the steps to be taken to ensure that the state of the land does not jeopardize public safety, while being rehabilitated or at the completion of rehabilitation. 	2.10, 4.11, Figure 2.9

NR = Not relevant.

N/A = Not Applicable

Note¹: Clause 13 is not considered relevant on the basis that the Mine has already been approved and as such the significance of the resource and economic benefits to the State have already been considered

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The aims of this SEPP are to integrate the provision of healthy water catchments with development in catchment areas by ensuring that consent authorities must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality and not hinder the achievement of water quality objectives for the Sydney drinking water catchment.

The Site is located within the Warragamba catchment which forms part of Sydney's water supply and as such the following must be considered when assessing the Proposed Modification:

- Incorporation of the current recommended practices and standards of WaterNSW or demonstration that proposed practices and performance standards meet or exceed these practices and standards.
- Demonstration of neutral or beneficial effect on water quality.

The former Sydney Catchment Authority (which now forms part of WaterNSW) provide guidelines for the assessment of a neutral or beneficial effect on water quality and **Table 3.3** provides a summary of these and where these have been addressed in the SEE.

Notably, as the Minister is the consent authority, concurrence of the Chief Executive of WaterNSW is not required (as nominated by Clause 11 of the SEPP).

Table 3.3 Application of the Extractive Industries SEPP

Guideline	Description	Section
Are there any identifiable potential impacts on water quality? What pollutants are likely? During construction and/or post construction?	It is important to identify any possible impacts, not go straight to a conclusion that there won't be any impacts because they will be contained by appropriate safeguards.	4.6, 4.7
For each pollutant, list the safeguards needed to prevent or mitigate potential impacts on water quality (these may be SCA endorsed current recommended practices (CRPs) and/or equally effective other practices)?	These are the safeguards, or water quality protection measures, that need to be in place during the construction and operational stages of the project. Wherever possible these safeguards should be based on SCA endorsed Current Recommended Practices (CRPs) & Standards.	4.6.4, 4.7.4
Will the safeguards be adequate for the time required? How will they need to be maintained?	Measures should be designed to cope with expected seasonal weather conditions, e.g. high intensity summer storms.	4.6.5, 4.7.6
Will all impacts on water quality be effectively contained on the site by the identified safeguards (above) and not reach any watercourse, water body or drainage depression? Or will impacts on water quality be transferred outside the site for treatment? How? Why?	The level of analysis should be in proportion to the risks related to the type of activity and sensitivity of the site. For routine projects, a qualitative assessment would be sufficient to deem the achievement of neutral or beneficial effect. For large scale projects or where they are located in particularly sensitive areas, some form of pollutant modelling is recommended.	4.6.5, 4.7.6
Is it likely that a neutral or beneficial effect on water quality will occur? Why?	When the activity has been completed, will the level of pollutants be the same as they were before work commenced (i.e. neutral effect)? Or lower than before (beneficial effect)? Or worse than before (adverse effect)?	4.7.6

State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33)

SEPP 33 requires the consent authority to consider whether an industrial Proposed Modification is a potentially hazardous industry or a potentially offensive industry. The aim of this policy is to link the permissibility of a Proposed Modification to its safety and pollution control performance. The assessment process establishes whether the Proposed Modification is potentially hazardous or offensive and if this is not the case, SEPP 33 is not applicable.

The Proposed Modification would not result in any modifications to the types, volumes, storage or use of hazardous or dangerous goods within the Quarry Site. These operations have been determined to not be a hazardous or offensive development. No further consideration of SEPP No. 33 is required.

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44)

The Lithgow City LGA is identified (as the former Greater Lithgow LGA) in Schedule 1 of SEPP 44 as an area that could provide habitat for Koalas. As a result, the Minister is required to consider whether potential or core Koala habitat would be disturbed by the Proposed Modification.

The clearing associated with the Proposed Modification would not result in disturbance of any tree species identified as feed tree species by Schedule 2 of SEPP 44, nor have Koalas been identified on or in the immediate vicinity of the Quarry (Lesryk, 2017, Ecoplanning, 2018, 2019). As a result, no further assessment is required.

State Environmental Planning Policy 55 – Remediation of Land (SEPP 55)

SEPP 55 aims to provide a state-wide planning approach to the remediation of contaminated land, and to reduce the risk of harm to human health and the environment, by consideration of contaminated land as part of the planning process. Under SEPP 55, a consent authority must not consent to the carrying out of development on land unless it has considered potential contamination issues.

There are no known areas of contaminated land within the site including no known contaminated areas associated with the existing operations. Therefore, SEPP 55 does not place any constraints on the Modification.

3.2.2.4 Other NSW Policies

Aquifer Interference Policy

The AIP clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation and establishes and objectively defines considerations in assessing and providing advice on whether more than minimal impacts might occur to a key water-dependent asset.

The AIP requires that, where mining will result in a loss of water from an overlying source covered by a water sharing plan (WSP), a water access licence is required under the *Water Management Act 2000* (WM Act) to account for this loss of water. In addition, the AIP requires Applicants of mining projects seeking project approval under Part 4 of the EP&A Act to provide estimates of all quantities of water likely to be taken from any water source during and following cessation of the activity, and all predicted impacts associated with the activity. Detailed groundwater modelling has been undertaken to support the Proposed Modification (refer to **Section 4.6.2**).

The AIP requires that potential impacts of the Proposed Modification on groundwater sources, including groundwater users and groundwater dependent ecosystems (GDEs), be assessed against the minimal impact considerations. If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. The groundwater modelling undertaken for the Proposed Modification indicates the minimal impact considerations of the AIP will not be exceeded (refer to **Section 4.6.5**).

Biodiversity Offset Policy

The NSW Biodiversity Offset Policy provides a standard method for assessing impacts of Major Projects on biodiversity and determining offsetting requirements. The Biodiversity Assessment Method (BAM) is the underlying tool which calculates the offsetting requirements for any given project.

In accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (BC Act), the Proposed Modification requires assessment under the BAM. A Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the BAM (refer to **Section 4.3** and **Appendix 6**).

A Biodiversity Offset Strategy (BOS) for the Quarry will include one or a combination of the following offsetting options under the BAM:

- In-perpetuity conservation through the establishment of proponent-managed Stewardship site established in accordance with Part 5 of the BC Act, achieved through the retirement of credits.
- Securing required credits through the open credit market, and/or
- Payments to the Biodiversity Conservation Fund (established under the BC Act). One of the key functions of the NSW Biodiversity Conservation Trust (BCT) is to secure land-based offsets on behalf of proponents who pay into the Biodiversity Conservation Fund (BCT). Through this process the BCT is able to combine offset obligations and funds to establish strategic, larger and more viable offset sites in NSW (NSW Government, 2018).

Noise Policy for Industry

The *NSW Noise Policy for Industry* (NPfI) (EPA, 2017) provides a framework and process for deriving operational noise criteria for development consents under the EPA&A Act and setting operational noise limits in environment protection licences under the *Protection of the Environment Operations Act 1997* (POEO Act).

Based on ongoing compliance with existing noise criteria, and the changes proposed being are unlikely to introduce new noise sources, the Proposed Modification is not expected to cause an exceedance of the project noise trigger level. Noise impacts of the Proposed Modification are discussed in detail in **Section 4.9.6**.

Voluntary Land Acquisition and Mitigation Policy

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) provides guidance on voluntary mitigation and land acquisition to address noise and dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments. The current VLAMP (2018) applies to:

Modification applications that involve increases to the approved dust or noise impacts of a development

Noise Impacts

The land acquisition and mitigation assessment criteria used to assess noise impacts can be found in *Table 1* of the VLAMP and *Table 2.2* of the NPfI (EPA, 2017). If noise levels exceed the land acquisition and mitigation assessment criteria at any residence or workplace, voluntary mitigation rights may apply to the development, even if best practice management has already been implemented. The VLAMP and NPfI are used in conjunction to characterize noise impacts and determine suitable treatments for noise level impacts that are considered marginal, moderate or significant.

As discussed in **Section 4.9.6**, the Proposed Modification is not expected to exceed noise trigger levels at any areas of privately owned land as the Proposed Modification will not introduce new noise sources.

Air Quality Impacts

The current VLAMP (2018) brings the air quality criteria in line with the National Environment Protection Measures (NEPM) standards and EPA criteria. From this Policy, voluntary mitigation rights may apply where, even with best practice management, the development contributes to exceedances of the following criteria at any residence or workplace:

- Annual average PM_{2.5} exceedance of 8 µg/m³ (cumulative).

- 24 hour average PM_{2.5} exceedance of 25 µg/m³ (incremental impact, i.e. increase in concentrations due to the Project alone).
- Annual average PM₁₀ exceedance of 25 µg/m³ (cumulative).
- 24 hour average PM₁₀ exceedance of 50 µg/m³ (incremental impact, i.e. increase in concentrations due to the Project alone).
- Annual average TSP exceedance of 90 µg/m³ (cumulative).
- Annual average deposited dust exceedance of 2 g/m²/month (incremental impact, i.e. increase in concentrations due to the Project alone) and 4 g/m²/month (cumulative).

The above criteria also apply to voluntary acquisition rights where the development contributes to exceedances, even with best practice management, at any or workplace on privately owned land, or on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

The Proposed Modification is not predicted to result in increased impacts to any areas of privately owned land relative to the approved operations (refer to **Section 4.10.6**). Accordingly, the VLAMP will not apply to the Proposed Modification.

3.2.2.5 Local Planning Controls

The Quarry Site lies entirely within Lithgow City Local Government Area with local environmental planning provisions undertaken in accordance with the *Lithgow Local Environment Plan 2014* (“Lithgow LEP”). Notwithstanding the fact that Clause 7 of the SRD SEPP that the planning provisions of the SEPP prevail over those of the Lithgow LEP (refer to **Section 3.2.2.3**), the following sections consider the key planning provisions which apply to the Proposed Modification.

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

Permissibility

The Quarry Site occurs on land within two zones of the Lithgow LEP, RU3 – Forestry and the ESEA on land zoned E4 – Environmental Living (see **Figure 3.2**).

Open cut mining is permissible with development consent within the RU3 zone. Within the E4 zone, mining is permissible by virtue of Clause 7(1) of the Mining SEPP (see Section 3.3.2) which states:

“Development for any of the following purposes may be carried out with development consent:

(b) mining carried out:

- (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or*
- (ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999,”*

Extensive agriculture is permissible within the E4 Zone.

As the development is permissible with consent, the Minister (or delegate) can approve the carrying out of Proposed the Modification.

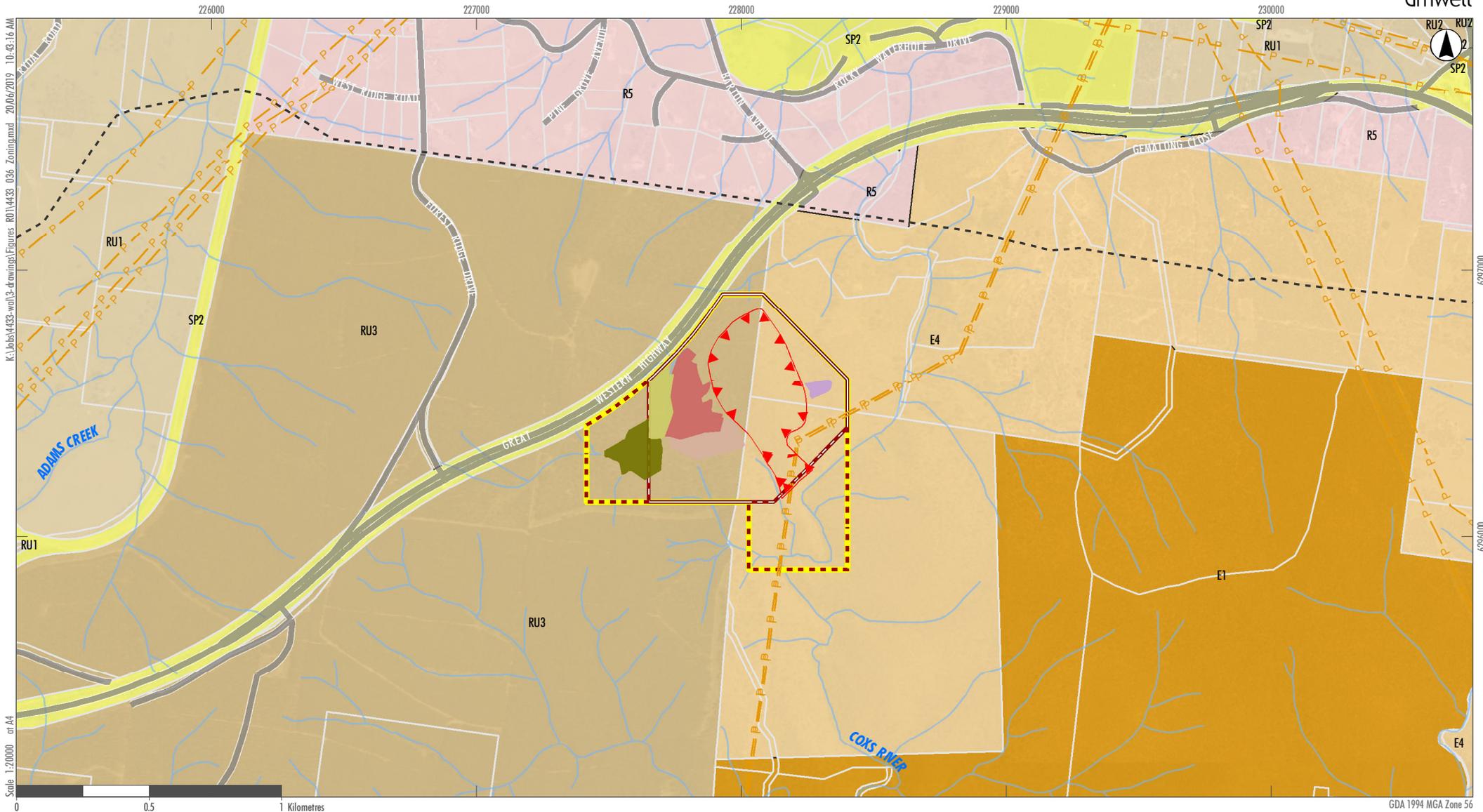
Heritage Conservation

Miscellaneous provision 5.10 of the Lithgow LEP provides for the conservation of:

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

One Aboriginal site (AHIMS Site #45-1-2802⁶) has been identified within the Quarry Site in the form of an open campsite consisting of scattered artefacts on the northern side of the former Hoskins Quarry (refer also to **Section 4.4** and **Figure 4.4**). In accordance with the recommendations provided by the consultant archaeologist and Bathurst Local Aboriginal Land Council at the time, the artefact has been protected and conserved through the installation of a fence.

⁶ Identified in previous environmental documentation as Site WQ1



Legend

- | | | | |
|--------------------------------|---|---------------------------------------|------------------------|
| Quarry Site (ML1633) | Main Stockpile Area (935m AHD) | Land Zoning | RU1 Primary Production |
| Project Site | Southern Stockpile Extension (935m AHD) | E1 National Parks and Nature Reserves | RU2 Rural Landscape |
| Proposed Extraction Area | Western Stockpile Area | E4 Environmental Living | RU3 Forestry |
| Electricity Transmission Lines | Western Stockpile Extension (940m AHD) | R5 Large Lot Residential | SP2 Infrastructure |
| Watercourses | Eastern Stockpile Area | | |
| Cadastre | | | |

Image Source: DFSI (2019) Data source: DFSI (2019); Walker Quarries (2019)

FIGURE 3.2
Local Land Use Zoning and Infrastructure

The Proposed Modification requires this site to be disturbed as it falls (partially) within the extended extraction area (as proposed). Assessment of this proposed disturbance, recommended mitigation and outcomes of consultation with the Registered Aboriginal Parties for the Proposed Modification are provided by OzArk (2019) (see **Appendix 7**) and summarised in **Section 4.4**.

A review of Lithgow LEP 2014 Heritage Map Sheet HER_002F confirms that there are no other identified sites of environmental heritage on or adjoining the Quarry Site.

Earthworks

Additional local provision 7.1 of the Lithgow LEP has the noted objective to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

The impacts of the proposed earthworks of the Proposed Modification are considered throughout **Section 4.0** to address the requirements of Clause 7.1(3).

Flood Planning

Additional local provision 7.2 of the Lithgow LEP has the noted objectives to:

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

A review of Lithgow LEP 2014 Flood Planning Map Sheet FLD_002 confirms that the Quarry Site is not located within the nominated flood planning area. There is no catchment based flood mapping for the Coxs River in the vicinity of the Quarry Site, however, the following provides context to the location of the Quarry Site with respect to the channel of the Coxs River:

- The proposed extensions to the extraction area and stockpile area would remain at least 60 m above the Coxs River channel.
- The bridge of the Great Western Highway traverses the Coxs River between 870 m and 880 m AHD, i.e. at a lower elevation than the extraction or stockpile areas of the Quarry Site.

On the basis of the above, the Quarry Site disturbance would remain well above the 1:100 average recurrence interval (ARI) flood level. A detailed flood impact assessment to address the requirements of Clause 7.1(3) is therefore not required. Aspects of surface water management, including further review of local flooding, is considered in a Surface Water Impact Assessment (see **Appendix 9**) and **Section 4.7**.

Terrestrial Biodiversity

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

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

The proposed disturbance footprint of the Quarry occurs over environmentally sensitive biodiversity, as nominated by the Lithgow LEP 2014 Environmental Sensitive Areas – Biodiversity Map Sheet BIO_002. Further consideration of the impacts of the Proposed Modification on biodiversity is provided by Ecoplaning (2019) (see **Appendix 6**) with a summary included as **Section 4.3**.

3.2.3 Environmental Performance

3.2.3.1 Environmental Monitoring

The Proponent currently undertakes the following monitoring at and surrounding the Quarry:

- Dust is monitored at four deposited dust gauges on and surrounding the Quarry Site.

With exceptions able to be explained by environmental factors external to Quarry operation, the results of this monitoring (see **Table 3.4**) has demonstrated compliance with the criteria of DA 344-11-2001 and EPL 13172 (refer also to **Section 4.7.2.2**).

Table 3.4 Dust Monitoring Results for the last 12 months

Month	Insoluble Solids (g/m ² /month)				Combustible Matter (g/m ² /month)				Ash (g/m ² /month)			
	DG1	DG2	DG3	DG4	DG1	DG2	DG3	DG4	DG1	DG2	DG3	DG4
April	0.6	0.6	0.8	1.0	0.1	0.2	0.2	0.2	0.4	0.4	0.7	0.8
May	0.3	0.3	2.4	0.9	0.1	0.1	0.1	0.3	0.2	0.1	2.2	0.6
June	<0.1	0.3	0.1	0.2	<0.1	0.3	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
July	0.4	0.8	1.6	1	0.2	0.6	0.2	0.4	0.2	0.3	1.4	0.5
August	0.7	0.9	3.9	0.9	0.2	0.2	0.3	0.3	0.5	0.7	3.6	0.6
September	0.9	1.6	0.8	0.8	0.3	0.6	0.2	0.3	0.5	1.0	0.6	0.5
October	0.2	0.4	1.6	0.4	0.2	0.2	0.6	0.3	<0.1	0.2	1.0	0.1
November	3.6	1.0	12	3.0	0.8	0.3	1.5	0.8	2.8	0.8	10	2.2
December	2.7	3.3	3.5	5.1	0.6	0.8	1.0	0.9	2.1	2.5	2.4	4.2
January	2.6	1.5	2.0	2.7	1.0	0.4	0.5	0.7	1.6	1.1	1.5	2.0
February	3.4	1.2	2.3	-	2.0	0.5	0.3	-	1.5	0.7	2.0	-
March	0.3	3.0	3.0	0.8	0.1	0.2	0.3	0.2	0.1	2.7	2.7	0.6
12 month average	1.3	1.2	2.8	1.5	0.5	0.4	0.4	0.4	0.8	0.9	2.3	1.1

- Noise is monitored every six months at receivers surrounding the Quarry.

Since attended noise monitoring was commenced in July 2016, compliance with the noise criteria of DA 344-11-2001 and EPL 13172 have been demonstrated on each occasion.

- Air overpressure and ground vibration are monitored for every blast.

Compliance with the criteria of DA 344-11-2001 and EPL 13172 has been demonstrated on each occasion.

- Water is sampled and analysed on discharge to confirm compliance with the quality criteria of EPL 13172. Water is also sampled annually within the Coxs River upstream and downstream of the Quarry.

Results to date have confirmed compliance with the water quality criteria of EPL 13172, noting that the criteria do not apply under rainfall conditions exceeding 5 day, 95th percentile conditions (55.6 mm over five consecutive days). The Proponent applies an anionic acrylamide copolymer flocculent (HydroBond® HB-4118) to water within the Quarry sediment basins to assist in settlement of water prior to controlled discharge. The MSDS for HydroBond® HB-4118 confirms this product has a LC₅₀ greater than 100mg/L for fish and EC₅₀ greater than 100mg/L for water invertebrates.

- Annual monitoring of remnant vegetation on the Quarry Site is undertaken for Purple Copper Butterfly and its habitat.

Commenced in October 2016, no Purple Copper Butterfly have been identified on the Quarry Site (Lesryk, 2016, 2017, Ecoplanning, 2018). Areas of available habitat remain on the Quarry Site and have been mapped and condition recorded. Other than the disturbance for which approval is sought, the Quarry does not appear to be having any negative effect on the patches of *Bursaria spinosa spp. lasiophylla* which provide habitat for the Purple Copper Butterfly.

Environmental monitoring at the Quarry to date demonstrates general compliance with criteria.

3.2.3.2 Environmental Incidents and Complaints

Complaints

Since January 2014, four complaints have been received. Three of these complaints had concerns relating to noise. Of these, one referred to the noise generated by reversing alarms and was resolved by replacing with low frequency alarms. Another complaint related to loud banging noises and was resolved by modified the method of truck loading. A third anonymous complaint referred to a loud noise at 4.30am with claims of photographic evidence to support night-time activities. The Proponent confirms that no activities outside the approved hours of operation have been undertaken at the Quarry. The fourth complaint received was in regards to a truck driver leaving the site in adverse (foggy) conditions. This was resolved by notifying the driver that he was in breach of the Truck Driver Code of Conduct, issuing a warning and re-inducting the driver to the Quarry site.

Incidents

In October 2016, Walker Quarries was issued with a penalty infringement notice for the unauthorized clearing of vegetation in areas beyond the approved disturbance area. This has since been rectified through the modification for DA 344-11-2001 approved in August 2017. It is to be noted that the contractor responsible was removed from the site and Walker Quarries then began managing the operations.

Other previous incidents include water quality criteria exceedances in June 2016 and March 2017. In both cases, water was discharged following heavy rainfall, conditions under which Walker Quarries assumed the water criteria of EPL 13172 did not apply. The 2018 Independent Environmental Audit (IEA) notes that this exemption was not applicable at the time of the discharges. Additionally, a noise non-compliance was generated due to a delay in noise monitoring which exceeded the six months nominated by the Noise Management Plan. This can be attributed to high wind and a period of reduced operational activities when the monitoring was originally scheduled leading to a delay in completion.

3.2.3.3 Independent Environmental Audit

In accordance with *Condition 13 (of Schedule 5)* of DA 344-11-2001, an Independent Environmental Audit (IEA) for the Wallerawang Quarry was completed by SLR Consulting Australia Pty Limited (SLR) on 12 and 13 April 2018, covering the period from 29 October 2015 (SLR, 2018).

The IEA assessed compliance against the conditions and commitments contained within the following documents:

- DA 344-11-2001, both as originally issued on 19 October 2004 and as subsequently modified on 25 August 2017
- DA 019/18, issued for the construction of two demountable office buildings
- Management Plans prepared as conditional requirements of DA 344-11-2001
- Environment Protection Licence (EPL) 13172 issued by the NSW Environment Protection Authority
- Mining lease (ML) 1633 issued for the period 15 July 2009 to 15 July 2019.

The IEA was submitted on 4 July 2018 and identified a number of non-compliances. Most of the non-compliances were recorded as either administrative non-compliances or low risk with a limited number identified as medium risk.

The major source of non-compliances was attributed to:

- the absence of approval for management plans
- implementation and content of management plans
- implementation of monitoring programs
- environmental reporting.

An Action Plan was prepared to accompany the IEA which documented the approach and schedule to correcting outstanding non-compliances. Confirmation of the actioning of all outstanding non-compliances was provided to the DPE in October 2018.

As noted in response to the IEA, many of the non-compliances were a result of actions taken by a former operator of the Quarry and related to:

- clearing beyond the approved disturbance limit
- discharges to water
- failure to maintain a weather station.

These non-compliances had been rectified at the time of the IEA, either through modification to DA 344-11-2001 or actions taken by the Applicant once it took over as the Quarry operator.

3.2.4 Summary

Considering the results of consultation, review of planning issues and assessment of environmental performance of the Quarry, the following environmental parameters have been identified as potentially affected by the Proposed Modification and therefore requiring assessment.

- **Biodiversity.** The Proposed Modification would require disturbance to additional areas of native vegetation and further assessment is required to assess the significance of this clearing on threatened species, populations or communities and how this could be minimised, mitigated or offset.
- **Cultural Heritage.** The Proposed Modification would require an identified Aboriginal site to be disturbed with further assessment required to assess the significance of this disturbance and identify appropriate management measures.
- **Groundwater.** The extended extraction area would be developed to a depth below the local groundwater table requiring an assessment of the likely impact on other groundwater users.
- **Surface Water.** Several modifications to the flow of water are proposed in order to establish the two extended stockpile areas and further assessment is required to confirm these modifications can be undertaken without adverse impacts on the local hydrological setting.
- **Noise and Air Quality.** With an extension of the extraction and stockpile areas, there is a potential for changes to the exposure of surrounding residential receivers to noise and dust emissions generated by the Quarry.
- **Visual Amenity.** With an increase in disturbance, the potential exposure of the Quarry to surrounding vantage points may be increased.
- **Land Resources (rehabilitation and final land use).** The Proposed Modification requires a modification to the final landform and rehabilitation of the Quarry. This has the potential to impact on local landforms and land use.
- **Bushfire.** By extending the area of disturbance into remnant native vegetation, the risk of bushfire is increased.
- **Socio-economic setting.** The extended life of the Quarry would result in any impacts on the local community (both positive and negative) extending beyond the term of the existing development consent.

Section 3.3 further considers these environmental issues to determine the level of priority and coverage to be assigned to each.

No additional impacts are likely on the following environmental parameters and as such no further assessment has been undertaken.

3.3 Issue Prioritisation and Coverage

For each of the environmental issues identified (refer to **Section 3.2.4**), a preliminary analysis of the possible impacts was undertaken to determine the specific assessment requirements and level of priority associated with each. This analysis was undertaken in conjunction with a review of the currently approved operations to determine whether the Proposed Modification would result in any material change to the impacts assessed originally (and therefore warrant further assessment).

The possible impacts of the Proposed Modification and their level of priority are summarized in **Table 3.5**.

Table 3.5 Summary of Potential Adverse Impacts Resulting from the Proposed Modification.

Environmental Issue	Identification				Potential Effect	Priority/Coverage
	CC	GC	PD	EP		
Biodiversity		✓	✓		The Proposed Modification requires disturbance up to an additional 14ha of remnant native vegetation and has the potential to impact on threatened flora and fauna listed under the NSW <i>Biodiversity Conservation Act 2017</i> and Commonwealth <i>Environmental Protection and Biodiversity Conservation Act 1999</i> . The Biodiversity Offset Scheme applies and assessment in accordance with the Biodiversity Assessment Methodology (BAM) is required.	High Priority. Targeted field survey and assessment in accordance with the BAM has been undertaken and a Biodiversity Development Assessment Report completed by Ecoplanning (refer to Section 4.3 and Appendix 6).
Cultural Heritage		✓	✓		A single Aboriginal heritage site (WQ1) containing 22 artefacts was identified within the Quarry Site boundary (Silcox, 2000). As a consequence of the Proposed Modification, the identified Aboriginal heritage would be disturbed. The proposed extension of disturbance would occur beyond where previous cultural heritage survey has been completed and therefore there is potential that other Aboriginal sites could be identified and impacted.	High Priority. Consultation with the Aboriginal community followed by an archaeological survey of the Quarry Site was completed by OzArk. The results of this consultation and assessment is summarised in Section 4.4 (see also Appendix 7).
Groundwater		✓	✓	✓	The extraction area would extend the depth of the void by up to 70m which could involve interception with the groundwater table. This may result in impacts to: <ul style="list-style-type: none"> • Groundwater bores located both on and surrounding the Quarry site (drawdown and water quality); • Groundwater dependent ecosystems (GDEs); • Base flow to the Coxs River; and • Post quarrying recovery. 	High Priority. A Groundwater Impact Assessment has been undertaken by Jacobs to assess the potential impacts of the Proposed Modification on the existing groundwater regime (refer to Section 4.6 and Appendix 8). Additionally, three groundwater bores have been installed across the Quarry site to obtain additional detail on the local groundwater table.

Environmental Issue	Identification				Potential Effect	Priority/Coverage
	CC	GC	PD	EP		
Surface Water		✓	✓		Changes to the local hydrological regime are proposed which could impact on flows to the Coxs River. Furthermore, the proposed increase in the disturbance footprint increases the potential for pollution to local watercourses.	Medium Priority. A Surface Water Impact Assessment has been commissioned to provide engineering solutions for the proposed hydrological modifications and demonstrate that the Proposed Modification may be undertaken without impact on local water quality or availability (refer to Section 4.7 and Appendix 9).
Visual Amenity	✓	✓			The approved Quarry takes into account the potential impact on the visual amenity of properties to the north of the Quarry Site. It is understood the initial 10 year limit on operations was implemented to allow for future consideration of visual impacts prior to any further quarry operations. Given the proposed increase in disturbance proposed, it is possible that the visibility of the Quarry may be increased and impact adversely on the amenity of landowners to the north.	Medium Priority. An assessment of the potential exposure of the extended extraction area and stockpiles from key vantage points to the north of the Quarry Site has been undertaken to demonstrate the Proposed Modification may proceed without adversely impacting on local visual amenity (refer to Section 4.8).
Noise		✓	✓		The Proposed Modification would result in the various noise and dust generating activities of the Quarry Site being relocated. While no new noise or air emission sources are proposed, the altered locations of these could result in an increase in the noise or particulate matter levels received at sensitive receivers surrounding the Quarry Site.	Medium Priority. A Noise Impact Assessment has been undertaken by MAC to assess the predicted noise emissions against relevant criteria (refer to Section 4.9 and Appendix 10).
Air Quality	✓	✓	✓			Medium Priority. An Air Quality Impact Assessment has been undertaken by Ramboll to assess the predicted air emissions against relevant criteria (refer to Section 4.10 and Appendix 11).
Land Resources (Rehabilitation, Final Landform and Land Use)	✓	✓	✓		The Proposed Modification would result in a reasonably significant change to local topography with a void to 860m AHD retained, drainage lines diverted and overburden emplacements all requiring rehabilitation.	Low Priority In consultation with the three landowners over which the Quarry Site is developed, a final landform which provides a secure, stable and non-polluting landform has been provided (refer to Section 4.11).
Traffic					No changes are proposed.	No further assessment required.

Environmental Issue	Identification				Potential Effect	Priority/Coverage
	CC	GC	PD	EP		
Waste Management					Other than management of overburden, which is assessed in relation to impacts on other environmental factors, no changes are proposed.	No further assessment required.
Bushfire		✓			With an increase in the disturbance footprint and increase in Quarry life, the potential for a bushfire incident on the Quarry Site is increased.	Low Priority. The proposed management of the Quarry under the existing Bushfire Management Plan has been reviewed (refer to Section 4.12).
Socio-economic Setting		✓			The Quarry provides a source of employment and economic contribution to the Lithgow economy which would be continued should the Proposed Modification be approved. The Quarry has the potential to impact negatively on the local Wallerawang community as a result of environmental and amenity impacts.	Low Priority. The relative costs (impacts) and benefits (contributions) of the Proposed Modification are reviewed and assessed (refer to Section 4.13).

CC = Community Consultation

GC = Government Consultation and Environmental Assessment Requirements

PD = Planning and Policy Documents

EP = Environmental Performance

4.0 Environmental Assessment

4.1 Introduction

This section provides an assessment of the impacts associated with those features of the local environment which could potentially be affected by the Proposed Modification. The proposed design and/or operational safeguards and an assessment of the level of impact the Proposed Modification may have after implementation of these safeguards is also described.

4.2 Local Land Ownership and Sensitive Receivers

Figure 4.1 displays land ownership information on and surrounding the Project Site. It is noted that Sitegoal Pty Ltd, who owns Lot 6 DP872230 on which a part of the Project Site is located, and Mr Connor McRae, the owner of Lot 7 DP872230, are both associated with the Applicant which provides a buffer to neighbouring properties to the north. Large portions of land to the west, south and east are Crown land which also provides a buffer to private landholdings.

There are no sensitive receivers such as schools, churches or community facilities within 1 km of the Project Site, with Wallerawang Public School located approximately 1.3 km north of the Project Site on Barton Avenue, Wallerawang. The town of Wallerawang is located approximately 1.8 km to the north-northwest of the Project Site.

The dam wall of Lake Wallace (a prescribed dam under the *Dams Safety Act 1978* and referred to as the Wallerawang Dam), is located approximately 800 m from the Project Site. The Project Site is located within the notification area of the Wallerawang Dam.

24 residential receivers have been identified within approximately 1 km of the Project, the majority of these located on Rocky Waterhole Drive (four), Cypress Place (four), Beacroft Place (four), Pine Grove Avenue (five) and Gemalong Close (four) (see **Figure 4.1**).

4.3 Biodiversity

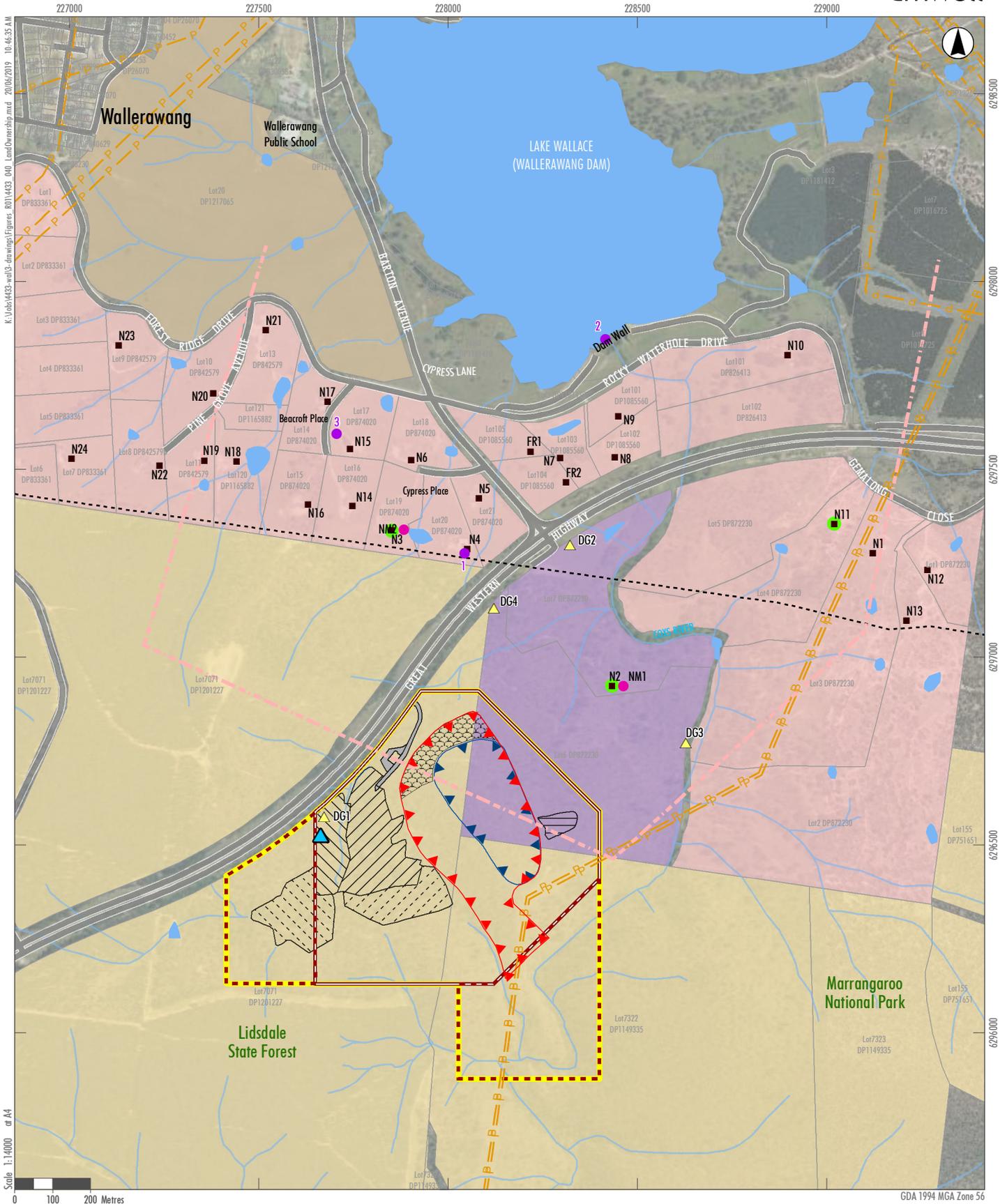
4.3.1 Introduction

A Biodiversity Development Assessment Report (BDAR) has been prepared for the Proposed Modification by Ecoplanning Pty Ltd (Ecoplanning, 2019). The BDAR was prepared in accordance with the assessment requirements of the NSW OEH who required the potential impacts of the Proposed Modification to be assessed in accordance with *Section 7.9* of the *Biodiversity Conservation Act 2016* (BC Act) and the Biodiversity Assessment Method (BAM) (OEH, 2017).

In accordance with the BAM (OEH, 2017), the BDAR was completed in two stages, namely:

- Stage 1 – biodiversity assessment: which provides the site context including landscape features, native vegetation and threatened species; and
- Stage 2 – impact assessment: which identifies measures to avoid and minimise impacts, assesses the residual impacts to biodiversity, and identifies offset (biodiversity credit) requirements.

The following sub-sections provide a summary of the BDAR, a complete version of which is provided in **Appendix 6**.



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Scale 1:14000 at A4

Legend

- Project Site
- Quarry Site Extension
- Quarry Site (ML1 633)
- Proposed Extraction Area
- Approved Extraction Area
- Wallerawang Dam Notification Area
- ▲ Quarry Automatic Weather Station
- Blast Monitor
- ▲ Air Quality Monitoring Locations
- Residential Receiver Locations
- Attended Noise Monitoring Locations
- Unattended Noise Monitoring Locations
- Main Stockpile Area (935m AHD)
- Southern Stockpile Extension (935m AHD)
- Western Stockpile Area
- Western Stockpile Extension (940m AHD)
- Eastern Stockpile Area
- Cobble Extraction Area (920m AHD)

- Land Ownership**
- Crown Land
 - Lithgow City Council
 - Private landholdings
 - Quarry-related

FIGURE 4.1

Land Ownership, Sensitive Receivers and Monitoring Locations

4.3.2 Assessment Methodology

The land within the Project Site that was assessed as a part of the BDAR, comprises approximately 32.2 ha and is termed the Subject Land (refer **Figure 4.2**). The Subject Land comprises areas within the Project Site that are likely to be disturbed but does not include cleared areas, nor areas of native vegetation within the approved extraction area for the Quarry (for which approval to disturb has already been obtained).

The assessment of biodiversity values for the Subject Land included both desktop and field methods.

Desktop survey was undertaken to develop a candidate list of threatened flora and fauna species and threatened ecological communities (TECs) that have previously been recorded or are predicted to occur within 1.5 km of the boundary of the Project Site. Desktop survey methods undertaken included:

- Searches of relevant databases and government mapping of biodiversity features.
- Identification of IBRA subregions and NSW Landscape Regions to define the landscape context.
- Review of recent and relevant literature including other ecological reports and surveys undertaken in the vicinity of the Quarry.
- Targeted field surveys were undertaken in accordance with Section 6.5 of the BAM and OEH threatened species survey guidelines and included undertaking surveys during the nominated survey period specified for each candidate species. The field surveys were undertaken in the months of July to November 2018, and in March 2019, comprising 11 days in total for flora, and 16 days for fauna. Survey methods included a range of techniques including targeted searches, parallel traverses, call playback, ultrasonic sound detection (Anabat), spotlighting, remote camera trapping and active searches.

A full description of desktop and field survey effort and methods employed are described in detail in **Appendix 6**.

4.3.3 Key Biodiversity Values

4.3.3.1 IBRA Subregion and NSW Landscape Region

The Hill End IBRA subregion and Mount Horrible Plateau NSW Landscape Region were used for the purposes of the BDAR and credit calculations within the BAM Calculator.

4.3.3.2 Native Vegetation

Two plant community types (PCTs) covering an area of 14.1 ha were identified within the Subject Land (refer **Figure 4.2**).

- PCT 732 – *Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion*, comprising 5.5 ha of the vegetation on the Subject Land.
- PCT 1093 – *Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion*, comprising 8.6 ha of the vegetation on the Subject Land.

It should be noted that approximately 0.3 ha of PCT 1093 within the Subject Land is located within a 330Kv powerline easement, and this vegetation has been slashed and cleared by the operators of the powerline. This area is referred to in this report as “PCT 1093 – Slashed”.

These PCTs are not identified within the BioNet Vegetation Classification as Threatened Ecological Communities (TECs), and TECs are therefore not discussed further in this report.

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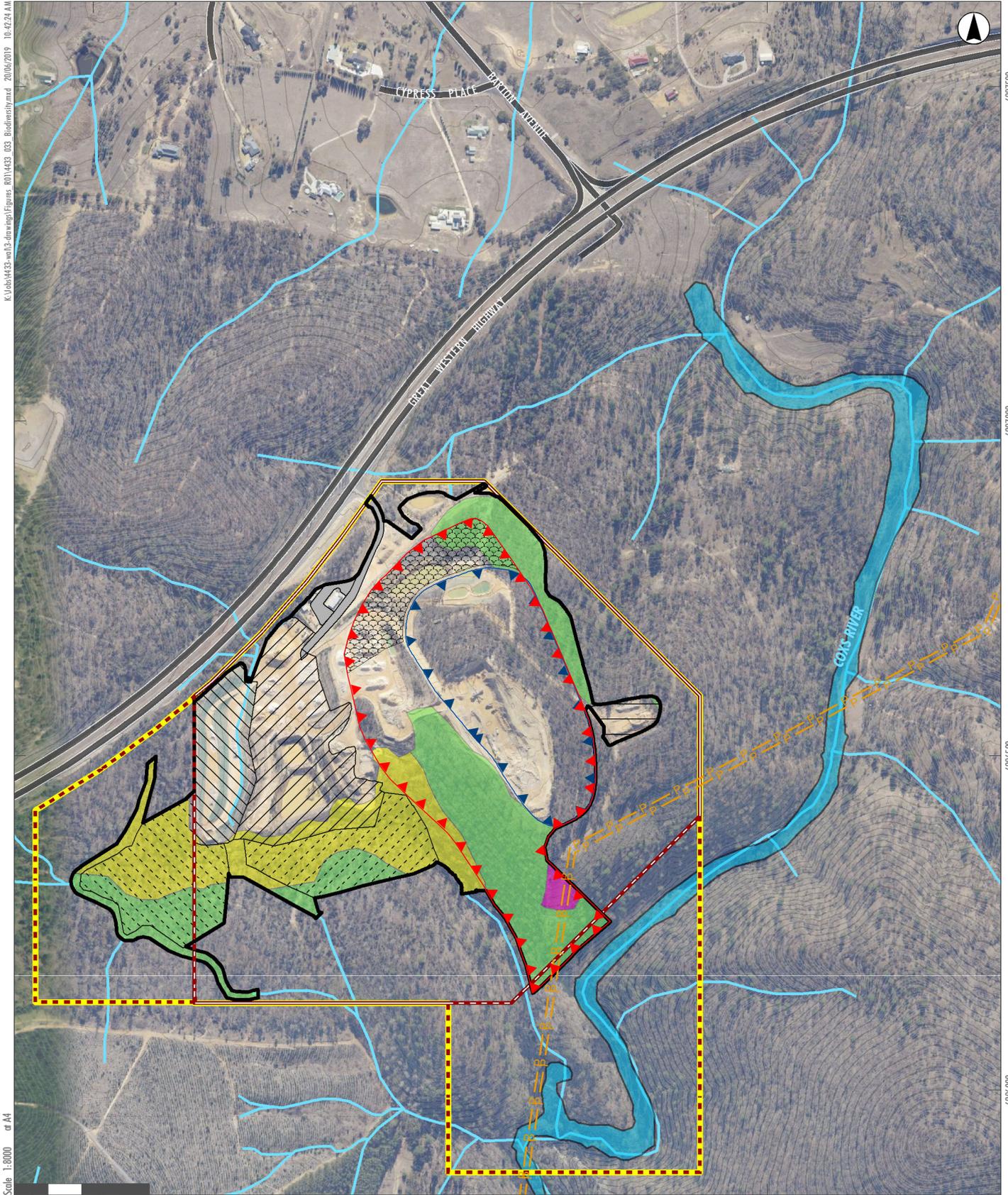
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GDA 1994 MGA Zone 56

Legend

- ▼ Approved Extraction Area
- ▼ Proposed Extraction Area
- Project Site
- Quarry Site Extension
- Quarry Site (ML1633)
- Existing Contours (1m)**
- Contour Major
- Contour Minor
- Main Stockpile Area (935m AHD)
- Southern Stockpile Extension (935m AHD)
- Western Stockpile Area
- Western Stockpile Extension (940m AHD)
- Eastern Stockpile Area
- Cobble Extraction Area (920m AHD)
- Local Wetlands (DEC, 2006)
- Subject Land (EcoPlanning, 2019)
- Plant Community Type**
- 732 – Broad-leaved Peppermint Ribbon Gum grassy open forest, Intact
- 1093 - Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest, Intact
- 1093 - Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest, Slashed

FIGURE 4.2

Plant Community Types of the Project Site

4.3.3.3 Drainage Lines

There are three minor drainage lines of Stream Order 1 to 3 that traverse the eastern part of the Subject Land. These drainage lines were identified as generally dry gullies with no aquatic flora present. The Coxs River is a 6th order stream which is located to the east of the proposed Quarry expansion area. Riparian scrub vegetation lines the banks of the river.

Based on the DPI Fisheries framework, an assessment of key fish habitat type and class determined that these drainage lines are considered unlikely to provide key fish habitat. A review of Freshwater Threatened Species Distribution Maps (DPI Fisheries, 2016) showed no threatened fish species were recorded in any of the tributaries within the Subject Land or within the Coxs River adjacent to the Subject Land.

4.3.3.4 Wetlands

No important wetlands, as defined by BAM, are present within or in the vicinity of the Subject Land.

The narrow band of vegetation which occurs along the banks of the Coxs River to the east of the Project Site (refer **Figure 4.2**) constitutes a local wetland as this area supports vegetation and flora species which are adapted to, and depend on, moist conditions for at least part of their life cycle. There are no local wetlands present within the Subject Land.

4.3.3.5 Groundwater Dependent Ecosystems

BoM mapping of Groundwater Dependent Ecosystems (GDEs) indicates the potential presence of terrestrial GDEs within the Subject Land (see **Figure 4.3**). As discussed in **Section 4.6**, existing groundwater depth and potential groundwater drawdown has been modelled for the Project Site and adjacent areas, with depth to groundwater across the Subject Land found to be greater than 10 m below the ground surface. The BDAR notes that research into sclerophyllous eucalyptus woodland suggests that groundwater uptake is unlikely to occur where depth to groundwater is greater than approximately 10 m. Consequently, the vegetation within the Subject Land is unlikely to be accessing groundwater and is unlikely to represent a terrestrial GDE.

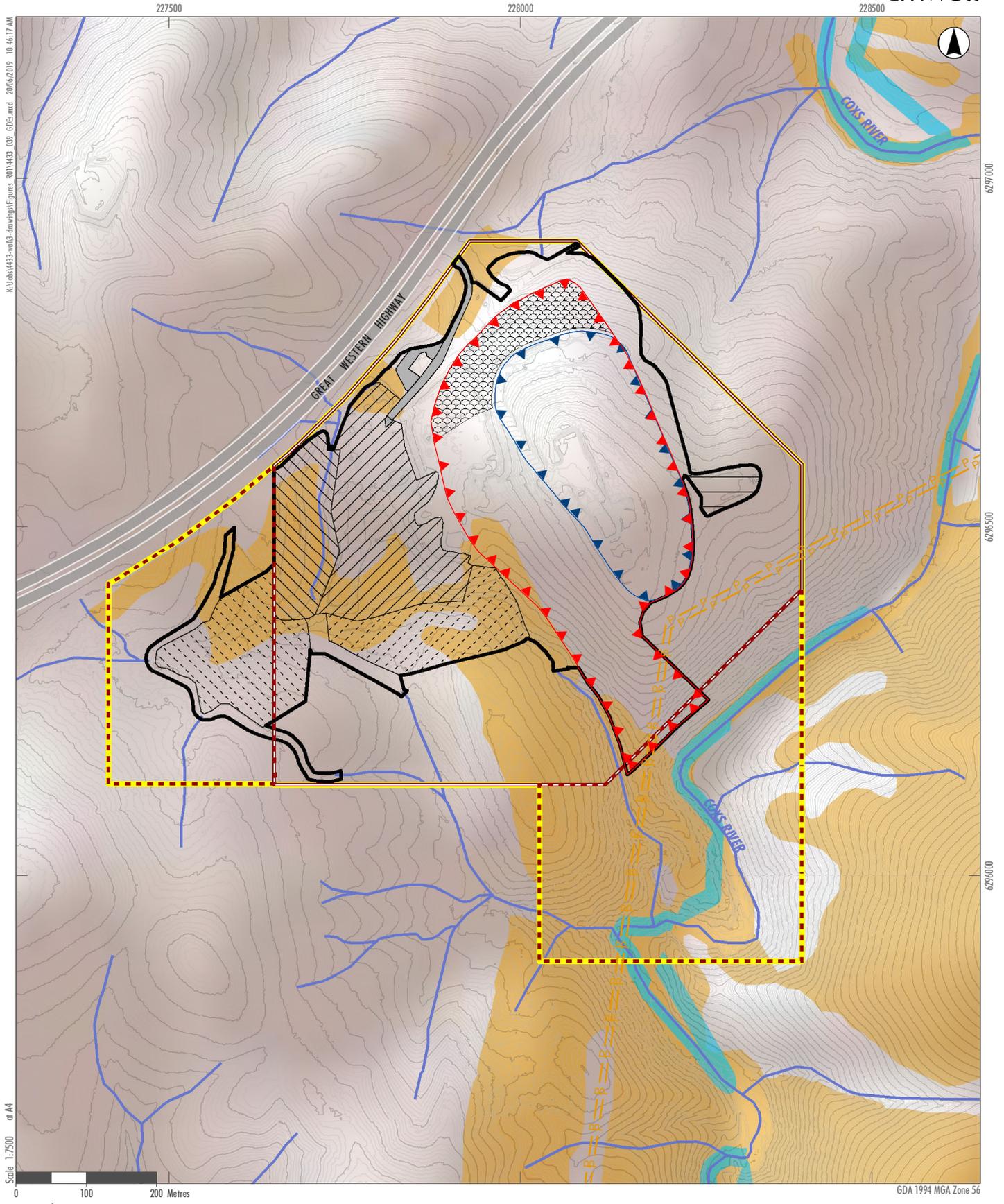
BoM mapping indicates that there are no aquatic GDEs within the Project Site, however a potential aquatic GDE is located along the Coxs River to the east of the proposed Quarry expansion area (see **Figure 4.3**). This GDE is likely to be associated with the riparian scrub vegetation along the banks of the river, and dependent on flows within the Coxs River.

4.3.3.6 Threatened Flora and Fauna Species

The BAM categorises species as either ecosystem credit species or species credit species which are defined as:

- Ecosystem-credit species – Species that can be reliably predicted to occur in PCTs and have a high likelihood of occurring on the site. Therefore, targeted surveys for ecosystem-credit species are not required and potential impacts to these species are assessed in conjunction with impacts to PCTs.
- Species-credit species – Species that cannot be reliably predicted based on a PCT, distribution or habitat criteria. These species require a targeted survey effort or an expert report to confirm their presence or absence on the site.

Some threatened species are identified as both ecosystem- and species-credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit.



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GDA 1994 MGA Zone 56

Legend

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|----------------------------------|---|----------------------------|
| Approved Extraction Area | Existing Contours (1m) | Potential Aquatic GDEs |
| Proposed Extraction Area | Contour Major | Potential Terrestrial GDEs |
| Project Site | Contour Minor | |
| Quarry Site Extension | Main Stockpile Area (935m AHD) | |
| Quarry Site (ML1633) | Southern Stockpile Extension (935m AHD) | |
| Subject Land (Ecoplanning, 2019) | Western Stockpile Area | |
| | Western Stockpile Extension (940m AHD) | |
| | Eastern Stockpile Area | |
| | Cobble Extraction Area (920m AHD) | |

FIGURE 4.3

Potential Groundwater Dependent Ecosystems of the Project Site

Image Source: NSW LPI Data source: Walker Quarries 2019; EcoPlanning (2019), Bureau of Meteorology GDE Atlas

The BAM calculator was utilised to provide a list of threatened species likely to occur within the Subject Land. This list included the following species recorded within or in proximity to the Subject Land during previous fauna surveys in the area:

- Purple Copper Butterfly (*Paralucia spinifera*) (recorded in 2002)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) (recorded in 1999)
- Varied Sittella (*Daphoenositta chrysoptera*) (recorded in 2016)
- Scarlet Robin (*Petroica boodang*) (recorded in 2016)
- Gang-gang Cockatoo (*Callocephalon fimbriatum*) (recorded in 2016).

Annual monitoring for the presence of Purple Copper Butterfly since 2016 has failed to identify the species on the Project Site, despite the species being recorded at other locations within the locality. It is considered likely that this species no longer inhabits the Subject Land.

The Quarry Site has been identified as comprising only a minor portion of the range of the Yellow-bellied Sheathtail-bat, Varied Sittella and Scarlet Robin, with significant areas of equivalent habitat available in the immediate surrounds. Targeted field surveys for the Project did not detect any of these species, nor any evidence of roosting/nesting, within the Subject Land.

The Gang-gang Cockatoo was recorded in 2016 foraging to the north-east of the Subject Land, however there was no evidence of breeding within the Quarry Site. Targeted field surveys for the Project did not detect any individuals nor any evidence of nesting within the Subject Land.

Ecosystem-Credit Species

The BDAR noted that 28 ecosystem-credit species were predicted to occur within the Subject Land, comprising 20 bird, two reptile and six mammal species (including four bat species). All ecosystem-credit species that were predicted to occur in association with the PCTs within the Subject Land were included in the impact assessment.

Targeted surveys for the Project identified two ecosystem-credit species as being present on the Subject Land, namely the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), and the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). Habitat for these species within the Subject Land is restricted to foraging habitat, and therefore the impacts to these species have been assessed in conjunction with the assessment of impacts to PCTs.

Species-Credit Species

The BDAR identified five flora and 15 fauna species-credit species as potentially occurring within the Subject Land. However, targeted surveys did not record any threatened flora or fauna species-credit species on the Subject Land.

4.3.3.7 Matters of National Environmental Significance (EPBC Act)

The EPBC Act protects identify Matters of National Environmental Significance (MNES), such as threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places (among others). Any actions that will, or are likely to, have a significant impact on the matters of MNES require referral and approval from the Australian Government Environment Minister.

A search of the Protected Matters Search Tool was completed by Ecoplaning Pty Ltd to identify MNES that may occur in, or may relate to, the Project Site and an approximately 10 km buffer. None of the identified

MNES were identified by field survey completed by Lesryk Pty Ltd and EcoPlanning Pty Ltd between 2016 and 2018. One MNES species, the Purple Copper Butterfly has previously been recorded within the subject land in 2002 (Wildthing Environmental Consultants, 2002). Habitat for one another MNES species, the Koala, is provided by the 5.5 ha of PCT 732 to be disturbed. No other MNES have been recorded within the Project Site or considered likely to be impacted by the Proposed Modification.

Purple Copper Butterfly

As noted in **Section 4.3.3.6**, annual monitoring has failed to identify the species on the Project Site and it is concluded (EcoPlanning, 2019) that this species is no longer on the Project Site.

Koala

With reference to the *EPBC Act Referral Guidelines for the Vulnerable Koala* (DoE 2014), EcoPlanning Pty Ltd assess the Project Site as providing 5.5 ha of moderate habitat. Considering this along with other factors including, the low Koala density within the site and surrounds, the lack of new or exacerbated threats, reduced area of impact (5.5 ha) relative to the area of habitat contiguous with the site (> 1000 ha), the proposed action is unlikely to interfere with the recovery of the species, the Proposed Modification is considered unlikely to significantly impact upon the Koala and does require referral to the Department of the Environment and Energy.

4.3.4 Impact Avoidance, Minimisation and Mitigation Measures

4.3.4.1 Impact Avoidance

During project planning, the Applicant implemented various measures to avoid and minimise impacts on native vegetation and biodiversity values. These measures included reducing the size of the project disturbance footprint, rationalising the size and location of stockpile expansion areas, and ensuring extraction rates remain within current approved limits. These project alternatives, which are discussed in detail in **Section 2.11**, would have resulted in increased clearing of native vegetation, impacts to connectivity of habitat, additional impacts to aquatic systems and values, and potentially increased indirect impacts such as vehicle strike due to an increase in extraction activities creating additional vehicular movements.

By rationalising the project design and approach, the overall impact of the project on native vegetation and biodiversity values has been minimised.

4.3.4.2 Impact Minimisation

The development of the extended extraction and stockpile areas has been planned in a staged manner (refer to **Figures 2.2** and **2.6 to 2.8**). This reflects the fact that development to the full extent identified on **Figures 2.1** and **Figure 2.2** may not be required over the life of the Quarry.

As discussed in **Section 2.3.3**, disturbance associated with the extraction area would be restricted to that required for the following 12 months activities. Over the life of the Quarry, extension to the full extent of the proposed extraction area may not occur should production levels not achieve the maximum annual levels. As discussed in **Section 2.5.1.1**, should markets for low grade or non-quartzite materials currently considered overburden be identified, the development of the Western Stockpile Extension may not be required. The staged approach to disturbance would ensure that the area of vegetation clearance is minimised over the life of the Quarry.

4.3.4.3 Impact Mitigation

The Applicant would continue to undertake clearing and other activities with the potential to impact, both directly and indirectly, on biodiversity in accordance with a Biodiversity Management Plan (BMP). The BMP details the Quarry's vegetation clearing protocols, noise and dust management, requirements for salvage and re-use of environmental resources (e.g. hollow-bearing trees, topsoil, coarse woody debris), weed and feral pest management, and erosion and sedimentation controls. On determination of the Proposed Modification, the BMP will be updated to reflect the modified operations.

4.3.5 Assessment of Impacts

The Proposed Modification would directly impact biodiversity values through the clearing of up to 14.1 ha of native vegetation. **Table 4.1** outlines the maximum impact on vegetation communities and the biodiversity credits required to be offset to counterbalance this impact. No species-credits are required to offset the residual impacts of the Project.

Table 4.1 Ecosystem-Credit Requirements

Vegetation (PCT)	Vegetation Integrity Score	Area Impacted (ha)	Credit Requirement
PCT 732	88.8	5.5	214
PCT 1093	74.1	8.3	268
PCT 1093 – Slashed	45.0	0.3	5
Totals		14.1	487

The Proposed Modification is to be undertaken in a staged manner and the BDAR also provides the credits for each of the disturbance stages identified on **Figure 2.2**. **Table 4.2** identifies the credit requirements for each of the disturbance stages.

Table 4.2 Staged Ecosystem-Credit Requirements

Stage	Vegetation (PCT)	Area (ha)	Proportion of Total Area (%)	Credit Requirement	
				PCT 1093	PCT 732
1	PCT 1093 – Intact	1.14	14.1	38	
	PCT 1093 – Slashed	0.01	4.0	1	
2A	PCT 1093 – Intact	0.15	1.8	5	
	PCT 732 – Intact	0.25	4.5		10
2B	PCT 1093 – Intact	0.63	7.6	20	
	PCT 732 – Intact	2.42	43.7		93
3	PCT 1093 – Intact	1.75	21.2	57	
	PCT 1093 – Slashed	0.24	96.0	4	
	PCT 732 – Intact	0.92	16.6		36
4	PCT 1093 – Intact	1.2	14.5	39	
5	PCT 1093 – Intact	1.61	19.5	52	

Indirect impacts associated with the Proposed Modification may include impacts arising from noise, dust, vehicle strike, edge effects and/or erosion associated with the Proposed Modification. However, given the Project Site is located directly adjacent to the existing Quarry operations, and that the Proposed Modification

is an extension of existing operations, it is considered unlikely that any indirect impacts on ecological values would be significantly increased beyond those that may be generated by the existing Quarry.

4.3.6 Biodiversity Offsets

In accordance with *Section 10.3.1* of the BAM, and as shown in **Table 4.1**, all vegetation zones within the subject land have current vegetation integrity scores of greater than 20 and therefore require offsets. The BDAR provides the offset rules that will apply to both impacted PCTs.

The measures proposed to address the offset obligation of the Proposed Modification are to be documented in an updated Biodiversity Offset Strategy (BOS) for the Quarry. Initial investigations have commenced to identify credits available for purchase, land available to purchase and enter into a Biodiversity Stewardship Agreement (BSA) and the costs of credits through payment into the Biodiversity Conservation Fund (BCF). An assessment of the vegetation on the remaining vegetation of Lot 6 DP872230 has been undertaken providing for:

- 59 credits for PCT 732
- 17 credits for PCT 1093.

The vegetation of Lot 6 continues onto Lot 7 DP 872230 (of equivalent size and vegetation types) which the Applicant also has access to through a landowner associated with Walker Quarries Pty Ltd. It is likely a similar number of credits, or more noting that Lot 7 retains a larger proportion of cypress pine for which removal and reinstatement of native woodland could generate more credits, could be identified and be available for retirement.

Considering there would remain a shortfall in the number of credits available on land to which the Applicant has current access, the Applicant is likely to implement a combination of measures to retire the required credits. An initial BSA may be created to allow for the retirement of credits associated with Disturbance Stages 1 and 2, with payment into the BCF and purchase of credits on the open market as an option should the Applicant not identify and establish a further BSA or BSAs for the retirement of credits for Stages 3 and beyond. Rehabilitation of impacted areas in accordance with any published 'ancillary rules' under Section 6.5 of the BC Reg may also be used to generate the required credits.

As indicated above, the Applicant proposes that the BOS would provide for a staged retirement of biodiversity credits to reflect the length of time before some stages of the Quarry would be disturbed (if ever), the changing value placed on the biodiversity credits and development of the biodiversity offset credit market (which may require reduced reliance on the development of BSAs or contribution to the BCF). This notwithstanding, the BOS would provide for retirement of the biodiversity credits for each disturbance stage within 12 months of commencement of disturbance within each stage.

4.4 Aboriginal Cultural Heritage

4.4.1 Introduction

A detailed Aboriginal Cultural Heritage Assessment (ACHA) has been undertaken by OzArk Environmental and Heritage Management Pty Ltd (OzArk, 2019) to identify and assess the Aboriginal heritage constraints relative to the proposed extensions to the Quarry Site. The assessment also identifies potential impacts to heritage sites, objects, places, or values, and provides management and mitigation measures.

The ACHA forms a part of the Aboriginal and Historic Cultural Heritage Assessment Report (AHCHAR) prepared by OzArk (2019). This section provides a summary of the key findings of the AHCHAR, which can be reviewed in full as **Appendix 7**.

4.4.2 Assessment Methodology

4.4.2.1 Approach and Objectives

The ACHA was undertaken in accordance with the requirements of State and Commonwealth legislation and guidelines, including the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *National Parks and Wildlife Act 1974* (NPW Act)
- *The Burra Charter* (Australia ICOMOS 1999)
- *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (Code of Practice; DECCW 2010a)
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs) (DECCW 2010b).

The objectives of the ACHA were as follows:

- to ensure compliance to the Code of Practice and ACHCRs
- to undertake appropriate consultation with and involvement of the Registered Aboriginal Parties (RAPs)
- to identify Aboriginal sites, objects, or places within the Project Site
- to determine the significance of any Aboriginal sites, objects, or places
- to assess the likely impacts of the project on Aboriginal heritage, and develop management measures and recommendations.

The ACHA incorporated consultation to identify local Aboriginal stakeholders with knowledge of the archaeological and historical setting, review of previous studies and databases, field survey to search for sites of Aboriginal significance and landform assessment and predictive modelling to determine the potential for unidentified sites to be present. **Sections 4.4.2.2 to 4.4.2.6** summarise these methods.

4.4.2.2 Consultation Process

Consultation with the Aboriginal community (including RAPs) was undertaken in accordance with the Code of Practice and ACHCRs. The consultant process was conducted over the following stages:

Stage 1: May 2018 – Formal notification of the development, including seeking registration of interest from Aboriginal parties. The following ten RAPs registered interest in the project:

- Yurrandaali Cultural Services
- Barraby Cultural Services
- Muragadi Heritage Indigenous Corporation
- Yulay Cultural Service

- Mingaan Wiradjuri Aboriginal Corporation
- Merrigarn
- Murra Bidgee Mullangari Aboriginal Corporation Heritage
- Warrabinga Native Title Aboriginal Corporation
- Gundungurra Tribal Council Aboriginal Corporation
- Bathurst Local Aboriginal Land Council

Stage 2/3: July 2018 – Information on the proposed development was sent to all RAPs. Feedback was received from five RAPs, endorsing the project. No response was received from the remaining RAPs. Information about cultural significance was also gathered during this stage.

Stage 3: August 2018 – Field survey was undertaken, including participation from two RAPs.

Stage 4: April 2019 – The draft AHCHAR was provided to RAPs for review and comment. OzArk (2019) confirms the RAPs acceptance of the proposed management of Aboriginal heritage.

Full details of the consultation process undertaken are documented the AHCHAR (see **Appendix 7**).

4.4.2.3 Previous Studies and Known Heritage

There have been a small number of archaeological investigations undertaken in the local and regional area. Of direct relevance, a study of the Aboriginal archaeological values was undertaken for the original Quarry development application (Silcox, 2000). During the field assessment, Silcox (2000) recorded one Aboriginal archaeological site (“WQ1”) (refer **Figure 4.4**), comprising an open artefact scatter of approximately 22 artefacts, dispersed over an area of 0.2 ha and situated on a gentle to moderate slope. WQ1 is currently protected from Quarry operations by fencing with signage noting the area as culturally sensitive.

In March 2018, OzArk was commissioned to further assess Site WQ1 to review the analysis of Silcox (2000). OzArk reported that while Quarry related ground disturbance impacts had not occurred, general erosion and surface sediment wash had impacted the site, with only 16 artefacts remaining, predominantly in the southern portion of the site. It was also identified that WQ1 had not been registered on the Aboriginal Heritage Information Management System (AHIMS) with OzArk completing this in July 2018 (now identified as AHIMS Site #45-1-2802).

In June 2018, OzArk completed a search of AHIMS database. The AHIMS database identified 48 registered sites within a 10 km radius of the Quarry, with only one site (WQ1 / Site #45-1-2802) located within the Project Site. Of the 48 sites, the majority occur within 200 m of a watercourse, and are typically artefact scatters and isolated finds identified on eroding creek banks, spurs and elevated flat areas overlooking watercourses. Rock shelters and grinding grooves had a moderate occurrence in the search radius, primarily within landforms containing escarpments and outcropping rock.

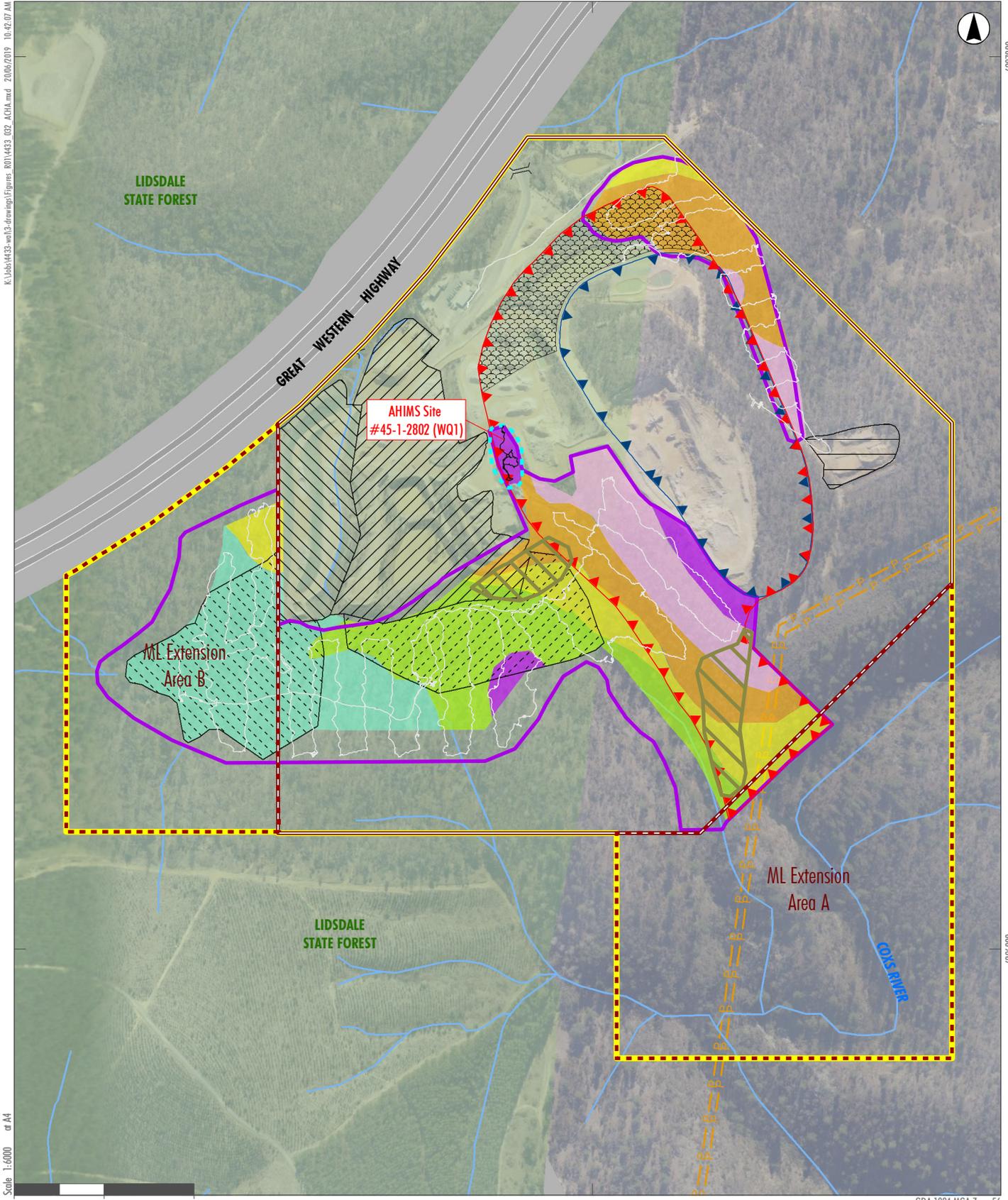
A search for active native title claims and other agreements was completed by OzArk in October 2018. One Native Title Claim (Warrabinga-Wiradjuri #7) and one Deed of Agreement have been identified over the area of the Project Site. As discussed in **Section 3.2.2.1**, native title rights are deemed to have been extinguished on the Lots 7071 DP1201227 and Lot 7322 DP1149225 by virtue of the reservation of this land as a stock route under the *Crown Lands Alienation Act 1861* (NSW). The Deed of Agreement between the Applicant and Gundungurra Tribal Council Aboriginal Corporation was formed in October 2007 with the term to expire upon completion of the mining project.

An overview of the other historical archaeological research undertaken, including a summary of key information on investigation type and area, and a summary of the findings from database searches is provided in the AHCHAR (refer to **Appendix 7**).

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Project Site	Pedestrian Transect Mar 2018	Cobble Extraction Area (920m AHD)
Quarry Site (ML1633)	Approved & Proposed Quarry Layout	Landform
Quarry Site Extension	Approved Extraction Area	Crest
Watercourses	Proposed Extraction Area	Upper Slope
Electricity Transmission Lines	Main Stockpile Area (935m AHD)	Mid - Upper Slope
State Forest	Southern Stockpile Extension (935m AHD)	Mid Slope
Extent of Registered AHIMS Site	Western Stockpile Area	Low - Mid Slope
Heritage Study Area	Western Stockpile Extension (940m AHD)	Lower (Drainage)
Pedestrian Transect Aug 2018	Eastern Stockpile Area	Inaccessible-unstable landforms

Image Source: DFSI Data source: Oz Ark EHM (2019)

FIGURE 4.4
Aboriginal Cultural Heritage
of the Project Site

4.4.2.4 Field Survey

An Aboriginal archaeological field survey was undertaken on 29 August 2018, led by a qualified archaeologist from OzArk, and attended by representatives from two RAPs:

- Gundungurra Tribal Council Aboriginal Corporation
- Bathurst Local Aboriginal Land Council.

There were no objections to the manner in which the survey was implemented and completed. The field survey included pedestrian traverses and targeted inspections over accessible areas of the Project Site (refer to **Figure 4.4**). While some areas were inaccessible due to steep terrain, the effective field survey area covers approximately 16.35 ha of the Project Site and includes the majority of the proposed disturbance footprint of the Quarry extension. During the field survey, landform change was discussed and the manner in which the survey was proposed was discussed and agreed upon prior to its enactment.

In the absence of the field survey over areas deemed unsafe to access, these areas were assessed in accordance with due diligence principles, given the low potential for sites to be located in this area.

4.4.2.5 Landform Assessment

An assessment of the topographical features within the Heritage Study Area was undertaken to identify landforms within the project footprint that may have encouraged past Aboriginal land use and occupation. The Heritage Study Area was found to comprise six landforms as described in **Table 4.3** and shown in **Figure 4.4**. The landforms within the Heritage Study Area were found to have undergone a moderate level of clearing and past disturbance associated with the clearing and formation of access roads, fencing and easement corridors. The assessment identified that the landforms most likely to contain intact Aboriginal sites are the lower slopes adjacent to drainage lines. Other landforms in the study area were found to be too steep or erosive for the retention of archaeological objects or deposits.

Table 4.3 Landforms of the Project Site

Landform	Description	Percentage of the Heritage Study Area
Crest	Raised area with a confined summit.	5%
Upper Slope	Sloping land adjoining hill tops or ridges. In the Heritage Study Area upper slopes are very steep between 20° and 25° slope.	14%
Mid-Upper Slope	Sloping land between the mid and upper slope landforms. In the Heritage Study Area mid – upper slopes are steep between 15° to 20°.	22%
Mid Slope	Sloping land often between mid - upper and lower slopes. In the Heritage Study Area mid slopes form a steady sloping topography, containing moderate undulations, with average slopes around 10°.	12%
Low-Mid Slope	Sloping land often between low-slopes and mid-slopes. In the Heritage Study Area these slopes are gentle to moderate and range from 5° to 10°.	21%
Low-Drainage	For the Heritage Study Area, low-drainage landforms include the low and gently slopes adjacent to a drainage line and range from 0° to 5°.	26%

4.4.2.6 Predictive Modelling

A predictive assessment of the likelihood of archaeological sites occurring in the project site was undertaken. The assessment considered the archaeological records in the vicinity of the site, as well as the landforms, past land use, and environmental context of the Heritage Study Area. The modelling identified

that isolated finds, quarry sites, stone procurement sites, grinding grooves, and rock shelters have the potential to be present within the study area.

4.4.3 Assessment of Significance

No new Aboriginal sites or objects were identified by OzArk during the field survey.

AHIMS Site #45-1-2802 (WQ1) occurs within the disturbance footprint of the proposed Quarry extension. On inspection, OzArk identified 16 artefacts and determined there to be sufficient exposures to allow the archaeological nature of the landform to be understood. OzArk concluded there to be little potential for identification of further intact archaeological deposits at the site. The significance of this site was assessed with respect to the scientific (archaeological), cultural (social), public (aesthetic) and historic significance, as defined in *Section 5.8.1* of the AHCHAR (**Appendix 7**), in order to determine the overall cultural heritage values of this site. **Table 4.4** provides the assessed significance attributed to Site #45-1-2802 by the AHCA.

Table 4.4 Significance Assessment of Site #45-1-2802

Cultural (Social) Value	Scientific (Archaeological) Value	Public (Aesthetic) Value	Historic Value
High	Low-Moderate	Moderate	Low

OzArk (2019) also assessed the significance of Site #45-1-2802 against the Burra Charter values of representativeness, rarity and integrity (see **Table 4.5**).

Table 4.5 Burra Charter Values of Site #45-1-2802

Representativeness	Rarity	Integrity
Representative of sites in the region that are located on similar landforms	Low density artefact scatters and isolated finds would remain the most common site type recorded	Low to moderate having been disturbed by surface water wash and erosion

Overall, the heritage significance of the Site #45-1-2802 is considered to be of medium importance by OzArk (2019).

4.4.4 Aboriginal Heritage Management Measures

Subject to the agreement of the RAPs, salvage of the artefacts at Site #45-1-2802 is proposed to be undertaken by a qualified archaeologist together with RAPs, utilising the methodology described in *Section 6.2.1* of **Appendix 7**. Limited salvage excavations is also proposed in accordance with the methodology described in *Section 6.2.2* of **Appendix 7**. All recovered artefacts will then be reburied at a location agreed to by the RAPs and where no future developments are planned or likely.

The Applicant would also implement the safeguards, controls and management measures.

- All ground disturbance activities must be confined to within the area assessed by the AHCHAR.
- The Quarry Aboriginal Cultural Heritage Management Plan (ACHMP) would be updated in consultation with the RAPs, OEH and DPE.

- The artefacts of Site AHIMS #45-1-2802 would be salvaged and relocated to a safe location (agreed to by the RAPs) away from impacts arising from the project or other planned or future developments.
- The agreed and finalised location and the manner of reburial of the Aboriginal objects would be detailed in the ACHMP following RAPs consultation. A site card would be submitted to AHIMS to register the location of any reburied artefacts. Alternatively the Aboriginal community may prefer that Aboriginal objects be held by an Aboriginal community or other party. Should this be the preferred option, it would be identified in the ACHMP.
- An Aboriginal Site Impact Recording Form would be completed by the archaeologist and submitted to AHIMS, recording the salvage results of the site, within four months of the salvage being completed.
- Should disturbance outside of the Heritage Study Area defined by the AHCHAR be proposed, the area would be subject to further field survey prior to commencement.
- Inductions for staff and contractors involved in the project will include the awareness of the legislative protection requirements for Aboriginal sites and objects in NSW and relevant fines for non-compliance.
- During the course of the proposed work, if Aboriginal artefacts or skeletal material are noted, all work will cease and the procedures in the *Aboriginal Heritage: Unanticipated Finds Protocol* (provided in **Appendix 7**) followed.

4.4.5 Assessment of Impacts

The Quarry operations are proposed to extend over the area encompassing Site #45-1-2802 (refer **Figure 4.4**). As such, all artefacts and site features would be subject to direct impact resulting in the total loss of value.

Avoidance of Site #45-1-2802 was considered by the Applicant but ultimately determined to be unfeasible given the restriction this would place on the westerly extension of the extraction which would in turn restrict the ability to extract to the target depth. The AHCHAR, implementing the methodology for standardising impact assessments developed by the Department of Planning and Environment in their “Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposed modifications” (DPE, 2016), have assessed that the disturbance to Site #45-1-2018 would result in medium loss of heritage value from the regional context. The proposed salvage and preservation of the artefacts of this site would, however, provide for mitigation of this loss in heritage value.

Approval to disturb site #45-1-2802 is required as part of the Proposed Modification to DA 344-11-2001⁷.

4.5 Historical Cultural Heritage

4.5.1 Introduction

A detailed Historic Cultural Heritage Assessment (HCHA) has been undertaken by OzArk (2019) to identify and assess the historic heritage constraints relative to the proposed extensions to the Quarry. The assessment also identifies potential impacts to heritage sites, objects, places, or values, and provides management and mitigation measures.

The ACHA forms a part of the AHCHAR (OzArk, 2019). This section provides a summary of the key findings of the AHCHAR, which can be reviewed in full as **Appendix 7**.

⁷ Section 4.41(1)(d) of the EP&A Act identifies that an Aboriginal Heritage Impact Permit (AHIP) is not required for a State Significant Development that is authorised by a Development Consent.

4.5.2 Assessment Methodology

4.5.2.1 Approach and Objectives

The HCHA was undertaken in accordance with the requirements of State and Commonwealth legislation and guidelines, including the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *The Burra Charter* (Australia ICOMOS 1999)
- *Historical Archaeology Code of Practice* (Historical Code of Practice; Heritage Council 2006)
- *Heritage Act 1977* (Heritage Act).

The objectives of the HCHA were to:

- identify historical sites or objects within the Project Site
- determine the significance of any heritage sites or objects
- assess the likely impacts of the project on historic heritage, and develop management measures and recommendations.

4.5.2.2 Historical Context

Lithgow Valley's first European settlers arrived in 1824. Settlement in the area was slow; by 1860 only four properties were settled in the valley. In 1868, the construction of the railway line through the Lithgow Valley spread workmen who built their campsites close to the cuttings, embankments and viaducts throughout the length of the valley. In 1870, the railway reached Wallerawang.

The exploitation of coal reserves began in Wallerawang around 1873 with a number of mines being opened on the Lithgow seam at Mount Piper, mid-way between Wallerawang and Lidsdale. Completion of the Wallerawang-Mudgee railway branch line in 1880s coincided with the rapid growth of the coal mining industry in the Western Coalfields.

A summary of the history of the Lithgow Valley is provided in *Section 8* of the ACHCAR (refer to **Appendix 7**).

4.5.2.3 Database Searches

A search of relevant Commonwealth, State and Local heritage databases was conducted.

4.5.2.4 Field Survey

The HCHA included a historic field survey undertaken on 29 August 2018 (simultaneously with the ACHA field survey), led by a qualified archaeologist from OzArk and included pedestrian traverses and targeted inspections over accessible areas of the Project Site (refer to **Figure 4.4**). While some areas were inaccessible due to steep terrain, the effective field survey area covers approximately 16.35 ha of the Project Site and includes the majority of the proposed disturbance footprint of the Quarry extension.

In the absence of the field survey over areas deemed unsafe to access, these areas were assessed in accordance with due diligence principles, given the low potential for sites to be located in this area.

4.5.3 Survey Results

No historic heritage items or sites were identified as occurring on or near the Project Site following database searches.

No historic heritage items or sites were recorded during the field survey.

4.5.4 Controls, Safeguards and Management Measures

Although no historic sites or objects were identified on the Project Site, to protect the area's historic heritage values, the following controls, safeguards and management measures would be implemented over the life of the Quarry.

- Ground disturbance will be restricted to the areas nominated for the Proposed Modification.
- Should disturbance beyond the surveyed area be proposed, this would not proceed until further archaeological assessment of the area is completed.
- Inductions for staff and contractors involved in the project will include the awareness of the legislative protection requirements for historic sites and items in NSW and the relevant fines for non-compliance.
- During the course of the proposed work, if objects are encountered that are suspected to be historic heritage items, all work will cease and the procedures in the *Historic Heritage: Unanticipated Finds Protocol* (provided in **Appendix 7**) followed.

4.5.5 Assessment of Impacts

No heritage sites were identified in database searches, and no sites or objects were identified during the field survey. Given the historic context of the Project Site and absence of identified historic sites or objects, it is considered unlikely that the Proposed Modification would impact on historic heritage.

4.6 Groundwater

4.6.1 Introduction

A detailed Groundwater Impact Assessment (GWIA) has been undertaken by Jacobs Pty Ltd (Jacobs, 2019) to assess the potential impacts of the Proposed Modification on the existing groundwater regime. The objectives of the GWIA were to address the recommended groundwater-related assessment requirements provide by DI Water (see **Section 3.2.1.2**) and the relevant content outlined in the NSW Aquifer Interference Policy (see **Section 3.2.2.4**) and in Fact Sheet 7 – Quarrying and Extractive Industries issued by the NSW Department of Primary Industries – Office of Water in July 2014 (DPI-Water, 2014).

A summary of the key findings of the GWIA, which can be reviewed in full as **Appendix 8**, is provided in the following subsections.

4.6.2 Assessment Methodology

4.6.2.1 Desktop Analysis and Groundwater Monitoring

An assessment of the available literature and geological drilling data was undertaken to enable characterisation of existing geology and groundwater in the region of the Quarry.

Desktop Analysis

In order to provide an initial overview of the hydrogeological setting, Jacobs reviewed the following datasets.

- The online database of groundwater bores maintained by DI Water. Five government-registered water supply bores (for stock / domestic use) with available data, were identified as occurring within 2.5 km from the Quarry Site. Standing water level (SWL) measurements were taken from all five bores, with groundwater quality data only available from one of these bores.
- Exploration data provided by the Applicant. The lithology from 64 bore logs, comprising 10 angled and 2 vertical boreholes ranging in depth from 5 m to 145 m, and 54 vertical blast holes ranging in depth from 10 to 36 m, was interrogated.
- Rainfall data from BOM gauging stations located near the study area.
- The Water Register (<http://www.water.nsw.gov.au/water-licensing/registers>) for data on existing groundwater users, including Water Access Licence (WAL) allocation volumes.

Groundwater Monitoring

Three monitoring bores were installed in the Quarry Site in mid-2018 to measure groundwater levels and quality and allow for testing of hydrogeological properties (see **Figure 4.5**).

- Groundwater levels in the monitoring bores are monitored by data loggers at a 6-hourly frequency. Data collected from the commencement of logging in each until 7 March 2019 has been analysed.
- Three rounds of groundwater quality sampling.
- Hydraulic conductivity was estimated by rising and falling head slug testing.

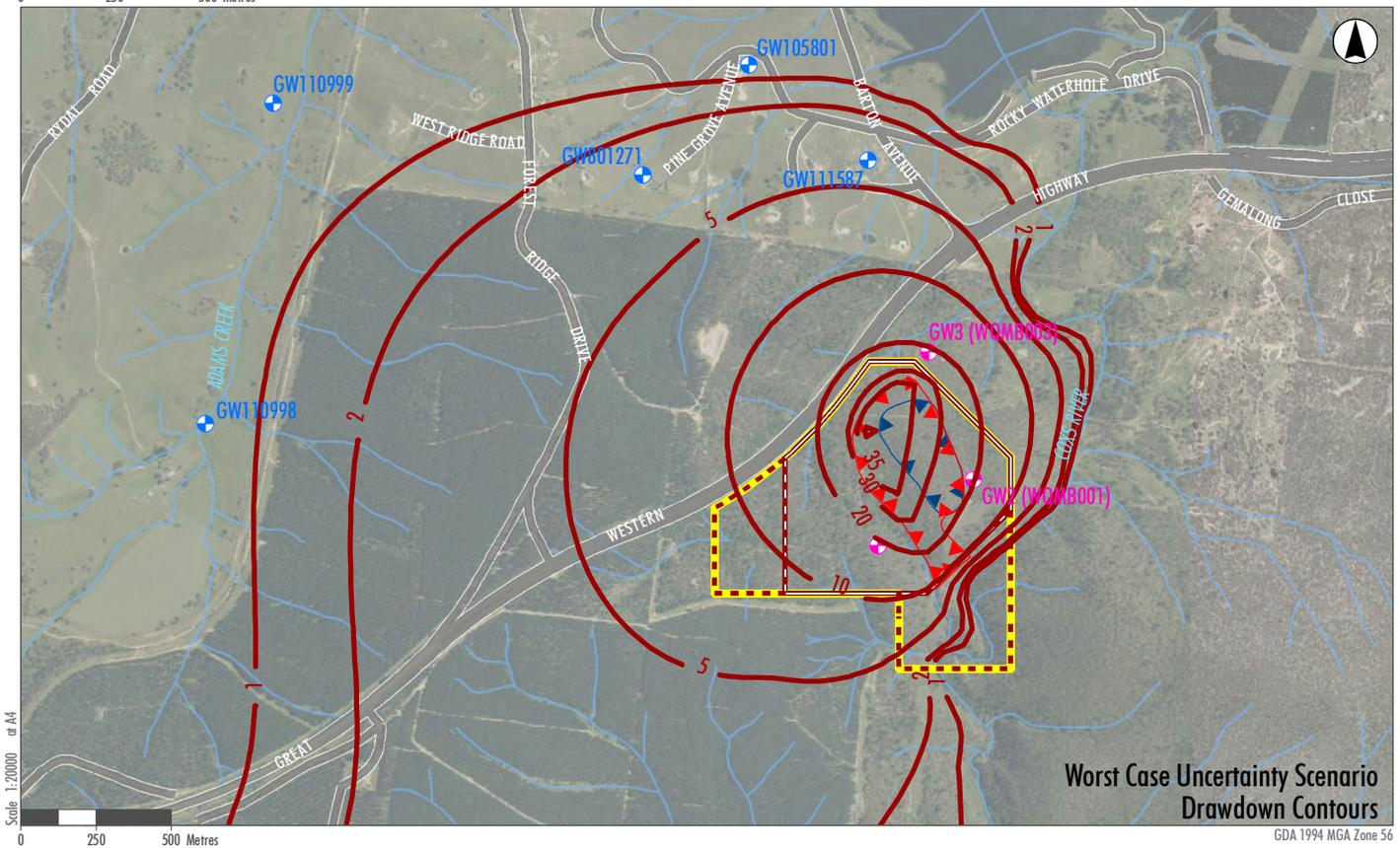
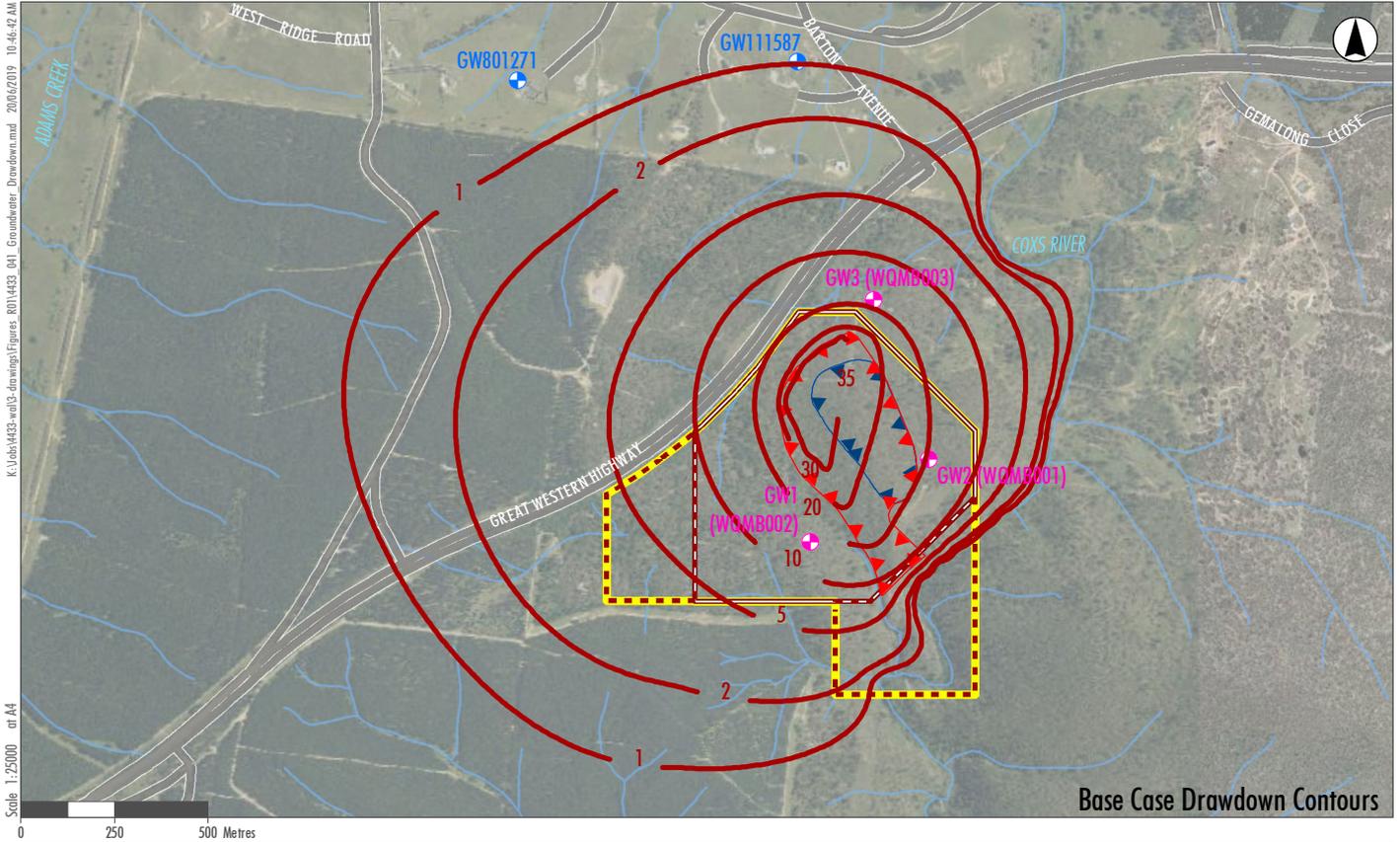
4.6.2.2 Modelling

A conceptual hydrogeological model was developed using AnAqSim, which is an analytical element groundwater modelling program, based on the data collected from desktop and field analysis described in **Section 4.5.2.1**. The model domain was designed to encapsulate the existing bores in the region of the Quarry and the expected drawdown extent associated with any dewatering resultant from inflows to the Quarry extraction area.

Five model predictive transient simulations were run, including a base-case scenario, three scenarios to address the sensitivity of the model and consider a worst-case scenario, and a scenario utilising a simulation of comparing an initial (2018) and amended (2019) extraction area design. The GWIA (Jacobs, 2019) describes these scenarios in detail (refer **Appendix 8**) noting that the worst case scenario provides for hydraulic conductivity and recharge an order of magnitude greater than the calibrated base case.

The model outputs generated by these simulations allowed for the quantification of potential impacts with respect to:

- drawdown at surrounding water supply bores
- Coxs River base flow reduction
- drawdown at mapped areas of GDEs
- groundwater inflow volume to proposed extraction area.



Legend

- Project Site
- Quarry Site (ML1633)
- Quarry Site Extension
- Approved Extraction Area
- Proposed Extraction Area
- Drawdown Contours (m AHD)
- Watercourses
- Water Supply Bores
- Quarry Groundwater Monitoring Bores

Image Source: DFSI Data source: DFSI (2019), Jacobs (2019)

FIGURE 4.5

Drawdown Contours and Groundwater Bore Locations

4.6.3 Existing Environment

4.6.3.1 Groundwater Resource

The geological setting of the Quarry Site (described in detail in **Section 2.2.1**) comprises mostly metamorphic lithologies, with granite to the north-east of the Quarry, and the Shoalhaven Group in the northern portion of the Quarry. Based on the data collected through the desktop and field investigations, Jacobs has established a conceptual hydrogeological model for the Project Site.

- Groundwater flow conditions are unconfined to semi-confined with flow direction similar to the broad topography trend, i.e. discharge to the Coxs River.
- Hydraulic gradients in the area of the Quarry are about 2% to 5% towards the Coxs River.
- The metamorphic unit has a low representative bulk hydraulic conductivity value, with isolated areas of moderate hydraulic conductivity in areas with a relatively higher concentration of fracturing.
- The granite unit has very low hydraulic conductivity due to limited fracturing. The granite unit's matrix hydraulic conductivity is negligible.
- Specific yield is low and likely less than 0.01. Specific storage is within the reported range in the literature (Bair and Lahm, 2006) for 'fissured and jointed rock' and 'sound rock' of less than $3.28 \times 10^{-6} \text{ m}^{-1}$ to $6.89 \times 10^{-5} \text{ m}^{-1}$.
- Low recharge rate by rainfall of the order of about 39 mm/year (4% of mean annual rainfall, as outlined in the WSP).
- Limited use as water supply source, as bore density in the region of the Quarry is low.
- Fresh to slightly saline groundwater at depth.
- Preferential flow paths down dip and along the strike of the metamorphic unit are probable.
- Groundwater flow into the proposed extraction area will be primarily from the metamorphic unit. The sedimentary unit is relatively shallow and not expected to be saturated in the area of the proposed extraction area.

The depth to the water table within the Project Site was inferred from data obtained from the three groundwater monitoring bores installed on the Quarry Site, and from relevant nearby public domain bores. This indicated that the groundwater is located over 10 m below the ground surface.

4.6.3.2 Water Licencing

The Quarry is located within the Coxs River Fractured Rock Groundwater Source of the WSP for the Greater Metropolitan Region Groundwater Sources.

As noted in **Section 2.1.3**, the Applicant holds WAL 42081 for this water source and was recently issued with approval for a water access licence dealing (Ref 10AL123089) under the *Water Management Act 2000* (WM Act) for a 100 unit (ML) share for extraction of water.

4.6.3.3 NSW Aquifer Interference Policy

The Quarry is considered to be situated within a water source that is categorized as a 'less productive groundwater source' on the basis of low water supply bore numbers and expected low yields.

Impact limits to high priority GDEs and culturally significant sites as outlined in the AIP are not applicable for the Quarry, as high priority GDEs and high priority culturally significant sites are not mapped within approximately 10 km of the Quarry. In addition, the BDAR that was prepared for the Proposed Modification (refer **Appendix 6**) confirms that no high priority GDE species listed in Schedule 4 of the WSP are present within the local setting.

4.6.3.4 Groundwater Dependent Ecosystems

GDEs are ecological communities that are dependent, either entirely or in part, on the presence of groundwater for their health or survival. An assessment of BoM's GDE Atlas indicates that there are some areas potentially containing terrestrial GDEs within and adjacent to the Quarry Site and proposed extension area (see **Figure 4.3**). Potential aquatic GDEs are located beyond the Quarry and Project Sites, along the Coxs River (refer to **Section 4.2.3.5**)

As discussed in **Section 4.2.3.5**, the BDAR (refer to **Appendix 6**) indicates that the mapped potential terrestrial GDEs are unlikely to be accessing groundwater based on the depths to groundwater being generally greater than 10 m. Therefore, this vegetation is unlikely to represent a terrestrial GDE. The potential aquatic GDEs which occur along the Coxs River are likely to be dependent on the flow of water within the Coxs River, rather than from groundwater base flows.

4.6.4 Controls, Safeguards and Management Measures

4.6.4.1 Aquifer Interference and Groundwater Availability

In order to ensure that any impacts on local groundwater resources are mitigated, the following recommendations of the GWIA (**Appendix 8**) would be implemented:

- A groundwater bore census of nearby water supply bores would be completed to confirm yields.
- A groundwater monitoring program, as described in **Section 4.6.6**, would be continued.
- Make good provisions would be developed and implemented as required in the event that Quarry-related drawdown is shown to impact the viability of water supply bores.
- Daily dewatering volumes would be recorded when active dewatering is undertaken. An analytical method would be developed and applied to establish the volume of groundwater 'taken' as a consequence of groundwater inflows.
- The Quarry's Soil and Water Management Plan would be updated to include the updated predictions of impact and additional mitigation and monitoring measures nominated in the GWIA.

4.6.4.2 Groundwater Contamination

The risk of groundwater contamination through operational activities (including blasting and equipment operation) is considered very low due to the low hydraulic conductivity of the geology.

All hydrocarbons would be stored in bunded containers or areas to prevent spillage and possible seepage to the groundwater. Effective spill prevention and clean-up would further safeguard against the accumulation of contaminants which could seep to the underlying groundwater.

4.6.5 Assessment of Impacts

4.6.5.1 Groundwater Drawdown

Groundwater modelling indicated that the drawdown of the groundwater table is predicted to be approximately 35 to 40 m immediately surrounding the extraction area but reducing to less than 1 m within 1 km to the west, <750 m to the north and south-west. To the east and south, drawdown did not extend beyond the Coxs River. Under a worst case uncertainty scenario, drawdown was predicted to be less than 5 m within 1 km of the extraction area. Drawdown contours for the base-case and worst case modelling scenario are shown in **Figure 4.5**, with contours for the other modelled scenarios provided in the GWIA (refer **Appendix 8**).

As mentioned in **Section 4.6.3.4**, it is unlikely that the BoM mapped potential terrestrial or aquatic GDEs within and in the vicinity of the Project Site are accessing groundwater resources. Drawdown is therefore not expected to impact the mapped GDEs.

4.6.5.2 Impacts on Water Supply Bores

Modelling indicated that under the base-case scenario, only one water supply bore (GW111587) is predicted to be impacted, with a potential drawdown of approximately 1 m (see **Figure 4.5**). This meets the AIP minimal impact consideration criteria for drawdown.

Modelling of the worst case scenario predicts that two water supply bores (GW111587 and GW801271) may experience draw down of 3 m and 4 m respectively. As the GWIA notes this magnitude of reduction is likely within, or close to, the long-term range in groundwater level caused by climate variations, should this occur (noting that model parameters were an order of magnitude greater than the calibrated base case it would be unlikely to affect the long-term viability of the bores. As noted in **Section 4.6.4.1**, the Applicant is committed to applying make good provisions in the event that Quarry-related drawdown is shown to impact the water supply from these bores.

4.6.5.3 Changes in Groundwater and Stream Baseflow Availability

To the east of the Quarry Site, the bank of the Coxs River varies from about 850 m AHD to 855 m AHD, with the water level generally flowing several metres below this. As the proposed maximum floor level of the extraction area is 860 m AHD, above this level, there will be no mechanism to induce leakage from the river to the groundwater system.

The GWIA reports that the groundwater head at the Coxs River adjacent to the Quarry is expected to remain approximately equivalent to the level of the river, the same as has been assumed for existing conditions. To the west of the river, the head will likely reduce due to the drawdown from the extraction area void and therefore discharge to the river is expected to decrease. However, this will not lower the groundwater head to below the level of the Coxs River.

Base flow contributions to the river were modelled for the base-case scenario to decrease by approximately 11%, representing a base flow reduction of 30 m³/d. While actual reductions are anticipated to be less than this due to the bedding direction and low permeability of the metamorphic unit, this conservative reduction is considered negligible when compared to the mean daily discharge near the site of about 58,000 m³/d.

As existing base flow contributions are likely very low, reductions to these base flows are not expected to result in material impacts.

4.6.5.4 Groundwater Dependent Ecosystems

Terrestrial DGEs

No high priority GDEs (karst and wetlands) are mapped within approximately 10 km of the Project Site and therefore would not be affected by the predicted drawdown associated with the Proposed Modification.

While drawdown in the order of up to 35 m is predicted to occur where in the area of mapped potential terrestrial GDEs, Ecoplanning (2019) (refer to **Appendix 6**) identifies that these are unlikely to be accessing groundwater due to groundwater depths being greater than 10 m below surface. As such, drawdown is not expected to impact on any potential terrestrial GDEs.

Aquatic GDEs

The Coxs River is generally mapped as a high potential GDE (BOM, 2018). As reductions in base flows to the Coxs River have been assessed as negligible (0.05%), the Proposed Modification is not expected to impact on this GDE.

4.6.5.5 Quarry Dewatering Rate

Base-case dewatering requirements are predicted to be 70 m³/d (<1 L/s). This is the long term predicted inflow with actual inflows to gradually increase as extraction proceeds below the water table. Physical dewatering requirements are likely to be less due to evaporative losses as the groundwater seeps through the extraction area walls.

4.6.5.6 Water Licensing Requirements

Based on the predicted reduction in base flow to the Coxs River (30 m³/d) and inflows to the extraction area (70 m³/d), the annual volume of surface and groundwater predicted to be 'taken' (when the extraction area is at its maximum extent) are as follows:

- 10.95 ML - Upper Nepean and Upstream Warragamba Water Source (Wywandy Management Zone) of the WSP for the Greater Metropolitan Region Unregulated River Water Sources
- 14.60 ML - Coxs River Fractured Rock Groundwater Source of the WSP for the Greater Metropolitan Region Groundwater Sources.

Post Quarry closure, groundwater inflows will continue in perpetuity at the same predicted rate of 25.55 ML/yr, and the same partitioning for licencing purposes will apply.

The Applicant has sufficient licence allocation for the extraction of water from the Coxs River Fractured Rock Groundwater Source of the Greater Metropolitan Region Groundwater Sources WSP (refer to **Section 4.6.3.2**).

The Applicant holds a zero allocation license (WAL 41884) for the Upper Nepean and Upstream Warragamba Water Source (Wywandy Management Zone). The Applicant intends on trading for a permanent or temporary transfer of water allocation from one of the WAL holders within the water source into WAL 41884. Once transferred, the allocation could be used to cover the partitioned surface water take that results due to base flow reduction.

4.6.5.7 Groundwater Quality

The GWIA concluded that the Project has limited potential to contaminate groundwater. Any spills/leaks of hazardous materials would be dealt with as per the controls outlined in the Quarry's Soil and Water Management Plan, which will be updated following determination of the Proposed Modification.

4.6.5.8 Aquifer Interference Policy

Table 4.6 provides a summary of the predicted impacts of the Proposed Modification against the minimal impact criteria outlined in the NSW Aquifer Interference Policy (DPI NOW, 2012).

Table 4.6 Aquifer Interference Policy Minimal Impact Criteria

Parameter	Minimal Impact Considerations	Response
Water table	<p>1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any:</p> <ul style="list-style-type: none"> (a) High priority groundwater dependent ecosystem; or (b) High priority culturally significant site; listed in the schedule of the relevant water sharing plan. <p>A maximum of a 2 m decline cumulatively at any water supply work.</p>	<p>No high priority GDEs or high priority culturally significant sites are mapped within approximately 10 km or identified through biodiversity assessment.</p> <p>The base-case drawdown < 2 m at surrounding groundwater supply bores.</p>
	<p>2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any:</p> <ul style="list-style-type: none"> (a) High priority groundwater dependent ecosystem; or (b) High priority culturally significant site; listed in the schedule of the relevant water sharing plan, then appropriate studies would be required to demonstrate to the Minister's satisfaction that the variations will not prevent the long-term viability of the dependent ecosystem or significant site. <p>If more than a 2 m decline cumulatively at any water supply work, then make good provisions should apply.</p>	<p>Due to potential water table drawdowns of greater than 2 m at bores GW111587 and GW801271 under the worst-case scenario, the bore should be inspected to assess current status and use. If the bores are productive (in use) and shown to be impacted by water level drawdown attributed to the Quarry, then make good provisions should apply.</p>
Water pressure	<p>1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work.</p>	<p>The base-case drawdown < 2 m at surrounding groundwater supply bores.</p>

Parameter	Minimal Impact Considerations	Response
	2. If the predicted pressure head decline is greater than requirement 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	Due to potential water table drawdowns of greater than 2m at bores GW111587 and GW801271 under the worst-case scenario, the bore should be inspected to assess current status and use. If the bores are productive (in use) and shown to be impacted by water level drawdown attributed to the Quarry, then make good provisions should apply.
Water quality	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.	The Quarry is not anticipated to result in a change in groundwater quality which would lower the beneficial use category beyond 40m from the Quarry activities.
	2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	Not applicable (see above).

4.6.6 Monitoring

The following groundwater monitoring would be implemented or continued following determination of the Proposed Modification.

Bore Census

Subject to landholder consent, groundwater bores GW111587 and GW801271 would be inspected to assess their current status and collect the following information:

- confirmation of bore coordinates/survey data
- construction/casing diameter
- description of bore physical status, including photographs, whether used/disused, water use, pump and headworks if any, yield if equipped
- bore depth, SWL, and physical water quality.

Groundwater level monitoring

Groundwater levels in the Quarry's three groundwater monitoring bores will continue to be monitored at a minimum daily interval by data logger. The data will continue to be collected bi-monthly and supported with manual groundwater level measurements at time of collection and summarised in an annual report.

Groundwater quality monitoring

The three groundwater bores will be sampled annually and analysed for field parameters, major ions and dissolved heavy metals.

Extraction area dewatering volumes

As the extraction area is developed below the groundwater table, daily dewatering volumes would be recorded.

4.7 Surface Water

4.7.1 Assessment Methodology

The Quarry is currently operated in accordance with a Soil and Water Management Plan (SWMP) (Umwelt, 2019a) which provides for water use, management and monitoring of the approved operations. As a result of the Proposed Modification, and the increase in the disturbance footprint of the Quarry, water management at the Quarry will require significant variation to ensure there are no adverse effects on the local and regional hydrological setting. A SWIA has been prepared to provide for:

- identification and description of the existing conditions for any water resources likely to be impacted by the project
- a review of the modified catchments of the Quarry Site associated with the Proposed Modification
- the preparation of an updated WMS, including modified water diversions, storages and erosion and sediment control features, to account for the modified disturbance footprint of the Quarry Site
- a review of the site water balance
- an assessment of the potential impacts on receiving waters, water users, flooding and licensing requirements which could result as a consequence of the Proposed Modification.

The SWIA, which was prepared by Umwelt, can be viewed in full as **Appendix 9**. The following sections provide the key descriptions, analyses and assessments of the SWIA.

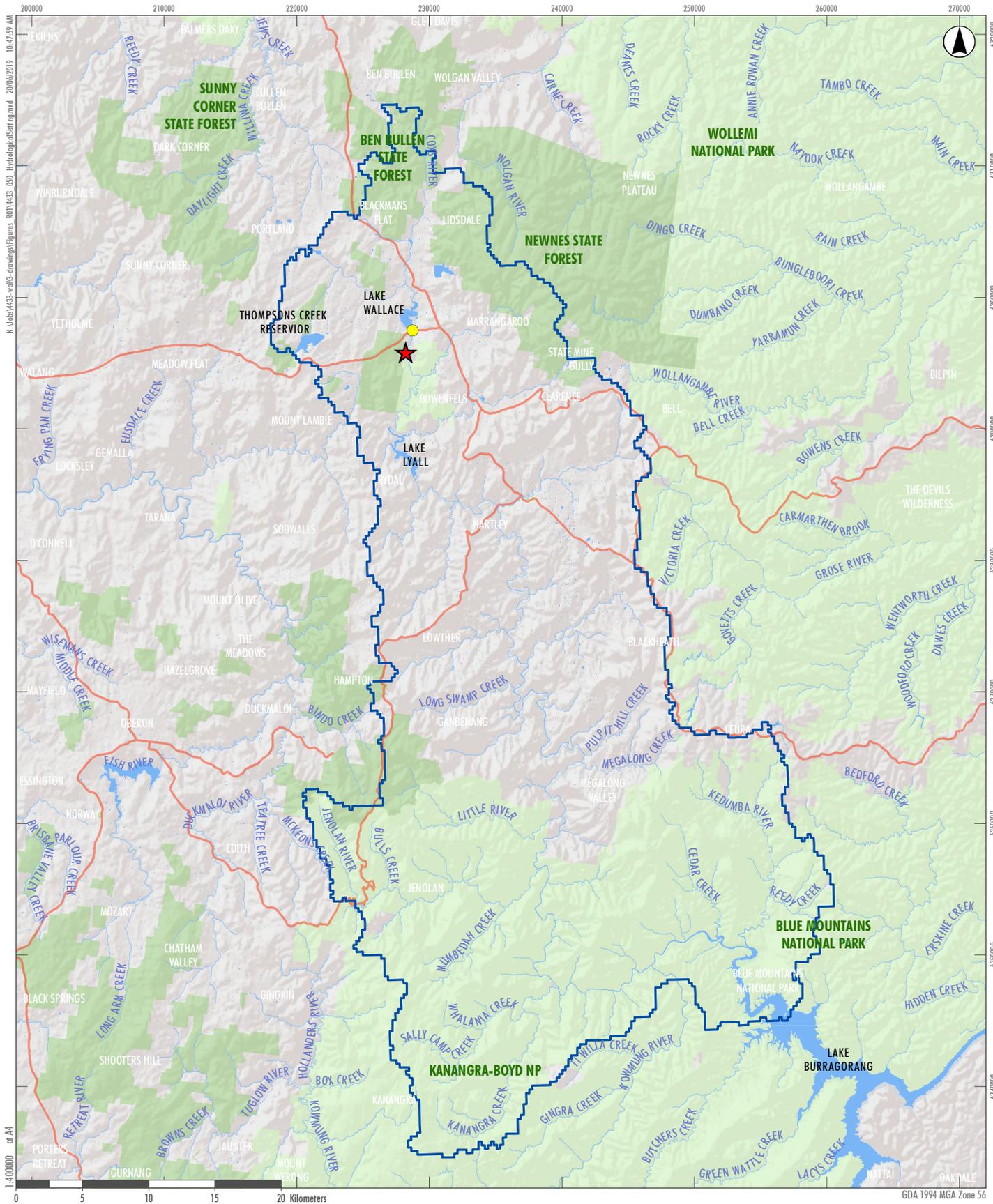
4.7.2 Hydrological Setting

4.7.2.1 Drainage, Watercourses and Water Users

The Quarry site is located within the Cox's River catchment which has a total area of 1,700 km² and is a sub catchment of the Hawkesbury-Nepean catchment (see **Figure 4.6**) (Herron et al, 2018). The headwaters of the Cox's River originate in Ben Bullen State Forest at an elevation of approximately 1,000 m AHD. The river flows 130 km along its course across dams at Lake Wallace and at Lake Lyell down to an elevation of 120 m AHD where it flows into Lake Burragorang, the main water source for greater Metropolitan Sydney.

The Quarry site is located approximately 1 km downstream of Lake Wallace and 11 km upstream of Lake Lyell. The Project Site traverses the Cocks River, however, the proposed extraction area would remain at least 40 m from the top of river bank. Flow monitoring of Cocks River occurs at a station 0.5 km upstream adjacent to the Great Western Highway and gives a mean annual flow volume of 21,077 ML (recorded for the period 1951 to 2016) (WaterNSW, 2019).

Runoff from undisturbed upslope catchment areas to the northwest of the Quarry site are diverted around disturbance areas, and eventually discharge to Cox's River via second order drainage channels at two locations (refer to *Figure 2.2* of the SWIA – **Appendix 9**).



- Legend**
- Quarry Location
 - Coffs River Flow Monitoring Location
 - Coffs River Catchment
 - State Forest
 - NPWS Estate

FIGURE 4.6
Hydrological Setting

Runoff within the Quarry Site is divided into nine separate catchments by site topography and water management infrastructure (as discussed in **Section 2.6**). Water is discharged from the Quarry site via two licensed discharge points, Main Storage Dam (SD1) and the Bottom Working Dam (SB2), into the Coxs River catchment.

4.7.2.2 Water Quality (and Water Quality Objectives)

Baseline water quality monitoring undertaken at locations upstream and downstream of the Quarry. **Table 4.7** presents the results of this monitoring which provides an indication of background water quality within the Coxs River.

Table 4.7 Coxs River Water Quality

Parameter	Units	Samples	Minimum	Maximum	Average
Upstream					
pH	-	7	7.5	8.9	8.4
Total Suspended Solids	mg/L	7	<5	<5	<5
Electrical Conductivity	µS/cm	7	597	1,229	976
Sulphate (SO ₄)	mg/L	7	111	208	142
Oil and Grease	mg/L	7	<5	<5	<5
Downstream					
pH	-	7	8.1	9.0	8.6
Total Suspended Solids	mg/L	7	<5	<5	<5
Electrical Conductivity	µS/cm	7	513	1,226	949
Sulphate (SO ₄)	mg/L	7	91	206	138
Oil and Grease	mg/L	7	<5	<5	<5

In the absence of NSW Water Quality Objectives (WQOs)⁸ for the Hawkesbury-Nepean catchment, default trigger values for slightly disturbed ecosystems in south-east Australia from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) may be used to assess the baseline receiving water condition downstream of the quarry (see **Table 4.8**).

Table 4.8 Default Trigger Values

Parameter	Units	Trigger Value
pH	-	6.5 – 8.0
Electrical Conductivity	µS/cm	125 – 350
Turbidity	NTU	2 - 25

⁸ WQOs are agreed environmental values and long-term goals for NSW's surface waters used across NSW to guide catchment management.

While restricted in sample size (seven), the results suggest the default WQOs for pH and EC are not representative of Cox's River water quality. Considering the non-representativeness of the default WQOs, the Quarry currently retains limits on discharge to the Coxs River (under EPL 13172) presented in **Table 4.9**.

Table 4.9 Water Quality Limits

Pollutant	Unit of Measure	Criteria
pH	pH	6.5-8.5
Total Suspended Solids	mg/L	30
Electrical Conductivity	µS/cm	1 500
Sulfate	mg/L	250
Grease and Oil	mg/L	10

In the absence of WQOs generated through additional monitoring of water quality within the Coxs River, the Applicant would continue to manage operations to ensure any discharge of water complies with the limits nominated in EPL 13172.

4.7.2.3 Flood Conditions

A review of Lithgow LEP 2014 Flood Planning Map Sheet FLD_002 confirms that the Quarry Site is not located within the nominated flood planning area. There is no catchment based flood mapping for the Coxs River in the vicinity of the Quarry Site, however, the following provides context to the location of the Quarry Site with respect to the channel of the Coxs River:

- The proposed extensions to the extraction area and stockpile area would remain at least 30 m above the Coxs River Channel.
- The bridge of the Great Western Highway traverses the Coxs River between 870 m AHD and 880 m AHD, i.e. at an equivalent elevation to the lowest area of the extraction boundary of the Quarry Site.

On the basis of the above, the Quarry Site disturbance is likely to remain above the 1:100 average recurrence interval (ARI) flood level. A detailed flood impact assessment to address the requirements of Clause 7.1(3) is therefore not required.

4.7.2.4 Water Users

A search of the NSW Water Register identifies 411 Water Access Licences with a total share component equivalent to approximately 669 GL/year within the Upper Nepean and Upstream Warragamba Water Source of the WSP for the Greater Metropolitan Region Unregulated River Water Sources.

In the vicinity of the Quarry, the primary water users are major and local water utilities and rural licence holders extracting water for domestic and stock watering purposes. Other water uses include general recreational use (particularly in Lake Lyell) and recreational fishing.

4.7.3 Management Issues and Constraints

4.7.3.1 Water Licensing

Water Sharing Plan

The Proposed Modification lies within the Wywandy Management Zone of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* ("the Water Sharing Plan"). In accordance with Part 5, Division 2, Clause 22 of the Water Sharing Plan, the Proponent is entitled to capture and store water sources pursuant to the harvestable rights order made under Section 53 of the *Water Management Act 2000* (WM Act). Section 53 of the WM Act permits landholders to harvest and use a portion of the total runoff from their land without requiring licence(s), provided that:

- the total capacity of the harvestable rights water storages are less than the capacity permitted under the right
- that all storages are constructed either off-line or on first or second order, non-spring fed streams.

Waterfront Land

Waterfront land includes the bed and a distance inland of 40m from a river, estuary or lake where a river is defined the *Water Management Act 2000* (WM Act) as.

- (a) *any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and*
- (b) *any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and*
- (c) *anything declared by the regulations to be a river, whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river."*

An accepted method to determine whether a topographic feature such as a gully represents a 'river' in accordance with the above definition is whether it is identified as a drainage line, i.e. a blue line, on a 1:25 000 scale topographic map. The proposed extensions to the stockpile areas occur such drainage lines and as such could be identified as impact on waterfront land.

Notwithstanding the above, a Controlled Activity Approval (CAA) is not required by virtue of Section 89J(g) of the EP&A Act.

4.7.3.2 Erosion and Sedimentation

The Quarry site is located within two soil landscapes.

- Cullen Bullen: characterised as having hard-setting topsoils with high water erosion hazard.
- Mount Walker: characterised as steep sloped, shallow soils with an extreme soil erosion hazard, steep slopes, and shallow soils.

Previous soil surveys of the Quarry Site (Pacrim, 2001) confirmed two soil types.

- Yellow uniform Lithosol soil: containing a large percentage of gravel and rock fragments which has a have high to very high erosion hazard when exposed to concentrated flows.

- Orange duplex Podzolic soil: characterised by a siliceous sandy material over a heavy red clay which has a high to extreme erosion hazard when exposed to concentrated flows.

In the absence of appropriate controls the clearing of groundcover and stripping of surface soils associated with the Proposed Modification could result in an elevated risk of erosion. This could lead to discharges of sediment and pollution within the Coxs River catchment. This would be contrary to the aims and objectives of the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011, as well as the general objectives of the Applicant to manage the Proposed Modification in a way which minimises impact on the environment, and Section 120 of the POEO Act.

4.7.3.3 Salinity and Acidity

Neither of the soil landscapes of the Quarry (refer to **Section 4.7.3.2**) is identified as being saline and do not pose a risk of increasing the salinity of the local catchments. The Mount Walker soil landscape is identified as strongly acid, however, in the elevated location in the landscape there is not a high risk of acid runoff given the lack of inundation.

4.7.3.4 Pollution of Downstream Water Courses

The Proposed Modification has the potential to have the following impacts on surface water resources:

- Capture of runoff from additional undisturbed catchments as a result of the interception of ephemeral creeks that drain through the Proposed Modification to the Coxs River.
- Degradation of downstream water quality as a result of
 - ground disturbing activities leading to erosion and transport of sediment to downstream water users and water courses including the Coxs River
 - additional volumes of water being discharged from the licensed discharge to the downstream water users and water courses including the Coxs River
 - potential spills of hydrocarbons and other chemicals.
- Increased water imports from alternate water sources to meet the increased operational demands.

Based on the potential sources of pollution, suspended solids, i.e. sand, silt or clay particles in water, and hydrocarbons are likely to be the major sources of surface water pollution arising from the Proposed Modification. In the event that fertilisers are used as part of progressive final landform rehabilitation, i.e. for areas returned to pasture, the discharge of water with elevated nutrient levels (nitrogen and phosphorous) may occur.

4.7.4 Proposed Water Management System

4.7.4.1 Overview

Management of surface water on the Project Site, to avoid or minimise the potential impacts identified in **Section 4.7.3**, would be undertaken as part of a modified WMS. The modified WMS, a schematic of which for the Year 2045 is presented in **Figure 4.7**, would incorporate all water diversion and capture infrastructure which could be required for the Quarry. The modified WMS will incorporate:

- additional undisturbed upslope catchment and clean water diversions
- extended extraction area catchment

- additional sediment basins and storage dams to capture, manage and store runoff from the extended and new stockpiling areas
- dirty and clean water diversions to ensure appropriate separation and management of clean and dirty water across the site.

4.7.4.2 Erosion and Sediment Control

Prior to the commencement of any surface disturbing works, appropriate erosion and sediment controls would be installed to ensure appropriate diversion of clean water around areas of disturbance and capture and management of runoff from areas of disturbance. Priority would be given to minimising erosion from disturbed areas through appropriate use of ground cover followed by management of sediment laden waters through the installation of appropriate sediment controls. The installation or construction of any erosion and sediment control structures will be undertaken in accordance with Managing Urban Stormwater Volumes 1 and 2 (Landcom, 2004 and DECCW, 2008) and the approved Quarry Soil and Water Management Plan.

Clean Water Diversion

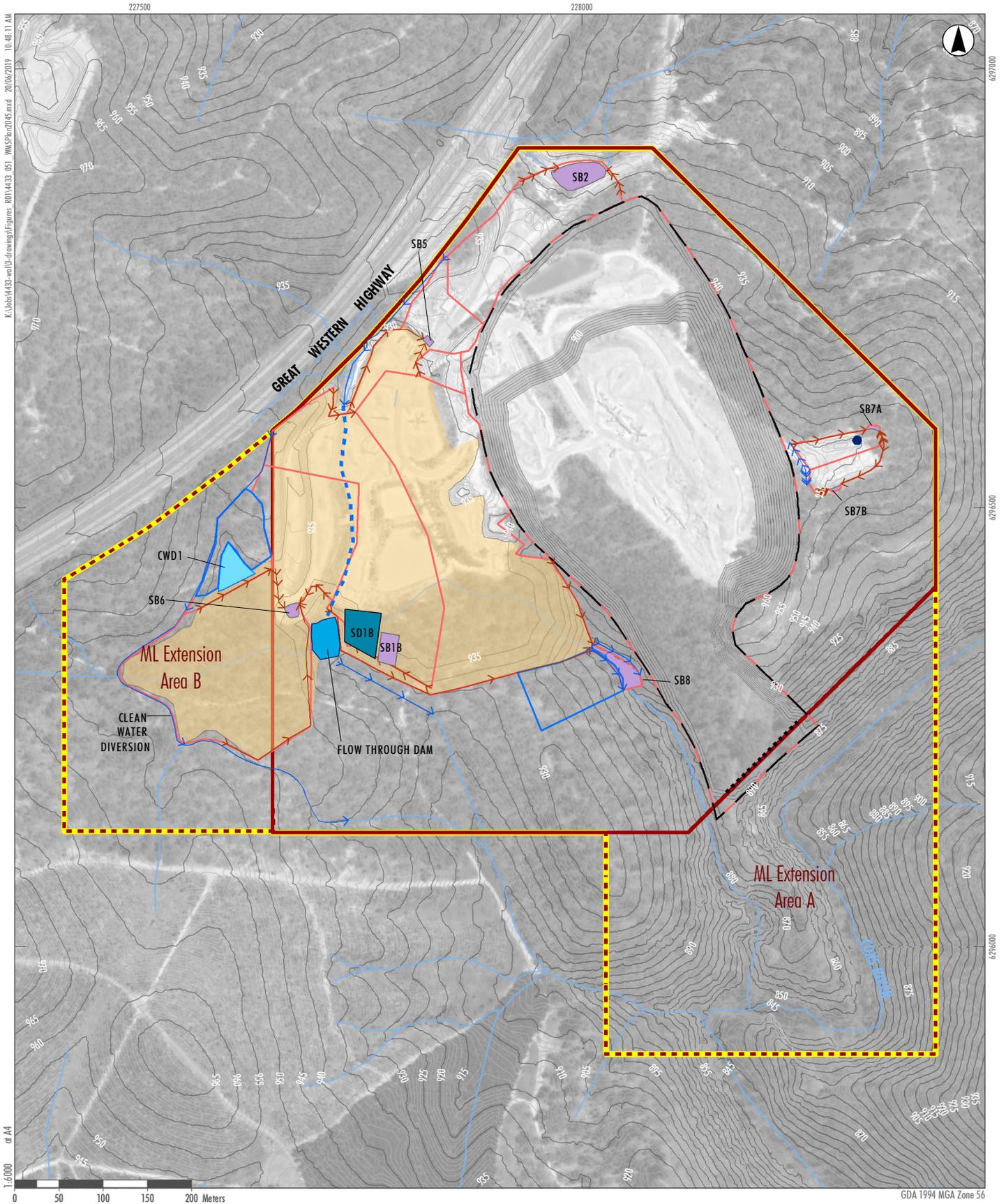
The Proposed Modification would include the following changes to clean water diversion:

- The HDPE pipeline section of the central clean water diversion drain would be extended to the current discharge point to allow for the main Stockpile Area to be increased in elevation to 935 m AHD.
- The discharge point of the extended pipeline would be rock-lined to provide for energy dissipation and outlet protection.
- Prior to the commencement of construction of the Southern Stockpile Area, an open rock-lined drain would be constructed from the discharge point of the pipeline to an alternative tributary of the Coxs River.
- Prior to commencement of construction of the Western Stockpile Area Extension, a clean water diversion drain would be constructed upstream to divert clean water from the second order drainage line originating within the Lidsdale State Forrest to an alternative tributary of the Coxs River.

Both clean water diversions would be appropriately stabilised before being permitted to carry clean water. Detailed design of the clean water diversions will be prepared and included in an updated SWMP prior to construction. This design will consider appropriate sizing based on upstream and downstream receiving water, channel stability assessment and consideration of environmental flows. **Table 4.10** provides a conceptual design for the longer of the two drains which would divert flows from Lidsdale State Forest to the east to the south of the Western Stockpile Area.

Water Storage and Settlement

As the Quarry is developed, and the extraction area and stockpile areas extended, Storage Dams (SD) 1 and 2 and Sediment Basin (SB) 1 would be decommissioned. In the case of SD 1 and SB 1, these would be replaced by equivalent storages on the Southern Stockpile Area (SD 1B and SB 1B). **Table 4.11** identifies minimum storage requirements of the existing sediment basins, as well as the modified and new sediment basin requirements of the Quarry. In the case of SB 8, this provides for the maximum storage requirements over the life of the Quarry. Notably, this storage will only be required during the construction of the Southern Stockpile Area, and may be decommissioned and removed once these are constructed and the slopes stabilised.



Legend

- Project Site
- Quarry Site - ML1633
- Quarry Site Extension
- Proposed Extraction Pit Shell (Pit to RL860)
- Clean Water Catchments
- Clean Water Dam
- Dirty Water Catchments
- Flow Through Dam
- Sediment Basins
- Settlement Ponds
- Storage Dam
- Water Tank
- Proposed_Stockpile_Area_MGA56.DGN Polygon
- Buried Pipe Culvert
- Clean Water Diversions
- Dirty Water Diversions
- In Pit Sed Basin Wall

FIGURE 4.7

Water Management System (2045)

Table 4.10 Western Clean Water Diversion Conceptual Design Information

Catchment area (ha)	Design Storm				Channel Lining	Hydraulic Results				Design					
	Average Recurrence Interval (ARI) (years)	Time of Concentration (mins)	C10 ¹	Frequency Factor		Flow (m ³ /s)	Velocity (m/s)	Maximum Permissible Velocity (m/s)	Depth of Flow	Slope (%)	Base Width (m)	Site Batters (v:h)	Freeboard	Minimum Channel Depth (m)	Channel Top Width (m)
56.8	20	37	0.25	1.21	Jute Mesh (close weave, bitumen sprayed) & seeded ²	2.47	1.3	1.7	0.22	1%	8 ²	1:3 ²	0.15	0.37	9.1

1 Undisturbed upslope catchment, determined using Figure 5.1 Volume 2 – Australian Rainfall and Runoff (ARR) 1987
2 To be determined if appropriate during detailed design

Table 4.11 Sediment Basins

Basin Reference	Catchment (ha)	Minimum Storage Requirements			Capacity (m ³)
		Water Settlement Zone (m ³)	Sediment Storage Zone (m ³)	Total (m ³)	
Existing (refer to Figure 1.3)					
SB 1	6.9	1,946	15	1,961	2,100
SB 2	7.3	2,002	2	2,004	2,800
SB 5	0.5	141	1	142	150
SB 6	0.6	169	1	170	300
SB 7(a/b)	0.5	141	1	142	300
Proposed (refer to Figure 2.1)					
SB 1B	2.9	1,211	608	1,818	At least 20% greater than the minimum storage requirement
SB2	1.57	656	328	984	
SB5	0.84	349	175	525	
SB6	4.28	1,786	894	2,680	
SB 7a	0.26	110	55	165	
SB 7b	0.22	93	47	140	
SB 8	4.33	1,808	904	2,712	

Prior to decommissioning SD 1, SD 1B would be constructed on the Southern Stockpile Area with an equivalent storage volume (8 ML). The water storage volume of SD 2 would not be replaced on decommissioning of this structure, with the reduced reliance on surface water harvesting provided by access to groundwater supplies reducing the requirement to retain large volumes of water in storage on the Project Site.

Additional temporary sediment basins may be required as quarrying and spoils emplacement progresses. These sediment basins would document within the Quarry ESCP in accordance with the requirements of the following documents:

- Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004)
- Managing Urban Stormwater: Soils and Construction – Volume 2C – unsealed roads (DECC, 2008a)
- Managing Urban Stormwater: Soils and Construction – Volume 2E – mines and quarries (DECC, 2008b).

In-Pit water management

The majority of runoff generated within the proposed extraction area would be produced by rainfall due to the nature of the surrounding natural topography, proposed Quarry development sequence and the WMS. It is therefore proposed that all water captured in-pit will be contained within a pit sump, to be constructed and relocated as required within the extraction area to service the active extraction area of the time.

4.7.5 Site Water Balance

4.7.5.1 Water Balance Model

A predictive water balance for the Year 2045 (refer to **Figure 2.8**) has been completed as part of the SWIA (Umwelt, 2019e) using GoldSim software. The daily time step Model uses historical climate data to estimate direct rainfall inflows and evaporative losses. Runoff inflows are estimated based on the Australian Water Balance Model (AWBM).

Quarry operations at Year 2045 of the Project have been modelled as this operational stage will have the greatest water demands.

The water demands, losses and sources nominated in Sections 2.6.2 and 2.6.3 were assumed with climatic data obtained as follows:

- Rainfall data was obtained from the Bureau of Meteorology Stations at Lidsdale (Station 63132), with data gaps infilled by records from Lithgow (Station 63226).
- Evaporative rates were obtained from the Bureau of Meteorology Stations Bathurst Agricultural Station (Station 63005).

4.7.5.2 Operating Rules and Assumptions

The following is a summary of the operating rules and assumptions applied:

- Dirty water captured in sediment basins is used in priority to clean water and groundwater.
- Clean water is used in priority to groundwater.
- Clean water and groundwater are imported to the Process Water Tank (or tanks) (see **Figure 4.6**) with an assumed capacity of 0.5 ML.

- All sediment basins are dewatered to SD 1B⁹ to allow these to reinstate the minimum storage requirements within five days following a rainfall event.
- Discharge to SD 1B from sediment basins (excluding SB 2) would proceed regardless of the available freeboard in SD 1B. Controlled discharges from SD1B were estimated based on the overflows from SD 1B.
- Controlled discharges from SB 2 would occur when SD 1B was at capacity and SB 2 did not have sufficient freeboard to accommodate a five day 95th percentile rainfall event.
- The Pit Sump is only dewatered to SD 1B when there is sufficient freeboard available.
- Evaporation of 50% of groundwater inflows is assumed.

4.7.5.3 Results

A detailed description of water balance results is provided in the SWIA. In summary, groundwater extracted from the approved bore is likely to be required to supplement surface water harvested from water storages on the Quarry Site. Furthermore, the water balance confirms that controlled discharges are likely to be required in order to maintain the minimum storage volume within Quarry sediment basins. This is a consequence short to medium term variations in climatic conditions and limited storage capacity on the Quarry. That is, after prolonged dry periods site water inventories are diminished and imports are required and after high or prolonged rainfall events site storages are full and discharges are required to maintain adequate freeboard in sediment basins. **Chart 4.1** presents the net water balance for a median rainfall year, identifying when groundwater imports and controlled discharges are required.

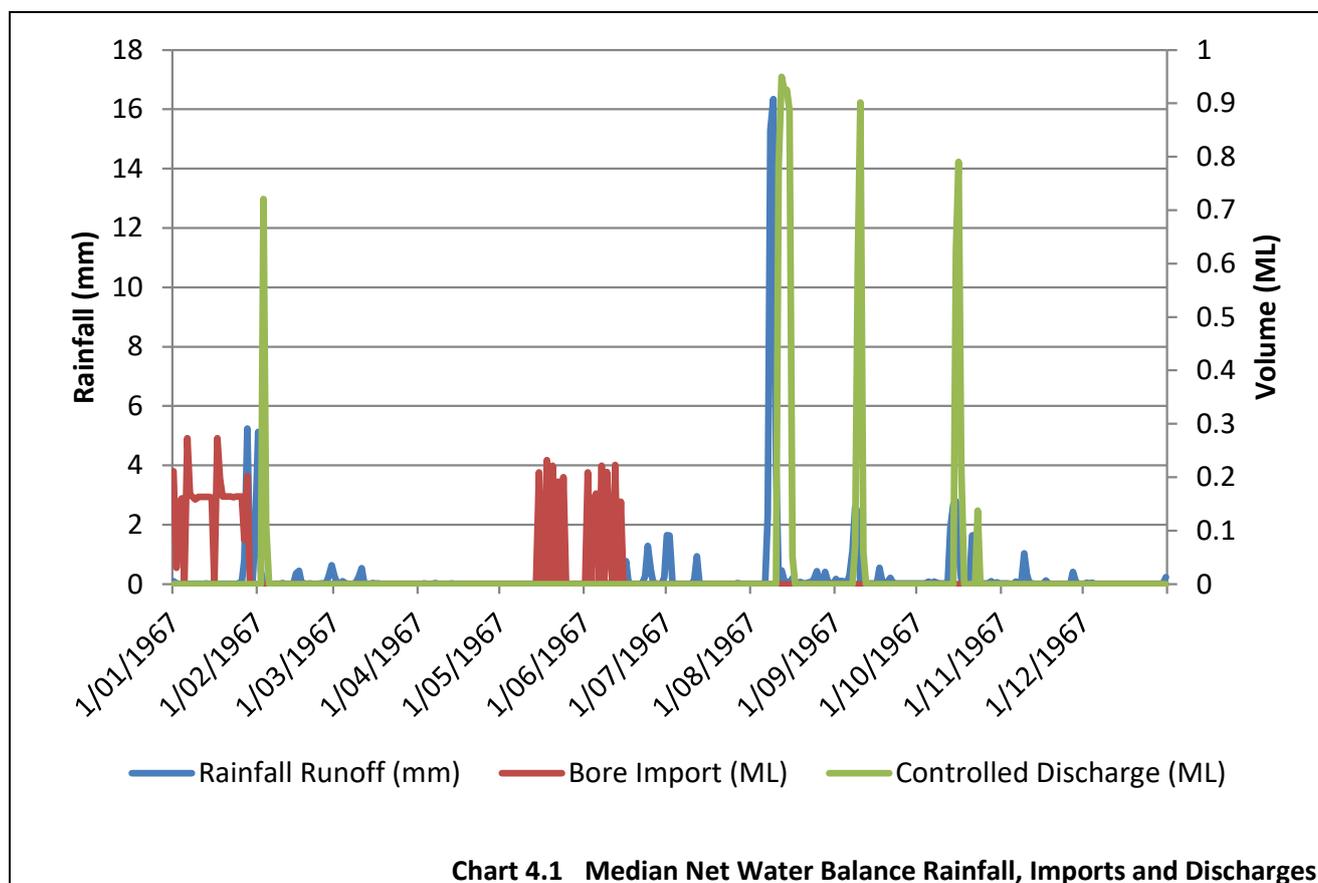


Chart 4.1 Median Net Water Balance Rainfall, Imports and Discharges

⁹ SD 1 before this is decommissioned.

Table 4.12 presents the predicted bore water import volume statistics for the modelled Year 2045.

Table 4.12 Bore Water Imports

Statistic	Result (ML/year)
Minimum	0.0
10 th percentile	0.0
50 th percentile	5.9
90 th percentile	19.6
Maximum	35.6

Source: SWIA (Umwelt, 2019) - Table 4.5

Table 4.13 and **Table 4.14** present the predicted controlled discharge volume and frequency statistics respectively for the modelled Year 2045.

Table 4.13 Controlled Discharge Volumes

Statistic	SD 1B Discharge (ML/year)	SB 2 Discharge (ML/year)
Minimum	0.0	0.0
10 th percentile	0.0	0.0
50 th percentile	7.0	0.0
90 th percentile	21.2	0.0
Maximum	41.4	1.6

Source: SWIA (Umwelt, 2019) - Table 4.6

Table 4.14 Controlled Discharge Frequency

Statistic	SD 1B Discharge (days/year)	SB 2 Discharge (days/year)
Minimum	0.0	0.0
10 th percentile	0.0	0.0
50 th percentile	17.0	0.0
90 th percentile	38.4	0.0
Maximum	67.0	17.0

Source: SWIA (Umwelt, 2019) - Table 4.7

Discharges are likely to be required in median to wet years to manage high site water inventories as a result of high or prolonged rainfall events. Predicted discharges from SB 2 are less frequent than from SD1B as SB 2 (an existing sediment basin) is oversized for the Year 2045 catchment that it services and has capacity in excess of the five day 95th percentile rainfall event, i.e. surplus water can be held in SB2 without the requirement to dewater.

Table 4.15 presents the frequency of spill events from sediment basins for the modelled Year 2045. The frequency of spill events from sediment basins are predicted to be less than one spill per year which is less than the expected frequency of sediment spills (one to two spills/year) from sediment basins designed in accordance with the Blue Book to accommodate the five day 95th percentile rainfall event.

Table 4.15 Sediment Basin Spill Frequency

Sediment Basin	Minimum (events/year)	Average (events/year)	Maximum (events/year)
SB2	0	<1	1
SB5	0	<1	6
SB6	0	<1	5
SB7a and SB7b	0	<1	3
SB8	0	<1	5
SB1B	0	<1	4

Source: SWIA (Umwelt, 2019) - Table 4.8

The frequency and volume of discharge could be less than modelled as the site water balance assumes the minimum storage volume for those sediment basins which are to be constructed or enlarged for the Proposed Modification. Increasing the size of these structures would provide for greater storage capacity and therefore potentially less frequent and smaller discharges.

4.7.6 Assessment of Impacts

4.7.6.1 Water Availability

The Proposed Modification would result in an increased catchment and therefore rainfall and runoff captured within the Project Site. The water balance completed for the Proposed Modification indicates that while discharges of water would still occur, the majority of the captured water would be retained for on-site use. This increased catchment (12.6 ha) represents only 0.005% of the Coxs River catchment, increasing the overall Quarry-related catchment to 0.018% of the Coxs River catchment. As such, the impacts associated loss of surface water catchment during the operational phase are expected to be negligible with respect to the existing approved operation.

The risk of the Applicant having insufficient water for operational or dust suppression requirements is minimal as the water balance results indicate that the even in the driest years the bore water import demand is significantly less than the groundwater entitlement of 100 ML/year associated with WAL 42081.

Following the Quarry extraction phase, the majority of the project Site would be rehabilitated so as to be free draining to the downstream environment (refer to **Section 2.10**). As such, the impacts associated loss of surface water catchment during the post operation are expected to be negligible with respect to the existing approved operation.

4.7.6.2 Water Quality

Water balance modelling predicts that both controlled discharges and sediment basin spills would occur. Importantly, the proposed Quarry WMS would minimised the number of controlled discharges required from SD 1B and SB 2 during median to high rainfall periods. As discussed in **Section 4.7.5.3**, the frequency and size of these could be reduced by increasing the storage capacity of the Quarry water storages and sediment basins. As is currently undertaken, any water to be discharged would be sampled and analysed prior to commencing a controlled discharge. Where the water does not achieve the discharge limits of EPL 13172, the water would be treated to ensure EPL criteria is achieved prior to discharge.

Spills from sediment basins occur when rainfall exceeds the sediment basin design rainfall capacity and may have elevated concentrations of suspended solids. For sediment basins designed and managed to accommodate a five day 95th percentile rainfall event, the Blue Book predicts spills to occur at a frequency

of one to two times per year. Water balance modelling predicts that the proposed sediment basins of the modified Quarry Site would spill at a frequency of less than one per year and only during periods of high rainfall when runoff from the broader catchment will be high and is already likely to contain elevated concentrations of suspended solids. The SWIA completed for the Proposed Modification assesses the impacts of controlled discharges and sediment basins spills to be acceptable on downstream water quality.

The potential for hydrocarbon contamination of runoff would be minimised by careful management of refuelling on the Quarry Site (with contingency measures implemented immediately in the event of spill or leak).

4.7.6.3 Stream Stability

The SWIA prepared for the Proposed Modification concludes that on the basis that the clean water diversions are appropriately designed and constructed to capture and divert water back to natural drainage lines to the south of the Quarry, changes to the Coxs River catchment and flows would be minimised. Prior to construction of the diversions, modelling to review existing flow conditions within the drainage channels (including flow depths, velocities and tractive stresses) for a range of design storm events will be completed with additional mitigation measures, such as channel armouring, implemented to minimise detrimental impacts to downstream drainage channel reaches

4.7.6.4 State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The SEPP requires that:

“A consent authority must not grant consent to the carrying out of development under Part 4 of the Act on land in the Sydney drinking water catchment unless it is satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality.”

A neutral or beneficial effect on water quality is defined as one that:

- has no identifiable impact on water quality, or
- contains any water quality impact on the development site and prevents it from reaching any watercourse, water body or drainage depression on site, or
- transfers any water quality impact outside of the site where it is treated and disposed of, to standards approved by the consent authority.

The following considers the potential impacts of the Proposed Modification on receiving water as detrimental, neutral or beneficial:

- No uncontrolled releases of water, other than those allowable in accordance with EPL 13172 and the Blue Book, would occur. **Neutral Impact.**
- Controlled discharges and spills from sediment basins may occur under high rainfall conditions (exceeding five day 95th percentile rainfall) may occur. Notably, any controlled discharge would only occur after water quality has been confirmed as achieving the discharge water quality limits of EPL13172. Spills from sediment basins would only occur under high rainfall conditions (exceeding five day 95th percentile rainfall) when suspended sediment concentrations in runoff will be elevated across the catchment. Furthermore, EPL 13172 excludes discharges under such rainfall conditions from the water quality discharge limits. **Neutral Impact.**
- The Proposed Modification provides for the separation of runoff from undisturbed catchments, from the disturbed WSEA catchment. **Beneficial Impact.**

- The Proposed Modification provides for capture and storage of dirty water in accordance with Blue Book recommendations. **Neutral Impact.**

A neutral or beneficial impact on the affected catchments is therefore demonstrated and therefore the Proposal achieves the objectives of the SEPP.

4.8 Visual Amenity

4.8.1 Introduction

As identified in **Section 3.2.1.1**, the potential visual impact of the Proposed Modification has been identified by residents to the north of the Quarry as a key concern. Lithgow City Council has also highlighted the importance of demonstrating that the Proposed Modification would not result in a detrimental impact on local visual amenity. The following assessment of potential visual impacts has been undertaken by Umwelt and provides a comprehensive review of the local visual setting, identification of Quarry components which could be visible from vantage points surrounding the Project Site and provides an analysis of future views following the implementation of operational controls aimed at limiting the exposure of the Quarry.

4.8.2 Assessment Methodology

4.8.2.1 Visual Setting

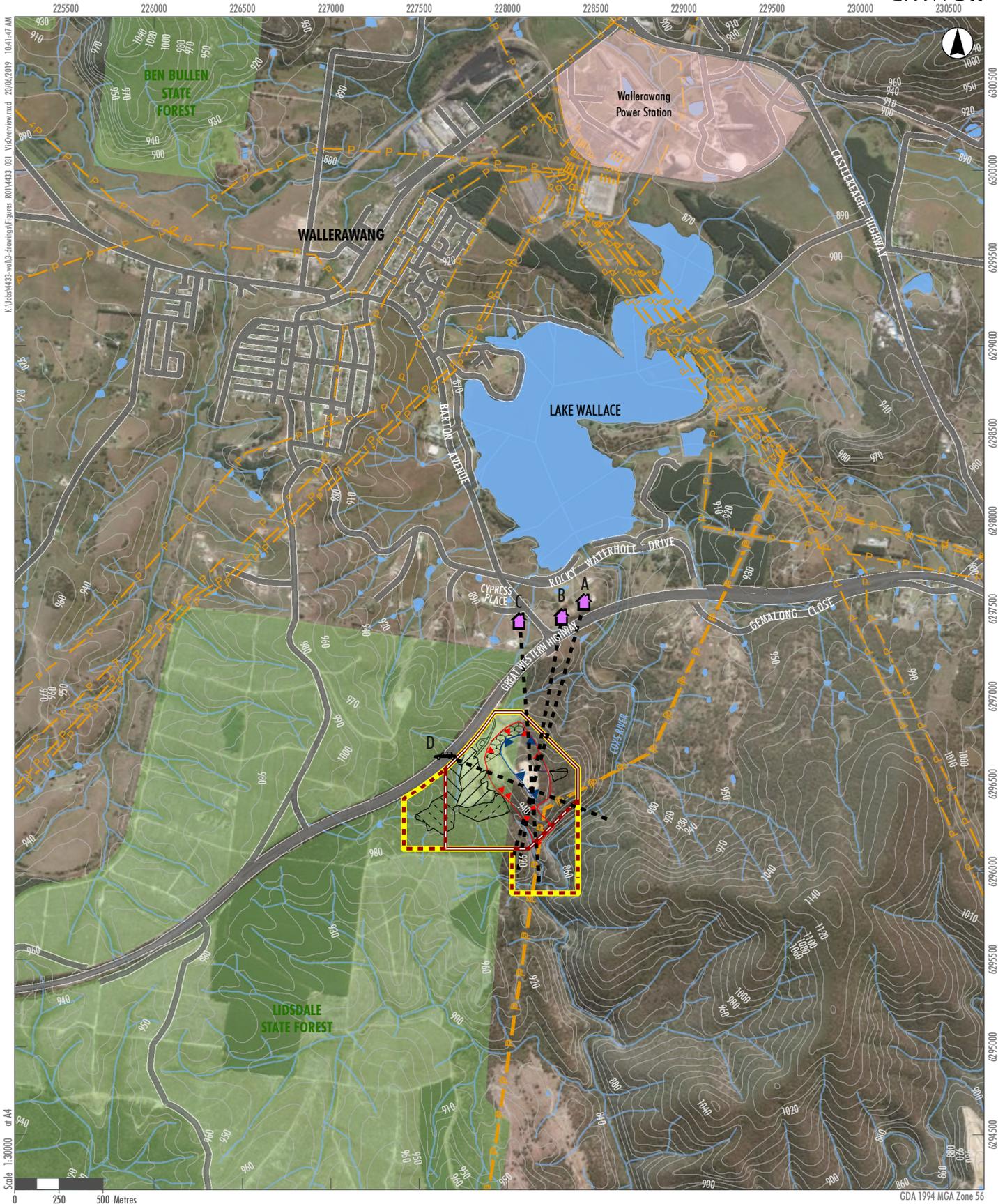
The Quarry, which has been operating since 2014, is located to the south of the Great Western Highway, approximately 1.8 km to the south of the township of Wallerawang which is situated in the hills above Lake Wallace (see **Figure 4.8**). The recently decommissioned Wallerawang Power Station is located approximately 1 km from the nearest residence in the town. The power station site currently includes two large chimney stacks, conveyors, buildings, as well as a large concrete cooling tower. This infrastructure dominates views from the township, however, it has been flagged for demolition.

The terrain in the region comprises a granite basin of rounded hills surrounded by steep slopes. Topography in the vicinity of the Quarry typically ranges from 850 m AHD within the Coxs River to over 1 000 m AHD to the west of the Lidsdale State Forest.

The area surrounding the Quarry Site is heavily vegetated with well-established, mature eucalypts at a typical height of approximately 15 m. The western half of the Project Site is situated within the Lidsdale State Forest. The Coxs River passes to the east of the Quarry Site and through the proposed southerly extension to ML 1633 of the Project Site.

The Great Western Highway passes to the west and north of the Quarry Site. It is a multi-lane dual carriageway, which is a well-used conduit between Sydney's western suburbs and Bathurst, used by travellers, residents and heavy vehicles. The highway rises to a crest of approximately 980 m AHD to the west of the Quarry, approximately 1.4 km from the entrance to the access road to the Quarry. To the east of the Quarry, the highway dips to approximately 875 m AHD at the crossing of the Coxs River, approximately 910 m from the Quarry's entrance.

The operating Quarry is currently visible from the Great Western Highway, principally from the eastbound lanes (travelling to Lithgow and Sydney). From residential receivers to the north, the most elevated activities on the Quarry Site have become just visible above the local vegetation, however, the approved sequence of extraction has been designed to prevent significant views of Quarry operations. Current views of the Quarry Site are considered further in **Section 4.8.2.3**.



Legend

- | | | | |
|--------------------------|---|--------------------------------|--|
| Quarry Site Extension | Main Stockpile Area (935m AHD) | Electricity Transmission Lines | Residential Receptor Locations |
| Quarry Site (ML1633) | Southern Stockpile Extension (935m AHD) | Road | Vehicle Receptor Location (travelling North) |
| Project Site | Western Stockpile Area | State Forest | Elevation Profiles |
| Approved Extraction Area | Western Stockpile Extension (940m AHD) | Waterbody | |
| Proposed Extraction Area | Eastern Stockpile Area | Wallerawang Power Station | |
| Watercourses | Cobble Extraction Area (920m AHD) | | |

FIGURE 4.8
Visual Setting

4.8.2.2 Quarry Components

The extraction area of the Quarry has been designed such that the vegetated slope which currently provides a visual barrier between properties to the north and extraction activities remains effective in screening the extraction area for the life of the Proposed Modification. This is considered in greater detail in **Section 4.8.4**.

Of the stockpile areas on the Quarry Site, which are currently the most visible element of the Quarry Site when viewed from the Great Western highway, the Proposed Modification seeks to establish a new Southern Stockpile Area (to a maximum elevation of 935 m AHD), extend the Western Stockpile Area (to maximum height of 940 m AHD) and raise the height of the Main Stockpile Area (to 935 m AHD). The footprint of the Southern Stockpile Area will be extended by 2.5 ha to the south. Crushing and screening reject material and non-saleable materials will continue to be stockpiled in this area. The footprint of the Western Stockpile Area will be extended by up to 2.8 ha to the southwest and will stockpile smaller volume materials and specialty products. The overall height of the stockpiles will not exceed current heights of 5 to 6 m, remaining below the approximate elevation of the Great Western Highway to the north on the Main and Southern Stockpile Areas.

The existing fixed infrastructure on the Quarry Site is located near the Quarry entrance and includes seven standard demountable buildings used for administration and worker facilities, and two water tanks. A third water tank is to be constructed on the eastern stockpile area. The Proposed Modification would not result in any change to the visual amenity associated with these structures.

The Quarry operations, which are described in detail in **Section 1.4** and **Section 2.1**, utilise mobile equipment to undertake extraction and stockpiling activities (refer to **Section 2.3.6** and **Table 2.4**). The only new mobile plant that could be operated at the Quarry would be a Pug Mill to be operated on the Main Stockpile Area. The mobile crushing trains, with stackers rising to 5 to 6 m above ground level are currently and will continue to be operated within the extraction area. As the Proposed Modification provides for a progressive deepening of the extraction area, the likelihood of this equipment becoming visible is negligible. The Applicant has included the construction of a fixed crushing plant following the construction of the Southern Stockpile Area which would replace the current mobile crushing trains operated within the extraction area. Notably, the proposed location of the future fixed crushing plant (refer to **Figure 2.1**) is located in the southern section of the Project Site to the south of the former Hoskins Quarry and is unlikely to be visible from vantage points to the north.

4.8.2.3 Key Vantage Points

Four key vantage points have been identified surrounding the Quarry Site as most likely to be affected by the extension of the Quarry operations and indicative of other locations in the vicinity. **Plates 4.1 to 4.4** illustrate the current views of the Quarry Site from these Locations (A to D)¹⁰.

Location A: 42 Rocky Waterhole Drive. Private residence 760 m to the north of the Quarry boundary.

Location B: Elevated location on Lot 104 DP1085560. Vacant private landholding 620 m to the north of the Quarry boundary.

Location C: 4 Cypress Place. Private residence 500 m to the north of the Quarry.

Location D: Great Western Highway, eastbound lanes approximately 360 m to the west of the Quarry entrance.

¹⁰ Plates 4.1 to 4.4 replicate Plates 1.1 to 1.4 presented in Section 1.5.



Plate 4.1 Location A: Current View from 42 Rocky Waterhole Drive toward the Quarry Site



Plate 4.2 Location B: Current View from elevated point on Lot 104 toward the Quarry Site



Plate 4.3 Location C: Current View from 4 Cypress Place toward the Quarry Site



Plate 4.4 Location D: Current View of the Quarry Site for eastbound traffic on the Great Western Highway

These locations, along with the potentially most exposed sight lines to the Quarry operations, are shown on **Figure 4.8**.

Plates 4.1 and **4.2** illustrate that a small stockpile of material within the extraction area was visible when the photos were taken. This material has subsequently been excavated and removed from the Quarry. **Plate 4.3** illustrates that the vegetation of Lidsdale State Forest on the northern side of the Great Western Highway provide a visual screen of the existing Quarry Site. An assessment of the potential views which would be available should the trees of Lidsdale State Forest be harvested is provide in **Section 4.7.4**. **Plate 4.4** confirms the Quarry operations are currently visible from the eastbound lane of the Great Western Highway. Views are also available from the west bound lane but principally only within 50 to 100 m of the Quarry Entrance.

It should be noted that Wallerawang township was not assessed as a visual receptor as the viewing distances of over 1.8 km from the nearest properties to the Quarry Site are considered too far to cause any significant impacts to the visual amenity of the residents (refer to **Figure 4.8**). The houses in the township are also noted to typically be orientated toward Lake Wallace and/or their street front, rather than toward

the Quarry. Any views toward the Quarry are generally screened with vegetation or topography. In addition, the existing built infrastructure in the region, such as the chimneys, buildings and cooling tower of the Wallerawang Power Station, are visible to the majority of residents and these features currently overwhelm views of the township.

4.8.3 Controls, Safeguards and Management Measures

The Main Extraction Area (as identified on **Figure 2.1**) will not progress any further north until such time as the extraction to the south of the current perimeter is at least 15 m below surface and therefore below the sightlines of vantage points to the north.

While a northerly extension to the extraction area is proposed to allow for the recovery of a decorative pebble resource (Cobble Extraction Area), this extraction would only be undertaken once the Main Extraction Area has been developed to an elevation allowing for the extraction of the cobble resource in a south to north direction. In doing so, this extraction could also be sequenced such that the vegetation slope which currently screens the majority of Quarry operations from views to the north would remain in place until such time as the extraction area to the south is developed below sight lines.

The Applicant would also limit the area of cobble extraction to one hectare at a time. This would allow each restricted excavation area to be developed to maximum depth before a new area is stripped of vegetation and developed, enabling progressive rehabilitation and minimisation of bare surface which could generate dust.

Other visibility management measures to be implemented at the Quarry would include:

- Establishment of screening vegetation on the bund wall which has been constructed along the northern (Great Western Highway) boundary of the Quarry Site immediately north of the Western Stockpile Area would continue to be promoted. Over time this will in-create a visual screen of views from vehicles on the Great Western Highway.
- Landscaping campaigns would be periodically undertaken to promote the establishment of the vegetation in the road reserve of the Great Western Highway. The Applicant has already undertaken significant plantings in the road reserve and will monitor the success of these plantings and target future works at infill planting.
- Vegetation will be established and maintained on the batters of internal dams and stockpile areas to reduce the exposure of these vehicles passing the Quarry.
- Bunds would continue to be constructed and vegetated at strategic locations to screen the development from external viewers as far as is reasonable.
- If night-time loading and transport operations are required, lights would be directed to the south, i.e. away from the Great Western Highway and vantage points to the north.

In accordance with the rehabilitation objectives and conditions of the Quarry, following the end of operations the final landform will be integrated with the surrounding natural landforms as far as is reasonable to minimise visual impacts when viewed from the surrounding land.

4.8.4 Assessment of Impacts

4.8.4.1 Visual Amenity

To assess the impact of the proposed south to north sequence of extraction and Quarry Site development on receivers to the north, an assessment of the potentially visible Quarry components as viewed from the identified sensitive visual receptor locations was undertaken.

Taking into account the proposed extension to the extraction area and stockpile area, **Figures 4.9** and **4.10** present line of sight sections to graphically demonstrate the visibility of these elements from the four viewing locations. These sight lines assumed a receptor viewing height of 1.6 m from ground level for residences, and 1.0 m from ground level for the vehicle to approximate the view from eye level. The locations and extents of the elements of the existing Quarry and surrounding Project Site have been included in the terrain surface.

Figures 4.9 and **4.10** also provide a bare earth visibility analysis was also undertaken from each of the viewing locations to provide a radial viewshed which identifies the ground surface that would be visible from the receptor based purely on the topography of the earth's surface. The bare earth visibility analysis does not consider any features (such as vegetation) that may screen the views with the green areas indicating potentially visible areas and the red areas indicating where the landform is not visible.

Based on the proposed Quarry Site layout and sequence of extraction, the following provides a summary of the visual impacts for each viewing location:

Location A: 42 Rocky Waterhole Drive

The line of sight from this location indicates that components of the existing Quarry pit could be temporarily visible as the top of the hill within the approved extraction area continues (as evidenced in **Plate 4.1**). However, the proposed extension to the extraction area is unlikely to be visible, as it will continue to be screened by trees to be retained on the slopes of the intervening topography.

Location A is indicative of elevated locations on the southern side of the ridgeline followed by Rocky Waterhole Drive on Lot 102 DP826413 further to the east.

Location B: Lot 104 DP1085560

The line of sight from this location indicates that components of the existing Quarry pit will be temporarily visible as the top of the hill within the approved extraction area continues (as evidenced in **Plate 4.2**). However, the proposed extraction area for the Project is unlikely to be visible, as it will continue to be screened by trees to be retained on the slopes of the intervening topography.

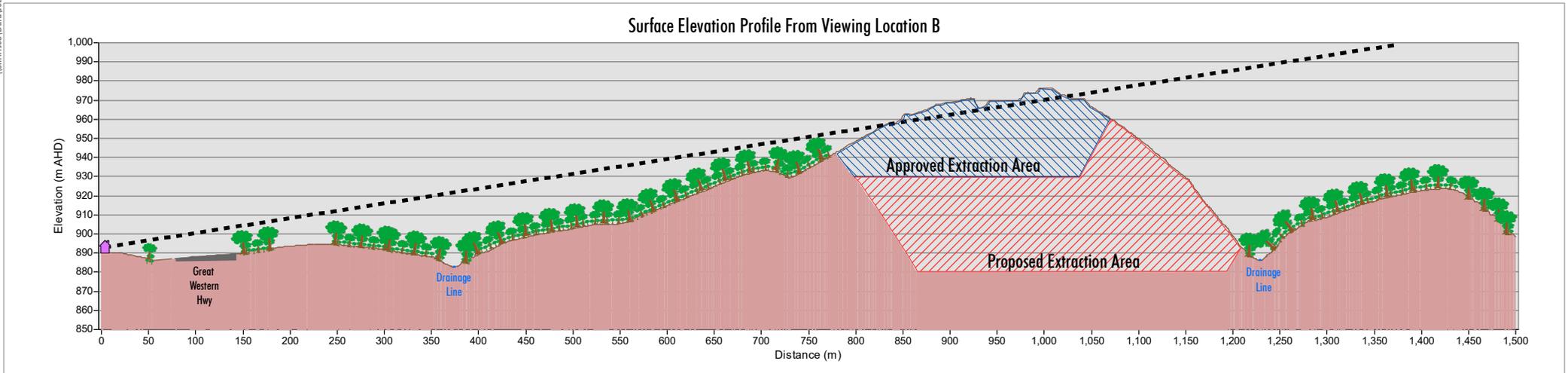
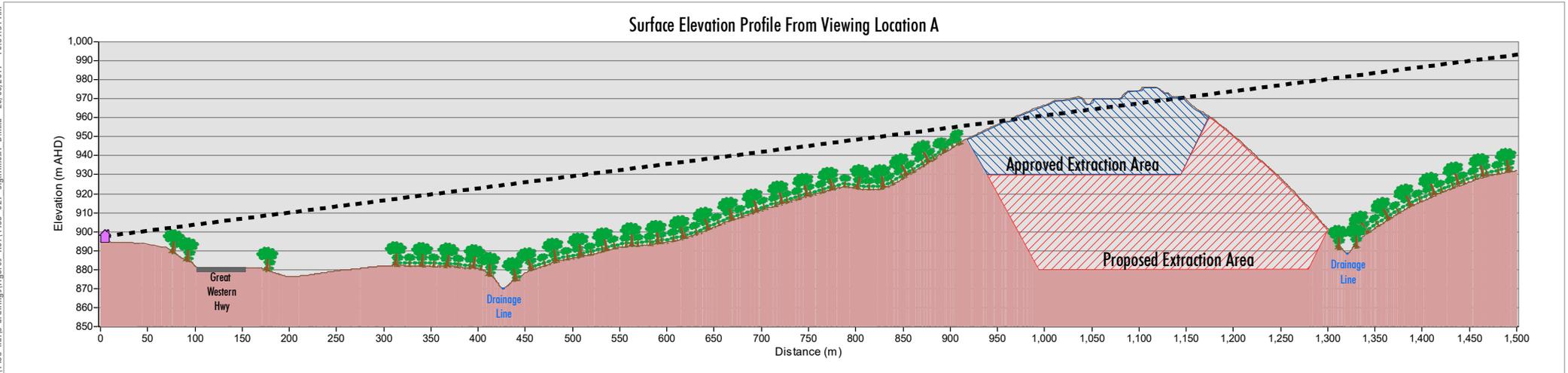
Location B is indicative of elevated locations on the southern side of the ridgeline followed by Rocky Waterhole Drive further of 22 Rocky Waterhole Drive to the east.

Location C: 4 Cypress Place

The line of sight from this location indicates that neither the existing Quarry nor the Proposed Modification will be visible, due to screening by trees and the intervening topography. The bare earth visibility analysis indicates that without intervening vegetation, some components of the Quarry would be visible from this viewing location.

Location C is indicative of all vantage points of Cypress Place.

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Legend

Surface Elevation Profiles

- Residential Receptor Locations
- Indicative Sight Lines Considering Visual Obstructions
- Existing Ground Surface
- Existing Vegetation Cover
- Approved Extraction Area
- Proposed Extraction Area

Bare Earth Visibility Analysis

- Visible
- Not visible
- Proposed Extraction Area
- Main Stockpile Area (935m AHD)
- Southern Stockpile Extension (935m AHD)
- Western Stockpile Area
- Western Stockpile Extension (940m AHD)
- Eastern Stockpile Area
- Project Site

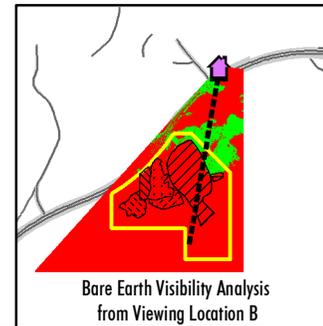
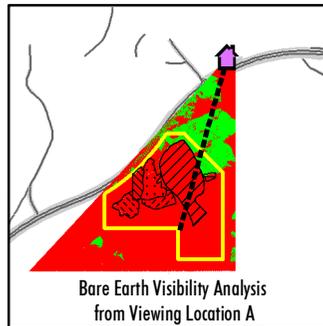
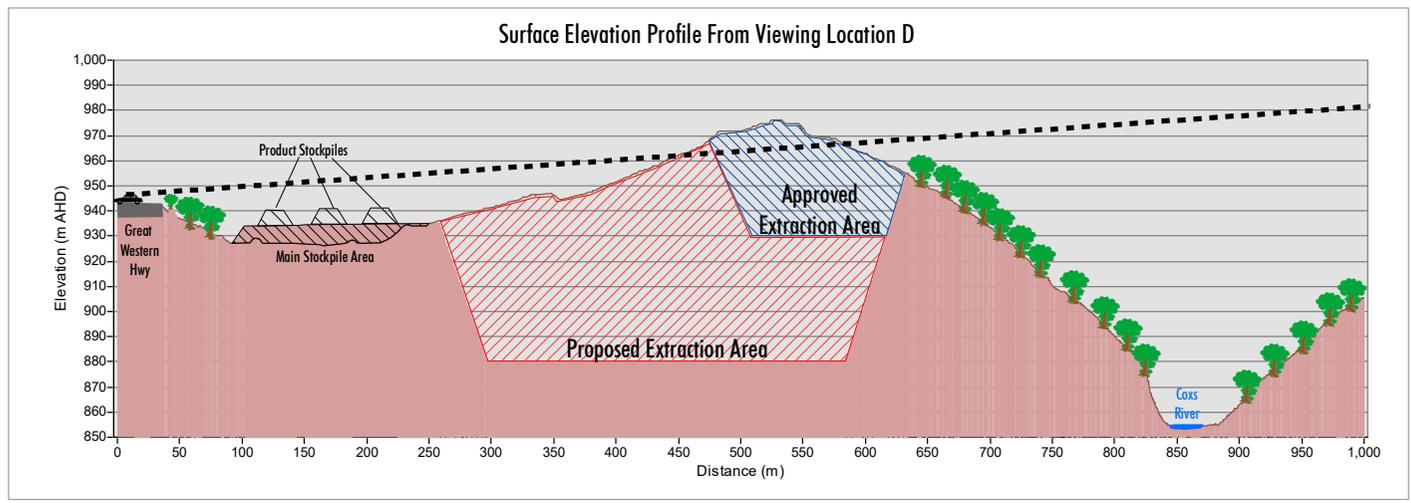
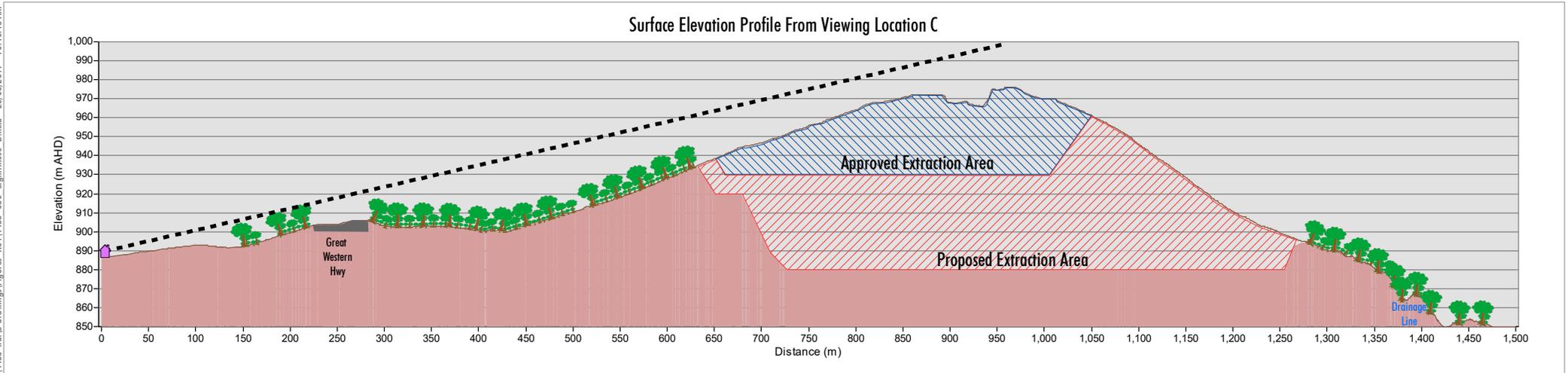


FIGURE 4.9
Elevation Profiles & Line of Sight Analysis from Viewing Locations A & B

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Legend

Surface Elevation Profiles

- Residential Receptor Locations
- Vehicle Receptor Location (travelling North)
- Indicative Sight Lines Considering Visual Obstructions
- Existing Ground Surface
- Existing Vegetation Cover
- Approved Extraction Area
- Proposed Extraction Area

Bare Earth Visibility Analysis

- Visible
- Not visible
- Proposed Extraction Area
- Main Stockpile Area (935m AHD)
- Southern Stockpile Extension (935m AHD)
- Western Stockpile Area
- Western Stockpile Extension (940m AHD)
- Eastern Stockpile Area
- Project Site

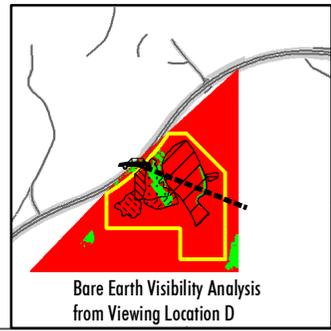
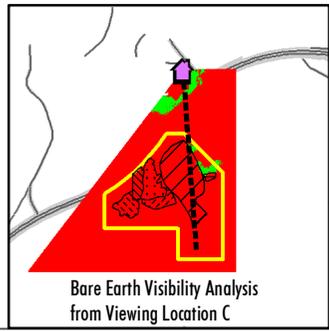


FIGURE 4.10
Elevation Profiles & Line of Sight Analysis from Viewing Locations C & D

Location D: Great Western Highway

The line of sight from this location indicates that components of both the existing Quarry and the Proposed Modification will be visible to eastbound vehicles on the Great Western Highway but remain similar to the existing views of the Quarry. The bare earth visibility analysis indicates that without intervening vegetation some components of the Quarry, such as the stockpile areas, would be visible from this viewing location.

It should be noted that views of the Quarry from vehicles travelling north along the Great Western Highway will be fleeting and lateral to the vehicle, and there are very limited views of the Quarry for vehicles travelling south along the highway. As noted in **Section 4.7.3**, the Applicant has planted vegetation along the western boundary of the Quarry site which will reduce views from the highway once this vegetation has established.

In undertaking this assessment of visual impacts, it is noted that the visible elements of the existing Quarry that are currently able to be seen by the residential receptors, represent the greatest exposure of Quarry operations for the remaining life of the approved and provide Quarry operations. The existing Quarry hill slopes and bunds will not be raised any further, and all future extraction activities will take place below the level of these bunds. In addition, views will be further screened once the vegetation that has recently been planted by the proponent establishes fully.

It is unlikely that the Proposed Modification will impact visual amenity beyond what is already experienced from the existing Quarry operations.

4.8.4.2 Lighting Impacts

The Quarry is a day-time only operation, although Quarry products may be transported from the Quarry 24 hours per day. To allow for night-time transport, which has not been required to date and is likely only in the event of a large short-term campaign, fixed lighting is provided at the Quarry Site Entrance and internal access road. In the event night-time loading is required at the Quarry, mobile lighting plants would be used. As noted in **Section 4.7.3**, these would be directed to the south, away from the highway and nearby housing.

On the basis of the minimal requirement that night-time operations would be required, and the mitigation provided by directing lighting away from the Great Western Highway and residences to the north no visual impacts from lighting associated with the Proposed Modification are likely.

4.9 Noise and Vibration

4.9.1 Introduction

A Noise and Vibration Impact Assessment (NVIA) has been undertaken by Muller Acoustic Consulting Pty Ltd (MAC) to quantify the potential noise and vibration emissions associated with the proposed extensions to the Quarry Site (MAC, 2019).

The NVIA was undertaken to address the following objectives:

- To identify the closest and/or potentially most affected receivers situated within the area of influence to the Project Site.
- To establish ambient (background noise levels) and Project Noise Trigger Levels (PNTLs) at surrounding receivers.

- To identify all noise sources of the Proposed Modification and predict noise levels that could be received at surrounding receivers under a range of operating scenarios.
- To assess the potential noise impacts associated with Proposed Modification against the PNTLs.
- To provide feasible and reasonable noise mitigation and management measures, and monitoring options, where PNTLs may be exceeded.
- To predict blasting emissions and compare these to relevant blasting emissions criteria.

A summary of the NVIA, which can be reviewed in full as **Appendix 10**, is provided in this section.

4.9.2 Existing Environment

4.9.2.1 Local Setting

The noise climate in the area surrounding the Project Site is dominated by the Great Western Highway which is the major highway between Sydney and Bathurst. Noise monitoring undertaken every six months at locations three residential receivers surrounding the Quarry has identified traffic, wind, birds and other ambient rural sources as the main noise sources in the local setting.

4.9.2.2 Sensitive Receivers

No sensitive locations such as schools, churches or major urban development are located near the Project Site. However, there are 26 residential receivers within 1 km of the Project Site (refer to **Figure 4.1**). Two properties on Rocky Waterhole Drive have also been identified as likely to have residences built on these in the coming years. For the purpose of the noise assessment, these are identified as Future Residences (FR) on **Figure 4.1** and have been positioned in the most exposed location on the property.

4.9.2.3 Ambient (Background) Noise Levels

To establish contemporary background levels in accordance with the NPI and to quantify the existing background noise environment of the area, MAC conducted unattended noise monitoring at two representative locations adjacent to the Project (see **Figure 4.1**). The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, “Acoustics - Description and Measurement of Environmental Noise” and the results are summarised in **Table 4.16**.

Table 4.16 Background Noise Monitoring Summary

Location	Period ¹	Measured Background Noise Level (RBL, dB L _{A90})	Measured Ambient Level (dB L _{Aeq(period)})
NM1 987 Great Western Highway	Day	38	47
	Evening	34	46
	Night	30 (29) ²	43
NM2 1B Cypress Place	Day	40	56
	Evening	35	55
	Night	30 (27) ²	40

Notes

¹ Day - 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - 6pm to 10pm; Night - the remaining periods.

² Minimum NPI RBL adopted for night, bracketed value denotes measured level.

For the purpose of establishing PNTLs, the noise levels of NM1 were used (being the lower RBL).

4.9.3 Assessment Criteria

4.9.3.1 Noise Criteria

The EPA released the Noise Policy for Industry (NPfI) in October 2017 (EPA, 2017) which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the *Protection of the Environment Operations Act 1997*. The NPfI provides a framework and process for deriving operational noise criteria for project approvals and development consents under the EP&A Act and setting operational noise limits in environment protection licences under the POEO Act. The Proposed Modification is a scheduled activity under Schedule 1 of this latter Act.

Project Noise Trigger Levels

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (i.e., the more stringent) value of the Project Intrusiveness Noise Level (PINL) and the Project Amenity Noise Level (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

- The PINL ($L_{Aeq(15min)}$) is the RBL + 5 dB and seeks to limit the degree of change a new noise source introduces to an existing environment.
- PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI).

As discussed in NVIA (refer to **Appendix 10**), the PINL provide the more stringent noise criteria in this case and are as follows:

- day: 43 dB(A)
- evening: 39 dB(A)
- night: 35 dB(A).

Sleep Disturbance (Maximum Noise Levels)

As the Quarry could operate during the night-time period (truck loading and transport operations), the potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The screening criteria of the NPfI, which would prompt the requirement for a detailed maximum noise level event assessment are as follows:

- $L_{Aeq(15min)}$ of 40 dB(A) or the prevailing RBL plus 5 dB(A) (40 dB(A)), whichever is the greater – 40 dB(A)
- L_{Amax} 52 dB(A) or the prevailing RBL plus 15 dB(A) (50 dB(A)), whichever is the greater – 52 dB(A).

Should the screening criteria be exceeded, the detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Voluntary Land Mitigation and Acquisition

The land acquisition and mitigation assessment criteria used to assess noise impacts can be found in *Table 1* of the VLAMP and *Table 2.2* of the NPfI.

4.9.3.2 Blasting Criteria

The EPA has adopted recommended air-blast and ground vibration levels published by the Australian and New Zealand Environment and Conservation Council (ANZECC). These recommended levels are based on prevention of human discomfort and have been adopted as the assessment criteria for the blasting assessment for residential receptors.

- The recommended maximum vibration level for air-blast is 115 dB linear peak. The vibration level of 115 dB may be exceeded on up to 5% of the total number of blasts over 12 months, however, should not exceed 120 dB linear peak at any time.
- Peak particle velocity (PPV) from ground vibration should not exceed 5 mm/s for more than 5% of the total number of blasts over 12 months, however, the maximum level should not exceed 10 mm/s at any time.

4.9.4 Assessment Methodology

4.9.4.1 Noise

Assessment of operational noise was conducted using the iNoise (Version 2019) noise modelling software, using sound power level spectra for each of the Quarry noise sources derived from on-site measurement or from MAC's database of measured quarry noise sources. To predict noise levels at the potential noise receivers, the model incorporated a 3-dimension digital terrain map, relevant noise source data, ground type, shielding such as barriers and/or adjacent buildings, and atmospheric information. All noise sources were assumed to be operating for the full 15 minute assessment period simultaneously.

The modelling was undertaken under meteorological conditions which would enhance received noise levels. This provides for source to receiver winds and temperature inversion in accordance with Option 1 of Fact Sheet D of the NPfI for noise enhancing meteorological conditions.

Six operating scenarios were modelled, representing the progressive development of the Quarry for daytime and evening / night-time operations. To provide for worst-case predictions of noise, equipment external to the production areas of the extraction area was assumed to be operating at surface. Additional information on the operating scenarios and approach to noise predictions is provided in the NVIA (refer to **Appendix 10**).

4.9.4.2 Blasting

An estimation of air-blast overpressure and ground-borne vibration levels has been conducted in accordance with methods in AS2187.2. The estimation adopted an MIC of 90 kg (the average MIC from historic blasts at the Quarry) with blasting locations assumed to be at the nearest drilling position within the proposed extension of the extraction area to receivers.

4.9.5 Controls, Safeguards and Management Measures

The Applicant would continue to implement the operational controls and management measures currently implement and identified in the Quarry's Noise Management Plan (Umwelt, 2019b) and Blast Management and Explosives Control Plan (Umwelt, 2019c). These measures are summarised as follows:

Noise Emissions Management

- All approved hours of operation will be strictly adhered to.

- The extraction area will be developed such that a high wall or other physical barrier is maintained between operating equipment within the extraction area and receivers to the north.
- Wherever practicable, loading of trucks would be undertaken from the southern aspect of stockpiles (to retain the remaining stockpile as a nose barrier to receivers to the north).
- Operations at exposed locations and under unfavourable weather conditions will be modified, where necessary, to reduce potential noise-related impacts.
- All relevant equipment will be regularly serviced to ensure sound power levels of each item remains equivalent to or less than the SPLs nominated by *Table 15* of MAC (2019) with the SPLs to be measured on an annual basis.
- All site personnel, subcontractors and suppliers shall undergo an induction that includes requirements in relation to potential noise impacts.
- The internal road network will be maintained to the current standard and if any new roads are proposed these will be constructed to similar standards to limit body noise from empty trucks.
- Maintenance work on all plant and equipment will only be undertaken outside the standard hours of operation if these are inaudible at all residential premises surrounding the Quarry Site.

Blast Emissions Management

- Notification of impending blasts will be provided to any landowner within 2 km of the Quarry requesting this.
- Blast energies are to be minimised as far as possible.
- Quality control practices are to be implemented on the ground to ensure blasts are kept within design tolerances.
- Adequate bur Blasts are only fired in optimal weather conditions. In the event that unfavourable meteorological conditions are identified, the shot-firer will liaise with the Quarry Manager to determine whether to postpone a blast. Unfavourable conditions include:
 - excessively wet conditions during which blast fumes may result; or
 - dry and windy conditions that may result in dust flumes leaving the site.

Blast events will be considered individually and additional mitigation measures or postponement of blasting considered by the Quarry Manager. den is to be maintained on all faces to prevent blowouts and blast anomalies.

- No blasting will be initiated within 30 m of any power line infrastructure, or within 100 m of any other public infrastructure or underground utilities (such as Telstra infrastructure) without the written permission of the agency responsible for managing that infrastructure.

4.9.6 Assessment of Impacts

The NVIA (**Appendix 10**) details the predictions of the modelling of operational noise levels at each receiver and provides noise contour figures for each of the six operational scenarios in relation to the receiver locations. The results of the modelling indicate that noise emissions from proposed operations satisfy the relevant criteria at all 26 assessed receivers for each modelled scenario.

The maximum noise level assessment indicates that the maximum level screening criteria will be satisfied for all residential receivers. It is noted that the predictions are below the EPA screening criteria, and hence no further assessment or detailed analysis is required.

As the results of the operational noise modelling remain below the PNTLs, the requirements of the VLAMP assessment are considered to be satisfied at all receivers, with impacts being categorised as negligible under the VLAMP.

Predictions of blast overpressure and vibration are demonstrated to satisfy the relevant ANZECC guidelines at all assessed receivers.

4.9.7 Monitoring

On the basis of the predicted noise and blasting emissions, it is assessed that the Proposed Modification presents a relatively low risk of exceeding the nominated PNTLs and blasting criteria, at surrounding receivers. This notwithstanding, it is recommended that the current noise and blast monitoring programs of the Quarry, as presented in the Noise Management Plan and Blast Management and Explosives Control Plan, are continued to confirm compliance with noise and blasting criteria.

4.10 Air Quality

4.10.1 Introduction

An Air Quality Assessment (AQA) has been undertaken by Ramboll Environ Australia Pty Ltd (Ramboll) to quantify the potential air emissions associated with the Proposed Modification (Ramboll, 2019). This section provides a summary of the key findings of the AQA, which can be reviewed in full as **Appendix 11**.

4.10.2 Local Setting

4.10.2.1 Local Terrain and Land Use

The Quarry Site and surrounding region is defined by undulating topography, with an elevated ridgeline immediately to the southeast and the broader elevated terrain of the Great Dividing Range further to the east.

The land use of the area is a mixture of cleared agricultural land, residential development, active forestry and industrial development. With respect to the primary sources of air emissions, the Quarry Site adjoins the plantation forest of Lidsdale State Forest and is bounded to the north by the Great Western Highway. Rural residential properties are located to the north of the Great Western Highway with the town of Wallerawang is located approximately 2 km to the north.

The existing air quality environment in the vicinity of the Quarry Site is expected to be influenced by industrial development of the surrounding area.

- The Mount Piper Power station located approximately 8 km to the north.
- The Lidsdale coal siding located approximately 4 km to the north.
- The Springdale Colliery located approximately 4.5 km to the north-east.
- The Metromix Marrangaroo Quarry located approximately 3.5 km to the south-east.

Considering the local land uses, the local airshed will also be influenced by the following:

- Wind generated dust from exposed areas.
- Fugitive dust emissions from agricultural activities during dry conditions.
- Dust entrainment due to vehicle movements along unsealed and sealed roads.
- Seasonal emissions from household wood heaters.
- Vehicle emissions from populated areas such as Lithgow.
- Episodic emissions from vegetation fires.
- Long-range transport of fine particles into the region.

4.10.2.2 Sensitive Receivers

As noted in **Section 4.9.2.2**, there are no sensitive locations such as schools, churches or major urban development located near the Project Site. 26 residential receivers have been identified within approximately 1 km of the Project Site (refer to **Figure 4.1**).

4.10.2.3 Ambient (Background) Air Quality Levels

To establish background air quality levels against which to compare emissions from the Quarry, the AQA considered available data from:

- The dust deposition monitoring program of the Applicant.
- Monitoring data collected for the Mt Piper Ash Placement Project and reported in the 2018 AEMR for this project.
- The OEH particulate matter monitoring station at Bathurst.

Further description of the data used to establish background air quality levels is provided in the AQA, with the following adopted for the purpose of assessing cumulative emission or deposition levels.

- 24-hour PM₁₀ concentration – daily varying with a maximum of 49.7 µg/m³
- Annual average PM₁₀ concentration – 18.8 µg/m³
- 24-hour PM_{2.5} concentration – daily varying with a maximum of 22.1 µg/m³
- Annual average PM_{2.5} concentration – 7.0 µg/m³
- Annual average TSP concentration – 47.1 µg/m³
- Annual average dust deposition – 1.5 g/m²/month.

4.10.3 Assessment Criteria

Predicted ground level concentrations (GLCs) for the Proposed Modification were assessed against the NSW EPA's impact assessment criteria, as presented in **Table 4.17**. The dust deposition criteria illustrate the maximum increase and total dust deposition rates which would be acceptable so that dust nuisance can be avoided.

Table 4.17 Impact Assessment Criteria

Particulate Matter Criteria			
Parameter	Averaging Period	Concentration ($\mu\text{g}/\text{m}^3$)	
TSP	Annual	90	
PM ₁₀	24-hour	50	
	Annual	25	
PM _{2.5}	24-hour	25	
	Annual	8	
Dust Deposition Criteria			
Parameter	Averaging Period	Maximum Increase in Dust Deposition	Maximum Total Dust Deposition Level
Dust Deposition	Annual	2 g/m ² /month	4 g/m ² /month

4.10.4 Assessment Methodology

4.10.4.1 Approach

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

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

A summary of these three key components of the AQA methodology are provided in **Sections 4.10.4.2 to 4.10.4.4**, with a full description included in **Appendix 11**.

4.10.4.2 Emissions Inventories

Particulate emissions for the modified Quarry operations were estimated for all relevant activities using best practice emission estimation techniques. It should be noted that gaseous combustion emissions from mining equipment (i.e., oxides of nitrogen, sulfur dioxide, carbon monoxide, carbon dioxide and volatile organic compounds) would not result in significant off-site concentrations and are unlikely to compromise ambient air quality goals. Therefore, only PM has been assessed as a part of the AQA, and other combustion emissions have not been quantitatively assessed.

Emissions inventories were developed for two representative scenarios, selected to assess the air quality impacts of worst-case operations:

- Scenario 1 assumes the mobile crushing plant is located within the extraction area with the extent of Quarry development equivalent to that presented on **Figure 2.6**.
- Scenario 2 assumes the operation of a fixed crushing plant on the Southern Stockpile Area, along with a larger extraction area and longer haul road lengths than Scenario 1. The extent of Quarry development being equivalent to that presented on **Figure 2.7**.

Both scenarios assume the maximum approved production rate of 500,000 tpa.

Emission factors developed by the US EPA were applied to estimate the amount of dust produced by each activity (topsoil stripping, overburden removal, rock extraction and processing, wind erosion, hauling). These emission estimates are provided in the AQA Report (**Appendix 11**) for PM₁₀ and PM_{2.5} for both scenarios.

4.10.4.3 Dispersion Modelling

Local air quality impacts were modelled using AERMOD, which is a steady-state plume dispersion model approved for use by the NSW EPA for extractive industries. The model was used to predict ground level concentrations for key pollutants at surrounding sensitive receptors.

Meteorological data used in the model were derived from 2018 data from the BoM weather stations at Marrangaroo, Mount Boyce, and Lidsdale, and also from the Applicant's automatic weather station (AWS) located at the Quarry (refer **Figure 4.1**). Hourly-varying atmospheric boundary layer heights were generated for modelling by AERMET, using a combination of surface observations from the Quarry's AWS and an adjusted TAPM-predicted upper air temperature profile.

The model inputs are described in detail in the AQA Report (**Appendix 11**).

4.10.4.4 Cumulative Impacts

Cumulative impacts were assessed by taking into account the combined effect of existing baseline air quality, other local sources of emissions, reasonably foreseeable future emissions, and any indirect or induced effects.

The background dataset for the cumulative assessment was based on dust deposition data derived from the Quarry air quality monitoring program, and particulate data derived from the OEH monitoring station located at Bathurst (approximately 40 km from the Project Site). The particulate data from the OEH monitoring station were found to be conservatively high and are considered likely to account for all existing emission sources in the vicinity of the Quarry.

The AQA Report (**Appendix 11**) outlines the background air quality values adopted for the cumulative assessment.

4.10.5 Controls, Safeguards and Management Measures

Air quality will continue to be managed in accordance with the Quarry's existing Air Quality Management Plan (AQMP) (Umwelt, 2019d), which will be updated to include the Proposed Modification.

Key features of air quality control within the AQMP are as follows:

- The seal on the Quarry Access Road between the Great Western Highway and the wheel wash (including the Surface Facilities Area) will be maintained to reduce dust tracking, degradation and surface dust lift-off.
- Banks and bunds will be stabilised with groundcover to limit the potential for dust lift-off.
- Blasting will be scheduled to avoid higher wind conditions, especially when winds from the south or south-east prevail.
- A water truck would be operated to reduce dust lift-off from internal roads and stockpile areas. The frequency of watering would increase during periods of extended dry weather and/or high winds.
- All vehicles travelling on internal unsealed roads are limited to a speed appropriate for the conditions and safety, i.e. less than 40 km/hr.
- Dump heights from trucks, front-end loaders and conveyors will be minimised.
- Trucks entering and leaving the premises that are carrying loads will be covered at all times, except during loading and unloading.
- All trucks leaving the Quarry will make use of the wheel wash facility to limit dust tracking on the sealed Quarry Access Road and the Great Western Highway.

In addition to these controls, the Applicant would implement the following management measures to limit dust emissions:

- Direct placement of overburden and soil where possible, reducing the double handling of material, potential for wind erosion and haulage distances.
- Minimising the double handling of material, wherever practicable (i.e. direct movement of rock to the processing plant).
- Avoiding disturbance, or temporary rehabilitation of long-term soil stockpiles and waste emplacements.

The AQMP also includes procedures for incident identification, management and reporting, and outlines reactive management measures and corrective actions to be applied in response to complaints and exceedances of air quality criteria.

4.10.6 Assessment of Impacts

4.10.6.1 Annual Emissions

Airborne Particulate matter

The predicted annual average PM₁₀, PM_{2.5} and TSP concentrations at residential receivers surrounding the Project Site, as well as the most exposed locations on vacant land where it is likely a future residence would be constructed, are presented in **Tables 4.18** and **4.19**.

Table 4.18 Predicted Annual Average Airborne Particulate Matter – Scenario 1

Receiver	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)		TSP (µg/m ³)	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
N1	0.2	19.0	0.1	7.1	0.7	47.8
N2	0.9	19.7	0.2	7.2	2.9	50.0
N3	0.3	19.1	0.1	7.1	1.1	48.2
N4	0.5	19.3	0.1	7.1	1.7	48.7
N5	0.4	19.2	0.1	7.1	1.3	48.3
N6	0.2	19.1	0.1	7.1	0.8	47.9
N7	0.3	19.2	0.1	7.1	1.1	48.2
N8	0.3	19.1	0.1	7.1	1.1	48.1
N9	0.3	19.1	0.1	7.1	0.9	48.0
N10	0.1	19.0	0.04	7.0	0.5	47.6
N11	0.2	19.0	0.1	7.0	0.7	47.8
N12	0.2	19.0	0.1	7.1	0.7	47.8
N13	0.3	19.1	0.1	7.1	0.9	47.9
N14	0.2	19.1	0.1	7.1	0.8	47.9
N15	0.2	19.0	0.05	7.0	0.6	47.7
N16	0.2	19.1	0.1	7.1	0.8	47.9
N17	0.1	19.0	0.04	7.0	0.5	47.6
N18	0.2	19.0	0.1	7.0	0.6	47.7
N19	0.2	19.0	0.05	7.0	0.6	47.7
N20	0.1	19.0	0.04	7.0	0.4	47.5
N21	0.1	18.9	0.03	7.0	0.4	47.5
N22	0.2	19.0	0.05	7.0	0.6	47.6
N23	0.1	18.9	0.03	7.0	0.4	47.4
N24	0.1	19.0	0.04	7.0	0.5	47.5
FR1	0.3	19.1	0.1	7.1	1.0	48.1
FR2	0.4	19.2	0.1	7.1	1.3	48.3

Source: Modified after Ramboll (2019) – Tables 7-1 and 7-3

Table 4.19 Predicted Annual Average Airborne Particulate Matter – Scenario 2

Receiver	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)		TSP (µg/m ³)	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
N1	0.2	19.1	0.1	7.1	0.8	47.8
N2	0.8	19.7	0.2	7.2	2.8	49.9
N3	0.3	19.2	0.1	7.1	1.2	48.2
N4	0.5	19.4	0.2	7.1	1.9	48.9
N5	0.4	19.2	0.1	7.1	1.4	48.5
N6	0.3	19.1	0.1	7.1	0.9	48.0
N7	0.4	19.2	0.1	7.1	1.2	48.3
N8	0.3	19.2	0.1	7.1	1.2	48.2

Receiver	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)		TSP (µg/m ³)	
	Incremental	Cumulative	Incremental	Cumulative	Incremental	Cumulative
N9	0.3	19.1	0.1	7.1	1.0	48.1
N10	0.1	19.0	0.04	7.0	0.5	47.6
N11	0.2	19.0	0.1	7.0	0.7	47.8
N12	0.2	19.1	0.1	7.1	0.8	47.9
N13	0.3	19.1	0.1	7.1	0.9	48.0
N14	0.3	19.1	0.1	7.1	0.9	48.0
N15	0.2	19.0	0.1	7.0	0.6	47.7
N16	0.2	19.1	0.1	7.1	0.8	47.9
N17	0.2	19.0	0.04	7.0	0.5	47.6
N18	0.2	19.0	0.1	7.0	0.7	47.7
N19	0.2	19.0	0.1	7.0	0.6	47.7
N20	0.1	19.0	0.04	7.0	0.5	47.5
N21	0.1	18.9	0.03	7.0	0.4	47.5
N22	0.2	19.0	0.1	7.0	0.6	47.7
N23	0.1	18.9	0.03	7.0	0.4	47.5
N24	0.1	19.0	0.04	7.0	0.5	47.6
FR1	0.3	19.1	0.1	7.1	1.1	48.2
FR2	0.4	19.2	0.1	7.1	1.4	48.4

Source: Modified after Ramboll (2019) – Tables 7-1 and 7-3

The annual average concentration of airborne particulate matter is predicted to comply with the criteria nominated in **Section 4.10.3** for both Scenarios, even assuming a conservatively high background from Bathurst. Contour plots provided by the AQA confirm that compliance on greater than 25% of the vacant lands surrounding the Project Site is expected.

Dust Deposition

The predicted annual average dust deposition concentration at residential receivers surrounding the Project Site, as well as the most exposed locations on vacant land where it is likely a future residence would be constructed, are presented in **Table 4.20**.

Table 4.20 Predicted Annual Average Dust Deposition

Receiver	Dust Deposition - Scenario 1 (g/m ² /month)		Dust Deposition - Scenario 2 (g/m ² /month)	
	Incremental	Cumulative	Incremental	Cumulative
N1	0.1	1.6	0.1	1.6
N2	0.4	1.9	0.4	1.8
N3	0.2	1.7	0.2	1.7
N4	0.2	1.7	0.2	1.7
N5	0.1	1.6	0.1	1.6
N6	0.1	1.6	0.1	1.6
N7	0.1	1.6	0.1	1.6

Receiver	Dust Deposition - Scenario 1 (g/m ² /month)		Dust Deposition - Scenario 2 (g/m ² /month)	
	Incremental	Cumulative	Incremental	Cumulative
N8	0.1	1.6	0.1	1.6
N9	0.1	1.6	0.1	1.6
N10	0.0	1.5	0.05	1.5
N11	0.1	1.6	0.1	1.6
N12	0.1	1.6	0.1	1.6
N13	0.1	1.6	0.1	1.6
N14	0.1	1.6	0.1	1.6
N15	0.1	1.6	0.1	1.6
N16	0.2	1.6	0.2	1.6
N17	0.1	1.6	0.1	1.6
N18	0.1	1.6	0.1	1.6
N19	0.1	1.6	0.1	1.6
N20	0.1	1.6	0.1	1.6
N21	0.1	1.6	0.1	1.6
N22	0.1	1.6	0.1	1.6
N23	0.1	1.6	0.1	1.6
N24	0.1	1.6	0.1	1.6
FR1	0.1	1.6	0.1	1.6
FR2	0.1	1.6	0.1	1.6

Source: Modified after Ramboll (2019) – Table 7-3

The annual average concentration of airborne particulate matter is predicted to comply with the criteria nominated in **Section 4.10.3** for both Scenarios, even assuming a conservatively high background from Bathurst. Contour plots provided by the AQA (**Appendix 11**) confirm that compliance on greater than 25% of the vacant lands surrounding the Project Site is expected.

4.10.6.2 Maximum 24-hour Emissions

The predicted maximum 24-hour emissions at residential receivers surrounding the Project Site, as well as the most exposed locations on vacant land where it is likely a future residence would be constructed, are presented in **Table 4.21**.

Table 4.21 24-hour average PM₁₀ and PM_{2.5} concentration

Receiver	Maximum 24-hour Concentration – PM ₁₀ (µg/m ³)				Maximum 24-hour Concentration – PM _{2.5} (µg/m ³)			
	Incremental		Cumulative		Incremental		Cumulative	
Scenario:	1	2	1	2	1	2	1	2
N1	1.8	2.1	49.8	49.8	0.5	0.6	22.2	22.2
N2	5.5	5.7	50.3	50.5	1.6	1.5	22.7	22.7
N3	3.3	3.7	49.8	49.9	1.0	1.1	22.5	22.5

Receiver	Maximum 24-hour Concentration – PM ₁₀ (µg/m ³)				Maximum 24-hour Concentration – PM _{2.5} (µg/m ³)			
	Incremental		Cumulative		Incremental		Cumulative	
Scenario:	1	2	1	2	1	2	1	2
N4	7.4	10.3	49.9	49.9	2.2	2.8	22.4	22.4
N5	5.9	8.0	49.8	49.8	1.8	2.1	22.3	22.3
N6	2.8	3.4	49.8	49.8	0.9	1.0	22.4	22.4
N7	4.7	5.8	49.8	49.8	1.5	1.8	22.2	22.2
N8	5.1	7.5	49.8	49.8	1.6	2.0	22.2	22.2
N9	4.8	6.7	49.8	49.8	1.5	1.9	22.2	22.2
N10	1.6	1.9	49.7	49.7	0.5	0.5	22.2	22.2
N11	2.5	2.8	49.8	49.8	0.7	0.7	22.3	22.3
N12	2.4	2.6	49.7	49.7	0.7	0.8	22.2	22.2
N13	3.7	4.1	49.8	49.8	1.1	1.2	22.2	22.2
N14	2.5	2.8	49.8	49.8	0.7	0.8	22.4	22.4
N15	1.8	2.0	49.8	49.8	0.5	0.6	22.3	22.3
N16	2.4	2.7	49.8	49.8	0.7	0.7	22.2	22.2
N17	1.5	1.7	49.8	49.8	0.4	0.5	22.2	22.2
N18	1.7	2.0	49.8	49.8	0.5	0.5	22.2	22.2
N19	1.7	1.9	49.8	49.8	0.5	0.5	22.2	22.2
N20	1.3	1.5	49.8	49.8	0.4	0.4	22.2	22.2
N21	1.2	1.4	49.8	49.8	0.4	0.4	22.2	22.2
N22	1.5	1.7	49.8	49.8	0.4	0.5	22.2	22.2
N23	1.1	1.2	49.7	49.8	0.3	0.3	22.2	22.2
N24	1.8	2.0	49.7	49.7	0.5	0.6	22.1	22.1
FR1	4.1	5.7	49.8	49.8	1.3	1.6	22.2	22.2
FR2	5.2	6.4	49.8	49.8	1.7	2.0	22.2	22.2

Source: Modified after Ramboll (2019) – Table 7-2

The highest predicted increment in 24-hour average PM₁₀ and PM_{2.5} is 10.3 µg/m³ and 2.8 µg/m³ (at receptor N4) respectively, well below the criteria nominated in **Section 4.9.3**.

When considering the corresponding 24-hour background of the Bathurst dataset, the predicted cumulative concentration is predicted to remain below the criteria at all receptors except N2. An additional exceedance of 24-hour cumulative PM₁₀ concentration was predicted at N2 (50.3 µg/m³ for Scenario 1 and 50.5 µg/m³ for Scenario 2. With respect to this additional exceedance, it is noted that this is principally due to an elevated background concentration (49.2 µg/m³), with the incremental contribution from the project on this day considered minor (1.1 and 1.3 µg/m³ for Scenarios 1 and 2 respectively). It is also noted that N2 is considered project-related due to the ownership of the property and that the highest incremental increase in PM₁₀ is 5.7 µg/m³ under Scenario 1 conditions.

4.10.7 Monitoring

The existing air quality monitoring program, comprising meteorological monitoring and four dust deposition gauges, is considered suitable for operations associated with the Proposed Modification. In line with existing procedures, should the results of deposited dust monitoring indicate elevated air levels (i.e. when the rolling 12 month average exceeds 4.0 g/m²/month), the Applicant will implement a program of PM monitoring to ensure levels of TSP and PM₁₀ remain within the Quarry's consent conditions.

4.11 Land Resources (Rehabilitation and Land Use)

4.11.1 Introduction

Section 2.10 reviews the proposed rehabilitation of the Quarry in light of the Proposed Modification. This section considers the implications of the nominated changes to the final landform on the established rehabilitation and land use objectives approved by DA 344-11-2001 and consolidated within the MOP for the Quarry.

4.11.2 Rehabilitation Objectives and Completion Criteria

With mining only having commenced in 2014, and noting that the Quarry has yet to require the construction and rehabilitation of waste rock (or overburden) stockpiles, large areas of land have yet to become available for progressive rehabilitation. As a consequence, a complete evaluation of rehabilitation against the objectives and criteria of the MOP (namely *Table 17* of RWC, 2018) is not possible. The Proponent has, however, remained cognisant of ensuring that rehabilitation planning remains central to overall Quarry scheduling and regularly reviews progress and plans with respect to rehabilitation.

The Proposed Modification requires some amendments to the final landform of the Quarry Site, namely Domain 3 - Processing and Stockpile Areas, and Domain 4 – Void Areas as described, however, the overriding rehabilitation objectives and completion criteria for these domains will remain consistent with those currently nominated in the Quarry MOP. **Tables 4.22** and **4.23** present the objectives, indicators and completion criteria for these domains.

Table 4.22 Rehabilitation Objectives, Performance Indicators and Criteria – Doman 3 (Processing and Stockpiling Areas)

Phase	Objective	Performance Indicator	Completion Criteria
Decommissioning	All plant decommissioned and surplus stockpiles removed	Removal of all services and Infrastructure not required as part of the final landform	Plant removed
		All remaining material sold and despatched or used in final landform creation	Final landform constructed in accordance with Figure 2.9
Landform Establishment	Stable and permanent landform established	Landform slope	All slopes <18°
	Landform non-polluting	Pollution potential	Discharged water complies with EPL limits
		Active erosion	No identifiable erosion or sedimentation

Phase	Objective	Performance Indicator	Completion Criteria
Growth Medium Development	Soil properties suitable for the establishment and maintenance of selected vegetation species	Soil occurrence	Soil thickness 100 – 600 mm
		Chemical and physical properties	pH 5.0 – 8.0
			Erodibility (K-Factor) <0.055
		Active erosion	<2 gullies or rills >0.3 m in width or depth in a 50 m transect
Ecosystem and Land Use Development	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Appropriate native plant species richness	Native plant species numbers (per 100 m ²) average within 20% of Analogue Site (refer to Note A)
		Appropriate density/structure of native overstorey	Average within 20% of Analogue Site (refer to Note A)
		Appropriate native groundcover is present	Average within 20% of Analogue Site (refer to Note A)
		Target Species occurrence	<i>Bursaria spinosa lasiophylla</i> present
		Weed species and abundance	Number of weed species and abundance average no greater than 20% more than that of analogue sites
Ecosystem and Land Use Stability	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Appropriate native plant species richness	Native plant species numbers (per 100 m ²) average within 50% of Analogue Site (refer to Note A)
		Appropriate density/structure of native overstorey	Average within 50% of Analogue Site (refer to Note A)
		Appropriate native groundcover is present	Average within 50% of Analogue Site (refer to Note A)
		Target Species occurrence	<i>Bursaria spinosa lasiophylla</i> present
		Weed species and abundance	Number of weed species and abundance average no greater than 20% more than that of analogue sites
	Vegetation is maturing and/or naturally regenerating and trending towards that of local remnant vegetation	Ecosystem growth and natural recruitment	Shrubs and juvenile trees present

Note A: Analogue Sites (AS) for each vegetation community are identified within the Biodiversity Management Plan for the Quarry. Each AS exhibits biometric and floristic parameters typical of remnant native vegetation of the local setting

Table 4.23 Rehabilitation Objectives, Performance Indicators and Criteria – Doman 4 (Void)

Phase	Objective	Performance Indicator	Completion Criteria
Landform Establishment	Final landform safe and secured	Access to void restricted by public	Fencing established to prevent inadvertent access by the public
	Stable and permanent landform established	Landform stability	Geotechnical report indicating no unacceptable risk of instability
		Landform suitable for growth media establishment	Floor slope <10° Eastern perimeter slope <55° Southern perimeter slope <70°
Landform non-polluting	Active erosion	No identifiable erosion or sedimentation	
Growth Medium Development	Soil properties suitable for the establishment and maintenance of selected vegetation species	Soil occurrence	Soil thickness 100 – 600 mm
		Chemical and physical properties	pH 5.0 – 8.0
		Active erosion	Erodibility (K-Factor) <0.055
Ecosystem and Land Use Development / Ecosystem and Land Use Stability	Final landform safe and secured	Access to void restricted by public	Fencing established to prevent inadvertent access by the public
	Stable and permanent landform established	Landform stability	Geotechnical report indicating no unacceptable risk of instability
		Landform suitable for growth media establishment	Perimeter slope <70°
Native Vegetation established	Appropriate native plant species richness	Natural regeneration on final benches	

Note A: Analogue Sites (AS) for each vegetation community are identified within the Biodiversity Management Plan for the Quarry. Each AS exhibits biometric and floristic parameters typical of remnant native vegetation of the local setting

The Quarry has yet to complete significant rehabilitation activities to evaluate performance against completion criteria.

4.11.3 Assessment of Impact

4.11.3.1 Final Landform

The final landform presented in **Figure 2.9** and described in **Section 2.10.3** represents a sympathetic extension of the landform already nominated for the Quarry and approved as part of the MOP (RWC, 2018). The proposed final landform does not rely on the importation of an additional materials, resources or specialist equipment. The following reviews the changes to the four rehabilitation domains of the Quarry.

Domain 1 – Infrastructure Areas

Following consultation with FC NSW, the Applicant has agreed to provide for the decommissioning and removal of the Quarry Site Entrance and internal roads, along with all building and fixed plant infrastructure.

As noted in **Section 2.10.2**, the Applicant believes that the current Quarry Site Entrance provides a far safer access point to the Lidsdale State Forest than provided by the less well defined access points to the west

and should be considered as the principal access point to the Lidsdale State Forest. The Applicant will therefore continue to liaise with FC NSW over the life of the Quarry with respect to the retention of the Quarry Site Entrance and key internal roads as a suitable and lawful use.

The Applicant's revised commitment to decommission and remove all infrastructure, unless a future agreement with the landowner over a preferred suitable and lawful use which allows for the retention of surface infrastructure, is considered reasonable and in accordance with the rehabilitation objectives currently nominated for the Quarry.

Domain 2 – Surface Water Management Structures

Following consultation with FC NSW, the Applicant has agreed to provide for the decommissioning and removal of all water storage structures. On the basis that the proposed clean water diversions would be well established, stable and well vegetated, the retention of these is considered appropriate and in accordance with the existing rehabilitation objectives for the Quarry.

The approach to the rehabilitation of the buried clean water pipeline within the final landform is considered reasonable and would avoid the unnecessary disturbance to the landform of the Main Stockpile Area.

The Applicant would continue to liaise with the landowners with respect to the possible retention of water storage structures within the final landform. The Applicant considers the retention of one or more water storages would provide an asset to bushfire management and dust suppression within the Lidsdale State Forest, however, would acquiesce with landowner requests at the time of final rehabilitation.

Domain 3 Processing and Stockpile Areas

The proposed landform, with slopes over the processing and stockpile areas of between 18° and 25°, would provide for an undulating landform which is sympathetic to the topography of the local setting and allow for the retention of applied soil resources and establishment of native open forest vegetation.

While the stockpile extensions would require the backfilling and diversion of ephemeral tributaries of the Coxs River, it is assessed that as the diversions would be well established at this time, rehabilitation objectives and completion criteria of the Quarry would be better achieved through retention of the diversions.

Domain 4 - Void Areas

It is noted that the final open cut void is significantly larger than that which is currently approved, however, this does represent a natural extension of the currently approved extraction area void. It is noted that the void would draw water from the surrounding fractured rock aquifer, however, as discussed in **Section 4.6.5.1**, this would not result in any significant drawdown effects resulting in adverse impacts on the Coxs River or surrounding groundwater users.

In assessing the proposed extended extraction area void, it is noted that FC NSW requested the retention of a void in the final landform be reviewed as part of the Proposed Modification. The nature of hard rock extractive industry is such that there is generally very little overburden available for replacement within the void. Furthermore, as the quartzite is present as a narrow but steeply dipping band, there is also limited opportunity to replace any overburden which is removed within the void until the extraction area is developed to its final depth. Options for future backfilling of the final void will continue to be investigated, however, do not form part of the Proposed Modification.

The geotechnical stability of the extraction area void was previously assessed by GE Holt & Associates Pty Ltd (Holt, 2000) (see **Appendix 5**). This assessment concludes that the nature of the proposed extraction, being a hilltop extraction which follows the eastern boundary of the dipping quartzite, would not create any long term stability consequence for the hill after the cessation of operations. Holt (2000) notes that any instability associated with benches constructed within the dipping strata would be contained within the extraction area

and be very localised to bedding plane slippage of rock fragments. Holt (2000) concludes that blasting vibrations would not affect the integrity of the rock barrier between the Quarry and the river for more than a few metres. It is noted that assessment of Holt (2000) is for the currently approved extraction area, however, as the propose extension remains within the same geological formation and would be completed to the same design specifications, the conclusions made in relation to the stability of void within these formations remains relevant to the extended extraction area. The conclusions of Holt (2000) and application to the extended extraction area notwithstanding, the Applicant would monitor bench stability over the life of the Quarry, engaging a geotechnical engineer as required to assess any matters of concern if identified. Further, the Applicant would engage a geotechnical engineer, as extraction operations approach final extent to complete a final geotechnical stability assessment.

The Proposed Modification allows for the further rehabilitation of the Hoskins Quarry void. The current landform objective for this component of the Quarry Site is to reinstate the landform as at the completion of historic quarrying from this location. As a result of the intended modification to the Processing and Stockpile Areas (Domain 3), the void would be backfilled and profiled to reinstate a landform more sympathetic to the surrounding topography.

On the basis that the void remains the only reasonable and feasible landform option, would not adversely impact on the water resources of the surrounding groundwater aquifer or Coxs River and would allow for the drainage of any accumulation of water within the void to the Coxs River, this aspect of the final landform is assessed as likely to achieve the rehabilitation objectives and completion criteria of the currently approved Quarry.

Based on the above, it is assessed that the proposed final landform is appropriate for the intended final land use (see below) and achievable.

4.11.3.2 Final Land Use

The Proposed Modification does not propose to modify the intended final land use of the Quarry (management for the conservation of native vegetation). Furthermore, the proposed final landform incorporates modifications reflecting the requests of FC NSW, one of the current landowners.

As noted above, the proposed final landform, excluding the final void, would be conducive to the establishment of native open forest vegetation with the proposed slopes of 18° to 25° being a feature of the surrounding landforms where the nominated vegetation types are established. There are no reasonable or feasible alternatives to the retention of the final void, however, the Applicant's proposed draining of the void through the boring of a hole from the final floor would ensure that accumulation of water would not prevent any future backfilling or other use of the landform.

Overall, the Proposed Modifications are effectively extensions to current activities on the Quarry Site and therefore, subject to the implementation of the rehabilitation procedures and strategies of the MOP, are unlikely to affect the likelihood of establishing native open forest vegetation as part of a final passive biodiversity conservation land use.

4.12 Bush Fire

4.12.1 Bush Fire Prone Land

On review of the NSW Rural Fire Service website, the Project Site is identified as occurring on bushfire prone land (<https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection/bush-fire-prone-land/check-bfpl>).

4.12.2 Quarry Operations and Potential Sources of Fire

Potential sources of fire initiation at the Quarry have been identified as follows:

- ignition of fuel or other flammable material on working equipment
- ignition of fuel or flammable materials during equipment or plant maintenance, e.g. welding, electrical maintenance
- ignition of vegetation leaf litter within uncleared areas, or areas under rehabilitation as a result of heat or spark from mobile equipment or vehicles
- inappropriate disposal of cigarettes
- lightning strike of vegetation or on-site structures.

4.12.3 Operational Safeguards and Controls

4.12.3.1 Prevention and Management of On-Site Fire

The Applicant provides a variety of controls to minimise the potential for its activities to result in fires being initiated on or surrounding the Quarry. These operational controls and safeguards, which are documented in the Quarry Bushfire Management Plan, are as follows:

Earthmoving Machinery

- All earthmoving machinery is maintained in good working order with efficient exhaust systems and spark arrestors.
- All earthmoving machinery and mobile equipment is fitted with appropriately sized and approved fire extinguishers suitable for the control of flammable liquid and electrical fires.

Workshops and Offices

- All workshops and offices are installed with an approved 80:BE rated fire extinguisher.

Fuel and Oil Management

- All fuel and oil storage are located and constructed in accordance with the requirements of the *Dangerous Goods Act*.
- Fuel and oil storage areas are signposted as to the contents of the storages and fitted with approved 80:BE rated fire extinguishers.
- All fuel tanks on-site are fully bunded to ensure that in the event of a leak or rupture, no fuel escapes from the bunded area.

No Smoking Areas

- Designated “No Smoking” areas will be clearly marked on-site. These will include:
 - fuel and oil storage areas;
 - within areas flagged or barricaded areas in preparation for blasting
 - when transporting explosives or within 20 m of a vehicle transporting explosives

- within workshops
- all buildings and offices
- any gas cylinder storage areas.
- No smoking will be permitted in any forested areas during the Bushfire Danger Period of October to March.

Fire Equipment

- All fire extinguishers will comply with AS/NZS 1841.11:1997 will be compatible with those of the Rural Fire Service.
- All fire equipment is kept in a serviceable condition and be inspected at Pre-start and inspected every six months.
- The water truck is maintained on-site to provide immediate response to a bushfire.

Water Truck

- A water truck will be:
 - available for use when the open cut quarry is in operation;
 - tested at least monthly for mobility and operation of the water pump
 - properly maintained, with operators trained in the use of all equipment
 - able to be supplied with water from operating mobile water trucks should the need arise
 - equipped with:
 - 2 x 80:BE fire extinguishers
 - Hose and fittings to fill Rural Fire Service Truck.

Water Supply

- Water will be retained within the Main Storage Dam and Top Storage Dam at all times.

Clearing Operations

- Clearing operations will be avoided during the Bushfire Danger Period (October to March) as far as practicable. If clearing is required during the Bushfire Danger Period, specific protocols will be followed.
- Immediately prior to and during clearing campaigns during the fire season, the Applicant will refer to the FC NSW daily Colour Code and observe all requirements and restrictions as per FC NSW's regulations.
- Stockpiling of cleared vegetation will be avoided. This will be mulched or chipped when safe to do so and used in rehabilitation of the Quarry. If stockpiling of cleared vegetation is unavoidable, it will be stockpiled away from potential ignition sources and will not be burned.
- All vehicle movements will be confined to defined roads or tracks.

Fire Breaks

- To prevent the potential for ignition of vegetation as a result of operations on the Quarry Site, an effective fire break will be established and maintained (in accordance with relevant legislation and RFS Guidelines) beyond these activities to ensure that equipment does not operate within 6 m of the surrounding vegetation.

Blasting Operations

- All blasting operations will be carried out and confined to the extraction area.
- All flammable material will be removed by pre-stripping the topsoil prior to any drilling and blasting operations taking place.

Welding/Hot Work Operations

- All welding activities will, as far as practicable, be conducted and confined to the workshop.
- The area within a 20 m radius will be cleared of all flammable material.
- All oils and greases will be cleared from the work area.
- Fire extinguishers of an 80:BE rating will be positioned within 10 m of the work area.
- A water truck will be put on stand-by during the welding or cutting operations.
- During welding, a second person will be present to observe the welding area.

4.12.3.2 Active Bushfire Response and Management

Following identification of an imminent bush fire threat, the following management measures will be implemented in accordance with the Quarry Bushfire Management Plan:

- Human life is the most important asset to be protected. If it is safe to do so, then property is the second asset to consider preserving.
- The fire will be reported to Emergency Services using the 000 telephone number. Once emergency services have been notified, contact the FC NSW 24 hr fire duty officer on 02 6332 4812.
- If a fire has started in close proximity to a work area and the facilities are on hand to put it out and it is safe to do so then it should be contained and extinguished as quickly as possible, possibly in conjunction with Rural Fire Service operations.
- If the fire is not in close proximity and it is determined to be safe to do so, work will continue with the following provisions.
 - Fire-fighting equipment, including the water truck and extinguishers will be brought close to hand
 - UHF radio, local AM radio and RFS Fires Near Me App/Website monitored for fire updates
 - Check regularly to determine if the fire front is moving closer.
- In the event of a local bushfire which threatens the Quarry boundary, all personnel on the Quarry Site would be directed to assemble at the designated Emergency Assembly Area. A head count would be undertaken to confirm all site personnel and visitors are accounted for. At this time, instructions as to specific procedures to be followed, i.e. site protection or evacuation, would be provided in accordance with the Emergency Management Plan and any advice provided by the RFS.

4.12.3.3 Managing Bushfire Risks – Agency Cooperation

As bushfires typically impact on more than one property, the Applicant is committed to ensuring that the RFS and other Emergency Services, as well as other agencies responsible for emergency response such as Mines Rescue, are adequately informed of activities within the Quarry Site.

At the request of relevant officers of FC NSW, the RFS or LCC, the Applicant will provide for an inspection of the Quarry Site to identify potential fire hazards, identify areas where fuel load reduction may be required and discuss any other relevant matters.

The Applicant is also committed to assisting emergency services to the extent practicable if there is a fire in the vicinity of the Quarry Site. This could include access to water storages or equipment to create fire breaks.

4.12.3.4 Monitoring and Notifications

An inspection of the Quarry and land boundaries owned and controlled by the Applicant will be carried out by the Fire Officer at least every six months. The following will be noted during these inspections:

- Maintenance of safe access and egress routes from the Quarry in the event evacuation is called.
- Maintenance of access to water storage dams and operation of water pumping equipment.
- Adequacy of fire breaks and access tracks to ensure that they remain free of vegetation and are accessible.
- Assessment of vegetation fuel loads to ensure that they remain at safe levels.

In addition, the following monitoring will also be undertaken:

- Quarterly inspections of fire-fighting equipment.

4.12.4 Assessment of Impacts

The Proposed Modification would not result in an increase to the number and type of ignition sources in the local area. It is acknowledged, however, that the Project Site is located on bush fire prone land and therefore remains at risk of a bush fire event. The risk of a fire being initiated on the Project Site and or detrimental impacts on public safety and assets in the event a local bush fire would continue to be minimised through the implementation of the nominated management and mitigation measures of the Quarry Bushfire Management Plan.

4.13 Socio-economic Impacts

4.13.1 Introduction

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

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

- People’s way of life, that is: how they live, work, play and interact with one another on a day to day basis.

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

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

4.13.2 Methodology

4.13.2.1 Approach

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

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

4.13.2.2 Project Stakeholders

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

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

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

- Landowners and residents of properties to the north and east of the Project Site.
- FC NSW and DI-Crown Lands, as managers of landholdings on and adjoining the Project Site.
- Lithgow City Council.
- Other government agencies and regulatory authorities.
- Employees and prospective employees of the Quarry.
- Residents of the Lithgow City LGA.

4.13.2.3 Mechanisms for engagement

A number of mechanisms have been utilised to obtain the input of various stakeholder groups. The mechanisms to engage with local landholders, key stakeholders and the wider community during the preparation of the SIA are outlined in **Table 4.24**.

Table 4.24 Engagement Mechanisms

Stakeholder Group	Engagement
Local Community	<ul style="list-style-type: none"> • Discussion of the Proposed Modification at Community Consultative Committee Meetings of 10 April and 8 November 2018. • Distribution of a Community Information Sheet and invitation to engage with the Applicant and be included in further consultation. • Targeted meeting with residents of Rocky Waterhole Drive. • Invitation to key community groups (Wallerawang and Lidsdale Progress Association and Lithgow Chamber of Commerce) to contribute to community engagement. • Distribution of a Visual and Noise Impact Summary to the residents of Rocky Waterhole Drive. • Correspondence with individual stakeholders by the Applicant and consultants. <p>Refer also to Section 3.2.1.1</p>
FC NSW and DI-Crown Lands	<ul style="list-style-type: none"> • Conceptual extension plans provided in March and April 2018. • Preliminary Environmental Assessment issued in June 2018 inviting comment and identification of key assessment requirements. • Meetings with key staff convened to discuss key matters. <p>Refer also to Section 3.2.1.2</p>

Stakeholder Group	Engagement
Other Government Agency	Refer to Section 3.2.1.2
Lithgow City Council	<ul style="list-style-type: none"> • Discussion of the Proposed Modification at Community Consultative Committee Meetings of 10 April and 8 November 2018. • Provision of Community Information Sheet and invitation to provide assessment requirements. Refer also to Section 3.2.1.2
Employees	<ul style="list-style-type: none"> • Employee briefings provided.

4.13.3 Social Profile

4.13.3.1 Demographic Analysis

Socio-economic characteristics of the relevant communities are largely based on State Suburb (SSC) and LGA levels of analysis and informed by data available from the latest 2016 Census. The primary communities of interest for the purposes of this assessment are as follows (see **Figure 4.11**):

- Wallerawang SSC: which includes the town of Wallerawang and the majority of residential receivers identified on **Figure 4.1**.
- Marrangaroo SSC: which includes a portion of the Project Site, several landholding and residential receivers to the north and northeast of the Project Site, as well as the smaller town of Marrangaroo. are located in the neighbouring Marrangaroo SSC.
- Lithgow LGA.
- NSW State (for comparative purposes).

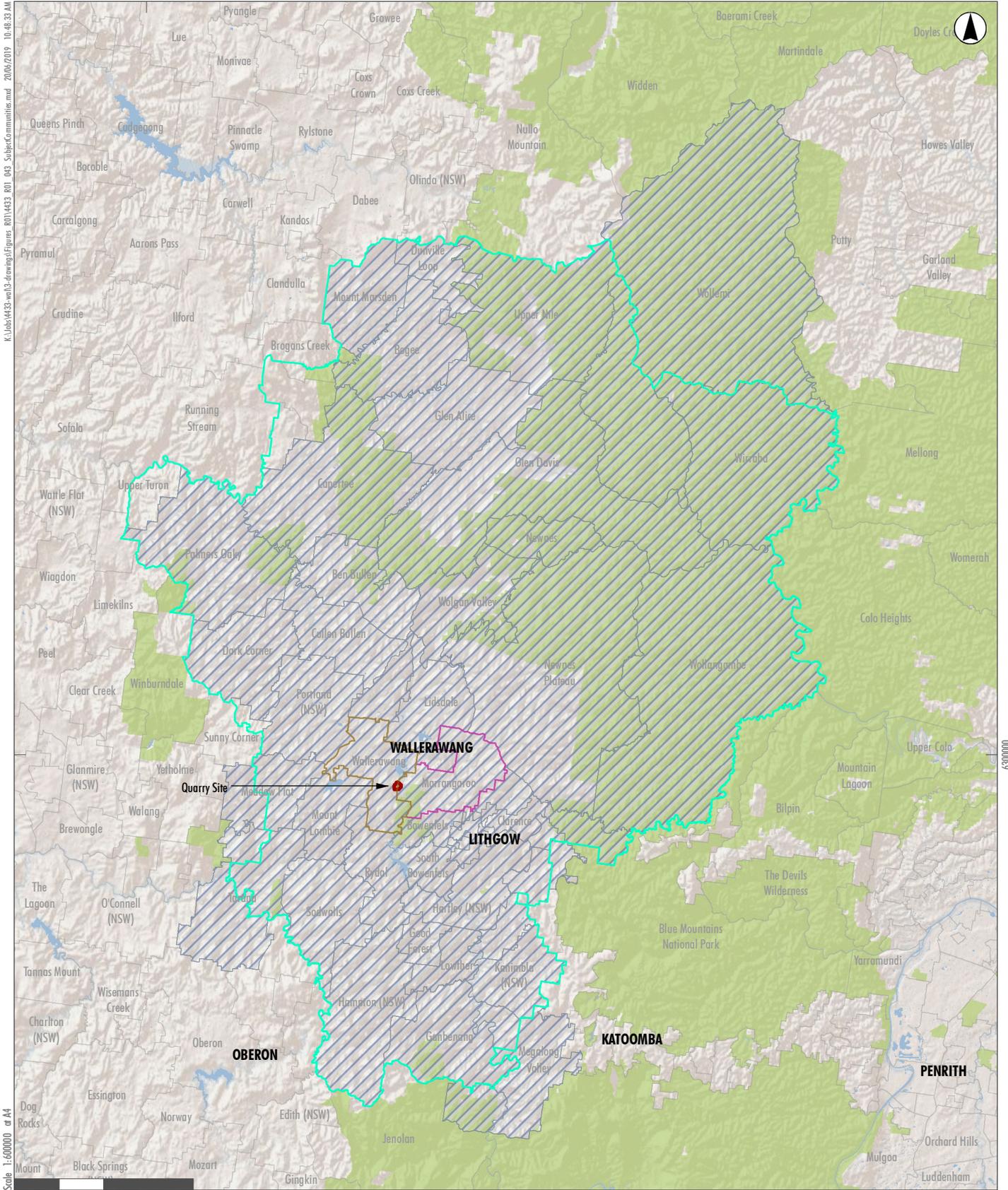
To gain an understanding of potential impacts specific to each locality, **Table 4.25** outlines key social indicators specific to each State suburb and affords comparable analysis to the Lithgow LGA and New South Wales (NSW) (ABS, 2016).

As highlighted in **Table 4.25**, key demographic characteristics of the communities of interest include:

- The age profile of Wallerawang (mean age 40 years) and Lithgow LGA (mean age 45 years) is older than the State average (38 years), while Marrangaroo (mean age 36 years) are older than the median age in NSW.
- The Indigenous population in all three study communities is proportionally higher than in NSW (3%).
- The cost of living across the study communities is equivalent or lower than the NSW average, as evidenced through lower mortgage repayment and rental prices. Income was lower in Wallerawang SSC and Lithgow LGA compared to NSW generally, but higher in Marrangaroo.
- Mining is identified in all three study communities as the main industry of employment.

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Scale 1:600000 or A4
0 10 20 Kilometres

- Legend**
- Quarry Site - MLI633
 - Subject Communities
 - Marrangaroo SSC
 - Wallerawang SSC
 - Lithgow LGA
 - Suburbs
 - NPWS Reserves

FIGURE 4.11

Subject Communities

Data source: DFSI (2017, 2019); ABS (2016)

Table 4.25 Key Social Indicators by Locality

Key Indicator		Wallerawang (SSC)	Marrangaroo (SSC)	Lithgow (LGA)	NSW
Population	Total Population	1,980	909	21,090	7,480,231
	Indigenous Population (%)	5.7	10.8	5.7	3
Age	Median Age (years)	40	36	45	38
Employment	Employed Full-time (%)	56.5	60.5	54.8	6.3
	Employed part-time (%)	30.5	28.9	31.7	
	Unemployment (%)	7.6	2.8	7.7	
	Labour Force Participation 15-85 years (%)	53.2	30.7	49.7	59.2
Occupation (top five)	Mining (%)	9.5	23.2	8.1	
	Other Social Assistance Services (%)	4.8	-	-	
	Accommodation (%)	4.0	-	2.8	
	Fossil Fuel Electricity Generation (%)	3.7	-	-	
	Correctional and Detention Services (%)	3.7	3.8	-	
	State Government Administration (%)	-	5.9	-	
	Aged Care Residential Services (%)	-	4.9	3.3	
	Hospitals (except Psychiatric Hospitals)	-	3.8	-	
	Supermarket and Grocery Stores	-	-	2.8	
	Local Government Administration	-	-	2.6	
Household income	Median Household Income (\$/week)	1,135	1,861	1,328	1,486
Housing	Owned outright (%)	35.0	48.4	41.8	32.24
	Owned with a mortgage (%)	36.2	43.8	29.3	32.25
	Rented (%)	25.7	7.8	24.6	31.75
	Median mortgage repayment (\$/monthly)	1,517	1,985	1,387	1,986
	Median rent (\$/weekly)	200	300	230	380

Source: ABS Quick Stats, 2016

4.13.3.2 Community Aspirations and Challenges

The *Our Place ... Our Future Community Strategic Plan 2030* (the Plan) (LCC, 2013) was adopted by Lithgow City Council in June 2017 and describes the community's strategic vision for the LGA. The Plan was developed following extensive community consultation and highlights concerns such as the low level of population growth, ageing population, and the issues of youth leaving the area to seek jobs and tertiary education in other areas.

Broadly, the Plan describes the following key activity areas.

- Caring for Our Community.
- Strengthening Our Economy.
- Developing Our Built Environment.
- Enhancing Our Natural Environment.
- Responsible Governance and Civic Leadership.

The Plan, included the results of ‘visioning workshops’ which identified the most valued aspects of the Lithgow area to be:

1. The community, specifically its friendliness and spirit.
2. The location of Lithgow allowing for a rural lifestyle whilst still being relatively close to Sydney.

The strengths that participants felt should be supported/sustained were:

1. The local community
2. Tourism and its potential to grow and increase revenue for the LGA.

Participants saw the greatest challenges over the next 10 years for the Lithgow LGA as being:

1. Increasing employment opportunities.
2. Encouraging new businesses to the area.
3. Engaging youth - supporting and keeping them in Lithgow.
4. Managing change whilst retaining the natural heritage and rural community spirit of the area.

4.13.3.3 Analysis and Prediction of Social Impacts

This section provides an assessment of the perceived and predicted social impacts that may occur as a result of the Proposed Modification. This section provides an overview of the potential issues affecting social amenity, expected as a result of the Proposed Modification, addressed via analysis and assessment of outcomes of consultation (**Section 3.2.1**), review of the predicted effects on the biophysical environment (**Sections 4.2 to 4.12**) and the effects of similar projects of this size and magnitude.

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

- **Extent** – geographical area affected by the impact (or the proportion of people or population groups affected).
- **Duration** – the timeframe over which the impact occurs.
- **Severity** – scale or degree of change from the existing condition as a result of an impact.

- **Sensitivity** – Susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, including value or importance to the community.

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

In consideration of limited primary data pertaining to potential positive and negative impacts of the Proposed Modification, **Table 4.26** provides a summary of impacts and the social impact ranking assessed using the criteria outlined above.

Table 4.26 Potential Positive and Negative Social Impacts of the Proposed Modification

Social Amenity		Affected Parties	Duration	Potential Social Impact	Social Impact Ranking
Visibility	Impact on views from external vantage points	Local Residents Road Users	Short term over the Life of the Quarry	Reduced amenity of landholdings Reduced property values	Moderate
Noise	Increased Quarry noise	Local Residents	Life of the Quarry	Social amenity Effect on health and wellbeing	Moderate
Vibration	Increased noise and vibration	Local Residents	Life of the Quarry	Property damage Nuisance effects	Low
Air quality	Dust emissions	Local Residents	Life of the Quarry	Nuisance/amenity impacts of dust Effect on health and wellbeing	Low
Water resources	Adverse impact on quality or availability of groundwater	Water Users	Life of the Quarry	Negative effect on landholder business or use Increased cost to obtain water	Low
Traffic	Driver Behaviour/ Safety	Road Users Local Residents	Long term	Potential for accident and increased danger to road users. It is noted the Proposed Modification proposes no change to currently approved transport	Low
Economic	Employment	Local and Regional Residents	Long term	Extended employment opportunities	High (Positive)

4.13.4 Social Impact Management and Community Enhancement Strategies

Considering the potential positive and negative social impacts of the Proposed Modification, **Table 4.27** identifies impact management and community enhancement strategies to be applied.

Table 4.27 Impact Management and Community Enhancement Strategies

Issue	Potential Impacts to stakeholders	Management or Enhancement Strategies
Way of life Culture Community	Reduced amenity as a result of increased and long-term visibility of the Quarry and increased noise and dust emissions	<p>Extraction sequence to prevent exposure of the extraction area.</p> <p>Targeted plantings and landscaping to reduce exposure to road users of the Great Western highway.</p> <p>Operational controls, safeguards and practices to ensure ongoing compliance with criteria.</p> <p>Continued monitoring, including on request of residences, to demonstrate compliance.</p> <p>No increase in production or change to approved methods of on-site operations.</p> <p>No change to transport operations.</p> <p>Promote and enforce safe driving practices.</p> <p>Continue to employ locally (within the main industry of employment of the Lithgow LGA) and contribute to the local economy.</p>
Environment	Potential increase in impacts e.g. biodiversity, heritage, visibility, noise, air emissions, groundwater, dust	<p>Extraction area and sequence designed to avoid views of the extraction area from vantage points to the north of the Quarry.</p> <p>Operational controls and safeguards to be implemented to minimise noise and dust emissions of the Quarry received at surrounding residences.</p> <p>Impacts on biodiversity identified and offsetting requirements established.</p> <p>Impacts on cultural heritage identified and mitigatory measures proposed in consultation with Registered Aboriginal Parties.</p> <p>Impacts on water resources predicted and water licensing allocation obtained.</p> <p>Ongoing monitoring of impacts to be continued with appropriate contingency strategies included in management plans.</p>
Health and wellbeing	Potential health related impacts including air and noise pollution	<p>Operational controls and safeguards to be implemented to minimise noise and dust emissions of the Quarry received at surrounding residences.</p> <p>Extraction sequence designed to prevent additional views of the Quarry which could impact on amenity and influence mental health.</p> <p>No increase in production or change to approved methods of on-site operations.</p> <p>No change to transport operations.</p> <p>Promote and enforce safe driving practices.</p>

Issue	Potential Impacts to stakeholders	Management or Enhancement Strategies
Personal and property rights	Increased visibility, noise and air quality impacts with the potential to reduce local amenity and property values.	Management or impacts associated with noise, air quality and visibility as above.
Fears and aspirations	Reduced amenity impacting on the value held by residents of their property and local setting.	Management or impacts associated with noise, air quality and visibility as above.
Economic contribution	Local employment and regional economic benefits of a sustainable extractive industry.	Continue to employ locally and invest in the local and regional economy.

4.13.5 Assessment of Impacts

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

Adverse Impacts

- (i) The predicted impacts on local noise, air quality, water resources and visibility, along with the continuation of transport operations from the Quarry, would continue for the extended life of the Quarry.
- (ii) The rehabilitation of the Quarry, and mitigation of the visual impact of the Quarry Site when viewed from the Great Western Highway, would be delayed. In noting this, the proposed design and sequence of the extraction area maximises the natural screening of activities by topography and remnant vegetation. Furthermore, targeted landscape plantings of screening vegetation are proposed to reduce the exposure of the Quarry from the Great Western Highway.

Beneficial/Positive Impacts

- (i) The Proposed Modification would provide for an investment of an estimated \$1.1 million for additional and upgraded equipment and works associated with extraction area extension.
- (ii) The Proposed Modification would allow for the sustainment and future increase in employment opportunities within the Lithgow LGA.
- (iii) The Proposed Modification would provide for flow-on benefits to the economy through the expenditure of wages paid to employees, profits made on the sale of quarry profits and through the purchase of goods and services for the ongoing operation of the quarry.
- (iv) The Quarry would continue to supply important construction and landscaping materials to local and regional industry.

- (v) The beneficial use of construction materials for the maintenance of roads within the Lithgow City LGA and surrounding regions.

The impact of the Proposed Modification on current and future land uses on and surrounding the Project Site has been considered. Importantly, as impacts would be restricted to the Project Site, the Proposed Modification would not adversely impact on the current land use(s) of surrounding properties (including rural residential uses which rely on local amenity).

As a consequence of the Applicant's commitment to employ and utilise local resources where practicable, there would be a direct economic benefit to the Lithgow LGA. It is also assessed that as a result of the proposed design features, operational safeguards, controls and management measures, any the impacts on local amenity associated with the Proposed Modification have been appropriately considered and addressed.

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

5.0 Summary of Environmental Management Commitments

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

Table 5.1 Summary of Environmental Management Commitments

Environmental Management Measures
Biodiversity
<ul style="list-style-type: none"> The existing Biodiversity Management Plan will be updated to include Project activities.
<ul style="list-style-type: none"> Impacts will be restricted to areas identified within the SEE and assessed as part of the BDAR.
<ul style="list-style-type: none"> Clearing will only be undertaken to allow for the following 12 months operations.
<ul style="list-style-type: none"> The Applicant will prepare an updated Biodiversity Offset Strategy to identify and document the methods for offsetting the progressive disturbance to native vegetation and threatened species habitat. It is likely that a combination of measures will be used to retire the required credits including entering into a Biodiversity Stewardship Agreement payment into the Biodiversity Conservation Fund and purchase of credits on the open market. Rehabilitation of impacted areas in accordance with any published 'ancillary rules' under Section 6.5 of the BC Reg may also be used to generate the required credits.
Aboriginal Cultural Heritage
<ul style="list-style-type: none"> Disturbance would be restricted to the area assessed in the Aboriginal Cultural Heritage Assessment.
<ul style="list-style-type: none"> An Aboriginal Cultural Heritage Management plan will be prepared in consultation with the RAPs, OEH and DPE.
<ul style="list-style-type: none"> The artefacts at the AHIMS Site #45-1-2802 will be salvaged and relocated to a safe location (agreed to by the RAPs) away from impacts arising from the project or other planned or future developments.
<ul style="list-style-type: none"> Salvage of the artefacts at site WQ1 (AHIMS Site #45-1-2802) will be undertaken by a qualified archaeologist together with RAPs.
<ul style="list-style-type: none"> The agreed and finalised location and the manner of reburial of the Aboriginal objects will be detailed in the ACHMP following RAPs consultation. A site card will be submitted to AHIMS to register the location of any reburied artefacts. Alternatively, the Aboriginal community may prefer that Aboriginal objects be held by an Aboriginal community or other party, which will need to be stipulated in the ACHMP.
<ul style="list-style-type: none"> An Aboriginal Site Impact Recording Form will be completed by the archaeologist and submitted to AHIMS recording the salvage results of the site, within four months of the salvage being completed.
<ul style="list-style-type: none"> Inductions for staff and contractors to the Quarry will include the awareness of the legislative protection requirements for Aboriginal sites and objects in NSW and the relevant fines for non-compliance.
<ul style="list-style-type: none"> During the course of the proposed work, if Aboriginal artefacts or skeletal material are noted, all work should cease and the procedures in the <i>Aboriginal Heritage: Unanticipated Finds Protocol</i> should be followed.
Historical Cultural Heritage
<ul style="list-style-type: none"> Disturbance would be restricted to the area assessed in the Historic Heritage Assessment.
<ul style="list-style-type: none"> Inductions for staff and contractors to the Quarry will include the awareness of the legislative protection requirements for historic sites and items in NSW and the relevant fines for non-compliance.
<ul style="list-style-type: none"> During the course of the proposed work, if objects are encountered that are suspected to be historic heritage items, all work should cease and the procedures in the <i>Historic Heritage: Unanticipated Finds Protocol</i> should be followed.

Environmental Management Measures
Groundwater
<ul style="list-style-type: none"> • A groundwater bore census is to be undertaken of nearby water supply bores to confirm yields.
<ul style="list-style-type: none"> • If required, make good provisions should apply in the event that Quarry-related drawdown is shown to impact the viability of water supply bores.
<ul style="list-style-type: none"> • An ongoing program of monitoring groundwater levels and quality in the Quarry's three monitoring bores will be implemented to enable identification of potential impacts of the Project on groundwater levels and quality.
<ul style="list-style-type: none"> • Daily dewatering volumes of pit water will be recorded when active dewatering is required, i.e. once extraction proceeds below the water table.
<ul style="list-style-type: none"> • Controls should be outlined in the Quarry's Soil and Water Management Plan (which will be updated to include the Project) to mitigate potential impacts to groundwater due to accidental spills or leakages of hazardous materials during quarrying.
Surface Water
<ul style="list-style-type: none"> • Prior to the commencement of any surface disturbing works, appropriate erosion and sediment controls would be installed to ensure appropriate diversion of clean water around areas of disturbance and capture and management of runoff from areas of disturbance.
<ul style="list-style-type: none"> • The HDPE pipeline section of the central clean water diversion drain would be extended to the current discharge point to allow for the main Stockpile Area to be increased in elevation to 935 m AHD.
<ul style="list-style-type: none"> • The discharge point of the extended pipeline would be rock-lined to provide for energy dissipation and outlet protection.
<ul style="list-style-type: none"> • Prior to the commencement of construction of the Southern Stockpile Area, an open rock-lined drain would be constructed from the discharge point of the pipeline to an alternative tributary of the Coxs River.
<ul style="list-style-type: none"> • Prior to commencement of construction of the Western Stockpile Area Extension, a clean water diversion drain would be constructed upstream to divert clean water from the second order drainage line originating within the Lidsdale State Forrest to an alternative tributary of the Coxs River.
<ul style="list-style-type: none"> • Both clean water diversions would be appropriately stabilised before being permitted to carry clean water.
<ul style="list-style-type: none"> • The sediment basins of the Quarry would be modified and upgraded to provide sufficient settlement and storage capacity for the modified catchment of the site.
<ul style="list-style-type: none"> • New sediment basins would be constructed to ensure all dirty water runoff is captured and prevented from discharging to the downstream clean water catchment (unless in accordance with EPL conditions).
Visual Amenity
<ul style="list-style-type: none"> • The Main Extraction Area will not progress any further north until such time as the extraction to the south of the current perimeter is at least 15 m below surface and therefore below the sightlines of vantage points to the north.
<ul style="list-style-type: none"> • Development of the Cobble Extraction Area will only proceed once the Main Extraction Area has been developed to an elevation allowing for the extraction of the cobble resource in a south to north direction.
<ul style="list-style-type: none"> • Active cobble extraction would be limited to one hectare.
<ul style="list-style-type: none"> • Screening vegetation will be established and maintained on the bund wall which has been constructed along the northern (Great Western Highway) boundary of the Quarry Site immediately north of the Western Stockpile Area.
<ul style="list-style-type: none"> • Landscaping campaigns would be periodically undertaken to promote the establishment of the vegetation in the road reserve of the Great Western Highway.
<ul style="list-style-type: none"> • Vegetation will be established and maintained on the batters of internal dams and stockpile areas to reduce the exposure to vehicles passing the Quarry.
<ul style="list-style-type: none"> • If night-time loading and transport operations are required, lights would be directed to the south, i.e. away from the Great Western Highway and vantage points to the north.

Environmental Management Measures
<ul style="list-style-type: none"> In accordance with the rehabilitation objectives and conditions of the Quarry, following the end of operations the final landform will be integrated with the surrounding natural landforms as far as is reasonable to minimise visual impacts when viewed from the surrounding land.
Noise and Vibration
<ul style="list-style-type: none"> It is recommended that the proposed MIC blast patterns should be designed specifically to meet the relevant ANZECC guidelines at receivers, and be completed in conjunction with an appropriate Blast Monitoring Program.
<ul style="list-style-type: none"> Noise and vibration will continue to be managed via the Quarry's existing Noise Management Plan and Blast Management and Explosives Control Plan, which will be updated to include the proposed Quarry extension.
Air Quality
<ul style="list-style-type: none"> Air quality will continue to be managed via the Quarry's existing AQMP, which will be updated to include the proposed Quarry extension.
<ul style="list-style-type: none"> Direct placement of overburden and soil will be undertaken where possible, to reduce double handling, potential for wind erosion and haulage distances.
<ul style="list-style-type: none"> Where practical, the double handling of material will be minimised (i.e. direct movement of rock to the processing plant).
<ul style="list-style-type: none"> Disturbance of long-term soil stockpiles and waste emplacements will be avoided where possible, or temporary rehabilitation will be undertaken.
<ul style="list-style-type: none"> The existing air quality monitoring program is considered suitable for operations associated with the Proposed Modification.
Rehabilitation, Final Landform and Land Use
<ul style="list-style-type: none"> The Quarry Rehabilitation Management Plan would be updated, in consultation with FC NSW, DI-Crown lands and the Resources Regulator.
Bushfire
<ul style="list-style-type: none"> The Quarry Bush Fire Management Plan would be updated, in consultation with FC NSW, DI-Crown lands and the Resources Regulator.

6.0 Evaluation and Justification of the Proposed Modification

6.1 Introduction

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

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

6.2 Evaluation

6.2.1 Residual Impacts

6.2.1.1 Biophysical Impacts

The Proposed Modification involves the extension to the extraction area and stockpile areas. Following the implementation of the proposed operational safeguards and controls, it has been determined that while some increase in environmental impact may occur, the level of these increases would be relatively minor and are assessed as likely to fall within specified criteria or reasonable community expectations. The impacts on the biophysical environment considered of greatest significance are summarised with respect to the affected environmental feature.

Biodiversity

The additional disturbance would directly impact biodiversity values through the clearing of 14.1 ha of the following native vegetation communities:

- 5.5 ha of PCT 732 – *Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion*
- 8.6 ha of PCT 1093 – *Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion.*

A total of 487 ecosystem credits are required to offset the impact of the Project. As the proposed Quarry extension is to be undertaken as a staged development, it is proposed that the retirement of these credits is also completed in a staged manner over the life of the Quarry.

Cultural Heritage

Previously identified Aboriginal Site WQ1 (AHIMS Site #45-1-2802) falls within the proposed extended extraction area. The Applicant proposes the salvage of this Site identified to be of medium importance in the context of the cultural heritage record. The salvage, and subsequent management of artefacts would

be undertaken in consultation with the RAPs for the Proposed Modification and therefore mitigate the impact by preventing the loss of this culturally significant material.

Groundwater

As a result of the extraction area being developed below the water table, a small volume of groundwater is likely to be lost through seepage to the void. The Applicant would account for this extraction of groundwater under the rules of the Water Sharing Plan (WSP) for the Greater Metropolitan Region Groundwater Sources through allocation of the nominated volume of water against WAL 42081 for the Coxs River Fractured Rock Groundwater Source.

A minor reduction in base flows to the Coxs River is predicted, however, this is less than 0.05% of base flows from this groundwater source to the Coxs River. The Applicant would account for this reduction by obtaining an appropriate allocation of water from the Upper Nepean and Upstream Warragamba Water Source of the WSP for the Greater Metropolitan Region Unregulated River Water Sources and allocation through a permanent or temporary transfer of water allocation from an existing WAL holders within the water source to Walker Quarries held WAL 41884.

Surface Water Resources

The Proposed Modification would require diversion of ephemeral tributaries of the Coxs River to accommodate the extended stockpile areas. These diversions have been designed as high flow channels to ensure erosion and sedimentation of the modified drainage lines is avoided. Erosion and sediment control measures would be implemented to prevent erosion or pollution of local drainage lines and the Coxs River catchment during construction of the extended stockpile areas or extension of the extraction area.

With the majority of water captured on the Project Site to be retained for operational and dust suppression purposes, there would be a small reduction in the flow of surface water to the Coxs River. The runoff would be collected in accordance with the maximum harvestable rights of the Project Site with the cumulative reduction in runoff to the Coxs River catchment (0.018%) negligible and unlikely to adversely affect hydrological function of the river or associated ecosystems.

The number of controlled discharges and sediment basin spills would be minimised through construction and maintenance of appropriately sized storage dams and sediment basins on the Project Site. Any water to be discharged would be sampled and analysed with the water treated as required to ensure EPL criteria is achieved prior to discharge. Spills from sediment basins, predicted to occur less than once per year under median conditions, would only occur when rainfall exceeds the sediment basin design rainfall capacity and only during periods of high rainfall when runoff from the broader catchment will be high and is already likely to contain elevated concentrations of suspended solids. The potential for hydrocarbon contamination of runoff would be minimised by careful management of refuelling on the Quarry Site (with contingency measures implemented immediately in the event of spill or leak).

Visual Amenity

Views of the Quarry from residential vantage points to the north would not be adversely affected as a result of the proposed design and sequencing of the extraction area.

Views of the Quarry Site from the Great Western highway are likely to be progressively reduced and screened as the extraction area is deepened and vegetation along the western boundary of the Project Site established.

Noise and Air Quality

While noise and air quality emissions would now continue for the extended life of the Quarry, these are predicted to remain compliant with noise and air criteria.

6.2.1.2 Socio-economic Impacts

The Proposed Modification would be unlikely to result in any significant change to the local socio-economic setting, albeit the Quarry life is to be significantly extended. Potentially detrimental impacts on local amenity are assessed as being managed such that these should not reduce local amenity of local landholders and other community stakeholders.

The Applicant would continue to provide employment within the Lithgow LGA and contribute to the local economy through payment of wages and purchase of goods and services.

On balance, by providing employment locally and minimising impacts on surrounding landowners, the impact of the Proposed Modification on the social-economic setting would be neutral to beneficial.

6.2.2 Ecologically Sustainable Development

6.2.2.1 Introduction

Ecologically Sustainable Development (ESD) is a concept which can be defined as development which uses, conserves, and enhances the community's resources in such a way that ecological processes are maintained and our existing and future quality of life can be improved. An alternative definition is "a development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations".

Production of road building, construction and landscaping products, and proposed resource recovery and composting activities, would contribute to the material and socio-economic well-being of the region. However, quarries and their related processing operations do involve some degree of environmental disturbance. In the context of ESD, the issue of whether environmental impacts are irreversible or affect long term ecological sustainability is important. For this reason, it is the overall objective of the ESD process to ensure compatibility between quarrying and the environment.

It is intended in this section to address how the Proposed Modification has been planned and would operate in a manner that is consistent with the following four inter-related principles, as defined under Schedule 2(6) of the Environmental Planning and Assessment Regulation 2000, as:

- the precautionary principle;
- the principle of social equity;
- the principle of the conservation of biodiversity and ecological integrity; and
- the principle for the improved valuation and pricing of environmental resources.

6.2.2.2 The Precautionary Principle

This principle states that "where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation". In the application of the precautionary principle, public and private decisions should be guided by:

- careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
- an assessment of the risk-weighted consequences of various options." (DoE, 1992).

To satisfy this principle of ESD, emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it. The environmental setting is considered in **Section 4.0** along with the potential impacts that could be associated with the Proposed Modification. Various operational controls, safeguards and management measures are then presented based on this knowledge of the existing environment and an appreciation of the potential impacts. This demonstrates that the assessment of potential impacts on the environment has focussed on those aspects considered to pose the greatest risk of irreversible or unacceptable impact.

After a full evaluation of the potential environmental impacts of the Proposed Modification, there are no activities or features for which achievement of an acceptable level of environmental performance is not possible. While the Proposed Modification would result in an increase in disturbance to native vegetation and the requirement to disturb and salvage artefacts from a registered Aboriginal heritage site, procedures necessary to minimise the impact of these are well known and would be implemented by the Applicant. While the Proposed Modification would require an extension to the disturbance footprint and life of the Quarry, careful consideration of extraction area design and sequence would prevent sensitive receivers surrounding the Project Site from being exposed to additional views of the Quarry or noise and air emissions which would exceed the existing criteria.

With the exception of the depletion of the quartzite and other hard rock resource, it is considered that there are no features of the local environment that would be irreversibly or unacceptably damaged. Features of the local environment such as water quality, soil resources, noise and air quality would be managed throughout the life of the Proposed Modification such that they will be comparable before and after the proposed quarry operations.

It would remain a guiding principle for the Applicant to be pro-active and anticipate problems rather than allow problems to develop.

6.2.2.3 Intra and Inter-Generational Equity

The objective of this ESD principle is that "the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations" (DoE, 1992). This principle is based on social equity for the current generation (intra-generational) and future generations (inter-generational).

Intra-generational equity requires that the economic and social benefits of the development be distributed appropriately among all members of the community. The Proposed Modification, and particularly the safeguards proposed with respect to water, noise, air emissions and visibility, has been designed to ensure that no part of the community would be unacceptably disadvantaged. As discussed in **Section 6.2.1.2**, the economic benefits of the continued operation of the Quarry would be felt by the wider community through:

- provision of local employment and flow-on benefits to local goods and service providers
- supply of product important for the maintenance of necessary infrastructure and development of new infrastructure.

The non-material well-being or "quality of life" of existing and future residents in the vicinity of the Project Site would continue to be maintained throughout and beyond the life of the Quarry through:

- implementation of safeguard measures and operational controls to mitigate any environmental impacts
- the planned progressive rehabilitation of the Project Site.

Ongoing communication between the Applicant and those landowners and residents surrounding the Project Site would be important in ensuring that issues associated with local amenity are appropriately managed.

6.2.2.4 Conservation of Biological Diversity and Ecological Integrity

Biological diversity or biodiversity describes life forms and is usually considered at three levels:

- genetic diversity
- species diversity
- ecosystem diversity.

Ecosystem integrity describes the condition of an ecosystem that is relatively unaltered from its natural state. For the purposes of this assessment, biodiversity is considered on the Project Site and its immediate surrounds.

Ecological surveys and assessment have determined that the Proposed Modification would be unlikely to have a significant impact on any threatened population, species or community. Up to 14.1 ha of native vegetation would be disturbed by the Proposed Modification with this to be offset in accordance with the NSW Biodiversity Offsets Policy.

Based on the implementation of the proposed impact avoidance, minimisation, mitigation and offset measures, and considering the area to be disturbed would not result in a significant impact on any threatened species or vegetation community, it is concluded that the proposed would not increase the risk of local extinction of any species.

6.2.2.5 Improved Valuation and Pricing of Environmental Resources

This principle involves consideration of the materials proposed to be extracted, accepted and produced, and the surrounding environmental resources (e.g. air, water, land and living things) which may be affected. The valuation and pricing of the quarry products comprises the cost of extraction, screening, importation, backfilling and rehabilitation costs, delivery costs and the final cost to Oberon rate payers.

The value placed by the Applicant on the environmental resources, other than the extracted and imported resources, is evident through the commitments made, and planning documented, in this SEE.

6.2.3 Environmental Planning & Assessment Act 1979 Considerations

6.2.3.1 Section 4.15 - Evaluation

In determining an application for the modification of development consent, the consent authority must take into consideration such of the matters referred to in Section 4.15(1) of the EP&A Act (as relevant to the development). These matters for consideration by the consent authority and the sections where they are addressed in this SEE are provided in **Table 6.1**.

Table 6.1 Section 4.15 Matters for Consideration

Matters for Consideration	Relevant SEE Section
(a) the provisions of:	
(i) any environmental planning instrument	Section 3.4
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	Section 3.4
(iii) any development control plan,	Not Applicable based on SSD provisions refer to Section 3.5.1
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	N/A
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	Not applicable as the development does not represent any of the development types nominated by Clause 92 of the EP&A Reg
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	Section 4.0
(c) the suitability of the site for the development,	Sections 1.5, 2.2, 4.0 and 6.3.1
(d) any submissions made in accordance with this Act or the regulations	N/A
(e) the public interest	Section 4.13

6.2.3.2 Objects of the EP&A Act

Table 6.2 provides a short description of how the Proposed Modification and this SEE have addressed and satisfy the objects of the EP&A Act.

Table 6.2 Objects of the EP&A Act

Object	SEE Coverage
(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	Socio-economic effects are assessed in Section 4.13, with the Proposed Modification likely to provide for an ongoing socio-economic benefit to the Lithgow LGA. The Proposed Modification would incorporate measures to avoid or mitigate impacts to the natural environment arising from the removal of native vegetation (Section 4.3.4) and potential impacts on water resources (Sections 4.6.4 and 4.7.4). Operational controls would also be implemented to manage potential impacts from noise (Section 4.9.5 and air emissions (Section 4.10.5).
(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The principles of ecologically sustainable development have been considered in Section 6.2.2 .

Object	SEE Coverage
(c) to promote the orderly and economic use and development of land,	The Proposed Modification would involve the continued operation and extension of the Quarry for a further 30 years and would maintain the supply of construction materials to the region. The Proposed Modification would be a significant contributor to the local and regional economy and community for the proposed 30 year life.
(d) to promote the delivery and maintenance of affordable housing,	The Proposed Modification would not limit the provision of affordable housing in the Lithgow LGA.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	Ecological surveys and assessment have determined that the Proposed Modification would be unlikely to have a significant impact on any threatened population, species or community. Up to 14.1 ha of naïve vegetation would be disturbed by the Proposed Modification with this to be offset in accordance with the NSW Biodiversity Offsets Policy. Based on the implementation of the proposed impact avoidance, minimisation, mitigation and offset measures, and considering the area to be disturbed would not result in a significant impact on any threatened species or vegetation community, it is concluded that the Proposed Modification would not increase the risk of local extinction of any species.
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The Proposed Modification would require disturbance to an identified Aboriginal heritage site (AHIMS Site #45-1-2802) resulting in a medium loss of heritage value from the regional context. The proposed salvage and preservation of the artefacts of this site would, however, provide for mitigation of this loss in heritage value
(g) to promote good design and amenity of the built environment,	The Proposed Modification would have no impact on the built environment.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The Proposed Modification does not require construction of buildings.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	The SEE includes a review of the relevant State, regional and local environmental planning regulations, plans and strategies including how these have been addressed (Section 3.0).
(j) to provide increased opportunity for community participation in environmental planning and assessment.	Lithgow City Council, various government agencies and local landholders were consulted during the planning of the Proposed Modification and preparation of the SEE.

6.3 Justification

6.3.1 Site Suitability

The Quarry has been in operation since late 2014 and in that time has produced significant volumes of construction materials without adverse impacts on the adjoining landowners and sensitive receivers to the north.

As discussed in **Sections 1.5** and **2.2**, the quartzite resource of the Project Site is extensive and is an important source of construction materials and concrete aggregates for the region and potentially into Sydney as well. As the Quarry is already operating without significant adverse impacts on the local biophysical and socio-economic environment, continued exploitation of this resource is likely to result in less impact than the development of an extractive industry elsewhere in the region of State.

The various assessments of **Sections 4.2** to **4.12** illustrate that the Proposed Modification could be undertaken without impacts which exceed established environmental criteria, further reductions in local amenity or without suitable mitigatory or offset measures available. Furthermore, **Section 4.13** demonstrates that a continuation of extractive industry at the Quarry could be undertaken without adversely impacting on the local socio-economic setting and surrounding land uses.

6.3.2 Need for the Proposed Modification

The Quarry has the potential to be a significant local and regional supplier of construction materials, coarse aggregates and sand through the crushing, screening and washing of quartzite and other hard rock resources. If approved to expand and continue beyond July 2020, the Quarry would contribute to the long-term supply of sand to local, regional and Sydney markets.

In particular, the Proposed Modification would serve several important functions:

1. Allow for a significant increase in the operational life of the Quarry.
2. Allow for access to additional resources.
3. Provide for continued supply of construction materials and other products to local, regional and Sydney markets.
4. Provide additional area for the stockpiling of Quarry products, which is important given the increasing reliance of the Applicant in producing a wide range of aggregate, sand and other construction and landscaping products.
5. Improve production efficiency through modifications to the layout and location of processing equipment and infrastructure.

6.3.3 Substantially the Same Development

The Proposed Modification is considered to be substantially the same development as that approved under DA 344-11-2001 on the basis of the following:

- The type of development, namely extractive industry, remains the same with no additional development types proposed.
- No increase in annual production limits, extraction methods, processing methods, product transportation or operating hours is proposed.
- The predicted impacts of the Proposed Modification would remain equivalent to those approved by DA 344-11-2001.
 - The proposed increase in the disturbance footprint occurs within the same vegetation types that are currently impacted and would not result in a significant impact on any threatened population, species or community.

- The modified operations would not result in the noise or air emissions received at sensitive receivers increasing over the existing criteria.
- The Proposed Modification could be completed without any increase in the visibility of the Quarry from local public and private vantage points.
- While extraction would extend below the local groundwater table, extraction of the small volume of groundwater predicted to seep into the extraction area could be taken under licence and without exceeding the minimum impact criteria of the NSW Aquifer Interference Policy.
- The continued operation of the Quarry has been assessed as likely to generate a net positive socio-economic impact on the local and regional setting.

Supporting legal opinion from Hicksons Lawyers confirming this assessment that the modified development would remain substantially the same to that originally approved is provided in **Appendix 1**. This legal opinion was provided along with a Project Overview and Preliminary Environmental Assessment to the DPE when requesting environmental assessment requirements. The subsequent issue of Environmental Assessment Requirements on 18 June 2018 (refer to **Section 3.2.1.2**) indicates the DPE's support of this assessment.

6.3.4 Consequences of Not Proceeding

Should the modification not proceed, the consequences are likely to include the following.

- Any shortfall in the production of coarse aggregates and sand to meet the anticipated demand would have a negative impact on the NSW economy as follows:
 - A reduction in the direct contribution of production to the NSW economy, which was estimated to be \$366 million by DTIRIS (2013) and \$405 million by the IQA.
 - Increased supply costs as a result of reduced availability (supply) or requirement to source from locations more distant to markets (in particular the Greater Sydney metropolitan area).
 - Indirect impacts on the NSW economy as a result of reduced construction activity in response to either increased cost or reduced supply of concrete and other construction materials.
- The ability of the Applicant to access additional resources and also to maximise production of a range of aggregate and sand products could be jeopardised, e.g. by a lack of stockpile area, which could impact on the competitiveness of the Quarry.
- This in turn could prevent the additional employment which would follow an increase in production or lead to a loss in employment should the Quarry cease to operate.

6.4 Conclusion

The Proposed Modification can be justified as the residual impacts on the biophysical environment are understood and where unavoidable can either be managed to reduce the impact as far as practically possible or be offset. No significant socio-economic impacts are expected as a consequence of the Proposed Modification, however, when considering the Proposed Modification is important to the ongoing viability of the Quarry, the consequences of not proceeding are considered more adverse than proceeding.

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