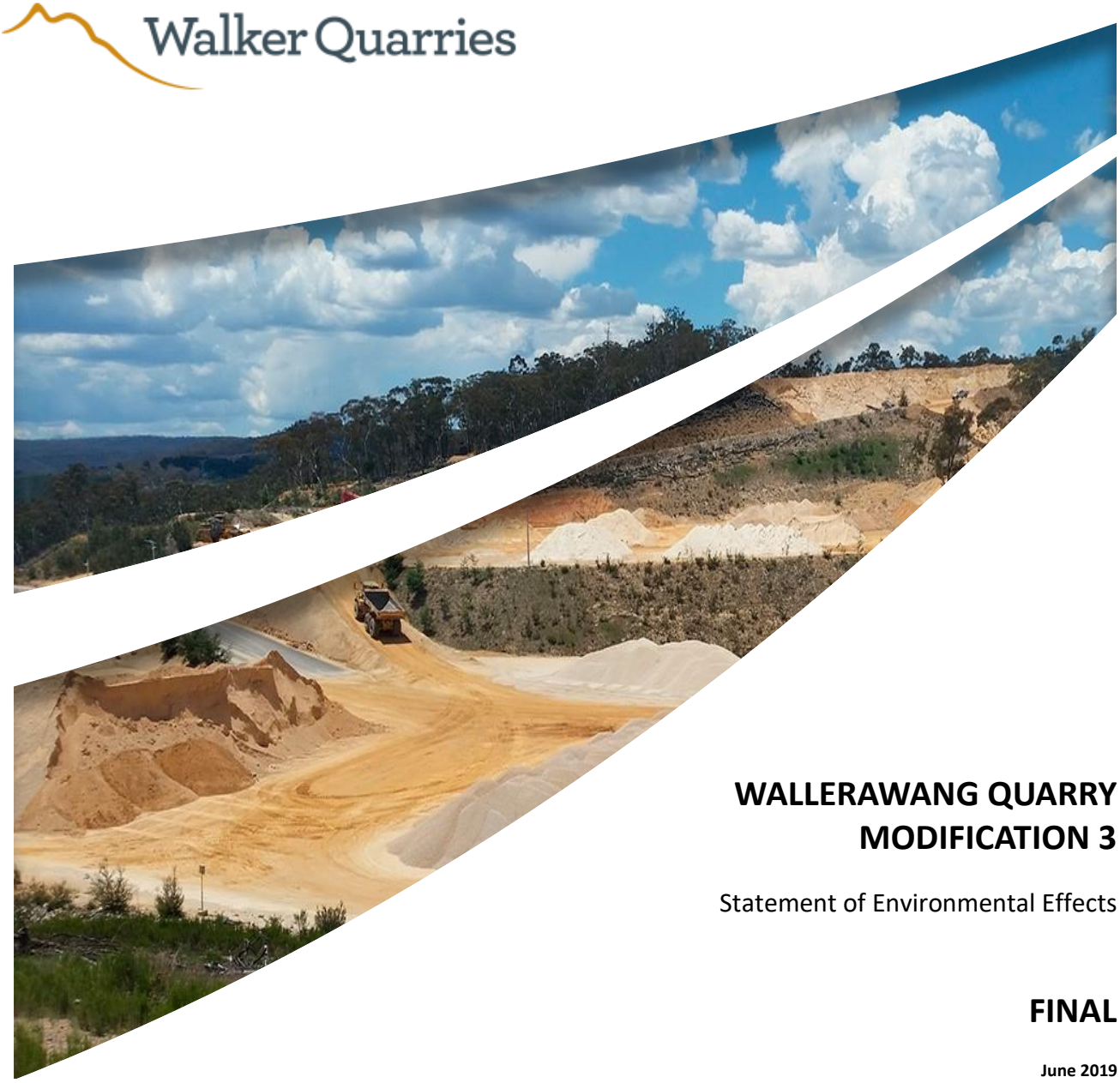
Walker Quarries

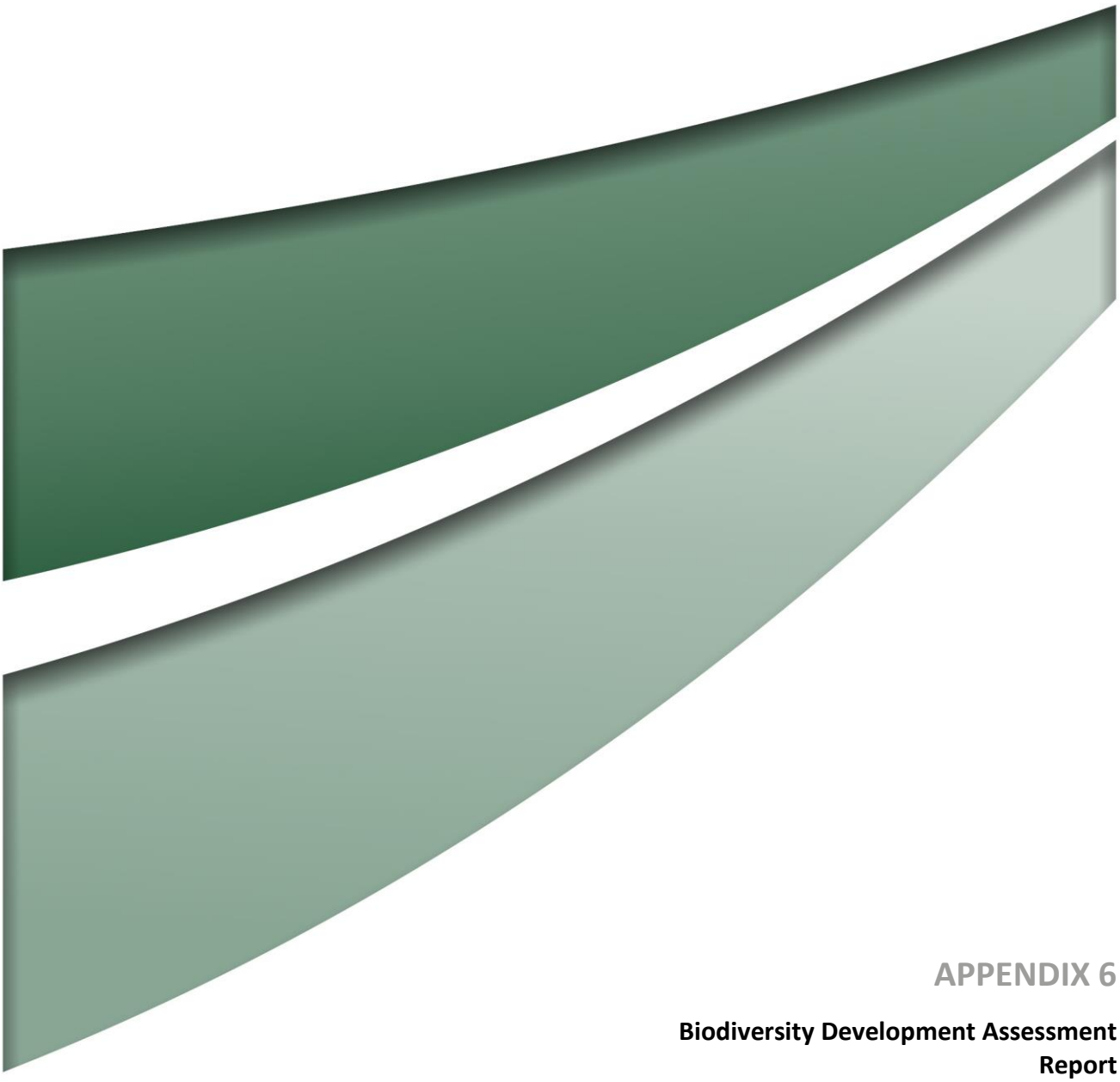


WALLERAWANG QUARRY MODIFICATION 3

Statement of Environmental Effects

FINAL

June 2019



APPENDIX 6

Biodiversity Development Assessment Report

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Biodiversity Development Assessment Report

Wallerawang Quarry, Great Western Highway, Wallerawang, NSW

Prepared for: Walker Quarries

30 May 2019 Version: Final 1.2

PROJECT NUMBER	2018-087		
PROJECT NAME	Biodiversity Development Assessment Report		
PROJECT ADDRESS	Wallerawang Quarry, Great Western Highway, Wallerawang, NSW		
PREPARED FOR	Walker Quarries		
AUTHOR/S	Brian Towle		
REVIEW	**Technical**	**QA**	**Version**
	Bruce Mullins	Bruce Mullins	1.2
VERSION	**Version**	**Date to client**	
	Final 1.1	17 May 2019	
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Glossary and abbreviations

Acronym	Description
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BCF	Biodiversity Conservation Fund
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOM	Bureau of Meteorology
BSA	Biodiversity Stewardship Agreement
CEEC	Critically Endangered Ecological Community
DEC	NSW Department of Environment and Conservation (now OEH)
DPI	NSW Department of Primary Industries
EIS	Environmental Impact Statement
EEC	Endangered Ecological Community
EPBC	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESEA	Eastern Stockpile Extension Area
GDE	Groundwater Dependent Ecosystem
IBRA	Interim Biogeographic Regionalisation of Australia
KFH	Key Fish Habitat
NPWS	NSW National Parks and Wildlife Services
OEH	NSW Office of Environment and Heritage
PCB	Purple Copper Butterfly
PCT	Plant Community Type
SAII	Serious and Irreversible Impacts
TEC	Threatened Ecological Community

Executive Summary

Walker Quarries Pty Ltd (Walker Quarries) currently operates Wallerawang Quarry (the Quarry), located on land adjoining the Great Western Highway to the south of Wallerawang, approximately 8 km northwest of Lithgow. The current approval (DA 344-11-2001) includes a condition which restricts quarrying operations to 15 July 2020 and Walker Quarries proposes to apply for a Modification to DA 344-11-2001 to extend the period of consent, extend the extraction area (both laterally and vertically) and to increase the area available for stockpiling. No increase in the Quarry's annual production rate nor any significant change to processing operations is proposed.

Secretary's Environmental Assessment Requirements ('SEARs') have been issued for the proposed modification which require biodiversity impacts related to the project to be assessed in accordance with Section 7.9 of the NSW Biodiversity Conservation Act 2016 (BC Act) and specifically must use the Biodiversity Assessment Method (BAM; OEH 2017a). This Biodiversity Development Assessment Report has been prepared in accordance with the BAM to document impacts to biodiversity and has been prepared by an Accredited Assessor in accordance with the BC Act and NSW Biodiversity Conservation Regulation 2017 (BC Reg). This format for this BDAR follows that of the different 'stages' outlined within the BAM including:

- Stage 1 – Biodiversity assessment. Includes sections 1 to 4 of this BDAR including the introduction, site context including landscape features, native vegetation and threatened species.
- Stage 2 – Impact assessment. Includes sections 5 to 7 of this BDAR which identify measures to avoid and minimise impacts, assessment of residual impacts to biodiversity, mitigation measures, offset requirements and credit calculations.

In accordance with the BAM, a number of features are assessed within the subject land and within a 1,500 m buffer around the subject land. These landscape features are used to identify biodiversity values that are important for the subject land and inform the habitat suitability of the subject land for threatened species.

Native vegetation was identified and mapped across 14.05 ha of the approximately 32.18 ha of the subject land. Areas that did not support native vegetation were limited to those areas in which vegetation clearing had occurred as part of existing Quarry operations. Areas of native vegetation within the approved extraction area for the existing Quarry operations was not included in the assessment of vegetation extent as this vegetation is being progressively removed as part of the existing operations. Two Plant Community Types (PCTs) were identified within the subject land, namely:

- PCT 732 – Broad-leaved Peppermint Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion; and
- PCT 1093 - Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion.

Neither of the PCTs within the subject land were identified as forming part of any listed Threatened Ecological Communities under the BC Act or the Commonwealth's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Habitat for threatened species has been assessed in accordance with section 6 of the BAM including targeted surveys for threatened flora and fauna species. No threatened species were observed within the subject land.

In accordance with section 8 of the BAM, this BDAR outlines actions taken to avoid and minimise impacts through reducing the subject land and avoiding impacts to adjacent areas of native vegetation. Mitigation measures to avoid impacts to biodiversity are recommended within this BDAR including management of impacts in accordance with the existing Biodiversity Management Plan (BMP) and Soil and Water Management Plan. The future operations of the Quarry as part of the proposed modification will be in accordance with the BMP including subsequent revisions and updates. Specific mitigation measures included within the BMP which should continue to operate for the proposed extension include appropriate pre-clearance protocols and the salvage and re-use of hollow-bearing trees and coarse woody debris.

All residual impacts to biodiversity, after measures to avoid, minimise and mitigate impacts have been assessed using the BAM calculator and offset requirements, in terms of biodiversity credits, have been calculated in accordance with section 11.2 and Section 11.3 of the BAM to achieve the 'no net loss standard' as established by the BAM. A total of 487 ecosystem credits are required to offset the impacts of the proposal. The proposed Quarry extension is to be undertaken as a staged development. Accordingly, the credits requirements have been determined for each stage, based upon the area of vegetation clearing for each stage. The measures proposed to address the offset obligation outlined above will be determined as the proposal approvals progress and may include a combination of retiring credits obligations through payment into the Biodiversity Conservation Fund, purchase of biodiversity credits from the open market and generation of credits from entering into a Biodiversity Stewardship Agreement (BSA) over surplus land or through ecological rehabilitation of disturbed land.

1 Introduction

Walker Quarries Pty Ltd (Walker Quarries) currently operates Wallerawang Quarry (the Quarry), located on land adjoining the Great Western Highway to the south of Wallerawang, approximately 8 km northwest of Lithgow (**Figure 1.1**). Raw material is extracted using conventional drill and blast, load and haul methods, with crushing and screening undertaken in-pit to produce quartzite aggregates, road base and other hard rock products. An additional screening and washing plant is also operated at the Quarry to produce a range of fine aggregates and sand products.

The current approval (DA 344-11-2001) restricts quarrying operations to 15 July 2020 and Walker Quarries is seeking to modify DA 344-11-2001 to extend the period of consent, extend the extraction area (both laterally and vertically) and to increase the area available for stockpiling. No increase in the Quarry's annual production rate nor any significant change to processing operations is proposed.

Secretary's Environmental Assessment Requirements ('SEARs') have been issued for the proposed modification (hereafter referred to as 'the Project'), which require biodiversity impacts related to the Project to be assessed in accordance with Section 7.9 of the NSW *Biodiversity Conservation Act* 2016 (BC Act) and specifically must use the Biodiversity Assessment Method (BAM; OEH 2017a). The BAM, established under Section 6.7 of the BC Act, assesses the impacts of developments on threatened species, ecological communities and their habitats as required under the BC Act. The process of applying the BAM for a proposed development must be fully documented in a Biodiversity Development Assessment Report (BDAR).

This BDAR has been prepared in accordance with the BAM to document the predicted impacts to biodiversity and has been prepared by Brian Towle, an Accredited Assessor (BAAS17057) in accordance with the BC Act and NSW Biodiversity Conservation Regulation 2017 (BC Reg). This BDAR describes the outcome of the development assessment case (00011653/BAAS17057/19/00011654) conducted consistent with the BAM.

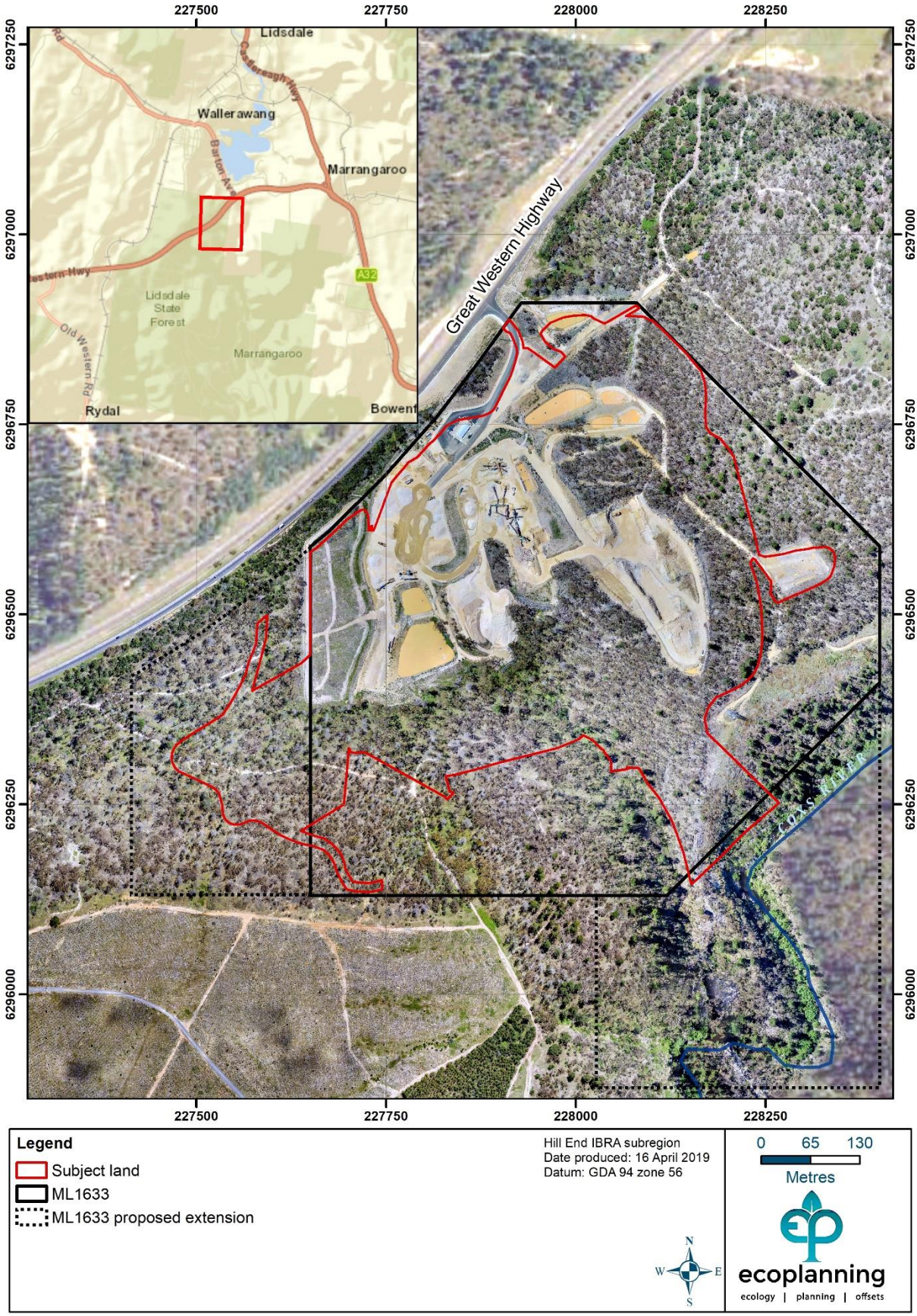


Figure 1.1: Location of the study area

1.1 Site description

The BAM defines the land to which the BDAR applies as the subject land which includes areas which are proposed to be directly and indirectly impacted. For the purposes of this BDAR, the subject land includes the approximately 32.18 ha land within the red polygon shown in **Figure 1.1**.

The subject land includes portions of Lots 6 // DP 872230, 7071 // DP 1201227 and Lot 7322 // 1149335 (**Figure 1.2**). Portions of the subject land and existing Quarry operations occur within the gazetted boundary of Lidsdale State Forest (**Figure 1.2**), with Walker Quarries having entered into a (Forestry) Compensation Agreement with the Forestry Corporation of New South Wales for the clearing of (Forestry) land under Section 265(1) of the NSW *Mining Act* (1992). The subject land generally consists of disturbed land associated with the existing Quarry operations in the north-west with the remainder of the subject land consisting of moderately to steeply inclined slopes which support grassy open forest and woodland vegetation. A high voltage (330kv) transmission line, and cleared easement, traverses the subject land in the south-east. The subject land is bound by (**Figure 1.1** and **Figure 1.2**):

- The Great Western Highway to the north and west with Lidsdale State Forest beyond the Great Western Highway.
- The native woodland of Lidsdale State Forest to the south and west. Plantation (pine) forest occurs further to the west and south-west beyond the native woodland.
- The Coxs River and steep slopes supporting native woodland to the east and south-east which extend to Marrangaroo National Park which occurs approximately 1 km south-east of the subject land.
- Moderately steep slopes supporting native vegetation immediately to the north, with the Great Western Highway and cleared agricultural landscapes occurring further to the north.

1.2 Proposed development

The Wallerawang Quarry is approved to extract, process and produce up to 500,000 tonnes of quartzite and other hard rock aggregates and sand annually from an open cut extraction area of approximately 8.9 hectares. Originally approved in October 2004 as DA 344-11-2004, operations at the Quarry commenced in 2014 with the construction of a new intersection with the Great Western Highway. Quarrying commenced in late 2014 and the Quarry now produces a range of aggregates, pebbles and sand. Since commencement, DA 344-11-2004 has 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.

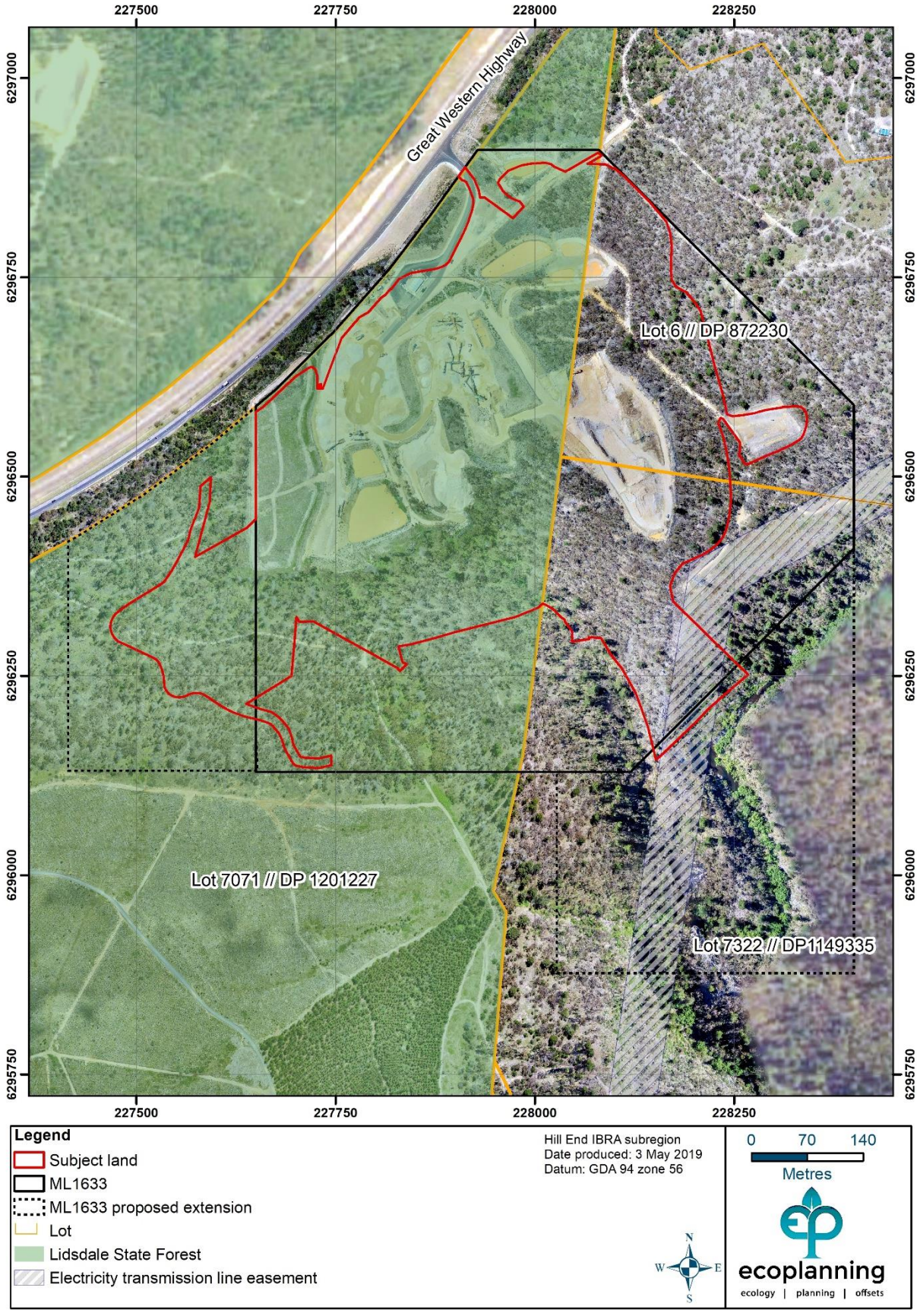


Figure 1.2: The subject land and administrative boundaries

At the time of assessment, the disturbance footprint of the Quarry was 15.3 ha which represents approximately 93% of the approved 16.5 ha disturbance area of DA 344-11-2004. The floor of the extraction area rises from approximately 950 m to 955 m AHD, remaining 20 m to 25 m above the approved maximum depth.

The proposed modification to approved operations are 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 to access additional resources identified in the areas adjacent to the existing Quarry Site. 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 8.9 to 13.3 ha and the depth of extraction 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.

3. 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.

4. An extension to the stockpile areas of the Quarry, using the overburden removed from the extraction area, is proposed to allow for the maintenance of the increased type and volume of Quarry products.

5. 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; and
    - the construction of an additional water storage dam for the harvesting and storage of water (required for processing and dust suppression).

The modified Quarry layout, identifying these key modifications, is shown in **Figure 1.3** and **Figure 1.4**.

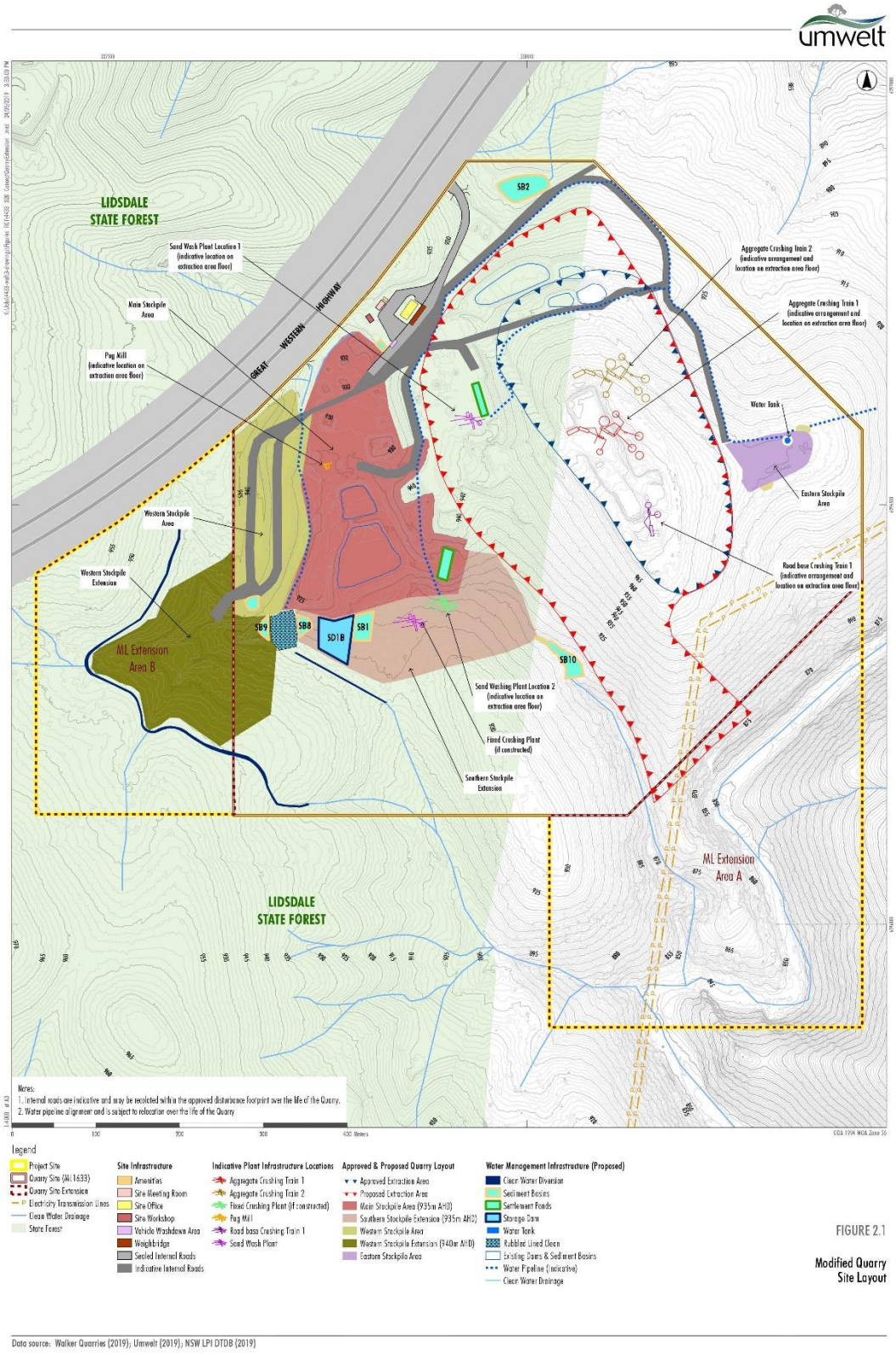


Figure 1.3: The proposed works (Source: Umwelt 2019)

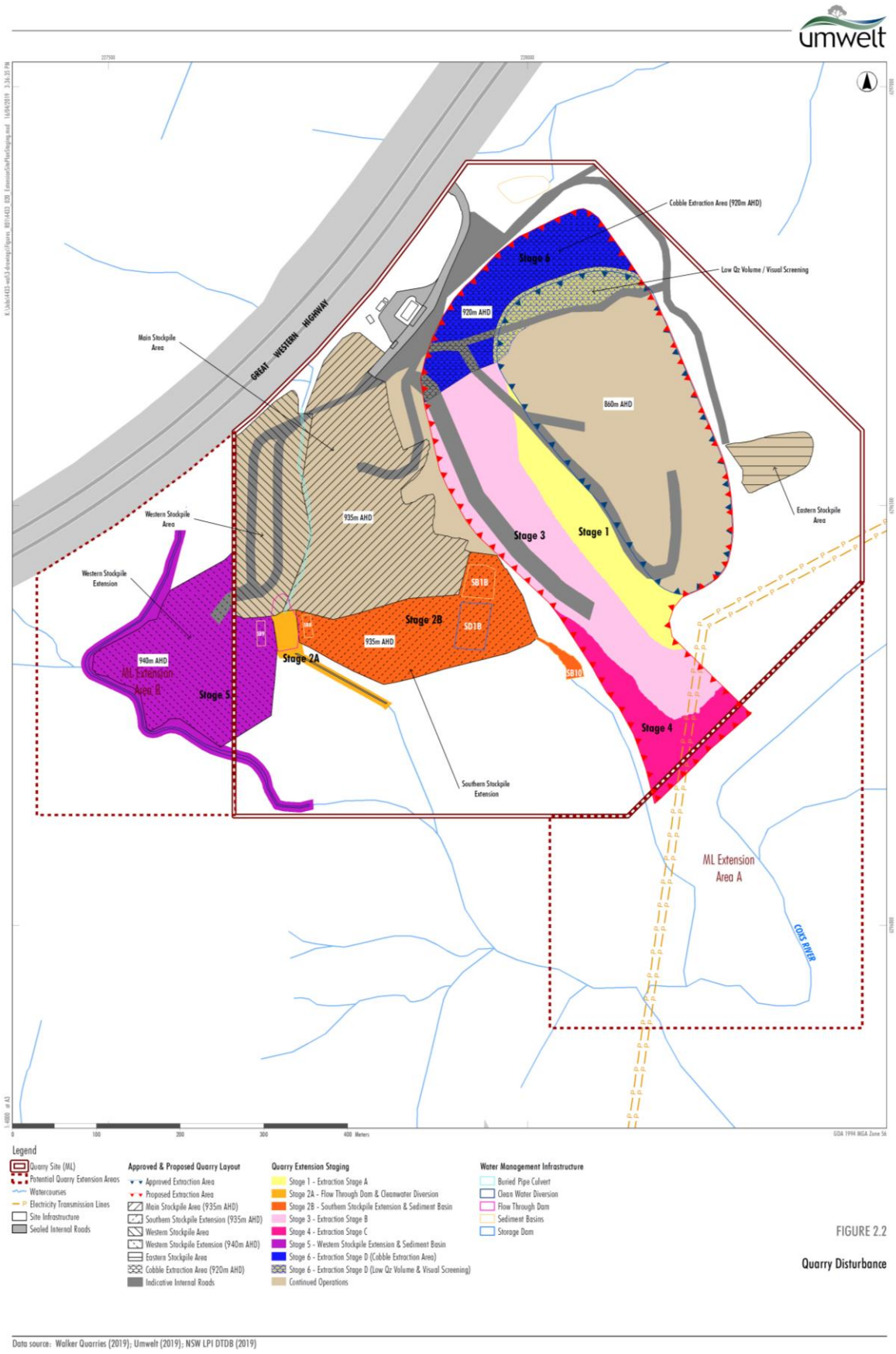


Figure 1.4: Development staging (Source: Umwelt 2019)

2 Landscape context

2.1 Identify landscape features

In accordance with the BAM, a number of features are assessed within the subject land and within a 1,500 m buffer around the subject land. These landscape features are used to identify biodiversity values that are important for the subject land and inform the habitat suitability of the subject land for threatened species. Other features, such as rivers, streams, estuaries and wetlands, habitat connectivity, karst areas or areas of outstanding biodiversity value are considered, where appropriate.

2.1.1 IBRA bioregions and subregions

The Interim Biogeographic Regionalisation of Australia (IBRA, DoEE 2012) represents a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna species present. The subject land is wholly located within the 'South Eastern Highlands' IBRA bioregion. The subject land includes areas within two IBRA subregions, the 'Hill End' and 'Capertee Uplands' subregions (**Figure 2.1**). In accordance with the BAM, the Hill End IBRA subregion has been used for the purposes of this BDAR and credit calculations within the BAM Calculator, as the largest proportion of proposed impacts will occur within this subregion.

2.1.2 NSW Landscape Regions

The subject land, and land within the 1,500 m buffer, includes multiple NSW Landscape Regions (Mitchell Landscapes). The majority of the subject land is located within the 'Mount Horrible Plateau' landscape while the north-west of the subject land is located within the 'Capertee Plateau' NSW Landscape (**Figure 2.1**). The 'Bathurst Granites' NSW Landscape also occurs within the 1,500 m buffer. For the purposes of this BDAR and credit calculations within the BAM Calculator, the 'Mount Horrible Plateau' NSW Landscape has been used.

2.1.3 River Stream and Wetlands

Rivers, streams and wetlands located within the 1,500 m buffer of the subject land, including the associated riparian buffers calculated in accordance with Appendix 3 of the BAM, are shown in **Figure 2.2** and **Figure 2.3**. It is noted that mapping of rivers and streams by NSW Department of Industry (DoI 2019) includes drainage lines which have been redirected as part of the existing Quarry operations.

The subject land contains three unnamed streams including two unnamed 1st order tributaries which flow into 2nd order stream. For the purposes of this report the central 2nd order stream has been termed 'Tributary A' while the two 1st order streams have been termed 'Tributary B' and 'Tributary C' as shown on **Figure 2.2**. Tributary A is a 2nd order stream in the west of the subject land, however, is identified as a 3rd order stream in the east below the former junction with tributaries which have been diverted as part of the existing quarry operations. For the purposes of this BDAR and identifying riparian buffers, the classification of Tributary A as a 3rd order stream in the east of the subject land has been maintained. All drainage lines within the subject land are tributaries of the Coxs River, which occurs to the south-east of the subject land as a 6th order stream.

Tributaries A, B and C show moderate levels of degradation caused by anthropogenic sources including gully erosion and weed invasion which is attributed to clearing of native vegetation and increasing surface flows within Lidsdale State Forest as part of Forestry operations. Nonetheless, these channels do not represent a significant departure from what would be considered a waterway in a natural state.

Mapping of Key Fish Habitat (KFH) by DPI Fisheries (2007) identified that the Coxs River and the portion of Tributary A which is classified as a 3rd order stream, are KFH. Assessment of KFH type and class following the framework set out by the updated DPI Fisheries (2013), shows at the time of assessment the drainage lines within the subject land represent Class 4 - Unlikely KFH. This was due to the observations of intermittent flow following rain events only, little or no flow or free-standing water or pools post rain events. The drainage lines within the subject land were identified as generally dry gullies with no aquatic flora present. 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.

No estuaries are present within the subject land, 1,500 m buffer or the broader region in which the Project is to occur.

The BAM defines important wetlands as those wetlands listed in the Directory of Important Wetlands of Australia (Environment Australia 2001) or a State Environmental Planning Policy 14 Coastal Wetland. No important wetlands are present within the subject land or 1,500 m buffer. Within the 1,500 m buffer, the narrow band of vegetation which occurs along the banks of the Coxs River 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. The extent of this local wetland is shown on **Figure 2.2** and is based upon regional vegetation mapping of the 'Tablelands Riparian Scrub Complex' as described and mapped by DEC (2006). No local wetlands are present within the subject land.

2.1.4 Habitat connectivity

No published regional corridors, flyways or other habitat connectivity features have been identified for the subject land or 1,500 m buffer. However, habitat within the subject land is contiguous with large areas supporting broadly similar forest and woodland vegetation to the south-east extending to Marrangaroo National Park (**Figure 2.4**). The subject land is not connected to any areas of habitat to the north of the subject land, with these areas supporting existing Quarry operations, the Great Western Highway, cleared agricultural land, and forestry plantations. The proposed works would involve clearing vegetation, however connectivity to the south-east would remain in areas surrounding the subject land and the project will not significantly fragment or isolate any areas of habitat (**Figure 2.4**).

2.1.5 Other landscape features

No other landscape features including areas of geological significance (including karst, caves, crevices and cliffs) or soil hazard features have been identified within the subject land and 1,500 m buffer around this land.

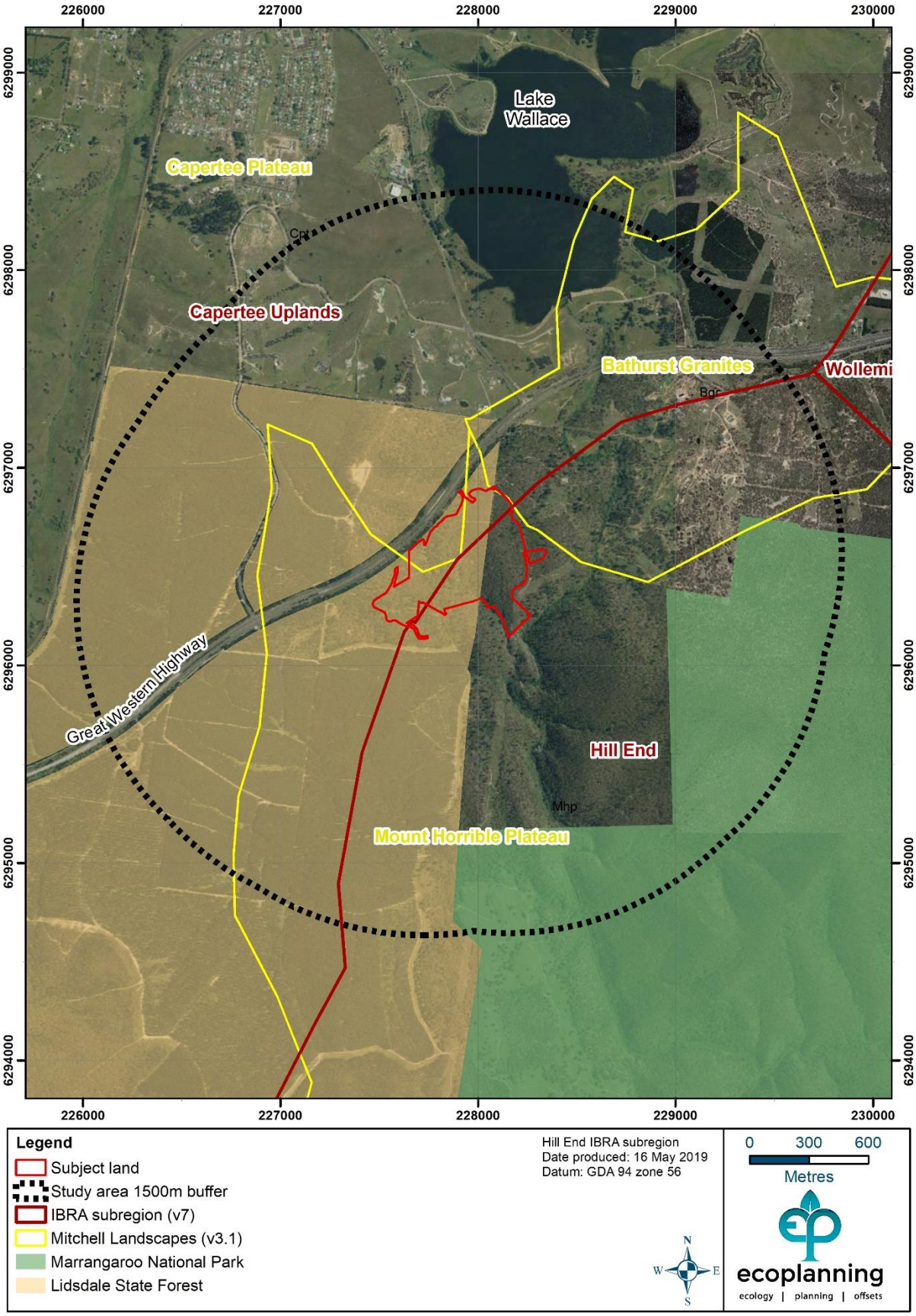


Figure 2.1: The IBRA subregions and Mitchell Landscapes within the subject land and 1500 m buffer

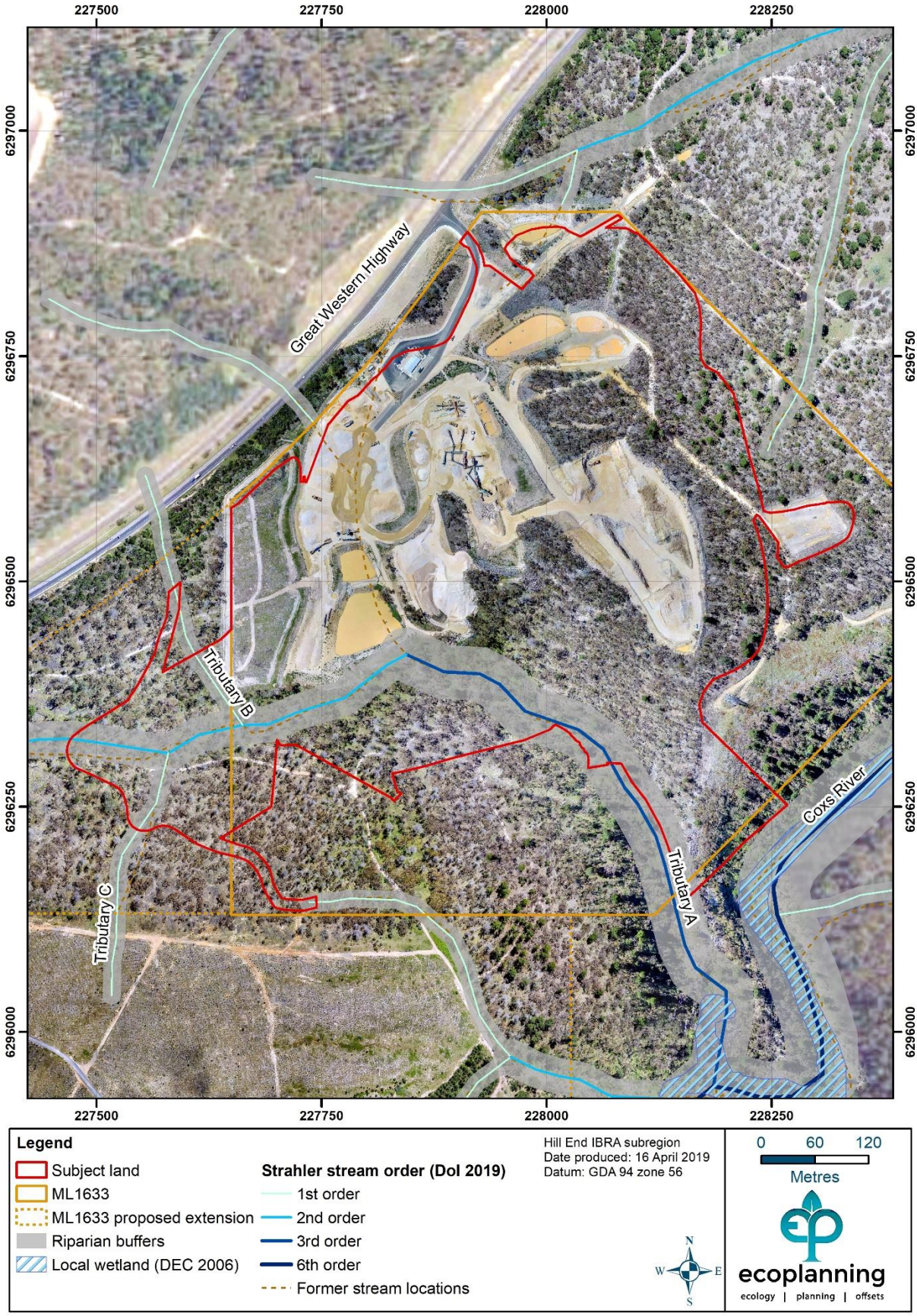


Figure 2.2: Rivers, streams and wetlands within the subject land

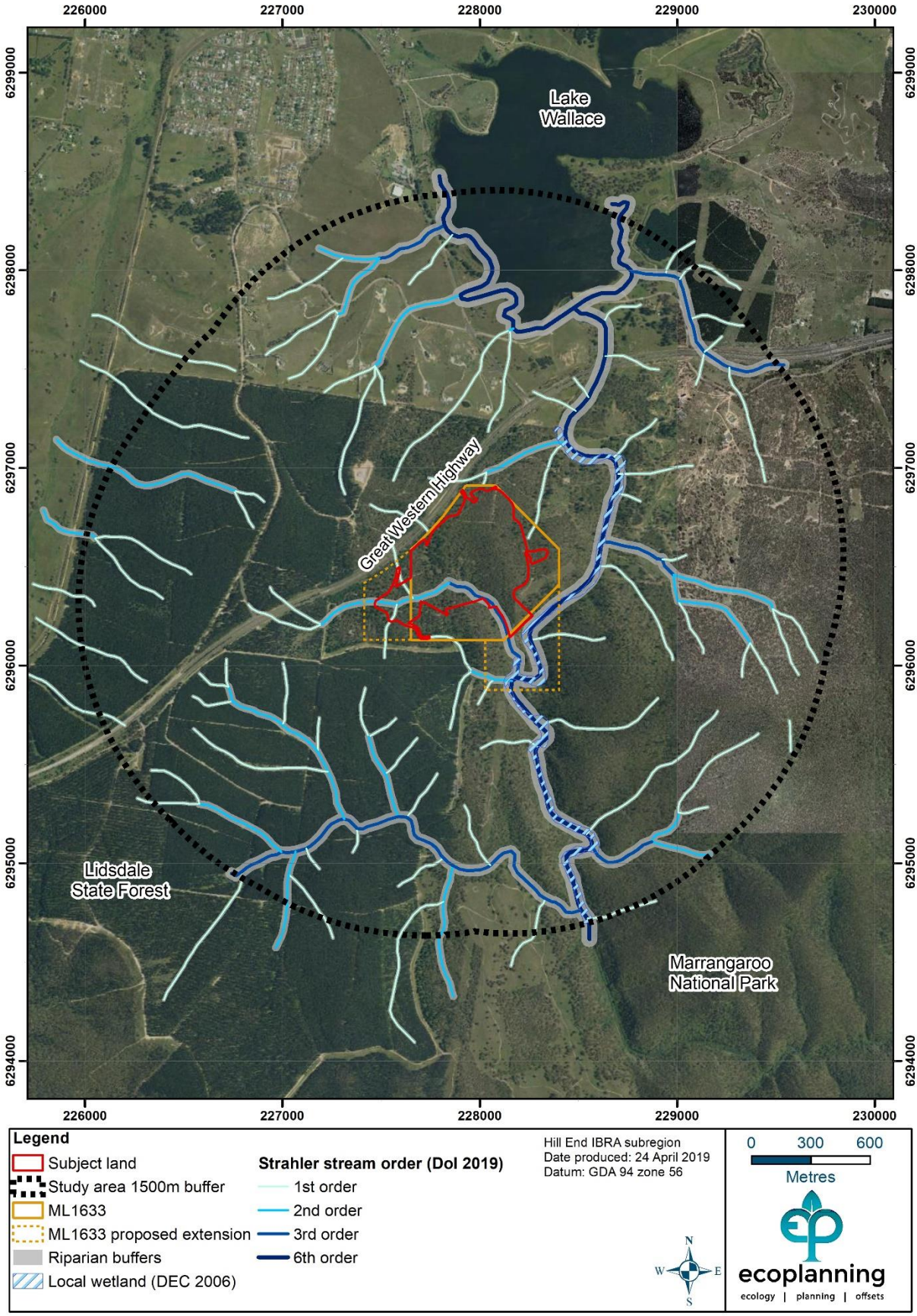


Figure 2.3: Rivers, streams and wetlands within the 1500 m buffer

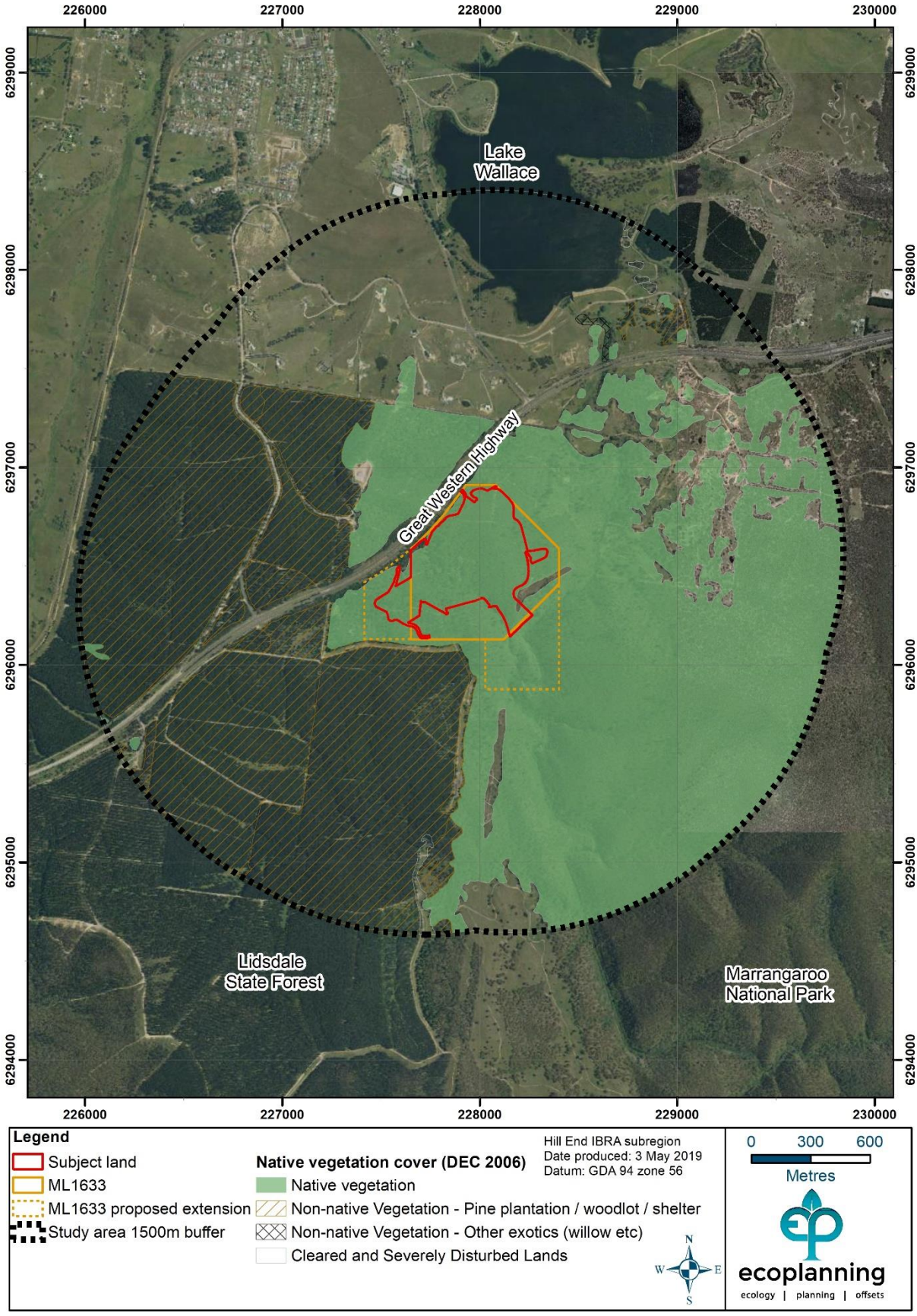


Figure 2.4: Habitat connectivity and native vegetation cover (source: modified from DEC 2006)

2.2 Determining site context

2.2.1 Assessing native vegetation cover

In accordance with Section 4.3.2 of the BAM, native vegetation cover must be estimated for a 1,500 m buffer around the subject land to determine the landscape context of the site. The extent of native vegetation on the subject site and immediate surrounds was mapped using the vegetation mapping for the Western Blue Mountains (DEC 2006) with revisions made based upon updated aerial photo interpretation.

Within the 1135.6 ha area which includes the subject land and a 1,500 m buffer, 456.92 ha was mapped as supporting native vegetation (**Figure 2.4**). This equates to a cover of native vegetation across 40.24% of the subject land including the 1,500 m buffer, which is within the >30 - 70% class in accordance with the BAM.

2.2.2 Assessing patch size

Patch size as defined by the BAM as "*an area of native vegetation that*:

a) *occurs on the development site or biodiversity stewardship site, and*

b) *includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).*

Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site."

Under the BAM, patch size is required to be assessed as one of four classes per vegetation zone mapped, being <5 ha, 5-24 ha, 25-100 ha or >100 ha. All vegetation within the subject land is contiguous with, or within 100 m of, areas of moderate to good native vegetation which extends south-east and south of the subject land to Marrangaroo National Park (**Figure 2.4**). The patch size for the area of vegetation extending from the subject land towards Marrangaroo National Park is in excess of 50,000 ha. In accordance with section 5.3.2 of the BAM, the patch size for all vegetation zones within the subject land was assigned as being within the >100 ha class.

3 Native vegetation

3.1 Existing information

In accordance with section 5.2.1.5 of the BAM, existing information relevant to the native vegetation of the subject land and the 1,500 m buffer area has been reviewed. Vegetation information associated with regional vegetation assessments (DEC 2006) and more site-specific vegetation assessments have been reviewed.

3.1.1 Regional vegetation mapping

Regional vegetation mapping for the subject land and 1,500 m buffer was reviewed (DEC 2006). Vegetation mapping by DEC (2006) identified two native vegetation communities and one modified vegetation type within the subject land (**Figure 3.1**), namely:

- 'Tableland Slopes Brittle Gum - Broad-leaved Peppermint Grassy Forest' (Map Unit 34) – mapped across upper and midslope areas within the subject land.
- 'Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest' (Map Unit 35) – mapped across the lower slopes and minor gullies within the subject land.
- 'Non-native Vegetation - Pine plantation / woodlot / shelter' (Map unit 59) – mapped across the western portions of the subject land, adjacent to pine plantations associated with Lidsdale State Forest.

The equivalent Plant Community Types (PCTs), the vegetation classification system used by the BAM, to vegetation communities mapped by DEC (2006) are identified in **Table 3.1**.

Table 3.1: Relationship between vegetation communities of DEC (2006) and PCTs

Vegetation community (DEC 2006)	Plant Community Type (PCT)	Threatened Ecological Communities (TECs)*
Tableland Slopes Brittle Gum - Broad-leaved Peppermint Grassy Forest (Map Unit 34)	1093 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Not identified as equivalent to any TECs listed under the BC Act.
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest (Map Unit 35)	732 – Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	Not identified as equivalent to any TECs listed under the BC Act.

3.1.2 Site specific assessments

Vegetation within portions of the existing ML1633 has been assessed as part of ongoing vegetation monitoring works and approvals associated with the existing approval for the Quarry. Field surveys conducted by Wildthing Environmental Consultants (1999) as part of the original Environmental Impact Statement (EIS, Pacrim 2001) for the Quarry identified

vegetation as 'Sub-Alpine Eucalypt Woodland' which was dominated by *Eucalyptus viminalis* (Ribbon Gum), *Eucalyptus pauciflora* (Snow Gum), *Eucalyptus dalrympleana* (Mountain Gum) and *Eucalyptus stellulata* (Black Sally). No threatened flora species were recorded during surveys undertaken by Wildthing Environmental Consultants, although potential habitat for *Eucalyptus pulverulenta* (Silver-leaved Mountain Gum) was observed (Wildthing Environmental Consultants 1999).

Lesryk (2017a) completed an ecological investigation across vegetation adjacent to the existing Quarry operations including the subject land for this BDAR and identified that two PCTs were present within their investigation area, namely:

- PCT 732 – Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion.
- PCT 1093 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion.

The PCTs identified within the investigation area by Lesryk (2017a) are consistent with the corresponding vegetation communities mapped by DEC (2006) across this area.

Lesryk (2017b) completed vegetation monitoring across areas of native vegetation adjacent to the Quarry, including the subject land for the BDAR, in accordance with a Flora and Fauna Management Plan for the Quarry. Lesryk (2017b) describes vegetation within six monitoring plots (10 x 10 m). The vegetation descriptions for these plots are broadly similar to the PCTs identified within this area by Lesryk (2017a) and DEC (2006). No flora species listed on the BC Act were detected as part of these surveys, although potential habitat for Silver-leaved Gum (*Eucalyptus pulverulenta*) is noted (Lesryk 2017b).

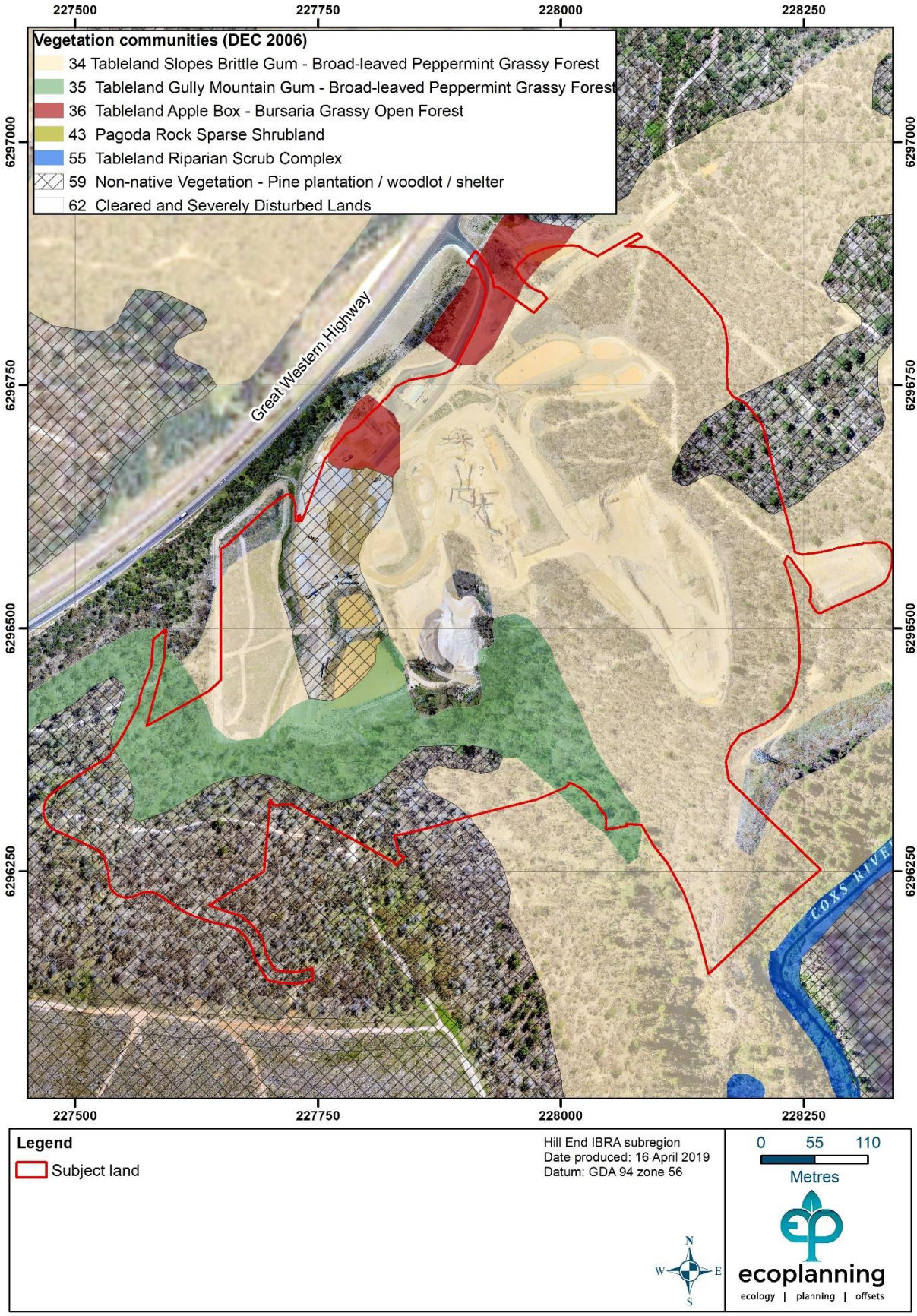


Figure 3.1: Regional vegetation community mapping for the Western Blue Mountains (source: DEC 2006)

3.2 Vegetation extent

In accordance with section 5.1 of the BAM the extent of native vegetation was identified and mapped across the subject land. A total of 14.05 ha of the approximately 32.18 ha of the subject land was identified as supporting native vegetation. It is noted that areas of native vegetation within the approved extraction area for the existing Quarry operations was not included in the assessment of vegetation extent as this vegetation is being progressively removed as part of the existing operations. Areas that did not support native vegetation were limited to those areas in which vegetation clearing had occurred as part of existing Quarry operations. Areas under the high voltage transmission line, present within the east of the subject land, have been previously cleared and slashed but do support native understorey vegetation and were included in the assessment of vegetation extent.

In accordance with section 5.1 of the BAM, areas which are not native vegetation do not require further assessment, except where they represent habitat for threatened species. No further assessment of the vegetation within 'cleared' areas has been undertaken.

3.3 Plant Community Types (PCTs)

Identification and mapping of vegetation community and PCTs was based upon validation of the mapping of vegetation communities within the subject land by DEC (2006). All areas of vegetation were traversed whilst observing the vegetation structure and dominant species within each structural layer. The entire distribution of each vegetation polygon mapped by DEC (2006) was traversed to sample any spatial variation within each polygon, validate boundaries between PCTs and to record any variation in the broad condition state of vegetation polygons to identify and map vegetation zones.

Based upon traverses of each of the vegetation polygons and revisions to mapped boundaries, vegetation communities within the subject land were identified. The floristics of each of these vegetation communities were then sampled within plot-based floristic vegetation surveys consistent with section 5.2.1.9 of the BAM. The location of floristic plots is shown in **Figure 3.2**. The plot locations also represented the location of vegetation integrity plots in accordance with section 5.3 of the BAM. The location of floristic vegetation plots was based upon randomly sampling areas of each vegetation community whilst ensuring that the plot-based surveys included representative areas within each community, sampling the geographic range of each community, and ensuring that plots were not influenced by edge effects (i.e. located close to edges of vegetation extent) or ecotones with adjacent vegetation zones. It is noted that as the impact footprint of the project has been reduced over time, some floristic vegetation plots which were located within preliminary footprints are now located outside of the subject land. Nonetheless, these floristic plots have sampled vegetation which is equivalent to vegetation within the subject land, including the PCT and broad condition state, and have been used to determine the vegetation integrity score for vegetation within the subject land.

The identification of PCTs for each vegetation community was in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Determination of the most appropriate PCTs for vegetation communities within the subject lands used the BioNet Vegetation Classification database to filter PCT types within the South Eastern Highlands IBRA region which included the canopy species which had the greatest percent foliage cover

and abundance as recorded within floristic plots. The data for each PCT including vegetation formation, descriptive attributes and distribution information were then reviewed to determine the most appropriate PCT for each of the vegetation polygons sampled within the subject land. Observations of vegetation structure and composition made during traverses of the subject lands as well as previous floristic data for adjacent land (section 3.2) also informed the determination of the most appropriate PCTs for the vegetation communities within the subject land.

No quantitative analysis of data recorded within vegetation integrity plots and PCT descriptions was undertaken due to the limited data available for many of the PCTs listed as occurring within the South-Eastern Highlands Bioregion. Additionally, PCTs listed for the South Eastern Highlands Bioregion commonly reference multiple sources (DEC 2006; Gellie 2005; Tozer et al. 2010) without identifying the specific vegetation communities or map units which PCTs are based upon.

3.3.1 Plant Community Types

Two PCTs were identified within the subject land with the distribution of these PCTs related to the topographical position within the subject land (**Figure 3.2**). The PCTs identified within the subject land and their distribution was generally consistent with the broad patterns identified by DEC (2006). Boundaries between the PCTs were often difficult to identify, with broad ecotones occurring between PCTS and with many flora species shared by adjacent PCTs. The boundaries were distinguished based upon changes in topography, vegetation structure and the dominance of primary canopy species. The two PCTs identified within the subject land are:

- PCT 732 – Broad-leaved Peppermint Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion; and
- PCT 1093 - Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion.

Details of each of these PCTs within the subject land are summarised in **Table 3.2**, with the distribution of the PCTs within the subject land shown in **Figure 3.2**. Descriptions of each of the PCTs identified within the subject land are outlined below.

Table 3.2: Details of PCTs recorded within the subject land

Plant Community Type (PCT)	Vegetation formation and class	Vegetation zone	Area within subject land (ha)	PCT percent cleared	Threatened Ecological Community[1] (TEC)
PCT 732: Broad-leaved Peppermint Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	Grassy Woodlands Southern Tableland Grassy Woodland	Intact	5.54	65	Not listed
PCT 1093: Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation) Southern Tableland Dry Sclerophyll Forests	Intact	8.27	61	Not listed
		Slashed	0.25		
Total	-		14.05*	-	-

1. As identified within the BioNet Vegetation Classification;
* Rounding errors may apply

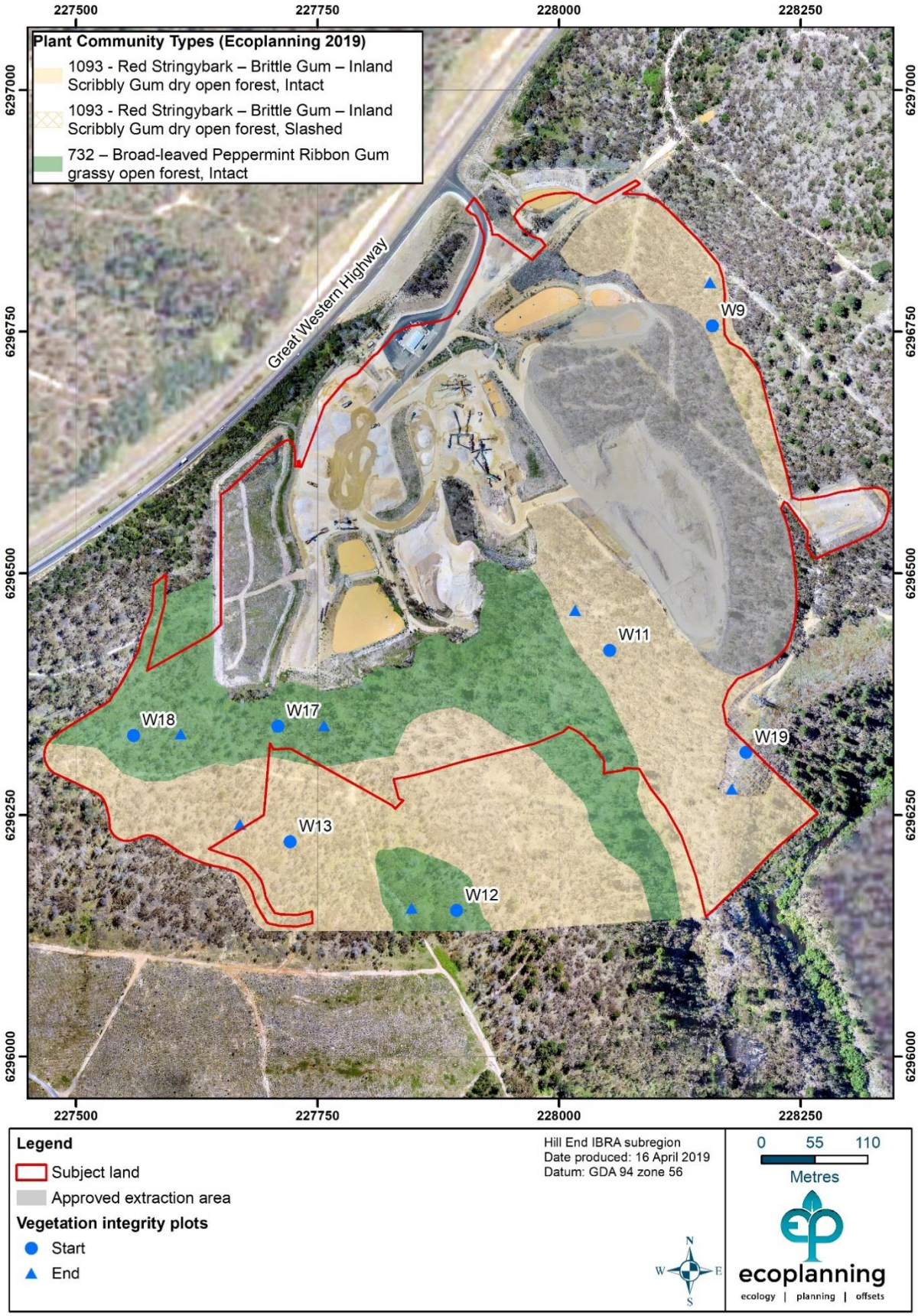


Figure 3.2: Plant Community Types within the subject land and vegetation integrity plot locations

PCT 732: Broad-leaved Peppermint Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion.

'Broad-leaved Peppermint Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion' (PCT 732) occurred across the mid to lower slopes and gullies within the subject land and occurred as a tall woodland or forest with an open midstorey and grassy understorey (**Plate 3.1**). This PCT was characterised by a moderate to tall and variable canopy including *Eucalyptus viminalis* (Ribbon Gum), *E. dives* (Broad-leaved Peppermint), *E. bridgesiana* (Apple box) and *E. pauciflora* (Snow Gum). A number of other canopy species were present at low densities within this PCT including *E. dalrympleana* (Mountain Gum), *E. rubida* (Candlebark), *E. melliodora* (Yellow Box) and *E. stellulata* (Black Sallee). The mid stratum, where present, was generally sparse within this PCT with *Acacia dealbata* (Silver wattle), *Bursaria spinosa* subsp. *lasiophylla* (Native Blackthorn) and *Melicytus dentatus* (Tree Violet) present at lower densities. A grassy understorey dominated this vegetation community with *Poa sieberiana* (Snow grass) and the exotic **Anthoxanthum odoratum* (Sweet Vernal Grass) dominant across much of this community with *Lomandra filiformis* (Wattle Mat-rush), *Stellaria pungens* (Prickly Starwort), *Aristida ramosa* (Purple Wiregrass), *Dianella revoluta* (Blueberry Lily) and *Lomandra longifolia* (Spiny-headed Mat-rush) also common. Across the subject land this PCT was identified as occurring as a single vegetation zone (areas of similar broad condition state), termed 'intact', with little evidence of past disturbance observed.

Plate 3.1: PCT 732 within the subject land

The identification of the most suitable PCT was based upon consideration of PCTs identified by the BioNet Vegetation Classification as having *E. viminalis* listed as a co-dominant and which occur within the Hill End or Capertee Uplands IBRA subregions. Of the four PCTs which matched this criteria, PCT 732 was considered to be the most suitable as the species listed for this PCT within BioNet Vegetation Classification and the profile sources (Tozer et al 2010; DEC 2006) were generally a good match for vegetation recorded within the subject land. Other potential PCTs were excluded based upon a poor match between species lists within the BioNet Vegetation Classification or the PCT reference (i.e. PCT 963 and 1191), or

the distribution identified within either the BioNet Vegetation Classification or the PCT reference did not include the subject land (i.e. PCT 1100).

Within the BioNet Vegetation Classification, PCT 732 is listed as being a partial subset of the TEC '*Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions*'. However, the final determination for this TEC does not include map unit 35 ('Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest') of DEC (2006), with which vegetation within the subject land is equivalent. In consultation with OEH, it was identified the BAM Calculator does not recognise this TEC as being associated with PCT 732 within the Hill End IBRA sub-region and OEH have advised that the vegetation within the subject land does not form part of the TEC.

PCT 1093: Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion.

This PCT occurred on upper slopes and more exposed ridges and crests within the subject land and generally occurred as a woodland or low woodland with a spare understorey of grasses and graminoids. This PCT was characterised by a low canopy dominated by *Eucalyptus mannifera* (Brittle Gum) with *E. dives* sub-dominant. On mid slopes where this PCT transitioned to adjacent PCTs, *E. bridgesiana* and *E. melliodora* also occurred at low densities. Within the most exposed occurrences of the community adjacent to, but outside of, the subject land *E. rossii* (Inland scribbly Gum) was also observed as forming part of the upper stratum. A mid stratum was absent or very sparse within this vegetation community and, where present, was generally limited to scattered individuals including *Acacia buxifolia* (box-leaf wattle), *Persoonia linearis* (Narrow-leaved Geebung) and *Hakea dactyloides* (Finger Hakea). The ground cover of this vegetation community was variable often limited to a sparse layer dominated by *Poa sieberiana* (Snowgrass), *Rytidosperma pallidum* (Silvertop Wallaby Grass) and *Lomandra filiformis* with a number of sub shrubs also present including *Brachyloma daphnoides*, *Dillwynia phylicoides, Hibbertia obtusifolia* and *Lissanthe strigosa*. In some areas of this PCT, often in the lower and slightly more sheltered areas of this vegetation community, *Lomandra longifolia* dominated the understorey and cover of this layer was greatly increased. Across the subject land this PCT was identified as occurring as two vegetation zones, including predominately undisturbed vegetation termed 'intact' (**Plate 3.2**) and the slashed vegetation under the high voltage powerline easement, termed 'slashed' (**Plate 3.3**).

Plate 3.2: PCT 1093 'intact' within the subject land

Plate 3.3: PCT 1093 'Slashed' within the subject land (foreground)

The identification of the most suitable PCT was based upon consideration of PCTs identified by the BioNet Vegetation Classification as having *E. mannifera* as a co-dominant and which occur within the Hill End or Capertee Uplands IBRA subregions. Of the four PCTs which matched this criteria, PCT 1093 was considered to represent the most suitable PCT for the following reasons:

- It is specifically identified in the profile source (Tozer et al 2010) as occurring at Wallerawang.
- This PCT includes the vegetation mapping of DEC (2006) as a source and vegetation within the subject land closely matches the description of 'Tablelands slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest' (MU34) as described by DEC (2006).

- Species listed for this PCT within BioNet Vegetation Classification and the profile sources (Tozer et al 2010; DEC 2006) were generally a good match for vegetation recorded within the subject land.

Other potential PCTs were excluded based upon a more westerly or southerly distribution (including PCT 351), or floristically the description of these PCTs within the BioNet Vegetation Classification or the PCT reference, were not as good a match with vegetation within the subject land.

PCT 1093 is not identified as forming part of any TECs listed under the BC Act or the EPBC Act.

3.4 Current and future vegetation integrity scores

As outlined above, variation in the broad condition class of each of the PCT within the subject land was assessed to identify any vegetation zones in accordance with section 5.3 of the BAM. The condition of both PCTs within the subject land was generally homogeneous across the subject land so that a single vegetation zone, termed 'intact', was identified for each PCT.

Each vegetation zone identified within the subject land was surveyed and quantitative measures of the composition, structure and function attributes recorded in accordance with section 5.3.4 of the BAM. The locations of the plot-based vegetation integrity surveys are shown in **Figure 3.2**. The number of plots surveyed for each vegetation zone are equal to the required number of plots as outlined in Table 4 of the BAM and shown in **Table 3.3**. For each plot/transect, the vegetation composition, structure and function were assessed in accordance with the BAM and using the BAM Calculator a vegetation integrity score was calculated for each vegetation zone (**Appendix A**). Vegetation integrity scores for each vegetation zone are presented in **Table 3.3**.

Vegetation integrity scores ranged from 45/100 to 88.8/100 for the three vegetation zones within the subject land (**Table 3.3**). Future vegetation integrity scores were allocated for each vegetation zone. The project would involve the complete removal of all vegetation within the subject land and the default future vegetation integrity score of 0 for each vegetation zone within the subject land was retained.

Table 3.3: Vegetation integrity scores for vegetation zones

Vegetation zone	Area impacted (ha)	Plots required	Plots surveyed	Veg integrity score
PCT 732 – 'Intact'	5.54	3	12, 17, 18	88.8
PCT 1093 – 'Intact'	8.27	3	9, 11, 13	74.1
PCT 1093 – 'slashed'	0.25	1	19	45
Total	**14.05***	**7**	**7**	**-**

* Rounding errors may apply

3.5 Groundwater Dependent Ecosystems (GDEs)

The identification and mapping of Groundwater Dependent Ecosystems (GDEs) forms part of the SEARs for the project. Additionally, under the BAM the impacts of development on hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence) must be considered in the context of prescribed impacts (**see section 6.2**). The NSW *Water Management Act 2000* and the NSW DPI *Water Risk Assessment Guidelines for GDEs* define GDEs as "*Ecosystems which have their species composition and ecosystem processes wholly or partially determined by groundwater*".

Schedule 4 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* identifies high priority GDEs and high priority karst environment GDEs. The subject land and adjacent areas do not form part of any of the listed high priority GDEs including karst environment GDEs.

A desktop review of aquatic and terrestrial GDE mapping generated by the Groundwater Dependent Ecosystem Atlas (BOM 2019), which is the most comprehensive inventory of the location and characteristics of potential GDEs for Australia, does not map aquatic GDEs within the subject land. The nearest aquatic GDE occurs in association with the Coxs River to the east of the subject land (**Figure 3.3**). Aquatic GDEs are ecosystems that rely on the surface expression of groundwater, whereas terrestrial GDEs are those ecosystems which rely on the subsurface presence of groundwater. The BOM (2019) mapping indicates the presence of high and low potential terrestrial GDEs across the subject land (**Figure 3.3**). The high potential GDEs identified by BOM (2019) within the subject land are noted as occurring in association with 'Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest' and the equivalent PCT 732. Low potential GDEs identified by BOM (2019) within the subject land are noted as occurring in association with 'Tableland Slopes Brittle Gum – Broad leaved Peppermint Grassy Forest' and the equivalent PCT 1093.

Existing groundwater depth and potential groundwater drawdown has been modelled across the subject land and adjacent areas by Jacobs (2019) with depth to groundwater across the subject land greater than 10 m below the surface. Research into sclerophyllous eucalyptus woodland suggests that groundwater uptake is unlikely to occur where depth to groundwater is greater than ~10 m (Benyon et al. 2006; Cook et al. 1998; O'Grady et al. 2010; and Zolfaghar et al 2014). Consequently, the vegetation within the subject land is unlikely to be accessing groundwater and is unlikely to represent a terrestrial GDE.

Modelling of groundwater drawdown as a result of the proposed modification Jacobs (2019) identifies potential groundwater drawdown extending beyond the subject land as shown in **Figure 3.3**. Investigations of the vegetation across the area of potential drawdown, including a review of regional vegetation mapping (DEC 2006) and ground-truthing of this mapping, identified that the area of potential groundwater drawdown supports the same PCTs as present within the subject land, with the exception of riparian scrub vegetation along the banks of the Coxs River. As outlined above, the PCTs within the subject land are unlikely to represent GDEs (as their species composition does not appear to be determined by groundwater) and, as such, the occurrences of these PCTs beyond the subject land are also unlikely to represent GDEs based upon the depth of groundwater and similar floristic composition to vegetation within the subject land.

Riparian vegetation, equivalent to the 'Tablelands Riparian Scrub Complex' (DEC 2006), occurred along the entire extent of the Coxs River to the east of the subject land and constitutes an aquatic GDE as the composition of this vegetation community would be determined by the flow of water within the Coxs River. The baseflow contributions to the Coxs River are expected to decrease by 11% (with uncertainty scenarios ranging from 8 to 15%; Jacobs 2019) as a result of the proposed modification. However, as the vast majority of flow along the Coxs River is sourced from overland flow, the estimated baseflow reduction of 30 m^3/day represents approximately 0.05% of the mean daily discharge recorded along the Coxs River near the subject land (Jacobs 2019). This minor reduction in base flow rates due to the project are not expected to reduce flow volumes along the Coxs River to the extent that a decline in the condition or extent of the riparian scrub GDE would occur.

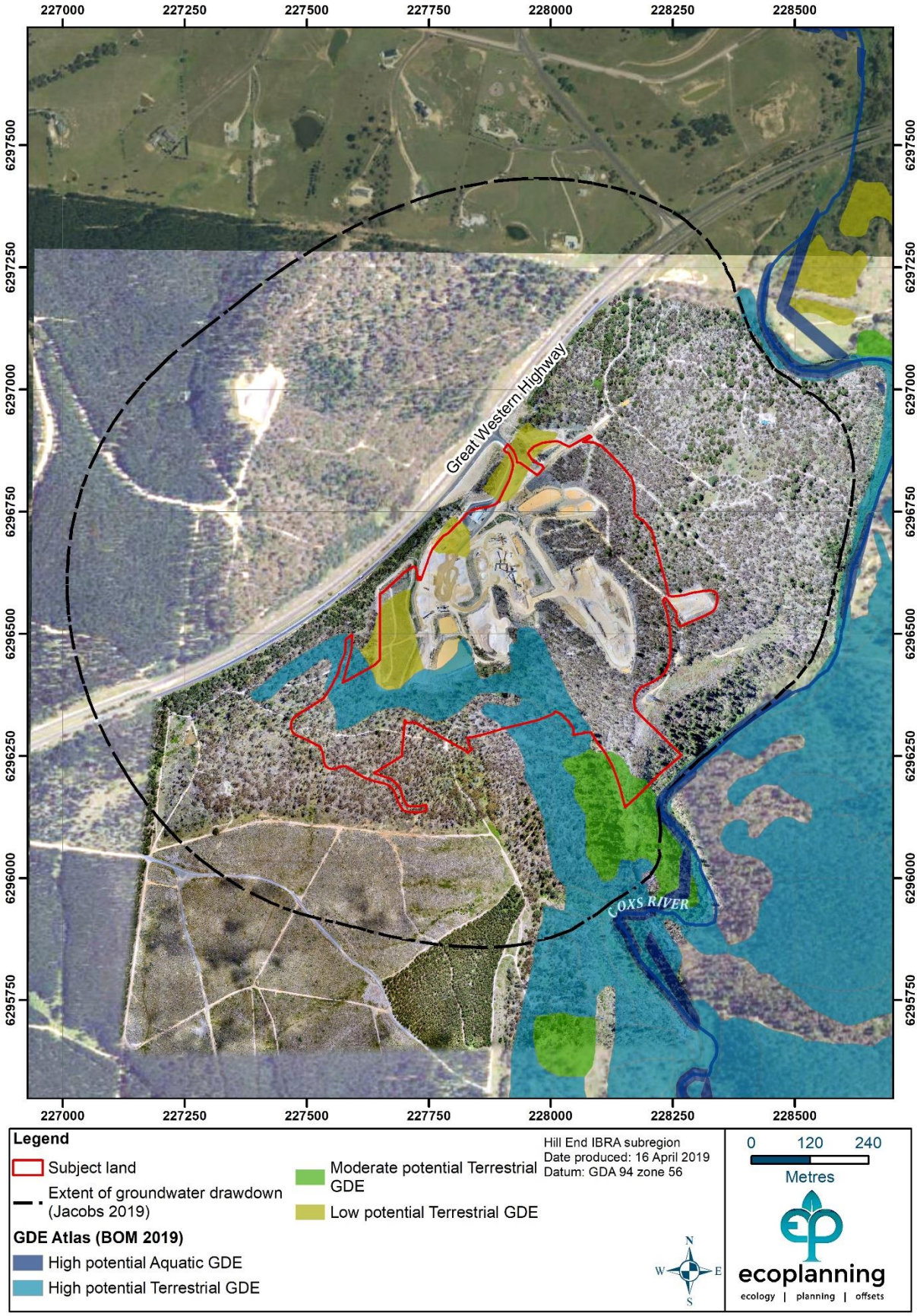


Figure 3.3: GDE mapping (BOM 2019) and extent of groundwater drawdown.

4 Assessing habitat suitability for threatened species

Section 6 of the BAM details the process for determining the habitat suitability for threatened species.

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey are identified as 'species' credit species. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

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.

The following sections outline the process for determining the habitat suitability for threatened species within the subject lands, and the results of targeted surveys for candidate threatened species.

4.1 Identify threatened species for assessment

Threatened species that require assessment are initially identified based upon the following criteria.

- The distribution of the species includes the IBRA subregion in which the subject land occurs.
- The subject land is within any geographic constraints of the distribution of the species within the IBRA subregion.
- The species is associated with any of the PCTs identified within the subject land.
- The native vegetation cover within an assessment area including a 1,500 m buffer around the subject land is equal to or greater than the minimum required for the species.
- The patch size that each vegetation zone is part of is equal to or greater than the minimum required for that species.
- The species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

The process for identifying threatened species which meet the above criteria is completed through the BAM Calculator. The PCTs identified within the subject land, patch sizes and native vegetation cover, as outlined in **Section 2** and **Section 3** of this report, were entered into the BAM Calculator and a preliminary list of threatened species were identified.

In accordance with the BAM operational manual (OEH 2018a), the list of predicted threatened species generated by the BAM Calculator must be reviewed to ensure it includes all species likely to occur within, or use habitat on the subject land, including any additional species identified from review of ecological reports. The following threatened species have previously been recorded within, or in proximity to, the subject land:

- Purple Copper Butterfly (*Paralucia spinifera*) – recorded within the footprint of the existing Quarry operations and under the high voltage powerline easement to the east of the subject land in 2002 (Wildthing Environmental Consultants 2002);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) was recorded within the existing quarry area using ultrasonic detectors by Wildthing Environmental Consultants (1999);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*) – recorded foraging north-east of the subject land, no evidence of breeding within the quarry site (Lesryk 2017b);
- Varied Sittella (*Daphoenositta chrysoptera*) – recorded to the north-east of the subject land, adjacent to the Eastern Stockpile Extension Area (ESEA) in October 2016 (Lesryk 2017b); and
- Scarlet Robin (*Petroica boodang*) – recorded to the north-east of the subject land, adjacent to the ESEA in October 2016 (Lesryk 2017b).

These threatened species were all predicted to occur within the subject land by the BAM calculator and no additional threatened species were added to the list of predicted threatened species based upon a review of previous ecological reports.

4.1.1 Ecosystem credit species

The ecosystem credit species predicted on site are provided in **Appendix B**. All ecosystem credit species predicted to occur in association with the PCTs within the subject land were maintained in the assessment.

4.1.2 Species credit species

As outlined above, species credit species are predicted in the BAM Calculator following assessment of geographic and habitat features in the credit calculator, such as site location (IBRA subregion), PCTs and condition, patch size and the area of surrounding vegetation within the 1,500 m buffer of the subject land. A total of five flora and 18 fauna species credit species were identified as potentially occurring within the subject land.

4.2 Assessment of habitat constraints, vagrant species and habitat suitability/degradation

Some candidate species credit species require further assessment of habitat constraints and/or geographic limitations before being confirmed as candidate species for assessment. Where a species has a specific habitat constraint, which is not present within the subject land, or if the species is a vagrant within the IBRA subregion, the species is considered unlikely to occur and no further assessment is required. None of the predicted candidate species were removed from the list of candidate species based upon habitat constraints identified within the BAM Calculator.

As outlined within the BAM operational manual (OEH 2018a) and in accordance with Sections 6.4.1.9 – 6.4.1.16 of the BAM, additional onsite assessment may be undertaken to determine the presence of habitat constraints or microhabitats for the threatened species predicted to occur on the subject land. Based upon onsite assessments, four predicted candidate species have been considered unlikely to utilise the subject land; Regent Honeyeater (*Anthochaera phrygia*), Broad-headed Snake (*Hoplocephalus bungaroides*), Swift Parrot (*Lathamus discolor*) and the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*). Justification for each of these species is provided in **Table 4.1**.

A predicted candidate species credit species that is considered unlikely to occur on the subject land (or specific vegetation zones), in accordance with section 6.4.1.17 of the BAM, does not require further assessment on the subject land (or specific vegetation zones). Accordingly, no further assessment of the Regent Honeyeater, Broad-headed Snake, Swift Parrot or Eastern Bentwing-bat is required.

Table 4.1: Candidate species credit species for which habitat is not present within the subject land

Species	Justification
Regent Honeyeater (*Anthochaera phrygia*) – breeding habitat.	There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution of this species is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. Under the BAM, breeding habitat and important habitat areas for this species have been mapped on the NSW Government Biodiversity Values Map and Offset Tool. The subject land is not mapped as breeding or important habitat for this species.
Broad-headed Snake (*Hoplocephalus bungaroides*)	As outlined within BioNet (OEH 2019), this species shelters in rock crevices and under flat sandstone rocks on exposed cliff edges and is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups. Individuals move from the sandstone rocks to shelter in crevices or hollows in large trees within 500 m of escarpments in summer. The subject land does not support sandstone cliffs or rock crevices, nor is it located within 500 m of any of these features.
Swift Parrot (*Lathamus*	This species breeds in Tasmania during spring and summer, migrating

Species	Justification
discolor) – breeding habitat.	in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. No breeding habitat for this species exists within the subject land. Additional areas of important foraging habitat have been identified for this species as mapped on the Biodiversity Values Map. No important habitat for this species has been mapped within the subject land.
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) – breeding habitat.	This species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. There are only 12 known maternity roosts nationwide (Hoye and Hall 2008) with only three caves located in proximity to the subject land including a cave in Wee Jasper Nature Reserve, located approximately 25 km south west of Yass (Church Cave), a cave in Bungonia State Recreation Area, located approximately 35km east of Goulburn (Drum Cave), and a cave in Willi Willi Caves Nature Reserve, located approximately 35 km west of Kempsey (Willi Willi Cave) (pers. comm. Greg Richards, Greg Richards and Associates, July 2010). Maternity caves have very specific temperature and humidity regimes. No caves representing potential breeding habitat are present within the subject land or within areas surrounding the subject land.

4.3 Determine the presence or absence of a candidate threatened species

Those candidate species credit species for which the habitat suitability of the subject land cannot be ruled out based upon habitat or geographic constraints or habitat degradation, require targeted surveys to determine their presence or absence from the subject land. Targeted surveys for species credit species must be undertaken in accordance within section 6.5 of the BAM, including undertaking surveys during the nominated survey period specified for each candidate species and in accordance with OEH threatened species survey guidelines. The following sections outline the surveys undertaken, and survey requirements, for the candidate species identified for the subject land.

4.3.1 Targeted surveys - flora

A total of five threatened flora species were identified from the BAM Calculator as candidate species for the surveys (**Table 4.2**). Targeted surveys for threatened flora were undertaken in accordance with OEH's *NSW Guide to Surveying Threatened Plants* (OEH 2016) and involved initial searches to determine potential habitat of the candidate species within the subject land and parallel traverses within areas of potential habitat. Total flora survey effort is shown on **Figure 4.1** and was approximately 64 survey hours including surveys undertaken on the following days:

- 19 and 20 July 2018

- 17 August 2018
- 27 September 2018
- 15, 16 and 23 October 2018
- 1 November 2018
- 15 November 2018
- 22, 23 November 2018
- 22 March 2019

No threatened flora species were recorded within the subject land. A full list of flora species recorded within the subject land is presented in **Appendix C**.

Table 4.2: Nominated survey months for candidate threatened flora species

Species	Nominated Survey Months (OEH 2019)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eucalyptus cannonii (Capertee Stringybark)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eucalyptus pulverulenta (Silver-leafed Gum)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grevillea divaricata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Persoonia marginata (Clandulla Geebung)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Veronica blakelyi	Y	Y						Y	Y	Y	Y	Y

Note: **BLUE** columns indicate the months that surveys took place

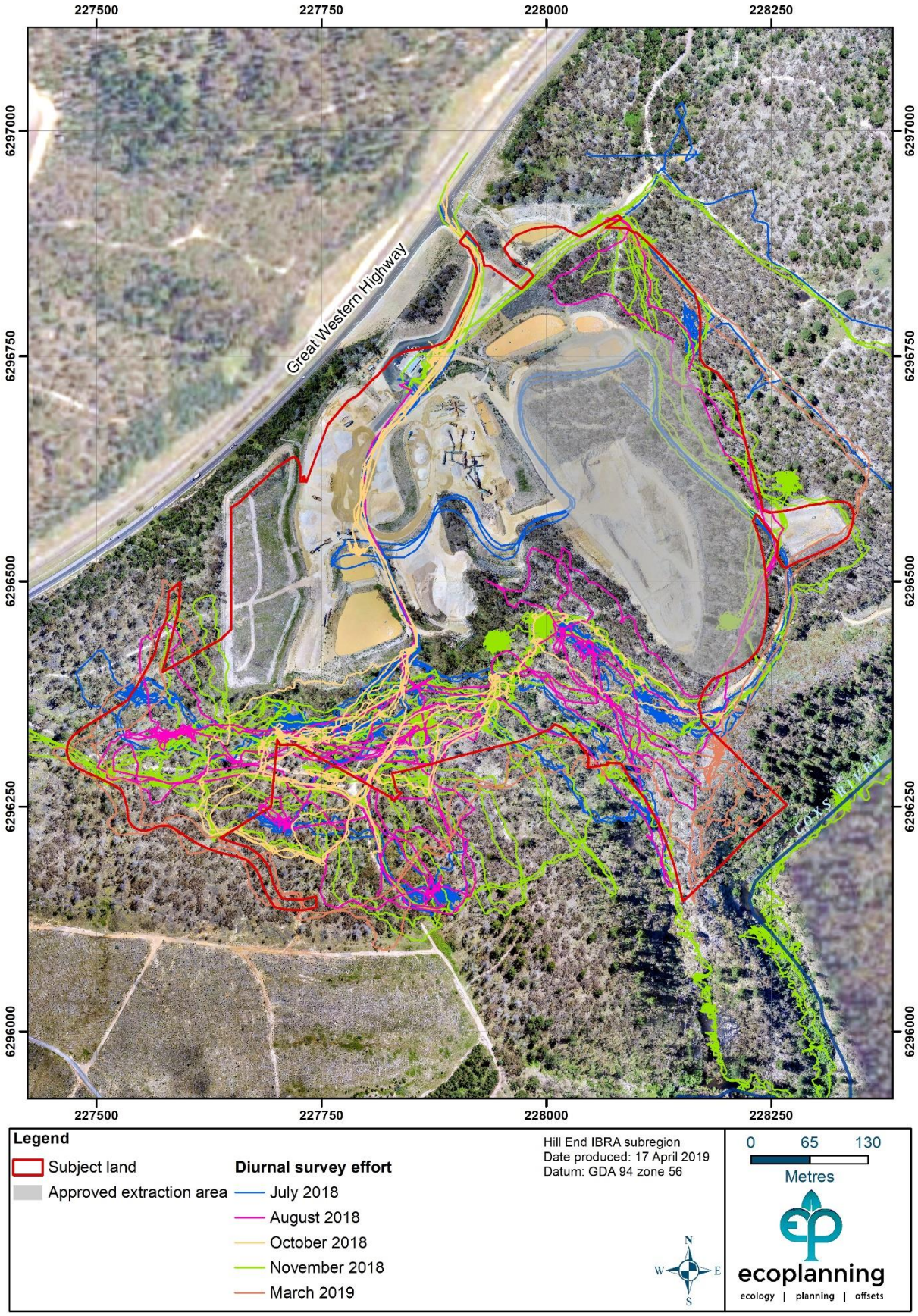


Figure 4.1: Survey effort for candidate threatened flora species

4.3.2 Targeted surveys – fauna

The fauna surveys undertaken were designed to create an inventory of the fauna species utilising the subject land with a focus on candidate threatened species. For the purposes of this fauna survey, the subject land was initially stratified into two stratification units based upon vegetation formations of the identified PCTs (Grassy Woodland and Dry Sclerophyll Forests – shrubby subformation). However, following field investigations the fauna habitat values were considered similar across both PCTs with both PCTs being characterised by a grassy woodland with a limited shrub layer. Additionally, given the distribution of the two PCTs within the subject land it was considered unlikely that any fauna species would be restricted to only one of the PCTs present. Consequently, the subject land was sampled as a single stratification unit and the survey designed to sample the full variation of vegetation and habitat types within the subject land.

Fauna surveys comprised the following survey methodologies:

- Nocturnal watercourse searches for amphibians
- Nocturnal call playback
- Spotlighting
- Diurnal bird surveys (incidental and 20 min / 2 ha surveys)
- Hollow-bearing trees and nest searches
- Remote camera trapping
- Ultrasonic sound detection (Anabats)
- Listening surveys during large owl breeding season
- Active searches including searches for indirect evidence of fauna species (white wash, pellets, scats, tracks, scratches)

The survey effort for each of these methods, including dates, are presented in **Table 4.3** with survey locations shown in **Figure 4.2**. All surveys dates are in accordance with the nominated survey periods in accordance with the BAM and as outlined within **Table 4.4**. Additional details regarding survey effort and survey results are presented for each fauna group in the following sections of this report. Weather conditions, as recorded at the Marrangaroo (Defence) meteorological station approximately 5 km east of the subject land, over the surveys periods are summarised **Table 4.5** with rainfall across the surveys period graphed in **Figure 4.3**.

A list of fauna species observed is included in **Appendix D**.

Table 4.3: Fauna survey methods, timing and effort

Reference	Date	Survey method	Survey effort
Diurnal birds			
Wildthing Environment Consultants (1999)	6 – 9 December 1999	Opportunistic observations	Four days
Lesryk 2017a	21 Feb 2017	Opportunistic	1-day x 2

Reference	Date	Survey method	Survey effort
		observations	observers
Lesryk 2017b	3, 4 October 2017	Opportunistic observations	2 days x 2 observers
This assessment (Ecoplanning 2019)	19, 20 July 2018	20-minute bird census x 2 observers	2 surveys
	19, 20 July; 17 August; 15, 16 October; 1 November; 15 November; 22, 23 November 2018.	Opportunistic observations x 2 observers	Approximately 96 hours
Nocturnal birds			
Wildthing Environmental Consultants (1999)	6 – 9 December 1999	Call playback – Powerful Owl, Barking Owl, Masked Owl, Sooty Owl. Calls broadcast 4 times with listening periods between each calls	3 nights
This assessment (Ecoplanning 2019)	19 July, 15 October, 22 November 2018	Targeted large forest owl survey – listening at dusk	3 hours x 2 observers x 3 nights
	19 July, 15 October, 22 November 2018	Spotlighting	3 hours x 2 observers x 3 nights
	19 July, 15 October, 22 November 2018	Call playback – Powerful Owl, Barking Owl, Masked Owl. 5 minutes listen, 5 minutes call, 5 minutes listen	15 minutes x 2 observes x 3 nights
	19, 20 July; 17 August; 15, 16 October; 1 November; 15 November; 22, 23 November 2018.	Diurnal habitat and signs search - opportunistic	7 days x 2 observers
Mammals (arboreal and terrestrial)			
Wildthing Environmental Consultants (1999)	6 – 9 December 1999	Elliott A terrestrial trapping	60 trap nights (3 nights x 20 traps)
		Cage traps	6 trap nights (3 nights x 2 traps)
		Elliott B arboreal trapping	30 trap nights (3 nights x 10 traps)

Reference	Date	Survey method	Survey effort
		Spotlighting	4 hours over two nights
This assessment (Ecoplanning 2019)	15 October – 22 November 2018	Remote camera facing an Eastern Pygmy-possum artificial nest	380 trap nights (10 traps x 38 nights)
	15 October – 22 November 2018	Eastern Pygmy-possum artificial nest without remote camera	228 trap nights (6 traps x 38 nights)
	15 October – 22 November 2018	Remote camera facing bait station	684 trap nights (18 traps x 38 nights)
	19 July, 15 October, 22 November 2018	Spotlighting	12 hours (2 hours x 2 observers x 3 nights)
Bats			
Wildthing Environmental Consultants (1999)	6 – 9 December 1999	Acoustic detectors	90 minutes (total)
This assessment (Ecoplanning 2019)	19 July, 15 October, 22 November 2018	Spotlighting	12 hours (2 hours x 2 observers x 3 nights)
	17 – 27 July 2018	Acoustic detectors (1 Anabat)	10 recording nights
	15 - 16 October 2018	Acoustic detectors (2 Anabat)	2 recording nights
	15 – 23 November 2018	Acoustic detectors (2 Anabat)	16 recording nights
Amphibians			
Wildthing Environmental Consultants (1999)	6 – 9 December 1999	Spotlighting / nocturnal watercourse searches	*Survey effort not recorded*
This assessment (Ecoplanning 2019)	19 July 2018	Spotlighting / nocturnal watercourse searches	1-hour x 2 observers
	15 October 2018	Spotlighting / nocturnal watercourse searches	1-hour x 2 observers
	22 November 2018	Spotlighting / nocturnal watercourse searches	1-hour x 2 observers
Invertebrates			
Wildthing	12-13, 24-25 September	Active searches	4 days (total time

Reference	Date	Survey method	Survey effort
Environmental Consultants (2002)	2002		unknown)
Lesryk 2016	26-27 September 2016	Active searches	8 hours
Lesryk 2017b	3,4 October 2017	Active searches	2 days x 2 observers
This assessment (Ecoplanning 2019)	27 September 2018	Active searches	6 hours x 2 observers
	23 October 2018	Active searches	6 hours x 1 observers
	1 November 2018	Active searches	6 hours x 2 observers
	22 November 2018	Spotlighting	4 hours (2 observers)

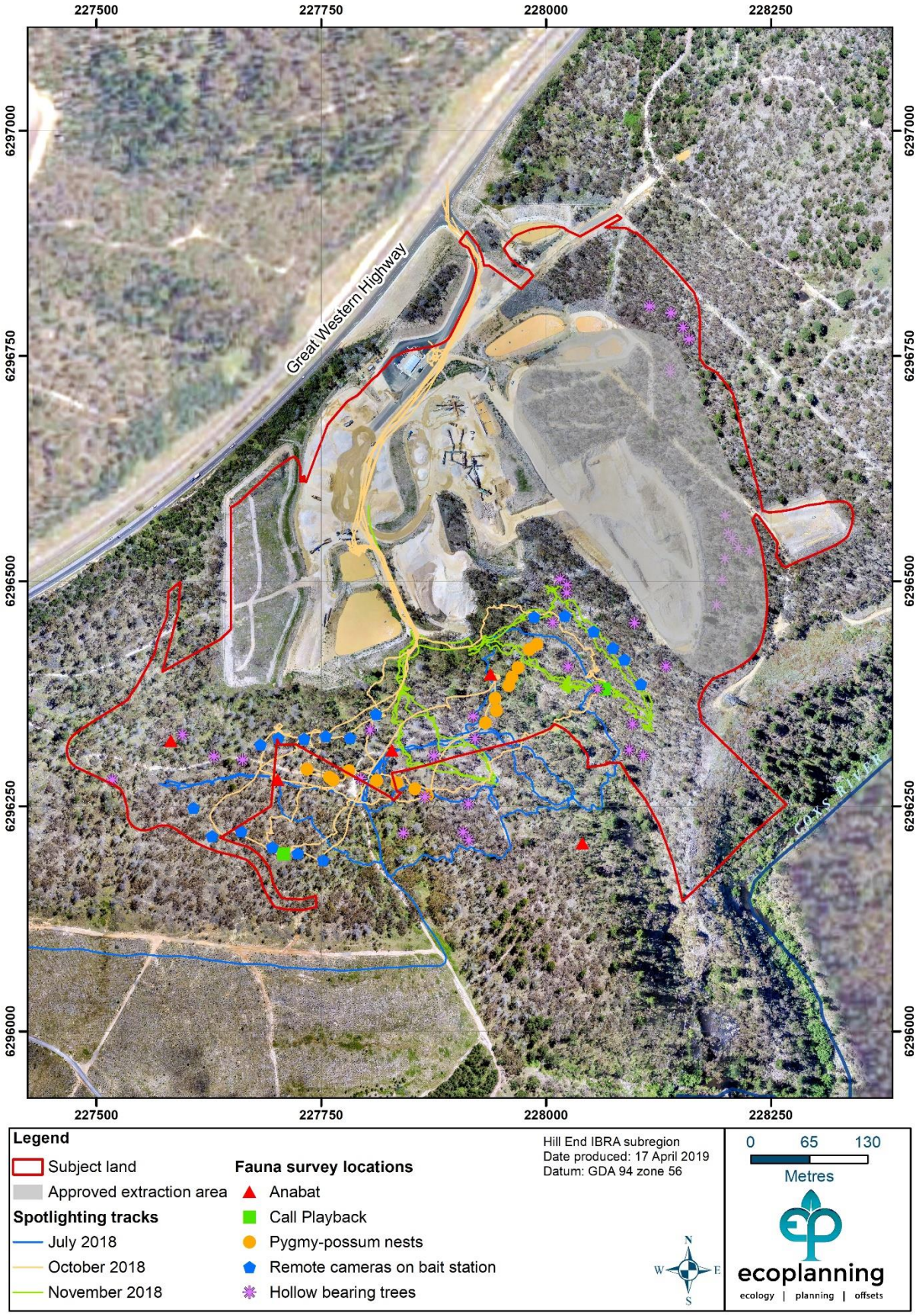


Figure 4.2: Fauna survey locations and survey effort

Table 4.4: Nominated survey months for candidate threatened fauna species

Species	Nominated Survey Months (OEH 2019)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gang-gang Cockatoo (Breeding) (*Callocephalon fimbriatum*)	Y									Y	Y	Y
Glossy Black-Cockatoo (Breeding) (*Calyptorhynchus lathami*)			Y	Y	Y	Y	Y	Y				
Eastern Pygmy Possum (*Cercartetus nanus*)	Y	Y	Y							Y	Y	Y
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Y	Y	Y						Y	Y	Y	Y
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)							Y	Y	Y	Y	Y	Y
Little Eagle (*Hieraaetus morphnoides*)								Y	Y	Y		
Booroolong Frog (*Litoria booroolongensis*)											Y	Y
Square-tailed Kite (*Lophoictinia isura*)	Y								Y	Y	Y	Y
Barking Owl (*Ninox connivens*)					Y	Y	Y	Y	Y	Y	Y	Y
Powerful Owl (*Ninox strenua*)					Y	Y	Y	Y				
Purple Copper Butterfly (*Paralucia spinifera*)									Y	Y		Y
Squirrel Glider (*Petaurus norfolcensis*)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Brush-tailed Phascogale (*Phascogale tapoatafa*)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Koala (Breeding) (*Phascolarctos cinereus*)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Masked Owl (*Tyto novaehollandiae*)					Y	Y	Y	Y				

Table 4.5: Daily weather observation across survey periods at Marrangaroo meteorological station

Date	Temperature (°C)		Rainfall (mm)	Wind speed (3 pm)	
	Min	Max		Direction	Speed (km/h)
19/07/2018	-3.8	14.6	0	NW	15
20/07/2018	1.2	13.6	0	W	73
17/08/2018	-7.1	10.5	0	WSW	15
27/09/2018	0.2	18.6	0	WNW	7
15/10/2018	10.1	17.6	0.4	NE	9
16/10/2018	11.9	19.4	2.0	NE	7
23/10/2018	6.7	25.4	0	WNW	13
01/11/2018	9.0	28.5	0	WNW	11
15/11/2018	6.0	25.2	0.2	NE	2
22/11/2018	11.3	16.2	16.2	W	22
23/11/2018	5.2	12.1	1.4	W	22
22/03/2019	11.7	24.2	0	SW	56

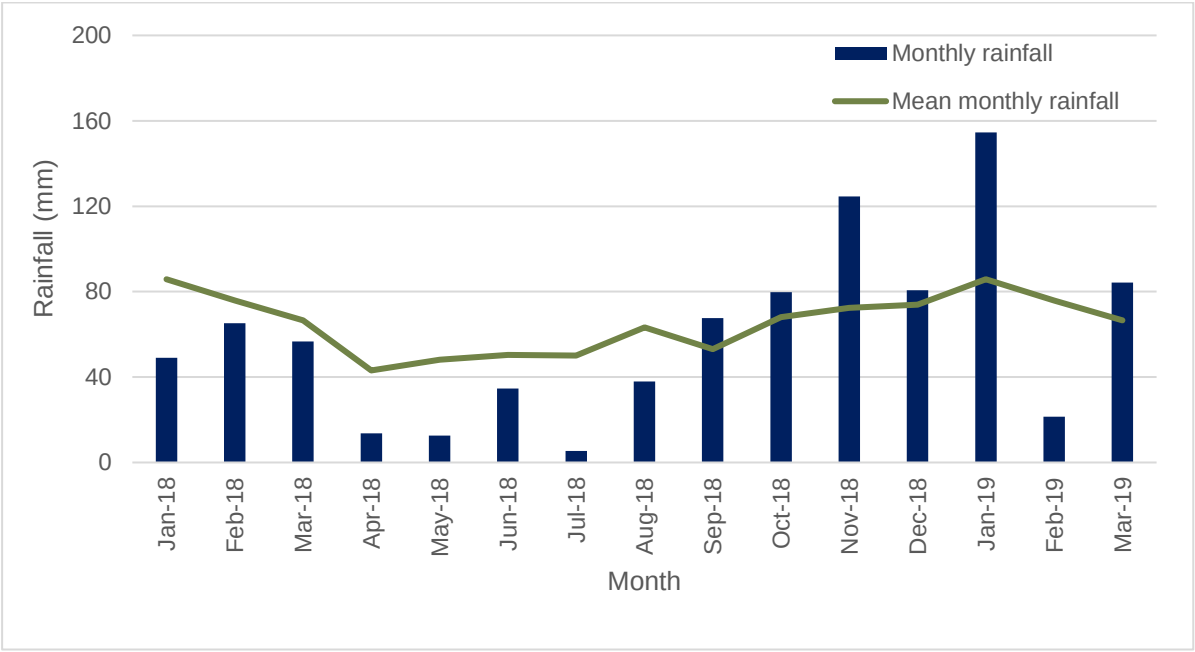


Figure 4.3: Monthly rainfall (mm) and mean monthly rainfall across the survey period as recorded at Lidsdale (Maddox Lane; 63132) meteorological station.

Diurnal birds

A total of five diurnal bird species were identified as candidate threatened species for the subject land, all of which are dual credit species with only impacts to breeding habitat representing a species credit.

Two medium sized cockatoos, the Gang-gang Cockatoo (*Callocephalon fimbriatum*) and the Glossy Black-Cockatoo (*Calyptorhynchus lathami*) were identified as candidate threatened species. The Gang-gang Cockatoo has previously been recorded foraging north-east of the subject land, although it was noted that there was no evidence of breeding within the quarry site (Lesryk 2017b).

Glossy Black-Cockatoos breed within hollows of large, old eucalypt trees, alive or dead with nests located between 3 m to 30 m above the ground (OEH 2019). In NSW, breeding takes place from March to August (OEH 2019). Gang-gang Cockatoos build nests within hollows that are 10 cm in diameter or larger and at least 9 m above the ground (OEH 2019). Breeding takes place over the spring to summer period (October to January; Birdlife 2018).

Targeted surveys for breeding Glossy Black-Cockatoos and Gang-gang Cockatoos were undertaken in the subject land which involved 20-minute bird census (two surveys undertaken) and searches for and observations of suitable hollow-bearing trees (including signs of hollow-use or nearby activity such as chewed cones). These observations were made during traverses of the subject land to record hollow-bearing trees and in conjunction with other targeted searches (July, August, September, October and November 2018). Opportunistic observations across all surveys period would also allow for identification of these species from their distinctive calls.

Three raptors were identified as candidate threatened species for the subject land; the White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*) and Square-tailed Kite (*Lophoictinia isura*). The raptor candidate species are listed as ecosystem credit species (for foraging habitat) and species credit species (for breeding habitat). Breeding habitat for all of these raptor species is a conspicuous, large nest made of sticks.

Targeted surveys for breeding habitat for these species involved searches for large stick-nests within canopy trees throughout the subject land. These searches were conducted in conjunction with vegetation, threatened flora and other fauna surveys in July, October and November 2018. The surveys undertaken coincided with the allowable survey periods for all the raptor candidate threatened fauna species (**Table 4.4**).

None of the candidate threatened bird species, or sticks nests were observed within the subject land. A list of all bird species detected within the subject land across all surveys is provided in **Appendix D**.

Nocturnal birds

Three large forest owl species were identified as candidate threatened fauna species for the Project; Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*) and Masked Owl (*Tyto novaehollandiae*). All three of these species are listed as ecosystem credit species (for foraging habitat) and species credit species (for breeding habitat). Breeding habitat for all of these species includes large hollow-bearing trees within woodland to rainforest vegetation

types. These three species have previously been subject to targeted survey as part of surveys for the existing Quarry operations (Wildthing Environment Consultants 1999). Call-playback for these species did not record any species within the subject land.

The DEC (2004) survey guidelines for large forest owls are based upon presence/absence surveys for these species and do not distinguish between surveys for breeding habitat compared to foraging habitat. Surveys for breeding habitat followed the guidelines of Birdlife (2015) and LMCC (2014) which involve listening for calls of owl species from high vantage point within the subject land from sunset until half an hour after dark. Calls heard near dusk will signify breeding activity nearby as the birds have not yet dispersed from their breeding habitat. One targeted dusk survey was conducted during the breeding period for large forest owls on the 19 July 2018. In addition to the survey targeting breeding habitat, surveys outside the breeding period (19 July, 15 October and 22 November 2018) included spotlighting and call playback for large forest owls. Call playback was performed before each spotlighting survey. The survey involved broadcasting the call of each large forest owl with a five-minute period of listening either side of the broadcast. Additionally, diurnal surveys (19 and 20 July 2018, 17 August 2018, 27 September 2018, 15 and 16 October 2018, 1 November 2018, 15 November 2018 and 22, 23 November 2018) were undertaken which included searches for roosting birds, whitewash, pellets or prey carcasses all of which are commonly observed around nest trees for these species.

The surveys undertaken for large forest owl included dusk surveys during the breeding season and nominated survey months within the BAM Calculator (**Table 4.4**). None of the candidate large forest owl species were observed within the subject land.

Invertebrates

One invertebrate species was identified as a candidate threatened fauna species for the subject land, the Purple Copper Butterfly (PCB; *Paralucia spinifera*). The PCB is endemic to the Central Tablelands of New South Wales, and more specifically the area between Mudgee, Bathurst, Lithgow and Hartley where it only occurs at elevations greater than 850 m (NPWS 2001; Madjawesch and Nally 2008; Healy and Wassens 2008). Males fly rapidly at a height of around 1 m above the ground and are known to spread their wings open as they perch on grasses, twigs and low shrubs under full sun (NPWS 2001; Madjawesch and Nally 2008). Adults of the species are mostly active between September to October with larvae present in November and December but can be small and difficult to detect in earlier parts of November. The larvae of the PCB are host-specific, feeding only *Bursaria spinosa* subsp. *lasiophylla* (NPWS 2001; Madjawesch and Nally 2008; Healy and Wassens 2008). Potential PCB habitat sites are described as sites which support the host plant *Bursaria spinosa* subsp. *lasiophylla* and that are exposed to direct sunlight for a large portion of the day, as a result of aspect orientation and / or canopy openness (NPWS 2001). Most known PCB sites have a westerly or northerly aspect or are generally high enough and flat enough to ensure that they also receive full sun (NPWS 2001).

The PCB has previously been recorded from the Wallerawang Quarry site and the subject land in 2002 (Wildthing Environmental Consultants 2002). Locations in which the species was recorded by Wildthing Environmental Consultants were in proximity to the Great Western Highway and the high voltage powerline easement which is located to the east of the subject land. With the exceptions of records from areas in proximity to the high voltage

powerline easement, all other records were made from areas which have subsequently been disturbed as part of the approved Wallerawang Quarry. Surveys for the PCB were undertaken in 2016 and 2017 by Lesryk Environmental (Lesryk 2017c) as part of monitoring surveys undertaken in accordance with the Biodiversity Management Plan for the existing Quarry operations. Monitoring surveys undertaken by Lesryk (2017c) surveyed all areas of habitat identified by Wildthing Environmental Consultants (2002) which have not been disturbed by Quarry works. No PCB were identified within the subject land or adjacent areas as part of monitoring surveys undertaken by Lesryk in 2016 or 2017.

Surveys for the PCB were undertaken as part of this BDAR including daytime active searches and nocturnal spotlighting. Active searches for the PCB were conducted on warm sunny days with light winds which are optimal conditions for the detection of this species. Surveys were undertaken on the 27 September, 23 October and 1 November 2018 between the hours of 10 am and 4 pm. Surveys locations are shown in **Figure 4.4**. Surveys were conducted during the allowable survey period for the PCB under the BAM (**Table 4.4**), although included surveys on 1 November, which is one day outside the nominated survey period (with surveys to be undertaken between September and October). Surveys coincided with periods when the species was active at reference sites as confirmed on the 27 September and 23 October (**Plate 4.1**). No PCB were detected during the daytime searches. Spotlighting survey for larvae of the species was also undertaken on the 22 November 2018 and involved traversing areas of potential habitat (stands of *Bursaria spinosa* subsp. *lasiophylla*) searching for larvae. No PCB were detected during spotlighting surveys. It is noted that larvae are generally small and more difficult to detect in November compared to December. However, as this species has not detected during daytime searches over three years of survey (Lesryk 2016; Lesryk (2017c), there is high confidence that the species is no longer present within the subject land and additional nocturnal surveys in December were considered unnecessary.

Plate 4.1: Purple Copper Butterfly recorded at reference sites on 27 September and 23 October 2018

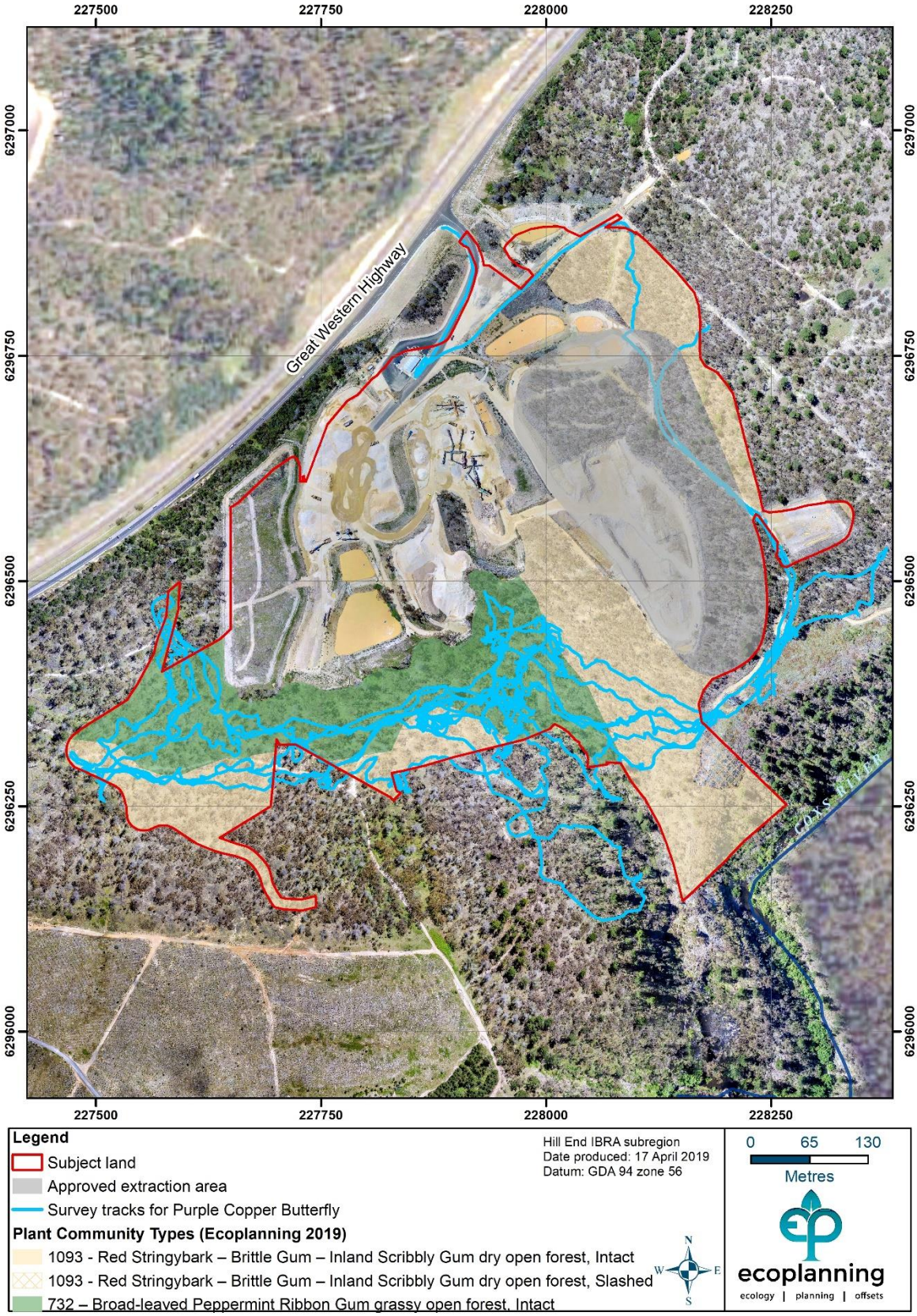


Figure 4.4: Survey tracks for Purple Copper Butterfly

Mammals – non flying

Four non-flying mammal species were identified as candidate species for the subject land, Eastern Pygmy-possum (*Cercartetus nanus*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Squirrel Glider (*Petaurus norfolcensis*) and Koala (*Phascolarctos cinereus*). These species have previously been subject to targeted survey including arboreal and terrestrial Elliott trapping and spotlighting as part of surveys for the existing Quarry operations (Wildthing Environment Consultants 1999). None of these species have previously been recorded within the subject land.

Surveys undertaken as part of this assessment targeted these species using a combination of artificial nest detection, remote camera detection and spotlighting.

Eastern Pygmy-possums were surveyed using artificial nests and remote cameras. A total of sixteen artificial nests were tied to a low shrub or tree near flowering shrubs. A remote camera was positioned to detect any activity in or near ten of the artificial nests. The nests and remote cameras were left in the subject land for 38 days/nights and those artificial nests without cameras were checked during the day up to four times for signs of occupation (i.e. such as nest construction) by fauna species (total survey effort included 608 artificial nest nights including 380 nights with cameras facing artificial nests).

Squirrel Glider and Brush-tailed Phascogale were surveyed using Reconyx HC500 remote camera detection. Bait tubes were positioned on tree trunks and branches approximately 2-3 m above the ground with a remote camera positioned to detect any activity in or near the bait tubes. The bait used was a universal bait with every second bait station including beef stock, specifically targeting the carnivorous Brush-tailed Phascogale.

Surveys for Koala, and other arboreal mammals, were undertaken by spotlighting surveys through the subject land. Spotlighting was conducted for approximately two hours over three nights (19 July, 15 October, 22 November 2018) by two observers with a total survey effort of approximately 12 hours. The locations of nocturnal surveys are shown in **Figure 4.2**.

No Eastern Pygmy-possum, Squirrel Glider, Brush-tailed Phascogale or Koala were observed within the subject land. A list of mammals recorded within the subject land is included in **Appendix D**.

Mammals - Bats.

One bat species, the Large-eared Pied Bat (*Chalinolobus dwyeri*), was identified as a candidate species for the subject land. Targeted surveys for the Large-eared Pied Bat and other microchiropteran bat species was undertaken by acoustic detectors over 19 nights (nights of the 17 – 26 July, 15 October and 15 – 22 November) using multiple devices equating to a total of 28 survey nights. However, only 16 of the survey nights were within the recommended survey period for the Large-eared Pied Bat (mid-November to end of January; OEH 2019). Nonetheless, the survey effort undertaken is equal to the recommended survey effort in the recently published OEH survey guidelines (OEH 2018b).

A total of 12 Microchiropteran bat species were detected from calls within the subject land (**Appendix D**) including the two species listed as Vulnerable under the BC Act, the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and the Eastern Bentwing-bat (*Miniopterus*

schreibersii oceanensis). No Large-eared Pied Bats were recorded. The Eastern False Pipistrelle is an ecosystem credit species and impacts of the proposed quarry extension on this species are assessed by the BAM in conjunction with the assessment of impacts to PCTs. The Eastern Bentwing-bat is a dual ecosystem and species credit species, with foraging habitat an ecosystem credit, and breeding habitat a species credit. Breeding habitat for the cave breeding Eastern Bentwing-bat includes caves with specific temperature and humidity regimes. In accordance with the recently released bat survey guidelines (OEH 2018b), breeding habitat for which the Eastern Bentwing-bat is a species credit includes breeding caves and a 100 m buffer around the breeding cave entrance. There are no caves or artificial breeding structures for this species within the subject land or within 100 m of the subject land and impacts from the proposed quarry extension are limited to foraging habitat only. As such, assessment of impacts to the foraging habitat of the Eastern Bentwing-bat are assessed in conjunction with assessment of impacts to PCTs.

Acoustic detectors also recorded two calls of either a long-eared bat (*Nyctophilus sp.*) or Southern Myotis (*Myotis macropus*). Based upon the quality of the two of the calls, the calls could not be confidently attributed to one species. As calls of a Long-eared Bat were regularly recorded during the surveys, with numerous records of Long-eared Bats in the region (BioNet; OEH 2019), and the Southern Myotis is not associated with the PCTs within the subject land (BioNet; OEH 2019), it is considered unlikely that these calls were a Southern Myotis. No further assessment of the Southern Myotis has been undertaken.

5 Avoiding and minimising impacts on biodiversity

5.1 Avoiding and minimising impacts on native vegetation and habitat during project planning

In accordance with section 8.1.1.6 of the BAM, actions taken to avoid and minimise impacts through locating the proposal must be documented and justified in the BDAR.

Actions undertaken to avoid and minimise impacts on native vegetation include an overall reduction in the size of the project footprint as part of the project planning process at the cost of significant quartzite resource. Initial investigations undertaken as part of this BDAR involved surveys across a larger area, with the final project footprint incorporating only a portion of this area. Additionally, the project footprint including the use of gullies for placement of overburden, along with the lifting of the main Stockpile Area, has been undertaken to reduce the overall size of the overburden stockpile areas. The perimeter of the extraction area has also been located to retain buffers to the Coxs River (40m and tributary (10m) to reduce impacts on riparian vegetation / ecosystems.

The staged approach to the project and disturbance footprint means that areas will only be disturbed if they must be. The western stockpile extension for example, may never be required if markets for clean fill or aggregates generated by the overburden are identified.

5.2 Avoiding and minimising prescribed biodiversity impacts during project planning

Prescribed biodiversity impacts are defined under clause 6.1 of the BC Reg and include impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. Prescribed biodiversity impacts are outlined within **Table 5.1** including their relevance to the subject land and the proposal. The proposed works are unlikely to cause any prescribed biodiversity impacts.

Table 5.1: Prescribed biodiversity impacts

Prescribed biodiversity impacts	Presence within the subject land
(a) the impacts of development on the following habitat of threatened species or ecological communities: (i) karst, caves, crevices, cliffs and other geological features of significance, (ii) rocks, (iii) human made structures, (iv) non-native vegetation,	No areas of karst, caves, crevices, cliffs and other geological features of significance, rocks, human made structures or non-native vegetation which may provide habitat for threatened species or ecological communities are present within the subject land.

Prescribed biodiversity impacts	Presence within the subject land
b) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,	The subject land has not been identified as providing connectivity between areas of habitat for threatened species that facilitates the movement of that threatened species across its range. Although the proposed works will remove areas of native vegetation, the connectivity with the surrounding area will remain and the project will not significantly fragment habitat to the extent that movement of species will be affected
(c) the impacts of development on movement of threatened species that maintains their lifecycle,	The subject land has not been identified as providing movement of threatened species that maintains their lifecycle.
(d) the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),	The proposed works would involve some impacts to streams within the subject land, however, as outlined in **Section 3.3.1** no threatened ecological communities have been identified as occurring in association with these drainage lines or within the subject land more broadly. As outlined in **Section 4**, no threatened species have been identified as occurring in association with the drainage lines within the subject land or within the subject land more broadly.
(e) the impacts of wind turbine strikes on protected animals,	Not applicable.
f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.	Not applicable. The proposed works are unlikely to cause any increased impact on threatened fauna species associated with vehicle strikes. The proposed works do not involve any high-speed vehicular movements.

6 Assessing and offsetting impacts

6.1 Assessment of impacts on native vegetation and habitat, TECs, and threatened species

6.1.1 Assessment of direct impacts

Direct impacts are anticipated through the clearing of approximately 14.05 ha of native vegetation. For the purposes of the BDAR, the clearing and subsequent quarrying operations across the subject land have been assessed as a complete impact, or loss, of this native vegetation and habitat. As outlined in Section 3.4 of this BDAR, and in accordance with Section 9.1.2.5 of the BAM, the future vegetation integrity score for all vegetation within the subject land has been assigned 0. It is noted that rehabilitation of the impact area is likely to be required consistent with the existing Condition 3(31) of DA 344-11-2001. Where this rehabilitation is undertaken in accordance with the yet to be released ancillary rules under section 6.5 of the BC Reg, this rehabilitation may be used to generate biodiversity credits and used to offset impacts to biodiversity. Accordingly, the starting point for rehabilitation would be a vegetation integrity score of 0.

All hollow bearing trees within the subject land (**Figure 4.2**) would be cleared as part of the proposal. It is recommended that all hollow bearing trees are salvaged and placed with the hollows facing up to provide habitat for ground-dwelling species or used to increase fallen woody debris in woodland areas within ML1633 surrounding the subject land.

6.1.2 Assessing indirect impacts

Indirect impacts associated with the proposal may include impacts arising from noise, vibration, dust, light spill, vehicle strike, edge effects and/or erosion associated with the development and operational phases of the proposal. Given the location of the subject land adjacent to existing Quarry operations, and that the project is an extension of existing operations, it is considered unlikely that the proposal would significantly increase any indirect impacts on ecological values. In addition, the proposal is considered unlikely to cause any increase in trampling of flora, rubbish dumping, firewood or bush rock collection or introduce any pests, weeds or pathogens to adjacent areas of native vegetation and habitat.

Changes to the drainage and hydrology of the subject land may have an impact on downstream habitats. However, given the nature of these drainage lines, generally dry gullies with no aquatic flora present, and the requirements for stormwater management in accordance with the Soil and Water Management Plan, this indirect impact can be avoided or mitigated.

Measures to mitigate and manage indirect impacts are discussed in Section 6.3.

6.2 Assessing prescribed impacts

As outlined in **Section 5.2**, the proposed works are unlikely to have any prescribed impacts to biodiversity.

6.3 Mitigating and managing impacts on biodiversity

As described in **Section 5.1** of this report, the overall proposal footprint has been located so as to minimise impacts to native vegetation, habitat and biodiversity values. Several measures are recommended to mitigate and manage direct and indirect impacts where possible, all of which represent a continuation of mitigation/management measures included within the Biodiversity Management Plan (BMP) for the existing Quarry operations.

In accordance with the existing BMP for the Quarry, impacts to biodiversity should be mitigated through appropriate pre-clearance protocols, the salvage and re-use of hollow-bearing trees and coarse woody debris and management of stormwater in accordance with an updated and revised Soil and Water Management Plan. The future operations of the Quarry as part of the proposed modification will be in accordance with the BMP, and other relevant management documents, including subsequent revisions and updates.

6.4 Adaptive management for uncertain impacts

Impacts associated with the proposal are largely certain and associated with the direct impacts as a result of vegetation clearing as documented within **Section 6.1**. Biodiversity monitoring associated with existing Quarry operations has not detected any large-scale disturbance to vegetation or soils which were attributable to the quarry operations. Additionally, observations of local fauna made during the monitoring indicate that the vegetated areas surrounding the Quarry continue to provide habitat for an array of native fauna species (Ecoplanning 2018). It is expected that this would also occur following the proposed extension of the Quarry. Nonetheless, ongoing biodiversity monitoring in accordance with the BMP, includes provisions for adaptive management based upon the biodiversity monitoring results. Specifically, the BMP notes that any records of additional threatened species, or observable or significant trends in the occurrence of specific species or quality / quantity of available habitat, would lead to additional monitoring or alternative management measures developed in response to the identification of additional threatened species.

The BMP also notes includes reporting requirements for any material impacts, or potential material impacts, to biodiversity which is not approved by DA 344-11-2001. This includes any additional reporting requested by OEH or the Department of Planning and Environment (DPE).

6.5 Thresholds for the assessment and offsetting of impacts of development

Section 6.7 of the BC Reg defines 'Serious And Irreversible Impacts' (SAII) as impacts likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

> (a) it will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or

(b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or

(c) it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or

(d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and, therefore, its members are not replaceable.

The Guidance to assist a decision-maker to determine a SAII (OEH 2017b) and the BioNet database identify potential SAII entities. None of the PCTs being impacted by the project are identified as a potential SAII entities in either the Guidance (OEH 2017b) or the BioNet Database.

6.5.1 Impacts which require an offset

Section 10.3.1 of the BAM outlines that the following vegetation zones require offsets:

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

All vegetation zones within the subject land have current vegetation integrity scores of greater than 20 and require offsets.

6.5.2 Impacts which do not require offsets

In accordance with section 5.1 of the BAM, impacts to those areas identified as 'Cleared land' do not require offsetting.

7 Credit calculations

A biodiversity offset requirement for residual impacts of a proposed development, must be calculated in accordance with section 11.2 and section 11.3 of the BAM. The following section outlines the credit requirements for the Project in order to achieve the 'no net loss standard' as established by the BAM.

7.1 Ecosystem credits

The ecosystem credits required to offset the residual impacts of the project are provided in **Table 7.1**. A total of 487 credits are required to offset the proposed development. The proposed Quarry extension is to be undertaken as a staged development as shown in **Figure 1.4**. Accordingly, the credit requirements have been determined for each stage, based upon the area of vegetation clearing for each stage (**Table 7.2**).

Table 7.1: Ecosystem credit requirements

Vegetation zone	Vegetation integrity loss	Area impacted (ha)	Credit requirement
PCT 732 – Intact	88.8	5.5	214
PCT 1093 – Intact	74.1	8.3	268
PCT 1093 – Slashed	45	0.3	5
Total	**-**	**14.1***	**487**

* Rounded to the nearest one decimal place consistent with the BAM Calculator. Rounding errors may apply

Table 7.2: Areas of disturbance and credit requirements for development stages

Stage	Vegetation zone	Area (ha)	Proportion of total area (%)	Ecosystem credit requirement	
				PCT 1093	PCT 732
1	PCT 1093 – Intact	1.17	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	

Stage	Vegetation zone	Area (ha)	Proportion of total area (%)	Ecosystem credit requirement	
				PCT 1093	PCT 732
	PCT 732 – Intact	1.95	35.2		75
6	PCT 1093 – Intact	1.76	21.3	57	
Total		**14.05***	**-**	**273**	**214**

* Rounding errors may apply

The following offset rules apply:

For PCT 732:

- Any PCT in the *'Southern Tableland Grassy Woodlands*' vegetation class (including PCT's 303, 312, 350, 654, 680, 703, 705, 731, 732, 1103, 1330, 1334, 1501) AND > 50% - <70% cleared group (including Tier 6 or higher).
- In the following IBRA subregions: Hill End, Bathurst, Capertee Uplands, Inland Slopes, Orange and Wollemi, or any subregion within 100 km of the subject land.
- Containing hollow-bearing trees

For PCT 1093:

- Any PCT in the '*Southern Tableland Dry Sclerophyll Forests'* vegetation class (including PCT's 299, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177) AND > 50% - <70% cleared group (including Tier 6 or higher).
- In the following IBRA subregions: Hill End, Bathurst, Capertee Uplands, Inland Slopes, Orange and Wollemi, or any subregion within 100 km of the subject land.
- Containing hollow-bearing trees

7.2 Species credits

No species credits are required to offset the residual impacts of the project.

7.3 Securing biodiversity offsets

The measures proposed to address the offset obligation outlined above will be determined as the project approvals progress. Initial investigations have commenced to identify credits available for purchase, land available to purchase and enter into a Biodiversity Stewardship Agreement (BSA) and the costs of credits through payment into the Biodiversity conservation Fund (BCF). It is likely that a combination of measures will be used to retire the required credits including entering into a BSA, payment into the BCF 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.

8 References

Benyon R.G., Theiveyanathan S. and Doody T.M. (2006). Impacts of tree plantations on groundwater in south-eastern Australia. *Australian Journal of Botany* 54, 181–192.

Birdlife (2015). Powerful Owl Survey Methodology. Available online: http://www.birdlife.org.au/documents/POW_Powerful_Owl_Survey_Methodology_2015.pdf

Birdlife (2019). Australia's Birds. Online database available at: http://birdlife.org.au/all-about-birds/australias-birds, accessed 28 March 2018.

Australian Bureau of Meteorology (BOM) (2019). Atlas of Groundwater Dependent Ecosystems. Available online: http://www.bom.gov.au/water/groundwater/gde/map.shtml, accessed 28 February 2019.

Cook P.G., Hatton T.J., Pidsley D., Herczeg A.L., Held A., O'Grady A. and Eamus D. (1998). Water balance of a tropical woodland ecosystem, northern Australia: a combination of micro-meteorological, soil physical and groundwater chemical approaches. *Journal of Hydrology* 210, 161–177.

Ecoplanning (2018) Biodiversity monitoring 2018 – Walker Quarry, Wallerawang, NSW. Unpublished report prepared for Walker Quarries.

Environment Australia (2001). *A Directory of Important Wetlands in Australia, Third Edition*. Environment Australia, Canberra.

NSW Department of Environment and Conservation (DEC) (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. NSW DEC, Hurstville.

NSW Department of Environment and Conservation (DEC) (2006). *The Vegetation of the Western Blue Mountains*. Unpublished report funded by the Hawkesbury – Nepean Catchment Management Authority. Department of Environment and Conservation, Hurstville.

Commonwealth Department of the Environment & Energy (DoEE) (2012). Interim Biogeographic Regionalisation for Australia, Version 7. Available online: http://www.environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps

Gellie, N.J.H. (2005) Native Vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes, and SE Corner bioregions. *Cunninghamia* 9(2): 219–254.

NSW Department of Industry (DOI) (2019). NSW *Water Management (General) Regulation 2018* hydro line spatial data.

Healy, S., and Wassens, S. (2008). *Review of the impacts of fire on the ecology and population persistence of the Purple Copper Butterfly (Paralucia spinifera)*. Department of Environment and Climate Change, NSW

Lesryk Environmental (2016a). Vegetation monitoring: Walker Quarry, Wallerawang, NSW. Unpublished report prepared for Walker Quarries Pty Ltd.

Lesryk Environmental (2016b). Purple Copper Butterfly Targeted investigation, Walker Quarry, Wallerawang, NSW. Unpublished report prepared for Walker Quarries Pty Ltd.

Lesryk Environmental (2017a). Ecological Investigation: Walker Quarry, Wallerawang, NSW. Unpublished report prepared for Walker Quarries Pty Ltd.

Lesryk Environmental (2017b). Vegetation Monitoring Walker Quarry, Wallerawang, NSW. Unpublished report prepared for Walker Quarries Pty Ltd.

Lesryk Environmental (2017c). Purple Copper Butterfly Monitoring report #2, Walker Quarry, Wallerawang, NSW. Unpublished report prepared for Walker Quarries Pty Ltd.

Lake Macquarie City Council (2014). Interim Lake Macquarie Large Forest Owl Planning and Management Guidelines. 2014. Available online: https://www.lakemac.com.au/downloads/7DF7C30B4236E83E2AAF2C9E528EFA312918F417.PDF

Madjawesch, R. and Nally, S. (2008) Emergency relocation of a Purple Copper Butterfly colony during roadworks: Successes and lessons learned. *Ecological Management & Restoration* 9 pp. 100-109.

NSW Department of Planning and Environment (DPE) (2018). NSW Planning Portal. Online database available at: https://www.planningportal.nsw.gov.au/find-a-property, accessed 28 March 2018.

NSW Department of Primary Industries – Fisheries (DPI) (2007). Key Fish Habitat Maps. Available online: https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps. Last accessed 18 April 2019.

NSW Department of Primary Industries – Fisheries (DPI) (2013). Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update).

NSW Department of Primary Industries (DPI) Fisheries (2016). *Freshwater threatened species distribution maps*. Available online: https://www.dpi.nsw.gov.au/fishing/species-protection/threatened-species-distributions-in-nsw/freshwater-threatened-species-distribution-maps. Last accessed 16 April 2019.

NSW National Parks and Wildlife Service (2001). *Bathurst Copper Butterfly (Paralucia spinifera) Recovery Plan*, Hurstville, NSW.

NSW Office of Environment and Heritage (OEH) (2016). NSW Guide to Surveying Threatened Plants. Office of Environment and Heritage for the NSW Government, Sydney.

NSW Office of Environment and Heritage (OEH) (2017a). Biodiversity Assessment Method. Office of Environment and Heritage for the NSW Government, Sydney.

NSW Office of Environment and Heritage (OEH) (2017b). Guidance to assist a decision-maker to determine a serious and irreversible impact. Office of Environment and Heritage for the NSW Government, Sydney.

NSW Office of Environment and Heritage (OEH) (2018a). Biodiversity Assessment Method Operational Manual – Stage 1. Office of Environment and Heritage for the NSW Government, Sydney.

NSW Office of Environment and Heritage (OEH) (2018b). 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method. Office of Environment and Heritage for the NSW Government, Sydney.

NSW Office of Environment and Heritage (OEH) (2019a). NSW BioNet. Online database available at: http://www.bionet.nsw.gov.au/ , accessed 14 February 2018.

O'Grady AP, Carter JL, Holland, K. (2010) Review of Australian groundwater discharge studies of terrestrial systems. CSIRO: Water for a Healthy Country National Research Flagship. CSIRO, Melbourne.

Pacrim Environmental (2001). *Environmental Impact Statement Proposed Wallerawang Quarry*. Unpublished report prepared for Sitegoal Pty Ltd, dated November 2001.

Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. (2010). Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11(3): 359–406.

Wildthing Environmental Consultants (1999) *Statement of effect on threatened flora and fauna over land proposed for a hard rock quarry within EL4473 near Wallerawang, NSW*. Unpublished report prepared for Pacrim Environmental Pty Ltd.

Wildthing Environmental Consultants (2002). *Paralucia spinifera (Bathurst Copper Butterfly) Survey for the proposed Wallerawang Quarry near Wallerwang NSW*. Unpublished report prepared for Pacrim Environmental Pty Ltd.

Zolfaghar, S., Villalobos-Vega, R., Cleverly, J., Zeppel, M., Rumman, R., & Eamus, D. (2014). The influence of depth-to-groundwater on structure and productivity of Eucalyptus woodlands. Australian Journal of Botany, 62(5), 428-437.

Appendix A Vegetation integrity plot data

Plot No.	Composition						Structure					
	Tree	Shrub	Grass	Forb	Fern	Other	Tree	Shrub	Grass	Forb	Fern	Other
9	2	4	5	3	1	0	40	0.4	12.6	0.3	0.1	0
11	4	9	6	14	0	2	29.5	6.3	50.4	4.7	0	0.2
12	4	3	7	17	1	1	19.1	1.8	24.3	6.9	5	0.1
13	2	5	4	11	1	1	7	2.8	52.5	2	0.1	0.1
17	5	5	4	8	1	2	20	5.3	37	2.1	0.1	0.2
18	5	5	8	11	1	1	13.5	3.3	17.8	9	0.1	0.1
19	2	8	8	13	0	0	1.3	2.7	19.5	2.9	0	0

Plot	Function										
	Large trees	Hollow trees	Litter cover	Fallen logs	Tree stem 5-10	Tree stem 10-20	Tree stem 20-30	Tree stem 30-50	Tree stem 50-80	Tree regen	High threat exotic
9	1	4	86	114	1	1	1	1	-	1	0
11	1	3	43	101	1	1	1	1	-	1	0.5
12	4	0	48	49	0	0	1	1	-	1	1.7
13	1	1	62	75	1	1	1	1	-	1	0
17	2	0	56	85	1	1	1	1	-	1	2.1
18	2	1	64	39	0	1	1	1	-	1	0.1
19	0	0	16	113	0	0	0	0	-	1	0.3

Appendix B Ecosystem credit species predicted to occur within the subject land

Species / Common name	NSW listing status (BC Act)	National listing status (EPBC Act)
Anthochaera phrygia Regent Honeyeater (Foraging)	CE	CE
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	V	-
Calyptorhynchus lathami Glossy Black-Cockatoo (Foraging)	V	-
Chthonicola sagittata Speckled Warbler	V	-
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	V	-
Daphoenositta chrysoptera Varied Sittella	V	-
Dasyurus maculatus Spotted-tailed Quoll	V	E
Falsistrellus tasmaniensis Eastern False Pipistrelle	V	-
Glossopsitta pusilla Little Lorikeet	V	-
Grantiella picta Painted Honeyeater	V	V
Hieraaetus morphnoides Little Eagle (Foraging)	V	-
Hoplocephalus bungaroides Broad-headed Snake (Foraging)	E	V
Lathamus discolor Swift Parrot (Foraging)	E	CE
Lophoictinia isura Square-tailed Kite (Foraging)	V	-
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	V	-
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Foraging)	V	-
Neophema pulchella Turquoise Parrot	V	-

Species / Common name	NSW listing status (BC Act)	National listing status (EPBC Act)
Ninox connivens Barking Owl (Foraging)	V	-
Ninox strenua Powerful Owl (Foraging)	V	-
Petaurus australis Yellow-bellied Glider	V	-
Petroica boodang Scarlet Robin	V	-
Petroica phoenicea *Flame Robin*	V	-
Phascolarctos cinereus Koala (Foraging)	V	V
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	V	-
Scoteanax rueppellii Greater Broad-nosed Bat	V	-
Stagonopleura guttata Diamond Firetail	V	-
Tyto novaehollandiae Masked Owl (Foraging)	V	-
Varanus rosenbergi Rosenberg's Goanna	V	-

V = Vulnerable; E = Endangered; CE = Critically Endangered; - = not listed

Appendix C Flora species recorded within the subject land

Family	Species	Common name	Growth form	Foliage cover (%)							Incidentals
				Plot 9	Plot 11	Plot 12	Plot 13	Plot 17	Plot 18	Plot 19	
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily	Forb (FG)		0.1						
	Hydrocotyle laxiflora	Stinking Pennywort	Forb (FG)		0.2				0.1	0.1	
Apiaceae	*Platysace lanceolata*		Shrub (SG)								X
Aspleniaceae	*Asplenium flabellifolium*		Fern (EG)								X
	Brachyscome spathulata		Forb (FG)								X
	Brachyscome spp.		Forb (FG)				1				
	Cassinia aculeata		Shrub (SG)					0.1			
	Cassinia arcuata	Sifton Bush	Shrub (SG)	0.1						1	
	Chrysocephalum apiculatum	Common Everlasting	Forb (FG)				0.1		0.1		
	*Cirsium vulgare**	Spear Thistle	Exotic			0.2		0.1			
	Conyza sp.*		Exotic			0.1				0.2	
	Coronidium scorpioides		Forb (FG)								X
	Cymbonotus lawsonianus	Bear's Ear	Forb (FG)			0.1		0.1			
	Euchiton involucratus	Star Cudweed	Forb (FG)							0.2	
	Euchiton sphaericum		Forb (FG)							0.2	
	Euchiton spp.		Forb (FG)		0.1		0.1				
	Gamochaeta sp.*		Exotic								X
	*Hypochaeris radicata**	Catsear	Exotic		0.2		0.1	0.1	0.1	10	
	Lagenophora stipitata	Common Lagenophora	Forb (FG)		0.2		0.1				
	Ozothamnus diosmifolius	White Dogwood	Shrub (SG)								X
	Pseudognaphalium luteoalbum	Jersey Cudweed	Forb (FG)							0.1	
	Senecio hispidulus	Hill Fireweed	Forb (FG)			0.1	0.1			0.2	
	Senecio quadridentatus		Forb (FG)								X
Asteraceae	*Senecio* spp.		Forb (FG)					0.1			

Family	Species	Common name	Growth form	Foliage cover (%)							Incidentals
				Plot 9	Plot 11	Plot 12	Plot 13	Plot 17	Plot 18	Plot 19	
	Xerochrysum viscosum		Forb (FG)							0.1	
Campanulaceae	*Wahlenbergia* sp.		Forb (FG)								X
Caryophyllaceae	*Stellaria pungens*		Forb (FG)							0.1	
Clusiaceae	*Hypericum gramineum*	Small St John's Wort	Forb (FG)		0.1		0.1		0.1		
	Hypericum perforatum	St. Johns Wort	High Threat Exotic			0.5				0.1	
Convolvulaceae	*Dichondra repens*	Kidney Weed	Forb (FG)		0.1	1		0.1			
Cyperaceae	*Lepidosperma gunnii*		Grass & grasslike (GG)	0.1	0.2						
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	Fern (EG)			5					
Dilleniaceae	*Hibbertia obtusifolia*	Hoary Guinea Flower	Shrub (SG)		4					0.1	
Droseraceae	*Drosera hookeri*		Forb (FG)								X
Ericaceae	*Acrotriche serrulata*	Honeypots	Shrub (SG)						0.1		
	Astroloma humifusum		Shrub (SG)								X
	Brachyloma daphnoides	Daphne Heath	Shrub (SG)								X
	Leucopogon virgatus		Shrub (SG)								X
	Lissanthe strigosa	Peach Heath	Shrub (SG)	0.1	1	0.2	2	1	1		
	Monotoca scoparia		Shrub (SG)		0.5					0.1	
Euphorbiaceae	*Euphorbiaceae indeterminate*		Forb (FG)			0.1					
Fabaceae (Faboideae)	*Bossiaea prostrata*		Forb (FG)		0.1				0.1		
	Dillwynia phylicoides	Parrot-pea	Shrub (SG)	0.1	0.1		0.1	0.1	0.1	0.1	
	Glycine clandestina	Twining Glycine	Other (OG)					0.1			
	Glycine tabacina	Variable Glycine	Other (OG)		0.1						
	Gompholobium uncinatum		Shrub (SG)		0.1						
	Hardenbergia violacea	False Sarsaparilla	Other (OG)		0.1			0.1			
	Hovea heterophylla		Forb (FG)		0.5				0.1		
	Mirbelia platylobioides		Shrub (SG)		0.1						
	Pultenaea microphylla		Shrub (SG)		0.1		0.1		0.1		

Family	Species	Common name	Growth form	Foliage cover (%)							Incidentals
				Plot 9	Plot 11	Plot 12	Plot 13	Plot 17	Plot 18	Plot 19	
	Pultenaea tuberculata		Shrub (SG)								X
	Vicia sp.*	Vetch	Exotic			0.1					
Fabaceae (Mimosoideae)	*Acacia dealbata*	Silver Wattle	Tree (TG)			0.1		2	0.5		
	Acacia gunnii		Shrub (SG)							0.1	
	Acacia echinula	Hedgehog Wattle	Shrub (SG)	0.1							
Gentianaceae	*Centaurium erythraea**	Common Centaury	Exotic								X
Geraniaceae	*Geranium homeanum*		Forb (FG)					0.1			
	Geranium retrorsum	Cranesbill Geranium	Forb (FG)			0.2					
	Geranium solanderi	Native Geranium	Forb (FG)						0.1		
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia	Forb (FG)	0.1			0.1		0.1		
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort	Forb (FG)	0.1	0.1	0.1	0.1	0.1	0.1	1	
Iridaceae	*Patersonia sericea*	Silky Purple-Flag	Forb (FG)	0.1	0.5					0.1	
Juncaceae	*Juncus* sp.		Grass & grasslike (GG)			0.1					
Lamiaceae	*Ajuga australis*	Austral Bugle	Forb (FG)		0.5						
	Mentha satureioides	Native Pennyroyal	Forb (FG)			0.1				0.1	
	Scutellaria humilis	Dwarf Skullcap	Forb (FG)			0.1					
Lauraceae	*Cassytha glabella*		Other (OG)				0.1		0.1		
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Matt-rush	Grass & grasslike (GG)	2	5	3	12		5	3	
	Lomandra longifolia	Spiny-headed Mat-rush	Grass & grasslike (GG)	5				30	10	5	
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush	Grass & grasslike (GG)			5		5	0.1		
Myrtaceae	*Eucalyptus bridgesiana*	Apple Box	Tree (TG)					5	1		
	Eucalyptus dalrympleana	Mountain Gum	Tree (TG)		1.5	3					
	Eucalyptus dives	Broad-leaved Peppermint	Tree (TG)		12					0.3	
	Eucalyptus macrorhyncha	Red Stringybark	Tree (TG)		8						
	Eucalyptus mannifera	Brittle Gum	Tree (TG)	15	8		5	10	1	1	
	Eucalyptus melliodora	Yellow Box	Tree (TG)				2				

Family	Species	Common name	Growth form	Foliage cover (%)							Incidentals
				Plot 9	Plot 11	Plot 12	Plot 13	Plot 17	Plot 18	Plot 19	
	Eucalyptus pauciflora	Snow Gum	Tree (TG)			1			1		
	Eucalyptus radiata	Candlebark	Tree (TG)						10		
	Eucalyptus rossii	Inland Scribbly Gum	Tree (TG)	25							
	Eucalyptus stellulata	Black Sally	Tree (TG)					1			
	Eucalyptus viminalis	Ribbon Gum	Tree (TG)			15		2			
Onagraceae	*Epilobium billardiereanum*		Forb (FG)							0.1	
	Caladenia fuscata		Forb (FG)								X
	Caladenia moschata		Forb (FG)								X
	Eriochilus spp.		Forb (FG)				0.1				
	Paracaleana minor		Forb (FG)								X
Orchidaceae	*Pterostylis* spp.		Forb (FG)			0.1	0.1	0.1	0.1		
Oxalidaceae	*Oxalis perennans*		Forb (FG)			0.1					
Phormiaceae	*Dianella revoluta*	Blueberry Lily	Forb (FG)		2	2		1	8	0.5	
	Phyllanthus hirtellus		Shrub (SG)								X
Phyllanthaceae	*Poranthera microphylla*	Small Poranthera	Forb (FG)								X
Pinaceae	*Pinus radiata**	Radiata Pine	High Threat Exotic		0.5	1		2			
	Billardiera scandens	Hairy Apple Berry	Other (OG)								X
Pittosporaceae	*Bursaria spinosa* subsp. *lasiophylla*	Native Blackthorn	Shrub (SG)			1.5	0.5	4	2	1	
	Plantago debilis		Forb (FG)								X
	Plantago gaudichaudii	Narrow Plantain	Forb (FG)								X
	*Plantago lanceolata**	Lamb's Tongues	Exotic			0.2					
	Veronica calycina	Hairy Speedwell	Forb (FG)			0.1				0.1	
	Veronica derwentiana		Forb (FG)								X
Plantaginaceae	*Veronica perfoliata*	Digger's Speedwell	Forb (FG)								X
	*Anthoxanthum odoratum**	Sweet Vernal Grass	Exotic		0.2	35		2	0.1	5	
Poaceae	*Aristida ramosa*	Purple Wiregrass	Grass & grasslike (GG)						0.5	10	

Family	Species	Common name	Growth form	Foliage cover (%)							Incidentals
				Plot 9	Plot 11	Plot 12	Plot 13	Plot 17	Plot 18	Plot 19	
	Aristida vagans	Threeawn Speargrass	Grass & grasslike (GG)				0.5				
	Dichelachne micrantha	Shorthair Plumegrass	Grass & grasslike (GG)	0.5					0.1		
	Echinopogon caespitosus		Grass & grasslike (GG)								X
	Echinopogon ovatus	Forest Hedgehog Grass	Grass & grasslike (GG)		0.1	0.1			0.1	0.1	
	Elymus multiflorus	Philip Island Wheatgrass	Grass & grasslike (GG)			0.1					
	Elymus scaber		Grass & grasslike (GG)								X
	Entolasia marginata		Grass & grasslike (GG)								X
	Eragrostis trachycarpa		Grass & grasslike (GG							0.1	
	Microlaena stipoides var. *stipoides*	Weeping Grass	Grass & grasslike (GG)		0.1	1		1			
	*Phalaris aquatica**	Phalaris	Exotic					0.1			
	Poa labillardierei var. *labillardierei*	Tussock grass	Grass & grasslike (GG)		5	15	15				
	Poa sieberiana	Snowgrass	Grass & grasslike (GG)	5					1	1	
	Poaceae sp.		Grass & grasslike (GG)						0.1		
	Rytidosperma sp.		Grass & grasslike (GG)								X
	Rytidosperma pallida	Silvertop Wallaby Grass	Grass & grasslike (GG)		40		25			0.2	
	Rytidosperma tenuior	A Wallaby Grass	Grass & grasslike (GG)					1			
	Rytidosperma racemosum var. *racemosum*		Grass & grasslike (GG)							0.1	
Polygonaceae	*Rumex brownii*		Forb (FG)								X
	Grevillea arenaria		Shrub (SG)							0.2	
	Hakea laevipes		Shrub (SG)								X
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	Shrub (SG)		0.2					0.1	
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	Fern (EG)	0.1			0.1	0.1	0.1		
	Clematis aristata	Old Man's Beard	Other (OG)			0.1					
	Clematis glycinoides		Other (OG)								X
Ranunculaceae	*Ranunculus* sp.	Buttercup	Forb (FG)			0.1					

Family	Species	Common name	Growth form	Foliage cover (%)							Incidentals
				Plot 9	Plot 11	Plot 12	Plot 13	Plot 17	Plot 18	Plot 19	
	Acaena novae-zelandiae	Bidgee-widgee	Forb (FG)					0.5			
	Acaena ovina		Forb (FG)			2					
	Rubus fruticosus sp. agg	Blackberry complex	High Threat Exotic			0.1		0.1	0.1	0.2	
	Rubus parvifolius	Native Raspberry	Shrub (SG)			0.1		0.1			
Rosaceae	*Rosa rubiginosa*	Sweet Briar	High Threat Exotic			0.1					
	Asperula conferta	Common Woodruff	Forb (FG)			0.5					
	Galium spp.		Forb (FG)			0.1					
	Opercularia diphylla	Stinkweed	Forb (FG)		0.1		0.1		0.1		
Rubiaceae	*Pomax umbellata*		Forb (FG)								X
Solanaceae	*Solanum nigrum**	Black-berry Nightshade	Exotic							0.1	
	Stackhousia monogyna		Forb (FG)								X
Stackhousiaceae	*Stackhousia* spp.		Forb (FG)		0.1				0.1		
Thymelaeaceae	*Pimelea curviflora* var. *sericea*		Forb (FG)				0.1				
	Melicytus dentatus		Shrub (SG)								X
Violaceae	*Viola betonicifolia*	Native Violet	Forb (FG)			0.1					

* denotes an exotic species

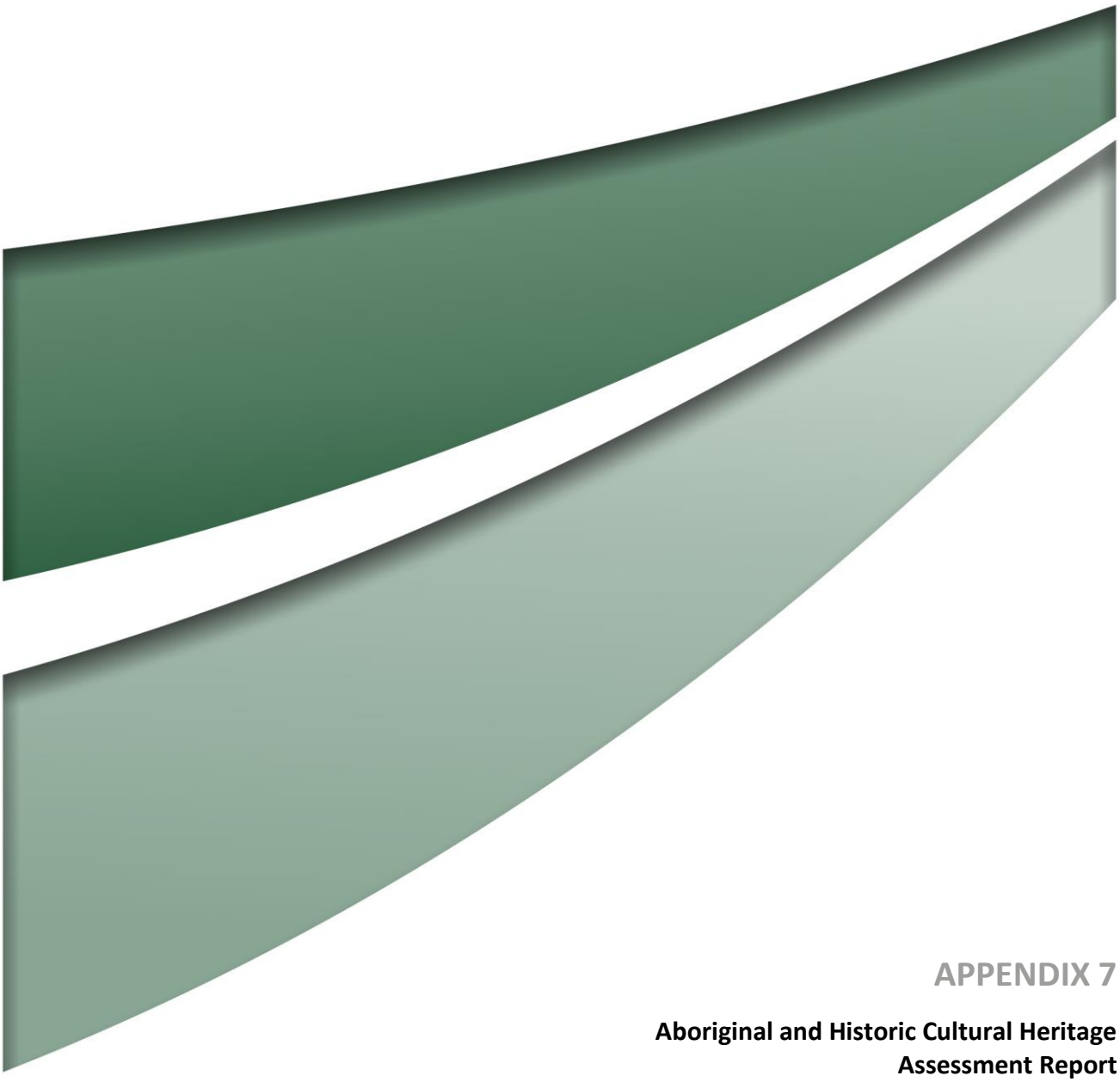
Appendix D Fauna species recorded within the subject land

Common name	Scientific name	Status (BC Act)	Observation type
MAMMALS (excluding bats)			
Yellow-footed/Brown Antechinus	*Antechinus flavipes/stuarti*		O
* Rusa Deer	*Cervus timorensis*		O
* Feral Cat	*Felis catus*		O
Eastern Grey Kangaroo	*Macropus giganteus*		O
Common Wallaroo	*Macropus robustus*		O
* Rabbit	*Oryctolagus cuniculus*		O
Sugar Glider	*Petaurus breviceps*		O
Common Ringtail Possum	*Pseudocheirus peregrinus*		O
Common Brushtail Possum	*Trichosurus vulpecula*		O
Common Wombat	*Vombatus ursinus*		O
* Fox	*Vulpes*		O
Swamp Wallaby	*Wallabia bicolor*		O
Red-necked Wallaby	*Macropus rufogriseus*		O
MAMMALS - Bats			
White-striped freetail Bat	*Austronomus australis*		Anabat
Gould's Wattled Bat	*Chalinolobus gouldii*		Anabat
Chocolate Wattled Bat	*Chalinolobus morio*		Anabat
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	Anabat
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	Anabat
Unidentified microbat (Southern Myotis / Long-eared Bat) #	Unknown *(Myotis macropus / Nyctophilus* sp.)		Anabat
Long-eared Bat	*Nyctophilus* sp.		Anabat
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*		Anabat
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	Anabat*
Inland Broad-nosed Bat	*Scotorepens balstoni*		Anabat
Little Broad-nosed Bat	*Scotorepens greyii*		Anabat
Large Forest Bat	*Vespadelus darlingtoni*		Anabat
Forest Bat species	*Vespadelus darlingtoni / V. regulus*		Anabat
Southern Forest Bat	*Vespadelus regulus*		Anabat
Little Forest Bat	*Vespadelus vulturnus*		Anabat
AVES (BIRDS)			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		W
Striated Thornbill	*Acanthiza lineata*		W
Brown Thornbill	*Acanthiza pusilla*		OW
Buff-rumped Thornbill	*Acanthiza reguloides*		W
Eastern Spinebill	*Acanthorhynchus tenuirostris*		O
Grey Goshawk	*Accipiter novaehollandiae*		O
Australian King Parrot	*Alisterus scapularis*		OW

Common name	Scientific name	Status (BC Act)	Observation type
Pacific Black Duck	*Anas superciliosa*		O
Red Wattlebird	*Anthochaera carunculata*		OW
Brush Wattlebird	*Anthochaera chrysoptera*		O
Wedge-tailed Eagle	*Aquila audax*		O
Fan-tailed Cuckoo	*Cacomantis flabelliformis*		O
Pallid Cuckoo	*Cacomantis pallidus*		O
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	O^
Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*		O
Australian Wood Duck	*Chenonetta jubata*		O
Spotted Quail-thrush	*Cinclosoma punctatum*		O
Red-browed Treecreeper	*Climacteris erythrops*		O
Grey Shrike-thrush	*Colluricincla harmonica*		O
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		W
White-winged Chough	*Corcorax melanorhamphos*		O
White-throated Treecreeper	*Cormobates leucophaea*		O
Australian Raven	*Corvus coronoides*		OW
Australian Magpie	*Cracticus tibicen*		O
Grey Butcherbird	*Cracticus torquatus*		O
Laughing Kookaburra	*Dacelo novaeguineae*		O
Varied Sittella	*Daphoenositta chrysoptera^*	V	O
Eastern Yellow Robin	*Eopsaltria australis*		O
Dollarbird	*Eurystomus orientalis*		W
White-throated Gerygone	*Gerygone albogularis*		W
Welcome Swallow	*Hirundo neoxena*		O
Yellow-faced Honeyeater	*Lichenostomus chrysops*		W
White-eared Honeyeater	*Lichenostomus leucotis*		O
Superb Fairy-wren	*Malurus cyaneus*		O
Brown-headed Honeyeater	*Melithreptus brevirostris*		OW
White-naped Honeyeater	*Melithreptus lunatus*		OW
Restless Flycatcher	*Myiagra inquieta*		W
Leaden Flycatcher	*Myiagra rubecula*		W
Red-browed Finch	*Neochmia temporalis*		O
Rufous Whistler	*Pachycephala rufiventris*		W
Spotted Pardalote	*Pardalotus punctatus*		W
Striated Pardalote	*Pardalotus striatus*		W
Scarlet Robin	*Petroica boodang^*	V	O
Red-capped Robin	*Petroica goodenovii*		O
Rose Robin	*Petroica rosea*		O
Noisy Friarbird	*Philemon corniculatus*		OW
New Holland Honeyeater	*Phylidonyris novaehollandiae*		O
Crimson Rosella	*Platycercus elegans*		W
Eastern Rosella	*Platycercus eximius*		OW
Tawny Frogmouth	*Podargus strigoides*		W
Grey Fantail	*Rhipidura albiscapa*		W

Common name	Scientific name	Status (BC Act)	Observation type
Willie Wagtail	*Rhipidura leucophrys*		OW
White-browed Scrubwren	*Sericornis frontalis*		O
Pied Currawong	*Strepera graculina*		OW
Grey Currawong	*Strepera versicolor*		O
Sacred Kingfisher	*Todiramphus sanctus*		OW
Silvereye	*Zosterops lateralis*		
AMPHIBIANS			
Common Eastern Froglet	*Crinia signifera*		W
Eastern Banjo Frog	*Limnodynastes dumerilii*		W
Peron's Tree Frog	*Litoria peronii*		W
Bleating Tree Frog	*Litoria dentata*		W
Whistling Tree Frog	*Litoria verreauxii*		W
REPTILES			
Copper-tailed Skink	*Ctenotus taeniolatus*		O
Pale-flecked Garden Sun-skink	*Lampropholis guichenoti*		O
Jacky Lizard	*Amphibolurus muricatus*		O

O – observed; W – Species detected from Calls;
* Recorded by Wildthing Environmental Consultants (1999); ^ recorded by Lesryk (2016); # See section 4.3.2 for discussion of records of this call group



APPENDIX 7

Aboriginal and Historic Cultural Heritage Assessment Report

View north to the current south-western boundary of the existing quarry.

ABORIGINAL AND HISTORIC CULTURAL HERITAGE ASSESSMENT REPORT

WALLERAWANG QUARRY EXTENSION PROJECT

LOT 6, GREAT WESTERN HIGHWAY, WALLERAWANG

LITHGOW CITY COUNCIL LGA

JUNE 2019

Report Prepared by

OzArk Environmental & Heritage Management Pty Ltd

for Umwelt (Australia) Pty Ltd

on behalf of

Walker Quarries Pty Ltd

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Acknowledgement

OzArk acknowledge Traditional Owners of the area on which this assessment took place and pay respect to their beliefs, cultural heritage and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

EXECUTIVE SUMMARY

OzArk Environmental & Heritage Management (OzArk) has been engaged by Walker Quarries Pty Ltd (the proponent) to complete an Aboriginal and Historic Cultural Heritage Assessment Report (AHCHAR) for a proposed extension of the Wallerawang Quarry (the Quarry) (the project). Contained within Mining Lease (ML) 1633, the Quarry Site is located within the Lithgow City Local Government Area. An extension to the Quarry Site is proposed to allow for the proposed extension to Quarry operations and is the subject of an application to extend ML 1633. The combined Quarry Site and proposed ML 1633 extension is referred to as the project Site. The area of the Project Site relating to the proposed Quarry extension and which is applicable to this AHCHAR is herein referred to as the 'Heritage Study Area' and encompasses approximately 17.77 hectares (ha) of land.

The purpose of the assessment is to inform and support a Statement of Environmental Effects (SEE) being prepared by Umwelt (Australia) Pty Limited to accompany an application to modify the State Significant Development (SSD) approval (DA 344-11-2001) under Section 4.55(2) of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The key components of the proposed modification being to:

- extend the period of mining beyond July 2020;
- extend the extraction area of the Quarry;
- increase the area currently available for stockpiling;
- modify water management and storage infrastructure of the Quarry Site; and
- support the continued production of a more extensive range of quartzite products principally for use in the Wallerawang, Lithgow, Blue Mountains and Sydney regions.

The fieldwork component of this assessment was undertaken by OzArk on 29 August 2018. Registered Aboriginal Party (RAP) representatives from the Bathurst Local Aboriginal Land Council and Gundungurra Tribal Council Aboriginal Corporation participated in the field survey of the Heritage Study Area. The field survey identified no new Aboriginal sites. However, one previously recorded Aboriginal site, AHIMS #45-1-2802 (WQ1), exists within the Quarry Site boundary and will require management and mitigation prior to the proposed work of the project commencing.

The historic heritage field survey component of the assessment was undertaken concurrently with the Aboriginal heritage field survey. No items of historic heritage significance were identified and it was assessed that the Project Site and Heritage Study Area has no potential for historic archaeological deposits.

The following archaeological recommendations are made in regards to the Aboriginal and historic heritage components of the assessment.

Aboriginal heritage

1. Should development consent for the project be granted, the SoC set out in **Section 6.3** will be followed.
2. All ground disturbance activities must be confined to within the assessed Heritage Study Area.
3. Prior to disturbance beyond the Heritage Study Area, further field survey should be completed prior to surface disturbance in these areas.
4. Following SSD approval for the project, a CHMP for the management and mitigation from impacts to Aboriginal heritage (including the implementation of an unanticipated finds protocol and heritage site induction for staff and contractors), would be development in agreement with the proponent, RAPs, OEH and DP&E. The archaeological management recommendations in this report would normally be incorporated into the CHMP that is usually formulated following development approval.

Historic heritage

5. The activities of the project can proceed without further historic heritage investigation provided that all ground disturbance activities are confined to within the Heritage Study Area. If the parameters of the proposed activity extend beyond the assessed area, then further archaeological assessment may be required.
6. This assessment has concluded that there is a low likelihood that the proposed work would harm any historic items. The CHMP will include protocols for the management and mitigation to historic heritage from the impacts, should objects be encountered that are suspected to be historic heritage items.
7. The CHMP shall include protocols for inductions for staff undertaking the proposed activity, and will include the legislative protection requirements for historic sites and items in NSW and the relevant fines for non-compliance.

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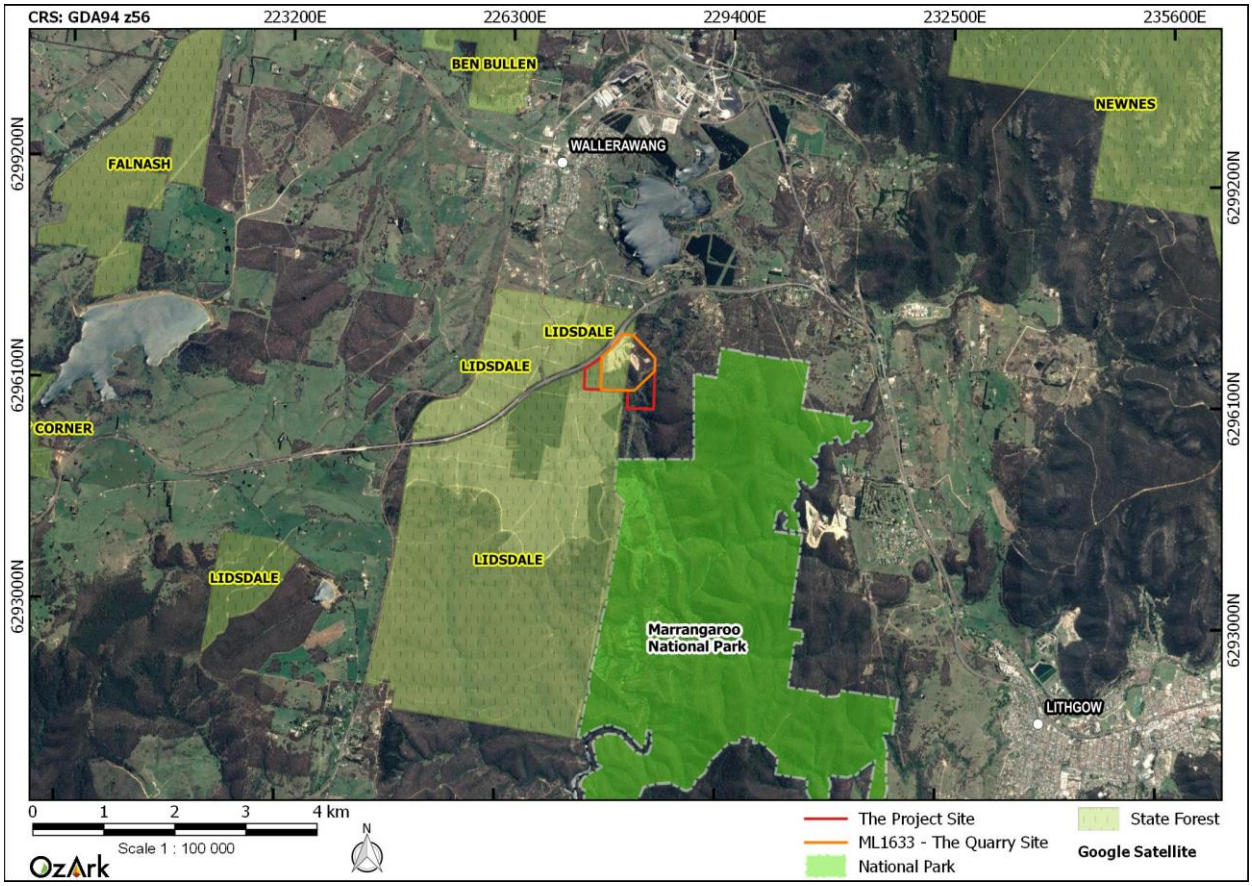
1 INTRODUCTION

1.1 BRIEF DESCRIPTION OF THE PROJECT

OzArk Environmental & Heritage Management (OzArk) has been engaged by Walker Quarries Pty Ltd (the proponent) to complete an Aboriginal and historic cultural heritage assessment report (AHCHAR) for a proposed extension of the Wallerawang Quarry (the Quarry) (the project). Contained within Mining Lease (ML) 1633, the Quarry Site is located within the Lithgow City Local Government Area (LGA) (**Figure 1-1**). An application to extend ML 1633 has been lodged separately by the proponent with the Department of Industry – Division of Resources & Geoscience (DRG). The combined Quarry Site and proposed ML 1633 extension is referred to as the Project Site.

The purpose of the assessment is to inform and support a Statement of Environmental Effects (SEE) being prepared by Umwelt (Australia) Pty Limited to accompany an application to modify the State Significant Development (SSD) approval (DA 344-11-2001).

Figure 1-1: Location of the Project Site in a regional context.



1.2 BACKGROUND

Silcox (2000) was engaged to undertake the Aboriginal archaeological values and assessment over an area of approximately 10 hectares as part of the assessment of the original Quarry proposal. The assessment identified one Aboriginal site; WQ1, situated within a spur landform to

the north of Hoskins Quarry. A total of 22 artefacts were identified at the site, scattered on the surface of an eroded, unsurfaced vehicle track. A number of artefacts were also noted to be partly buried sediment, although it was unclear whether they were eroding out of *in situ* deposit or out of redeposited sediment. Walker Quarries placed (and has maintained) a permanent fence around the WQ1 site boundary for its protection from quarry operations. Site WQ1 is registered on the Aboriginal Heritage Information Management System (AHIMS) as Site #45-1-2802.

In 2018, OzArk undertook an assessment of Site WQ1, for the purpose of locating the site and confirming its status and previously recorded features. It was noted that since Silcox's recording in 2000 that natural erosion related impacts, including surface sediment wash, have since occurred at the site. The ground-truthing of the site identified up to 16 artefacts, the majority within a gently sloping landform with moderately extensive exposures in the southern portion of the site adjacent to the fence line. Artefacts were also recorded along a disused track in the western portion of the site (**Figure 1-2**). OzArk considered that the archaeological potential of WQ1 could be determined without the need for test excavation as sufficient exposures to understand the nature of the site were present.

Figure 1-2: The ground-truthed location of AHIMS #45-1-2802.

Avoidance of the site has been confirmed by the Proponent as not feasible as developing the Quarry to the proposed target depth requires a westerly extension of the extraction area on to the land which currently occupies the site. As such, approval to disturb Site WQ1 will be required as

part of the proposed modification to DA 344-11-2001 (note, Section 4.41(1)(d) identifies that an Aboriginal Heritage Impact Permit (AHIP) is not required for a State Significant Development that is authorised by a development consent). Approval of the proposed modification and authorisation of the disturbance to Site WQ1 will be informed by the results of this AHCHAR. Project understanding & proposed work

1.2.1 Project Site

The Project Site is approximately eight kilometres northwest of Lithgow, NSW, and is bounded to the northwest by the Great Western Highway, to the east and southeast by existing vegetated land and the Coxs River. The Project Site adjoins the Lidsdale State Forest in the west and southwest, with the western half of the ML boundary being situated within the boundary of the Lidsdale State Forest.

The proponent currently operates the Quarry on ML 1633, located at 963 Great Western Highway and traversing three lots (Lot 6 DP872230 - being freehold title owned by the proponent, Lot 7071 DP1201227 – being crown land contained within Lidsdale State Forest and managed by Forestry Corporation of NSW, and Lot 7322 DP1149335 – being crown land managed by the Department of Industry – Lands & Water). An extension of the ML 1633 to the west (onto Lot 7071 DP1201227 of Lidsdale State Forest) and to the south (onto Lot 7322 DP1149335 which is managed as crown land) is required and the Project Site incorporates these extensions.

1.2.2 Approved and Current Quarry Operations

The original Quarry approval (DA 344-11-2001) was granted to Sitegoal Pty Ltd (parent company of Walker Quarries Pty Ltd) in 2004. ML 1633 was obtained in July 2009 with activities commencing in 2014.

The proponent is approved to extract and transport up to 500,000 tonnes per year from an extraction area with a maximum depth of 930m AHD and surface area of approximately 4ha. DA 344-11-2001 was modified in August 2017 to regularize several constructed components of the Quarry and formalise the approval of production of a more extensive range of quartzite products. DA 344-11-2001 was modified again on 7 December 2018 to provide for a short-term extension to the limits on quarry operations (from July 2019 to July 2020).

1.2.3 The Proposed Modification

Following the completion of an exploration drilling program and resource assessment (RME, 2018), the Applicant confirmed the extension (laterally and vertically) of the quartzite resource beyond the approved extents of the extraction area. Following this confirmation, and on review of other operational constraints of DA 344-11-2001 and approved, the proponent proposes the following modifications to Quarry operations.

- An extension of the extraction area to increase the total resource approved for extraction by an additional 12 to 15 million tonnes. The extended area would allow for the extraction of the high silica, high purity metamorphosed (indurated) quartzose sandstone (quartzite) which is currently exposed and extracted from the open cut, as well as other resources such as hornfels, sandstone and cobble conglomerate.

  The proposed extraction area would be developed to a maximum depth of 860m AHD (70m below the current approved limit and between 40m and 100m below the surrounding landform once the extraction area is developed to its full surface area) and extend the surface disturbance footprint by approximately 5ha.

  The extraction area would remain a minimum of approximately 50m from the Coxs River and 10m above the river bank.
- An extension to product stockpiling areas of approximately 5.3ha to the southwest and south of the approved stockpile areas.
- Some water diversions to accommodate the stockpile area extensions and construction of an additional dam to improve water security for the Quarry.
- An extension to the life of the Quarry of 30 years.

The project requires an extension to ML 1633 (and the Quarry Site) to the west on to Lot 7071 DP1201227 (Lidsdale State Forest). The key features and concept design plan that comprise the Quarry extension are illustrated on **Figure 1-3**.

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 (see **Figure 1-4**).

1.2.4 Heritage Study Area

Field survey was completed over approximately 17.77 hectares of the Project Site and includes the majority of the proposed disturbance footprint of the proposed Quarry extension. The landscape context and details of the field survey area discussed in **Sections 3** and **5.1.**

Figure 1-3: Proposed Quarry Site layout.

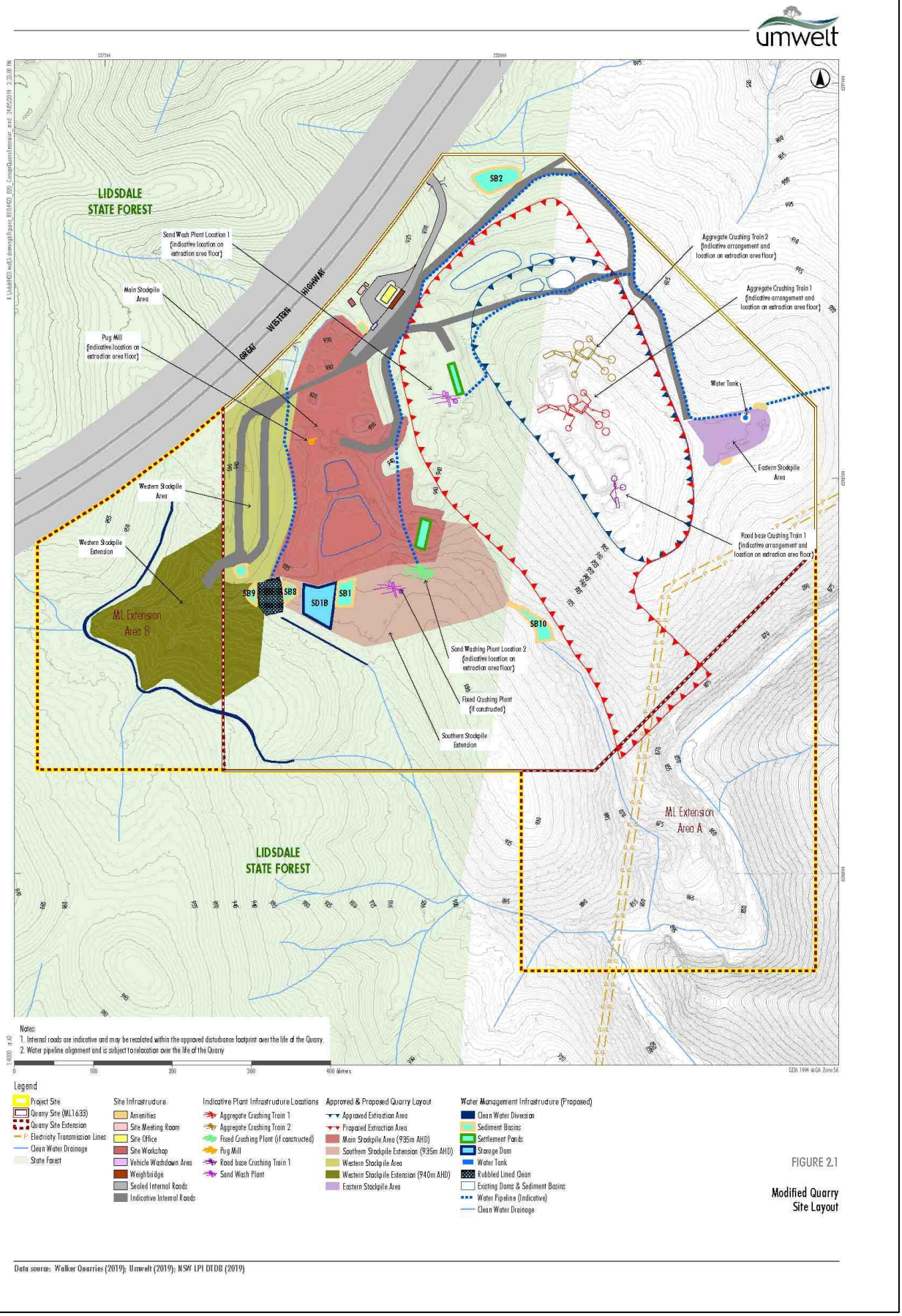


Figure 1-4: The Quarry Site plan showing the staged extensions.

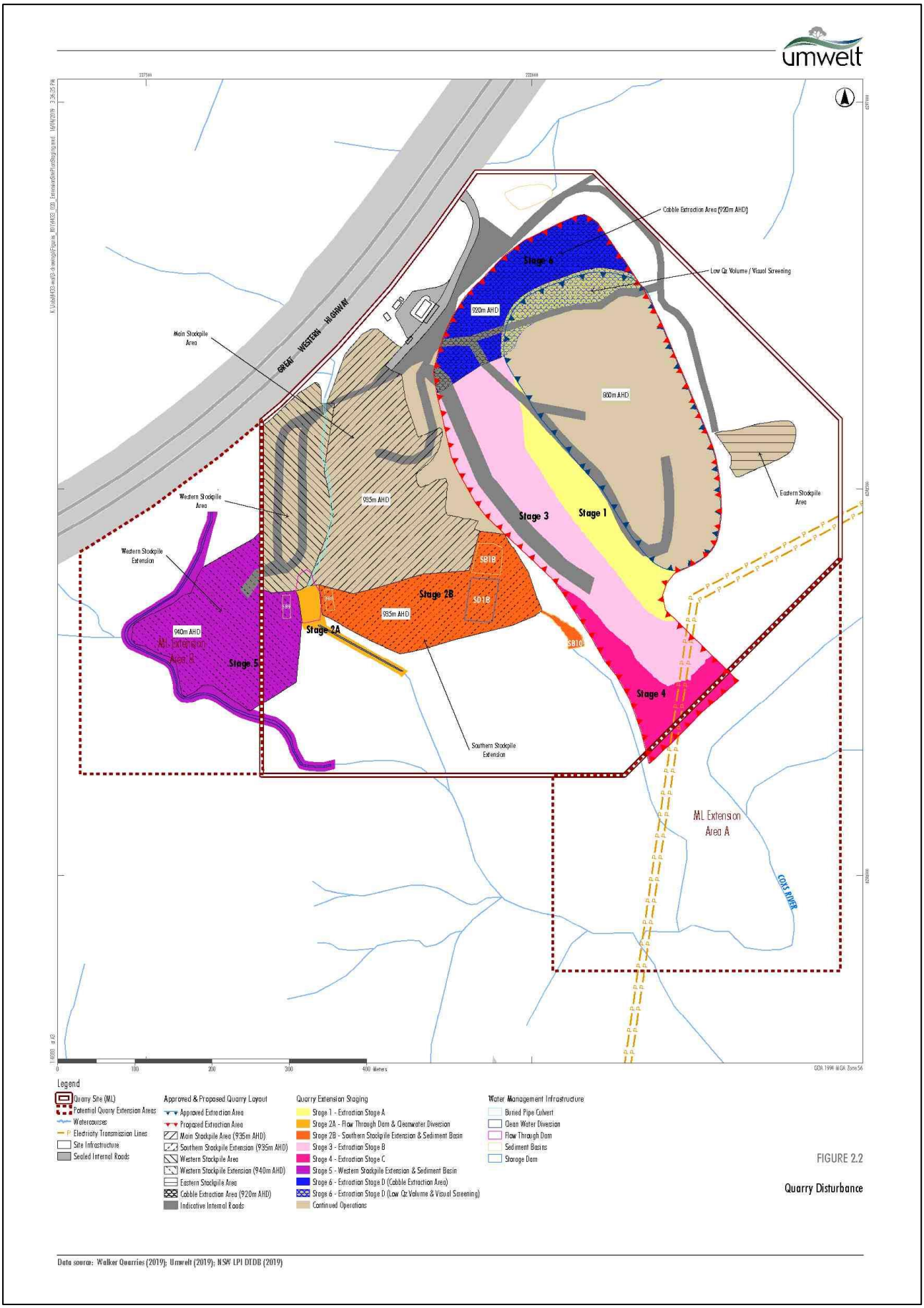
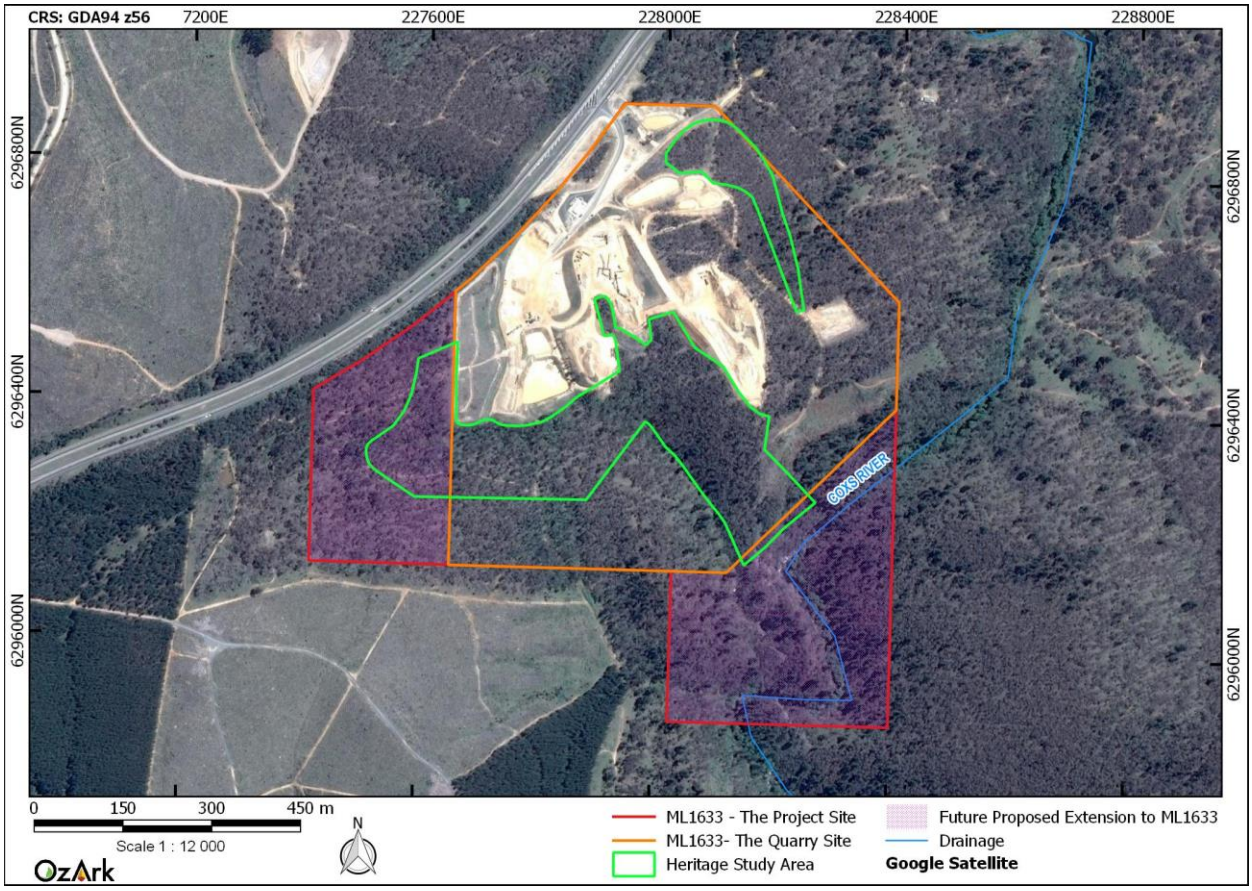


Figure 1-5: Location of the Heritage Study Area in relation to the Quarry Site.



This report covers the desktop review and assessment, and field survey assessment applicable to the Heritage Study Area.

1.3 RELEVANT LEGISLATION

Cultural heritage is managed by a number of state and national Acts. Baseline principles for the conservation of heritage places and relics can be found in the *Burra Charter* (Australia ICOMOS 2013). The *Burra Charter* has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The *Burra Charter* generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a state level.

A number of Acts of parliament provide for the protection of heritage at various levels of government.

1.3.1 State legislation

Environmental Planning and Assessment Act 1979 (EP&A Act)

This Act, amended by the *Environmental Planning and Assessment Amendment Act 2017,* establishes requirements relating to land use and planning. The framework governing environmental and heritage assessment in NSW is contained within the following parts of the EP&A Act:

- **Part 4:** Local government development assessments, including heritage. May include schedules of heritage items;
    - **Division 4.7:** Approvals process for state significant development;
        - **Section 4.41**: Authorisations that are not required for state significant development:
            - Part 4, or excavation permit under section 139 of the *Heritage Act 1977*.
            - Aboriginal Heritage Impact Permit (AHIP) under section 90 of the *National Parks and Wildlife Act 1974*.
- **Part 5:** Environmental impact assessment on any heritage items which may be impacted by activities undertaken by a state government authority or a local government acting as a self-determining authority; and
    - **Division 5.2:** Approvals process for state significant infrastructure.

National Parks and Wildlife Act 1974 (NPW Act)

Amended during 2010, the NPW Act provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Under the Act (Part 6), an Aboriginal object is defined as: any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

As of 1 October 2010, it is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the Act provides a series of defences against the offences listed in Section 86, such as:

- The defendant exercised 'due diligence' to determine whether the action would harm an Aboriginal object; or
- The harm to the Aboriginal object occurred during the undertaking of a 'low impact activity' (as defined in the regulations).

Under Section 89A of the Act, it is a requirement to notify the Office of Environment and Heritage (OEH) Director-General of the location of an Aboriginal object. Identified Aboriginal items and sites are registered on Aboriginal Heritage Information Management System (AHIMS).

1.3.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Matters of National Environmental Significance listed under the EPBC Act include the National Heritage List and the Commonwealth Heritage List, both administered by the Commonwealth Department of the Environment and Energy. Ministerial approval is required under the EPBC Act for proposals involving significant impacts to National/Commonwealth heritage places.

1.3.3 Applicability to the project

The current project will be assessed under Part 4 of the EP&A Act.

Any Aboriginal sites within the Study Area are afforded legislative protection under the NPW Act.

It is noted there are no Commonwealth or National heritage listed places within the Study Area, and as such, the heritage provisions of the EPBC Act do not apply.

1.4 ASSESSMENT APPROACH

The current assessment follows the *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (Code of Practice; DECCW 2010). Field assessment and reporting followed the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011).

The historic heritage assessment component follows the Heritage Council's *Historical Archaeology Code of Practice* (Historical Code of Practice; Heritage Council 2006).

The Aboriginal Cultural Heritage Assessment Report (ACHAR) is presented in **Sections 2** to **6** of this report and the Historic Heritage Assessment Report (HHAR) is presented in **Sections 7** to **10** of this report.

Recommendations regarding Aboriginal cultural heritage and historic heritage are provided in **Section 11**.

ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT

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2 THE ARCHAEOLOGICAL ASSESSMENT

2.1 PURPOSE AND OBJECTIVES

The purpose of the current study is to identify and assess heritage constraints relevant to the proposed works.

2.1.1 Aboriginal archaeological assessment objectives

The current assessment will apply the Code of Practice, in the completion of an Aboriginal archaeological assessment, in order to meet the following objectives.

Objective One: To undertake an Aboriginal archaeological survey of the Heritage Study Area as per the Code of Practice.

Objective Two: To assess the significance of any recorded Aboriginal sites, objects or places likely to be impacted by the project, in consultation with the RAPs, consistent with the Code of Practice and *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs; DECCW 2010b).

Objective Three: To assess the likely impacts of the project to any recorded Aboriginal sites, objects, places or cultural values, and to develop management recommendations, in consultation with RAPs, consistent with the Code of Practice and the ACHCRs.

2.2 DATE OF ARCHAEOLOGICAL ASSESSMENT

The fieldwork component of this assessment was undertaken by OzArk on Wednesday 29 August 2018.

2.3 ABORIGINAL COMMUNITY INVOLVEMENT

The assessment had followed the ACHCRs. Information regarding the ACHCRs, detailing the main stages, are as follows.

2.3.1 Stage 1: Notification of the development and registration of interest

- Advertisement placed in the Lithgow Mercury by R.W. Corkery & Co. Pty Limited on 15 May 2018 (**Appendix 1**).
- Letter seeking information from government agencies sent on 15 May 2018 (**Appendix 1**[1]). Letters were sent to NTSCORP, Local Land Services, Native Title Tribunal, OEH, Bathurst Local Aboriginal Land Council (LALC) and Lithgow Shire Council.

[1] Please note that **Appendix 1** contains only a sample of each stage letter sent. Should OEH require every letter sent to all agencies and RAPs, OzArk can provide these.

- By the closing date registration of interest concerning this project, 10 groups registered to be consulted as a RAP for the project.
    - Yurrandaali Cultural Services
    - Barraby Cultural Services
    - Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage
    - Mingaan Wiradjuri Aboriginal Corporation
    - Merrigarn
    - Muragadi Heritage Indigenous Corporation
    - Yulay Cultural Service
    - Warrabinga Native Title Aboriginal Corporation
    - Gundungurra Tribal Council Aboriginal Corporation
    - Bathurst LALC

2.3.2 Stage 2/3: Presentation of information about the proposed development and gathering information about cultural significance

On 3 July 2018 RAPs were sent the following documents (**Appendix 1**).

- Cover letter and project overview.
- Background research, predictive modelling and survey methodology.

The following responses to the Stage 2/3 information package were received by OzArk.

- Barraby Cultural Services
    - Written feedback was received stating that Barraby Cultural Services support the methodology for this project.
- Yurrandaali Cultural Services
    - Written feedback was received stating that Yurrandaali supports the methodology for this project.
- Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage
    - Endorsement was received from the methodology recommendations made by OzArk. Murra Bidgee Mullangari also stated that ‘the Lithgow area holds a lot of history for our family, my grandfather and cousins lived and hunted on the land with our great great uncle Neville who was a Wiradjuri’
- Muragadi Heritage Indigenous Corporation
    - Written response stating that the project information and methodology was read and that Muragadi endorse the recommendations made by OzArk.

2.3.2.1 Field survey participation

The following RAPs participated in the fieldwork.

- Colleen Fisk – Bathurst LALC.
- Vaimoana Kengike – Gundungurra Tribal Council Aboriginal Corporation.

2.3.3 Stage 4: Review of draft AHCHAR

A draft copy of the AHCHAR was sent to the RAPs for review and comment on 30 April 2019. Comments were received by one group within the review time period. A second email was sent to the RAPs, who had not responded to the first email, providing another opportunity for comments and feedback on the AHCHAR on 5 June 2019; one additional comment was received. The RAP comments are provided below:

- Muragadi Heritage Indigenous Corporation
    - Written feedback from Anthony, stating: “I have read the project information and draft report for the above project, I agree with the recommendations made by OzArk."
- Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage
    - Written feedback from Darleen Johnson, stating: "I have read the project information and ACHAR for the above project, I endorse the recommendations made. We would also like to be involved in all aspects of the project i.e. surveying and fieldwork."

Copies of the correspondence sent and received for Stage 4 are included in **Appendix 1**.

2.4 OZARK INVOLVEMENT

2.4.1 Field assessment

The fieldwork component of the assessment was undertaken by:

- Archaeologist: Philippa Sokol (OzArk Project Archaeologist, BA and DipScience, University of New England).

2.4.2 Reporting

The reporting component of the assessment was undertaken by:

- Report Author: Philippa Sokol; and
- Reviewer: Ben Churcher (OzArk Principal Archaeologist; BA[Hons], Dip Ed).

3 LANDSCAPE CONTEXT

An understanding of the environmental contexts of a specific study area is requisite in any Aboriginal archaeological investigation (DECCW 2010). It is a particularly important consideration in the development and implementation of survey strategies for the detection of archaeological sites. In addition, natural geomorphic processes of erosion and/or deposition, as well as humanly activated landscape processes, influence the degree to which these material cultural remains are retained in the landscape as archaeological sites; and the degree to which they are preserved, revealed and/or conserved in present environmental settings.

The Heritage Study Area is located within the Hill End subregion (east of the area) and Capertee Uplands subregion (west of the area), within the South Eastern Highlands Bioregion (NPWS 2016). The bioregion represents the plateau and dissected ranges of the Great Dividing Range bounded by the slopes of the inland drainage basins to the west, the Great Escarpment to the east, and the Australian Alps to the south. This region incorporates portions of the Macquarie, Lachlan, Murrumbidgee, and Murray River catchments (NPWS 2016).

3.1 TOPOGRAPHY

Topography of the Bathurst subregion is primarily comprised of a granite basin of rounded hills surrounded by steep slopes (NPWS 2016). As such the topographical features within the Heritage Study Area that would have encouraged past Aboriginal land use and occupation, include:

- the gently sloped and spurred and crest landforms in the northeast and southwest of the Study Area have the potential to contain stone artefact sites and/or the potential as being identified as a landform of cultural significance;
- the landforms nearest the Coxs River have the capability of providing elevated landforms adjacent to water: landforms recognised in the region as having archaeological sensitivity; and
- the potential for outcropping may exist on the Study Area's spurs and crests, which may be a source of raw material procurement for artefact manufacture.

Explanations of the terms used on **Figure 3-2** are in **Table 3-1**. **Table 3-2** quantifies the extent of these landforms specific to the Heritage Study Area and representative photos of the sloping and flatter landforms of the Heritage Study Area are shown on **Figure 3-3**.

Figure 3-1: Map showing the topographical and hydrological features of the Project Site and Heritage Study Area's surrounding landforms.

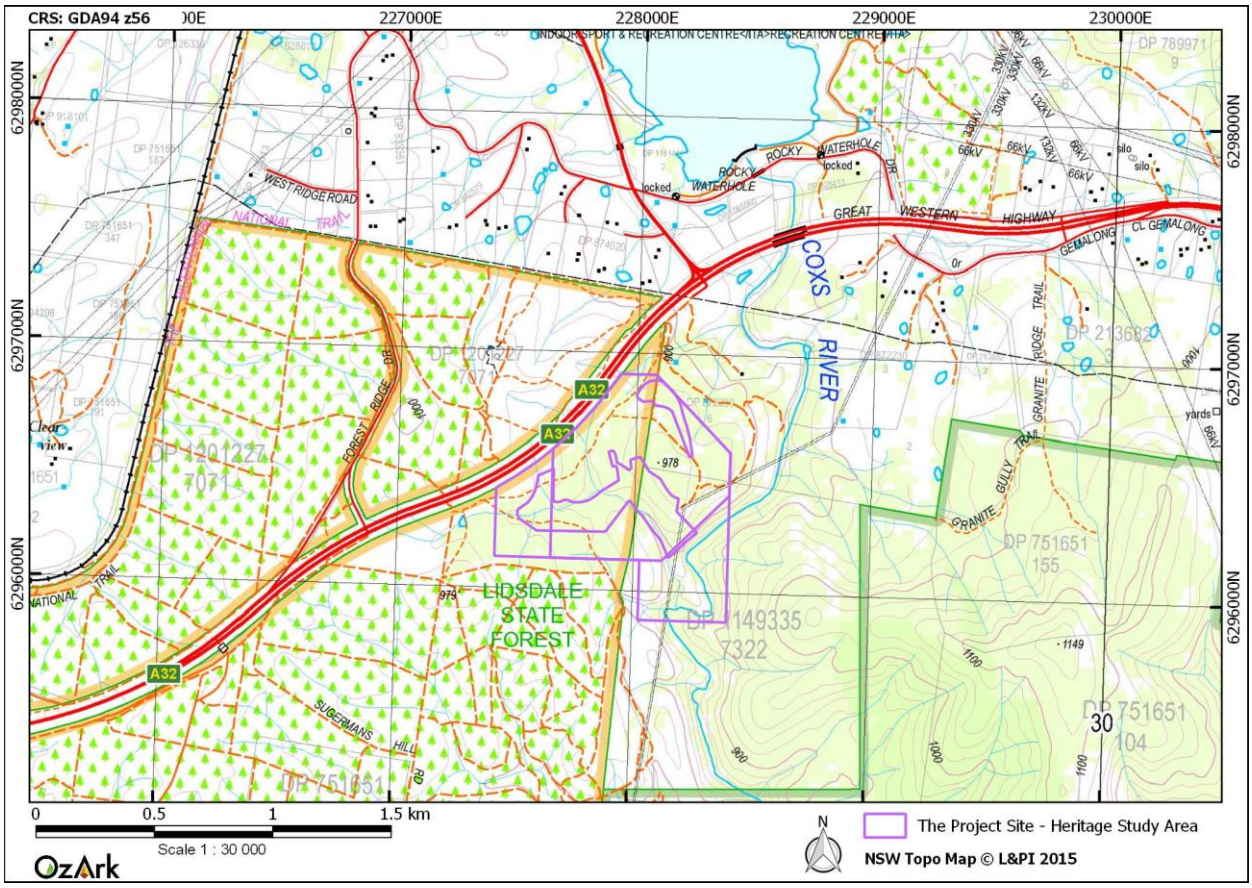


Figure 3-2: Landforms units within the Heritage Study Area.

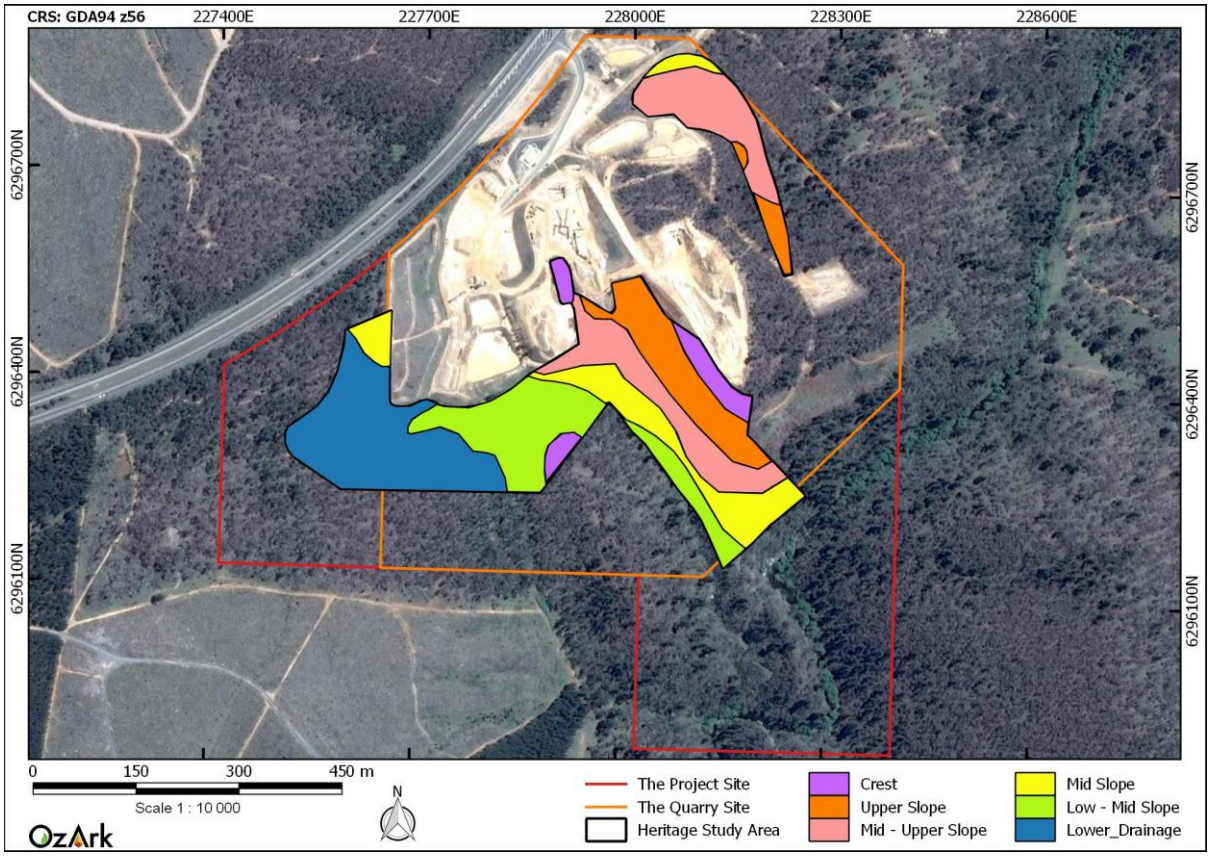


Table 3-1. Landform descriptions of the Heritage Study Area.

Landform	Description
Crest	Raised area with a confined summit.
Upper slope	Sloping land adjoining hill tops or ridges. In the Heritage Study Area upper slopes are very steep between 20° and 25° slope.
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°.
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°.
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°.
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°.

Table 3-2. Summary of key terrain features within the Heritage Study Area.

Total Survey Area	Crest	Upper slope	Mid-upper slope	Mid slope	Low-mid slope	Low-drainage
17.77ha	0.92ha 5.17%	2.57ha 14.46%	4.03ha 22.68%	2.55ha 14.35%	3.38ha 19.02%	4.32ha 24.31%

Figure 3-3: Topography of the Heritage Study Area.

1. View of a lower slope – drainage landform unit within the Heritage Study Area.

2. View of the upper slope and very steep landform unit within the Heritage Study Area.

3.2 GEOLOGY AND SOILS

Understanding land formation processes is an important part of assessing the availability of exploitable resources in the landscape and predicting the ability of that landscape to preserve archaeological material (DECCW 2010).

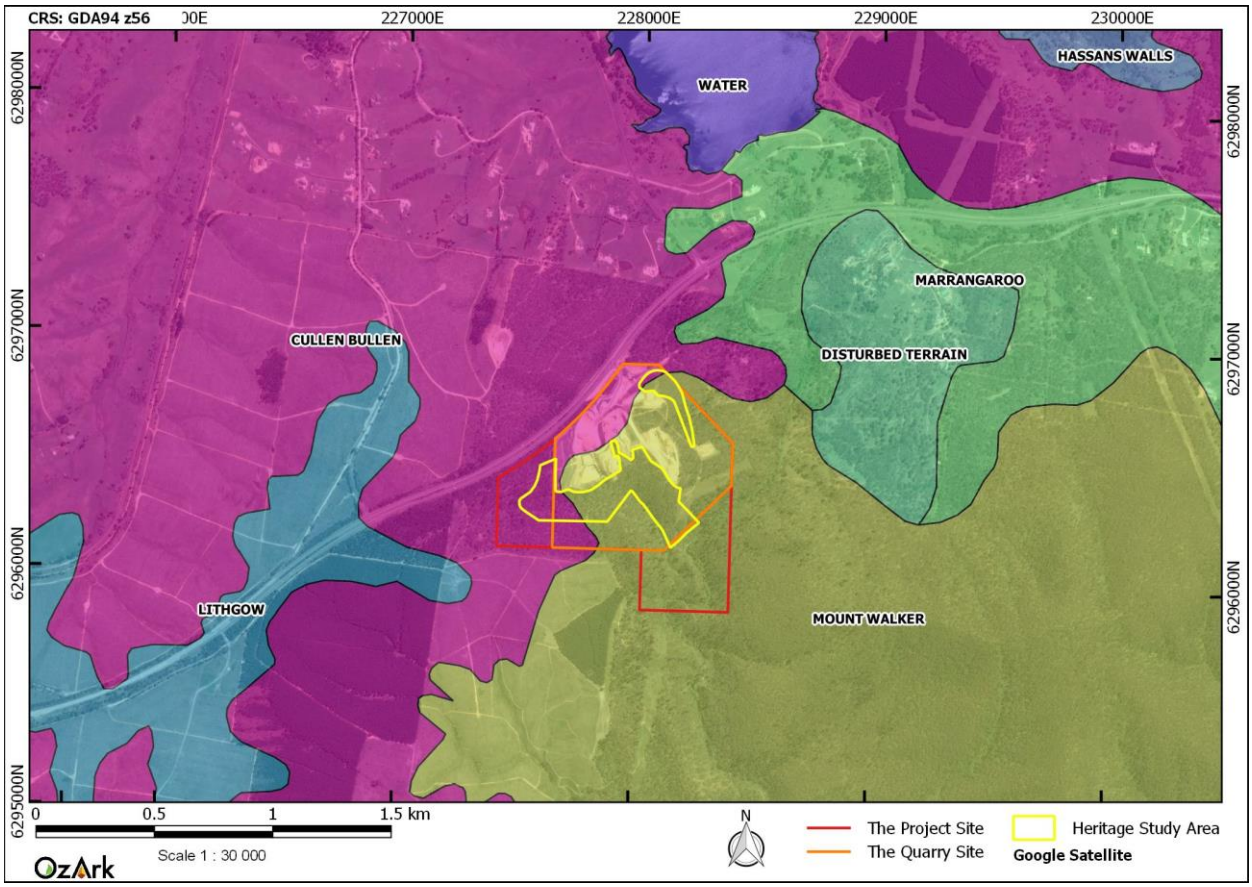
Geology of the Hill End subregion is typically characterised by Silurian and Devonian slates, sandstone and volcanics with numerous quartz veins and Tertiary basalt caps. The Capertee Uplands is primarily characterised by Permian Shoalhaven Group conglomerates, sandstones, and shales with coal at the base of the Sydney Basin. The Heritage Study Area is covered by two

soil landscapes: Mount Walker which occupies the majority in the east and Cullen Bullen which occupies the west of the area (**Figure 3-4**).

Mount Walker soil landscape is characterised by steep to very steep hills with narrow rounded crests, with a local relief of 40–200 metres and elevation of 780–1190 metres. Soils of this landscape are shallow and stony on crests with moderately deep to deep red earths, yellow earths and leached loams on steep side slopes, and yellow podzolic soils on lower slopes near drainage lines. The parent rock primarily represents metasediments of the Upper Devonian Lambie Group comprising massive white quartzites, shales, siltstones, sandstone, impure limestones, claystones and conglomerates (King 1993: 66).

Cullen Bullen soil landscape is characterised by rolling low hills and rises on Illawarra Coal Measures and Berry Formation, with a local relief of <50 metres and elevation of 550–1050 metres. Soils of this landscape are shallow to moderately deep yellow earths on crests, moderately deep yellow leached earths on upper and mid slopes, and moderately deep yellow solodic and yellow podzolic soils on lower slopes near and along narrow drainage lines. The parent rock primarily represents shale, sandstone, conglomerate, limestone, dolomite, claystone, mudstone, coal and torbanite within the Illawarra Coal Measures, and grey siltstone with thin beds of limestone and sandstone within the Berry Formation (King 1993: 79).

Figure 3-4: Map showing the Project Site and Heritage Study Area in relation to soil landscape units (King 1993).



3.3 HYDROLOGY

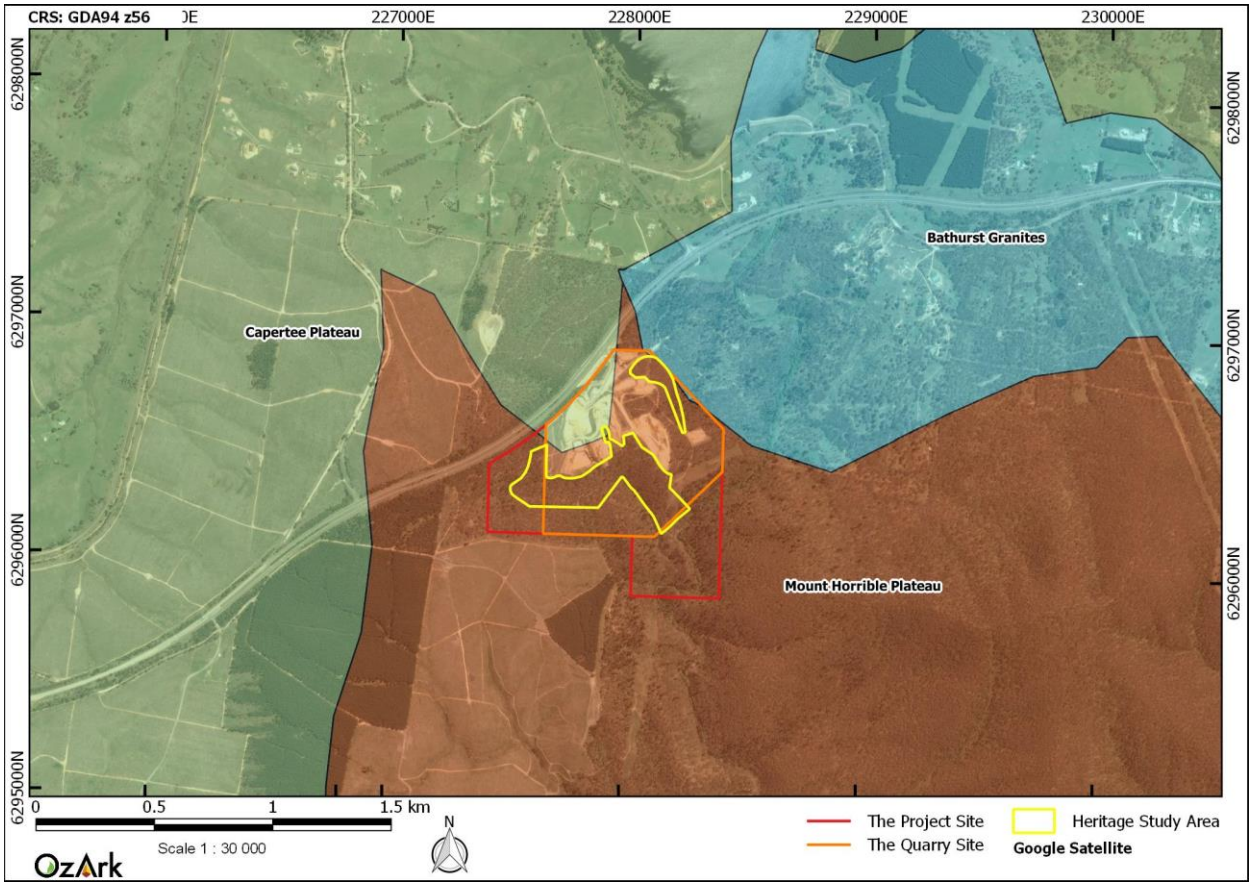
The South Eastern Highlands Bioregion incorporates portions of the Macquarie, Lachlan, Murrumbidgee, and Murray River catchments (NPWS 2016). The primary water source of the landscape immediately surrounding the Project Site is the Coxs River, meandering past the south-eastern boundary of the Project Site at a distance of between 80 and 200 metres. Hydrological resources directly within the Heritage Study Area are limited to first and second order tributaries, and ephemeral drainage lines of the Coxs River (see **Figure 3-1**).

3.4 VEGETATION

Recorded vegetation within the Hill End and Capertee Uplands subregion, of the South Eastern Highlands Bioregion, is largely comprised of Yellow box, Red box and Blakely's red gum with Broadleaved peppermint and White gum on hills and Scribbly gum, Red stringybark, Red box and Broad-leaved ironbark on talus slopes. Shrubby understorey and wallaby grass in common (NPWS 2016). Much of this characterisation is likely to be representative of the landscape pre-1788. According to Mitchell landscape data, the Project Site is situated across three vegetation landscapes: Mount Horrible Plateau; Capertee Plateau; and a small portion of Bathurst Granites in the northeast (**Figure 3-5**). However, the Heritage Study Area is entirely situated within the Mount Horrible Plateau landscape unit, which prior to historical clearing would have supported snow gum on crests above 1000 metres. Red stringybark, Broad-leaved peppermint, Candlebark, Brittle gum and Scattered cypress pine on ridges; Apple and White box with Mountain gum and Stringybark on slopes; and Yellow box, Blakely's red gum, Manna gum and scattered Brown barrel along streams (Mitchell 2002: 134–135). Recent vegetation mapping of the Quarry Site undertaken by Ecoplanning (2019), identified the remnant vegetation as dominated by three Plant Community Types (PCTs):

- PCT 732: Broad-leaved peppermint ribbon gum and grassy open forest.
- PCT 1100: Ribbon gum – snow gum grassy forest on damp flats.
- PCT 1093: Red stringybark, brittle gum, inland scribbly gum dry open forest.

Figure 3-5: Project Site and Heritage Study Area in relation to environmental landscape units.



3.5 CLIMATE

The Bureau of Meteorology (BOM) weather station nearest to the Project Site is located at Mount Boyce in the Blue Mountains, approximately 27 kilometres to the southeast. Climate statistics from Mount Boyce (BOM 2018) indicate that the region experiences a mostly temperate to cool climate with temperatures just above zero during the cooler months. The climate statistics show that the highest mean maximum temperatures are in January (24.1°) and the lowest mean minimum temperatures are in July (2.5°). Rainfall is greatest in February (mean rainfall: 123.7mm) and the lowest in July (mean rainfall: 41.1mm). The average annual rainfall is 972.9mm. As such, the climate of the region would have been suitable for past Aboriginal occupation.

3.6 LAND–USE HISTORY AND EXISTING LEVELS OF DISTURBANCE

Crucial for the preservation of archaeological deposits is the history of past land use in a particular area, particularly the European settlement and associated agricultural practices of a given area. Satellite imagery of the Project Site shows that, while not as extensive as surrounding areas, the immediate landscape has been subject to historical clearing and much of the vegetation represents regrowth. Mature trees are, however, likely to be present. In addition, the previously cleared portions of the Study Area is likely to not have completely removed archaeological

material from the area, though it will have disturbed the upper layers of any archaeological deposits.

3.7 CONCLUSION

An examination of the landforms within the Heritage Study Area indicate that the landforms have undergone a moderate level of clearing and past disturbances associated with the clearing and formation of access roads, fencing and easement corridors. Natural disturbances caused from water wash and erosion would be evident within the steep landforms, particularly the moderately to very steep landform units, where the soils may have been moved from the slopes towards the creek systems. This would have the effect of displacing or impacting on archaeological deposits had they existed in the Heritage Study Area. The lower drainage landforms in the west would additionally be subject to increased water wash and erosion during heavy rain periods leading to increased aggrading and displacement of any archaeological material.

Reference to the landform map (**Figure 3-2**) indicates that the impact to Potential Archaeological Deposits (PADs) will vary depending on the landform in which they may exist. With respect to the landforms within the Heritage Study Area, the following observations can be made.

- Crest landforms have the potential to preserve archaeological deposits, however, the presence of this landform unit within the Heritage Study Area is rather limited. A portion of the crest area lies in the east and south, although situated within approximately 200 metres of the Coxs River. The Coxs River would likely have been the main source of water in the area and is considered substantial enough to sustain occupation over a long period of time. Additionally, this landform represents a degrading environment with soil loss stemming from some vegetation clearing, soil movement and the erosional characteristics of the landscape; that if such sites existed in the past they would have been removed or dissipated.
- Mid – upper slopes are generally moderately to steeply sloped and commonly have very thin soils due to soil loss following clearing and water wash. Intact Aboriginal sites are highly unlikely to be located on the flank of slopes and any objects identified in this environment would be in a secondary context.
- Low – mid slopes are low to moderately sloping and are generally placed at the foot of the steep sloped landforms. In the Heritage Study Area they are commonly associated with the sloped landforms and bank adjacent to drainage lines. As this landform is sloped it is considered to be in a potentially degrading and redeposited environment, as such soil loss would have had an impact on sites had they existed within the landform, and would have caused them to become displaced. Creek systems in this landform type are moderate to low lying and may be unsuitable for long-term occupation should high periods of rain occur.

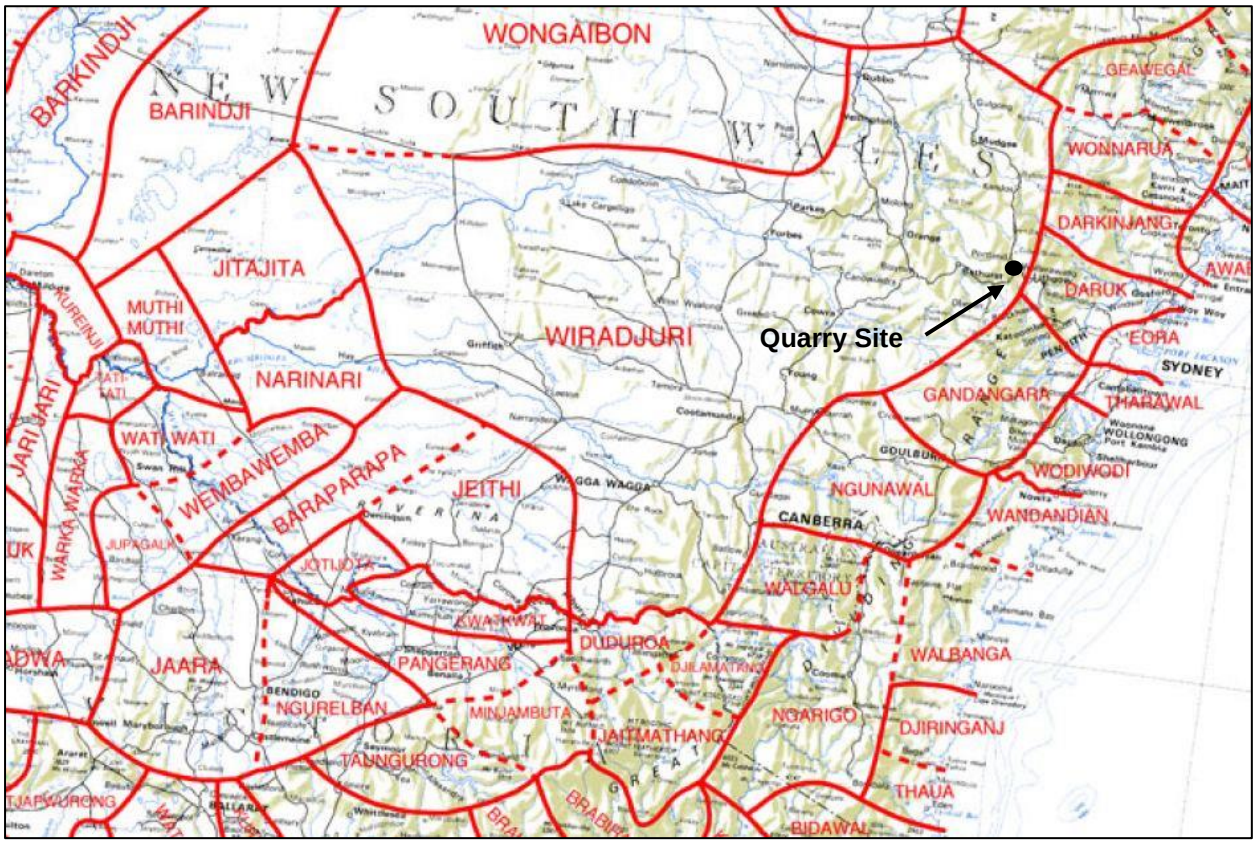
- Lower slopes and drainage are most commonly associated with low lying areas and drainage lines. Should these landforms have adequate elevation above water sources, they would be suitable for camping and the retention of artefacts. These landforms have the potential to retain A-Horizon soils and may contain intact sites, depending on previous levels of disturbance. However, evidence of this occupation may have become obscured or dissipated due to the impact of inundation events and sheet wash in this landform type. The tributaries in the Heritage Study Area are considered to be semi-permanent, and as such, likely only supported short-term occupation resulting in sites with a low artefact density and a low level of site complexity.

4 ABORIGINAL ARCHAEOLOGY BACKGROUND

4.1 ETHNO-HISTORIC SOURCES OF REGIONAL ABORIGINAL CULTURE

According to Tindale (1974), the current Project Site falls within the eastern limits of the lands occupied by the Wiradjuri tribe. However, due to the location of this area at the western base of the mountains it has often been referred to as zone of interaction between the Wiradjuri, the Dharug to the east and the Gundungurra to the south (Bowdler 1983).

Figure 4-1: Location of the Project Site in relation to Tindale (1974).



Although tribal boundaries still retain some uncertainty, it is thought that the Dharug people occupied much of the Sydney area, and west towards the Hawkesbury, Blue Mountains and Nepean District. The Wiradjuri people were the largest language group in New South Wales, with dialects spoken from Coonabarabran in the north, the Murray River to the south, western Blue Mountains in the east and Condobolin in the west. The Gundungurra people lived chiefly in the southern highlands, but reached as far north as western Sydney near Liverpool, west to parts of the Blue Mountains and south to Lake George.

Although separate nations, all three language groups were neighbours and shared certain similarities with other Aboriginal groups in south-eastern Australia. Plants were used for food, as well as in the manufacture of practical items, decorative items and medicines, with some species providing more than one resource. Grass stalks could be used for weaving or producing baskets. Large trees were useful in providing bark and fibres used for the manufacture of tools, containers

and possibly the construction of watercraft. The resin obtained from Grass Trees, for example, were an adhesive that could be used in hafting processes. Bark fibres were twisted into twine which could then be woven into traps, containers or baskets and a variety of wooden tools. Stone was also used for tools (RPS 2014).

The Blue Mountains offered a variety of resources to Aboriginal people, including flora, fauna and stone material. Gunyahs or bark huts were usually made from the broad leafed paperbark, box or stringybark trees and were constructed mostly by women. They were generally located close to a reliable water source or opportunistically situated on trade routes. Rock shelters are common in the Blue Mountains region, and would likely have been occupied periodically as shelter or in association with camp sites. Camp sites were places commonly used for sleeping, eating, tool making, social activity and as a base for hunting and gathering (RPS 2014).

4.2 REGIONAL ARCHAEOLOGICAL CONTEXT

The National Parks and Wildlife Service commissioned Gollan (1987) to undertake a regional study of the Newnes Plateau in order to provide a comprehensive assessment of the archaeological resources of the area and their corresponding regional and local significance. Through this research, a number of regional archaeological patterns based on the relationship between site types and land use were identified. Gollan concluded that the overall plateau area provided suitable resources for Aboriginal occupation. Gollan proposed that artefact scatters (and isolated finds) are likely to be found on fringes of swamps, as lithic material and food resources were available in these areas. There was also evidence of the grinding of stone artefacts with several grinding groove sites and ground edge artefacts recorded. Shelters with art were also present in areas of the plateau where suitable rock types such as pagodas and interbedded sandstone and claystone rock outcrops were found. Gollan considered the plateau to be a landform of high scientific and social significance based on the diversity of Aboriginal cultural heritage sites, including the forested upland areas with having the potential to have provided substantial archaeological resources for an upland hunter gatherer economy (Gollan 1987).

Oral histories of recorded of Aboriginal people in the area were noted to have been recorded by a resident of nearby Lidsdale, Fay Hasler (reproduced in part in Kelton 2002: 12–13), which are held by the Lithgow and District Family Historical Society. The salient points derived from these notes are as follows.

- A large Aboriginal settlement is described as being located at Pipers Flat, with the burial ground being located at Lidsdale.
- The Pipers Flat Aboriginal group would regularly travel to Richmond to fight the local Aboriginal communities and bring back women to combat in-breeding.
- The communities occupying the valleys in the area were wiped out by disease including measles and small pox.

Interviews with Fay Hasler during March and May 1999 (Gay 1999) indicate that the burial ground at Lidsdale was located on the river flats either side of Coxs River. It is noted that the colliery railway line was constructed through this area in the 1920s, and further disturbance would have affected this area during the Coxs River realignment in the 1950s (Gay 1999: 15).

Gay (1999: 16) also notes an historical reference to the burial of an Aboriginal Elder in the Wallerawang area. King Myall (Mylles) had worked for James Walker who had been granted land in the Wallerawang and Lidsdale districts during the 1820s. The burial site of King Myall was drawn and published in the Sydney Illustrated News in October 1880, showing a burial mound and carved trees. This may be part of the burial ground referred to by Fay Hasler (Gay 1999: 16).

4.3 LOCAL ARCHAEOLOGICAL CONTEXT

4.3.1 Previous archaeological surveys

There have been a small number of archaeological investigations in the local and regional area; of note, is the archaeological study undertaken by Silcox (2000) over the land currently operating as the Quarry. The results of the investigations summarised below provide the basis for an archaeological context for the current assessment and were used in the preparation of a predictive model for Aboriginal site location (**Section 4.4**). This section refers to the archaeological assessments and investigations that were undertaken in the region of the Heritage Study Area.

4.3.1.1 Archaeological survey: Proposed Springvale Colliery and Conveyor, Wallerawang (Rich and Gorman 1992).

In 1992, a survey by Rich and Gorman (1992) recorded 35 sites, including two open sites, Sites 2 and 9, situated in the Cox's River Valley. Site 2, located on the southern bank of Pipers Flat Creek, consisted of over 100 artefacts within a 200 x 40 metre (m) area. Two quartz knapping floors with artefact densities of over 25/m^2 were identified at Site 2 as were a smaller number of indurated mudstone artefacts. Site 9, located c. 700 m west of Duncan street, on elevated terrain above and on the west side of the Cox's River, was comprised of 26 artefacts, primarily quartz, with a maximum artefact density of 6/m^2. As a result of this study, Rich argues that the larger sites within her study area lie closest to the Cox's River and Pipers Flat Creek.

4.3.1.2 Archaeological survey, salvage and test excavation: Augmentation works at Lyell Dam (Barton and McDonald 1995; Gay 1999).

Lyell Dam, situated in the Coxs River catchment, was formed by damming the Coxs River. Three open sites located on the slopes of spurs overlooking the Coxs River floodplain were investigated here in 1994, prior to raising the water level in the lake. All three sites were situated c. 400 m from the river margin (Gay 1999: 14).

At open site Lyell Dam 3 (LD3) a quartz block fractured knapping floor was found. Although the assemblage was dominated by quartz, other raw materials such as indurated mudstone and stone of volcanic origin was also present. In terms of surface manifestations of this site, the highest artefact density recorded was 3/m^2, with most sample areas showing lower densities (Barton & McDonald 1995: 25). The excavated assemblage, however, was far larger, with estimated thousands of artefacts present at this location. Barton & McDonald (1995: 35) interpreted this site as being repeatedly occupied by people carrying out the same range of tasks.

Conclusions of the Lyell Dam site investigation project can be summarised as follows (from Barton & McDonald 1995: 67 as summarised in Gay 1999: 15):

- Cobbles of igneous, metamorphic and sedimentary rocks were procured locally, primarily from the bed of the Coxs River;
- Quartz was locally available and the ease with which it was procured eliminated the need to flake using the bipolar technique;
- Quartz was used to create medium sized flakes and some smaller retouched tools;
- Volcanic stone was used to create large or heavy tools; and
- All three sites were interpreted as representing repeated short-term occupation areas that focussed on acquiring resources such as specific plants or animals endemic to the swampy margins of the Coxs River.

4.3.1.3 Archaeological test excavation: Springvale coal project (McIntyre 1993).

In 1993, McIntyre carried out test excavation to investigate the possibility of an Aboriginal burial area being located close to the Springvale coal project (McIntyre 1993). Oral history from a local informant provided primary data for the location of the burial ground. During this work two areas were tested, one on the west side of the railway line and the second along the area proposed as a flood mitigation embankment. This second area, thought to be on the east side of the current river alignment, was tested using auger holes only. No skeletal remains were uncovered during these excavations, although a minor open site was identified on the west side of the railway line (#45-1-0237), where stone tools were said to have been manufactured or repaired. This site was assessed as having low scientific significance. McIntyre concluded that the reported burial ground may have been destroyed during the Cox's River deviation works in the 1950s, although there is still the possibility that skeletal material may occur east of the railway and river. She further notes that the presence of artefacts within the level ground adjacent to the river indicates the potential this landscape unit has for the occurrence of Aboriginal sites (McIntyre as reported in Gay 1999: 16–17).

4.3.1.4 Archaeological survey: Wallerawang and Marrangaroo (Kelton 1999, 2000).

In 1999 and 2000, Kelton undertook surveys in the Wallerawang and Marrangaroo areas respectively. Of the seventeen sites recorded at Marrangaroo, the majority were rock shelter sites, as most of the study area was within the sandstone escarpment. Kelton notes that the location and nature of sites recorded conforms to the generally accepted site prediction principles for the region, primarily the presence of precipitous sandstone geology and the proximity of permanent water sources (Kelton 2000: 101).

4.3.1.5 Archaeological assessment: Proposed hard rock quarry, Wallerawang (Silcox 2000).

Silcox (2000) was engaged to undertake the Aboriginal archaeological values and assessment over an area of approximately 10 hectares as part of the assessment of the original Quarry proposal, immediately north and south of the current Heritage Study Area (**Figure 1-2**). In addition to the assessment for the Quarry, the assessment also included a proposal for associated facilities such as: an amenities block; carpark and service area; a feed stockpile; a crushing and screening area; and a product stockpile.

During the field assessment one Aboriginal archaeological site, WQ1, was identified (see **Figure 4-2**). The site was observed as an eroding open artefact scatter to the north of the existing Hoskins Quarry and on the mid sloped, spurred landform of an ephemeral tributary of the Coxs River which is located approximately 500 metres to the southeast. Although Silcox identified the site to be highly eroded, he also assessed the site to have potential heritage significance and the possibility of subsurface archaeological deposits. A total of 22 artefacts were identified at the site on an eroded exposure and an unsurfaced vehicle track. Silcox (2000) noted that several artefacts were identified as partially buried in the surface sediment; however, it was unclear whether they were eroding out of *in situ* deposit or out of redeposited sediment. Silcox considered that the site was more extensive than what was apparent at the time.

4.3.1.6 Lidsdale, Site #45-1-2574

Test excavation of two PADs was undertaken by OzArk (OzArk 2003) in February 2003 in the face of potential impacts from the realignment of the Castlereagh Highway at Lidsdale, NSW.

These PADs, located on terraces above the Coxs River, had been identified by Gay (1999) and were recorded as PAD1 (#45-1-2573) and PAD2 (#45-1-2574). The results of the test excavation indicated the presence of an extensive open site with low to moderate artefact densities. The test excavation revealed that a variety of activities appear to have been carried out on the site, evidenced by the presence of hammers/anvils for on-site stone tool production or food preparation. The systematic flaking of stone was carried out at several locations across the site, with one discrete knapping event, associated with a stone feature, showing the manufacture of

backed artefacts (specifically bondi points). Pits showing deeper soil profiles, mainly located in the area of PAD2, also revealed preliminary evidence for possible stratification, and higher artefact densities in this part of the site may indicate repeated occupation. Quartz was the predominant raw material, although silicified tuff apparently increases in incidence in the upper portion of the profile. The excavated test pits revealed soil profiles indicative of an intact site with good structural integrity.

On the basis of the text excavation results, PAD2 was assessed as being of high Aboriginal significance and moderate to high archaeological significance. It was considered to have the potential to provide data on a range of archaeological questions, including:

- Whether the site showed evidence of use as a transient camping location for a specific activity or, was repeatedly occupied through time;
- Possible changes through time in the use of various raw materials and stone tool production, and the technological strategies that underpin these factors; and,
- Whether the site exhibited spatially discrete activity areas.

Consequently, it was recommended that #45-1-2574 was worthy of salvage excavation prior to any further impacts.

Salvage excavations were completed on the 18th July 2003 under Consent to Destroy Permit #1666.

The salvage excavation (OzArk 2004) showed that Lidsdale PAD2 (# 45-1-2574) is a large and complex site. The site showed internal spatial variation in lithic assemblages. The deeper soil in Area I was found to have retained some cultural stratigraphy: the lithic assemblages from spits 1, 2 and 3+4 differing and showing change over time. Areas II and III were excavated in locations with more shallow soils, but the lower spits also retain slight variations in the frequencies of different raw material types, suggesting that early occupation of the site may have been widespread, not just confined to the area of deeper soils.

Excavation of this site has been quite extensive with a total of 132m^2 excavated as part of the salvage work, and an additional 22m^2 excavated during the test excavation phase: a total of 154m^2 of excavation. Almost 6,100 artefacts were recovered. Additional monitoring of the site during construction works provided an additional 441 artefacts.

The key features of the Lidsdale assemblages were:

- Raw materials varied across the site. In Area I quartz was strongly predominant (76%), less predominant in Area II (52%) and a minor material in Area III (17%). Silicified tuff was not uncommon in Area I (20%), much more frequent in Area II (43%) and relatively rare in Area III (9%). Silcrete, and a material which appears to vary between quartzite and silcrete, occurred very rarely in Area I (just 1 artefact comprising <0.1%), a little more frequent in Area II (2.6%) and it dominated the assemblage from Area III (68%).

- Quartz occurs as large pebbles & cobbles, one artefact weighed 373g and three others between 150g and 166g. The large size of quartz artefacts contrasts regionally with smaller quartz pebbles found in the sandstones and conglomerates of the Narrabeen formation which forms the surrounding sandstone country.

- Non-local materials, particularly silicified tuff and silcrete, and probably also other fine-grained siliceous (FGS) materials, were also taken to the Lidsdale site. Together, these materials made up 40% of the artefacts recovered, indicating the importance of non-local stone.

- The imported silcrete, and much of the imported silicified tuff was used for systematic flaking and backed artefact production (knapping floors). These materials may have augmented local quartz, which was also sometimes used for these kinds of lithic activities. The FGS materials were used for limited flaking events.

- Backed artefacts were not uncommon on the site, making up 2.4% of the assemblage overall, and c. 2% of the assemblages from spits 1 and 2 in Area I. The backed artefacts varied in shape and size. One from Area II (and another from the monitoring) appears to have been used as a steep-edged tool ("scraper") at one end.

- An array of retouched and/or used flake tools were recovered, one of quartz with a rare dentate worked edge.

- An igneous broken flake had a bifacially ground edge. This is not an overly large artefact (just 3–3.5cm in size and 9.0g in weight), and while bifacial grinding occurs more often on cobbles as edge-ground hatchets (or on a ground-edge adze that was found at Lyell Dam site LD3 [Barton & McDonald 1995: 27]), edge-grinding on a flake of this size was noted as rare.

- Several hammers and anvils were also recovered.

- Change over time was evident within Area I. The assemblage from the lower spits 3 and 4 appeared to be of Pre-Bondaian age. It lacked backed artefacts and lacked evidence of asymmetric alternating flaking: no cores showing this flaking pattern and no faceted platforms were recovered from these spits. This Pre-Bondaian assemblage is dominated by quartz, and has higher frequencies of quartzite and igneous artefacts than more recent assemblages. The assemblage also includes two hammers and no bipolar artefacts.

- The assemblage from spits 1 and 2 both included backed artefacts, cores showing asymmetric alternating platforms and debitage with faceted platforms. Both assemblages are dominated by quartz, but silicified tuff is more frequent in spit 1 than in spit 2. A few bipolar artefacts occurred in spit 2. A piece of utilised pigment was also found in spit 2.

- Deeper sediments from the site (Area I square 35E 118N) have been dated using Optically-Stimulated Luminescence dating. The sample 30cm depth was 7,400+700 years before 2000 AD and sample 45cm depth was 13,500+1,000 years before 2000 AD. While these age determinations do not directly date the lithic assemblages they suggest a time frame consistent with other early dates from sites in the region (from c. 6,000–14,000 years before present) such as Kariwara sites 22 and 35, Capertee 3 and Noola, Bobadeen 1, Horseshoe Falls and Lyre Bird Dell.

As a result, no other site in the Lidsdale–Wallerawang area has been investigated in a manner comparable to site #45-1-2574.

4.3.2 Desktop database searches conducted

A desktop search was conducted on the following databases to identify any potential previously-recorded heritage within the Project Site and the Heritage Study Area. The results of this search are summarised in **Table 4-1** and presented in detail in **Appendix 2**.

Table 4-1: Aboriginal heritage: desktop-database search results.

Name of Database Searched	Date of Search	Type of Search	Comment
Commonwealth and National Heritage Listings	8/10/2018	NSW and Lithgow City Council LGA	No places listed on either the National or Commonwealth heritage lists are located within the Project Site or Heritage Study Area.
National Native Title Claims Search	8/10/2018	NSW	One Native Title Claim has been identified over the area of the Project Site. One Deed of Agreement identified over the Project Site.
OEH AHIMS	27/6/2018	10 x 10 km centres on the Project Site	48 sites within the search area. No sites in the Heritage Study Area. One site – WQ1 AHIMS #45-1-2802 within the Project Site.
Local Environment Plan (LEP)	8/10/2018	Schedule 5 and maps of Lithgow LEP of 2014	No places listed on either the National or Commonwealth heritage lists are located within the Project Site or Heritage Study Area.

4.3.2.1 Native Title Claim

As per **Table 4-1**, it is noted that the Project Site is situated on land that falls under a Native Title Claim (*NC2017/001, NSD857/2017, Warrabinga-Wiradjuri #7*). The proponent has sought title advice from Hetherington Exploration & Mining Title Services and legal opinion from Hickson's Lawyers who advise that as the Project Site and Heritage Study Area fall within ML 1633 and Exploration Lease (EL) 4473, both of which are situated within Travelling Stock Reserve (TSR) 70. As such, the investigations by Hetherington (2018), supported by Hicksons Lawyers, determined that the Native Title Rights over the ground subject to TSR 70 were fully extinguished upon notification of the reservation of portion No. 70 in the Cook County Parish of Lidsdale on 23 September 1879.

4.3.2.2 Walker Quarries – Deed of Agreement

A Deed of Agreement was established between Walker Quarries Pty Limited and Gundungurra Tribal Council Aboriginal Corporation (who previously held a Native Title Claim over the Project Site). The Deed was formed in October 2007. The term of the Deed is states that it expires upon completion of the mining project.

4.3.2.3 AHIMS search results

A search of the AHIMS database was undertaken for a 10 x 10 kilometre area centred on the Project Site. A total of 47 previously recorded Aboriginal sites were returned in the search, with no previously recorded sites identified in the Project Site or the Study Area (**Figures 4-2** and **4-3**; and **Table 4-2**).

OzArk (2018) undertook a ground-truth assessment of an Aboriginal artefact scatter site (WQ1) identified and recorded by Silcox (2000). By undertaking the AHIMS search, it was identified that WQ1 had not previously been entered on the AHIMS database (as Site #45-1-2802). It is since being updated on the AHIMS database and has been included in **Table 4-2,** changing the total count of registered Aboriginal sites in the search area to 48.

Table 4-2: AHIMS search results and frequency.

Site type	Frequency
Artefact/s (unspecified number)	6
Artefact-PAD	1
Axe Grinding Groove	2
Axe Grinding Groove-Rock Engraving	1
Axe Grinding Groove-Shelter with Art-Shelter with Deposit	2
Axe Grinding Groove-Shelter with Deposit	2
Burial/s	1
Burial/s-Carved Tree	1
Isolated Find	4
Open Camp Site	23
PAD	2
Scarred Tree	1
Shelter with Art-Shelter with Deposit	1
Shelter with Deposit	1
Total	**48**

Of the 48 sites identified, the majority occur within 200 metres of a watercourse. These sites are typically artefact scatters and isolated finds identified on eroding creek banks, spurs and elevated flat areas overlooking watercourses. Rock shelters and grinding grooves have a moderate occurrence in the search area, primarily within landforms containing escarpments and outcropping rock. Additionally, PADs are more likely to be identified within such elevated landforms.

Two AHIMS sites #45-1-2573 and #45-1-2574 have previously been issued with determined permits and were subject to test excavation. As a result, the status of these sites has been updated: AHIMS #45-1-2573 (destroyed) and #45-1-2574 (partially destroyed). Additionally, the status of AHIMS #41-1-0238 has been updated to ‘deleted’ and is likely a duplicate of valid AHIMS site #45-1-2583 (**Appendix 2**).

The results of previous investigations summarised in **Section 4.3.1**, and the summary of previously recorded sites in **Table 4-2**, would suggest that:

- the most common site type will be stone artefact sites; either low density artefact scatters or isolated finds;
- culturally modified trees are rare due to the level of historical clearing yet they may be present;
- PADs may be recorded where there are undisturbed deposits on elevated landforms above permanent water sources;
- site types such as rock shelters with art and deposit, and grinding grooves are identified in the search area and are generally associated with landscape features such as suitable outcropping rock and overhangs, and rock platforms containing good quality sandstone suitable for sharpening stone tools; and
- burials are uncommon and have been previously recorded in areas with less ground disturbance and with more suitable landscape features than those of the Heritage Study Area.

Figures 4-2 and **4-3** illustrates the spatial patterning of AHIMS recorded sites.

Figure 4-2: AHIMS #45-1-2802 (WQ1) in relation to the Project Site and Heritage Study Area.

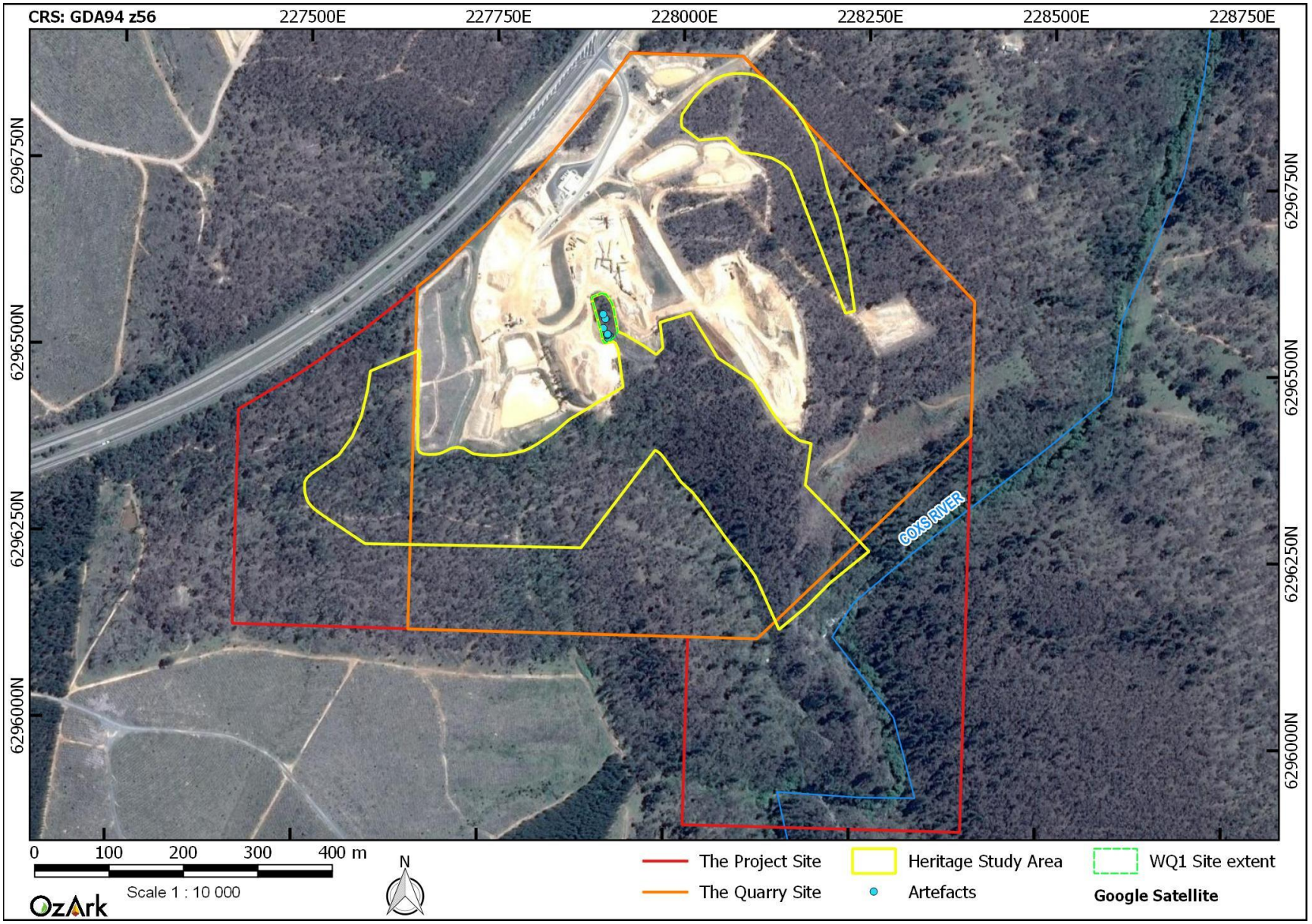
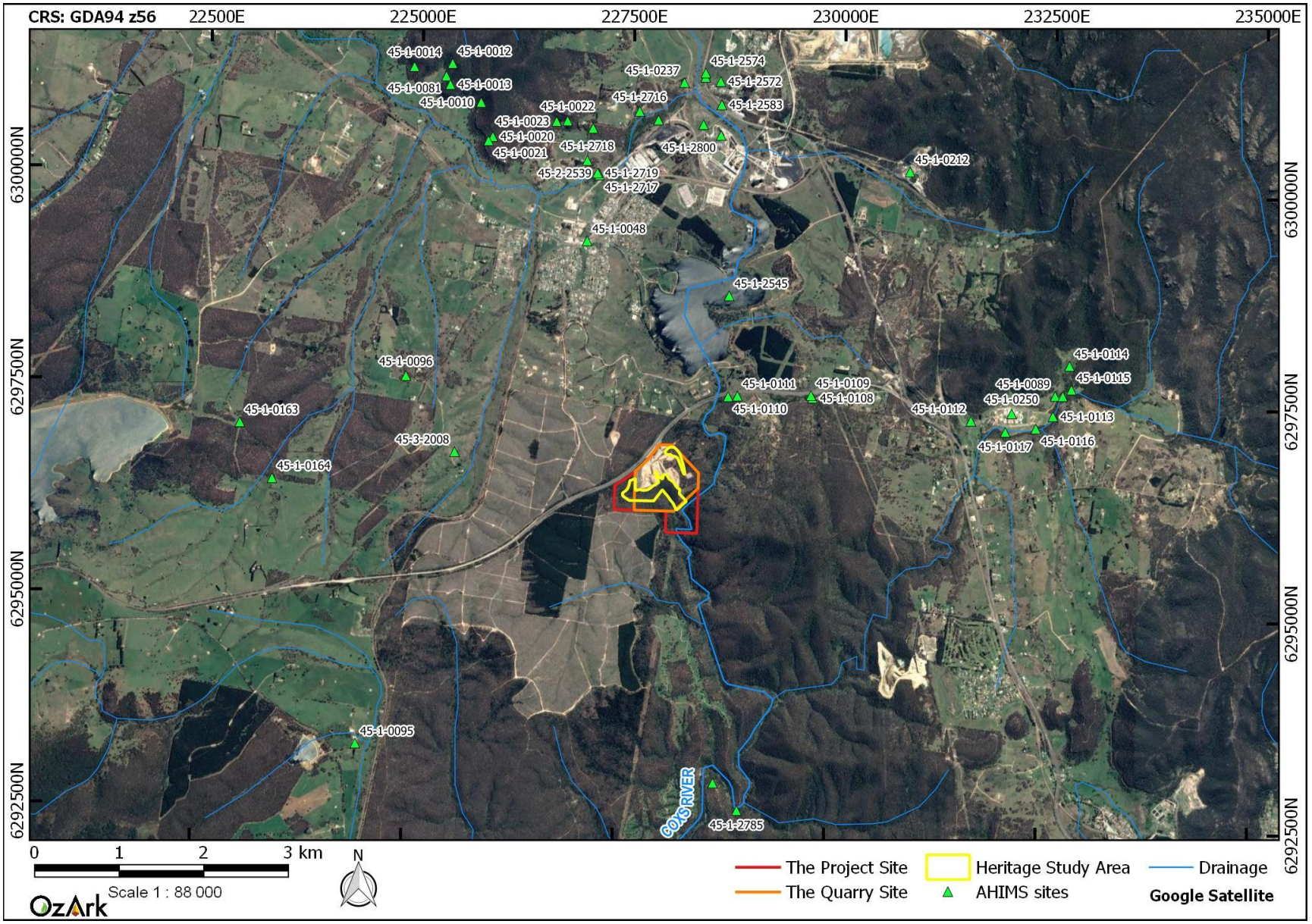


Figure 4-3: Project Site and Heritage Study Area in relation to the recorded AHIMS sites.



4.4 PREDICTIVE MODEL FOR SITE LOCATION

Across Australia, numerous archaeological studies in widely varying environmental zones and contexts have demonstrated a high correlation between the permanence of a water source and the permanence and/or complexity of Aboriginal occupation. Site location is also affected by the availability of and/or accessibility to a range of other natural resources including: plant and animal foods; stone and ochre resources and rock shelters; as well as by their general proximity to other sites/places of cultural/mythological significance. Consequently sites tend to be found along permanent and ephemeral water sources, along access or trade routes or in areas that have good flora/fauna resources and appropriate shelter.

In formulating a predictive model for Aboriginal archaeological site location within any landscape it is also necessary to consider post-depositional influences on Aboriginal material culture. In all but the best preservation conditions very little of the organic material culture remains of ancestral Aboriginal communities survives to the present. Generally it is the more durable materials such as stone artefacts, stone hearths, shell, and some bones that remain preserved in the current landscape. Even these however may not be found in their original depositional context since these may be subject to either (a) the effects of wind and water erosion/transport—both over short and long time scales—or (b) the historical impacts associated with the introduction of European farming practices. Scarred trees, by their nature, may survive for up to several hundred years but rarely beyond.

Knowledge of the environmental contexts of the Heritage Study Area and a desktop review of the known local and regional archaeological record, the following predictions are made concerning the probability of those site types being recorded:

- Isolated finds may be indicative of: random loss or deliberate discard of a single artefact, the remnant of a now dispersed and disturbed artefact scatter, or an otherwise obscured or sub-surface artefact scatter. They may occur anywhere within the landscape but are more likely to occur in topographies where open artefact scatters typically occur.
    - As isolated finds can occur anywhere, particularly within disturbed contexts and landforms that have been subject to extensive land use, it is predicted that this site type could be recorded within the Heritage Study Area.
- Open artefact scatters are here defined as two or more artefacts, not located within a rock shelter, and located no more than 50 metres away from any other constituent artefact. This site type may occur almost anywhere that Aboriginal people have travelled and may be associated with hunting and gathering activities, short or long term camps, and the manufacture and maintenance of stone tools. Artefact scatters typically consist of surface scatters or sub-surface distributions of flaked stone discarded during the manufacture of tools, but may also include other artefactual rock types such as hearth and anvil stones. Less commonly, artefact scatters may include archaeological stratigraphic features such as hearths and artefact concentrations which relate to activity areas. Artefact density can vary considerably between and across individual sites. Small ground exposures revealing

low density scatters may be indicative of background scatter rather than a spatially or temporally distinct artefact assemblage. These sites are classed as 'open', that is, occurring on the land surface unprotected by rock overhangs, and are sometimes referred to as 'open camp sites'.

Artefact scatters are most likely to occur on level or low gradient contexts, along the crests of ridgelines and spurs, and elevated areas fringing watercourses or wetlands. Larger sites may be expected in association with permanent water sources.

Topographies which afford effective through-access across, and relative to, the surrounding landscape, such as the open basal valley slopes and the valleys of creeks, will tend to contain more and larger sites, with camp sites mostly evidenced by open artefact scatters.

  - The Heritage Study Area encompasses a number of spur/crest features and moderate to steep slopes within proximity to the Coxs River. One previously recorded Aboriginal site, WQ1, exists within the Project Site, and given the presence of a named water source within the vicinity (**Figure 3-1**), further manifestations of this site type are considered possible. Consideration will need to be made in regards to the past agricultural and recent industrial practices in the area and if this would indicate the potential for artefact scatters to have become displaced. Given past land use such as historical vegetation clearing and associated agricultural practices, should artefact scatters exist, they most likely have a low artefact density and a low complexity of tool types.

- Aboriginal scarred trees contain evidence of the removal of bark (and sometimes wood) in the past by Aboriginal people, in the form of a scar. Bark was removed from trees for a wide range of reasons. It was a raw material used in the manufacture of various tools, vessels and commodities such as string, water containers, roofing for shelters, shields and canoes. Bark was also removed as a consequence of gathering food, such as collecting wood boring grubs or creating footholds to climb a tree for possum hunting or bark removal. Due to the multiplicity of uses and the continuous process of occlusion (or healing) following removal, it is difficult to accurately determine the intended purpose for any particular example of bark removal. Scarred trees may occur anywhere old growth trees survive. The identification of scars as Aboriginal cultural heritage items can be problematical because some forms of natural trauma and European bark extraction create similar scars. Many remaining scarred trees probably date to the historic period when bark was removed by Aboriginal people for both their own purposes and for roofing on early European houses. Consequently the distinction between European and Aboriginal scarred trees may not be clear.

  - Due to the historical clearance of trees from within the Project Site, and partially within the Heritage Study Area, and the rarity of this site type at a regional level, the likelihood of recording culturally modified trees is considered moderate to low. A field survey is necessary, however, to determine the extent to which local vegetation represents old growth trees or regrowth.

- Quarry sites and stone procurement sites typically consist of exposures of stone material where evidence for human collection, extraction and/or preliminary processing has survived. Typically these involve the extraction of siliceous or fine grained igneous

and meta-sedimentary rock types for the manufacture of artefacts. The presence of quarry/extraction sites is dependent on the availability of suitable rock formations.

  - This site type could be recorded within the Project Site should ground visibility exposing suitable rock outcrops, such as granite, hornfels, sandstone and quartzite, be available.

- Grinding grooves are typically present within landforms associated with reliable water and suitable outcropping sandstone along creek lines and may be found near to rock shelters. The presence of fine-grained uniform sandstone is the preferable material type for these sites to occur.

  - This site type could be recorded in the Heritage Study Area should the creek lines present contain suitable sandstone rock platforms.

- Rock shelters are generally identified in landforms that contain cliff faces, pagodas and exposed sandstone outcrops or large boulders. Commonly rock shelters are discovered as a result of outcropping sandstone along creek lines, in gorges, escarpments and slopes.

  - The site type has the potential to be recorded in the Heritage Study Area should suitably sized rock outcrops and overhangs be available.

- Burials are generally found in soft sediments such as aeolian sand, alluvial silts and rock shelter deposits. In valley floor and plains contexts, burials may occur in locally elevated topographies rather than poorly drained sedimentary contexts. Burials are also known to have occurred on rocky hilltops in some limited areas. Burials are generally only visible where there has been some disturbance of sub-surface sediments or where some erosional process has exposed them.

  - Although it is possible that this site type could be found within the Heritage Study Area, it is considered a rare site type especially given the disturbance that has occurred across the landforms and the types of landforms present which are generally associated with thin A-Horizon soils.

5 RESULTS OF ABORIGINAL ARCHAEOLOGICAL ASSESSMENT

5.1 SAMPLING STRATEGY AND FIELD METHODS

Standard archaeological field survey and recording methods were employed in this study (Burke & Smith 2004). The archaeological methods used in the Aboriginal archaeological assessment followed the Code or Practice and the proposed survey methodology which was sent to RAPs for review and comment. The Heritage Study Area was assessed using pedestrian transects, traversing all characterising landforms types. The surveyors were spaced apart at a distance variable with the landform types, degree of slope, inaccessibility (steeply incised drainage lines and unstable ground), and past disturbances. Although all landform types were inspected in order to characterise the landforms within the Heritage Study Area, the average transect width ranged from approximately 10 metres to 30 metres.

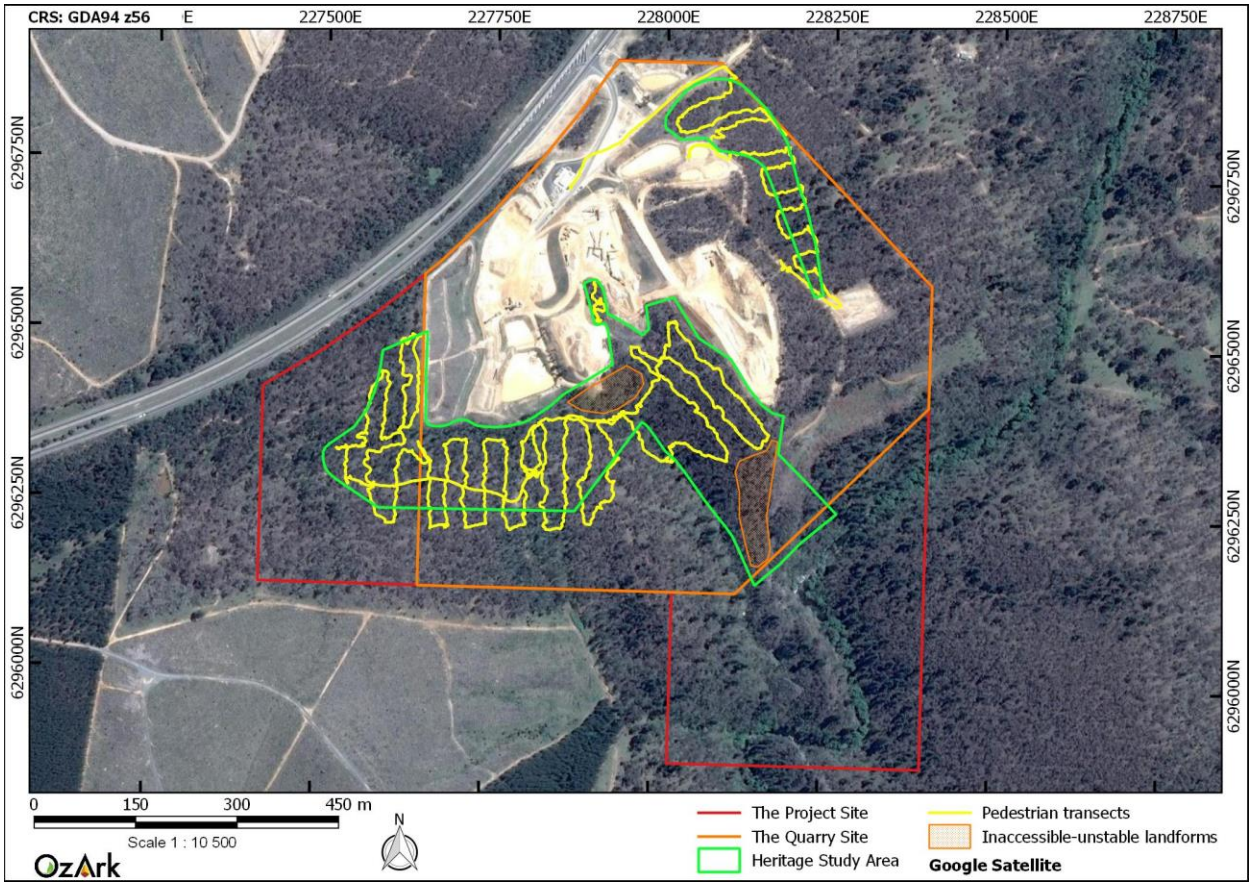
The field survey included:

- pedestrian survey of the Heritage Study Area. A vehicle was used to access the area and not as a means of inspecting the area;
- targeted and more focused inspections of areas of good ground surface visibility (GSV) and areas where the ground surface had been previously disturbed were identified, as these were areas of heightened exposure with an increased potential of revealing surface artefacts;
- ground exposures that presented a surface scatter of stone material, especially likely raw materials, were targeted for more focused inspection;
- landforms and banks associated with the tributaries of the Coxs River were more closely inspected as these are classified as landform features of increased archaeological potential; and
- all mature, native trees existing within the Heritage Study Area, with the potential to contain Aboriginal cultural scarring were inspected.

The RAPs assisted the archaeologist by alerting them to areas and features of interest. A located feature was then more closely examined and required details were recorded. Features were recorded using digital photography and by GPS (global positioning system) units with Mobile Mapper software and were described on field recording sheets. General notes pertaining to the survey and ground covered by the archaeologist were kept as well.

Figure 5-1 illustrates the pedestrian coverage of the Heritage Study Area. It should be noted that the below figure only displays the recorded transects of one surveyor although the Heritage Study Area was assessed by three surveyors in pedestrian transect format. Additionally, some of the landforms were inaccessible due to a high level of disturbance, unstable ground and degree slope not considered safe to traverse. These areas are indicated on **Figure 5-1**.

Figure 5-1: The Heritage Study Area showing pedestrian survey transects.



5.2 PROJECT CONSTRAINTS

The majority of the Heritage Study Area presented no significant constraints in completing the archaeological assessment. The levels of available ground surface exposure (GSE) across the area presented a level of constraint during the field survey (**Section 5.3**). Although the greatest constraints identified were those areas that presented very steep and unstable ground and those areas where works associated with the existing quarry operations had occurred.

5.3 EFFECTIVE SURVEY COVERAGE

Two of the key factors influencing the effectiveness of archaeological survey are ground surface visibility (GSV) and ground surface exposure (GSE). These factors are quantified in order to ensure that the survey data provides adequate evidence for the evaluation of the archaeological materials across the landscape. For the purposes of the current assessment, these terms are used in accordance with the definitions provided in the *Code of Practice* (DECCW 2010).

GSV is defined as:

> *… the amount of bare ground (or visibility) on the exposures which might reveal artefacts or other archaeological materials. It is important to note that visibility, on its own, is not a reliable indicator of the detectability of buried archaeological material. Things like*

> *vegetation, plant or leaf litter, loose sand, stone ground or introduced materials will affect the visibility. Put another way, visibility refers to 'what conceals'* (DECCW 2010b: 39).

GSE is defined as:

> *… different to visibility because it estimates the area with a likelihood of revealing buried artefacts or deposits rather than just being an observation of the amount of bare ground. It is the percentage of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground. Put another way, exposure refers to 'what reveals'* (DECCW 2010: 37).

These factors are quantified in order to ensure that the survey data provides adequate evidence for the evaluation of the archaeological potential and objects across the Heritage Study Area. For the purposes of the current assessment, these terms are used in accordance with the definitions provided in the Code of Practice (DECCW 2010).

Tables 5-1 and **5-2** and **Figure 5-2** present the effective survey coverage within the Heritage Study Area in more detail.

The effective survey coverage across the Heritage Study Area was variable; either due to the availability of good GSE, ground disturbance areas offering good GSV, or the degree of slope which was generally reflected through higher erosion patterns. **Tables 5-1** and **5-2** indicate that the most effective surveyed landform was the crest landform (32%), followed closely by the mid – upper (26.25%) and low – mid sloped (26%) landforms. The crest landform is the higher point within the Heritage Study Area and the general landscape, with a gentler slope compared to the upper and mid slopes landforms, thus increasing its archaeological potential. Survey efficacy was higher in this landform mostly due to previous vegetation clearing and the presence of wildlife tracks which had subsequently widened through the added effects of erosion. However, no sites were recorded within this landform (**Table 5-2**).

The landform with the lowest survey efficacy was the lower slope – drainage line landform (15%). This landform, while having a moderately gentle gradient contained a higher ground vegetation cover, encouraged by the increased water holding abilities of this landform, therefore limiting the amount of available exposed ground surface for inspection.

GSV was higher immediately above the drainage and lower landforms and mid – upper slopes. The increase in slope gradient from the lower – drainage landform to the mid landforms was rather considerable with increased exposure due in most part from water wash and erosion. Exposures in these landforms were afforded by wildlife tracks, dispersed vegetation clearing, minor occurrence of vehicle tracks, and erosion. In these landforms the GSV ranged from 60-75%. While the GSV across the entire Heritage Study Area did not allow for a full investigation of the ground surface of all landforms, there remained sufficient exposures and coverage of all

landform types to adequately characterise and assess the area's archaeological potential. Sample photographs of the Heritage Study Area are presented in **Plates 1** to **12**.

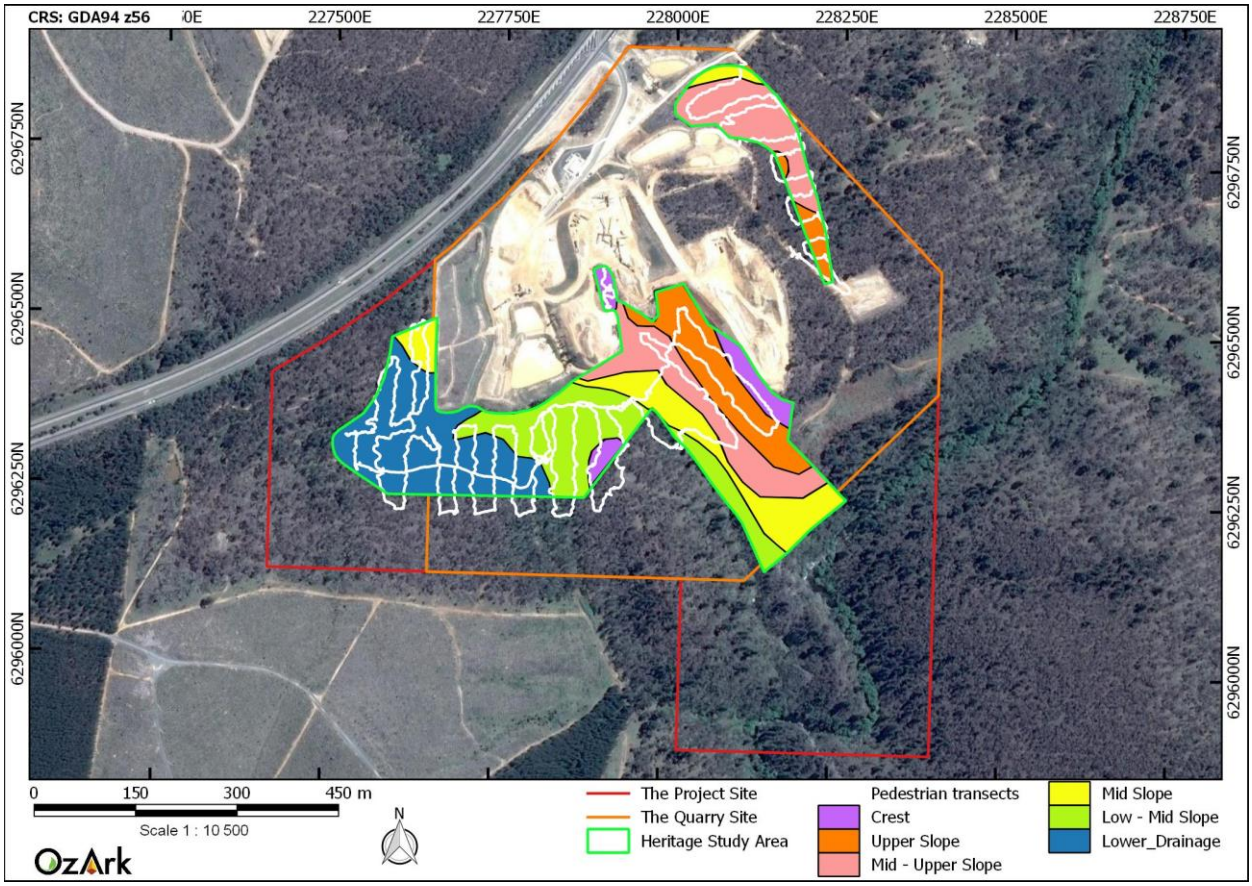
Table 5-1: Survey coverage data.

Survey Unit	Landform	Survey Unit Area (sq m)	Visibility %	Exposure %	Effective Coverage Area (sq m) (= Survey Unit Area x Visibility % x Exposure %)	Effective Coverage % (= Effective Coverage Area / Survey Unit Area x 100)
1	Crest	9,200	80	40	2,944	32%
2	Upper slope	25,700	70	30	5,397	21%
3	Mid – upper slope	40,300	75	35	10,578.75	26.25%
4	Mid slope	25,500	60	30	4,590	18%
5	Low – Mid slope	33,800	65	40	8,788	26%
6	Lower - Drainage	43,200	50	30	6,480	15%

Table 5-2: Landform summary—sampled areas.

Landform	Landform area (sq m)	Area Effectively Surveyed (sq m) (= Effective Coverage Area)	% of Landform Effectively Surveyed (= Area Effectively Surveyed / Landform x 100)	Number of Sites/features
Crest	9,200	2,944	32%	1 (AHIMS #45-1-2802)
Upper slope	25,700	5,397	21%	0
Mid – upper slope	40,300	10,579	26.25%	0
Mid slope	25,500	4,590	18%	0
Low – Mid slope	33,800	8,788	26%	0
Lower - Drainage	43,200	6,480	15%	0

Figure 5-2: The Heritage Study Area showing pedestrian transects and landforms.



5.4 ABORIGINAL SITES RECORDED

No newly identified Aboriginal sites were recorded as a result of the field survey.

5.5 PREVIOUSLY RECORDED ABORIGINAL SITES IN THE PROJECT SITE

One previously recorded Aboriginal site: AHIMS #45-1-2802 (WQ1), is located within the Project Site boundary though outside of the Heritage Study Area.

A ground-truth assessment and confirmation of site status was undertaken for #45-1-2802 by OzArk (March 2018). The site comprised an area of approximately 65m x 27m which is permanently fenced off, and is situated on a gentle to moderate slope, within a mid-slope landform. The closest permanent watercourse to the site is the Coxs River approximately 500 metres to the southeast. The ground-truth assessment identified up to 16 artefacts predominantly within extensive exposures in the southern portion of the site with further artefacts recorded along a disused vehicle track in the western portion of the site. Quarry related ground disturbance impacts have not occurred within the site area since it was initially recorded by Silcox (2000) as a result of the permanent fencing. However, ongoing erosion related impacts have occurred, including general erosion and surface sediment wash. Overall, the majority of the original site features recorded by Silcox (2000) were considered to have remained present in the site area

(**Section 1.2** and **Section 4.3.1**). A sample of artefacts recorded are detailed in **Table 5-3** with a sample of site photographs presented in **Figure 5-3**.

Table 5-3: Artefacts recorded at AHIMS #45-1-2802.

Artefact type	Material	Integrity	Reduction	Size	Notes
Flake	Quartz	Complete	Tertiary	1 (1-2cm)	
Flake	Quartz	Complete	Tertiary	2 (2-4cm)	
Flake	Mudstone	Distal flake	Tertiary	2 (2-4cm)	Right lateral usewear
Blade flake	Quartz	Complete	Tertiary	2 (2-4cm)	
Flake	Quartz	Complete	Tertiary	3 (4-6cm)	
Flake	Mudstone	Medial flake	Tertiary	2 (2-4cm)	
Flake	Quartzite	Proximal flake	Tertiary	2 (2-4cm)	Longitudinal break noted
Flake	Quartz	Complete	Tertiary	3 (4-6cm)	
Flake	Volcanic	Proximal flake	Tertiary	3 (4-6cm)	
Flake	Quartz	Medial flake	Tertiary	2 (2-4cm)	

Figure 5-3: AHIMS #45-1-2802 (WQ1): Site location and a selection of recorded artefacts.

1. View south across WQ1, from the northern end of the site.

2. View southeast across WQ1 from the northern end of the existing track.

3. View north at WQ1 showing identified artefacts on the track.

4. View east to the southern end of WQ1 showing artefacts identified on exposed ground.

5. View towards the south of WQ1 showing Hoskins Quarry in the background and further south of the site.

6. WQ1: View of artefacts 1 to 5.

7. WQ1: View of artefact 6.

8. WQ1: View of artefact 7.

9. WQ1: View of artefact 8.

10. WQ1: View of artefacts 9 to 11.

The proponent is proposing to extend quarrying operations into the Heritage Study Area and into the area where AHIMS #45-1-2802 exists (**Figure 4-2**). As such, management and mitigation of the site's Aboriginal heritage is required prior to the commencement of the project (**Section 6.3**).

5.6 ABORIGINAL COMMUNITY INPUT

Nominated site officers from the Bathurst LALC and Gundungurra Tribal Council Aboriginal Corporation were present during the field survey (**Section 2.3.2**). There were no objections to the manner in which the survey was implemented and completed. Each stage and landform change during the field survey was discussed and the manner in which the survey was proposed was discussed and agreed upon prior to its enactment.

5.7 DISCUSSION

The field survey of the Heritage Study Area identified no additional Aboriginal sites/objects or features. One previously recorded Aboriginal site (AHIMS #45-1-2802) is situated to the north of the Heritage Study Area and within the overall Project Site for the Quarry. Further mitigation for the management of this site in relation to the proposed Quarry extension impacts is outlined in **Section 6**.

In review of the predictive model (**Section 4.4**), predictions for the occurrence of certain site types were made based on the previously recorded sites identified through the AHIMS search. The predictive model postulated that the presence of a nearby permanent water source, the Coxs River, would influence the potential for site to be present. The presence of a second order tributary of the Coxs River may also be a contributing factor for the increase in identified sites. Stone artefact sites were considered the most likely to occur, as these sites are generally present in a variety of landforms, and vary in size and complexity based on previous disturbances and impacts. The predictive model considered that the presence of scarred trees would have a moderate likelihood of occurrence, should native vegetation exist amongst regrowth vegetation.

The field survey confirmed there were a number of large mature trees though none that contained evidence of cultural scarring. Grinding groove and rock shelters had a moderate occurrence in the AHIMS search and had the potential to occur in the Heritage Study Area should the landscape features required to support these site types be present (i.e. sandstone overhangs, outcrops, pagodas, and fine-grained sandstone benching associated with creek lines). These landscape features were not present, generally sandstone cobbles and rock were high but nothing in the form of a boulder or pagoda to support habitation or sandstone benches within drainage lines that would be suitable for sharpening stone tools. The other likely site type for the Project Site as per the predictive model, were stone quarry sites. These were considered a possibility given that the area has been targeted for quarrying activities in the past and for the current proposal. However, no evidence of raw material procurement for stone tool manufacture was observed.

The field survey (pedestrian) was conducted across all landform types within the Project Site, with closer attention being paid in the vicinity of resources (tributaries of the Coxs River, gentle elevated slopes and crests) and areas of ground exposure. However, no Aboriginal sites or objects were identified. The landforms that were considered to have increased potential for the surface manifestation of Aboriginal heritage, such as the crest, gentle elevated slopes and landforms adjacent to the drainage lines, did not reveal any surface evidence. This is considered to be a result of soil removal caused by minor vegetation clearing, increased sheet wash and erosion on moderate to steep slopes and areas of extensive gully erosion within drainage areas, burrowing animals within lower sloped drainage areas, and other activities such as fencing and minor clearing and grading for tracks.

5.8 ASSESSMENT OF SIGNIFICANCE

5.8.1 Introduction

The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance, as well as the likely impacts of any proposed developments. Scientific, cultural and public significance are identified as baseline elements of significance assessment, and it is through the combination of these elements that the overall cultural heritage values of a site, place or area are resolved.

Social or Cultural Value

This area of assessment concerns the importance of a site or features to the relevant cultural group: in this case the Aboriginal community. Aspects of social value include assessment of sites, items, and landscapes that are traditionally significant or that have contemporary importance to the Aboriginal community. This importance involves both traditional links with specific areas, as well as an overall concern by Aboriginal people for their sites generally and the continued

protection of these. This type of value may not be in accord with interpretations made by the archaeologist: a site may have low archaeological value but high social value, or vice versa.

Archaeological/Scientific Value

Assessing a site in this context involves placing it into a broader regional framework, as well as assessing the site's individual merits in view of current archaeological discourse. This type of value relates to the ability of a site to answer current research questions and is also based on a site's condition (integrity), content (rarity) and representativeness.

The overriding aim of cultural heritage management is to preserve a representative sample of the archaeological resource. This will ensure that future research within the discipline can be based on a valid sample of the past. Establishing whether or not a site can contribute to current research also involves defining 'research potential' and 'representativeness'. Questions regularly asked when determining significance are: can this site contribute information that no other site can? Is this site representative of other sites in the region?

Aesthetic Value

This refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with the social values. It may consider form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use (Australia ICOMOS 2013).

Historic Value

Historic value refers to the associations of a place with a historically important person, event, phase or activity in an Aboriginal community. Historic places do not always have physical evidence of their historical importance (such as structures, planted vegetation or landscape modifications). They may have ‘shared’ historic values with other (non-Aboriginal) communities.

Places of post-contact Aboriginal history have generally been poorly recognised in investigations of Aboriginal heritage. Consequently the Aboriginal involvement and contribution to important regional historical themes is often missing from accepted historical narratives. This means it is often necessary to collect oral histories along with archival or documentary research to gain a sufficient understanding of historic values.

5.8.2 Assessed significance of recorded sites

As discussed in **Section 5.4**, no other Aboriginal sites were recorded during the most recent field survey. The previously recorded Aboriginal site: AHIMS #45-1-2802 (WQ1), identified within the Project Site has been assessed for significance based on the criteria outlined in **Section 5.9.1** and the results are discussed below.

Social or Cultural Value

The social value of Aboriginal sites is determined by the Aboriginal community. Aboriginal sites have a high significance to the local Aboriginal community, as they demonstrate the occupation and use of the land by their ancestors. AHIMS #45-1-2802 would be considered to hold a strong social value to the Aboriginal community. As such, it has been assessed as having **high social/cultural values**.

Archaeological/Scientific Value

Silcox (2002) considered the likelihood for site WQ1 to contain more artefacts than were immediately apparent on the ground surface. Silcox noted that several artefacts were identified as being partially buried in the surface sediment; however, it was unclear whether they were eroding out of *in situ* deposit or out of redeposited sediment. Silcox considered that the site was more extensive than what was apparent at the time. The OzArk (2018) ground-truth assessment identified sufficient exposures to allow the archaeological nature of the landform to be understood and recommended that limited salvage excavation be conducted to confirm that there is little potential for intact archaeological deposits at the site. As such, it is considered that this site is limited in what additional information it can add to the archaeological context of the region; therefore, it has been assessed as having **low-moderate archaeological/scientific values**.

Aesthetic Value

AHIMS Site #45-1-2802 is situated in a moderately disturbed context, largely from natural weathering and erosional processes. The site comprises a gentle elevated landform and an old formed track. The majority of the artefacts were identified within an exposure in the south of the site and along the vehicle track. As the site was fenced after it was originally identified, no activities associated with the Quarry operations have impacted on the site. As such, this site has been assessed as having a **moderate aesthetic value**.

Historic Value

AHIMS Site #45-1-2802 has been provisionally assessed as having **low historic values**, as information directly relating to a period in history significant to the recorded site is presently unknown. Further research is needed to gain a better understanding of the period of use of this site in order to provide a more accurate and contextualised history.

A summary of the assessed significance of WQ1 is provided in **Table 5-4**.

Table 5-4: Significance assessment.

Site Name	Social or Cultural Value	Archaeological / Scientific Value	Aesthetic Value	Historic Value
WQ1	High	Low-moderate	Moderate	Low

5.8.3 Representativeness, rarity and integrity

All values of the *Burra Charter* are considered when evaluating the significance of the Aboriginal site. The significance of open sites is extremely variable and dependent upon several factors relating to:

- Preservation: Whether the site has the potential for the presence of intact, subsurface deposit, or whether disturbance (human: land surface impacts, or environmental: erosion, deflation) has reduced its integrity and thus its potential.
- Representativeness: If this is the type of site one may expect in this landscape. (Relates back to the predictive model), i.e. do many such sites occur nearby?
- Artefacts: If the artefacts present (material, types or combinations thereof) are rare in the area or unusual for that type of site.
- Potential Archaeological Deposits: It is impossible to determine the scientific significance of PADs that do not have visible surface artefacts, as there is no site material or soil data to assess. Consequently, test excavation is required for such areas to investigate the presence, extent, nature and integrity of any possible site material such that their significance can be assessed.

The features of representativeness, rarity and integrity of the archaeological site within the Heritage Study Area (AHIMS #45-1-2802 (WQ1) Artefact Scatter) were assessed and are discussed below:

Representativeness

WQ1 is an artefact scatter identified within the proposed quarry extension area and is representative of sites in the region that are located on similar landforms. In terms of the site's size, artefact density, raw materials and artefact types, the presence of the Aboriginal site is consistent with the archaeological context highlighted in **Section 4.2** and **Section 4.4**.

Rarity

In the past, sites such as isolated finds and artefact scatters would not have been rare and on a state-wide scale, low density artefact scatters and isolated finds would remain the most common site type recorded. Although the open site within the Heritage Study Area is of low to moderate density with a reduced archaeological significance, its presence alone, in albeit a landscape that has been affected by water wash and erosion, remains a memory of the past in a landscape that is fast changing.

Integrity

The results of the field survey conclude that the general site integrity is low to moderate and it has been disturbed by surface water wash and erosion.

The Quarry Site is predominantly represented by existing landform modifications associated with the mining activities, however the site is permanently fence off and has been protected since it was initially recorded by Silcox (2000) (**Section 4.3.1** and **Section 5.5**) by the surrounding quarry activities.

5.9 LIKELY IMPACTS TO ABORIGINAL HERITAGE FROM THE PROJECT

The Aboriginal site, AHIMS #45-1-2802 (WQ1), would be disturbed by the proposed Quarry extension. **Table 5-4** summarises the assessment of the impact to AHIMS #45-1-2802.

Table 5-5: Impact assessment.

Site Name	Type of Harm (Direct/Indirect/ None)	Degree of Harm (Total/Partial/None)	Consequence of Harm (Total/Partial/No Loss of Value)	Potential impact
#45-1-2802 (WQ1)	Direct	Total	Total loss of value	The Quarry operations are proposed to extend over the entire area comprising the site. As such all artefacts and site features will be subject to direct impact from the proposed work.

5.10 OVERALL VALUE OF POTENTIAL IMPACT ON HERITAGE ITEMS

A series of guidelines have been developed by the Department of Planning and Environment to quantify and standardise impact assessments (DP&E 2016). The rubric outlined in DPE (2016) leads to all impacts being graded within the matrix shown in **Figure 5-4**. **Table 5-5** assesses the heritage item to arrive at a standardised 'value of impact'. In **Table 5-5**, the highest variable (2) has been given to cultural heritage and a medium variable (1) has been given to aesthetic values. Both scientific and historical values were ranked as low (0).

Figure 5-4: Potential impact to heritage items reference matrix.

	Significance of heritage object or place				
Degree of potential impact on heritage item		Very high	High	Medium	Low
	Total impact	Very high value	High value	Medium value	Low value
	High partial impact	High value	High value	Medium value	Low value
	Medium partial impact	Medium value	Medium value	Low value	Minimal value
	Minimal partial impact	Low value	Low value	Minimal value	Minimal value

Table 5-6: Overall value of potential impact on heritage item.

	Heritage item 1
Name or location of the heritage object or place	WQ1
Social or cultural value	2
Historical	0
Scientific	0
Aesthetic	1
Significance of heritage item	Medium importance
Degree of impact (partial or full)	Full impact
Overall value of potential impact on heritage item	Medium value
Reasoning behind scores	General natural disturbance at site and no impacts from Quarry operations; moderate artefact density.

As can be seen in **Table 5–5**, the proposed impact to the recorded site (WQ1) has been evaluated as having a medium value. This can be interpreted as meaning that should this site be destroyed, it would result in a medium loss of heritage value from the regional context. As such, the management measures set out in **Section 6** will be required to mitigate the loss of this heritage value.

5.11 ECOLOGICALLY SUSTAINABLE DEVELOPMENT AND CUMULATIVE IMPACT FOR THE PROJECT

Australia's *National Strategy for Ecologically Sustainable Development* (Ecologically Sustainable Development Steering Committee 1992) defines ecologically sustainable development (ESD) as:

> *…using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.*

The management and mitigation of Aboriginal sites involves consideration of ESD principles including cumulative impacts, the precautionary principle and the principle of intergenerational equity (OEH 2011: 12-13).

With regards to cultural heritage, the most important aspect of ESD is inter-generational equity whereby the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. Similarly inter-generational equity maintains that places and items of cultural heritage value should be preserved for the education, enjoyment and use of future generations.

The project adds to the cumulative impact on the region's Aboriginal cultural heritage as one site will be harmed. While the heritage impact value of this loss to the site has a medium value, the site is a very common site type for the region (refer **Section 4.3.2.2**), and the proposed salvage and excavation of the site will increase the scientific knowledge of occupation in the region. Therefore, the loss of the site is considered to have a negligible cumulative impact on the region's Aboriginal cultural heritage resource.

6 MANAGEMENT AND MITIGATION: ABORIGINAL HERITAGE

6.1 INTRODUCTION

Appropriate management of cultural heritage items is primarily determined on the basis of their assessed significance as well as the likely impacts of the proposed development. No new Aboriginal sites were identified within the Heritage Study Area during the field survey; however, one previously recorded site (AHIMS #45-1-2802, WQ1) is located within the Project Site and will be subject to impact as a consequence of the project.

While impact avoidance through modification to project design is the preferred approach to management, this is not feasible in this case as the westerly extension of the extraction area is required in order to develop the Quarry to the nominated depth and maximise the recovery of quartzite.

As impact avoidance is not feasible, management measures to minimise or mitigate the impacts are proposed (see **Section 6.3**) along with a Statement of Commitments (SoC) in terms of heritage management.

An AHIP which is normally required for impacts to Aboriginal sites under the NPW Act is not necessary (under Section 4.41[1d] of the EP&A Act) as the project is being assessed under Part 4 Division 4.7 of the EP&A Act (SSD) and impacts to Aboriginal heritage would normally be managed under a Cultural Heritage Management Plan (CHMP). Notwithstanding this, the spirit of site protection and management in the face of impacts remains the same. In place of an AHIP under the NPW Act, a Statement of Commitments (SoC) in terms of heritage management is prepared (**Section 6.3**). This SoC forms the basis for the Minister's approval which would usually contain one or more conditions, including a requirement for the preparation of a CHMP, with which the proponent would be required to operate in accordance with.

6.2 MANAGEMENT AND MITIGATION OF THE RECORDED ABORIGINAL SITE

Impact avoidance to WQ1 (artefacts and site features) at AHIMS #45-1-2802 is not considered feasible as described previously. **Table 5-4** describes the proposed disturbance to WQ1.

Sections 6.2.1 and **6.2.2** provide for the proposed management of the objects and features of Site WQ1.

6.2.1 Archaeological salvage: surface artefact collection

Objects from AHIMS #45-1-2802 will be recorded and collected from the whole of the site area by a qualified archaeologist together with RAPs. The site boundary is currently demarcated by a permanent fence. This shall stay in place to ensure the surface collection of artefacts takes place within the site boundary, as well as to prevent any damage or inadvertent entry into the site by quarry operations until the recovery process is complete.

The following methodology will be followed for the surface collection of Aboriginal artefacts at the site:

- All visible artefacts at the site will be flagged.
- The artefacts will be photographed after flagging and before recording.
- The following information will be collected for each artefact:
    - GPS location;
    - type;
    - size;
    - reduction level;
    - raw material; and
    - any relevant notes.
- Once all recording is complete, the artefacts will be collected and placed in appropriately labelled bags.
- The recording and analysis of the artefacts recovered will be largely completed in the field and this data will be interpreted and documented in a salvage report to OEH and the RAPs.
- The supervising archaeologist would be responsible for submitting an *Aboriginal Site Impact Recording Form* to the AHIMS to update the register with the results of the salvage works at the site.
- The salvaged artefacts should be reburied at an agreed location. This will take place in accordance with Requirement 26 “Stone artefact deposition and storage” in the Code of Practice. The location chosen for reburial will be an area where future developments will not occur and as close as possible to their original location. A site card will be submitted to AHIMS to record the relocation area.

6.2.2 Salvage excavation

A limited salvage excavation will take place at AHIMS #45-1-2802 in order to:

- confirm that the highly eroded surface disturbance recorded at the site is apparent at the subsurface level; and
- to confirm that there is no subsurface archaeological deposits of conservation value are present.

No more than six 50cm x 50cm squares should be excavated. The excavation squares will be positioned so a valid sample of the site area is obtained so that the archaeological vales of the site can be characterised. Up to three additional excavation squares can be added to extend the existing squares, should intact archaeological deposits or archaeological features be encountered near the perimeter of the squares. Additional squares may also be triggered if rare or unusual artefacts are identified (such as manufactured from a rare stone type or less-common

tool forms such as ground edge axes, hammerstones, etc), or other signs of human occupation (i.e. ground ovens/hearths or charcoal concentrations) are found. The excavation director will determine if an expansion is required to gain the appropriate scientific information.

All artefacts recovered from the salvage excavation should be recorded and photographed. The following attributes will be recorded:

- Artefact type;
- Material;
- Integrity;
- Reduction;
- Size;
- Rotation;
- Platform type;
- Platform size; and
- Termination type.

The excavated material from all pits will be sieved on site using dry sieving through nested sieves of 6-8 millimetres (mm) and 2.5-3.5mm mesh (which is considered to satisfy the 5mm aperture wire-mesh sieve requirement). Deposits will be sieved on to tarpaulins and the spoil used to the backfill the excavation square.

Storage of artefacts recovered during the salvage excavations will follow the procedure for the surface collected artefacts, as outlined in **Section 6.1.1**.

6.2.2.1 Excavation square recording

If appropriate (i.e. if intact archaeological stratigraphy is recorded) section drawings will be completed for the appropriate excavation square(s). If no archaeological stratigraphy is recorded then digital photographs shall be taken of a representative section of each excavation square and a suitable representative drawing made of the excavation square section to show the profile.

6.3 STATEMENT OF COMMITMENTS

An AHIP, which is normally required under the NPW Act for impacts to Aboriginal sites, is not necessary under Section 4.41[1d] of the EP&A Act, as the project is being assessed under Part 4 Division 4.7 of the EP&A Act (SSD). In place of an AHIP under the NPW Act, a Statement of Commitments (SoC) in terms of heritage management has been prepared. This SoC forms the basis for the Minister's approval which would usually contain one or more conditions, including a requirement for the preparation of a Cultural Heritage Management Plan (CHMP).

The proponent shall undertake the following SoCs:

1) Should the project be approved, the proponent will develop the CHMP in consultation with the RAPs, OEH and DPE. The CHMP will include the recommendations contained in this report (**Section 11**) and this SoC.
2) The impacted Aboriginal site, AHIMS #45-1-2802 that has been recorded in the Quarry Site will be salvaged under the methodology set out in **Section 6.1.1** and **Section 6.1.2**, and relocated to a safe location away from impacts arising from the project.
3) The recovered artefacts should be reburied at a location at a location agreed to by the RAPs and where no future developments are planned or likely. The agreed and finalised location and the manner of reburial of the Aboriginal objects will be detailed in the CHMP following RAPs consultation. As one option, Requirement 26 “Stone artefact deposition and storage” in the Code of Practice will be considered. 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 CHMP.
4) 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.

HISTORIC HERITAGE ASSESSMENT REPORT

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7 HISTORIC HERITAGE ASSESSMENT: INTRODUCTION

7.1 BRIEF DESCRIPTION OF THE PROJECT

Please refer to **Sections 1.1** to **1.4** for a description of the project, the Quarry Site and the Heritage Study Area.

7.2 RELEVANT LEGISLATION

7.2.1 State legislation

Environmental Planning and Assessment Act 1979 (EP&A Act)

See **Section 1.4.1** for a brief description of the EP&A Act.

Heritage Act 1977 (Heritage Act)

The *Heritage Act 1977* (Heritage Act) is applicable to the current assessment. This Act established the Heritage Council of NSW. The Heritage Council's role is to advise the government on the protection of heritage assets, make listing recommendations to the Minister in relation to the State Heritage Register, and assess/approve/decline proposals involving modification to heritage items or places listed on the Register. Most proposals involving modification are assessed under Section 60 of the Heritage Act.

Automatic protection is afforded to 'relics', defined as 'any deposit or material evidence relating to the settlement of the area that comprised New South Wales, not being Aboriginal settlement, and which holds state or local significance' (note: formerly the Act protected any 'relic' that was more than 50 years old. Now the age determination has been dropped from the Act and relics are protected according to their heritage significance assessment rather than purely on their age). Excavation of land on which it is known or where there is reasonable cause to suspect that 'relics' will be exposed, moved, destroyed, discovered or damaged is prohibited unless ordered under an excavation permit.

7.2.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

See **Section 1.5.2** for a brief description of the EPBC Act.

7.2.3 Applicability to the project

The current project will be assessed under Part 4, Division 4.7, Section 4.41(2) of the EP&A Act.

Any items of local or state historical heritage significance within the Project Site are afforded legislative protection under the Heritage Act.

It is noted there are no Commonwealth or National heritage listed places within the Project Site, and as such, the heritage provisions of the EPBC Act do not apply.

7.3 HISTORIC HERITAGE ASSESSMENT OBJECTIVES

The current assessment applies the Heritage Council *Historical Archaeology Code of Practice* (Heritage Council 2006) in the completion of the historical heritage assessment, including field investigations, in order to meet the following objectives.

Objective One: Conduct database searches to identify whether or not historical heritage items or areas are, or are likely to be, present within the Heritage Study Area.

Objective Two: Assess the significance of any recorded historical heritage items or areas.

Objective Three: Determine whether the activities of the proponent are likely to cause harm to recorded historical heritage items or areas.

Objective Four: Provide management recommendations and options for mitigating impacts to heritage items through the activities of the project.

7.4 DATE OF HISTORIC HERITAGE ASSESSMENT

The fieldwork component of this assessment was undertaken simultaneously with the Aboriginal heritage assessment on Wednesday 29 August 2018. Please refer to **Section 5** for details on the assessment.

7.5 LANDSCAPE CONTEXT

Please refer to **Sections 3.1** to **3.7** for a description of the landscape context of the Heritage Study Area.

8 HISTORIC HERITAGE ASSESSMENT: BACKGROUND

8.1 BRIEF HISTORY OF THE LITHGOW VALLEY

Lithgow Valley's first European settlers arrived in 1824 and the town was named in 1827 by the explorer Hamilton Hume, in honour of William Lithgow, Governor Brisbane's private secretary (RPS 2014). Settlement in the area was slow; by 1860 only four properties were settled in the valley. In 1838, one of the owners of those properties, Andrew Brown of "Cooerwull", wrote in his diary "getting coal", which was the first written record of coal noted in the Lithgow Valley.

In 1868, the construction of the railway line through the Valley spread workmen who built their campsites close to the cuttings, embankments and viaducts throughout the length of the valley. To support the needs for cooking fires and heating during winter, Mr. Poole in 1868 opened the Hermitage Colliery as the first commercial mine to engage in mining and selling coal. By 1874, there were four mine producing – Eskbank Colliery (at the eastern end of Main Street near the present Hoskins Church), the Lithgow Valley Colliery, Vale of Clywdd Colliery and the Hermitage Colliery. The owners of the Lithgow Valley Colliery secured contracts to supply coal to the Railways to run their locomotives. The exportation of coal also became commercially viable with the construction of the railway line.

The nature of coal as a low value, high volume resource necessitated its need to be made available to be delivered in bulk or to be located near to established transport infrastructure. The failure of several coal mines in the Cullen Bullen region prior to the development of the Wallerawang-Mudgee railway line is testament to the importance of developing bulk haulage networks for coal (Christison 2003).

In 1870, the railway reached Wallerawang. The Cobb and Co. Coach Service provided transport between the station at Wallerawang, Bathurst and Mudgee, utilising the route approximating the current Castlereagh Highway. The exploitation of coal reserved 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. The mines in the Wallerawang district generally followed the railway line and included Irondale Colliery (1883), Ivanhoe Colliery (1893) and the Commonwealth Colliery (1895), which became the first open cut mine in NSW during World War (1940) (Carne 1908).

By 1900, Lithgow boasted nine hotels, three banks, a municipal water supply and gaslights in the main street. The population increased from 5,628 in 1901 to 8,196 in 1911, increasing the pressure on housing. In 1908, the sale of a portion of Cooerwull, one of the earliest settled properties in the area, provided an increase in the amount of available land; however, it was only marginally successful in easing the demand (Cremin 1989).

8.2 LOCAL CONTEXT

8.2.1 Desktop database searches conducted

A desktop search was conducted on the following databases to identify any potential previously-recorded heritage within the Study Area. The results of this search are summarised in **Table 8-1**.

Table 8-1: Historic heritage: desktop-database search results.

Name of Database Searched	Date of Search	Extent of Search	Comment
National and Commonwealth Heritage Listings	10/10/2018	NSW	No places listed on either the National or Commonwealth heritage lists are located within the Quarry Site or Heritage Study Area.
NSW State Heritage Register (NSW)	10/10/2018	Lithgow City LGA	No places of state historic heritage significance are listed within the Quarry Site or Heritage Study Area.
Australian Heritage Database	10/10/2018	Lithgow City LGA	No places of state historic heritage significance are listed within the Quarry Site or Heritage Study Area.
LEP	10/10/2018	Lithgow City LGA	No places of state historic heritage significance are listed within the Quarry Site or Heritage Study Area.

A search of the Heritage Council of NSW administered heritage databases and the Lithgow City Council LEP returned no records for historical heritage sites within the designated search areas.

8.3 SURVEY METHODOLOGY

The fieldwork component of this assessment was undertaken simultaneously with the Aboriginal heritage assessment. Please refer to **Section 5** for details on the assessment methodology and coverage.

9 RESULTS OF HISTORIC HERITAGE ASSESSMENT

The historic heritage assessment of the Heritage Study Area was undertaken concurrently with the Aboriginal cultural heritage assessment (**Section 5**). No historic heritage items or sites were recorded during the field survey.

As such, there are no likely impacts to historic heritage from the activities of the project.

10 MANAGEMENT AND MITIGATION: HISTORIC HERITAGE

10.1 GENERAL PRINCIPLES FOR THE MANAGEMENT OF HISTORIC SITES

Appropriate management of heritage items is primarily determined on the basis of their assessed significance as well as the likely impacts of the proposed development.

In terms of best practice and desired outcomes, avoiding impact to any historical item is a preferred outcome, however, where a historical site has been assessed as having no heritage value, impacts to these items does not require any legislated mitigation.

10.2 MANAGEMENT AND MITIGATION OF RECORDED HISTORIC SITES

No items or sites of historic heritage significance were identified in the Heritage Study Area. Should any items of historic heritage significance be uncovered then the mitigation of impacts to these items will need to be managed under conditions of the CHMP. The CHMP will stipulate the protocols to follow should likely historic objects become uncovered through the activities of the project.

11 RECOMMENDATIONS

11.1 ABORIGINAL HERITAGE

Under Section 89A of the NPW Act, it is mandatory that all newly-recorded Aboriginal sites be registered with OEH AHIMS. As a professional in the field of cultural heritage management it is the responsibility of OzArk to ensure this process is undertaken.

To this end it is noted that **one Aboriginal site** (WQ1) exists within the Quarry Site.

No other Aboriginal sites were recorded within the Heritage Study Area during the field survey.

The following recommendations are made on the basis of the proposed impacts to WQ1 and with regard to:

- legal requirements under the terms of the NPW Act whereby it is illegal to damage, deface or destroy an Aboriginal place or object without the prior written consent of OEH;
- the findings of the current investigations undertaken within the Heritage Study Area; and
- the interests of the Aboriginal community.

Recommendations concerning the proposed activities within the Quarry Site, and to ensure any necessary protection to the area's Aboriginal cultural heritage values, are as follows:

1. Should development consent for the project be granted, the SoC set out in **Section 6.3** will be followed.
2. All ground disturbance activities must be confined to within the assessed Heritage Study Area.
3. Prior to disturbance beyond the Heritage Study Area, further field survey should be completed prior to surface disturbance in these areas.
4. Following SSD approval for the project, a CHMP for the management and mitigation from impacts to Aboriginal heritage (including the implementation of an unanticipated finds protocol and heritage site induction for staff and contractors), would be development in agreement with the proponent, RAPs, OEH and DP&E. The archaeological management recommendations in this report would normally be incorporated into the CHMP that is usually formulated following development approval.

11.2 HISTORIC HERITAGE

The historic heritage assessment concluded that no heritage items of intact archaeological deposits are likely to be harmed by the project. The following recommendations are made on the basis of these impacts and with regard to:

- legal requirements under the terms of the Heritage Act;

- guidelines presented in the *Burra Charter* (Australia ICOMOS 2013);
- the findings of the current assessment; and
- the interests of the local community.

To ensure that historic heritage values are protected, the following recommendations are made:

5. The activities of the project can proceed without further historic heritage investigation provided that all ground disturbance activities are confined to within the Heritage Study Area. If the parameters of the proposed activity extend beyond the assessed area, then further archaeological assessment may be required.
6. This assessment has concluded that there is a low likelihood that the proposed work would harm any historic items. The CHMP will include protocols for the management and mitigation to historic heritage from the impacts, should objects be encountered that are suspected to be historic heritage items.
7. The CHMP shall include protocols for inductions for staff undertaking the proposed activity, and will include the legislative protection requirements for historic sites and items in NSW and the relevant fines for non-compliance.

REFERENCES

Australia ICOMOS 2013	International Council on Monuments and Sites 2013. *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*, 2013.
Barton and McDonald 1995	Barton, H. and McDonald, J. *Archaeological investigation of sites affected by augmentation works at Lyell Dam, near Lithgow, NSW. Salvage and test excavation report*. Report prepared for Pacific Power.
BOM 2018	Bureau of Meteorology 2018, Climate statistics for Australian Locations, Blayney Post Office, website viewed 9 October 2018, <http://www.bom.gov.au/climate/averages/tables/cw_063010.shtml>.
Bowdler 1983	Bowdler, S. 1983 *Aboriginal sites on the Crown timber lands of NSW.* Report to the Forestry Commission of NSW.
Burke & Smith 2004	Burke, H. and Smith, C. 2004. *The Archaeologist's Field Handbook*, Blackwell, Oxford.
Carne 1908	Carne, J.E. 1908. *Geology and mineral resources of the Western Coal Field*. Government Printer, Sydney.
Christison 2003	Christison, R. 2003. *The cultural inheritance of coal mining communities*. University of New England.
Cremin 1987	Cremin, A, Jack, R.I. 1987. *Survey of historical sites in Lithgow Area*. Report on a survey prepared for the Heritage Council of NSW by the University of Sydney.
DECCW 2010	Department of Environment, Climate Change and Water, Sydney (now OEH). *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*.
DECCW 2010b	Department of Environment, Climate Change and Water, Sydney (now OEH). *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.*
DP&E 2016	Department of Planning and Environment. Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals.
Gay 1999	Gay, L. *Proposed Realignment of the Castlereagh Highway, Lidsdale, NSW: Indigenous Heritage Assessment*. Report to the RTA.
Gollan 1987	Gollan, K. 1987. *Archaeological investigations on Newness Plateau*. Report for National Parks and Wildlife Service NSW.

Heritage Council 2006 — Heritage Council of NSW. 2006. *Historical Archaeology Code of Practice.* In *NSW Office of Environment & Heritage* [website]. Available from: http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/HistArchCodeofPractice.pdf [accessed January 2018].

Hetherington 2018 — Hetherington Exploration & Mining Title Services. 2018. *Native Title Clearance Report*. Prepared for Walker Quarries Pty Ltd.

Kelton 1999 — Kelton, J. *An Archaeological survey of the proposed silicon plant at Wallerawang, near Lithgow, Central tablelands of NSW*. Report to R.W. Corkery, Orange.

Kelton 2000 — Kelton, J. *An Aboriginal Archaeological study of the Marrangaroo Department of Defence site, Lithgow, NSW*. Report to Dames and Moore Pty Ltd, North Sydney.

Kelton 2002 — Kelton, J. *An Aboriginal Archaeological Study & Non-Indigenous Heritage Overview of the Proposed Boulder Road Coal Mine, Near Cullen Bullen*. A report to International Environmental Consultants P/L.

King 1993 — King, D.P. 1993. *Soil Landscapes of the Wallerawang 1:100,000 Sheet map and report*. NSW Department of Land and Water Conservation, Sydney.

McIntyre 1993 — McIntyre, S. *Springvale coal project – Aboriginal burial site*. Report prepared for Clutha Limited and Samsung (Australia) Pty Ltd).

Mitchell 2002 — Mitchell, P. 2002. *Description for NSW (Mitchell) Landscapes Version 2.* Department of Environment and Climate Change NSW.

NPWS 2016 — New South Wales National Parks and Wildlife Services. 2016. *South Eastern Highlands*. Accessed 9/10/18.

OEH 2011 — Office of Environment and Heritage 2011. *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW.*

OzArk 2003 — *Archaeological Test Excavation of PADs 1 and 2 (site L2: NPWS #45-1-2573 & 45-1-2574): Proposed corridor of the new Castlereagh highway 86, Lidsdale, NSW*. Report to the RTA.

OzArk 2004 — *Salvage Excavation of Site L2 (DEC AHIMS #45-1-2573 & 2574). Proposed Corridor of the new Castlereagh Highway 86, Lidsdale, NSW.* Report to the RTA.

OzArk 2018 — OzArk. 2018. *Assessment and heritage advice for site WQ1*. Report to Walker Quarries Pty Ltd.

Rich and Gorman 1992 — Rich, E. and Gorman, A. *Proposed Springvale Colliery and Conveyor, Wallerawang: Archaeological Survey for Aboriginal Sites*. Report prepared for Clutha Limited and Samsung (Aust) Pty Ltd.

RPS 2014 — RPS. 2014*. Cultural Heritage Impact Assessment: Angus Place Extension Project, Lithgow Local Government Area.* Report to Centennial Coal Pty Ltd.

Silcox 2000 — Silcox, R. *Archaeological Assessment for a Proposed Hardrock Quarry, Wallerawang*. Report to Pacrim Environmental Pty Ltd.

Tindale 1974 — Tindale, A. 1974. Aboriginal *Tribes of Australia.* University of California Press.

PLATES

Plate 1: View southeast along an existing formed track and into the northeast portion of the Heritage Study Area.

Plate 2: View of typical vegetation and low ground surface exposure in the northeast portion of the Heritage Study Area.

Plate 3: Overall good visibility and partially cleared ground surface within the mid – upper slope landform.

Plate 4: View of previous clearing and ground disturbance identified along the boundary of the Heritage Study Area.

Plate 5: Typical soils and gravel fragments identified on the ground surface.

Plate 6: View north in the west of the Heritage Study Area showing a previously formed track and a drainage line in the background.

Plate 7: View of the steeply incised drainage line in the Heritage Study Area.

Plate 8: View east across the gentle and lower elevated crest landform in the south of the Heritage Study Area.

Plate 9: Good ground surface exposure identified on one of the previously formed tracks.

Plate 10: View northwest showing the steep upper slope landform in the Heritage Study Area.

Plate 11: View from the drainage line looking southeast from the mid slope to the upper slope and crest landform.

Plate 12: View of previous landform disturbance identified in the southern portion of the Heritage Study Area.

APPENDIX 1: ACHCR DOCUMENTATION

Log of Aboriginal community consultation

Aboriginal Consultation Log - Wallerawang			
Date	**Organisation**	**Comment**	**Method/comments**
15.5.18	Lithgow Mercury	R.W. Corkery and Co. placed an advertisement seeking EOI	
15.5.18	Bathurst LALC	Stage 1 agency letter requesting potential stakeholders sent by R.W. Corkery and Co.	
15.5.18	OEH	Stage 1 agency letter requesting potential stakeholders sent by R.W. Corkery and Co.	
15.5.18	Office of The Registrar, ALRA	Stage 1 agency letter requesting potential stakeholders sent by R.W. Corkery and Co.	
15.5.18	NTSCORP	Stage 1 agency letter requesting potential stakeholders sent by R.W. Corkery and Co.	
15.5.18	National Native Title Tribunal	Stage 1 agency letter requesting potential stakeholders sent by R.W. Corkery and Co.	
15.5.18	Lithgow Shire Council	Stage 1 agency letter requesting potential stakeholders sent by R.W. Corkery and Co.	
15.5.18	National Native Title Tribunal	R.W. Corkery and Co. *Records held by the National Native Title Tribunal as at 15th May 2018 indicate that there are two Native Title Determination Applications (Wendy Lewis, Mavis Agnew and Martin de Launey on behalf of Warrabinga-Wiradjuri #2, Warrabinga-Wiradjuri #7) Zero Determinations of Native Title and one Indigenous Land Use Agreements (Gundungurra Area Agreement) over the identified area of Lithgow LGA.*	
17.5.18	NTSCORP	R.W. Corkery and Co. Received response advising their privacy guidelines prevent them from providing any contact details of traditional owners and that they will forward our correspondence to and individual or group they are aware of with relevant knowledge and interest in the area and request they contact us by the 28th May 2018	
28.5.18	OEH	Responded and suggested R.W. Corkery and Co contact Dhuuluu-Yala Aboriginal Corporation, Gundungurra Aboriginal Heritage Association Inc, Gundungurra Tribal Council Aboriginal Corporation, Hawkesbury-Nepean Catchment Management Authority, Lyn Syme, Mingaan Aboriginal Corporation, Mooka, Murra Bidgee Aboriginal Corporation, North-Eastern Wiradjuri, Trevor Robinson, Warrabinga Native Title Claimants Aboriginal Corporation, Wiradjuri Council of Elders, Wiradjuri Interim Working Party	
6.6.18	Office of The Registrar, ALRA	Responded and suggested R.W. Corkery and Co contact Bathurst Local Aboriginal Land Council	
29.5.18	Mr Bill Allen	Stage 1 Community letters expression of interest sent	
29.5.18	Chairperson, Dhuuluu-Yala Aboriginal Corporation*	Stage 1 Community letters expression of interest sent	Letter returned to sender
29.5.18	Chairperson, Gundungurra Aboriginal Heritage Association	Stage 1 Community letters expression of interest sent	
29.5.18	Chairperson, Gundungurra Tribal Council Aboriginal Corporation	Stage 1 Community letters expression of interest sent	
29.5.18	Aboriginal Reference Group, Hawkesbury-Nepean Catchment Management Authority*	Stage 1 Community letters expression of interest sent	Letter returned to sender
29.5.18	Mingaan Aboriginal Corporation	Stage 1 Community letters expression of interest sent	
29.5.18	Mr Neville Williams, Mooka	Stage 1 Community letters expression of interest sent	

Aboriginal Consultation Log - Wallerawang			
29.5.18	Murra Bidgee Aboriginal Corporation	Stage 1 Community letters expression of interest sent	
29.5.18	North – Eastern Wiradjuri	Stage 1 Community letters expression of interest sent	
29.5.18	Mr Trevor Robinson*	Stage 1 Community letters expression of interest sent	Letter returned to sender
29.5.18	Ms Lyn Syme	Stage 1 Community letters expression of interest sent	
29.5.18	Mr Lance Syme, Director, Warrabinga Native Title Claimants Aboriginal Corporation*	Stage 1 Community letters expression of interest sent	Letter returned to sender
29.5.18	Mr Robert Clegg, Wiradjuri Council of Elders	Stage 1 Community letters expression of interest sent	
29.5.18	Wiradjuri Interim Working Party	Stage 1 Community letters expression of interest sent	Letter returned to sender
29.5.18	Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage	Ryan responded and indicated he would like to be a RAP for the project	email
30.5.18	Gundungurra Tribal Council Aboriginal Corporation	Responded, would like to be a RAP for this project	email
30.5.18	Muragadi Heritage Indigenous Corporation	Jesse Carroll – Johnson responded would like to be a RAP for this project	email
4.6.18	Mingaan Aboriginal Corporation	Responded, would like to be a RAP for this project	email
25.6.18	Central Tablelands Local Land Services	Stage 1 Community letters expression of interest sent, closes 9th July 2018	email
21.6.18	Yulay Cultural Services@gmail.com	AI from RWC received a confirmation of RAP from Yulay Cultural Services@gmail.com	email
3.7.18	Yurrandaali Cultural Services	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Barraby Cultural Services	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Mingaan Wiradjuri Aboriginal Corporation	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.6.18	Gundungurra Tribal Council Aboriginal Corporation	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Muragadi Heritage Indigenous Corporation	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Yulay Cultural Service	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Bathurst LALC	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
3.7.18	Warrabinga Native Title Claimants Aboriginal Corporation*	SB sent stage 2 package. Requested confirmation would like to be a RAP as did not receive response initially. Feedback closes 1st August 2018	email
4.7.18	Gundungurra Tribal Council Aboriginal Corporation	SB sent amended letter with correct contact details	email
4.7.18	Merrigarn	SB sent amended letter with correct contact details	email
6.7.18	Barraby Cultural Services	SB received response supporting methodology	email

Aboriginal Consultation Log - Wallerawang			
6.7.18	Yurrandaali Cultural Services	SB received response supporting methodology	email
9.7.18	OEH	RH sent letter advising of RAPs	email
9.7.18	Bathurst LALC	RH sent letter advising of RAPs	email
10.7.18	Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage	SB received response supporting methodology	email
31.7.18	Muragadi Heritage Indigenous Corporation	SB received response supporting methodology	email
17.8.18	Bathurst LALC	RH sent invitation to survey. Fieldwork on 29th August. Requested confirmation to participate by 22.8.18	email
17.8.18	Gundungurra Tribal Council Aboriginal Corporation	RH sent invitation to survey. Fieldwork on 29th August. Requested confirmation to participate by 22.8.18	email
20.8.18	Bathurst LALC	RH received response that Colleen Fisk will be attending as the site officer	email
22.8.18	Gundungurra Tribal Council Aboriginal Corporation	RH phoned to check if attending fieldwork as RSVP ends at 3pm today, went straight to voice mail.	phone
22.8.18	Gundungurra Tribal Council Aboriginal Corporation	RH received email with insurances to confirm will be attending as a site officer	email
22.8.18	Gundungurra Tribal Council Aboriginal Corporation	RH responded to email to clarify who the site officer will be	email
27.8.18	Gundungurra Tribal Council Aboriginal Corporation	RH received response that the site officer will be Vaimoana Kengike and asked how many days field work is.	email
29.8.18		Field survey undertaken with OzArk, Gundungurra Tribal Council and Bathurst Land Council.	in person
29.8.18	Gundungurra Tribal Council Aboriginal Corporation	RH responded advising field work is just the one day, 29th August	email
30.4.19	Bathurst LALC	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Mingaan Wiradjuri Aboriginal Corporation	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Yurrandaali Cultural Services	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Barraby Cultural Services	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Muragadi Heritage Indigenous Corporation	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Yulay Cultural Service	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Gundungurra Tribal Council Aboriginal Corporation	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email
30.4.19	Warrabinga Native Title Claimants Aboriginal Corporation*	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19. Sent to Lance Syme as info 2warrabinga address not receiving emails	email
30.4.19	Merrigarn	Philippa Sokol (PS) sent a copy of the draft heritage report to RAPs for review and comment - report comments close COB Wednesday 29.5.19.	email

Aboriginal Consultation Log - Wallerawang			
		The email kept bouncing back. PS called Shaun to confirm the email address to forward on the report - the mobile number is no longer connected. Unable to get in contact with Merrigarn	
1.5.19	Muragadi Heritage Indigenous Corporation	Anthony of Muragadi sent email response to heritage report: "*I have read the project information and draft report for the above project, I agree with the recommendations made by OzArk."* PS thanked Anthony for taking the time to read the report and his speedy response.	email
5.6.19	Project RAPs	PS sent reminder email for return of comments/feedback to report - except Muragadi which have already responded. Merrigarn could not be sent(see entry 30.4.19), phone and email no longer connected	email
8.6.19	Murra Bidgee Mullangari Aboriginal Corporation Cultural Heritage	PS received a response to the heritage report from Darleen Johnson: *"I have read the project information and CHAR for the above project, I endorse the recommendations made. We would also like to be involved in all aspects of the project i.e. surveying and fieldwork."* PS (11.6.19) thanked Darleen for sending through her response and her interest in participating in future project work.	email

Stage 1 advertisement placed in the *Lithgow Mercury* newspaper, Tuesday 15 May 2018

Expression of Interest

Cultural Heritage Management

OzArk Environmental & Heritage Management P/L has been engaged by RW Corkery Pty Ltd on behalf of the proponent Walker Quarries Pty Ltd and is seeking registrations of interest from Aboriginal groups or individuals of the Lithgow area, who wish to be consulted over the proposed Wallerawang Quarry Extension Project. The Wallerawang Quarry is located south of Wallerawang, approximately 8km northwest of Lithgow, NSW.

The purpose of this consultation is to identify stakeholders to assist in the Aboriginal cultural heritage assessment of the proposed development site. If you hold cultural knowledge relevant to determining the impacts to the cultural significance of the above mentioned area, please register your interest by post: OzArk EHM, PO Box 2069, Dubbo NSW 2830; email: sheridan@ozarkehm.com.au, or by phoning OzArk between 9.00am and 5.00pm weekdays on 02 6882 0118.

All submissions should be received no later than **9am Friday 29th June, 2018.**

Stage 1 letter to agencies and Aboriginal community organisations

R.W. CORKERY & CO.
PTY. LIMITED ABN 31 002 033 712
GEOLOGICAL & ENVIRONMENTAL CONSULTANTS

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14 May 2018

Ms Tonilee Scott,
Bathurst Local Aboriginal Land Council Pty Ltd
149 Russell St,
BATHURST NSW 2795.

Originally sent by email to:
bathlalc2@bigpond.com

Dear Ms Scott,

Re: Aboriginal Cultural Heritage Impact Assessment and Community Consultation: Wallerawang Quarry, Wallerawang, NSW

Walker Quarries Pty Ltd (WQ) has requested RW Corkery & Co. Pty Limited (RWC) to commence Aboriginal community consultation, in accordance with the OEH *Aboriginal cultural heritage consultation requirements for proponents 2010*, for the Wallerawang Quarry (the Quarry). This consultation is to assist with establishing Registered Aboriginal Parties for future consultation, field survey and the potential assessment of impact on sites of Aboriginal Heritage significance.

WQ currently operates the Quarry, located on land adjoining the Great Western Highway to the south of Wallerawang, approximately 8km northwest of Lithgow. Project approval (DA 344-11-2001) was granted to Sitegoal Pty Ltd (parent company of Walker Quarries Pty Ltd) in 2004 by the then Minister for Planning as a 'State Significant Development'. An open camp site was identified on the Quarry Site by R. Silcox in 2000 (as Site WQ1) with a condition of DA 344-11-2001 requiring this Aboriginal site to remain undisturbed. WQ has fenced the location of Site WQ1 which remains undisturbed by Quarry operations. WQ recently commissioned OzArk Environmental and Heritage Management Pty Ltd to assess the nature and extent of the site in March 2018. OzArk confirmed WQ1 as intact and protected (see **Figure 2**) although noted it is not currently recorded in the Aboriginal Heritage Information Management System (AHIMS) database.

WQ proposes to apply for a Modification to DA 344-11-2001 to:

- extend the period of consent beyond July 2019;
- extend the extraction area (both laterally and vertically); and
- increase the area available for stockpiling (to the west of the Western Stockpile Area).

The proposed extensions to the extraction area and stockpiling area are shown in **Figure 1** and would require disturbance to Site WQ1.

Brooklyn Office:
First Floor, 12 Dangar Road, PO Box 239, BROOKLYN NSW 2083
Telephone: (02) 9985 8511 Email: brooklyn@rwcorkery.com
Orange Office:
62 Hill Street, ORANGE NSW 2800
Telephone: (02) 6362 5411 Email: orange@rwcorkery.com
Brisbane Office:
Suite 5, Building 3, Pine Rivers Office Park, 205 Leitchs Road, BRENDALE QLD 4500
Telephone: (07) 3205 5400 Email: brisbane@rwcorkery.com

14 May 2018 - 2 -

We are seeking Expressions of Interest from relevant Aboriginal groups and individuals in the Wallerawang and Lithgow areas to form a consultation group. This consultation is to assist RWC, WQ and archaeological consultants (to be confirmed) in the design and completion of a field survey over the areas of extension identified in **Figure 1** (which may be refined following further definition of the proposed site layout), consideration of the management of Site WQ1, and to assist in assessment and determination of the proposed modification to DA 344-11-2001.

I would be grateful if your organisation can recommend and provide contact details for any known Aboriginal groups who may have an interest for the Quarry area and hold knowledge relevant to determining the cultural significance of Aboriginal objects and/or places such that we can then include them in the consultation process with regards to the proposed heritage management.

We would appreciate it if you could provide any feedback regarding these Aboriginal stakeholder groups by COB Monday 28 May 2018 or sooner if possible.

Yours sincerely

Alex Irwin
Senior Environmental Consultant

Copy: Walker Quarries Pty Ltd

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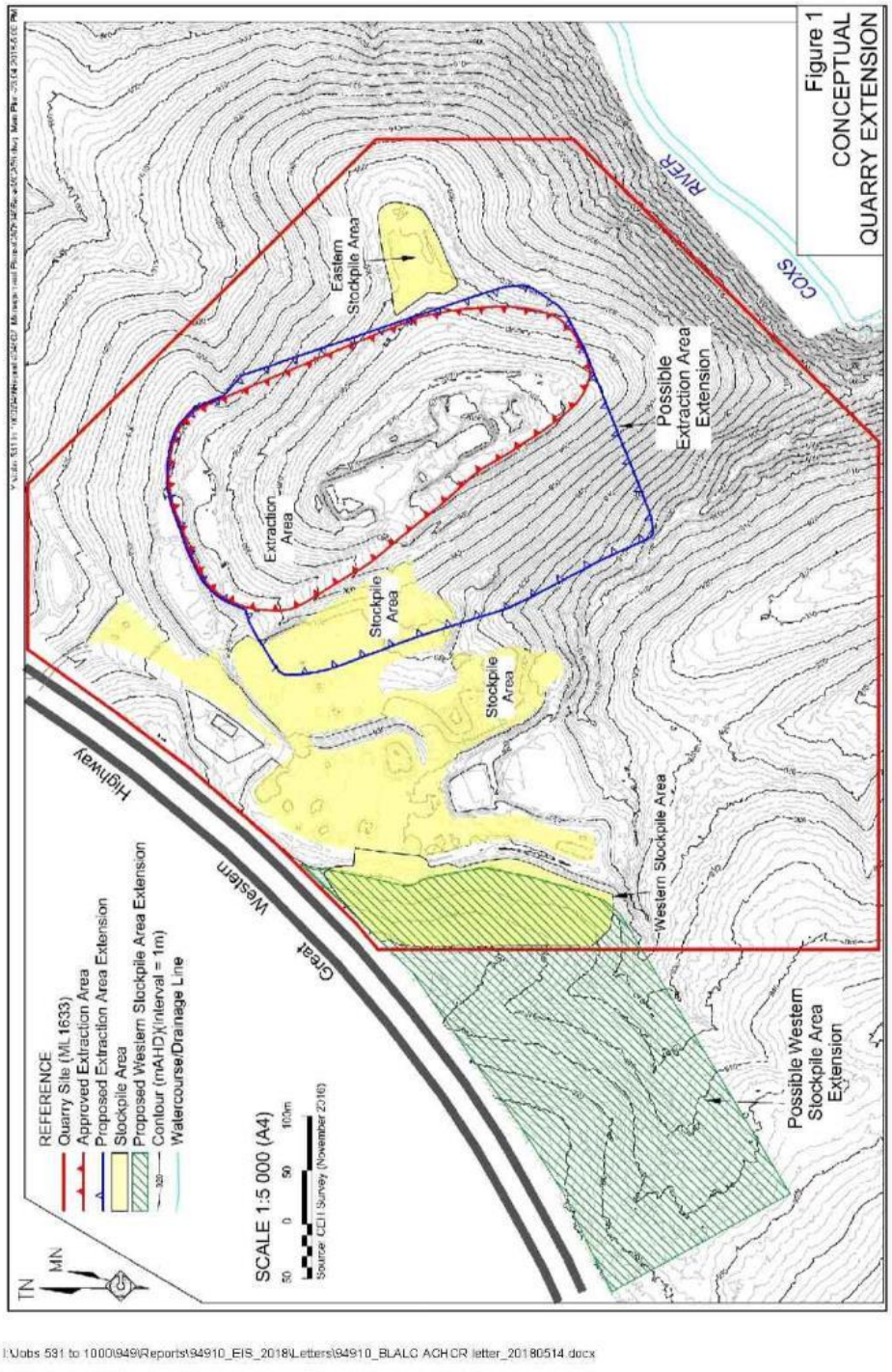
14 May 2018 - 3 -



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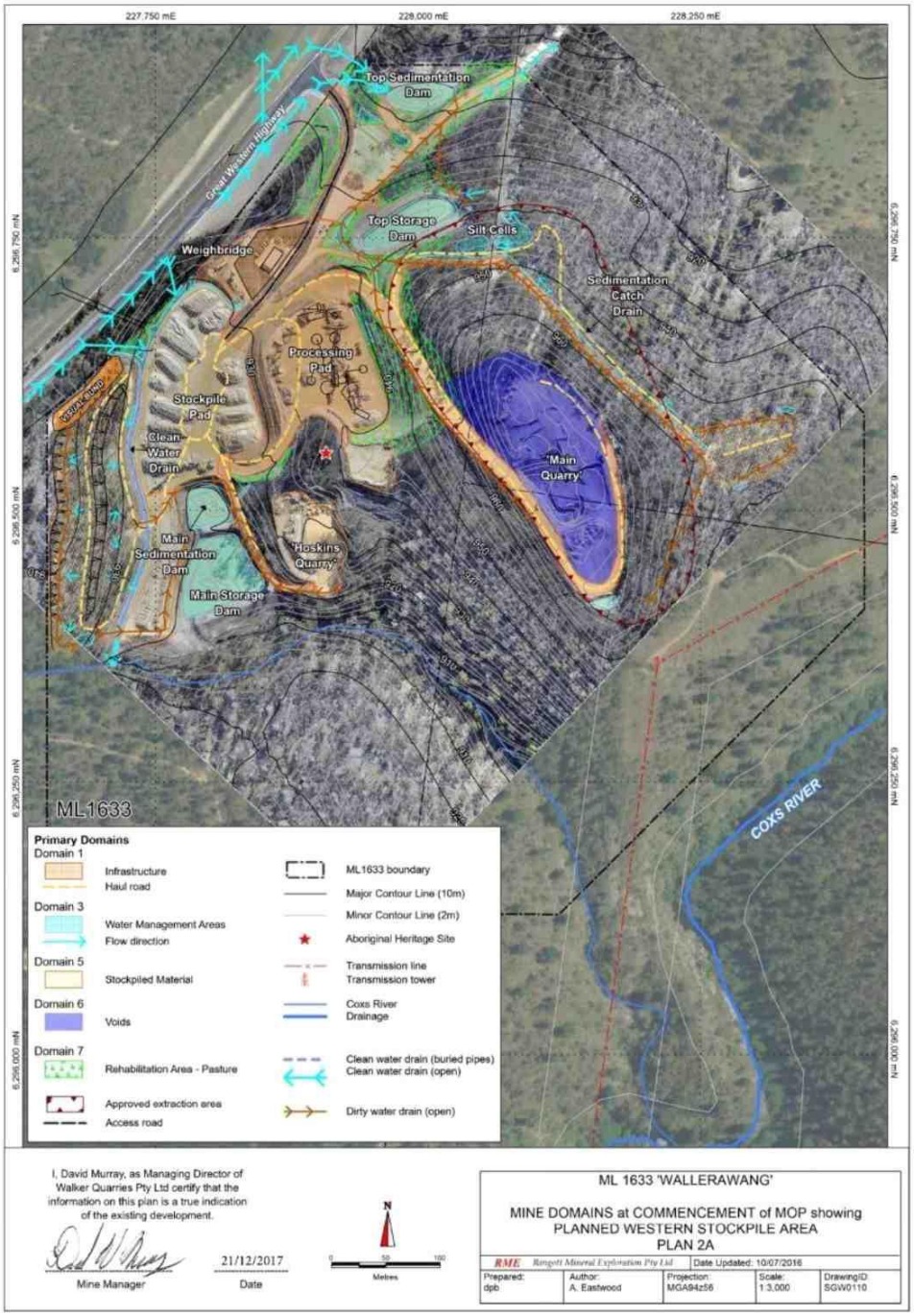
14 May 2018 - 4 -



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Initial Stage 2/3 consultation letter (sent to all RAPs) accompanied the desktop assessment & survey methodology document.

The survey methodology document is a moderately sized document so at this stage has not been inserted here, however, a copy of this document may be requested and can be supplied.

OzArk Environmental & Heritage Management Pty Ltd
ABN: 59 104 582 354

3rd July 2018

Members
Bathurst Local Aboriginal Land Council
c/-Tonilee Scott
149 Russell St
Bathurst NSW 2795
bathlalc2@bigpond.com

Dear Members,

Re: Aboriginal and Historic Heritage Assessment for the proposed Wallerawang Quarry Extension Project.

Thank you for your registration of interest to form part of the stakeholder group to be consulted concerning the potential Wallerawang Quarry Extension, near Lithgow, NSW.

The purpose of this letter is to invite you to comment on the enclosed draft methodology for the heritage assessment survey methodology, Wallerawang Quarry Extension, near Lithgow, NSW. This assessment will support the preparation of a Cultural Heritage Management Plan (CHMP).

In addition to comments on the draft methodology, if you can share any Aboriginal cultural heritage knowledge relevant to the proposed study area, we welcome this input so as to improve our assessment outcomes and to ensure additional Aboriginal cultural values are considered. OzArk is required to give you 28 days to supply feedback on the attached documents. This period closes 5pm **on Wednesday 1st August 2018.** If you need any help supplying feedback please do not hesitate to contact our office.

Should you have any queries in relation to the enclosed information please do not hesitate to contact our office.

Kind regards,

Sheridan Baker

Community Liaison Officer

Dubbo | Queanbeyan
HEAD OFFICE: 145 Wingewarra St/PO Box 2069 DUBBO NSW 2830
ph 02 6882 0118 | enquiry@ozarkehm.com.au | www.ozarkehm.com.au

Stage 4 consultation letter (sent to all RAPs) accompanied the draft ACHAR for RAP review and feedback.

OzArk Environment & Heritage ABN 59 104 582 354
Dubbo T: 02 6882 0118 145 Wingewarra St
Queanbeyan enquiry@ozarkehm.com.au PO Box 2069
Newcastle www.ozarkehm.com.au DUBBO NSW 2830

30th April 2019

Members
Bathurst Local Aboriginal Land Council
C/ - Tonilee Scott
149 Russell Street
Bathurst NSW 2795
bathlalc2@bogpond.com

ABORIGINAL AND HISTORIC HERITAGE ASSESSMENT FOR THE PROPOSED WALLERAWANG QUARRY EXTENSION PROJECT.

Dear Members,

Thank-you for your continued participation as a Registered Aboriginal Party (RAP) and involvement in the above-mentioned project.

Walker Quarries Pty Ltd (the Proponent) would like to offer you the opportunity to provide feedback on the draft report that has been undertaken in accordance with stage four (4) of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCR).

As per the ACHCRs we are required to give you twenty-eight (28) days to supply feedback on the attached documents. This period closes on the **Wednesday 29th May 2019**.

Should our office not be contacted within this time frame, we will presume that you are satisfied with the contents of the report as it stands.

Should you need any help supplying feedback or have any queries, please do not hesitate to contact our office.

Kind regards,

Rebecca Hardman
Community Liaison & Administration

Stage 4 – RAP response and feedback.

Wed 1/05/2019 11:48 AM

Muragadi <muragadi@yahoo.com.au>

RE: Wallerawang Walkers Quarry - Heritage report review and feedback

To philippa

You replied to this message on 1/05/2019 11:50 AM.

Hi Philippa,
I have read the project information and draft report for the above project, I agree with the recommendations made by Ozark.
Kind regards
Anthony
0418970389

From: philippa [mailto:Philippa@ozarkehm.com.au]
Sent: Tuesday, 30 April 2019 1:02 PM
To: muragadi@yahoo.com.au
Cc: Rebecca Hardman <rebecca@ozarkehm.com.au>
Subject: Wallerawang Walkers Quarry - Heritage report review and feedback

Dear Members,

Thank you for your registration of interest in the above project and for your involvement in the project to date.

It has taken a little time to complete a draft report for this project, however, it is now done and ready for review.

As per Stage 4 of the consultation guidelines, please find attached the Stage 4 letter and the draft report for your review and feedback. Can you please send any feedback you may have through by **COB Wednesday 29th May 2019**.

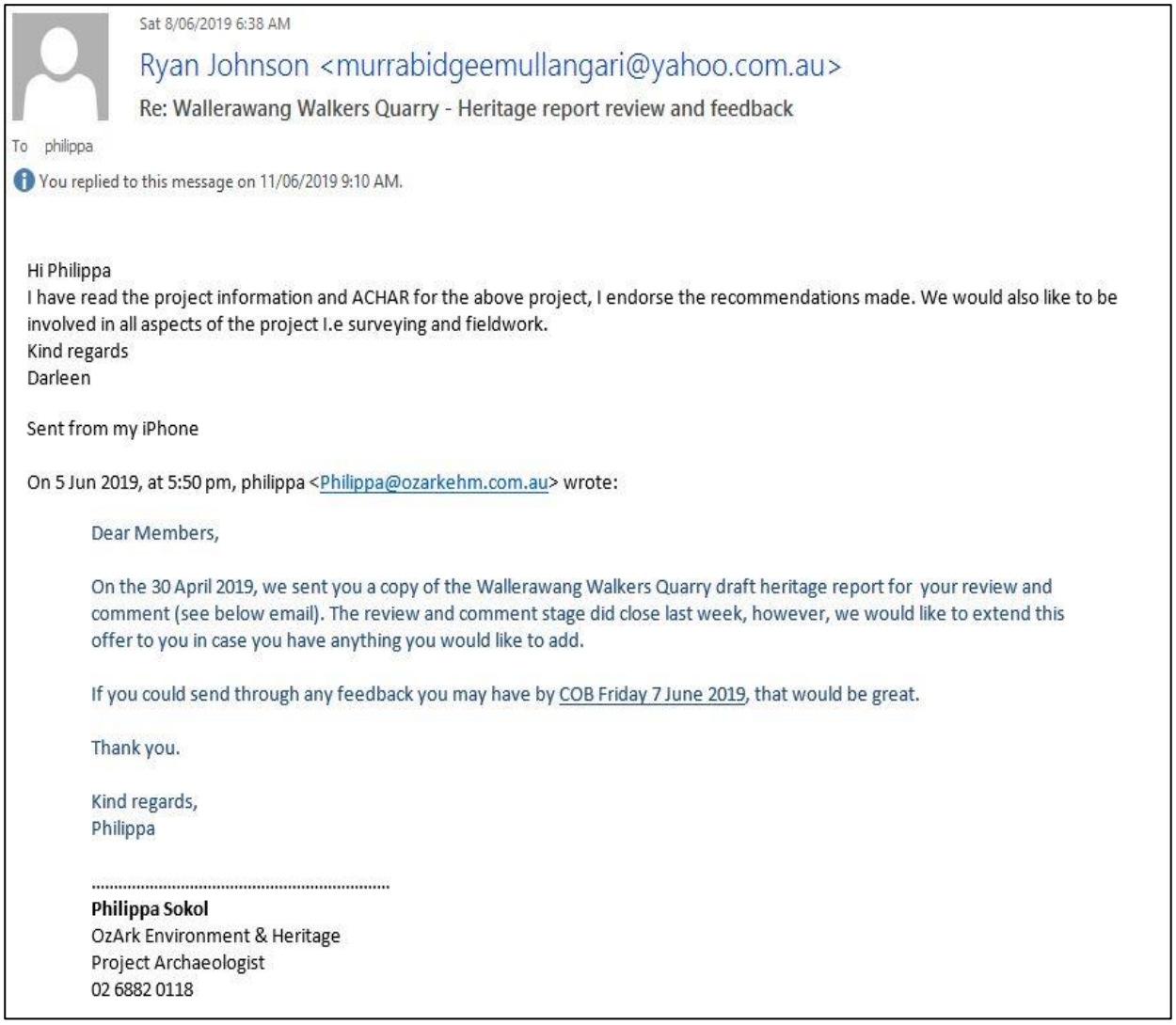
Thank you.

Kind regards,
Philippa

Philippa Sokol
Project Archaeologist

OzArk Environment & Heritage
PO Box 2069 DUBBO 2830
02 6882 0118
philippa@ozarkehm.com.au; www.ozarkehm.com.au

OzArk and staff respectfully acknowledge the Traditional Owners and Custodians of the Country on which we work.



Sat 8/06/2019 6:38 AM

Ryan Johnson <murrabidgeemullangari@yahoo.com.au>

Re: Wallerawang Walkers Quarry - Heritage report review and feedback

To philippa

You replied to this message on 11/06/2019 9:10 AM.

Hi Philippa
I have read the project information and ACHAR for the above project, I endorse the recommendations made. We would also like to be involved in all aspects of the project I.e surveying and fieldwork.
Kind regards
Darleen

Sent from my iPhone

On 5 Jun 2019, at 5:50 pm, philippa <Philippa@ozarkehm.com.au> wrote:

> Dear Members,
>
> On the 30 April 2019, we sent you a copy of the Wallerawang Walkers Quarry draft heritage report for your review and comment (see below email). The review and comment stage did close last week, however, we would like to extend this offer to you in case you have anything you would like to add.
>
> If you could send through any feedback you may have by COB Friday 7 June 2019, that would be great.
>
> Thank you.
>
> Kind regards,
> Philippa
>
> .....
> **Philippa Sokol**
> OzArk Environment & Heritage
> Project Archaeologist
> 02 6882 0118

APPENDIX 2: AHIMS EXTENSIVE SEARCH RESULT

Office of Environment & Heritage NSW

AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/PO Number : Wakers
Client Service ID : 353557

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-1-2572	Site 1, Castlereagh Highway Realignment, Lidsdale	AGD	56	228430	6301025	Open site	Valid	Artefact : -		4549
	Contact	Recorders	Ms Louise Gay					Permits		
45-1-2573	PAD 1, Castlereagh Highway Realignment, Lidsdale	AGD	56	228250	6301070	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		98700;102443
	Contact	Recorders	Ms Louise Gay					Permits	1436;1666	
45-1-2574	PAD 2, Castlereagh Highway Realignment, Lidsdale	AGD	56	228250	6301120	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		98700;102443
	Contact	Recorders	Ms Louise Gay					Permits	1436;1707	
45-1-2583	Duncan/Main Street PAD	AGD	56	228450	6300750	Open site	Valid	Artefact : -		
	Contact	Recorders	Doctor Jodie Benton					Permits	1793	
45-1-0238	Duncan Street PAD(refer to site 45-1-2583)	AGD	56	228450	6300750	Open site	Deleted	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Doctor Jodie Benton					Permits		
45-1-0250	MC7 (IF2);Marrangaroo Creek (IF2);	AGD	56	231900	6297200	Open site	Valid	Artefact : -	Isolated Find	
	Contact	Recorders	Elizabeth Rich					Permits		
45-1-0163	Site 6;	AGD	56	232850	6296850	Open site	Valid	Artefact : -	Open Camp Site	1706
	Contact	Recorders	Doctor Susan McIntyre-Tamwoy					Permits		
45-1-2785	Marrangaroo NP Cox's River	GDA	56	228960	6292622	Open site	Valid	Artefact : -		
	Contact	Recorders	Miss Sharon Alley					Permits		
45-1-2786	Marrangaroo NP Camp Ground	GDA	56	228668	6292938	Open site	Valid	Artefact : -		
	Contact	Recorders	Miss Sharon Alley					Permits		
45-1-0095	Rydal Mount 1 Rydal	AGD	56	224320	6293100	Open site	Valid	Artefact : -	Open Camp Site	950
	Contact	Recorders	Elizabeth Rich,Shelly Greer,Doctor Susan McIntyre-Tamwoy					Permits		
45-1-2716	SU1a - A5	GDA	56	227585	6300837	Open site	Valid	Artefact : 19		
	Contact	Recorders	Ms Cheng-Yen Loo,RPS East Australia Pty Ltd - Echuca Victoria					Permits		
45-2-2539	SU1a - A7	GDA	56	227122	6300093	Open site	Valid	Artefact : 4		
	Contact	Recorders	Ms Cheng-Yen Loo,RPS East Australia Pty Ltd - Echuca Victoria					Permits		
45-1-2717	SU1a - A8	GDA	56	227130	6300072	Open site	Valid	Artefact : 1		
	Contact	Recorders	Ms Cheng-Yen Loo,RPS East Australia Pty Ltd - Echuca Victoria					Permits		
45-1-2718	SU1a - A9	GDA	56	226981	6300239	Open site	Valid	Artefact : 1		
	Contact	Recorders	Ms Cheng-Yen Loo,RPS East Australia Pty Ltd - Echuca Victoria					Permits		
45-1-2719	SU1a - A6	GDA	56	227105	6300095	Open site	Valid	Artefact : 1		
	Contact	Recorders	Ms Cheng-Yen Loo,RPS East Australia Pty Ltd - Echuca Victoria					Permits		

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Office of Environment & Heritage NSW

AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/PO Number : Wakers
Client Service ID : 353557

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-1-2799	Brays Lane AS1	GDA	56	227039	6300622	Open site	Valid	Artefact : -		
	Contact	Recorders	Biosis Pty Ltd - Wollongong,Mrs Samantha Keats					Permits		
45-1-2800	WPS-IF1	GDA	56	228556	6300579	Open site	Valid	Artefact : -		
	Contact	Recorders	Biosis Pty Ltd - Wollongong,Mrs Samantha Keats					Permits		
45-3-2008	Dharug NP;	AGD	56	225400	6296570	Open site	Valid	Art (Pigment or Engraved) : -, Grinding Groove : -	Axe Grinding Groove,Rock Engraving	1333
	Contact	Recorders	Warren Bluff					Permits		
45-1-0164	Site 7;	AGD	56	233250	6296200	Open site	Valid	Artefact : -	Open Camp Site	1706
	Contact	Recorders	Doctor Susan McIntyre-Tamwoy					Permits		
45-1-0211	S2;Wallerawang;	GDA	56	227811	6300741	Open site	Valid	Artefact : -	Open Camp Site	2300
	Contact	Recorders	Mr Neville Baker,Elizabeth Rich,Biosis Pty Ltd - Wollongong,Mrs Samantha Keats					Permits	467	
45-1-0212	GS1;Springvale Colliery;	AGD	56	230700	6300020	Open site	Valid	Artefact : -	Open Camp Site	2300;2608
	Contact	Recorders	Elizabeth Rich,Alice Gorman					Permits		
45-1-0117	MC6;	AGD	56	231910	6296980	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Helen Brayshaw,Elizabeth Rich					Permits		
45-1-0237	Springvale Colliery;	AGD	56	228000	6301000	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Doctor Susan McIntyre-Tamwoy					Permits	496	
45-1-0247	Wallerawang Schoolhouse;	AGD	56	228240	6300510	Open site	Valid	Artefact : -	Open Camp Site	3858
	Contact	Recorders	Ms Elizabeth White					Permits		
45-1-0095	Rydal;Pipers Flat Range;	AGD	56	225180	6301000	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Art,Shelter with Deposit	
	Contact	Recorders	Ann Jelinek					Permits		
45-1-0099	Marangaroo Ridge 4;	AGD	56	232490	6297420	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	Helen Brayshaw					Permits		
45-1-0090	Marangaroo Ridge 5;	AGD	56	232580	6297420	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	ASRSYS					Permits		
45-1-0096	Elizabeth Vale 1;Wallerawang;	AGD	56	224800	6297450	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	950
	Contact	Recorders	Elizabeth Rich,Shelly Greer,Doctor Susan McIntyre-Tamwoy					Permits		
45-1-0100	W1;	AGD	56	229620	6297320	Open site	Valid	Artefact : -	Open Camp Site	1515
	Contact	Recorders	Rex Silcox					Permits		
45-1-0109	W2;	AGD	56	229600	6297350	Open site	Valid	Artefact : -	Open Camp Site	1515

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Office of Environment & Heritage NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Walkers
Client Service ID : 353557

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Rex Silcox					Permits		
45-1-0110	W4;	AGD	56	228620	6297310	Open site	Valid	Artefact : -	Open Camp Site	1515
	Contact	Recorders	Rex Silcox					Permits		
45-1-0111	W3;	AGD	56	228730	6297320	Open site	Valid	Artefact : -	Open Camp Site	1515
	Contact	Recorders	Rex Silcox					Permits	78	
45-1-0112	MC1;	AGD	56	231500	6297100	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	Helen Brayshaw,Elizabeth Rich					Permits		
45-1-0113	MC2;	AGD	56	232470	6297150	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	Helen Brayshaw,Elizabeth Rich					Permits		
45-1-0114	MC3;	AGD	56	232650	6297780	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	Elizabeth Rich					Permits		
45-1-0115	MC4;	AGD	56	232680	6297500	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	Helen Brayshaw,Elizabeth Rich					Permits		
45-1-0116	MC5;	AGD	56	232270	6297030	Open site	Valid	Artefact : -	Open Camp Site	1414
	Contact	Recorders	Helen Brayshaw,Elizabeth Rich					Permits		
45-1-0010	Pipers Flat Creek;	AGD	56	225600	6300700	Closed site	Valid	Artefact : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Deposit	1515
	Contact	Recorders	D Miller					Permits		
45-1-0012	Pipers Flat Creek;	AGD	56	225250	6301150	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Deposit	
	Contact	Recorders	D Miller					Permits		
45-1-0013	Pipers Flat Creek;	AGD	56	225230	6300900	Closed site	Valid	Artefact : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Deposit	
	Contact	Recorders	ASRSYS					Permits		
45-1-0014	Pipers Flat Creek;	AGD	56	224800	6301100	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	R Miller					Permits		
45-1-0020	Pipers Flat Creek;	AGD	56	225750	6300300	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Art,Shelter with Deposit	
	Contact	Recorders	R Miller					Permits		
45-1-0021	Pipers Flat Creek;	AGD	56	225700	6300250	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	R Miller					Permits		

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Office of Environment & Heritage NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Walkers
Client Service ID : 353557

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-1-0022	Pipers Flat Creek;Bald Rock;	AGD	56	226630	6300510	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	R Miller					Permits		
45-1-0023	Pipers Flat Creek;Bald Rock;	AGD	56	226500	6300500	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	R Miller					Permits		
45-1-0048	Wallerawang; Lithgow;	AGD	56	226900	6299100	Open site	Valid	Burial : -, Modified Tree (Carved or Scarred) : -	Burial/s,Carved Tree	
	Contact	Recorders	David Bell,NPWS - Blackheath Office,Betty Meehan					Permits	473	
45-1-2545	Wallerawang Station Massacre	AGD	56	228600	6299500	Open site	Valid	Burial : -	Burial/s	
	Contact	Recorders	Ms Adrienne Howe-Pienlap					Permits		

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