YANCOAL
兖煤澳大利亚有限公司

Moolarben Coal Project
Stage 1 Optimisation Modification

Environmental Assessment

Prepared for Moolarben Coal Operations Pty Limited | May 2013

Volume 1 – Main Report

MOOLARBENCOAL
PART OF THE YANCOAL AUSTRALIA GROUP

EMM
EMGA Mitchell McLennan

Moolarben Coal Project - Stage 1 Optimisation Modification

Environmental Assessment

Prepared for Moolarben Coal Operations Pty Limited | 14 May 2013

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

T +61 2 9493 9500
F +61 2 9493 9599
E info@emgamm.com

emgamm.com

Moolarben Coal Project - Stage 1 Optimisation Modification

Final

Report J12090RP1 | Prepared for Moolarben Coal Operations Pty Limited | 14 May 2013

Prepared by	**John Arnold**	Approved by	**Luke Stewart**
Position	Project Manager	Position	Project Director
Signature		Signature	
Date	14 May 2013	Date	14 May 2013

Document Control

Version	Date	Prepared by	Reviewed by
1	14 May 2013	John Arnold	Luke Stewart

EMM
EMGA Mitchell McLennan

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

emgamm.com

ENVIRONMENTAL ASSESSMENT CERTIFICATION

For submission of an environmental assessment (EA) under Section 75W of the NSW *Environmental Planning and Assessment Act 1979.*

EA prepared by

Luke Stewart

BAppSc (Hons)

John Arnold

BA (Hons); BTP

EMGA Mitchell McLennan Pty Limited

Ground Floor, Suite 1

20 Chandos Street

St Leonards NSW 2065

Applicant

Moolarben Coal Operations Pty Limited

4250 Ulan Road, ULAN NSW 2850

Proposed development

Moolarben Coal Project – Stage 1 Optimisation Modification

Refer to Chapter 4 of the EA for a detailed description of the proposed modification

Land to be developed

Refer to Appendix 1 of the Project Approvals in Appendix A to the EA

Certification

We certify that we have prepared this EA and to the best of our knowledge the information contained in this EA is neither false or misleading

Luke Stewart

Project Director

14 May 2013

John Arnold

Project Manager

14 May 2013

Executive Summary

ES1 Introduction

The Moolarben Coal Project (MCP) is in the Western Coalfields of NSW, approximately 40 km north-east of Mudgee (Figure ES.1). Moolarben Coal Operations Pty Limited (MCO) operates Stage 1 of the MCP, which was granted Major Project Approval 05_0117 (MP 05_0117) under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007, for an open cut and underground coal mine.

Since gaining approval, MP 05_0117 has been modified on seven occasions to make administrative changes, changes to infrastructure and allow the construction of a borefield. The main components of the MCP Stage 1, as modified, comprise:

- three open cut pits, referred to as Open Cuts 1, 2 and 3, which have an approved combined maximum extraction rate of 8 million tonnes per annum (Mtpa) of run of mine (ROM) coal;
- one underground mine, referred to as Underground 4, which has an approved maximum extraction rate of 4 Mtpa of ROM coal;
- coal handling, processing, rail loop, load-out and water management infrastructure; and
- associated facilities such as offices, bathhouses, workshops and fuel storages.

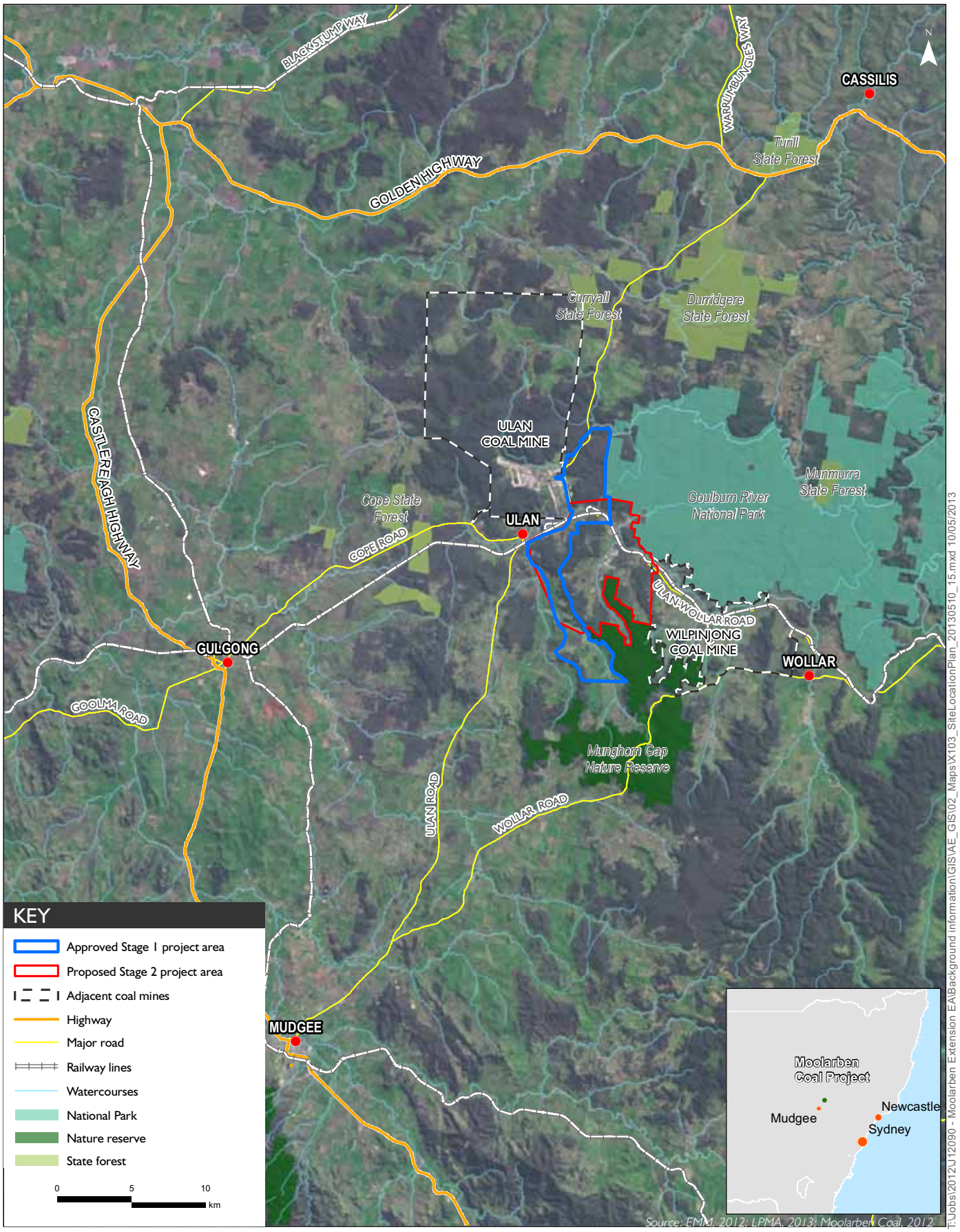
To date, mining has occurred within Open Cut 1 only, commencing at the south-western perimeter and progressing in a north-easterly direction.

The disturbance limit granted under MP 05_0117, as modified, is limiting potential access to substantial economically viable recoverable coal resources. MCO proposes to extend the area approved for mining into land adjacent to Open Cuts 1 and 2. The proposed mine extensions are the principal subject of this environmental assessment (EA). The resource is approximately 30 Million tonnes (Mt) of ROM coal. Implementation of the proposed modification is primarily intended to enable these resources to be mined. The proposed modification's implementation will also greatly improve the efficiency of mining operations within Open Cuts 1 and 2, reducing extraction costs.

All elements of the proposed modification are encompassed by the Stage 1 project approval boundary, which forms the 'project area' for the proposed modification. The Open Cut 1 and 2 extension areas are referred to collectively as the 'proposed extension areas'.

ES2 EA purpose

This EA accompanies an application by MCO for the proposed modification, in accordance with Section 75W of the EP&A Act. It provides an assessment of the potential impacts resulting from the proposed modification and details measures that will be implemented, subject to approval, to avoid, minimise and/or offset potential impacts. The EA provides information to allow NSW government authorities to assess the merits of the proposed modification and to enable the Minister for Planning and Infrastructure or the Minister's delegate to make a determination as to whether or not to grant approval.



MCP location plan

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure ES.1

ES3 Assessment approach

The mine plans and mining methods utilised for the purposes of this assessment provide an indicative worst case analysis.

It is important to note that a Major Project Application for Stage 2 of the MCP, MP 08_0135, is currently being assessed by the NSW Department of Planning and Infrastructure (DP&I). If approved, Stage 2 will consist of one open cut pit, Open Cut 4, and two underground mines, Undergrounds 1 and 2, and associated additional infrastructure.

The proposed modification is a standalone proposal that will not affect Stage 2. However, if both Stage 2 and the proposed modification are approved, Stage 1 (including the proposed modification) and Stage 2 will operate concurrently. To enable probable worst case environmental impacts to be considered, this EA is based on assessment of Stage 1, Stage 2 and the proposed modification.

In the course of operational implementation, mine plans and mining methods may be utilised that differ from those currently approved under MP 05_0117, as modified, provided that in all cases the environmental impacts remain within the envelope of effects assessed in this report.

ES4 Regional context

The MCP is bordered by the Goulburn River to the north-west; privately-owned grazing land to the north; Goulburn River National Park, Wilpinjong Coal Mine and Munghorn Gap Nature Reserve to the east; privately-owned grazing land to the south; and privately-owned grazing land, Ulan settlement and Ulan Coal Mine to the north-west. Photograph ES1 shows an aerial view of the mine and its immediate surrounds with Open Cut 1 in the mid-ground of the photograph.

Photograph ES.1 Aerial view of MCP facing north towards the mine

The majority of the project area is similar to its surrounds, namely undulating pastoral land with stands of native woodland retained along the hillsides and creeks. Most of the proposed extension areas are steeper wooded hillsides, which present severe constraints to agricultural production. The proposed Open Cut 1 extension area contains Crown-owned land and land owned by Ulan Coal Mine. The entirety of the proposed Open Cut 2 extension area is owned by MCO.

Coal mining in the area has been ongoing since the early 1900s. The Ulan Coal Mine, which is adjacent to the north-west of the MCP, was commissioned in the 1980s. The Wilpinjong Coal Mine, to the east of the MCP, was commissioned in 2007. The Sandy Hollow to Gulgong Railway provides the transport link for delivery of coal to export markets via the Port of Newcastle and to domestic markets.

The Ulan settlement west of the MCP includes a small primary school, a church, a hotel, mine-owned residential dwellings and vacant and Council owned-land. A rural residential development known as Cook's Gap, with a residential population of approximately 490 residents, is located about 4 km to the south-west of the MCP. A small number of farms and scattered homesteads occupy the rest of the surrounding freehold land.

The Upper Goulburn River has a catchment area of approximately 2,455 km^2. The ephemeral Moolarben Creek is a tributary of the upper Goulburn River catchment, flowing in a northerly direction along the western boundary of the project area. The majority of Open Cuts 1 and 2 and the proposed extension areas are located within the Moolarben Creek catchment. There are no surface waterbodies in the proposed extension area footprints.

The climate in the vicinity of the project area is typical of temperate regions and is characterised by hot dry summers with some thunderstorms, and cold winters with frequent frosts. Mean annual rainfall is 639 mm whilst the mean daily temperature during January, the hottest month in summer, is 31.0 degrees-centigrade (°C). The mean daily temperature in July, the coolest month in winter, is 14.6°C.

The MCP is located in the northern part of the Western Coalfield and occupies the north-west margin of the Sydney Basin in NSW. This coalfield contains measures of mid to late Permian age, which are known as the Illawarra Coal Measures. The Illawarra Coal Measures include (inter alia) the Ulan Seam, the only seam of economic significance in the MCP, and the target seam for MCO. The total coal resource in the project area is estimated at 187 Mt, which includes an estimated ROM coal reserve of approximately 127 Mt.

ES5 Project approval and existing operations

ES5.1 Project approval

A summary of the approved Stage 1, as previously modified, is provided in Table ES.1.

Table ES.1 Stage 1 project summary

Aspect	Description
Project life	• 21 years (December 2028)
Mining operations (open cut)	• three open cut mines, Open Cuts 1, 2 and 3, will be mined at a combined rate of up to 8 Mtpa ROM coal
Mining operations (underground)	• one underground mine, Underground 4, will be mined at up to 4 Mtpa ROM coal
Blasting	• up to two blasts per day and nine blasts a week over any 12 month period, between the hours of 9:00 am to 5:00 pm, Monday to Saturday
Coal handling, preparation and processing	• coal from the open cut pits will be transferred by truck and conveyor to the coal handling and preparation plant (CHPP) • coal from Underground 4 will be transferred to the CHPP by conveyors • up to 12 Mtpa of ROM coal will be processed
Coal production, loading and rail transport	• product coal will be produced at up to 10 Mtpa • product coal will be loaded onto trains via a rail loop and rail load out facility with up to four trains a day during any 24-hour period
Water demand and supply	• water demand at peak production will be approximately 6.9 mega litres (ML)/day (2,520 ML/year) • water will be supplied from mine inflows, surface water capture, recycled process water, water sharing with adjoining mines and groundwater borefield, where required
Hours of operation	• construction during daylight hours, seven days a week • civil works in the Main Infrastructure Area will occur 24-hours a day, seven days a week • mining operations will occur 24-hours a day, seven days a week
Employment	• 220 construction and 317 full time positions
Rehabilitation	• all disturbed areas will be progressively rehabilitated

ES5.2 Environmental management

Environmental management is a central component of the MCP's overall management structure and is considered during every stage of the mining process to ensure that environmental impacts are minimised. Environmental management at the MCP is undertaken in accordance with:

- MCO's Environmental Management Strategy (EMS);
- commitments made in the EAs for the Stage 1 approval and subsequent modifications;
- environmental management plans (EMPs) prepared under the EMS;
- MCO's Mining Operations Plan (MOP); and
- MCO's Environment Protection Licence (EPL).

The existing environmental management processes and procedures are referred to where relevant in the EA technical assessments.

ES6 Proposed modification

MCO seeks approval to modify MP 05_0117 under Section 75W of the EP&A Act to enable:

- the extension of mining within Open Cuts 1 and 2;
- the construction and operation of additional water management infrastructure; and
- a minor change to the rehabilitation sequencing and final landform.

The Stage 1 approval period will be extended from 2028 to 2033 to accommodate the proposed modification (refer to Section ES3).

The proposed modification elements are shown in Figure ES.2.

No other changes are proposed under the modification: there will be no change to the maximum annual rate of coal production or extraction, mining methods, equipment, employee numbers, operating hours, coal handling and processing, coarse rejects and tailings management, site access or external coal transport.

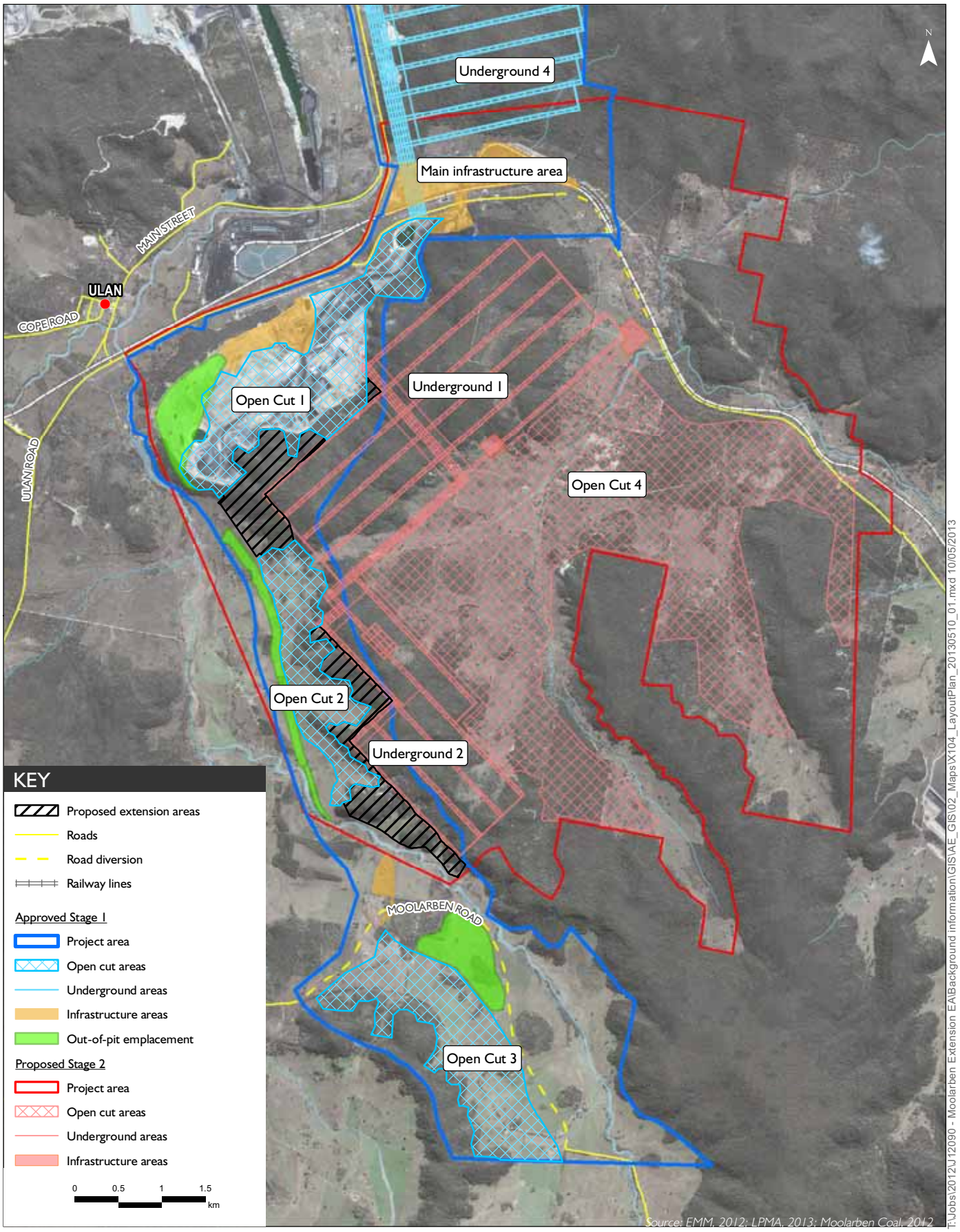
Potential environmental impacts under the proposed modification are largely similar to those associated with the existing approved operation. For example, potential impacts on water resources are negligible and amenity impacts minor, with no additional privately-owned residences predicted to be subject to acquisition upon request. Where residual unavoidable impacts have been identified to ecology, a substantial offset package has been developed in accordance with relevant NSW and Commonwealth policies to ensure the proposed modification has a net positive impact on biodiversity.

ES7 Statutory framework

MCO is seeking approval for a proposed modification to MP 05_0117, granted under the provisions of Part 3A of the EP&A Act. Although Part 3A has been repealed, the proposed modification is deemed to be a transitional Part 3A project. Section 75W of the EP&A Act enables the Minister to modify a project approval granted under Part 3A of the EP&A Act. In determining whether changes to a Part 3A project can be modified under Section 75W, consideration is given to the project and any possible change in potential associated environmental impacts. The features of the proposed modification, and the scale of its environmental impacts, indicate that the proposed modification is within the scope of Section 75W.

The proposed modification is permissible under the relevant local government planning instrument, namely the Mid-Western Regional Local Environmental Plan (MWR LEP) 2011.

A referral of proposed action will be submitted to the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999* for impacts on matters of national environmental significance. Specifically, this includes 16.5 ha of the Critically Endangered Ecological Community, White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands.



Proposed modification layout plan

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure ES.2

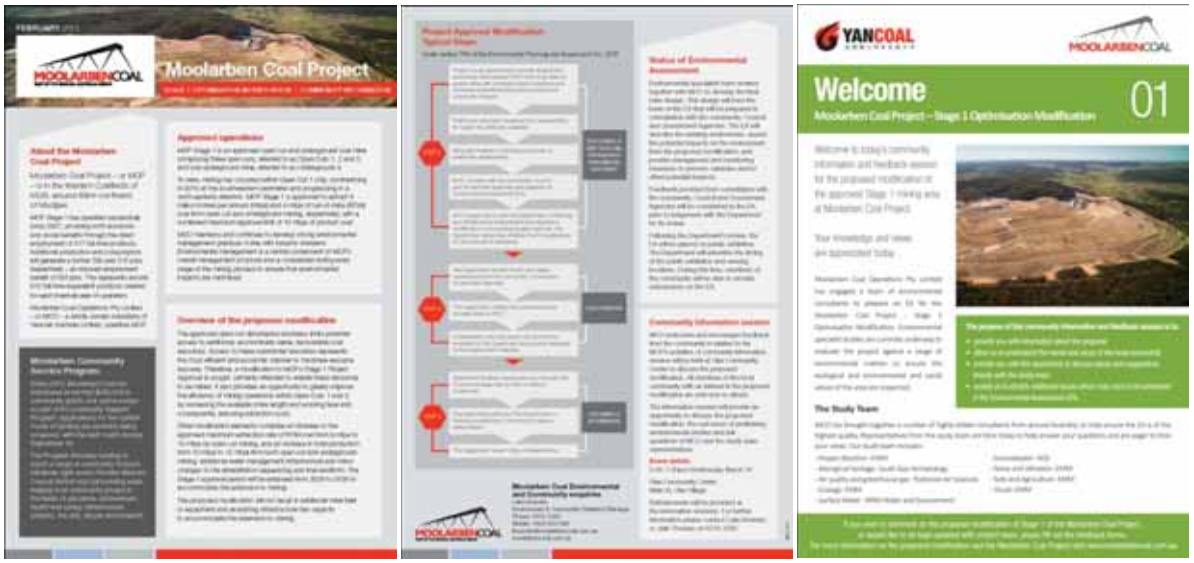
ES8 Stakeholder engagement

A stakeholder engagement strategy was developed for the proposed modification. The strategy identified stakeholders for direct engagement which were divided into two groups, namely:

- community and special interest groups; and
- government and service providers.

MCO is committed to communicating and engaging with the community and other stakeholders in respect to ongoing operations at the MCP. Information sharing and community engagement activities such as a 24 hour community response line, MCO website, Community Consultative Committee and publication of environmental monitoring results are ongoing.

Engagement activities related specifically to the proposed modification and comprised the issuing of a community newsletter and community information and feedback session, as well as meetings with government agencies and other key stakeholders. An example storyboard from the community information and feedback session and community newsletter is provided below.



Matters raised during community and special interest group engagement activities are listed in Table ES.2.

Table ES.2 Matters raised by community and special interest groups

Stakeholder	Matters raised
CCC (Meeting 12/03/2013)	• Hours of operation
	• Relationship of the proposed modification with Stage 2
	• Areas of additional disturbance
Local residents Community information and feedback session (13/03/2013)	• Justification for the limit of the existing acquisition zone
	• Acquisition zone under the proposed modification
	• Compensation and/or house improvements for noise impacts
	• Loud noise and sleep disturbance
	• Potential impacts on property from blasting
	• Impacts on native fauna from habitat removal
	• Safety concerns from cumulative mining traffic on Ulan Road
	• Quality of existing road network
	• Drawdown of bore water
	• Timeframes for and approach to rehabilitation
	• Success of rehabilitation to date and establishment timeframes
	• Land use at completion of mining
	• Assessment of dust impacts and health risks
	• Timing for the publication of monitoring results
	• Changes in viewscape resulting from the proposed modification
	• Timeframe of changes
	• Fragmentation/loss of local community
	• Existing community infrastructure and services
	• Uncertainty of property values
	• Lack of information/surety on future expansion plans
	• Need for proactive community engagement by mines generally
Ulan Coal Mine (Meeting 11/03/2013)	• Potential cumulative noise and dust impacts

Matters raised by government agencies and service providers are listed in Table ES.3.

Table ES.3 Matters raised by government agencies and service providers

Stakeholder	Matters raised
Department of Planning and Infrastructure (DP&I) (Meeting 17/12/2012)	• Magnitude of potential noise impacts
	• Assessment approach
	• Legislation pathway
	• Offset requirements and approach to offsetting
	• Naming of vegetation communities
	• Commonwealth approval requirements
	• Potential visual impacts from extension of mining the ridgeline
	• Harvestable water rights and the need to demonstrate an ability to offset any water take
	• Final landform, including void
Environment Protection Agency (EPA) (Meeting 5/02/2013)	• Potential noise and air quality impacts
	• Additional consultation with DP&I and EPA
Office of Environment and Heritage (OEH) - Heritage (Meeting 11/02/2013)	• Additional consultation with DP&I and EPA
	• Stakeholder engagement and the mechanism for the management of minor rock shelters identified in preliminary assessment
	• Aboriginal Heritage Management Plan
	• Offset areas and archaeological considerations
OEH/National Parks and Wildlife Service - Biodiversity (Meeting 15/02/2013)	• Offset management and approach to offsetting
EPA and DP&I (Meeting 7/3/2013)	• Meteorological conditions and assessment approach
	• Validation factor and its implication to modelling
	• EPA recommended the adoption of more conservative inversion conditions than the INP recommends
	• Meteorological conditions and assessment approach
	• Existing background dust levels and the 'clean air environment'
NSW Office of Water – Policy (Meeting 18/03/2013)	• Further investigation required into the potential encroachment on and water take from Moolarben Creek and its associated alluvium
	• Licensing for water take
	• Groundwater dependent ecosystems

All the matters raised in the tables above were addressed in the EA. Other stakeholders engaged that did not raise specific matters comprised:

- Mid-Western Regional Council;
- Wilpinjong Coal Mine;
- Port Waratah Coal Services;

- Division of Resources and Energy (within the Department of Trade and Investment, Regional Infrastructure Services);
- Roads and Maritimes Services (within Transport NSW);
- Australian Rail Track Corporation;
- Department of Primary Industries;
- Hunter Valley Coal Chain Coordinator;
- Newcastle Port Corporation; and
- Aurizon.

ES9 Environmental risk assessment

An environmental risk assessment was undertaken to determine the proposed modification's potential environmental impacts, the risk of them occurring and the consequence of occurrence. The identification of risks enabled the determination of assessment priorities for the EA and further amelioration measures to be incorporated into the design of the proposed modification.

The assessment found that the majority of environmental risks from the proposed modification were considered low or moderate, with the exception of five high risk environmental attributes, namely noise, ecology, socio-economic, Aboriginal cultural heritage and visual. One ecological risk, adverse impacts on Box Gum Woodland, was rated as extreme.

Following mine plan optimisation, environmental assessment and the development of additional measures to prevent, minimise and offset potential impacts, all levels of risk were reduced. There were no residual extreme or high risks, with all risks either being rated moderate or low.

ES10 Environmental assessment

The findings of the various environmental studies are summarised below.

ES10.1 Acoustics

A risk assessment prepared during the scope development for the proposed modification identified noise as a potential high risk issue requiring detailed assessment. Accordingly, EMM worked together with MCO mine planning engineers to develop an operational strategy that achieved MCO production objectives whilst minimising the potential for environmental noise impacts. This was generally achieved by revising the sequence of mine activity in all approved and proposed open cut mining areas to reduce the intensity of mining activity (ie in comparison to previous assessments) at nearest assessment locations over the mine life.

It is noted that a technical peer review of the noise and vibration impact assessment was carried out by Dr Rob Bullen, Wilkinson Murray. Feedback received was incorporated as appropriate into the assessment.

The operational noise assessment of the optimised mine plans predicted that during adverse weather conditions for all assessment periods and all stages of the mine life with all reasonable and feasible mitigation included, the majority of assessment locations will experience noise levels below MP 05_0117 noise impact assessment criteria.

Six assessment locations are, however, predicted to experience noise levels between 1 and 5 dB(A) above the MP 05_0117 noise impact assessment criteria, which place these assessment locations in a potential noise management zone. One of these, assessment location 63, is currently listed in the additional noise mitigation section of MP 05_0117 (Condition 8), and the owners of the property have entered into a noise agreement with MCO, that will take effect subject to the positive determination of the Stage 2 proposal.

No assessment locations have been predicted to be in a potential noise acquisition zone during adverse weather conditions for all assessment periods, for all stages of the mine life.

The assessment found that no private landholders are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of their total land area. However, within two privately owned properties, six individual lots listed in Table 6.4, are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of the individual lot land area.

It is important to note that noise levels at Ulan Public School are predicted below the 35 dB(A) internal noise limit during calm and adverse meteorological conditions.

All other noise and blasting criteria relevant to the proposed modification are predicted to be met. Management and monitoring will continue in accordance with the Noise Management Plan and Blast Management Plan for the MCP. This includes predictive and real time noise monitoring and implementation of innovations and initiatives such as application of impact resistant rubber tray lining to several dump trucks and use of dedicated production assistants to monitor and support real time noise mitigation strategies.

ES10.2 Air quality and greenhouse gases

The air quality and greenhouse gas assessment utilised air dispersion modelling and focused on potential dust impacts from the mine in isolation (incrementally) and cumulatively with other nearby mines and background levels of dust.

The current air quality levels associated with the MCP and the incremental levels predicted under the proposed modification meet the relevant air quality criteria for deposited dust, TSP, annual average PM_{10} and $PM_{2.5}$ at nearby privately-owned residences. Exceedence of the PM_{10} maximum 24-hour average concentrations is predicted at a commercial assessment location, however the exceedance is predicted to occur no more than one day in a year, which is below the DP&I acquisition criterion.

Total (cumulative) impacts predicted with the proposed modification meet the relevant air quality criteria for TSP and deposited dust at all assessment locations. Exceedences of PM_{10} total annual average concentrations are predicted at one commercial assessment location.

It is important to note that dust levels at the Ulan Public School are predicted to be below all air quality criteria under all modelled scenarios.

The assessment included a range of air quality management measures in accordance with the existing Air Quality Management Plan for the MCP, which incorporate best practices for the control of dust emissions from coal mines. These measures will continue to be implemented by MCO under the proposed modification.

The annual contribution of greenhouse gas emissions from the proposed modification in comparison to the Australian greenhouse emissions for the period October 2011 to September 2012 is estimated to be approximately 0.016%. The estimated annual average Scope 1 greenhouse emissions for the proposed modification are similar to the equivalent greenhouse gas emissions estimated at 0.1Mt CO_2-e for the Stage 2 Preferred Project Report (PAE Holmes, 2011).

Management of greenhouse gas emissions will continue to be undertaken in accordance with MCO's energy savings action plan.

ES10.3 Ecology

Numerous ecological studies have been undertaken within the study area and surrounds. These studies have enabled ecological risks to be incorporated into the mine design for the proposed modification, limiting its potential adverse impacts.

Previous studies were supplemented by detailed surveys of the areas with the potential to be directly and indirectly impacted by the proposed modification.

The proposed modification requires the progressive removal of approximately 171.4 ha of native vegetation and 6.6 ha of exotic pasture, with a total impact area of approximately 178 ha, including 17.2 ha of an endangered ecological community under the TSC Act (containing 16.5 ha of a critically endangered ecological community listed under the EPBC Act). Likely significant impacts are predicted for one threatened bird and cave-roosting microbat.

Management of potential impacts have been addressed according to the hierarchy of avoid, mitigate then compensate. Avoidance measures principally related to the modification of the mine design to be offset from the Moolarben Creek riparian zone and to ensure connectivity between forested areas to the north and south was maintained. Mitigation includes implementation of measures to prevent adverse impacts to fauna during progressive clearing, maximisation of seed collection where practical and restoration and enhancement of fauna habitat.

A Biodiversity Offset Strategy (BOS) was prepared to compensate for the unavoidable residual impacts on native vegetation and threatened species habitats from the proposed modification. The BOS includes a proposed Biodiversity Offset Package (BOP) which comprises seven strategically located properties that will be permanently protected via an appropriate conservation mechanism and managed for conservation outcomes.

The BOS was prepared to provide "*a comprehensive offset strategy to ensure that the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term*" in general recognition of the NSW Offsetting Principles (OEH 2008) and the Office of Environment Heritage (OEH) Interim Policy on assessing and offsetting impacts of Part 3A, State Significant Development (SSD) and State Significant Infrastructure Projects (OEH 2011). The BOS also provided consideration to EBPC Act Offset Policy (SEWPaC).

Investigations for suitable offset properties provided consideration to identifying lands with appropriate conservation values in proximity to the MCP including land owned by MCO, land for sale or landowners who had expressed interest in managing their properties for conservation, identifying where these lands have potential to provide "like for like" vegetation and threatened species habitat (consistent with the provisions of the OEH's (2011) Policy).

Where possible, focus was directed to land adjacent to existing conservation areas including Goulburn River National Park, Munghorn Gap Nature Reserve, approved Stage 1 and proposed Stage 2 offsets, thereby adding to the overall extent and connectivity of conserved land in the area. The approach also focused on increasing the strategic value of MCO's offsets for the MCP in its entirety.

Following extensive investigations the BOP was formed. The locations of the offset properties, together with offset areas approved under Stage 1, proposed under Stage 2 and approved for other mines' in locality, are shown in Figure 10.3.

The BOP accords with both NSW and Commonwealth offsetting principles and achieves a maintain or improve biodiversity outcome.

As with vegetation disturbance, rehabilitation will take place progressively as mining advances. It is also noted that offsets will be conserved and enhanced for biodiversity outcomes as soon as practical, subject to the proposed modification's approval.

The proposed avoidance, mitigation and compensation measures will provide a net positive biodiversity outcome.

ES10.4 Aboriginal cultural heritage

An Aboriginal Cultural Heritage Assessment (ACHA) was prepared to identify, assess and manage the Aboriginal cultural heritage values associated with the proposed modification. This was achieved through desktop research and field surveys in consultation with registered Aboriginal stakeholders. A total of 33 Aboriginal sites (including potential archaeological deposits) were identified.

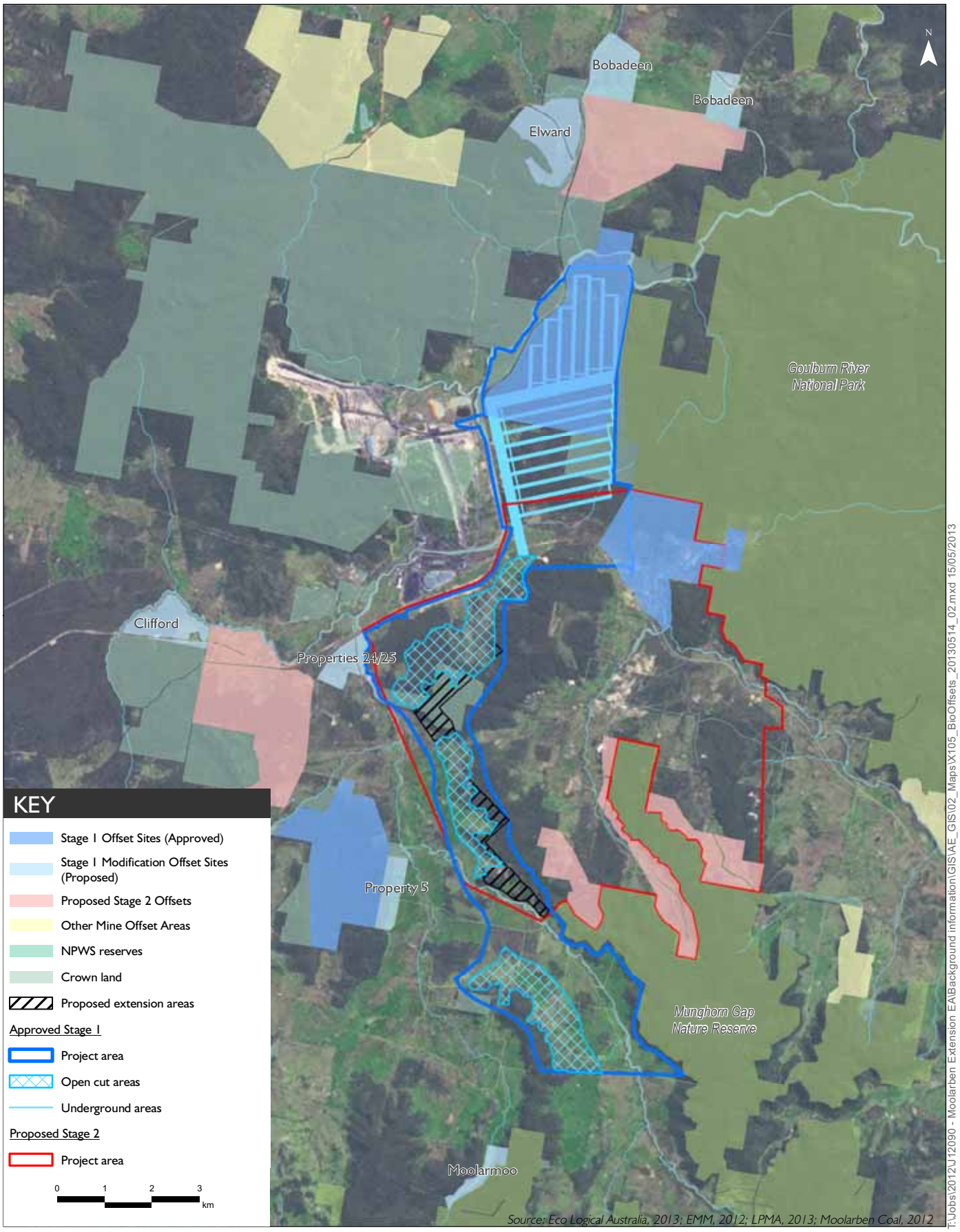
The ACHA determined that the impacts from the proposed modification, subject to management and monitoring, will be low within a local context and very low within a regional context.

Management and monitoring of Aboriginal cultural heritage will be conducted in accordance with the draft Stage 1 Aboriginal Cultural Heritage Management Plan which will be reviewed and updated to include the management of the additional sites within the proposed extension areas.

ES10.5 Historic heritage

The entire project area has been the subject of previous historic heritage assessments. Additional database searches, review of relevant literature and additional surveys were undertaken to verify the relevant outcomes from the previous assessments and to support the current study.

No historic heritage items will be impacted by the proposed modification. The measures described in the Heritage Management Plan, including protocols for identification of previously unidentified sites, will be implemented to ensure the continued protection of historic heritage items.



Existing and proposed offset areas

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure ES.3

ES10.6 Visual

The proposed modification will result in both temporary and permanent changes in the visual landscape. Changes will be more prevalent in the early stages of mining prior to the full establishment of rehabilitated areas and maturation of screen landscaping.

Of the 12 viewpoints assessed as part of the visual impact assessment, only one viewpoint, on Ridge Road, was considered to have a moderate/significant visual impact. However, a number of commitments have been made that will reduce the impacts to a level that is considered acceptable.

Where operational mitigation measures are considered inadequate to reduce impacts to an acceptable level, MCO will investigate the feasibility of targeted vegetation planting to screen visual and lighting impacts on privately-owned properties along Ridge Road that have unimpeded lines of sight to the proposed extension areas. Where appropriate, impacts deemed will be of a short to medium term in nature, until vegetative screening is established. Once an effective visual screen is established, the significance of impacts in these instances will reduce to negligible.

ES10.7 Surface water

The proposed extension areas have been designed to be offset from the ephemeral Moolarben Creek and its floodplain. There are no surface water bodies within the proposed extension areas' footprints.

The proposed modification will remove a small area of catchment draining to Moolarben Creek, namely 1.1% of the Moolarben Creek catchment area. However, this small reduction in catchment area will have a negligible impact on the flow characteristics of Moolarben Creek.

The water balance model shows that an additional 200 ML/year (on average) of imported water is required to sustain site demands, as a result of the proposed modification. A total maximum of approximately 1,940 ML/year, including the proposed modification, approved Stage 1 operations and Stage 2 proposal, is modelled to be required. This maximum external water requirement can be satisfied from current water sources, ensuring no adverse impacts on water availability for other licensed water users.

The mine water balance model also shows that under the full range of historical rainfall conditions, the proposed mine water management system will have sufficient capacity to contain all mine water on the site without uncontrolled releases, when operated in accordance with the proposed release conditions specified in MCO's EPL. The proposed mine site water management strategy and infrastructure will ensure that the proposed modification has a negligible impact on the quality of surface runoff and receiving waters. The existing receiving water quality data indicates that the current operation has had no measurable impact on receiving water quality.

The potential impacts which result from the proposed modification will be managed under the existing surface water management system and in accordance with the Water Management Plan (WMP) for the MCP. The WMP and relevant sub-plans will be reviewed and updated as required to accommodate the proposed modification.

ES10.8 Groundwater

The groundwater systems within and surrounding the MCP are well understood. The Ulan Seam is the only geological unit that could be termed an 'aquifer' within the sequence that may discharge to, or be impacted by, the proposed modification. It is essentially dry either naturally or from the historical dewatering from the Ulan Coal Mine.

The proposed modification will result in a negligible increase in seepage rates to the mine and 'nil' impact on the surrounding groundwater regime over the approved impacts from Stage 1. As there is no predicted increase in pit inflows due to the proposed extension, MCO's water licence of 150 ML/year will remain adequate to account for take from the Permian Coal Measures.

Piezometric levels are expected to change little in response to the proposed modification and no impacts to external bores or groundwater dependent ecosystems are expected from the proposed modification.

The proposed modification is consistent with the objectives of the NSW Government's Aquifer Interference Policy.

Groundwater will continue to be managed under the existing groundwater management system and in accordance with the WMP for the MCP. Present monitoring arrangements for groundwater levels and water quality will be suitable for the proposed modification.

ES10.9 Soils and agriculture

With the exception of a small area within the proposed Open Cut 2 extension area, the current landform presents a severe constraint to agricultural production. The land capability class of the proposed extension areas is between Class IV and VII, with the majority Class VII, 'extremely severe limitations', where most land uses are restricted and limitations cannot be overcome. The agricultural suitability of the proposed extension areas are classified as Class 3, 4 and 5, with the majority being Class 5, land unsuitable for agriculture or best suited to only light grazing.

Verification assessments of the proposed extension areas demonstrate that the areas do not contain biophysical strategic agricultural land or critical industry clusters. Government criteria have been established for the existence of both of these. An agricultural impact statement is accordingly not required.

Consistent with MCO's commitment to returning areas disturbed by mining operations to their pre-mining land use, the majority of the proposed extension areas will be rehabilitated for biodiversity outcomes. Small areas, currently used for agriculture, will be reinstated with overriding principles of stability, sustainability and minimal maintenance.

MCO's Landscape Management Plan and MOP will be extended where required to accommodate any changes in management that might be required as a result of mining activity within the proposed extension areas.

ES10.10 Waste

The proposed modification will not change the wastes generated from the MCP or the approach to their management. Non-mineral waste will continue to be managed in accordance with the Waste Management Plan for the MCP.

ES10.11 Transport

The proposed modification will have no additional impacts on road or rail networks utilised by the MCP; rather the current impacts will be experienced for a further five years. Accordingly, potential road and rail impacts will continue to be managed under MCO's existing management regime.

ES10.12 Social

As the proposed modification will not directly increase the workforce numbers, continued operations will provide sustained income, ongoing employment and positive flow-on effects. The proposed modification will not result in any direct increase in the region's population. Potential environmental impacts from the proposed modification will be managed by MCO to acceptable levels and are therefore unlikely to result in potential property acquisition. Adverse social impacts on community infrastructure and services will be negligible. However, the proposed modification will enable MCO to continue to support the local community as a local employer, economic contributor and community partner. This includes the continuation of the contribution from MCO's Community Support Program to improve public infrastructure and provide funding for community projects in the local region.

The proposed modification will have no noticeable effects on the social amenity of the surrounding area. MCO has implemented a range of measures to actively communicate and inform local stakeholders of its activities and to ensure it is able to identify opportunities to improve local amenity.

ES10.13 Economics

The proposed modification is estimated to have total net production benefits of $188M to Australia. This is equivalent to each household in the Mid-Western Region Local Government Area, NSW and Australia valuing residual environmental impacts of the proposed modification at $20,000, $70 and $23, respectively.

The sensitivity analysis conducted as part of the benefit cost analysis (BCA) of the proposed modification indicated that the results of the BCA are not sensitive to reasonable changes in assumptions. The results were most sensitive to decreases in the value of product coal.

The environmental, social and cultural costs of the proposed modification that are not already included in the calculation of net production benefits and accrue to NSW are estimated at less than $1M. These are considerably less than the net production benefits that directly accrue to NSW through royalties ($85M). NSW will obtain additional benefits through infrastructure and services provided with a share of Commonwealth Government Company tax from the proposed modification. There are also additional benefits to NSW from the potential non-market employment benefits ($39M). Consequently, as well as resulting in net social benefits to Australia, the proposed modification would result in net social benefits to NSW.

ES11 Commitments

Environmental management of the MCP is undertaken in accordance with MCO's Environmental Management System (EMS), which was prepared in compliance with Schedule 5, Condition 1 of MP 05_0117 and approved by DP&I.

Commitments have been made throughout the EA, to prevent, minimise and/or offset potential adverse impacts from the implementation of the proposed modification. A summary of commitments that are additional to those currently implemented under the existing EMS are listed in Table 21.1 of the main document. Given that potential environmental impacts under the proposed modification are largely similar to those associated with the existing approved operation the current EMS framework would generally remain for the proposed modification.

The commitments will be implemented through the strategies, plans and programs which form part of the EMS framework.

ES12 Conclusion

The disturbance limit granted under MP 05_0117, as modified, is limiting potential access to substantial economically viable recoverable coal resources. The resource is approximately 30 Mt of ROM coal. Implementation of the proposed modification is primarily intended to enable these resources to be mined. The proposed modification's implementation will also greatly improve the efficiency of mining operations within Open Cuts 1 and 2, reducing extraction costs.

A preliminary risk assessment was undertaken based on the initial mine design to, amongst other purposes, enable identification of environmental risks and risk management controls that could be incorporated in the design of the proposed modification to eliminate or reduce the level of risk. The intent of the optimised mine plan is to maximise resource recovery, whilst minimising adverse environmental and social impacts. The optimised mine plan formed the basis for this EA.

The EA was prepared using the most recent and accurate scientific data relevant to the proposed modification. Feedback received from community and government stakeholder engagement also provided guidance to the assessment approach, ensuring that all potential matters of relevance associated with the proposed modification were assessed.

Technical studies adopted conservative assumptions, including the progression of the Stage 2 proposal, to enable the upper limit of potential environmental impacts to be determined.

Given that potential environmental impacts under the proposed modification are largely similar to those associated with the existing operations, the current EMS framework would generally remain for the proposed modification. MCO has committed to a range of management and monitoring measures that will be implemented throughout the life of the proposed modification to prevent and/or minimise adverse impacts. Following the implementation of these measures, all residual risks were determined as low to moderate. It is important to note that residual ecological impacts will occur where impacts are unavoidable. These impacts will be compensated by an offset package that will ensure the proposed modification has a net positive biodiversity outcome.

MCO's important role in the social wellbeing of the local community and its economic benefits will continue. The proposed modification will extend the substantial regional and local economic and social benefits from the Stage 1 operation. It will also promote the continuity of economic benefits to the local region from business expenditure, to the NSW Government in the form of royalties and to the Commonwealth Government in the form of company and income taxes. Overall, the proposed modification will have net production benefits to Australia of $188M.

The proposed modification is consistent with the objects of the EP&A Act.

In conclusion, it is considered that potential environmental and social impacts are largely similar to those approved under Stage 1 and can be avoided, minimised and/or offset by the implementation of the measures included in the EA. The proposed modification will provide important benefits to the local, state and national economies.

Table of Contents

Table of Contents *(Cont'd)*

Table of Contents *(Cont'd)*

Table of Contents *(Cont'd)*

Table of Contents *(Cont'd)*

Table of Contents *(Cont'd)*

Table of Contents *(Cont'd)*

Appendices

Tables

Tables

Figures

Figures

Photographs

Abbreviations

ABS	Australian Bureau of Statistics
ACHA	Aboriginal cultural heritage assessment
ACHMP	Aboriginal cultural heritage management plan
AEMR	annual environmental management report
AGE	Australasian Groundwater and Environmental Consultants Pty Ltd
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
AIS	agricultural impact statement
ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	air quality management plan
ARTC	Australian Rail Track Corporation
As	arsenic
Ba	barium
BCA	benefit cost analysis
BMP	blast management plan
BoM	Bureau of Meteorology
BOP	biodiversity offset package
BOS	biodiversity offset strategy
BSAL	biophysical strategic agricultural land
CCC	Community Consultative Committee
CCD	census collection district
Cd	cadmium
CHPP	coal handling and preparation plant
CIC	critical industry clusters
CMA	Catchment Management Authority
CO_2-e	carbon dioxide equivalent
Cr	chromium
Cu	copper
DCCEE	Commonwealth Department of Climate Change and Energy Efficiency
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEEWR	Commonwealth Department of Education, Employment and Workplace Relations
DEHWA	Commonwealth Department of the Environment, Water, Heritage and Arts

DLWC	Department of Land and Water Conservation
DNG	derived native grassland
DPI	Department of Primary Industries
DP&I	Department of Planning and Infrastructure
DRE	Division of Resources and Energy
DTIRIS	Department of Trade, Investment, Regional Infrastructure and Services
EA	environmental assessment
EC	electrical conductivity
ELA	Eco Logical Australia
EMM	EMGA Mitchell McLennan Pty Limited
EMP	environmental management plan
EMS	environmental management strategy
EPA	Environment Protection Authority
EPI	environmental planning instruments
EPL	environmental protection license
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
ESAP	energy action savings plan
ESD	ecologically sustainable development
Fe	iron
GDE	groundwater dependent ecosystems
ha	hectares
HMP	heritage management plan
HVAS	high volume air sampler
HVCCC	Hunter Valley Coal Chain Coordinator
ICOMOS	International Council on Monuments and Sites
IEA	International Energy Agency
IGANRIP	Interim Guideline for Assessment of Noise from Rail Infrastructure Projects
INP	Industrial Noise Policy
km	kilometre
km^2	square kilometre
LAC	local area command
LEP	local environmental plan
LGA	local government area
LHD	local health district

Li	lithium
LMP	landscape management plan
m	metre
MCO	Moolarben Coal Operations Pty Limited
MCP	Moolarben Coal Project
MGSTSIC	Murong Gialinga Aboriginal and Torres Strait Islanders Corporation
Mining Act	*Mining Act 1992*
Mining SEPP	State Environmental Planning Policy (Mining, Petroleum and Extractive Industries 2007)
ML	mega litres
mm	millimetre
Mn	manganese
MOP	mining operations plan
MPS	multi-purpose service
MR	main road
Mt	million tonnes
Mtpa	million tonnes per annum
Mudgee LALC	Mudgee Local Aboriginal Land Council
MWR	Mid-Western Region
MWR LEP	Mid-Western Regional Local Environmental Plan
MWRC	Mid-Western Regional Council
NEPC	National Environment Protection Council
NES	national environmental significance
NEWCO	North-East Wiradjuri Company Ltd
NGA	National Greenhouse Accounts
NHPA	National Health Performance Authority
Ni	nickel
NMP	noise management plan
NOW	NSW Office of Water
NPC	Newcastle Port Corporation
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	National Park and Wildlife Service
NSW	New South Wales
OEH	Office of Environment and Heritage
PAD	potential archaeological deposit
PB	Parsons Brinckerhoff

Pb	lead
Part 3A Repeal Act	*Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011*
PoEO Act	NSW *Protection of the Environment Operations Act 1997*
PPR	preferred project report
PRP	pollution reduction program
PWCS	Port Waratah Coal Services
RFDS	Royal Flying Doctor Service
RMS	Roads and Maritime Services
RNP	*Road Noise Policy*
ROM	run of mine
ROMP	rehabilitation and offset management plan
RTA	Roads and Traffic Authority
SAL	strategic agricultural land
Se	selenium
SEPP	State Environmental Planning Policy
SEWPaC Communities	Commonwealth Department of Sustainability, Environment, Water, Population and
SF	State Forest
SLA	statistical local area
Sr	strontium
SRLUP	strategic regional land use plan
TAS	Todoroski Air Sciences
TEC	threatened ecological communities
TEOM	tapered element oscillating microbalances
TSC Act	NSW *Threatened Species Conservation Act 1995*
TDS	total dissolved solids
TSP	total suspended particulate
TSS	total suspended solids
UNESCO	United Nations Educational Scientific and Cultural Organisation
UWSA	Ulan Water Sharing Agreement
VPA	voluntary planning agreement
Water Act	*Water Act 1912*
WM Act	*Water Management Act 2000*
WMP	water management plan
WNTCAC	Warrabinga Native Title Claimants Aboriginal Corporation

WRM	WRM Water & Environment
Yancoal	Yancoal Australia Ltd
Zn	zinc
°C	degrees-centigrade

1 Introduction

1.1 Background

The Moolarben Coal Project (MCP) is an approved open cut and underground coal mine in the Western Coalfields of New South Wales (NSW), approximately 40 km north-east of Mudgee (Figure 1.1). The MCP is managed and operated by Moolarben Coal Operations Pty Limited (MCO), a wholly owned subsidiary of Yancoal Australia Ltd (Yancoal).

The MCP Stage 1 Major Project approval 05_0117 (MP 05_0117) was approved under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2007. Since gaining approval, MP 05_0117 has been modified on seven occasions to make administrative changes, changes to infrastructure and allow the construction of a borefield. A copy of MP 05_0117, as modified, is given as Appendix A. The main components of the MCP Stage 1 comprise:

- three open cut pits, referred to as Open Cuts 1, 2 and 3, which have an approved combined maximum extraction rate of 8 million tonnes per annum (Mtpa) of run of mine (ROM) coal;
- one underground mine, referred to as Underground 4, which has an approved maximum extraction rate of 4 Mtpa of ROM coal;
- coal handling, processing, rail loop, load-out and water management infrastructure; and
- associated facilities including offices, bathhouses, workshops and fuel storages.

To date, mining has occurred within Open Cut 1 only, commencing at the south-western perimeter and progressing in a north-easterly direction.

The current disturbance limit granted under MP 05_0117 is restricting the extraction of large quantities of the deposit which are economically viable in today's market. The proposed modification will extend the disturbance boundary enabling increased resource utilisation, a longer life for Open Cuts 1 and 2 and promote the continuity of Stage 1 operations. All of the elements of the proposed modification are described in Section 1.2.

This environmental assessment (EA) of the Moolarben Coal Project - Stage 1 Optimisation Modification (proposed modification) supports an application to modify the Stage 1 approval. The EA was prepared by EMGA Mitchell McLennan Pty Limited (EMM) on behalf of MCO, with input from a number of external specialists. The study team is given in Appendix B.

1.2 Overview of proposed modification

MCO seeks approval to modify MP 05_0117 under Section 75W of the EP&A Act to enable:

- the extension of mining within Open Cuts 1 and 2;
- the construction and operation of additional water management infrastructure; and
- a minor change to the rehabilitation sequencing and final landform.

The Stage 1 approval period will be extended from 2028 to 2033 to accommodate the proposed modification (refer to Section 1.5).

No other changes are proposed under the modification: there will be no change to the maximum annual rate of coal production or extraction, mining methods, equipment, employee numbers, operating hours, coal handling and processing, coarse rejects and tailings management, site access or external coal transport.

Potential environmental impacts under the proposed modification are largely similar to those associated with the existing approved operation. For example, potential impacts on water resources are negligible and amenity impacts minor, with no additional privately-owned residences predicted to be subject to acquisition upon request. Where residual unavoidable impacts have been identified to ecology, a substantial offset package has been developed in accordance with relevant NSW and Commonwealth policies to ensure the proposed modification has a net positive impact on biodiversity.

The proposed modification elements are shown in Figure 1.2. They are all within the Stage 1 project approval boundary, which forms the 'project area' for the proposed modification. Within the project area, Open Cut 1 and 2 extension areas are referred to collectively as the 'proposed extension areas'. It is noted that proposed extension areas include a disturbance buffer of up to 50 m that will enable the development of a services road and infrastructure if required, such as water pipelines. This ensures that all potential impacts associated with the proposed extension to mining have been assessed. In accordance with the *Coal Mine Health and Safety Act 2002* the proposed extension area footprints also ensure that a minimum 40 m barrier is maintained between any proposed or approved underground workings and any open cut working situated within the MCP.

A description of the project area, including the proposed extension areas, and its context is provided in Chapter 2.

1.3 The proponent

MCO is a wholly owned subsidiary of Yancoal Australia Limited (Yancoal). Further information on MCO and its operations can be found at: http://www.moolarbencoal.com.au.

1.4 Purpose of this report

This EA accompanies an application by MCO for the proposed modification, in accordance with Section 75W of the EP&A Act. It provides an assessment of the potential impacts resulting from the proposed modification and details measures that will be implemented, subject to approval, to avoid, minimise and/or offset potential impacts. The EA provides information to allow NSW government authorities to assess the merits of the proposed modification and to enable the Minister for Planning and Infrastructure or the Minister's delegate to make a determination as to whether or not to grant approval.

It is noted that there are no Director-General's requirements for the proposed modification. Environmental risk assessment and scope development workshops, together with an extensive stakeholder engagement program, supported the development of the EA scope.

1.5 Assessment approach

The mine plans and mining methods utilised for the purposes of this assessment provide an indicative worst case analysis.

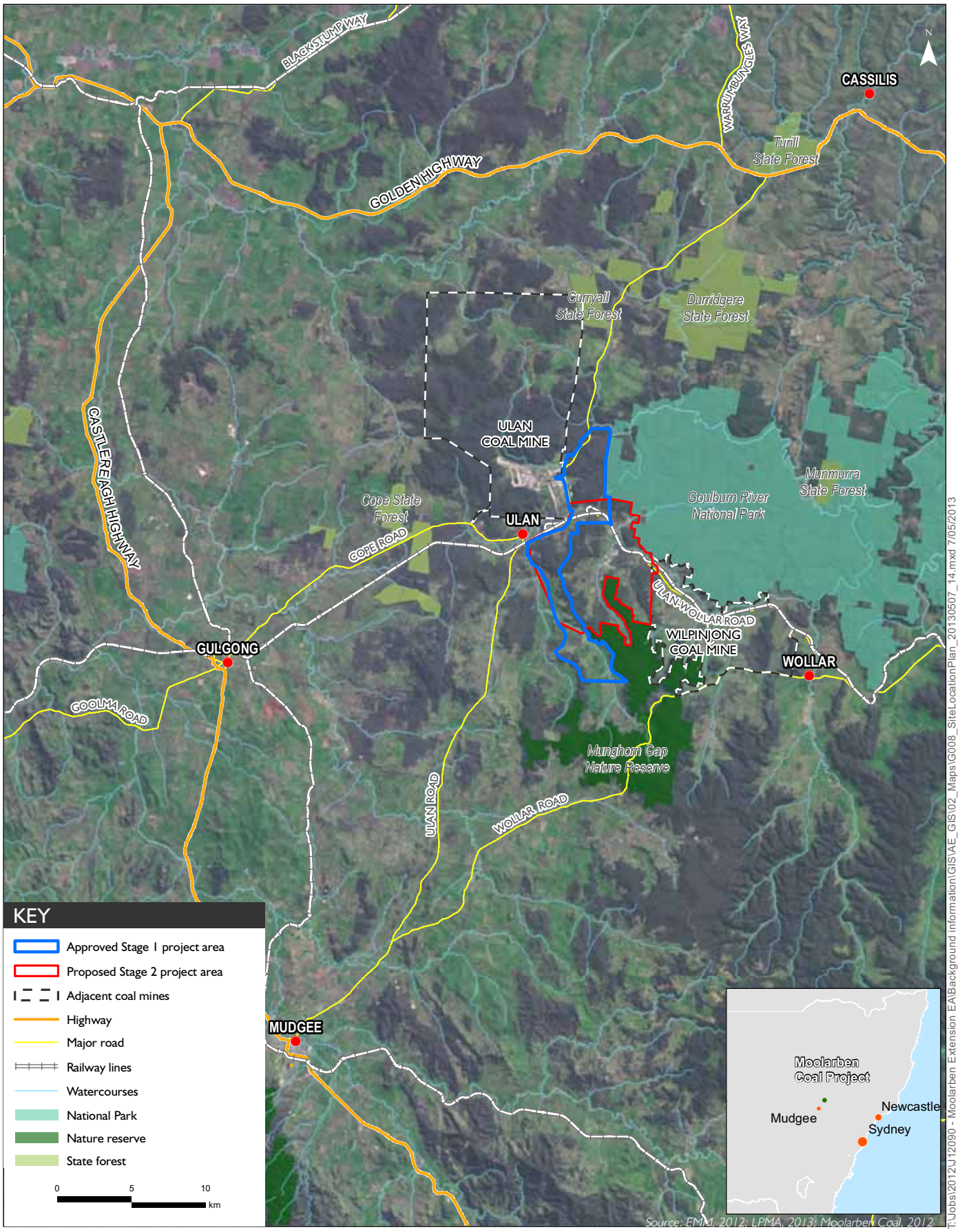
It is important to note that a Major Project Application for Stage 2 of the MCP, MP 08_0135, is currently being assessed by the NSW Department of Planning and Infrastructure (DP&I). If approved, Stage 2 will consist of one open cut pit, Open Cut 4, and two underground mines, Undergrounds 1 and 2, and associated additional infrastructure.

In conjunction with the application for Stage 2, MCO has also applied to modify Stage 1 in order that the approved Stage 1 project infrastructure can receive, handle, store and load coal from the Stage 2 project. This includes extending the operational life of the approved Stage 1 project infrastructure to 2033, and that infrastructure processing up to 17 Mtpa of ROM coal and transporting 13 Mtpa of product coal from the Stage 1 and Stage 2 projects, together with associated infrastructure modifications. This modification application is currently being assessed by DP&I.

The proposed modification is a standalone proposal that will not affect Stage 2. However, if both Stage 2 and the proposed modification are approved, Stage 1 (including the proposed modification) and Stage 2 will operate concurrently. To enable probable worst case environmental impacts to be considered, this EA is based on assessment of Stage 1, Stage 2 and the proposed modification.

In the course of operational implementation, alternative mine plans and mining methods may be utilised such as those currently approved under MP 05_0117, as modified, provided that in all cases the environmental impacts remain within the envelope of effects assessed in this report. For example, should Stage 2 not proceed, MCP would continue to be operated generally in accordance with the mine plans presented in the Stage 1 EA, however with mining areas varied to include the proposed extension areas, again provided that environmental impacts remain within the envelope of effects approved under MP 05_0117 as modified.

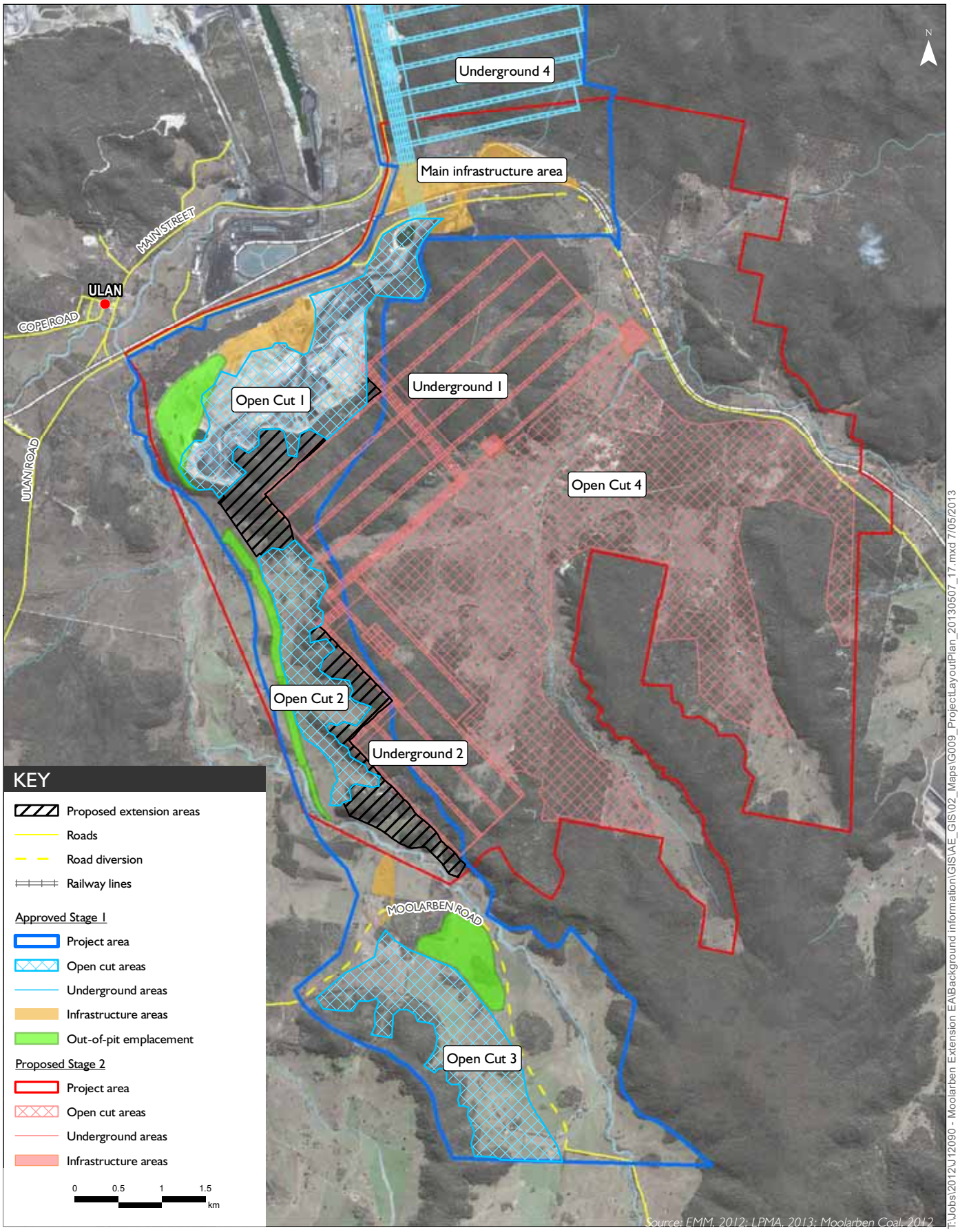
The table of contents sets out the structure of the EA.



MCP location plan

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 1.1



Proposed modification layout plan

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 1.2

2 Regional context

2.1 Overview

The MCP is bordered by the Goulburn River to the north-west; privately-owned grazing land to the north; Goulburn River National Park, Wilpinjong Coal Mine and Munghorn Gap Nature Reserve to the east; privately-owned grazing land to the south; and privately-owned grazing land, Ulan settlement and Ulan Coal Mine to the north-west.

The locality is serviced by the Ulan to Cassilis Road (linking Mudgee and Cassilis), Cope Road (linking Gulgong and Ulan) and Ulan to Wollar Road (linking Wollar and Ulan). The Sandy Hollow to Gulgong Railway provides the transport link for delivery of coal to export markets via the Port of Newcastle and to domestic markets.

2.2 Land ownership

Land ownership across the project area and immediate surrounds is shown on Figure 2.1. The majority of land within the approved Stage 1 disturbance boundary is owned by MCO. MCO also owns a substantial area of land surrounding the project area. The proposed Open Cut 1 extension area contains Crown-owned land and land owned by Ulan Coal Mine. The entirety of the proposed Open Cut 2 extension area is owned by MCO. Properties owned by MCO in the surrounding area are generally tenanted by occupiers who have entered into agreements with MCO.

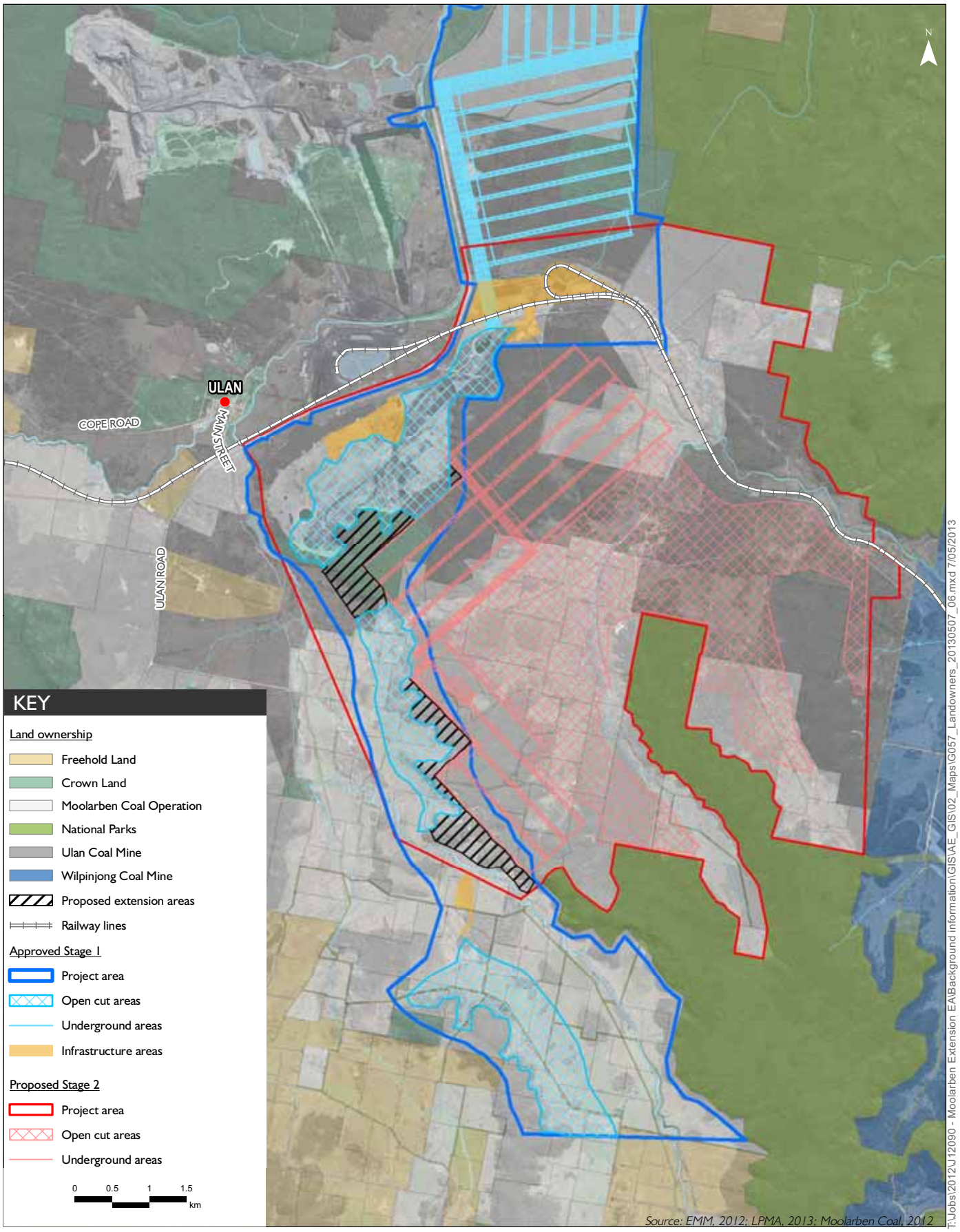
2.3 Land uses

The MCP is located in the western end of the Hunter Valley, in the upper Goulburn River catchment. The majority of the local area is characterised by mining areas and associated infrastructure and agricultural land, mainly pasture, with moderate sized stands of native woodland retained along the steeper hillsides and ridgelines and in patches along creek lines.

The Goulburn River National Park adjoins most of the north-eastern boundary of the project area, and conserves approximately 70,300 hectares (ha) of dissected sandstone country. Munghorn Gap Nature Reserve adjoins most of the south-eastern boundary of the project area and conserves just under 6,000 ha of native vegetation and fauna habitat (NSW NPWS 2003). Both of these reserves are listed as *National Heritage Areas* under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The majority of the project area is similar to its surrounds, namely undulating pastoral land with stands of native woodland retained along the hillsides and creeks. Most of the proposed extension areas are steeper wooded hillsides, which present severe constraints to agricultural production.

Coal mining in the area has been ongoing since the early 1900s. The Ulan Coal Mine, which is adjacent to the north-west of the MCP, was commissioned in the 1980s. The Wilpinjong Coal Mine, to the east of the MCP, was commissioned in 2007. The locations of both mines are shown in Figure 1.1.



Land ownership plan

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 2.1

The Ulan settlement north-west of the MCP includes a small primary school, a church, a hotel, mine-owned residential dwellings and vacant and Council owned-land. A rural residential development known as Cook's Gap, with a residential population of approximately 490 residents, is located about 4 km to the south-west of the MCP. A small number of farms and scattered homesteads occupy the rest of the surrounding freehold land.

2.4 Topography and drainage

The Upper Goulburn River has a catchment area of approximately 2,455 km^2. The ephemeral Moolarben Creek is a tributary of the upper Goulburn River catchment, flowing in a northerly direction along the western boundary of the project area.

The majority of Stage 1 mining operations, including Open Cuts 1 and 2 and the proposed extension areas, are located within the Moolarben Creek catchment. The Moolarben Creek catchment has an area of approximately 125 km^2. The upper reaches of the Moolarben Creek catchment, which include the proposed extension areas, are characterised by steep, heavily forested slopes of up to 20%, draining into a cleared and relatively flat floodplain.

The majority of the Stage 1 infrastructure (described in Section 3.1) is located within the Bora Creek catchment. The ephemeral Bora Creek is a small tributary of the Goulburn River with a catchment area of about 6.7 km^2.

At a regional scale, small ridges and valleys associated with the Goulburn River and associated creeks and tributaries characterise the area. Land surface elevation varies from approximately 600 m Australian Height Datum (AHD) on the ridges to approximately 370 m AHD in the Goulburn River Valley. The topography in the project area has been controlled by regional geological structures, including various faults and folds, which have in turn formed a number of erosional sandstone escarpments and plateaus.

At a local scale, the project area ranges in elevation from 560 m AHD on the upper slopes of the ridgeline in the eastern part to 460 m AHD along Moolarben Creek. The ridgeline extends north and south of the proposed extension areas and contains sandstone, conglomerates and siltstones, forming rocky outcrops in some locations. The elevation decreases markedly to the west toward Moolarben Creek, where the land use is predominantly cattle and sheep grazing.

The proposed extension areas are characterised by moderately to steeply inclined slopes, which comprise approximately 63% of the area. Gently inclined slopes compromise approximately 36% of the area and level to very gently inclined slopes comprise the remainder. Forest and woodland cover most of the proposed extension areas, with small agricultural areas in the south-western section and three small disused quarries on the western edge.

2.5 Climate

The climate in the vicinity of the project area is typical of temperate regions and is characterised by hot dry summers with some thunderstorms, and cold winters with frequent frosts. In accordance with Schedule 3, Condition 25 of MP 05_0117, MCO currently has two meteorological monitoring stations. One is located adjacent to MCO's administration office in the northern section of the project area and the other station is to the west of the project area. The latter is newly constructed and replaces a station that was found approximately 2 km to the south-west of the proposed Open Cut 2 extension area, at the Property ID 60 (referred to as the Rayner weather station). Data from the no longer operational station were used in this EA (refer to Chapters 8 and 9). The data adopted for the studies was the most appropriate for the purposes of assessment as it provided the most recent full year of information and was representative of the majority of assessment locations.

Most common winds on an annual basis are from the east with very few winds originating from the north and south at the northern most meteorological station. Similar wind distribution, but with more influence of south-westerly winds in winter and north-easterly winds in spring, is found at the southern most meteorological station.

Daily rainfalls have been recorded at the Ulan Water rainfall station located at the Ulan Post Office (Bureau of Meteorology (BoM) Station No. 062036), about 1 km from the project area, since 1906. Highest rainfall is generally recorded between October and March, with the mean annual rainfall recorded at 639 mm.

The mean daily temperature during January, the hottest month in summer, is 31.0 degrees-centigrade (°C). The mean daily temperature in July, the coolest month in winter, is 14.6°C. In summer daily temperatures can exceed 38°C, while winter overnight temperatures occasionally drop below freezing point.

2.6 Geology and soils

The MCP is located in the northern part of the Western Coalfield and occupies the north-west margin of the Sydney Basin in NSW. This coalfield contains measures of mid to late Permian age, which are known as the Illawarra Coal Measures.

The Illawarra Coal Measures include (inter alia) the Ulan Seam, the only seam of economic significance in the MCP, and the target seam for MCO.

In the northern part of the project area the Illawarra Coal Measures are generally 100 m to 120 m thick and this area has been identified for underground mining, including Underground 4. In the southern and central parts of the project area, erosion has largely removed the upper parts of the coal measures (including the Ulan Seam) and overlying Triassic sandstone. Consequently, the Ulan Seam in this area is present under relatively thin Triassic sandstone cover. It is these areas where open cut mining will occur, including Open Cuts 1, 2 and 3 and the proposed extension areas. The geological setting of the project area and surrounds is shown in Figure 2.2.

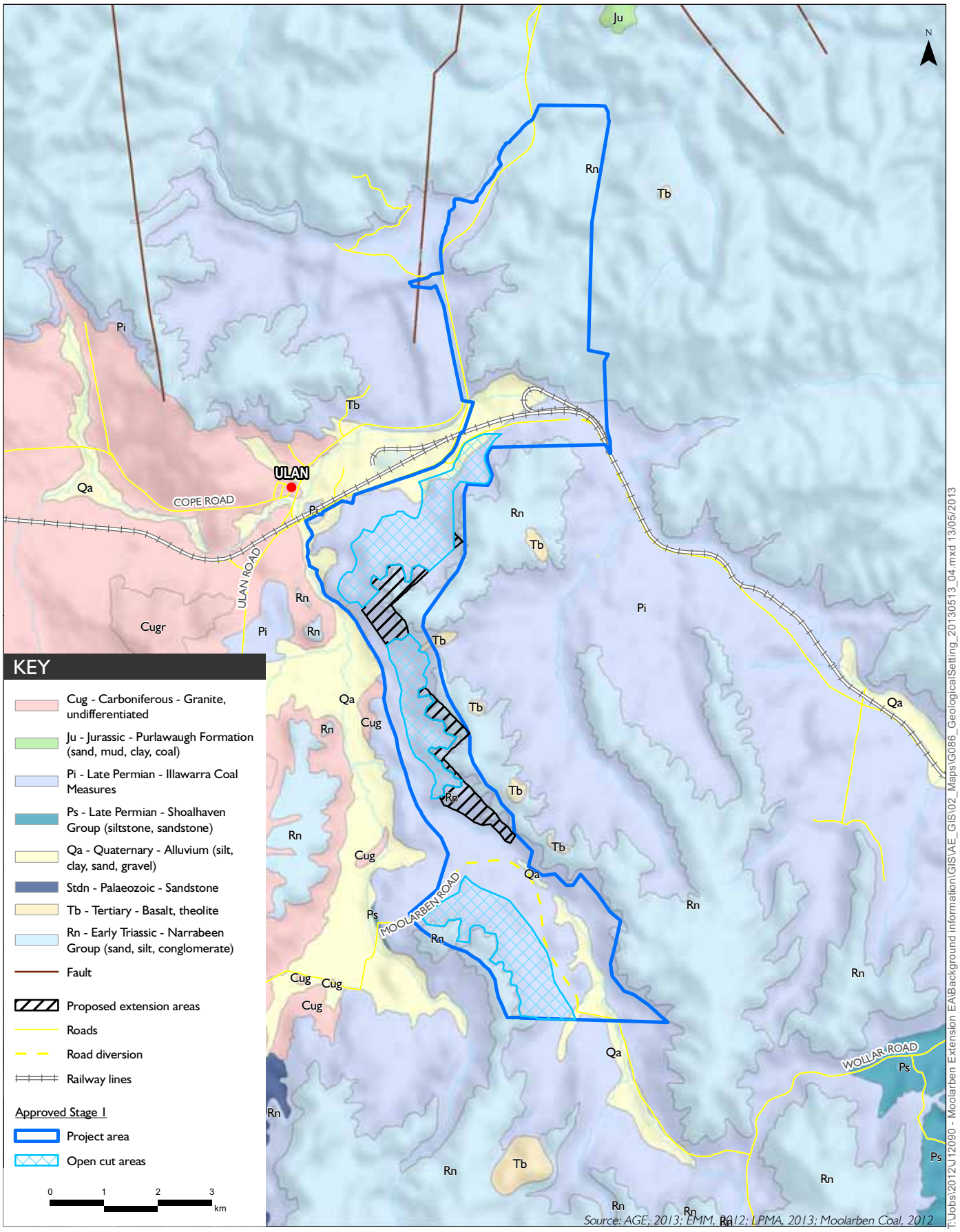
The total coal resource in the project area is estimated at 187 million tonnes (Mt), which includes an estimated ROM coal reserve of approximately 127 Mt (Wells Environmental Services, 2006).

The distribution of coal across the project area is shown in Table 2.1.

Table 2.1 Stage 1 coal resources and reserves

Mine area	Coal resources (Mt)	Coal ROM reserves (Mt)
Open Cut 1	49.0	44.5
Open Cut 2	18.0	15.8
Open Cut 3	46.2	18.3
Underground 4	74.0	48.3
Total	**187.2**	**126.9**

The Munghorn Plateau and Lees Pinch Soil Landscapes cover much of the ridgelines of the project area, while an isolated occurrence of the Ulan Soil Landscape occurs near the proposed Open Cut 2 extension area, and a small occurrence of the Bald Hill Landscape occurs between the proposed extension areas (Jammel Environmental and Planning Services 2006).



Geological setting

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 2.2

3 Project approval and existing operations

This chapter provides information on MP 05_0117 and existing operations. Although the proposed modification relates explicitly to Stage 1 only, for the purposes of context an overview of the Stage 2 proposal is also given.

3.1 Approved Stage 1

MP 05_0117 was approved under Part 3A of the EP&A Act. At full production, Stage 1 will produce up to 10 Mtpa of product coal for export and domestic markets and employ in excess of 300 permanent full time workers. The approval is to develop and operate Stage 1 for a period of 21 years, to December 2028.

A summary of the approved Stage 1, as previously modified, is provided in Table 3.1.

Table 3.1 Stage 1 project summary

Aspect	Description
Project life	• 21 years (December 2028)
Mining operations (open cut)	• three open cut mines, Open Cuts 1, 2 and 3, will be mined at a combined rate of up to 8 Mtpa ROM coal
Mining operations (underground)	• one underground mine, Underground 4, will be mined at up to 4 Mtpa ROM coal
Blasting	• up to two blasts per day and nine blasts a week over any 12 month period, between the hours of 9:00 am to 5:00 pm, Monday to Saturday
Coal handling, preparation and processing	• coal from the open cut pits will be transferred by truck and conveyor to the coal handling and preparation plant (CHPP) • coal from Underground 4 will be transferred to the CHPP by conveyors • up to 12 Mtpa of ROM coal will be processed
Coal production, loading and rail transport	• product coal will be produced at up to 10 Mtpa • product coal will be loaded onto trains via a rail loop and rail load out facility with up to four trains a day during any 24-hour period
Water demand and supply	• water demand at peak production will be approximately 6.9 mega litres (ML)/day (2,520 ML/year) • water will be supplied from mine inflows, surface water capture, recycled process water, water sharing with adjoining mines and groundwater borefield, where required
Hours of operation	• construction during daylight hours, seven days a week • civil works in the Main Infrastructure Area will occur 24-hours a day, seven days a week • mining operations will occur 24-hours a day, seven days a week
Employment	• 220 construction and 317 full time positions
Rehabilitation	• all disturbed areas will be progressively rehabilitated

Since gaining Stage 1 approval, eight separate applications to modify MP 05_0117 have been made with one approval still pending. A summary of these applications is given in Table 3.2.

Table 3.2 Stage 1 project approvals

Reference	Approval legislation	Approval authority	Approval period	Description of activity
Project Approval Ref: 05_0117(M1)	Section 75W of the EP&A Act	DP&I	26/11/2008-20/12/2028	Modifications of Conditions 12, 42(b), 51(a), 52 and 56 and the relocation and rearrangement of some items of infrastructure.
Project Approval Ref: 05_0117(M2)	Section 75W of the EP&A Act	DP&I	18/12/2008-20/12/2028	Modification to allow preliminary construction activities to be commenced prior to completion of the site access intersection via amendments to the wording of Condition 51(a) and (b). In addition, the 'note' to Condition 56 was amended to clarify the proponent's responsibility in relation to road works.
Project Approval Ref: 05_0117(M3)	Section 75W of the EP&A Act	Pending approval	Pending approval	Modification to enable Stage 1 infrastructure to receive, handle and process Stage 2 coal, including the extension of Stage 1 infrastructure (CHPP, rail loading facility and rail loop) to 31 December 2033, to enable continued handling, processing and transport of Stage 2 coal for the life of Stage 2. An additional void in Open Cut 1 is also proposed to allow access to Underground 4.
Project Approval Ref: 05_0117(M4)	Section 75W of the EP&A Act	DP&I	30/06/2009-20/12/2028	Modification to the design of the Stage 1 rail loop to incorporate a balloon loop design.
Project Approval REF: 05_0117(M5)	Section 75W of the EP&A Act	DP&I	05/10/2009-20/12/2028	Modification to enable the relocation of the Stage 1 ROM coal facility and develop a water sharing pipeline from the Ulan Mine.
Project Approval Ref: 05_0117(M6)	Section 75W of the EP&A Act	DP&I	11/01/2010-20/12/2028	Modification to enable the relocation of the Stage 1 reject bin and to increase its throughput.
Project Approval Ref: 05_0117(M7)	Section 75W of the EP&A Act	DP&I	03/02/2011-20/12/2028	Modification of Stage 1 to include access tracks, powerlines, pipelines, transfer pumps, groundwater bores and water storage tanks to enable the development and operation of a water supply and dewatering borefield.
Project Approval Ref: 05_0117(M8)	Section 75W of the EP&A Act	DP&I	27/05/2010-20/12/2028	Modification of Stage 1 to include a 100,000 tonne ROM stockpile at the approved ROM coal facility.

It is noted that Commonwealth approval for Stage 1 was granted in accordance with Part 9 of the EPBC Act (Approval reference 2007/3297).

3.1.1 Approved operations

A general description of the approved operations is given below.

i Extraction rate

The current approval is for a maximum extraction rate of 8 Mtpa of ROM coal from open cut mining operations and 4 Mtpa ROM from underground mining operations. Overall, the total maximum amount of ROM coal that can be extracted each year from approved Stage 1 operations is 12 Mt, with maximum processed coal output of 10 Mtpa.

An indicative mining schedule was assessed in the Stage 1 EA and included mining within Open Cuts 1, 2 and 3 and Underground 4.

ii Mining method and coal handling and processing

Stage 1 open cut mining is a truck and shovel operation. Overburden and coal is blasted and removed with excavators and rear dump trucks. Overburden is hauled to in-pit dumps and coal is hauled to the ROM coal hopper. The washed product is stored on the product coal stockpile at the CHPP and later fed to the rail load-out bin by an underground reclaim tunnel and conveyors. The CHPP currently produces two thermal coal products, being a low ash export coal and medium ash domestic coal. Underground mining will be by the retreating longwall mining method.

iii Train load-out

MP 05_0117 includes an industry standard automated train loading system, which has been modified (MP 05_0017(M4)) to a balloon loop design.

At full production, approximately four trains per day are required to transport product coal off-site connecting into the Sandy Hollow to Gulgong rail line.

iv Mining equipment

The excavators and trucks removing the overburden and coal are supported by an ancillary fleet of graders, dozers, watercarts and drills, to be shared across all open cut areas.

Equipment used during underground mining will include continuous miners, specialist integrated mining and roof support equipment, shearer, shuttle cars and conveyor system.

v Water management infrastructure

The mine water management system operates to preferentially reuse mine water collected on the site to meet minesite demands. The water management system includes:

- sediment dams to collect and settle runoff from disturbed areas;
- mine water dams to contain groundwater inflows to the open cut pit and runoff potentially impacted by contact with coal; and
- a clean water dam to store water harvested from groundwater bores.

vi Water supply requirements and sources

Water demand during peak production will be approximately 6.9 ML/day or 2,520 ML/year.

MCP water supply requirements are met through surface water capture, recycled process water, mine inflows and access to external water sources, comprising MCP's northern and southern groundwater borefields, and surplus mine water from the Ulan Coal Mine through a water sharing agreement.

Further information of MCP's external water requirements and licensing is provided in Chapters 14 and 15.

vii Workforce and working hours

Stage 1 operates 24-hours a day seven days a week. At full production, the operational workforce for Stage 1 will be approximately 317 full time personnel.

viii Rehabilitation and final landform

MCO is committed to progressively rehabilitating all areas disturbed by mining to achieve specific post-mining land uses. Rehabilitation objectives and details of final landforms for each open cut area are provided below.

a. Open Cut 1

Open Cut 1 and the environmental bund adjacent to the west will be rehabilitated for biodiversity outcomes. A section of the highwall located east of the infrastructure area will be left exposed and a pit void maintained to allow future access to underground reserves.

Open Cut 1 will be rehabilitated to create Box Gum Woodlands and Sedimentary Ironbark Forests with stands of *Allocasurina spp.*

b. Open Cut 2

Open Cut 2 and the environmental bund adjacent to the west will be principally reinstated to agricultural land following mining. However, land adjoining the northern part of Open Cut 2 will be revegetated to enhance vegetation cover and connectivity with vegetated areas to the north.

The final landform surface for Open Cut 2 will be shaped some 2 m to 4 m below the original topography, with the final void being approximately 6 m to 30 m below the original topography. The void is currently designed with a gentle gradient into the void and steeper slopes against the existing escarpment.

c. Open Cut 3

Open Cut 3 will principally be reinstated for agricultural use. The final landform surface for Open Cut 3 will be shaped some 2 m to 4 m below the original topography. The mining of Open Cut 3 will result in a final void in the south of the open cut area. The void will be approximately 26 ha, being 8 m deep on its eastern side to approximately 40 m deep below the original topography at its western extent.

3.1.2 Status of mining

Since the approval of Stage 1, the CHPP, rail load-out facility, and support facilities have been constructed and are operational.

Mining has commenced in the lower strip ratio areas in the south-west of Open Cut 1 and has proceeded north-east.

Initially overburden was emplaced out-of-pit to construct the environmental bund on the south-western perimeter of Open Cut 1. Since the completion of the environmental bund, and as mined out areas of Open Cut 1 have become available, in-pit overburden emplacement has commenced.

Rehabilitation to date has been undertaken on the outer face of the environmental bund, which has been shaped to the final landform. Rehabilitation of in-pit overburden emplacements is ongoing. Approximately 130 ha of disturbed land has been rehabilitated to the end of March 2013 to re-establish Box Gum Woodland and Sedimentary Ironbark Forest vegetation communities.

3.1.3 Environmental management

Environmental management is a central component of the MCP's overall management structure and is considered during every stage of the mining process to ensure that environmental impacts are minimised. Environmental management at the MCP is undertaken in accordance with:

- MCO's Environmental Management Strategy (EMS);
- commitments made in the EAs for the Stage 1 approval and subsequent modifications;
- environmental management plans (EMPs) prepared under the EMS;
- MCO's Mining Operations Plan (MOP); and
- MCO's Environment Protection Licence (EPL).

The existing environmental management processes and procedures are referred to where relevant in the EA technical assessments. An overview is provided below.

i Environmental management strategy

MCO has prepared and continues to implement an EMS for the MCP in accordance with Condition 1, Schedule 5 of MP 05_0117. The EMS is an overarching document which identifies the relevant environmental management procedures which are included in MCO's various plans, strategies and programs. The EMS identifies the personnel who are accountable for implementing management procedures and describes their roles and responsibilities.

ii Management plans

In accordance with the approval requirements of MP 05_0117, MCO has implemented a regime for environmental management and reporting. MCO implements the following plans:

- Aboriginal cultural heritage management plan (ACHMP);
- air quality management plan (AQMP);
- blast management plan (BMP);
- bushfire management plan;
- energy savings action plan (ESAP);

- environmental monitoring program;
- heritage management plan (HMP);
- landscape management plan (LMP);
- pollution incident response management plan;
- noise management plan (NMP);
- waste management plan; and
- water management plan (WMP).

iii Mining operations plan

The NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) has approved a MOP which considers operation and rehabilitation of Open Cut 1 over a five year timeframe. The scope of the MOP includes the activities associated with:

- further mining development in Open Cut 1;
- support infrastructure; and
- rehabilitation works.

The MOP will be amended as required to accommodate the proposed modification.

iv Environmental Protection Licence

MCO operates the MCP in accordance with conditions of EPL 12932, issued by the Environment Protection Authority (EPA) under the *Protection of the Environment Operations 1997* (PoEO Act). EPL 12932 includes specific limits for environmental aspects including air quality, noise, vibration, water and waste; and includes specific monitoring to be undertaken for air quality, water quality, noise, vibration and weather.

v Annual reviews and independent audits

In accordance with the provisions of Schedule 5, Condition 5 of MP 05_0117, MCO prepares an annual environmental management report to report on the environmental performance of the Stage 1 project. The report:

- describes development carried out in the previous calendar year and that proposed for the next 12 months;
- provides a review of monitoring results over the previous year and a comparison against relevant statutory requirements;
- identifies any non-compliance over the past year and describe actions to ensure compliance;
- identifies trends in monitoring data;

- identifies discrepancies between predicted and actual impacts, and analyse the potential causes; and

- describes what measures will be implemented over the coming year to improve the project's environmental performance.

Under the provisions of Schedule 5, Condition 6 of MP 05_0117, within two years and every three years thereafter, unless the Director-General directs otherwise, MCO is required to commission an independent environmental audit of the Stage 1 project. In accordance with Schedule 5, Condition 7 of MP 05_0117, within six weeks of the completion of this audit, or as otherwise agreed by the Director-General, MCO must submit a copy of the audit report to the Director-General, together with its response to any recommendations contained in the audit report. The last audit was completed in April 2013.

3.2 Proposed Stage 2

The Stage 2 Major Project application (MP 08_0135) was submitted under Part 3A of the EP&A Act in 2008. Stage 2 comprises one open cut mine, Open Cut 4, two underground mines, Underground 1 and 2, and some additional infrastructure. Stage 2 is proposed to be developed adjacent to Stage 1 and, if approved, will operate in conjunction with and utilise the Stage 1 infrastructure. The application seeks to develop and operate Stage 2 for a period of 24 years. The Stage 2 application is currently pending, with determination expected in 2013.

As noted in Section 1.5, in conjunction with the Stage 2 application, MCO has also applied to modify the Stage 1 approval, to enable both Stages 1 and 2 to be operated as an integrated mining complex, the Moolarben Coal Complex. The Stage 1 modification (MP 05_0117(M3)) seeks approval for Stage 1 to accept, process and export Stage 2 coal.

A Stage 2 Preferred Project Report (PPR) was prepared for Stage 2 in 2012 at the request of the Director-General of DP&I and a summary is provided in Table 3.3.

Table 3.3 Stage 2 Preferred Project summary

Aspect	Description
Project life	• 24 years
Mining operations (open cut)	• one open cut mine, Open Cut 4, extracting up to 12 Mtpa ROM coal
Mining operations (underground)	• two underground mines, Underground 1 and 2, will be mined at a maximum combined rate of up to 4 Mtpa ROM coal
Blasting	• up to nine blasts a week over any 12 month period, between the hours of 9:00 am to 5:00 pm, Monday to Saturday
Coal handling, preparation and processing	• coal from Open Cut 4 will be transferred to the Stage 2 ROM coal facility via haul truck, prior to transfer to the Stage 1 ROM coal facility via conveyor • coal from underground mines will be transferred via haul truck to the Stage 1 ROM coal facility or ROM stockpile, prior to transfer to the CHPP • up to 17 Mtpa ROM coal (from Stage 1 and Stage 2 combined) will be processed

Table 3.3 Stage 2 Preferred Project summary

Aspect	Description
Coal production, loading and rail transport	• product coal will produced at up to 13 Mtpa • product coal will be loaded onto trains via a rail loop and load-out facility, and railed to market on the Sandy Hollow to Gulgong rail line in up to five trains a day during any 24-hour period
Water demand and supply	• water will be supplied from the mine inflows, surface water capture, recycled process water, groundwater borefield and water sharing with adjoining mines, where required
Hours of operation	• operations will occur 24-hours a day, seven days a week
Employment	• up to 122 full time personnel in addition to the 317 Stage 1 employees
Rehabilitation	• all disturbed areas not required for life of mine operations will be progressively rehabilitated

4 Proposed modification

4.1 Overview

This chapter describes the need for the proposed modification, details its components and provides an overview of alternatives that were considered during its development.

4.2 Need for the proposed modification

4.2.1 Extension of mining area

The current disturbance limit granted under MP 05_0117 is restricting the extraction of large quantities of the deposit which are economically viable in today's market. The proposed modification will enable mining of this substantial resource, approximated at 30 Mt of ROM coal, extending the life of Open Cuts 1 and 2 and, consequently, promote the continuity of Stage 1 operations.

The proposed modification is consistent with MCO's commitments under mining leases ML1605, ML1606 and ML1628, which cover Open Cut 1 and the proposed Open Cut 1 extension area and require MCO to maximise resource extraction subject to environmental and economic considerations. A mining lease is currently being applied for Open Cut 2, including the proposed extension area.

Coal has met almost half of the increase in global energy demand over the last decade (International Energy Agency [IEA] 2012). In the World Energy Outlook 2012, IEA examined a number of future energy scenarios, including: maintaining current policies; implementing recent government policy commitments in a cautious manner; and the policies required to limit the long-term increase in the global mean temperature to 2°C above pre-industrial levels.

All of the energy scenarios involve an increase in coal consumption in the next decade (at least), with coal consumption in 2035 at least similar to total world coal demand in 2009 (IEA 2011). The proposed modification will allow for the extraction of State significant reserves located within existing mining tenements using existing infrastructure.

Mining of black coal is one of Australia's most important industries, creating significant employment and revenue in regional Australia. Australia is the world's largest coal exporter and black coal is Australia's second highest export commodity (Australian Coal Association 2012). Approximately 167 Mt of saleable black coal was produced in NSW in 2011/2012, or 44% of the total Australian production (derived from Australian Bureau of Agricultural and Resource Economics and Sciences 2012). The proposed modification will provide continued supply of these important reserves.

In addition to accessing substantial additional reserves, the proposed modification will greatly improve mining efficiencies in Open Cuts 1 and 2.

The current disturbance boundaries in these mining areas restrict the available strike length and working face which consequently increases extraction costs. The proposed modification will 'straighten-up' the boundaries of the high walls and enable more efficient extraction, thus improving the cost competitiveness of the mine.

4.2.2 Water management infrastructure

An outcome of the proposed extension to mining is that additional surface water management infrastructure will be constructed and operated, as required, to amongst other purposes, prevent potential adverse off-site impacts from sediment laden runoff.

4.2.3 Rehabilitation sequencing and final landform

MCO requires greater flexibility in the sequencing of rehabilitation in response to the indicative mine plans that were developed for the proposed modification, to include the proposed extension areas and extension of the Stage 1 mine life. It is important to note, however, that MCO's existing rehabilitation management framework will continue to pertain, including its commitment to rehabilitate areas disturbed by mining activities as soon as practical (refer to Section 3.1.3).

Minor changes to the final landform will result from the extension of mining. In accordance with MCO's commitments under its MOP, the mine design ensures that the post-mining landform is generally consistent with surrounding landforms and elevations.

4.2.4 Extension of mine life

The indicative mine plans for the proposed modification have been developed in consideration of mine plans presented in the Stage 2 PPR and potential environmental consequences of MCP operating as one single mine complex. To ensure MCP can be mined efficiently and environmental impacts are minimised, the sequencing of Stage 1 open cut mining has been modified. The revised sequencing results in an extension of the approved mine life from 2028 to 2033.

This timeframe also aligns with that contemplated in the Stage 1 Modification 3 (05_0117(M3)) which seeks to, amongst components, use Stage 1 infrastructure to cater for both Stages 1 and 2 and extend the operational life of Stage 1 infrastructure until 2033.

4.3 Proposed modification description

The elements of the proposed modification comprise:

- the extension of mining within Open Cuts 1 and 2;
- the construction and operation of additional water management infrastructure; and
- a minor change to the rehabilitation sequencing and final landform.

The Stage 1 approval period will be extended to accommodate the proposed modification.

A summary of the approved Stage 1 and proposed modification is given in Table 4.1.

Table 4.1 Stage 1 approval and proposed modifications

Project aspect	Current Stage 1 approval	Proposed modification
Total life of mine coal production (product coal)	10 Mtpa	No change
Total life of mine ROM coal production from open cut and underground mining	12 Mtpa	No change
ROM coal extraction limit from open cut mining	8 Mtpa	No change
ROM coal extraction limit from underground mining	4 Mtpa	No change
Life of mine	21 years (2028)	Five year extension (2033)
Operating hours	Seven days per week, 24 hours per day	No change
Number of employees (operation only)	Operational workforce of 317 full time positions	No change
Mining methods	Open cut truck and shovel operation	No change
Total footprint of open cut areas	708 ha	Increase footprint of open cut areas by approximately 178 ha to 886 ha to include the proposed extension areas
Total disturbance area	1,184 ha	Increase disturbance area by ha approximately 178 ha to 1,364 to include the proposed extension areas
Coal handling and processing	Coal from the open cut pits transferred by truck and conveyor to the CHPP. Coal from Underground 4 transferred to the CHPP by conveyors. Up to 12 Mtpa of ROM coal processed	No change
Overburden emplacement	8,431,021 m^2	An additional 1,480,537 m^2 of in-pit overburden emplacement
Coarse rejects and tailings management	Reject back hauled and placed in overburden. Fines recovered at the CHPP either added to product or coarse reject streams. Emergency tailings storage adjacent to the CHPP	No change
Final voids	One void in Open Cuts 1, 2 and 3	Two voids in Open Cut 1, as contemplated in Stage 1 Modification 3 (Project Approval Ref: 05_0117 (M3)) and one void in Open Cut 3 (no change)
Site access	Access to main infrastructure area and Underground 4 from Ulan to Cassilis Road north of rail line; and access to open cut pits from Ulan to Wollar Road south of the rail line	No change
External coal transport	Four daily coal train paths	No change

Detail on each of the proposed modification elements is given in the sections below.

4.3.1 Extension of mining area

i Overview

The proposed modification will increase the approved Stage 1 disturbance boundary by approximately 178 ha. Open Cuts 1 and 2 will be extended but Open Cut 3 will not change.

The Open Cut 1 extension area is approximately 84 ha and will extend Open Cut 1 to the south to connect with Open Cut 2. The Open Cut 2 extension area is approximately 94 ha and extends Open Cut 2 to the south and east (refer Figure 1.2).

The proposed extension areas will increase the total footprint of the open cut areas by approximately 25% from 708 ha to 886 ha.

As stated in Section 4.2.1, the proposed extension areas will enable access to an additional 30 Mt (approximate) of ROM coal reserves.

ii Indicative mine plans

In order to address potential impacts from the proposed extension areas, indicative mine plans were developed for the proposed modification.

Indicative mine plan layouts for open cut operations in Years 2, 6, 11, 16 and 21 are shown in Figures 4.1 to 4.5 and described below.

- Indicative Year 2 –mining in the proposed Open Cut 1 extension area is a continuation of mining the existing Open Cut 1 area. No mining has occurred in Open Cut 2 at this stage;
- Indicative Year 6 –mining in the proposed Open Cut 1 extension area has continued in a south-westerly direction and has broken into the ridge, with disturbance up to approximately 530 m AHD. No mining has occurred in Open Cut 2 at this stage;
- Indicative Year 11 –mining in the proposed Open Cut 1 extension area is complete and the majority of the area rehabilitated to its final landform. Coal extraction has extended into the northern part of Open Cut 2 as a continuation of Open Cut 1;
- Indicative Year 16 –mining in the proposed Open Cut 2 extension area has commenced, extending south-east to include the straightening of the high wall; and
- Indicative Year 21 –the sequencing of mining for Open Cut 3 will be the same as that shown in the approved Stage 1 EA. All mining in Open Cut 2 has finished and mining in Open Cut 3 is close to completion, with active mining occurring only in the southern tip and the mined and backfilled area rehabilitated.

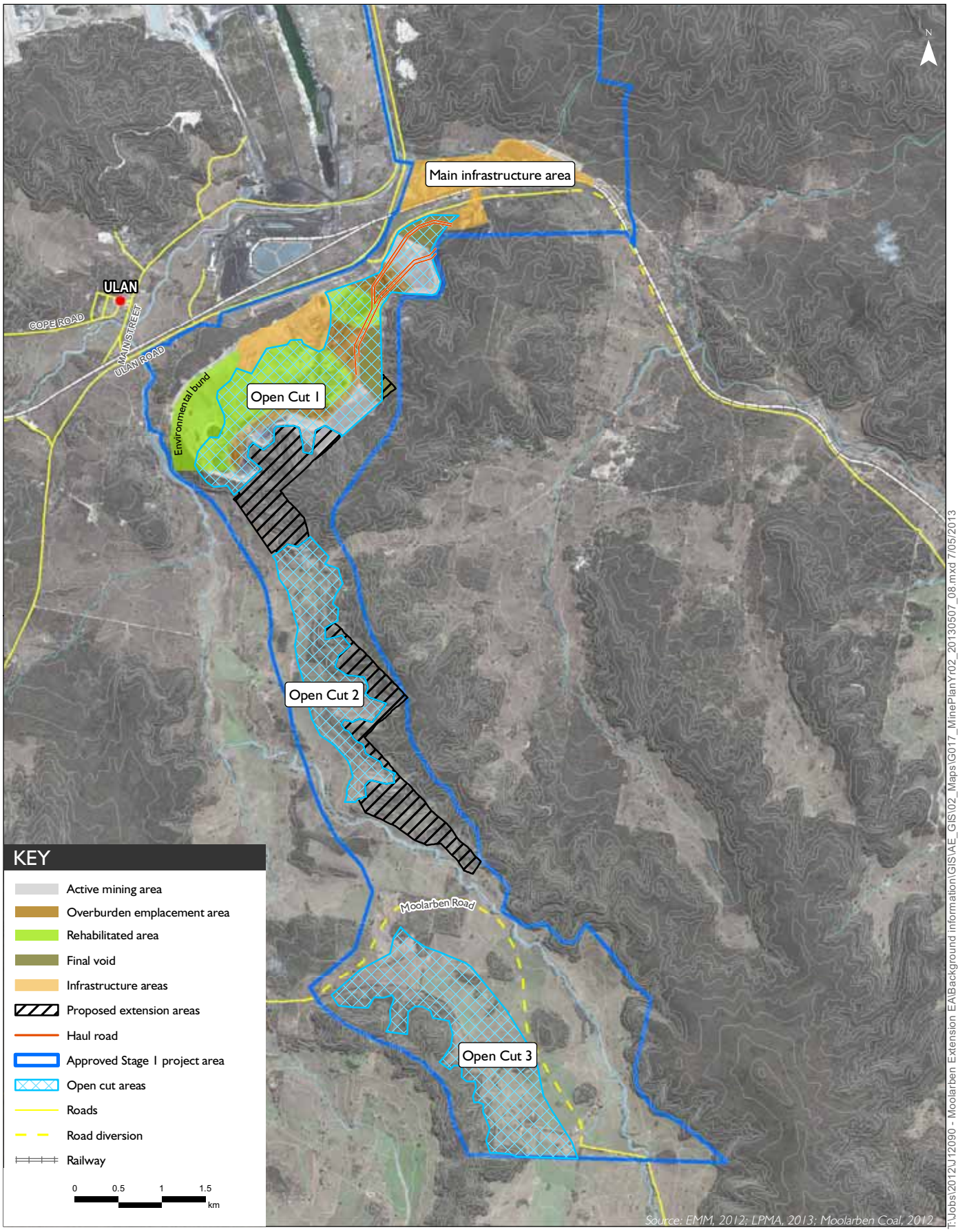
During operations, alternative mine plans may be used to the indicative plans above, provided that the environmental impacts remain within the envelope of effects assessed in this EA. For example, mine plans may be varied for the purposes of environmental management such as noise and dust minimisation under particular meteorological conditions or to enable access to an area of lower strip ratio coal at a particular time. The mining operations can therefore retain some flexibility within the constraints of the identified environmental envelope.

It should be noted that the proposed modification only extends Open Cuts 1 and 2. The mining areas and sequence of Open Cut 3 will not change to that approved under MP 05_0117. Therefore, the impacts are assessed for mining of Open Cuts 1 and 2. Previous predictions for mining within Open Cut 3 will not change under the proposed modification.

No additional infrastructure beyond that contemplated in Section 4.3 is proposed under the modification. However, it is noted that the infrastructure area at the north-western extent of Open Cut 1 is shown as extended on the indicative mine plans presented in Figures 4.1 to 4.5 to be consistent with those contemplated in the Stage 2 proposal and the Stage 1 Modification 3 (Project Approval Ref: 05_0117 (M3)). All infrastructure areas remain within the currently approved disturbance boundary.

iii Process

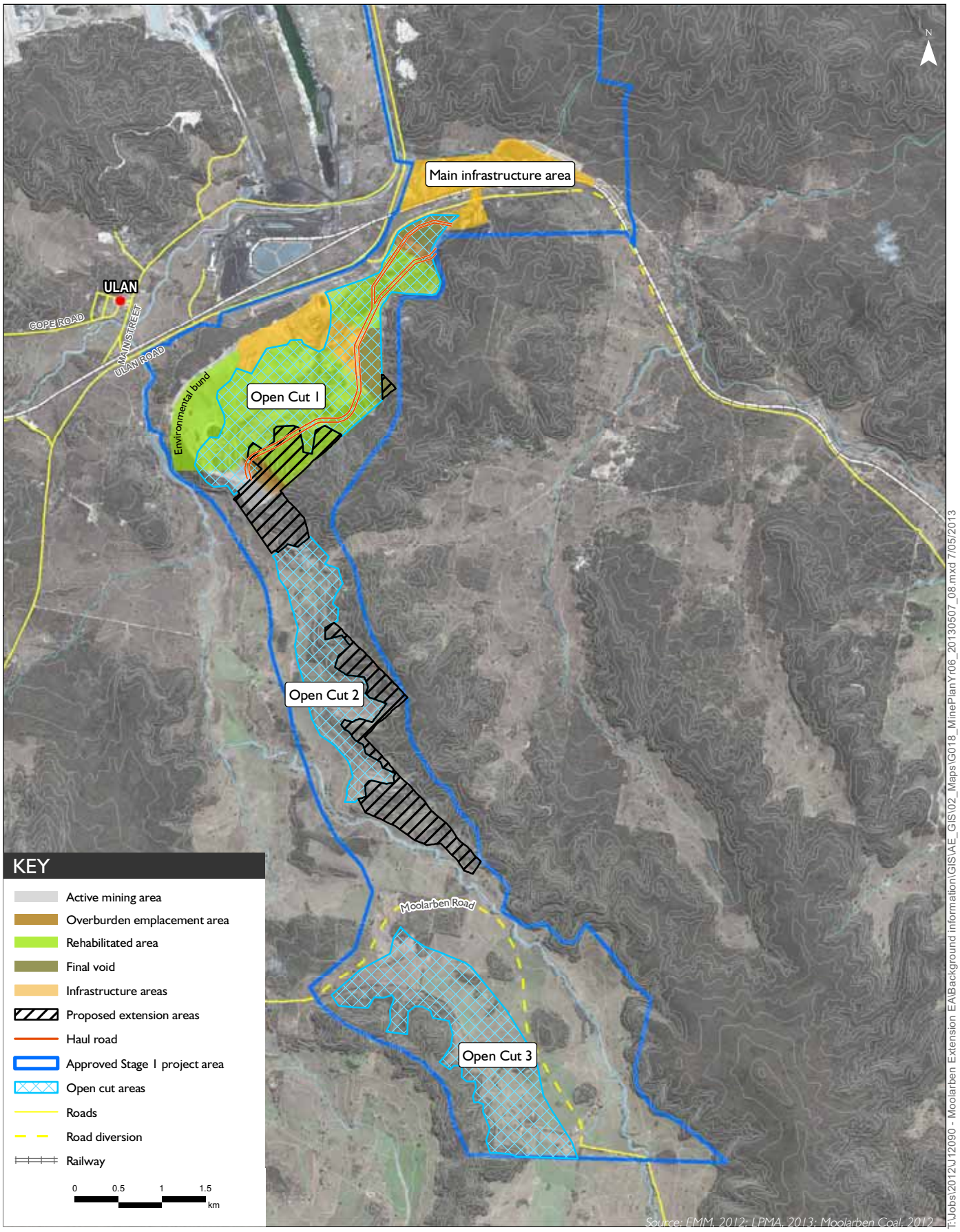
Open cut mining will continue to be undertaken using trucks and shovels. There will be no change to existing coal handling and processing methods and no additional plant and equipment will be required to support mining.



Indicative Stage 1 open cut mine plan - Year 2

Moolarben Coal Project - Stage 1 Optimisation Modification

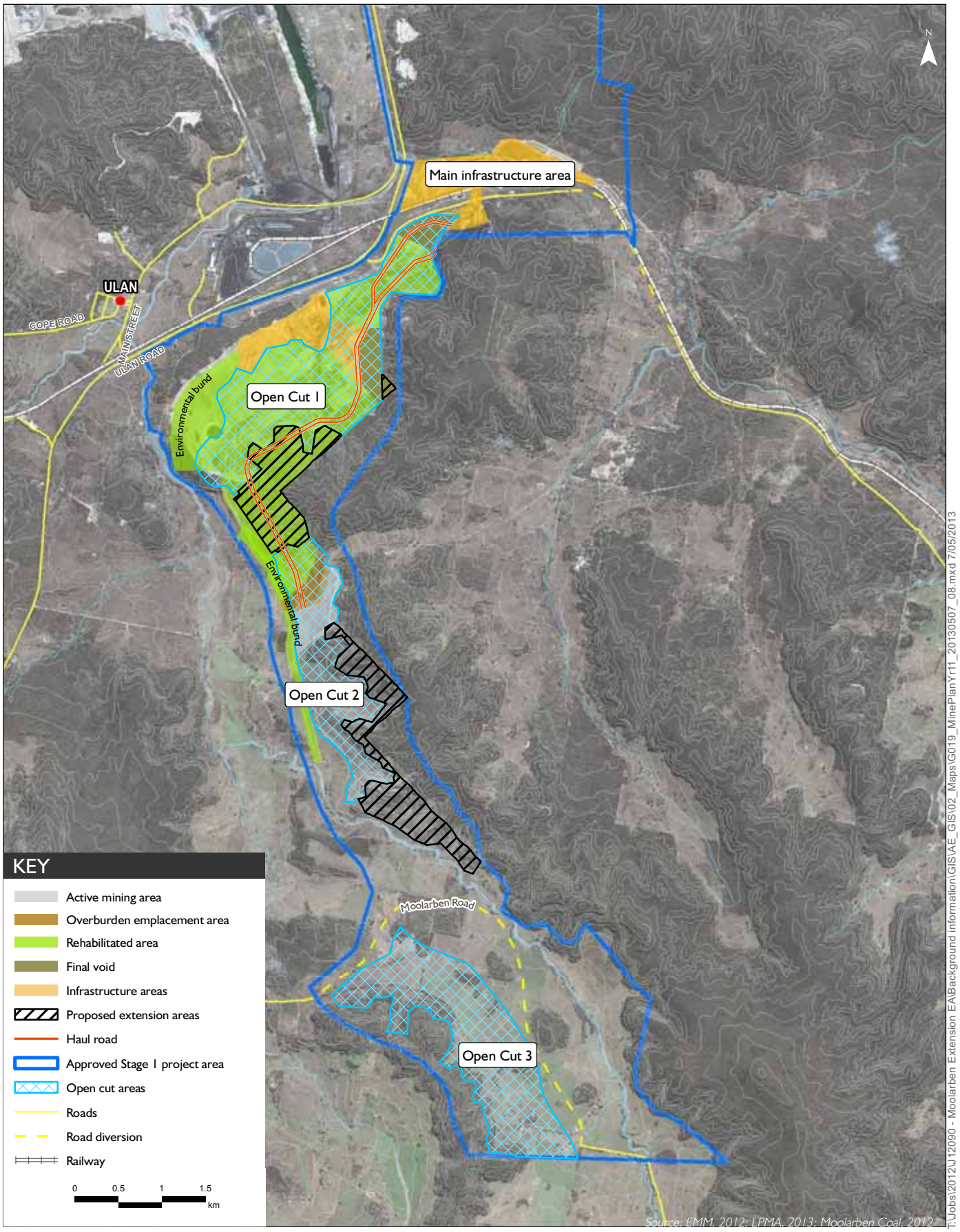
Figure 4.1



Indicative Stage 1 open cut mine plan - Year 6

Moolarben Coal Project - Stage 1 Optimisation Modification

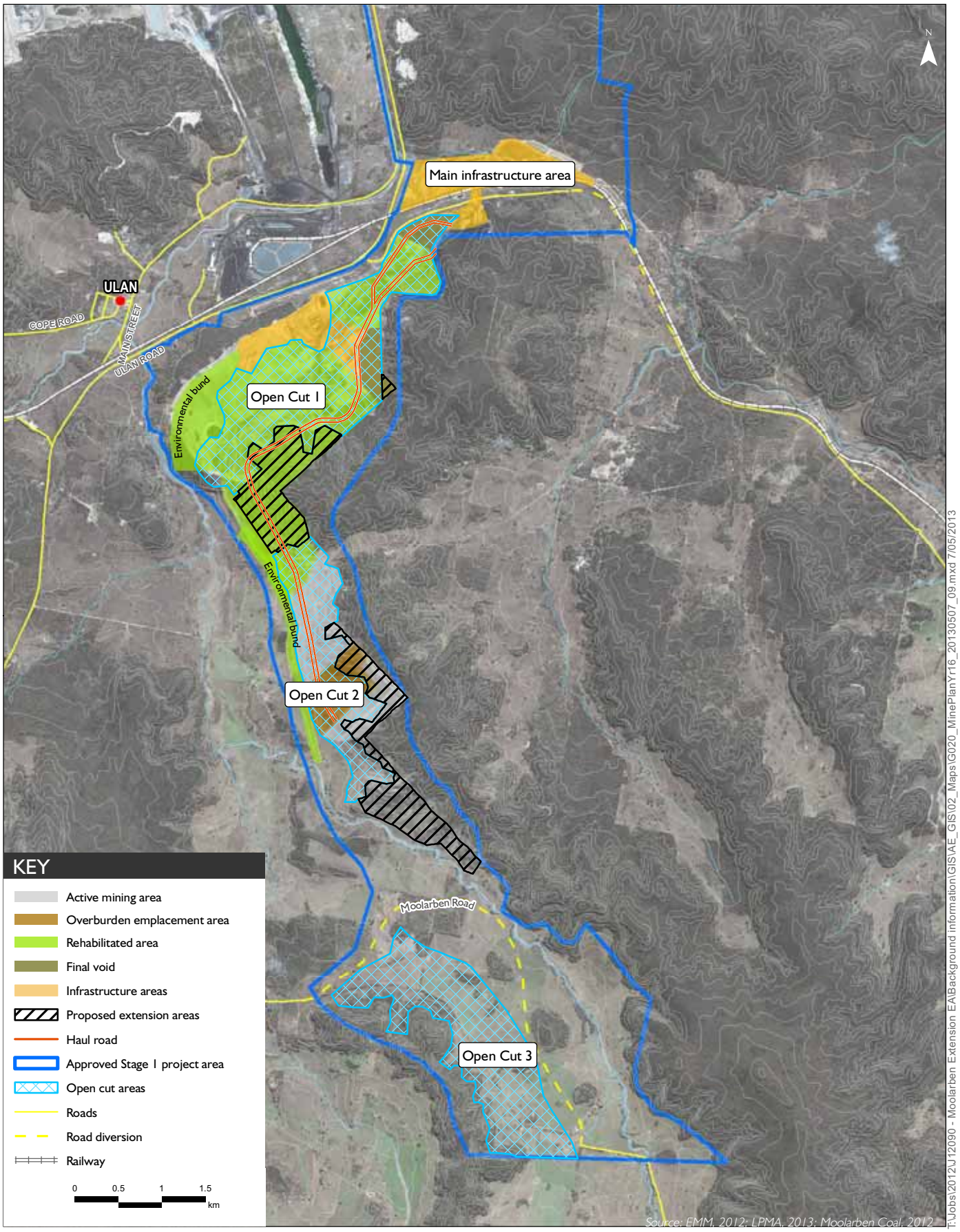
Figure 4.2



Indicative Stage 1 open cut mine plan - Year 11

Moolarben Coal Project - Stage 1 Optimisation Modification

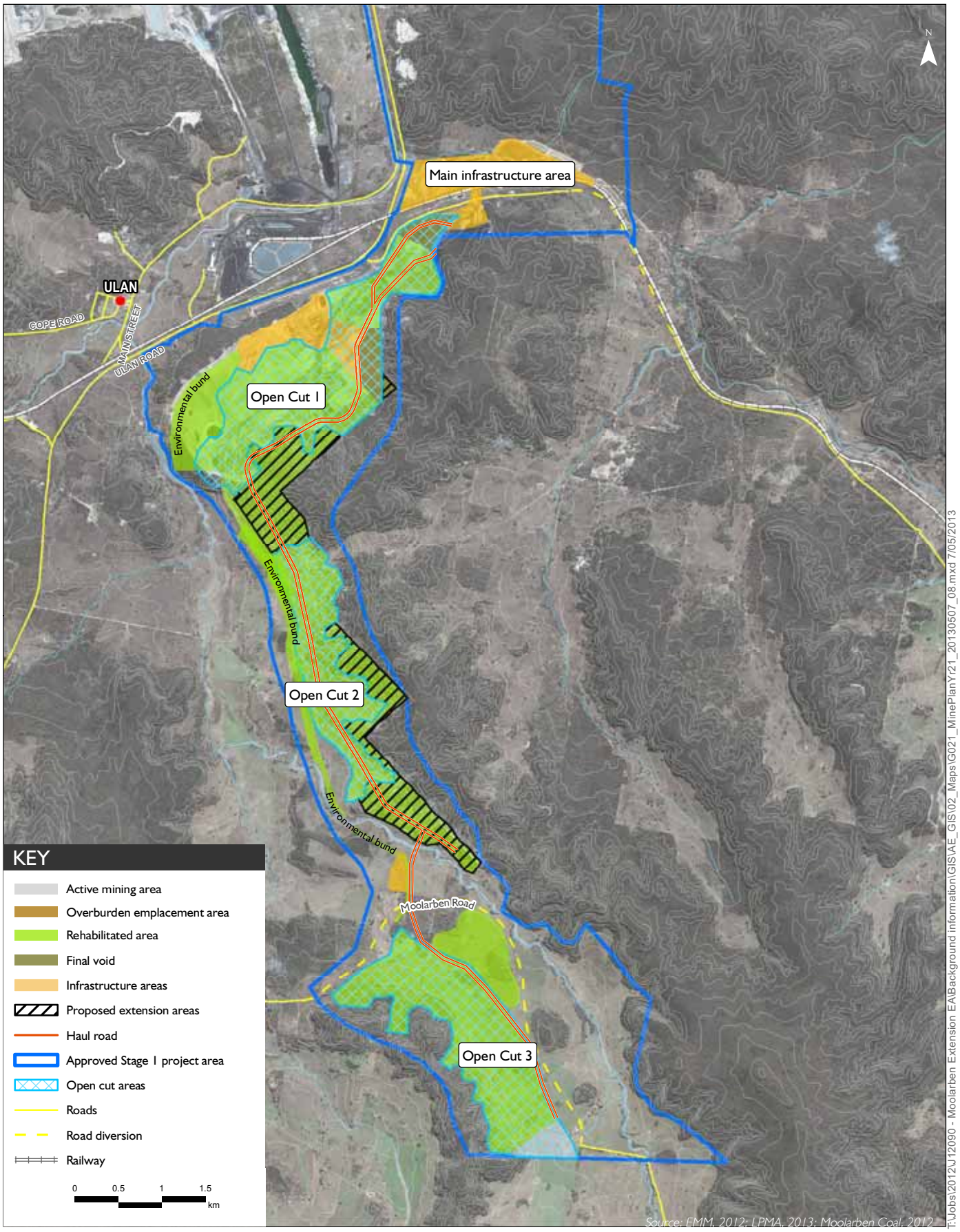
Figure 4.3



Indicative Stage 1 open cut mine plan - Year 16

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 4.4



Indicative Stage 1 open cut mine plan - Year 21

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 4.5

4.3.2 Water management infrastructure

Based on the findings of the surface water assessment (Appendix I), additional surface water management infrastructure will be constructed and operated, as required, to amongst other purposes, prevent potential adverse off-site impacts from sediment laden runoff. The additional disturbance areas associated with the remainder of the proposed extension areas will be managed in accordance with MCO's WMP.

Additional sediment dams will be required as a result of the proposed modification. These storages will capture disturbed area runoff from the extension areas and will not result in additional disturbance outside the footprint of the extension area. It is noted that the location of the storages included within the surface water assessment are indicative only and will be confirmed as part of detailed design. An indicative plan of the water management infrastructure as proposed is provided in Figure 6.1 of Appendix I.

4.3.3 Rehabilitation sequencing and final landform

Consistent with the existing approach to post mining landform development, final landform design for the proposed extension areas will be based on four main factors:

- landform stability;
- erosion minimisation;
- landform compatibility with the surrounding environment; and
- cost of earthworks.

Rehabilitation will involve the reshaping with large dozers of the majority of overburden emplacement to slopes of 10° or less and incorporation of contour-graded banks to reduce erosion risks. The spacing and ultimate dimensions of these structures will be a function of the final slope and catchment area and, consequently, these design details will be provided in MCO's MOP.

In line with MCO's existing commitment to return areas disturbed by mining operations to their pre-mining land use, the proposed extension areas will be rehabilitated as described below. Disturbance areas will continue to be progressively rehabilitated in accordance with MP 05_0117 approval conditions, as soon as practicable following disturbance.

Figure 4.6 shows the indicative post mining landform of the project area, including the proposed extension areas. Two cross sections across the proposed Open Cut 1 and 2 extension areas are given in Figure 4.7.

i Open Cut 1

The Open Cut 1 extension area will be rehabilitated for biodiversity outcomes. It will be seeded with a combination of native perennial grasses, shrubs and woodland species consistent with those species found in the local area. Species selection will be designed to promote the development of native forest and woodland with structured understorey, mid-storey and tree canopy coverage. This will increase overall biodiversity values and promote survival of these vegetation types in the post-mining landscape.

Rehabilitation has been designed to mirror, as much as practical, the pre-mining landform with mined areas being filled back up to the disturbance line in the ridges of Open Cut 1.

As shown in the indicative mine plans (Figures 4.1 to 4.5) an additional final void is shown in the most northern extent of Open Cut 1, adjacent to the south of the main infrastructure area. This void will allow access to Underground 4, as contemplated in the Stage 1 Modification 3 (Project Approval Ref: 05_0117 (M3)) which is pending approval.

Overburden generated from mining within the proposed extension area will be emplaced in-pit.

ii Open Cut 2

In accordance with MCO's commitment to creating long term habitat corridors and returning areas disturbed by mining to their pre-mining land use, the majority of the extension area will be rehabilitated with native vegetation to develop habitats similar to the existing undisturbed environment. A small area in the south-western section will be restored to agricultural land. As above, rehabilitation has been designed to mirror, as much as practical, the pre-mining landform.

At this time no final void is proposed in Open Cut 2.

As above, overburden generated from mining within the proposed extension area will be emplaced in-pit.

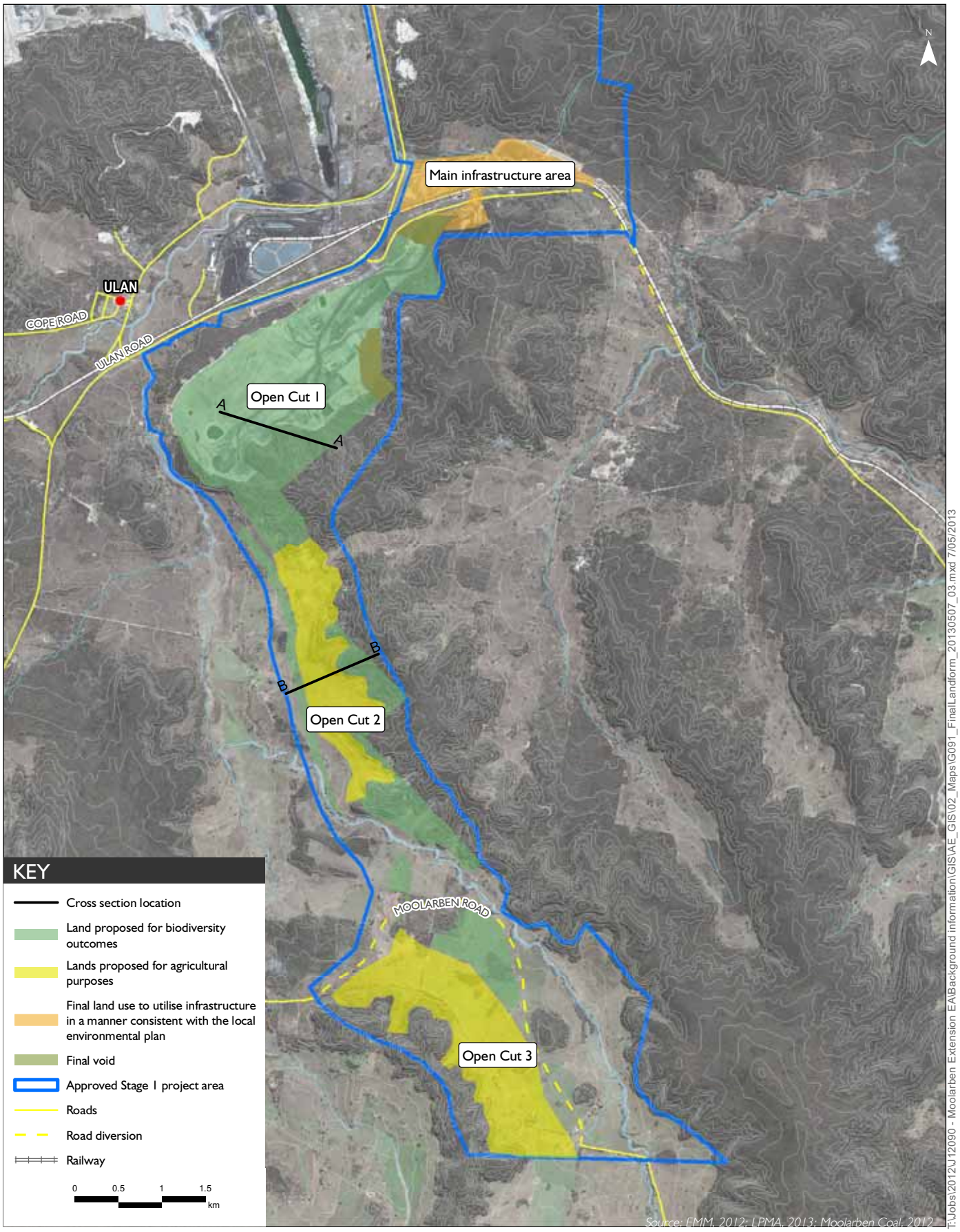
iii Open Cut 3

There is no change to Open Cut 3 under the proposed modification.

4.3.4 Extension of mine life

MCO intends that Stage 1 and, should it be approved, Stage 2 of the MCP operate as one single mine complex. Stage 1 Modification 3 seeks to modify MP 05_0117 to enable this objective to be met. Modification 3 seeks to, amongst components, using Stage 1 infrastructure to cater for both Stages 1 and 2 and extend the operational life of Stage 1 infrastructure until 2033.

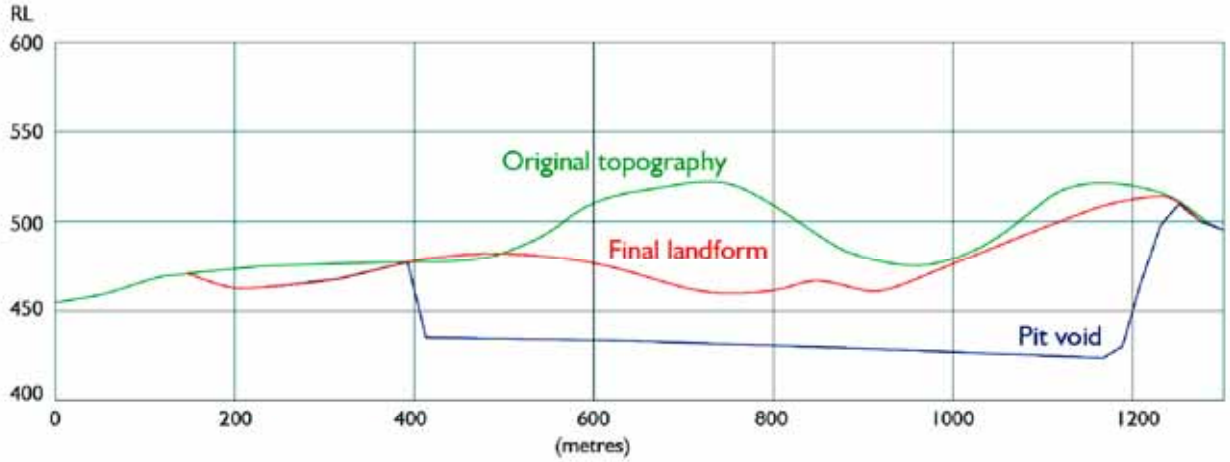
Consistent with the above and in order to allow the full integration of Stage 1 and 2 open cut operations, MCO seeks to modify MP 05_0117, to allow for mining until 2033.



Indicative final landform plan

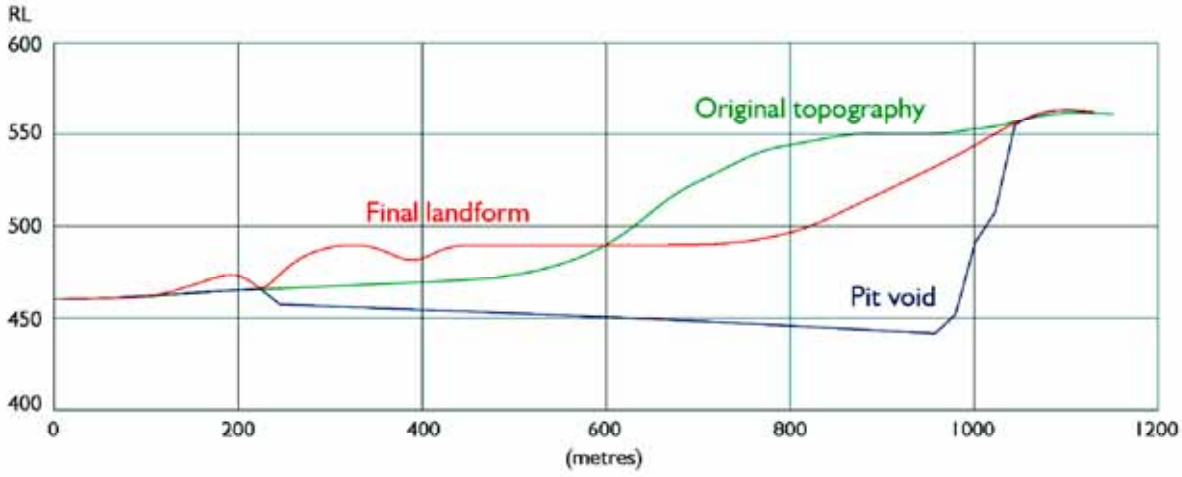
Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 4.6



Section A - Indicative Open Cut 1 Cross Section

Vertical Exaggeration 2:1



Section B - Indicative Open Cut 2 Cross Section

Vertical Exaggeration 2:1

Source: Moolarben Coal, 2012

T:\Jobs\2012\J12090 - Moolarben Extension EA\Background information\GIS\AE_GIS\02_Maps\G092_CrossSections_20130507_03.mxd 9/05/2013

Indicative post-mining landform cross sections

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 4.7

4.4 Alternatives considered

Proposal alternatives considered included variations of the proposed extension areas and the 'do nothing' option.

i Proposed extension areas

A number of configurations and extents were considered for the proposed extension areas. These included:

- Option 1 – extending Open Cuts 1 and 2 towards the eastern extent of the Stage 1 project approval boundary, and the Open Cut 2 extension area further to the west;
- Option 2 – extending Open Cut 3 to the west and east; and
- Option 3 – adopting the currently proposed extension areas.

Considerations related to the Option 1 included:

- encroachment on Moolarben Creek and its floodplain;
- vegetation connectivity and fauna habitat disturbance;
- potential acoustic impacts;
- potential dust impacts;
- potential visual impacts; and
- encroachment on a Aboriginal cultural heritage item located to the east of the currently proposed Open Cut 2 extension area.

This option was dismissed upon consideration of the collective environmental risk of the above.

Option 2 was dismissed due to the high overburden to coal strip ratio which varied between 10.1 and 16.9 in the western sections of the Open Cut 3 extension area. The area to the east was excluded primarily due to the indicative timeframe for mining within this area which is not currently planned until the later years of the proposed mine life.

Option 3 was preferred as it will enable the efficient extraction of a relatively low strip ratio coal resource whilst minimising potential adverse environmental impacts.

ii Production rate

A number of alternative production scenarios were considered during the scope development for the proposed modification. An increased intensification of mining that would be required to increase the approved production rate in the northern parts of Open Cut 1 would be likely to increase the risk of amenity impacts sensitive locations such as Ulan School. Accordingly, the majority of these scenarios were dismissed. One option, comprising an increase in the approved combined maximum rate of ROM coal production from open cut pits from 8 Mtpa to 10 Mtpa, was given more detailed consideration.

Preliminary impact assessment adopting the increased production predicted that potential noise and dust impacts were unlikely to be substantially beyond those approved under Stage 1 operations. However, further consideration by mine plan engineers concluded that equipment that would be required to extract the increased tonnage could not be practically accommodated in the Stage 1 open cut mining areas. Mining inefficiencies that would result render this option as unviable.

iii Do-nothing option

The 'do nothing' option would avoid the marginal increase in potential environmental impacts associated with the proposed modification and the costs associated with development of the proposed modification and environmental management measures. However, it would result in the potential sterilisation of an economic resource at an existing mine operation where considerable social and physical capital is already in place. Under this scenario, the attendant social and economic benefits would not be realised.

5 Statutory framework

5.1 Overview

This chapter outlines the statutory framework that applies to the proposed modification. It provides an overview of the applicable environmental planning approval process under the relevant NSW and Commonwealth legalisation.

5.2 Environmental Planning and Assessment Act 1979

MCO is seeking approval for a proposed modification to the MP 05_0117, granted under the provisions of Part 3A of the EP&A Act.

5.2.1 Transitional Part 3A projects

Part 3A was repealed by the *Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* (Part 3A Repeal Act) which was passed by the NSW Parliament on 22 June 2011, and commenced on 1 October 2011. Under the Part 3A Repeal Act, projects deemed to be 'transitional Part 3A projects' will continue to be subject to Part 3A of the EP&A Act (as in force immediately before the repeal and as modified by the Part 3A Repeal Act). Transitional Part 3A projects include certain projects that were the subject of an existing approval under Part 3A. As the current approval was granted under Part 3A of the EP&A Act, the proposed modification is deemed to be a transitional Part 3A project.

i Permissibility

The Stage 1 project area is wholly within the LGA of the Mid-Western Regional (MWR) Council. The project area is zoned RU1 Primary Production and E3 Environmental Management, pursuant to the Mid-Western Regional Local Environmental Plan (MWR LEP) 2011. Open cut mining is identified in the MWR LEP as a use that is permissible with consent in both the RU1 and E3 zone.

Notwithstanding this, clause 7 of the State Environmental Planning Policy (Mining, Petroleum and Extractive Industries 2007) (Mining SEPP) specifies that both the following are permissible with consent:

- *mining carried out on land where development for the purposes of agriculture or industry may be carried out, and*
- *facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out, if they were mined from that land.*

The zones within the project area permit agriculture and, due to the provisions of the Mining SEPP, mining is permissible with consent.

The proposed modification falls under the definition of 'mining' and is, therefore, permissible with consent in accordance with the Mining SEPP.

ii Applicability of other approvals

Section 75U of the EP&A Act identifies authorisations, approvals and licences that are not required once a Part 3A project approval is granted. Those approvals that may be relevant to the proposed modification are described in Table 5.1.

Table 5.1 Approvals that do not apply

Legislation	Authorisation
Fisheries Management Act 1994	Section 219 permit for works or structures within a waterway
Heritage Act 1977	An approval under Part 4 Section 139 excavation permit
National Parks and Wildlife Act 1974	Section 90 Aboriginal heritage impact permit
Water Management Act 2000	Section 89 water use approval Section 90 water management work approval Section 91 activity approval
Native Vegetation Act 2003	Section 12 authorisation to clear native vegetation on state protected land

Accordingly, should project approval be granted, MCO would not be required to apply for any of the above licences, approvals or authorisations.

Section 75V of the EP&A Act identifies authorisations that the relevant determining authority must not refuse and that must be granted substantially consistent with the terms of a project approval. Those approvals relevant to the proposed modification are listed in Table 5.2.

Table 5.2 Consents to be consistent with project approvals

Legislation	Authorisation
Mining Act 1992	A Mining Lease
Protection of the Environment Operations Act 1997	An EPL
Roads Act 1993	Section 138 consent for works or structures on public roads
Pipelines Act 1967	A licence

While sections 75U and 75V of the EP&A Act have now been repealed, they remain in force for transitional Part 3A projects.

5.2.2 Section 75W of the EP&A Act

Section 75W of the EP&A Act enables the Minister to modify a project approval granted under Part 3A of the EP&A Act. In determining whether changes to a Part 3A project can be modified under Section 75W, consideration is given to a project and any possible change in potential associated environmental impacts.

Section 75W states:

> *"(1) In this section:*
>
> ***Minister's approval** means an approval to carry out a project under this Part, and includes an approval of a concept plan.*
>
> ***modification of approval** means changing the terms of a Minister's approval, including:*
>
> *(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and*

(b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.

(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.

(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.

(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification."

The features of the proposed modification, and the scale of its environmental impacts, indicate that the proposed modification is within the scope of Section 75W. Detailed assessments provided in Chapters 8 to 20 quantify the potential environmental and social impacts of the proposed modification.

5.2.3 Section 147 of the EP&A Act

MCO has disclosed reportable political donations, as required under Section 147 of the EP&A Act, for its application to modify Stage 1 05_0117 MOD 6 and these are on the public file. MCO has not made any further reportable political donations since modification application 05_0117 (M6) for Stage 1 was approved. A political donations disclosure form has been submitted with this EA.

5.3 Other NSW legislation and policies

5.3.1 Strategic Regional Land Use Policy

The NSW Government recently introduced strategic regional land use plans (SRLUPs) aimed at restricting major proposals for mining and coal seam gas production on strategic agricultural land (SAL). The project area does not fall within the two existing SRLUPs drafted for the New England North West and Upper Hunter regions. However, MCO is committed to providing additional information as required once mapping of SAL is completed over the project area. This matter is discussed in more detail in Chapter 16 (soils and agriculture).

Table 5.3 summarises other NSW legislation that is of relevance to the proposal.

Table 5.3 Summary of applicable NSW legislation

Legislation	Requirement	Comment
PoEO Act	The PoEO Act requires that scheduled premises, which are defined in Schedule 1 of the Act, are required to obtain and operate under an EPL.	The MCP is a scheduled premise that operates under EPL 12932. If the proposed modification is approved, EPL 12932 will be reviewed and updated if required.
Threatened Species Conservation Act 1995 (TSC Act)	The TSC Act is administered by OEH and aims to manage terrestrial threatened species, populations and ecological communities. If a planned development or activity will have an impact on a threatened species, population or ecological community listed under the TSC Act, this must be taken into account in the approval process.	The potential impacts of the proposed modification on threatened species, populations and ecological communities are considered in detail in the ecological assessment (Appendix E). Subject to the implementation of the proposed avoidance, management and monitoring measures and offset package, the proposed modification will have a net positive biodiversity outcome.
Mining Act 1992 (Mining Act)	The Mining Act regulates the granting of Mining Leases and mining activities generally and, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, and rehabilitation and environmental management activities.	As outlined in Section 3.1.3, the MCP currently has a MOP for Open Cut 1, as required under its mining lease conditions, which considers operation and rehabilitation of Open Cut 1 over a five year timeframe. If approved, the MOP will be updated to include the proposed modification. The proposed Open Cut 1 extension area is covered by ML1605, ML1606 and ML1628. A mining lease is currently being applied for Open Cut 2, including the proposed extension area.
National Parks and Wildlife Act 1974 (NPW Act)	The NPW Act is administered by OEH and aims to conserve nature and objects, places or features of cultural value. Consent is normally required under section 90 of the Act to knowingly destroy, deface or damage an Aboriginal object or place. However, because of section 75V of the EP&A Act no such consent is required for transitional Part 3A project approvals	A detailed Aboriginal cultural heritage impact assessment has been undertaken (Chapter 11). Impacts to Aboriginal sites will be low within a local context and very low within a regional context. Any sites impacted will be salvaged and managed in accordance with the specified guidelines. Part 8A of the NPW Act provides for protection of flora and fauna, as discussed in Chapter 10.
Water Act 1912 (Water Act)	The Water Act regulates the issue and trade of water licences in NSW water sources where water sharing plans have not yet commenced. This includes a water licence or authority to extract groundwater under Part 5 of the Water Act.	A groundwater impact assessment is given in Chapter 15. The proposed modification will not require any additional water licences to those required for the existing approved Stage 1.
Water Management Act 2000 (WM Act)	The WM Act regulates the use and interference with surface and groundwater in NSW and applies to those water sources which are managed by an operational water sharing plan. The NSW government recently implemented an Aquifer Interference Policy. This policy establishes requirements for licensing and approvals for aquifer interference activities under the Water Act, WMA Act and other relevant legislation.	A surface water impact assessment is given in Chapter 14. Impacts from MCP complex (Stage 1, proposed modification and Stage 2) on Water Sharing Plan water sources are all within licensed allocations being finalised for the Stage 2 proposal.

5.3.2 State Environmental Planning Policies

SEPPs are environmental planning instruments prepared by the Minister to address planning issues significant to NSW. The following SEPPs are relevant to the proposed modifications:

- Mining SEPP;
- SEPP (Major Development) 2005; and
- SEPP (State and Regional Development) 2011.

The Mining SEPP aims to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of the State. The policy establishes appropriate planning controls to encourage ecologically sustainable development (ESD). The proposed modifications are consistent with the aims and controls of this policy.

Open cut mining is permissible under clause 7(1)(b) of the Mining SEPP if development for the purpose of agriculture or industry maybe be carried out (with or without development consent) under the terms of the relevant LEP. As discussed in Section 5.2.1, Stage 1 is permissible under the MWR LEP (the relevant LEP) and is therefore permissible under clause 7(1)(b) of the Mining SEPP.

SEPP (*Major Development*) 2005 previously defined classes of development to which Part 3A of the EP&A Act applied. This SEPP was amended by SEPP (*State and Regional Development*) 2011 in accordance with the repeal of Part 3A, though it is still relevant to the proposed modification as it continues to apply to transitional Part 3A projects. Prior to the repeal of Part 3A of the EP&A Act, Clause 6 of SEPP (*Major Development*) 2005 stated:

> *(1) Development that, in the opinion of the Minister, is development of a kind:*
>
> *(a) that is described in Schedule 1 or 2, or*
>
> *…*
>
> *is declared to be a project to which Part 3A of the Act applies.*

Coal mining was a form of development described in Schedule 1 of SEPP (*Major Development*) 2005 and, therefore, Part 3A of the EP&A Act applies to the proposed modification.

5.4 Commonwealth legislation

The EPBC Act aims to protect matters deemed to be of national environmental significance (NES) including:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;

- Commonwealth marine areas; and
- nuclear actions (including uranium mining).

If an action (or project) will, or is likely to, have a significant impact on any matters of NES it is deemed to be a Controlled Action and requires approval from the Commonwealth Environment Minister or the Minister's delegate. To determine whether a proposed action will or is likely to be a Controlled Action an action may be referred to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

Stage 1 was referred to SEWPaC and deemed a controlled action under the EPBC Act. A new referral will be submitted to SEWPaC under the EPBC Act where the proposed modification has the potential to impact matters of NES to determine whether the proposed modification is deemed to be a Controlled Action.

The ecological assessment, Appendix E, found that one matter of NES was considered likely to be significantly impacted by the proposed modification being approximately 16.5 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grasslands. As such, a referral of proposed action will be submitted to SEWPaC.

6 Stakeholder engagement

6.1 Introduction

This chapter describes the process for, and outcomes from, stakeholder engagement undertaken for this EA. Specifically, it describes the:

- stakeholder identification and engagement objectives;
- stakeholder engagement activities;
- stakeholder engagement results; and
- matters raised during engagement.

6.2 Stakeholder identification and engagement objectives

The objectives of stakeholder engagement were to:

- provide accurate and relevant information to stakeholders and the community to create, maintain or increase awareness of the proposed modification; and
- enable stakeholders and the community to comment on the proposed modification so that feedback could be considered during the EA process.

A stakeholder engagement strategy was developed for the proposed modification. The strategy identified stakeholders for direct engagement which were divided into two groups, namely:

- community and special interest groups; and
- government and service providers.

Table 6.1 provides a list of stakeholders that were engaged during the EA process for the proposed modification.

Table 6.1 Identified stakeholders

Stakeholder group	Stakeholder
Community and special interest groups	
Community	Community Consultative Committee (CCC)
	Local residents
Special interest groups	Wilpinjong Coal Mine
	Ulan Coal Mine
	Port Waratah Coal Services (PWCS)

Table 6.1 Identified stakeholders

Stakeholder group	Stakeholder
Government and service providers	
State government agencies	DP&I
	OEH – Biodiversity division, including National Parks and Wildlife (NPWS)
	OEH - Heritage branch
	Division of Resources and Energy (DRE) within the Department of Trade and Investment, Regional Infrastructure Services (DTIRIS)
	EPA
	NSW Office of Water (NOW)
	Roads and Maritime Services (RMS) within Transport for NSW
	Australian Rail Track Corporation (ARTC)
	Department of Primary Industries (DPI)
	Hunter Valley Coal Chain Coordinator (HVCCC)
	Newcastle Port Corporation (NPC)
Local government authorities	MWRC
Service providers	Aurizon

6.3 Stakeholder engagement activities

Stakeholder engagement commenced in December 2012, when the proposed modification was discussed with DP&I. Advice from this meeting influenced the stakeholder engagement strategy for the proposed modification.

6.3.1 Community and special interest groups

MCO is committed to communicating and engaging with the community and other stakeholders in respect to ongoing operations at the MCP. MCP has implemented the following information sharing and community engagement measures:

- a 24 hour community response line (1800 556 484) providing community the opportunity to provide feedback, including on matters of concern, relating to operations at the MCP;
- the MCO website (www.moolarbencoal.com.au) which contains information on mine operations and management, project applications, community engagement and contact details;
- the publication of environmental monitoring results associated with the MCP's operation on the website; and
- the CCC.

A community newsletter was prepared and an information and feedback session held for the proposed modification. An overview of these engagement activities together with additional information on the CCC is provided in the following sub-sections.

i Community consultative committee

MP 05_0117 approval conditions required the establishment of the CCC for the construction and operation of Stage 1 of the MCP. The CCC has an independent Chairperson, comprises representatives from the local community, MWRC and MCO and generally meets every two to three months. Its purpose is to keep the community informed on the progress of the mine and provide a forum for open discussion between committee representatives. The CCC's scope covers approval conditions relating to Stage 1, the MCP's environmental performance and community relations.

The proposed modification was discussed at CCC meeting on 12 March 2013. MCO representatives described the proposed modification, mine design considerations, the approval pathway and the expected approval timeframe. MCO representatives responded to questions regarding disturbance areas, the relationship with Stage 2 and proposed hours of operation. The community information and feedback session and the method of notification for this session have also discussed and CCC members were invited to attend. Minutes from the CCC meetings are available on MCO's website.

ii Community newsletter

A newsletter which provided details of the proposed modification and the community information session was prepared and dropped in letter boxes to all private properties within close proximity to the MCP, including all properties on Ridge Road to the south-west of the MCP. Flyers notifying the time, date and location of the session were placed in local community establishments and an advertisement was published on 8 and 11 March 2013 in the Mudgee Guardian.

iii Community information and feedback session

A community information and feedback session was held, to promote awareness and provide information on the proposed modification and provide a forum for feedback on any issues/concerns which would require consideration as part of the environmental assessment process. The session took place between 15:30 and 19:00 on 13 March 2013 at the Ulan Community Centre, Main Street, Ulan, and was led by representatives of MCO and EMM.

Details of the proposed modification were displayed during the session via a series of 'story boards' which described current MCP operations, the proposed modification and environmental considerations and the planning process. Photomontages from a series of viewpoints were also presented. Attendees were encouraged to ask questions and provide feedback.

The session was attended by approximately 30 to 40 people, who were predominantly from the local community. Matters raised during the session and where these have been addressed in this EA are provided in Table 6.2.

6.3.2 Government and service providers

On 17 December 2012 representatives from MCO and EMM met with DP&I to outline the proposed modification and discuss important matters for consideration, the required approval pathway and consultation requirements.

Following this meeting a comprehensive consultation strategy was implemented. Matters raised during consultation and where these have been addressed in this EA are provided in Table 6.3.

6.4 Stakeholder engagement results

6.4.1 Community and special interest groups

Matters raised during community and special interest group engagement activities are listed in Table 6.2, together with a reference where each matter has been addressed in this EA.

Table 6.2 Matters raised by community and special interest groups

Stakeholder	Theme	Matters raised	EA reference
CCC (Meeting 12/03/2013)	Proposal	Hours of operation	Section 3.1.1
		Relationship of the proposed modification with Stage 2	Section 1.5 and Section 3.2
	Disturbance	Areas of additional disturbance	Section 4.3
Community information and feedback session (13/03/2013)	Noise and vibration	Justification for the limit of the existing acquisition zone	Chapter 8
		Acquisition zone under the proposed modification	Chapter 8
		Compensation and/or house improvements for noise impacts	Chapter 8
		Loud noise and sleep disturbance	Chapter 8
		Potential impacts on property from blasting	Chapter 8
	Ecology	Impacts on native fauna from habitat removal	Section 10.3
	Traffic	Safety concerns from cumulative mining traffic on Ulan Road	Chapter 18
		Quality of existing road network	Chapter 18
	Groundwater	Drawdown of bore water	Chapter 15
	Rehabilitation	Timeframes for and approach to rehabilitation	Section 4.3.3
		Success of rehabilitation to date and establishment timeframes	Section 3.1
		Land use at completion of mining	Section 4.3.3
	Air quality	Assessment of dust impacts and health risks	Chapter 9
		Timing for the publication of monitoring results	Chapters 8 and 9
	Visual	Changes in viewscape resulting from the proposed modification	Chapter 13
		Timeframe of changes	Chapter 13
	Community	Fragmentation/loss of local community	Chapter 19
		Existing community infrastructure and services	Chapter 19
		Uncertainty of property values	Chapter 19
		Lack of information/surety on future expansion plans	Chapter 19
		Need for proactive community engagement by mines generally	Chapters 6 and 19
Wilpinjong Coal Mine (Meeting 18/02/2013)	Proposal	No perceived issues with proposed modification	Not required

Table 6.2 Matters raised by community and special interest groups

Stakeholder	Theme	Matters raised	EA reference
Ulan Coal Mine (Meeting 11/03/2013)	Proposal	Potential cumulative noise and dust impacts	Chapters 8 and 9
NPC (Letter 5/4/2013)	Proposal	No response received to date	Not required
PWCS (Letter 5/4/2013)	Proposal	No response received to date	Not required

6.4.2 Government and service providers

Matters raised from those government agencies and service providers that provided feedback during consultation are listed in Table 6.3, together with a reference where each matter is addressed in this EA.

Table 6.3 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EA reference
Government			
DP&I (Meeting 17/12/2012)	Noise	Magnitude of potential noise impacts	Chapter 8
	Proposal	Assessment approach	Section 2.5
		Legislation pathway	Chapter 5
	Ecology	Offset requirements and approach to offsetting	Section 10.5
		Naming of vegetation communities	Section 10.3
		Commonwealth approval requirements	Section 5.4
	Visual	Potential visual impacts from extension of mining the ridgeline	Chapter 13
	Water	Harvestable water rights and the need to demonstrate an ability to offset any water take	Chapters 14 and 15
	Final landform	Final landform	Section 4.3.3 and Figure 4.6
EPA (Meeting 5/02/2013	Air quality and noise	Potential noise and air quality impacts	Chapters 8 and 9
		Additional consultation with DP&I and EPA	Section 6.4.2
DRE (Meeting 15/01/2013)	Proposal	No objection to the proposed modification	Not required
OEH - Heritage (Meeting 11/02/2013) Aboriginal heritage	Heritage	Stakeholder engagement and the mechanism for the management of minor rock shelters identified in preliminary assessment	Chapter 11
		Aboriginal Heritage Management Plan	Chapter 11
		Offset areas and archaeological considerations	Chapter 11 and Section 10.5

Table 6.3 Matters raised by government and service providers

Stakeholder	Theme	Matters raised	EA reference
OEH/NPWS - Biodiversity (Meeting 15/02/2013)	Ecology	Offset management and approach to offsetting	Section 10.5
Mid Western Regional Council (Meeting 28/02/2013)	General	No objection to the proposed modification	Not required
EPA and DP&I (Meeting 7/3/2013)	Noise	Meteorological conditions and assessment approach	Chapter 8
		Validation factor and its implication to modelling	Chapter 8
		EPA recommended the adoption of more conservative inversion conditions than the INP recommends	Chapter 8
	Air quality	Meteorological conditions and assessment approach	Chapter 9
		Existing background dust levels and the 'clean air environment'	Chapter 9
NoW – Policy (Meeting 18/03/2013)	Groundwater and surface water	Further investigation required into the potential encroachment on and water take from Moolarben Creek and its associated alluvium	Chapter 15
		Licensing for water take	Chapters 14 and 15
		GDEs	Chapter 15
DRE (Letter 25/3/2013)	Overview of proposed modification	No response received	Not required
DPI (Letter 25/3/2013)	Overview of proposed modification	No response received	Not required
HVCCC (Letter 25/3/2013)	Overview of proposed modification	No response received	Not required
ARTC (Letter 25/3/2013)	Overview of proposed modification	No response received	Not required
OEH - Biodiversity (ongoing discussions)	Biodiversity offsets	Discussions between the study team and OEH are ongoing. A formal meeting will be held between these parties towards the end of May 2013.	Chapter 10
Service providers			
Aurizon (Letter 3/7/2013)	Overview of proposed modification	No response received	Not required

7 Environmental risk assessment

7.1 Introduction

An environmental risk assessment was undertaken to determine the proposed modification's potential environmental impacts, the risk of them occurring and the consequence of occurrence. The identification of risks enabled the determination of assessment priorities for the EA and further amelioration measures to be incorporated into the design of the proposed modification. This chapter presents the preliminary risk ratings and residual risk ratings based on the outcomes of the EA.

7.2 Methodology

Initial project scope development workshops were held between relevant stakeholders to reaffirm MCO's project objectives and ensure environmental risks were considered in the preliminary mine design.

Following the preparation of the preliminary mine design an information gaps analysis was completed by the study team to aid in the definition of technical study scopes and enable an informed environmental risk assessment workshop.

The environmental risk workshop was held to determine potential environmental impacts from the proposed modification, likelihood that these would occur and the consequence of occurrence. The workshop was attended by representatives from MCO, EMM and technical specialist consultants. Following this process, the mine design was optimised to ensure MCO's objectives were met, whilst minimising potential environmental risks.

The workshop process was based generally on Yancoal's environmental risk procedure and *HB 203: 203: 2006 Environmental Risk Management – Principle and Process*.

Risks were determined assuming standard safeguards, design or management measures are applied using the following variables:

- the potential severity or consequences of the impact, described in Table 7.1; and
- the likelihood of the impact occurring, described in Table 7.2.

Table 7.1 Qualitative measures of consequence

Level	Descriptor	Description
5	Catastrophic	**Extreme environmental harm** – irreversible impacts on environmental values of extreme and widespread areas, or those of national conservation significance, community fatalities or pollution or contamination. Prosecution. Licence revoked.
4	Major	**Major environmental harm** – long term irreversible impacts to area of regional conservation significance, health statistics in community alter as a result of this incident or pollution or contamination. Prosecution likely.
3	Moderate	**Serious environmental harm** – medium term impact to area of local conservation value, medium term physical remediation, actual community health impacts or significance or pollution or contamination Infringement. Notice received but prosecution unlikely.
2	Minor	**Minor environmental harm** – short term impact to area of limited local significance, limited physical remediation. Reportable breach /minor non-compliance, potential warning notice, other notices (infringement / prosecution) unlikely.

Table 7.1 Qualitative measures of consequence

Level	Descriptor	Description
1	Insignificant	**Environmental nuisance** – trivial or negligible, short term impact to area of low significance, minimal or no physical remediation required. No regulation.

Table 7.2 Qualitative measures of likelihood

Level	Descriptor	Description
A	Almost certain	Likely that the unwanted event could occur several times per year at this location.
B	Likely	Likely that the unwanted event could occur several times per year in the Australian mining industry; or could happen annually.
C	Possible	The unwanted event could well have occurred in the Australian mining industry at some time in the past 10 years.
D	Unlikely	The unwanted event has happened in the Australian mining industry at some time; or could happen in 50 years.
E	Rare	The unwanted event has never been known to occur in the Australian mining industry; or is highly unlikely that it could ever occur.

The consequence and likelihood measures were compared using the matrix in Table 7.3 to determine risk ratings, shown in Table 7.4. The risk ratings were used to determine environmental impact assessment priorities for this EA.

Table 7.3 Environmental risk assessment matrix

		Consequence				
		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
Likelihood	A Almost certain	11 (Moderate)	16 (High)	20 (High)	23 (Extreme)	25 (Extreme)
	B Likely	7 (Moderate)	12 (Moderate)	17 (High)	21 (Extreme)	24 (Extreme)
	C Possible	4 (Low)	8 (Moderate)	13 (High)	18 (High)	22 (Extreme)
	D Unlikely	2 (Low)	5 (Low)	9 (Moderate)	14 (High)	19 (High)
	E Rare	1 (Low)	3 (Low)	6 (Moderate)	10 (Moderate)	15 (High)

Table 7.4 Risk ratings

Level	Descriptor	Description
21-25	Extreme	Stop operations or don't proceed with activity. Immediate intervention required from senior management.
13-20	High	Imperative to eliminate or reduce risk by introduction of controls. Activity does not proceed until reviewed by senior management.
6-12	Moderate	Corrective action to be determined. Activity does not proceed without authorisation from supervisor.
1-5	Low	Safe to continue activity once risk is minimised.

7.3 Results

The results of the preliminary environmental risk assessment are shown at the left side of Table 7.5. These show that the majority of environmental risks from the proposed modification were considered low or moderate, with the exception of high risk(s) to five environmental attributes, namely:

- noise;
- ecology;
- socio-economic;
- Aboriginal cultural heritage; and
- visual.

One ecological risk, adverse impacts on Box Gum Woodland, was rated as extreme.

The preliminary environmental risk assessment has been updated at the right side of Table 7.5 to reflect the outcomes of this EA. Following mine plan optimisation, environmental assessment and development of additional measures to prevent, minimise and offset potential impacts, all levels of risk were reduced. There were no residual extreme or high risks with all risks either being rated moderate or low.

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Noise							
Additional private residences and privately-owned land impacted from modification, particularly those elevated on Ridge Road to west.	13H	Preliminary noise modelling based on the draft mine plans will be undertaken to determine the magnitude of potential impacts. If unacceptable, mine plans will be revised and further noise amelioration investigated to reduce the level of predicted impact. Implementation of MCO's NMP.	As required under MCO's NMP, predictive and real time noise monitoring will continue to be undertaken to enable operations to be modified as required to minimise adverse noise impacts.	There are no additional residences subject to acquisition upon request as a result of the proposed modification. Six assessment locations, however, are predicted to experience marginal exceedances of the MP 05_0117 noise impact assessment criteria, which place these assessment locations in a potential noise management zone. Six lots located near to the edge of the project area boundary are predicted to receive noise levels of greater than 40 dB(A), on more than 25% of the land. These six lots are owned by two landowners. Notwithstanding, the assessment found that no private landholders are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of their total land area.	2	C	8M
Cumulative noise with Ulan and Wilpinjong mines adversely affecting sensitive receptors.	12M	As above.	As above.	As above.	2	C	8M
Adverse impacts from blasting.	12M	Implementation of MCO's BMP.	No additional controls warranted.	The criteria and impacts identified previously are likely to be unchanged as a result of the proposed modification.	2	D	5L
Selection of unrepresentative modelling scenarios for modification leading to inaccurate impact predictions.	9M	Acoustic engineers will work closely with MCO mine planners to ensure mine sequencing is accurately captured, proposed Stage 2 operations are accounted for and probable worst case impacts identified.	No additional controls warranted.	As confirmed by peer review, representative modelling scenarios were used in the assessment of potential noise impacts.	1	E	1L

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Ecology							
Adverse impacts, including cumulative, on Box Gum Woodland which is listed as a critically endangered ecological community under the EPBC Act and an endangered ecological community under the TSC Act.	23E	If this vegetation is cleared as a result of the proposed modification, MCO is committed to working with the relevant stakeholders to develop an offset package that provides for a positive ecological outcome. In accordance with its LMP, MCO has successfully restored areas of disturbed Box Gum Woodland.	Rehabilitation of the proposed extension areas will include planting/seeding of Box Gum Woodland. In addition, a substantial offset package has been developed in recognition of relevant NSW and Commonwealth offset policies that will conserve approximately 19 times the Box Gum Woodland being disturbed under the proposed modification in the long term.	It is considered that the proposed modification will provide a net benefit to Box Gum Woodland.	1	A	11M
Potential removal of rare (*Boronia rubiginosa* and *Pseudanthus divaricatissimus*) and threatened (*Diuris tricolor, Eucalyptus cannonii* and *Leucochrysum albicans var. tricolor*) flora species and their habitat.	18H	Detailed surveys will be undertaken to determine the likelihood of potential impact. MCO is committed to appropriate offsetting.	Implementation of MCO's LMP, including vegetation clearance protocols and Ground Disturbance Permit procedure. Offset package developed with a guiding principle of conserving like for like habitat.	There were no significant impacts to flora identified by the ecological assessment.	1	A	11M

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Reduction in known and potential habitat for TSC and EPBC Act threatened fauna species.	17H	As above.	As above. In addition, the LMP includes measures such as collection and stockpiling of habitat features important to threatened fauna species for reinstatement in rehabilitation areas in accordance with the LMP.	Management measures have been developed to minimise potential adverse impacts. Residual impacts will be compensated by biodiversity offsets.	2	B	12M
Reduction in ease of use of habitat linkages between Goulburn River National Park and Munghorn Gap Nature Reserve through the proposed extension to mining.	9M	Ecological constraints, including connectivity, will be considered in the mine optimisation process. MCO's LMP objectives will be extended to incorporate the proposed extension areas.	Rehabilitation will reinstate vegetated areas as soon as practical following mining.	Habitat linkages will be maintained. Disturbed habitat will be rehabilitated as soon as practical.	1	D	2L
Increased noise and dust in retained habitat areas to the east and south of the open pits.	5L	Noise and dust measures will be implemented in accordance with the respective management plans which will be updated to include the proposed modification.	No additional controls warranted.	Potential indirect impacts associated with noise and dust were assessed as not significant.	1	D	2L
Invasion of introduced species (weeds and pests) in retained habitat areas to the east and south of the open pits.	5L	Implementation of MCO's LMP which includes management of introduced species.	No controls additional to those in the LMP warranted.	Considered a low risk subject to implementation of LMP.	1	D	2L
Location of suitable and representative offset sites that satisfy the OEH and SEWPaC's requirements.	14H	MCO will liaise with OEH and SEWPaC at appropriate stages in the assessment process to enable requirements to be understood and met.	A substantial offset package has been prepared in consultation with the OEH. Further consultation with SEWPaC is planned.	The offset package will provide for a net positive biodiversity outcome.	3	D	9M

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Groundwater							
Impact on existing bores / groundwater supplies through reduction in piezometric levels.	5L	The groundwater assessment will consider potential impacts to existing bores/ groundwater supplies. If impacts are predicted, they will be managed in accordance with MCO's WMP.	Groundwater will continue to be managed under the existing groundwater management system and in accordance with the WMP. No additional controls warranted.	Negligible impact on piezometric levels under the proposed modification and no impacts on external bores/ groundwater supplies.	2	E	3L
Reduction in baseflow to local creeks and rivers due to mine dewatering activities.	8M	MCO is committed to offsetting any water take associated with its operations.	As above.	There will be negligible impact on Moolarben Creek and no alluvial water take from the proposed modification.	2	D	5L
Changes in groundwater flux to and from alluvial aquifers.	5L	As above.	As above.	The proposed modification will have a negligible impact on the Goulburn River water source.	2	D	5L
GDEs sensitive to changes in piezometric levels due to mine dewatering.	5L	Potential impacts to GDEs will be considered in the groundwater assessment in consultation with ecologists, if required.	As above.	The proposed modification will not impact GDEs.	2	E	3L
Availability of water licences to mitigate effects from mine dewatering activities.	2L	The preliminary results of the groundwater and surface water assessments will be considered against existing water licence entitlements held by MCO.	As above.	The proposed modification will not result in the requirement for additional water entitlements beyond those already held or currently being sought by MCO.	1	D	2L
Cumulative impacts of other mines.	12M	The impact assessment will consider the potential impacts of the Stage 1 operation, as modified, together with surrounding mines.	As above.	Ulan Seam is the only geological unit that could be termed an 'aquifer' within the sequence that may discharge to, or be impacted by, the proposed modification. It is essentially dry either naturally or from the historical dewatering from the Ulan Coal Mine.	2	D	5L
Adverse changes to groundwater quality.	5L	Potential impacts to groundwater quality will be assessed. Monitoring will continue to be undertaken in accordance with MCO's WMP.	As above.	The proposed modification will not impact groundwater quality.	2	E	3L

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Surface water							
Potential impacts on Moolarben Creek due to possible extension of Open Cut 2 to the south. May require a diversion of Moolarben Creek main channel.	18H	Preliminary mine plan will be revised in consultation with water engineers to ensure no impact on Moolarben Creek.	The mine design was optimised to ensure no disturbance of Moolarben Creek or its floodplain.	The proposed modification will not physically impact Moolarben Creek or its floodplain.	2	E	3L
Impacts on site water balance due to extension of Open Cuts 1 and 2. Enlarging pit areas will capture additional rainfall runoff which will need to be accommodated within the site water management system.	12M	A robust assessment will be prepared comprising two steps: the first, to confirm the assumptions to be used in the model; the second, the development of a new model to enable the most accurate water balance predictions possible.	No additional controls warranted.	Modelling predicts that the proposed modification will result in an additional imported water requirement of 200 ML/year. The maximum external water requirement can be readily satisfied from current water sources.	1	D	2L
Additional water management infrastructure will be required to divert clean water and capture disturbed area runoff.	16H	Appropriately qualified water engineers will work together with MCO to ensure that additional water management infrastructure is effective.	The proposed modification seeks approval for the construction and operation of additional water management infrastructure to ensure the effective management of water from Stage 1 under the proposed modification. The WMP will be updated to include monitoring and management of extension areas.	The mine water management system will be operated to fully contain sediment laden runoff.	1	B	7M
Impacts on downstream runoff volumes will be increased due to capture of additional disturbed catchment area.	16H	The assessment will consider impacts on the flow characteristics of Moolarben Creek.	No additional controls warranted.	The additional disturbance area associated with the proposed modification removes some of the catchment draining to Moolarben Creek. The loss of catchment area has been calculated at 1.1% of the Moolarben Creek catchment area. Such a small reduction in catchment area will have a negligible impact on the flow characteristics of the ephemeral Moolarben Creek.	1	D	2L

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Additional water licences may be required.	12M	Following the preliminary results of the surface water assessment, existing water licences will be reviewed to ascertain if additional entitlements are required. The requirement for additional entitlements is, however, considered unlikely.	No additional controls warranted.	No additional water licences are required.	2	E	3L
Air quality							
Increased dust impacts on private residences and privately-owned land.	12M	Preparation of robust assessment enabling potential impacts to be clearly identified and appropriate management measures developed.	Continued implementation of best practice dust management and mitigation in accordance with the MCO's AQMP.	All relevant criteria are predicted to be met at all privately-owned residences.	2	D	5L
Cumulative dust impacts with Ulan and Wilpinjong Coal Mines.	8M	In addition to the above, as required under MCO's AQMP predictive and real time air quality monitoring is undertaken to enable operations to be modified as required to minimise adverse air quality impacts.	As above. Additional monitoring measures are also proposed as outlined in Section 9.4.	Cumulative impacts predicted with the proposed modification meet the relevant air quality criteria for Total Suspended Particulate and deposited dust at all assessment locations. The air quality assessment criteria concluded that there was a low potential risk for cumulative 24-hour average PM_{10} impacts to arise. No additional risk of increase dust impacts at Ulan Public School.	2	L	8M
Potential implications of improved modelling software in air quality assessment.	12M	In accordance with its EMS, MCO promotes continuous improvement wherever possible. Greater robustness in assessment is actively encouraged and no controls are necessary in this regard.	No applicable.	As above.	1	D	2L
Increase in greenhouse gas emissions.	12M	Continued implementation of MCO's ESAP.	No additional controls warranted.	Under the proposed modification, projected GHG emissions are predicted to decrease by 0.01Mt of carbon dioxide equivalent when compared to the most relevant GHG emission assessment, which was prepared for the MCP Stage 2 proposal.	1	B	7M

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Traffic and transport							
Potential road and rail impacts are limited as there will be no increase in employees or maximum approved production rates.	5L	Given the limited potential for road and rail impacts associated with the proposed modification, a minor desktop assessment will be prepared for the proposed modification.	No additional controls warranted.	The proposed modification will have no additional impacts on road or rail networks utilised by the MCP; rather the current impacts will be experienced for a further five years.	2	E	3L
Socio-economic							
Adverse amenity impacts.	13H	Refer to noise, air quality and visual sections above and below. The proposed modification will not result in an increase in employee numbers or traffic generation.	Refer to noise, air quality and visual sections above and below.	Refer to noise, air quality and visual sections above and below.	2	D	5L
Historic heritage							
Disturbance of historically significant heritage items by the proposed extension areas, including Carrs Gap Road.	8M	Previous studies and appropriate databases will be reviewed together with an additional survey focussed on the proposed extension areas to enable a robust assessment and development of appropriate management measures, if required.	No additional controls warranted.	The proposed modification will not adversely impact any historically significant heritage items.	2	E	3L
Aboriginal heritage							
Impacts to identified Aboriginal heritage sites, potential Aboriginal heritage evidence and cultural values.	13H	Significant additional survey effort will be undertaken in accordance with the relevant guidelines. If required, appropriate management measures will be developed and would be incorporated into MCO's ACHMP that would continue to be implemented under the proposed modification.	Additional controls, including the test excavation and potential salvage of two sites of moderate local significance and assessment of potential blasting impacts on several rock shelters, will be incorporated into the draft ACHMP.	The impacts from the proposed modification will be low within a local context and very low within a regional context.	2	D	5L

Table 7.5 Environmental risk assessments

	Preliminary environmental risk assessment (November 2012)		Environmental risk assessment (May 2013)				
Attribute and key potential impact	**Risk rating**	**Comments / controls**	**Additional controls**	**Residual predicted impacts**	C	L	Risk rating
Visual							
Increased visual exposure to active mining operations within extended Open Cuts 1 and 2 from privately owned receivers.	16H	A comprehensive visual impact assessment will be undertaken, including preparation of photomontages, to enable potential impacts to be clearly identified and appropriate mitigation measures developed. Continued implementation of MCO's visual amenity commitments.	Controls include the development of additional lighting protocols and the continued implementation of MCO's existing visual amenity commitments.	Of the 12 viewpoints assessed as part of the visual impact assessment, only one viewpoint (located on Ridge Road) was considered to have a moderate/significant visual impact. However, a number of commitments have been made that will reduce the impacts to a level that is considered acceptable.	2	C	8M
Increased visual exposure to active mining operations within extended Open Cuts 1 and 2 from pubic areas (roads, National Parks and reserves, etc).	12M	As above.	As above.	As above.	2	C	8M
Soils and agriculture							
Interpretation and application of the recent Strategic Regional Land Use Policy (DP&I 2012).	8M	Although a plan does not apply to the project area, the principles contained in the Upper Hunter Strategic Regional Land Use Plan will be considered in the assessment.	None warranted.	Based on site verification analysis using criteria in the Upper Hunter SRLUP the project area contains no BSAL or CIC.	1	E	1L
Potential impacts on agricultural land if additional properties are affected by noise and air quality due to the proposed modification.	4L	The agricultural and soil impact assessment will consider, where relevant, the outcomes of the noise and air quality assessments.	None warranted.	No additional residences are subject to acquisition upon request as an outcome of the noise or dust impacts from the proposed modification.	1	C	4L

8 Acoustics

8.1 Introduction

EMM prepared a noise and vibration impact assessment for the proposed modification. The associated report is given in Appendix C. The findings of the report are summarised in this chapter.

A peer review of the noise and vibration impact assessment was carried out by Wilkinson Murray Director, Dr Rob Bullen. All peer review comments were addressed in the technical assessment and are reflected in this chapter where applicable. A copy of the peer review letter is attached to the noise and vibration impact assessment report.

8.2 Existing environment

The existing acoustic environment at properties surrounding the MCP is typical of rural residential settings there, influenced by existing mining noise at times, Ulan Road traffic as well as agricultural equipment and machinery. Noise from rail activity is received at locations near to the local rail network.

For properties to the west and north-west of the MCP, mining from Ulan Coal Mine and the MCP were identified as audible at times, while properties to the south-west experience audible noise from the MCP during north-easterly winds. Historically noise from the Wilpinjong Coal Mine, located to the east of project area, is indiscernible at most assessment locations, however recent site observations note that this noise source contributes to the noise environment in areas to the south and south-west of the MCP.

The local topography, as described in Section 2.4, provides acoustic shielding to a number of assessment locations from approved operations.

8.3 Impact assessment

8.3.1 Methodology

i Information review

The noise study has been carried out with reference to the following studies, standards, guidelines and policies:

- Spectrum Acoustics August 2006, *Noise and Vibration Impact Assessment, Proposed Moolarben Coal Mine, Ulan NSW*;
- Global Acoustics January 2012, *Stage 2 Noise Modelling, Environmental Noise Assessment;*
- NSW EPA 2000, *Industrial Noise Policy* (INP);
- NSW EPA 2011, *Road Noise Policy* (RNP);
- NSW EPA and DP&I 2007, *The Interim Guideline for Assessment of Noise from Rail Infrastructure Projects* (IGANRIP); and
- Australian and New Zealand Environment Conservation Council (ANZECC) 1990; *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.*

The methods adopted for this assessment are provided in the following sections.

ii Assessment locations

Assessment locations considered in the noise and vibration impact assessment comprised privately-owned residences, commercial, school and church properties, as shown in Figure 8.1 and with details provided within Table A.1 (Appendix C). Property details listed were current at the date of technical report preparation. In accordance with contemporary noise and vibration impact assessments, mine-owned properties were not included in the assessment.

iii Noise modelling

An initial risk assessment undertaken during the scope development for the proposed modification identified noise as a potential high risk issue requiring detailed assessment. Noise was recognised as an important issue during the Stage 1 assessment and was considered in detail by the independent hearing and assessment panel (IHAP) during the determination of MP 05_0117. Accordingly, EMM worked together with MCO mine planning engineers to develop a mine plan that achieved its production objectives whilst minimising the potential for environmental noise impacts. This process involved a detailed review of the past noise impact assessments (including the Stage 1 IHAP report), mine plans and plant and equipment operating schedules for each assessed stage of mining, in consultation with MCO mine planning engineers.

Noise modelling of the preliminary mine plans was undertaken to assess the magnitude of potential noise impacts from the optimised mine design. Once modelling demonstrated that noise amelioration was effective, the indicative mine plan was finalised and formed the basis for this detailed noise and vibration impact assessment.

The assessment considered potential noise levels from the current approved Stage 1, proposed Stage 1 extension and operations proposed under Stage 2. Noise modelling was based on three-dimensional digitised ground contours for the surrounding land and indicative mine plans, including layouts for mine pits and overburden emplacement areas for five stages, Years 2, 6, 11, 16 and 21. The mine plan years were chosen to reflect the years modelled in the Stage 2 EA and to enable an assessment of probable worst case impacts. The indicative mine plans represent a snapshot of mining activity, with equipment placed at various locations and heights, representing worst case operating conditions for each of these stages under the proposed modification.

As noted in Section 4.3.1 ii, the mining areas and sequence of Open Cut 3 will not change under the proposed modification. However, given that noise was determined as a potential high risk during the initial risk assessment, it was decided to remodel Open Cut 3 mining together with proposed Stage 2 operations as part of the noise and vibration impact assessment. This scenario is represented by indicative mine plan Year 21.

Noise predictions were carried out using Brüel and Kjær 'Predictor' software. Predictor calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The model considers factors such as the lateral and vertical location of plant, source-to-receptor distances, ground effects, atmospheric absorption, topography of the mine and surrounding area and applicable meteorological conditions.

The main noise sources and associated sound power levels of plant and equipment proposed to be used as part of the proposed modification can be seen in Table 5.2 of the noise and vibration impact assessment.

The MCP is a well established site with a long-term commitment to the management of operational noise, including the implementation of many noise mitigation measures. All noise mitigation currently employed at the site was included in the noise model.

iv Meteorology

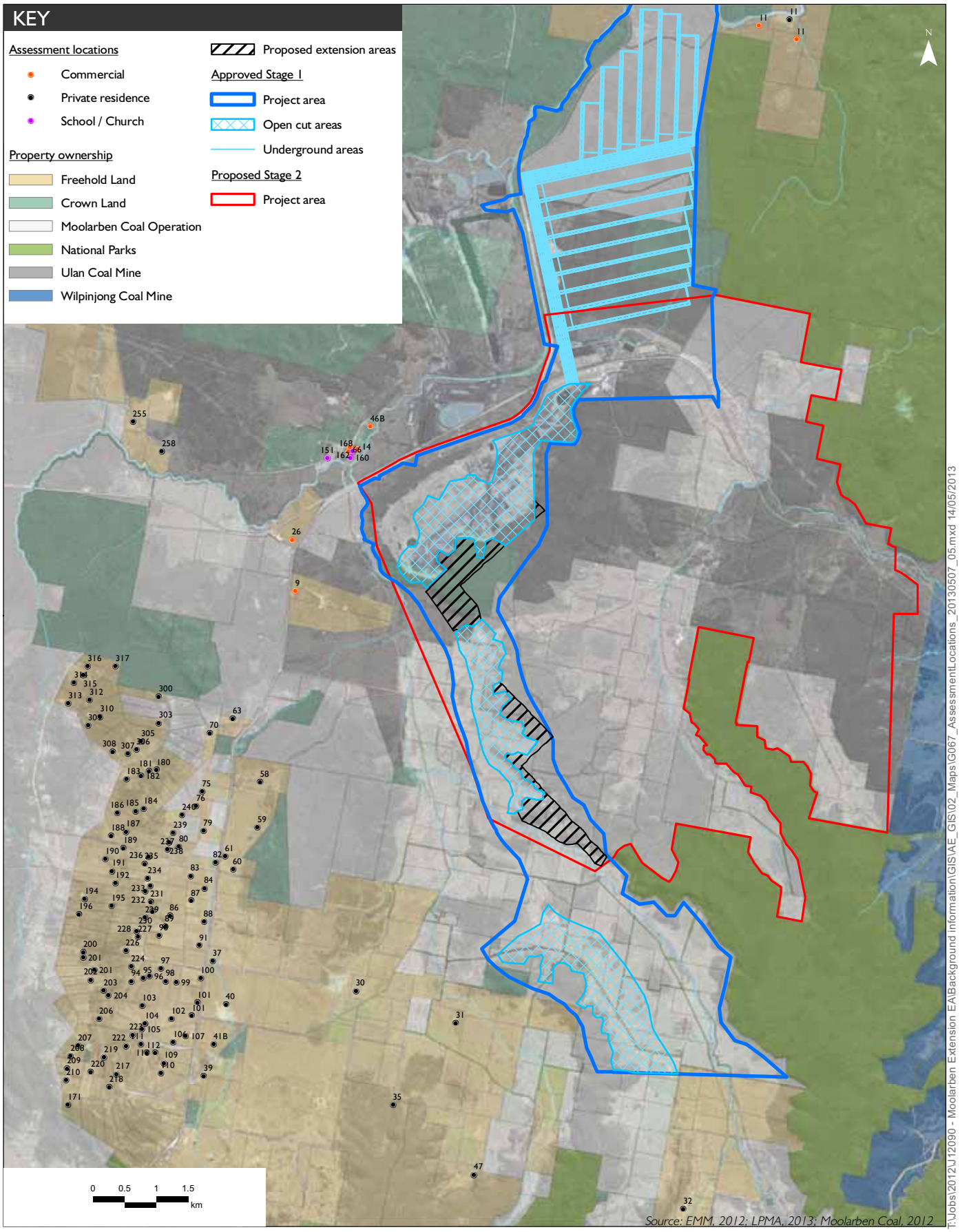
During wind and temperature gradient conditions such as temperature inversions, mining noise levels at receivers may increase or decrease compared with noise during calm conditions. This change is due to refraction caused by the varying speed of sound with increasing height above ground. Noise levels increase when the wind blows from source to receivers or under temperature inversions. Conversely, the noise level decreases when the wind blows from receivers to source or under temperature lapse conditions (ie the opposite to temperature inversions).

The INP provides procedures for identifying and combining 'noise enhancing' prevailing meteorological conditions typical of an area and assessing the noise levels against the relevant criteria during such conditions.

Site specific weather data during 2011 was provided from the Rayner weather station, located approximately 2 km to the south-west of the proposed Open Cut 2 extension area. The data was analysed to determine the presence of 'noise enhancing' prevailing winds and temperature inversions.

A summary of calm and identified worst case prevailing weather conditions considered typical to the area and used in the noise modelling is provided in Table 8.1.

It is noted that a number of prevailing winds were also identified during the evening period, however wind speeds were found to be either less than those identified during the day and/ or night periods (ie from the same direction), or travelling in an opposite direction to assessment locations. The assessment of day and night prevailing winds is therefore considered representative of worst case noise impacts from the MCP.



Noise and vibration impact assessment locations

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 8.1

Table 8.1 Relevant site-specific meteorological parameters

Assessment condition	Period	Temperature	Wind speed (m/s)/ direction	Relative humidity	Temperature gradient
Calm	Day/Night	20°C/10°C	nil	90%	nil
Prevailing winds	Day	20°C	2.5 / NNE (22.5°)	70%	nil
			2.7 / NE (45°)		
			2.7 / ENE (67.5°)		
			2.6 / E (90)		
			2.2 / ESE (112.5°)		
			2.1 / N (0°)		
	Night	10°C	1.7 / NNE (22.5°)	90°C	nil
			1.9 /NE (45°)		
			2.1 /ENE (67.5°)		
			2.2 /E (90)		
			2.1 /ESE (112.5°)		
			1.8 / SE (135°)		
			1.6 / SSE (157.5°)		
			1.5 / S (180 °)		
'F class' temperature inversion	Night	10°C	-	90%	3.9°/100m
Drainage wind[1]	Night	10°C	2 / ENE (67.5°)	90%	3°/100m

Notes: 1. A drainage flow wind has been applied to noise model predictions where sources are elevated in relation to assessment locations and where a drainage flow from the ENE would be supported by local topography.

8.3.2 Criteria

i Operational noise and blasting

Operational noise and blasting limits and conditions that apply to the MCP are provided in MP 05_0117. Operational noise limits are based on the project specific noise levels (PSNLs) derived in accordance with the INP as part of the Stage 1 assessment process. The background noise levels measured to derive the PSNLs as part of the Stage 1 assessment process are considered appropriate for the assessment of the proposed modification.

These limits and conditions have been applied in the assessment of the proposed modification and have been referenced where applicable in Section 4.1 of Appendix C.

ii Low frequency noise

Section 4 of the INP provides guidelines for applying 'modifying factor' adjustments to account for low frequency noise emissions.

There are several scales for describing noise, the most common being the 'A' weighted scale, which attempts to closely approximate the frequency response of the human ear. In comparison, the 'C' weighted scale is commonly used in low frequency noise assessment as it contains a lesser weighting in audible low frequencies.

The INP states that where there is a difference of 15 dB or more between 'C' weighted and 'A' weighted levels, then a correction factor of 5 dB applies. The 'C' weighted noise level contains the low frequency noise assessment for the proposed modification.

Industry accepted practice also acknowledges that low frequency noise is not likely to result in impacts unless received levels are above 60 dB(C) (for the night time period). Therefore, the noise and vibration impact assessment also considered 60 dB(C) for the assessment of low frequency noise.

iii Zones of impact

Section 1.4.8 of the INP describes zones of impact. The common approach to zones of impact accepted by the DP&I and EPA, is that after all reasonable and feasible mitigation has been applied, a noise management zone or noise acquisition may be stipulated if noise limits cannot be reached. These zones are explained in more detail in the following sections.

a. Noise management zone

The noise management zone is where modelled noise levels are above and within 5 dB of the noise impact assessment criteria, after all reasonable and feasible mitigation has been applied. Within the management zone, assessment locations may experience noise levels up to 5 dB above the noise impact assessment criteria. Depending on the degree of exceedance (1 to 5 dB), noise impacts in the noise management zone could range from minor (1 to 2 dB) to moderate (3 to 5 dB). DP&I recommended management procedures to implement in this zone, include:

- prompt response where issues of concern are raised by community;
- noise monitoring on-site and within the adjacent community;
- consideration in mine operations planning of on-site noise mitigation measures and plant maintenance procedures and where appropriate sound suppression components and preventative maintenance;
- investigation of, and where practical and cost-effective, acoustical treatment/mitigation at assessment locations where levels are 3 - 5 dB above noise limit; and
- consideration of negotiated agreements with property owners who are situated above the noise limits. This process is initiated when the:
    - regulatory authority is satisfied that no further reduction in noise levels can be made through a viable mitigation strategy; and
    - proponent demonstrates that even when using its best economically viable, reasonable and feasible strategies it cannot achieve the noise limits.

This negotiation is designed to be available to those whose acoustic amenity is potentially affected by the MCP, where predicted worst case noise levels are within 1 to 5 dB(A) above the MP 05_0117 noise impact assessment criteria. While negotiations of an agreed noise limit can occur at this time, further negotiations will be triggered when site noise exceeds the recommended noise limits.

Current assessment locations in a noise management zone are listed in Condition 8, Schedule 3 of MP 05_0117.

b. Noise acquisition zone

The noise acquisition zone is where modelled noise levels are more than 5 dB over the MP 05_0117 noise criteria, after all reasonable and feasible mitigation has been applied. Implementation of the following measures may be required:

- discussions with relevant property owners to assess concerns and provide solutions;
- implementation of acoustical mitigation at assessment locations; and
- negotiated agreements with property owners, or acquisition of the property by the project proponent.

Acquisition noise criteria are contained within Condition 3, Schedule 3 of MP 05_0117 and have been applied in this assessment. All properties identified in a noise acquisition zone by previous assessments (as reflected in Condition 1, Schedule 3 of MP 05_0117) have been acquired by MCO.

8.3.3 Results

i Operational noise modelling results

Operational noise levels were predicted for each meteorological condition (refer Table 8.2) during all assessed mining stages for all privately-owned residence, commercial, school and church assessment locations. The noise modelling results represent noise levels after reasonable and feasible mitigation was implemented.

The noise model predictions were then assessed by comparing the higher of the calm and prevailing (winds and temperature inversion) results to the MP 05_0117 criteria. A full list of predicted noise levels for all assessment locations can be found in Table 6.1 of the noise and vibration impact assessment (Appendix C).

With the exception of the assessment locations contained within a potential noise management zone listed in Table 8.2, the assessment found that noise level predictions are below MP 05_0117 criteria at all assessment locations, during calm and prevailing meteorological conditions for all stages of the mine life.

No assessment locations have been predicted in a potential noise acquisition zone during adverse weather conditions for all assessment periods, for all stages of the mining life. This is predominantly attributed to less intensive mine activity in Open Cuts 1 and 2 with the proposed modification, in comparison to that assessed for the Stage 2 proposal (Global Acoustics 2012) and acquisition in response to affected landowner requests.

Table 8.2 Assessment locations within management zone during adverse weather conditions

Assessment location	MP 05_0117 criteria, dB(A), $L_{Aeq,15min}$	Level above MP 05_0117, dB(A), $L_{Aeq,15min}$	Year
30	35/35/35	moderate exceedance, 3 to 5 dB(A)	21
31	35/35/35	minor exceedance, 1 to 2 dB(A)	21
58	35/35/35	minor exceedance, 1 to 2 dB(A)	6, 11, 16, 21
63	38/38/37	minor exceedance, 1 to 2 dB(A)	6, 11
70	35/35/35	minor exceedance, 1 to 2 dB(A)	6, 11, 16, 21
75	35/35/35	minor exceedance, 1 to 2 dB(A)	11

Results in Table 8.2 show six assessment locations are predicted to experience noise levels above the operational limits and are, therefore, potentially located in a noise management zone. One of these, assessment location 63, is currently listed in the additional noise mitigation section of the MP 05_0117 (Condition 8), and has entered into a noise agreement with MCO that will take affect, subject to the positive determination of the Stage 2 proposal.

It is important to note that, noise levels at Ulan Public School are predicted below the 35 dB(A) internal noise limit during calm and adverse meteorological conditions.

Previous studies prepared for the Stage 2 proposal (Global Acoustics 2012, Stage 2 Noise Modelling, Environmental Noise Assessment) do identify potential property acquisition and these results remain relevant when Stage 2 is approved. It is noted that potential impacts modelled for the current assessment were generally lower than those presented in Global Acoustics 2012. The variance is predominantly due to the difference in plant and equipment locations modelled in Open Cut 3 in the Stage 2 and proposed modification assessments. Similarly, where previous studies have identified moderate impacts, noise mitigation rights afforded to such properties continue to apply in accordance with MP 05_0117.

ii Assessment of drainage flow winds

The meteorological data analysis identified the potential for drainage flow winds to increase noise levels at selected assessment locations where this condition may apply. The assessment locations include commercial properties only, as their location in relatively low lying areas as compared to the site and operating plant and equipment makes them susceptible to this condition. Note, drainage flow winds typically occur during the night only and, therefore, the assessment of noise during such conditions at the school and church assessment locations near the identified commercial assessment locations is not relevant.

The predicted noise levels have been assessed against the INP amenity criteria. The results of this assessment are provided in Table 8.3.

Table 8.3 Drainage flow wind noise level predictions, dB(A)

Assessment location	Criterion, $L_{eq(period)}$	Modelled night time noise levels during drainage flow wind conditions, $L_{eq,15min}$				
		Year 2	Year 6	Year 11	Year 16	Year 21
9	65	42	46	44	42	44
26	65	41	42	39	39	39
46B	65	47	46	45	44	44
66	65	46	45	43	43	43
149	65	47	45	44	43	44
162	65	46	45	43	43	43

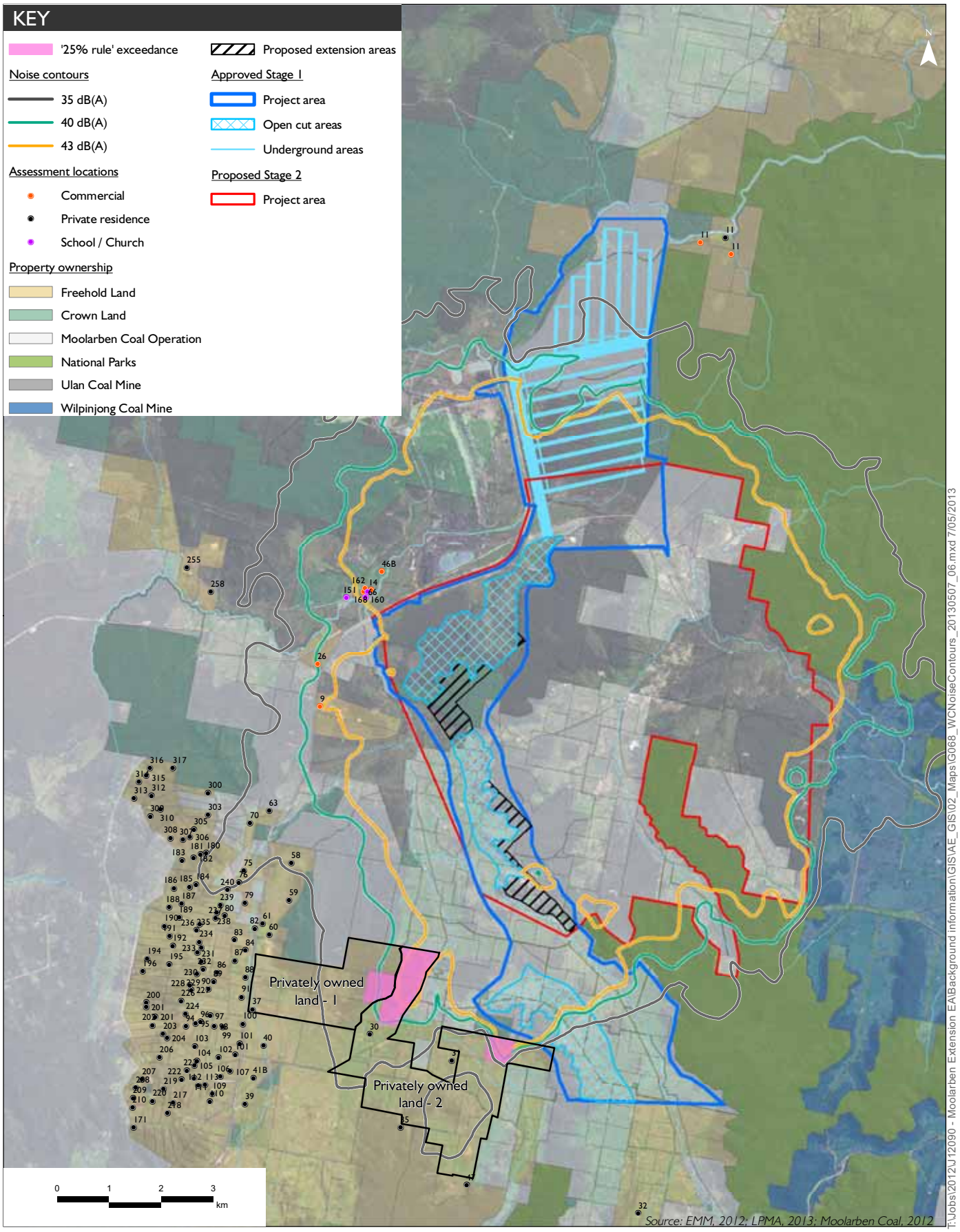
Noise level predictions are below the INP amenity criteria at all assessment locations. Therefore, increased noise levels due to potential drainage flow winds are not predicted to cause adverse noise impacts.

iii Privately-owned land assessment

The $L_{eq(15\text{-}min)}$ noise contours derived from all five indicative operational stages for adverse weather conditions are presented in Table 8.2.

The assessment found that no private landholders are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of their total land area.

The assessment however identified six individual privately-owned land parcels that are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of the land area. The land parcels include 7(Lot)/115031(DP); 111/755442; 112/755442; 114/755442; 124/755442; and, 224/755442. These six properties are owned by two land-owners as shown in Figure 8.2.



Predicted noise levels on privately owned land parcels
(worst case meteorological conditions, all years, $L_{eq(15\text{-}min)}$ dB(A))

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 8.2

iv Low frequency noise assessment

The C-weighted noise levels at assessment locations were calculated by applying the octave band C-weighting values to the predicted octave band noise levels.

Noise levels have been predicted for prevailing winds, temperature inversions and drainage flow winds (where applicable) and the maximum noise level from these meteorological scenarios was used in the low frequency assessment. Predictions have been provided for select worst case assessment locations in terms of proximity to the project area and, therefore, levels at all other locations would be equal to or less than those presented. The results are provided in Table 8.4.

Table 8.4 Predicted operational low frequency noise levels, $L_{eq,15min}$

Assessment location	Year 2			Year 6			Year 11			Year 16			Year 21		
	dBA	dBC	C-A	dBA	dBC	C-A	dBA	dBC	C-A	dBA	dBC	C-A	dBA	dBC	C-A
9[1]	43	51	8	43	51	8	42	51	9	40	50	10	39	49	10
26[1]	47	54	7	43	52	8	42	51	9	41	51	9	40	50	10
30	<30	n/a	n/a	32	46	14	32	46	13	35	48	12	39	48	9
31	<30	n/a	n/a	32	45	14	30	44	13	33	46	12	34	45	12
35	<30	n/a	n/a	30	45	15	30	45	15	32	46	14	31	45	14
40	<30	n/a	n/a	<30	n/a	n/a	<30	n/a	n/a	<30	n/a	n/a	<30	n/a	n/a
46	38	49	11	48	54	7	47	54	7	43	51	8	41	50	9
47	<30	n/a	n/a	<30	n/a	n/a	<30	n/a	n/a	<30	n/a	n/a	32	45	13
58	35	48	14	36	48	12	37	49	11	35	47	12	35	47	12
59	34	48	14	32	45	13	33	45	12	35	46	12	32	44	12
60	<30	n/a	n/a	<30	n/a	n/a	30	42	12	31	42	11	<30	n/a	n/a
63	36	48	12	37	49	12	39	50	11	37	49	12	36	48	12
66[1]	42	48	6	40	47	7	37	46	9	37	46	9	36	44	9
149[1]	37	48	11	34	47	12	34	46	13	33	46	13	32	46	13
151	42	49	7	42	51	9	39	48	9	39	49	10	40	50	10
160	43	50	7	43	51	8	41	50	9	40	50	10	41	51	10
162[1]	46	53	7	42	51	9	41	50	9	40	50	10	39	49	10
258	35	47	12	34	47	12	34	46	13	33	46	13	32	46	13

Notes: n/a denotes predicted dB(A) noise levels below 30 where a low frequency adjustment would not cause a penalty corrected noise level over the criteria for all assessment locations.

1. Drainage flow prediction is worst case for these assessment locations.

Results show that low frequency noise levels (dB(C)) for all assessment locations are predicted below the recommended 60 dB(C) night time criteria. Results also show the difference between dB(A) and dB(C) noise levels are less than the recommended INP 15 dB difference for all assessment locations during worst case meteorological conditions. The potential for adverse low frequency noise impacts are, therefore, not expected from the proposed modification.

v Sleep disturbance assessment

Intermittent noises, such as bulldozer track plates, reversing alarms, or truck pass-by or loading activity were assessed against sleep disturbance criteria, as provided in MP 05_0117.

Predicted maximum noise levels for the night-time period during calm and adverse meteorological conditions are provided in Table 8.5 for privately-owned residence assessment locations. Predictions have been provided for select worst case assessment locations in terms of proximity to the project area and, therefore, levels at all other locations would be equal to or less than those presented.

Predictions show that maximum noise levels from the site are below the 45 dB(A) noise criterion during calm and adverse weather conditions.

Table 8.5 Maximum noise from intermittent sources, dB(A)

Assessment location	L_1 criterion	Modelled L_1 night time noise level during prevailing weather conditions				
		Year 2	Year 6	Year 11	Year 16	Year 21
30	45	<30	<30	<30	32	37
31	45	<30	<30	30	33	35
35	45	<30	<30	<30	<30	37
40	45	<30	<30	<30	<30	34
47	45	<30	<30	<30	<30	<30
58	45	30	33	36	34	34
59	45	<30	30	<30	<30	33
60	45	<30	<30	<30	<30	<30
63	45	31	35	36	35	35
258	45	32	31	34	31	31

Predictions show that maximum noise levels from the site are below the 45 dB(A) noise criterion during calm and adverse weather conditions.

vi Cumulative noise

As noted in Section 2.3, there are two mining operations adjacent to the MCP, namely: Ulan Coal Mine, located to the north-west; and, Wilpinjong Coal Mine, located to the east. For some assessment locations, there is potential for noise levels from each of these mining operations to 'add' with MCP operational noise levels. However, given the location of Ulan Coal Mine and Wilpinjong Coal Mine in relation to the MCP, it is unlikely that noise levels from all three operations would add at any one assessment location. An assessment has been prepared in two parts to address cumulative noise impacts from: Ulan Coal Mine with the MCP; and Wilpinjong Coal Mine with the MCP.

Representative assessment locations were selected based on their proximity to the MCP, Ulan Coal Mine and Wilpinjong Coal Mine operations, which are listed in Table 8.6.

Worst case predicted noise levels from Ulan Coal Mine were obtained for identified assessment locations using results provided in the Wilkinson Murray 2009, *Ulan Coal – Continued Operations Noise and Vibration Impact Assessment*. This was supplemented by data contained in the Global Acoustics 2012, *MCP Stage 2 Noise Modelling, Environmental Noise Assessment*.

Worst case predicted noise levels from Wilpinjong Coal Mine were estimated for identified assessment locations using results provided in the Heggies 2010, *Wilpinjong Coal Mine - 75W Modification Noise Impact Assessment*.

The levels chosen for the assessment represent the highest predicted noise level from all assessed meteorological conditions for all assessed stages of mining from Ulan Coal Mine and Wilpinjong Coal Mine sites. These noise levels were logarithmically added to the highest noise levels from all assessed meteorological conditions for all assessed mining years from the MCP. A minus 3 dB(A) correction was applied to convert the presented $L_{Aeq,15minute}$ to $L_{Aeq,period}$ noise levels as per EMM's experience and commonly accepted practice. This correction adjusts a worst case 15 minute operation as assessed, to represent typical operating noise levels over the entire day, evening or night period, which in practice would be less in comparison.

For residential assessment locations, the night criterion is most stringent and was assessed only. For school and church assessment locations, a facade reduction of 8 dB(A) was applied to predicted external noise levels to provide direct comparison with the 35 dB(A) internal noise criteria nominated in MP 05_0117. This 8 dB(A) reduction is considered conservative, as generally a facade with windows open will provide 10 dB of noise reduction.

It is important to highlight that it is highly unlikely that worst case impacts from each mine would occur during the same meteorological condition, during the same stage of mine life. For this reason the assessment is considered highly conservative. Results of the cumulative noise impact assessment are provided in Table 8.6.

Table 8.6 Cumulative noise level predictions, dB(A)

Assessment location	Criteria, $L_{eq,period}$	Highest $L_{eq,15\ min}$, all years, all assessed meteorological conditions			Predicted cumulative noise level, $L_{eq(period)}$ ($L_{eq,15min}$ minus 3 dB(A))
		MCP	UCM	WCM	
30	40	39	n/a	34	37
31	40	36	n/a	34	35
35	40	32	n/a	34	33
40	40	30	n/a	34	32
41B	40	32	n/a	34	33
47	40	33	n/a	34	34
58	40	37	<30	n/a	35
59	40	35	<30	n/a	33
63	40	39	31	n/a	37
70	40	37	31	n/a	35
75	40	36	31	n/a	34
151[1]	35	34	34	n/a	34
160[1]	35	35	34	n/a	35
255	40	33	35	n/a	34
258	40	35	35	n/a	35
300	40	33	<30	n/a	32
303	40	34	<30	n/a	32
316	40	30	<30	n/a	30
317	40	31	<30	n/a	31

Notes: *1. A facade noise level reduction of 8 dBA has been added to convert external noise levels to internal noise levels. Only applies when in use*

2. n/a denotes negligible noise levels that would not add to the cumulative noise level contribution.

The assessment shows cumulative noise levels at representative worst case assessment locations comply with criteria provided in MP 05_0117.

vii Road traffic and offsite rail noise

The proposed modification does not seek to increase employee numbers, road or rail traffic movements and, therefore, an increase in rail and road traffic noise is not expected. Accordingly, further assessment of road and rail traffic noise is not required for the proposed modification.

viii Blasting

The blasting noise overpressure and ground vibration for all mining areas approved under MP 05_0117 and proposed under Stage 2 have been previously assessed. The proposed distances from the Open Cut 1 and 2 extension areas to assessment locations are representative of distances considered in past assessments. Increased blast elevation in the proposed extension areas is also unlikely to increase vibration and overpressure levels, as elevated areas are typically set-back from the site boundary nearest to assessment locations. The criteria and impacts identified previously are, therefore, likely to be unchanged as a result of the proposed modification.

8.4 Management and monitoring

8.4.1 Noise

Noise management and monitoring at the site is carried out in accordance with MCO's NMP which was prepared in consultation with the NSW EPA. Objectives of the NMP are to:

- minimise operational and construction noise impacts from the MCP;
- maintain compliance with conditions of approval, EPLs and legislation relating to noise;
- provide a protocol for monitoring and evaluation of noise impacts on surrounding private residences and sensitive receivers; and
- communicate with the local community and regulators regarding MCO's activities.

MCO currently implement operational and engineering controls to manage noise emissions from the site which will continue under the proposed modification.

Such controls include MCO initiatives such as the research, development and on site implementation of the Duratray on rear dump trucks. Duratray is an impact resistant rubber tray lining which has been proven to reduce loading associated impact noise significantly. A rear dump truck with Duratray fitted is shown in Photograph 8.1.

Photograph 8.1 Dump truck fitted with Duratray

MCO has also employed mine production environmental assistants to monitor and manage the real-time environmental noise emissions from the site.

No additional management or monitoring of noise is required as a result of the noise and vibration impact assessment. Notwithstanding, the NMP will be updated to capture the outcomes of the proposed modification.

8.4.2 Blasting

Blasting management and monitoring at the site is carried out in accordance with MCO's BMP which was prepared in consultation with the EPA. Objectives of the BMP are to:

- minimise off-site disturbance during blasting events;
- maintain compliance with conditions of approval, environmental protection licences and legislation relating to airblast and ground vibration;
- provide a protocol for monitoring and evaluation of blast impacts on surrounding private residences, infrastructure and sensitive receivers; and
- communicate with the local community and regulators regarding MCO's blasting activities.

MCO currently implement controls to manage blast emissions from the site which will continue under the proposed modification. No additional management or monitoring of blasting is required as a result of this noise and vibration impact assessment.

8.5 Conclusion

An initial risk assessment for the proposed modification identified potential noise impacts as a high risk issue. Accordingly, EMM worked with MCO early in the mine planning process and developed mine stages that best represented probable worst case noise impacts over the mine life. These mine plans include current approved Stage 1 operations, proposed Stage 1 extension areas and proposed Stage 2 operations.

EMM worked with MCO to optimise the mine plan and design to include noise amelioration measures where possible.

The operational noise assessment of the optimised mine plans predicted that during adverse weather conditions for all assessment periods and all stages of the mine life with all reasonable and feasible mitigation included, the majority of assessment locations will experience noise levels below MP 05_0117 noise impact assessment criteria.

Six assessment locations are, however, predicted to experience noise levels between 1 and 5 dB(A) above the MP 05_0117 noise impact assessment criteria, which place these assessment locations in a potential noise management zone. One of these, assessment location 63, is currently listed in the additional noise mitigation section of MP 05_0117 (Condition 8), and has entered into a noise agreement with MCO that will take affect subject to the positive determination of the Stage 2 proposal.

No assessment locations have been predicted to be in a potential noise acquisition zone during adverse weather conditions for all assessment periods, for all stages of the mining life.

The assessment found that no private landholders are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of their total land area. The assessment however identified six individual privately-owned land parcels predicted to experience noise levels of greater than 40 dB(A), on more than 25% of the land area. The land parcels include 7(Lot)/115031(DP); 111/755442; 112/755442; 114/755442; 124/755442; and, 224/755442 which span over two individual land-owner properties. It is not explicit in MP 05_0117 whether the land acquisition criteria applies to total privately-owned land or individual privately-owned land parcels, however based on contemporary project approvals it is anticipated this would likely apply on a lot by lot basis.

All other noise and blasting criteria relevant to the proposed modification are predicted to be met. Management and monitoring will continue in accordance with the MCO's NMP and BMP.

9 Air quality and greenhouse gases

9.1 Introduction

Todoroski Air Sciences prepared an air quality and greenhouse gas impact assessment for the proposed modification. The associated report is given as Appendix D. The findings of the report are summarised in this chapter.

9.2 Existing environment

As discussed in Section 2.5, MCO operated two automatic weather stations to assist with the environmental management of the MCP, one adjacent to MCO's administration office in the northern section of the project area, and the other approximately 2 km to the south-west of the proposed Open Cut 2 extension area (Rayner weather station). The latter station has now been replaced by a weather station to the west of the project area. The pattern of wind distributions at the two monitoring locations used in the assessment, MCO's administration office and Rayner weather station, are generally similar, and the differences generally consistent with the expected variations that would arise due to the effects of the surrounding terrain.

Mining activities at the MCP have the potential to generate fugitive dust emissions in the form of particulate matter. Particulate matter consists of dust particles of varying size and composition. Of particular note is total suspended particulate matter (TSP), nominally taken to have diameters of 30 micrometres, which refers to the total mass of all particulates suspended in the air. TSP is defined into further sub-classes which have designated diameters of 10 micrometres or less (PM_{10}) or 2.5 micrometres or less ($PM_{2.5}$).

The main sources of particulate matter surrounding the MCP area include emissions from mining, agriculture, and anthropogenic activity such as motor vehicles, wood heaters and commercial or industrial activities.

The MCP has an extensive air quality monitoring network consisting of two high volume air samplers (HVAS) measuring PM_{10}, three tapered element oscillating microbalances (TEOM) and nine dust deposition gauges, in and around the mine. The nearby Ulan Coal Mine air quality monitoring network consists of two HVAS measuring TSP, one TEOM and eight dust deposition gauges. The locations of MCO and Ulan Coal Mine monitoring stations are shown in Figure 9.1. It is noted that TEOM03 was relocated in July/ August 2011 and was re-named TEOM04.

Air quality monitoring data from the MCP and Ulan Coal Mine network recorded between 2010 and 2012 were reviewed to establish the existing environment.

Data from the MCO and Ulan Coal Mine TEOM monitoring stations show dust concentrations are nominally highest in the spring and summer months, with the warmer weather raising the potential for drier ground and elevating the level of windblown dust, the occurrence of bushfires and pollen levels. The 24-hour average and annual average PM_{10} concentrations for each monitoring station were below the NSW EPA criteria of 50µg/m^3 and 30µg/m^3, respectively.

The monitoring results from the two MCO HVAS monitoring stations indicate that annual average PM_{10} levels are below the annual average PM_{10} criteria of 30µg/m^3 and are comparable to the annual average PM_{10} results at the MCO and Ulan Coal Mine TEOM monitoring stations for the same period. The measured 24-hour average PM_{10} levels were also less than 50µg/m^3 during the monitoring period.

The monitoring results from the two Ulan Coal Mine HVAS monitoring stations indicate that annual average TSP concentrations were less than the EPA criteria of 90µg/m^3 between January 2010 and December 2012. The dust deposition monitoring sites operated by MCO and Ulan Coal Mine recorded an annual average insoluble deposition level below the NSW EPA criterion of 4g/m^2/month and in general, the air quality in terms of dust deposition is considered good.

9.3 Impact assessment

9.3.1 Methodology

i Assessment locations

All surrounding properties in the local area have been assessed for potential dust impacts. This approach is consistent with contemporary air quality impact assessments whereby potential dust levels must be quantified to protect the health of all residing occupants surrounding the project. This approach differs slightly from the noise and vibration impact assessment which excludes mine-owned properties as per the accepted approach. Property details used in the assessment were current at the date of technical report preparation. Assessment locations are shown in Figure 9.2 and details are provided within Table A-1 (Appendix D).

ii Modelling

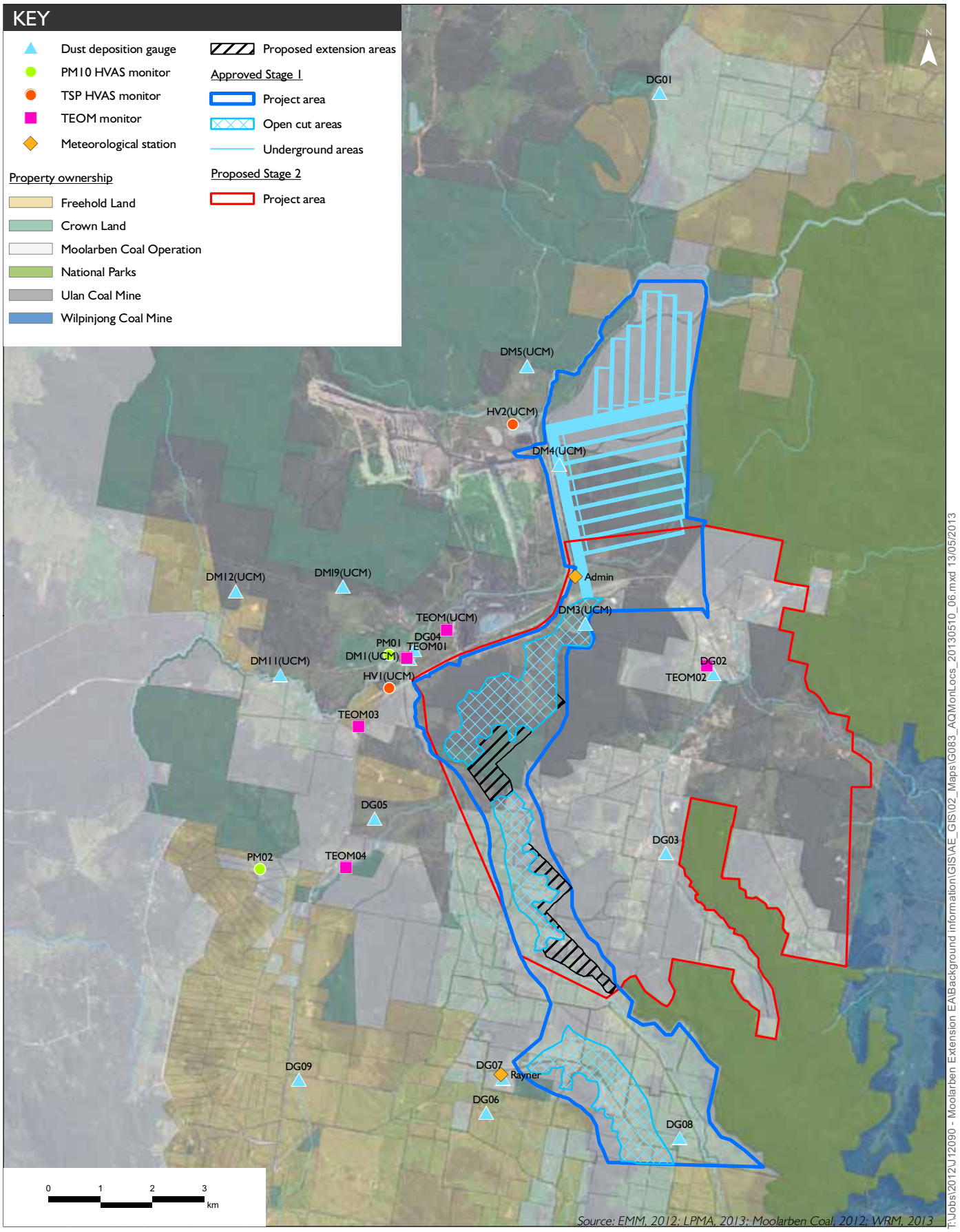
The potential impacts of the proposed modification were determined using dispersion modelling. The modelling used in the assessment was a combination of the CALPUFF Modelling System for dispersion modelling and the meteorological model TAPM. The CALPUFF model is an advanced 'puff' model that deals with the effects of complex local terrain on dispersion meteorology. It allows for spatial variation of meteorology, such as wind patterns, over a three-dimensional modelling domain in hourly time steps. CALPUFF is accepted by NSW EPA as an appropriate modelling system for open cut coal mines. The potential impacts of the proposed modification, adding estimated maximum dust emissions to existing air quality maximum background levels, were modelled using local topographical and meteorological data. Estimated concentrations were calculated at assessment locations and assessed against the air quality criteria presented in Table 9.1 and Table 9.2.

It is important to note that Stage 2 activity does not form part of the proposed modification, but has been assessed together with the proposed modification to ensure that all potential emissions from the MCP have been addressed cumulatively.

There are no proposed changes to the mining method or activity in Open Cut 3 as part of the proposed modification. Open Cut 3 activity occurs in the final years of the approved Stage 1. As the final years would not be altered by the proposed modification, the air quality impacts would remain as previously assessed in the EA for Stage 1 (HAS, 2006).

The assessment considers four indicative mine plan years (Years 2, 6, 11, and 16), chosen to represent potential impacts over the life of the proposed modification by reference to the location of the operations and the potential to generate dust in each year. For each of the four years selected, the rate of dust emission was calculated by analysing the various types of dust generating activities taking place in each year and applying suitable emission factors. Total dust emissions from all significant dust generating activities for the assessed mining operations are presented in Table 6.1 of the air quality and greenhouse gas impact assessment (Appendix D).

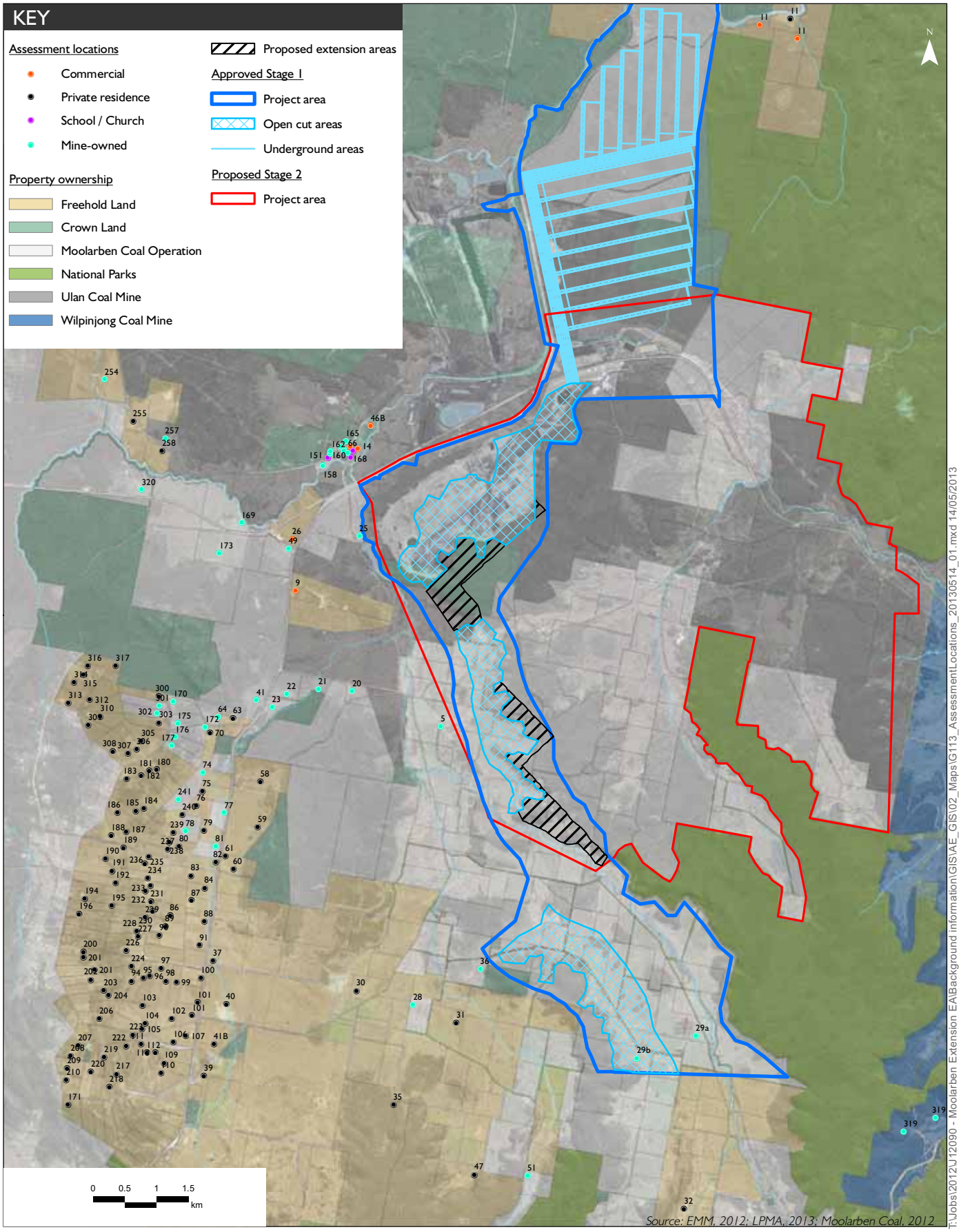
The emissions reflect the application of best practice dust mitigation currently implemented at the MCP in accordance with MCO's AQMP.



Meteorological and air quality monitoring network

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 9.1



Air quality impact assessment locations

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 9.2

In addition to the estimated dust emissions from the proposed modification, the nearby approved mining operations of Ulan Coal Mine and Wilpinjong Coal Mine were modelled commensurate with their current approvals, to assess potential cumulative dust effects. Emission estimates from these sources were derived from information provided in air quality assessments available in the public domain at the time of modelling. These estimates are likely to be conservative, as in many cases, mines do not continually operate at the maximum extraction rates assessed in their respective environmental assessments.

iii Air quality assessment criteria

Impact assessment criteria specific for mining related activities are presented in Table 9.1 (NSW Department of Environment and Conservation (DEC) 2005). Criteria for $PM_{2.5}$ have not yet been developed and, therefore, the National Environment Protection Council's (NEPC) advisory reporting standards were adopted for the assessment.

Table 9.1 Air quality impact assessment criteria

Pollutant	Averaging period	Impact	Criterion
TSP	Annual	Total	90µg/m^3
PM_{10}	Annual	Total	30µg/m^3
	24 hour[2]	Total	50µg/m^3
Deposited dust	Annual	Incremental	2g/m^2/month
		Total	4g/m^2/month
$PM_{2.5}$	24 hours[1]	-	25µg/m^3
	Annual[1]	-	8µg/m^3

Notes: 1. Source 'National Environment Protection Measure' (NEPC 2003)
2. Source 'National Environment Protection Measure' (NEPC 1988)

While the NSW EPA applies the maximum 24-hour average PM_{10} level in any year to assess the potential for impacts from a project, the DP&I, in contemporary planning approvals, has invoked requirements for acquisition and negotiated agreements if there are systemic exceedances of the NSW EPA criterion. In the context of impact assessments for approval of new projects and modifications to existing projects, this is interpreted to mean where the NSW EPA criterion is exceeded on more than five days in any year (a 98.6 percentile level of compliance). This DP&I criterion and other relevant criteria are outlined in Table 9.2.

Table 9.2 Air quality acquisition criteria for particulate matter

Pollutant	Averaging period	Impact	Criterion
TSP	Annual	Total	90µg/m^3
PM_{10}	Annual	Total	30µg/m3
	24 hours	Incremental	50µg/m3
Deposited dust	Annual	Incremental	2g/m^2/month
		Total	4g/m^2/month

9.3.2 Results

i Predicted incremental air quality impacts

The incremental impacts of the proposed modification were assessed for each of the indicative mine plan years. Incremental impacts are the predicted emissions from the proposed modification operating in isolation, and exclude background dust concentrations.

Modelling results for all years show that the air quality criteria (refer to Table 9.1) are expected to be met at all privately-owned and mine-owned assessment locations for deposited dust.

Modelling results for all years show that all privately owned assessment locations are predicted to experience PM_{10} maximum 24-hour average concentrations below the relevant criteria, with the exception of commercial assessment location 46B (Year 6 - 52.8 $\mu g/m^3$). Notwithstanding, this level is predicted to occur no more than one day in a year which is below the DP&I acquisition criterion (ie no more than five days in a year with levels above 50 $\mu g/m^3$).

Modelling results for all years show that all mine-owned assessment locations are predicted to experience PM_{10} maximum 24-hour average concentrations below the relevant criteria, with the exception of those presented in Table 9.3.

Table 9.3 PM_{10} maximum 24-hour average concentration predictions above 50 $\mu g/m^3$ – mine-owned assessment locations

Assessment location	Year	Predicted concentration	Criteria
5	6	59.4 $\mu g/m^3$	50 $\mu g/m^3$
	11	116 $\mu g/m^3$	50 $\mu g/m^3$
	16	101.6 $\mu g/m^3$	50 $\mu g/m^3$
20	11	62.3 $\mu g/m^3$	50 $\mu g/m^3$
21	11	54.1 $\mu g/m^3$	50 $\mu g/m^3$
25	2	52.4 $\mu g/m^3$	50 $\mu g/m^3$
	6	54.8 $\mu g/m^3$	50 $\mu g/m^3$

It is important to note that dust levels at the Ulan Public School are predicted to be below all air quality criteria under all modelled scenarios.

A full set of results is provided in Appendix D.

ii Predicted cumulative air quality impacts

a. Total annual average impacts

The total impacts of the proposed modification have been assessed for each of the indicative mine plan years. The total impacts of the proposed modification are the predicted emissions from the proposed modification, including the predicted emissions of other nearby sources (ie Ulan and Wilpinjong Coal Mines) and annual average background dust levels from non-mine sources. The total emissions for annual average PM_{10}, TSP and deposited dust were assessed. The cumulative assessment for PM_{10} maximum 24-hour average is presented in Section 9.3.2 b below.

Modelling results for all years show that the air quality criteria (refer to Table 9.1) are predicted to be met at all privately-owned and mine-owned assessment locations for TSP and deposited dust. Exceedence of the PM_{10} annual average concentration is predicted at the commercial assessment location 46B (31.5 $\mu g/m^3$) in the indicative Year 2 mine plan.

b. PM_{10} maximum 24-hour average

An assessment of cumulative impacts of PM_{10} maximum 24-hour average concentrations was undertaken in general accordance with the OEH's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the approved methods) (NSW DEC 2005).

Cumulative impacts are the incremental impacts of the proposed modification (ie mine only operating in isolation), plus background dust concentrations which include dust emissions from other nearby mining operations and various other smaller sources. A Level 2 contemporary method as outlined in the approved methods was used to assess cumulative impacts; this is because maximum background levels are close to the criterion (depending on the monitoring location and time). The Level 1 method of adding maximum background levels to maximum predicted incremental (mine only) levels will show levels above the criterion. This is unlikely to provide a representative assessment of actual background conditions, as maximum background levels do not typically occur all the time.

Four monitoring locations (TEOM monitors TEOM01 and TEOM3/TEOM04, and HVAS stations PM01 and PM02, shown on Figure 9.1) were chosen to represent the assessment locations surrounding the project area. It is noted that TEOM3 was relocated closer to the majority of assessment locations in July/August of the modelled year and was re-named to TEOM04. Dust concentration data from these stations for January 2011 to December 2011 were chosen to represent the prevailing background conditions for nearby assessment locations. Stage 1 was operating during this period and dust contributions from mining activities are likely to be captured in the monitoring data from these stations.

To account for dust generation from MCP during January 2011 to December 2011 (the year of meteorological and air quality monitoring data adopted for assessment), actual operations at the MCP during this period were modelled and accounted for to determine the incremental change resulting from the proposed modification. The incremental change was then added to the monitoring data to provide cumulative dust emissions for 24–hour average PM_{10}.

A summary of the 24-hour average PM_{10} cumulative assessment is shown in Table 9.4.

Table 9.4 NSW EPA assessment - maximum number of days above 24-hour average criterion depending on background level at monitoring sites

Location	Year 2	Year 6	Year 11	Year 16	Year 21
TEOM01	0	0	0	0	0
TEOM03/TEOM04	0	1	0	0	0
PM01	0	0	0	0	0
PM02	0	0	0	0	0

Notes: TEOM03 was relocated in July/ August 2011 closer to the majority of assessment locations and was re-named TEOM04.

The results indicate that it is unlikely that cumulative 24-hour average PM_{10} impacts would arise at the assessment locations near the monitoring locations TEOM01, PM01 and PM02 during all years assessed.

Out of all years assessed, potential cumulative 24-hour average PM_{10} impacts near TEOM03/TEOM04 during the first half of the year have been predicted in the indicative Year 6 mine plan as a result of activity occurring close to this monitor during these periods. Notwithstanding this, the potential risk of cumulative impacts at this monitor is relatively low, with only one day of predicted impact above the relevant criterion. Furthermore, this day contains several hours where a wind with low dispersion potential is directed with little variation directly across all MCP activity, towards the assessment locations. In reality, the locations of plant and equipment would move over this period and hence the actual emissions picked up by this wind would not be focussed to this degree in one place. Such wind conditions also appear to be rare, with only one occurrence in the year assessed.

The assessment indicates only low potential for any cumulative 24-hour average PM_{10} impacts to occur at the monitoring locations. The monitoring locations are considered to represent areas where the highest risk of cumulative impacts are most likely to occur, ie near human activity near Ulan settlement and at locations closest to the project area. Given these locations show little potential for any significant impact to occur, it can be inferred that there would also be little prospect of any significant impact to occur at all other receiver locations.

iii Greenhouse gas

The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE), *National Greenhouse Accounts (NGA) Factors* document provides calculations suitable to estimate greenhouse gas emissions from various industry sources. The NGA Factors document defines three scopes (Scope 1, 2 and 3) for different emission categories based on whether the emissions generated are from 'direct' or 'indirect' sources. Scope 1 and 2 emissions encompass the direct sources from an activity and Scope 3 emissions occur due to indirect sources.

Scope 1 and 2 greenhouse emission sources were identified as those from on-site combustion of diesel fuel, petrol fuel, petroleum based greases and oils, emissions of methane from the exposed coal seams and on-site consumption of electricity. Scope 3 emissions were identified as those resulting from the purchase of diesel and electricity for use on-site, the transport of product to its final destination and the final use of the product.

The estimated greenhouse gas emissions generated in Scope 1, 2 and 3 for the proposed modification are based on approximate qualities of materials, and where applicable generic emission factors available in the public domain. Overall the estimated emissions are considered conservative.

Calculations of greenhouse gas emissions for the proposed modification are provided in Table 9.5.

Table 9.5 Summary of total $C0_2$-e emissions

Category of emissions	**Total CO_2-e emissions (t CO_2-e)**
	Proposed modification
Scope 1	1,830,764
Scope 2	1,506,143
Scope 3	572,778,336
Total	**576,115,243**
Average annual emissions (Scope 1, 2 and 3)	**27,434,059**

Notes: 1. Based on a 21 year approval period.

The estimated annual greenhouse emissions for Australia for the period October 2011 to September 2012 were 546.1 Mt carbon dioxide equivalent (CO_2-e) (DCCEE, 2013). In comparison, the conservative estimate of annual average greenhouse emissions for the life of the proposed modification (ie approval period of 21 years) is 0.09Mt CO_2-e (Scope 1). Therefore, the annual contribution of greenhouse emissions from the proposed modification in comparison to the Australian greenhouse gas emissions for the period October 2011 to September 2012 is estimated to be approximately 0.016%.

Furthermore, the estimated annual average Scope 1 greenhouse gas emissions from the proposed modification (0.09Mt CO_2-e) is similar to that reported in the Stage 2 PPR (0.1 Mt CO_2-e) (PAEHolmes, 2011).

9.4 Management and monitoring

9.4.1 Air quality

Dust management and monitoring at the site is carried out in accordance with MCO's AQMP which will continue with the proposed modification.

MCO will continue to implement best practice dust management and mitigation as outlined in the recent NSW EPA document, *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*, prepared by Katestone Environmental (Katestone, 2010).

Based on the predicted impacts presented in this assessment, changes to the existing monitoring network are recommended to allow MCO to manage dust impacts and to verify the environmental performance over the life of the proposed modification.

The proposed changes are set out below:

- addition or re-location of a TEOM to the south-west of the operation at the mid to late lifetime of the mine. This would be used to determine compliance at assessment locations to the south as the mine progresses into the southern areas of Open Cut 2 and Open Cut 3 locations; and

- in the event that measured dust impacts begin to occur, for example due to increased dust levels arising due to prolonged drought, installation of an upwind TEOM monitor to the north-east of the project area (if possible) in order to provide MCO, EPA and the community with the ability to evaluate background dust levels and mine related dust levels separately. However, whilst dust levels at the existing monitoring locations remain low, this additional layer of monitoring would not be warranted.

9.4.2 Greenhouse gas

The proposed modification will continue to utilise various mitigation measures to minimise the overall generation of greenhouse gas emissions.

The greenhouse gas management system will continue to provide the basis for identifying and implementing mitigation measures for various on-site activities. Some examples of actions from which energy efficiency opportunities may arise include:

- monitoring fuel efficiency of diesel equipment;

- optimising conditions for fleet operations to minimise double handling and utilisation of efficient routes;
- developing targets for greenhouse gas emissions generated from site operations; and
- consideration of alternative renewable energy sources where economically and practically feasible.

9.5 Conclusion

The air quality and greenhouse gas assessment has identified the potential air quality impacts that may arise from the proposed modification. The assessment utilised air dispersion modelling and focuses on potential dust impacts from the mine in isolation (incrementally) and cumulatively with other nearby mines and background levels of dust.

The current air quality levels associated with the MCP and the incremental levels predicted under the proposed modification meet the relevant air quality criteria for deposited dust, TSP, annual average PM_{10} and $PM_{2.5}$ at nearby privately-owned residences. Exceedence of the PM_{10} maximum 24-hour average concentrations is predicted at commercial assessment location 46B, however the exceedance is predicted to occur on no more than one day in a year which is below the DP&I acquisition criterion. Exceedence of the PM_{10} maximum 24-hour average concentrations are predicted at mine-owned assessment locations 5, 20, 21 and 25.

Total (cumulative) impacts predicted with the proposed modification meet the relevant air quality criteria for TSP and deposited dust at all assessment locations. Exceedences of PM_{10} total annual average concentrations are predicted at commercial assessment location 46B.

It is important to note that dust levels at the Ulan Public School are predicted to be below all air quality criteria under all modelled scenarios.

The assessment included a range of air quality management measures in accordance with the existing AQMP for the MCP, which incorporate best practices for the control of dust emissions from coal mines. These measures will continue to be implemented by MCO under the proposed modification.

The annual contribution of greenhouse gas emissions from the proposed modification in comparison to the Australian greenhouse emissions for the period October 2011 to September 2012 is estimated to be approximately 0.016%. The estimated annual average Scope 1 greenhouse emissions for the proposed modification are similar to the equivalent greenhouse gas emissions estimated at 0.1 Mt CO_2-e for the Stage 2 PPR (PAEHolmes, 2011).

Management of greenhouse gas emissions will continue to be undertaken in accordance with MCO's ESAP.

10 Ecology

10.1 Introduction

EMM has prepared an ecological impact assessment for the proposed modification. The associated report is given in Appendix E.

Based on the outcomes of the impact assessment, a biodiversity offset strategy was developed to ensure the proposed modification provides a net positive biodiversity outcome. The biodiversity offset strategy was prepared by Eco Logical Australia (ELA) and is given in Appendix D of the ecological impact assessment report. The findings of both studies are summarised in this chapter.

10.2 Existing environment

The MCP is in the north-west corner of the Sydney Basin Bioregion, and borders both the South Western Slopes and Brigalow Belt South Bioregions. The north-west corner of the Sydney Basin Bioregion is a transitional zone for flora species; representing plants and communities from the south-east, north-west and western parts of NSW.

Two areas protected under the NPW Act occur in proximity to the project area, namely, the Goulburn River National Park, covering an area of approximately 72,000 ha, and Munghorn Gap Nature Reserve, covering an area of approximately 6,000 ha.

Cope State Forest (SF) and Durridgere SF are located approximately 8 km west and 16 km north-east of the project area, respectively. These are the only areas reserved under the *Forestry Act 1916* in close proximity.

For the purposes of the ecological impact assessment, a 'study area' was defined inclusive of the proposed extension areas and additional areas comprising the riparian corridor of Moolarben Creek, vegetation directly west of the proposed extension areas, and additional areas adjacent to the proposed extension area to assist with identifying and assessing potential off-site and indirect impacts. Vegetation communities in the study area are shown on Figures 10.1 and 10.2.

As noted previously, the proposed extension areas cover approximately 178 ha and connect to large expanses of native bushland to the north, east and south. Forest and woodland cover most of the proposed extension areas, with small agricultural areas in the south-western section and three disused quarries on the western edge.

Land use practices such as previous clearing and ongoing grazing, in and adjacent to the proposed extension areas have contributed to the decline in condition of native vegetation communities and fauna habitats. Sheep and cattle grazing to the south and the west of the proposed extension areas have contributed to a reduction in floristic diversity, native vegetation and habitat condition.

Fauna, flora and vegetation communities within the defined study area and their conservation significance are described in Section 10.3.2 below.

10.3 Impact assessment

10.3.1 Methodology

i Overview

The following tasks were undertaken to investigate biodiversity and the likely ecological impacts associated with the proposed modification:

- literature and database review;
- gap analysis and risk assessment;
- flora and fauna surveys; and
- impact assessment.

ii Literature and database review

Numerous studies have been completed within the study area and surrounds. Relevant literature and databases were reviewed to compile a list of threatened species, populations and communities likely to occur in the project area. Information reviewed is provided in Appendix E.

It is noted that although the entirety of the study area was previously surveyed by Moolarben Biota (2006) as part of the Stage 1 EA, it was determined that additional surveys were required due to the time elapsed, and the changes to vegetation and fauna habitat use that may have occurred within this timeframe (for example, as an outcome of indirect impacts from the clearing associated with Open Cut 1). Further, the Moolarben Biota (2006) study area was much larger than that for the proposed modification and, therefore, a lower level of survey effort was dedicated to the proposed extension areas. Accordingly, additional surveys were required to confirm and refine the results of Moolarben Biota's 2006 study.

iii Gap analysis and risk assessment

A gap analysis was undertaken to familiarise the study team with information available and allow any information gaps to be identified and an ecological risk assessment to be completed.

As an outcome of the risk assessment, the mine design was modified to ensure no disturbance of Moolarben Creek, its riparian zone or floodplain, and connectivity was maintained between vegetated areas to north and south of the proposed extension areas.

The review of existing material enabled the development of the scope for field investigations. Following an initial scoping assessment in which the presence of suitable habitat was assessed, species deemed unlikely to occur were excluded from further analysis. Targeted surveys were then formulated to detect species with the potential to occur in the project area.

iv Flora and fauna surveys

Vegetation types were assessed in the field using a combination of plot-based surveys and rapid assessment surveys. Vegetation type boundaries were mapped either on foot or from a vehicle using a global positioning satellite receiver, whilst referencing aerial photographs and topographic maps. Field based assessments were followed by aerial photograph interpretation and analysis using a geographic information system, to create a comprehensive vegetation map of the proposed extension areas.

Targeted searches were undertaken for threatened flora and fauna species likely to occur in the study area. This included targeted flora surveys, active reptile searches, diurnal bird timed area searches, nocturnal bird spotlighting and call broadcasting, ultrasonic detection of microbat calls, microbat harp trapping, microbat roost searches, arboreal mammal trapping, searches for tracks, scats and signs, the Koala (*Phascolarctos cinereus*) spot assessment technique and camera trapping. An example of an image captured on the motion-sensitive camera is provided in Photograph 10.1. It is noted that no native species were captured by the motion-sensitive camera.

Photograph 10.1 European Red Fox in footslope woodlands

A summary of all survey methods, survey effort (ie number of hours spent surveying and number of plots surveyed) for the proposed modification is provided in Table 10.1.

Table 10.1 Summary of survey effort

Taxa group	Survey method	Total survey effort
Flora		
	Plot and transect surveys	7 plots and 7 transects
	Rapid vegetation assessments	42 points
	Targeted threatened flora searches	80 person hours
Fauna		
General	Habitat assessments and searches for signs	Over 80 person hours
Reptiles	Active search	24 person hours
	Nocturnal search	48 person hours
Birds	Timed diurnal search	8 search areas (20-60 minutes per search)
Microchiropteran bats	Anabat detection	32 detector nights
	Harp trapping	32 trap nights
	Koala spot assessment	5 person hours
	Infrared camera surveys	64 trap nights

Table 10.1 Summary of survey effort

Taxa group	Survey method	Total survey effort
Arboreal mammal trapping	Arboreal traps	160 trap nights
Koala	Spot assessment technique	5 person hours
Nocturnal birds and mammals	Call broadcasting and spotlighting	30 person hours

10.3.2 Results

i Flora and vegetation communities

Six native and one exotic vegetation type were recorded in the study area. These comprised Shrubby White Box Forest, Grassy White Box Woodland, Ridgetop Broad-leaved Ironbark – Black Cypress Pine Forest on shallow sands, Ridgetop Broad-leaved Ironbark Grey Gum Forest, Rough-barked Apple Alluvial Woodland, Rough-barked Apple – Cypress Pine Woodland on slopes, and exotic pasture (Figure 10.1). When assessed against the benchmarks for the assigned Biometric Vegetation Types, all native vegetation communities were considered to be in good condition as they fell within the benchmark values.

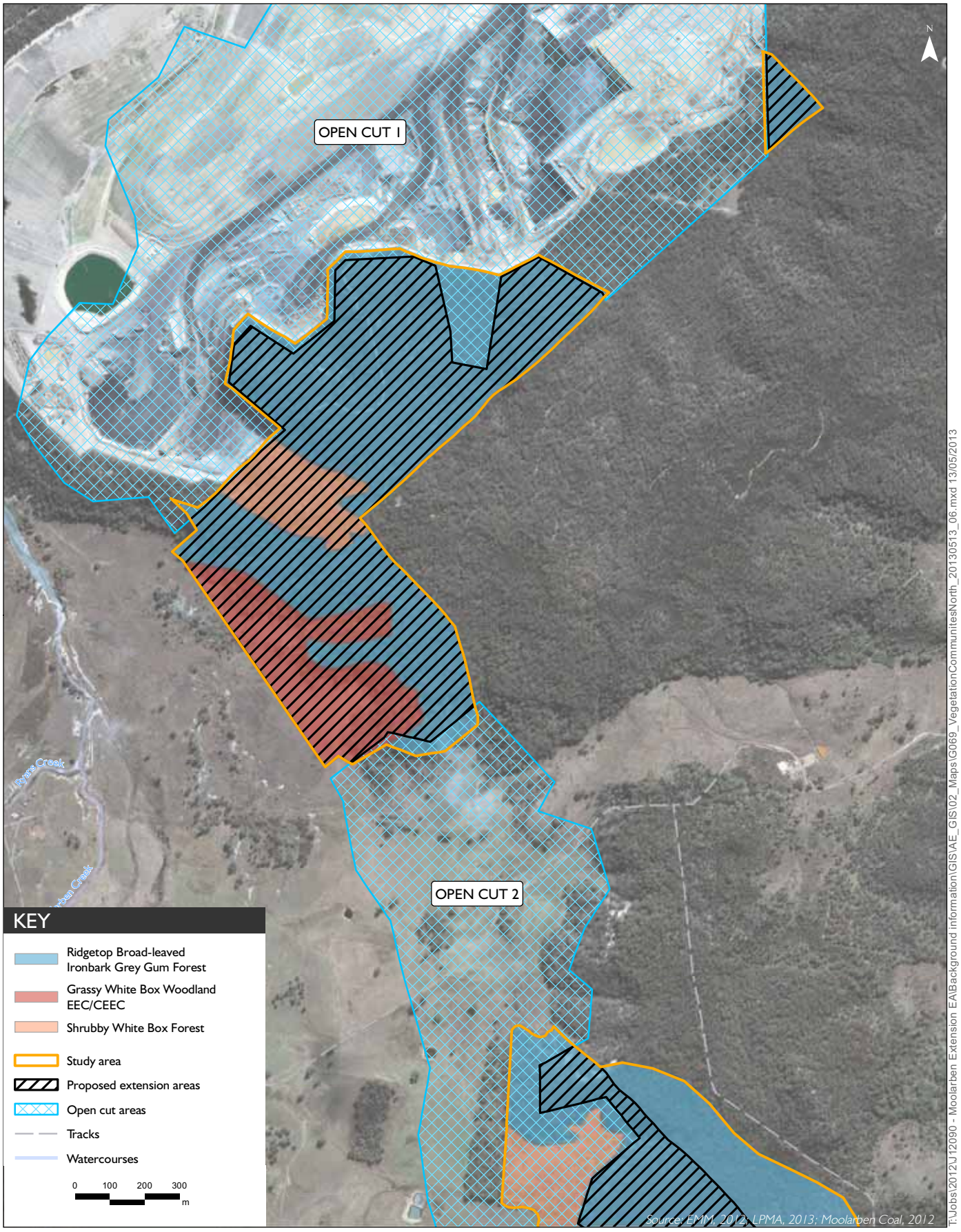
Of these six native vegetation communities, one meets the description of White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community under the TSC Act and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland critically endangered ecological community under the EPBC Act. There are differences in the listing criteria for the community, thus they were assessed separately in the ecological impact assessment.

Nineteen individuals that were suspected to be Cannon's Stringybark (*Eucalyptus cannonii*), listed as vulnerable under both the TSC and EPBC Acts, were found in the proposed Open Cut 1 extension area. Samples were taken which were reviewed by identification botanists at the Royal Botanic Gardens in Sydney. The identification botanists concluded that the samples collected were hybrids of Cannon's Stringybark and Red Stringybark (*Eucalyptus macrorhyncha*). The hybrid is not recognised in the approved Commonwealth conservation advice (DSEWPaC 2008) or the NSW Environmental Impact Assessment Guidelines (NPWS 2000) for the species. No other individuals of this species were detected in the study area.

The study area also contains potential habitat for a number of threatened flora species not detected during surveys. Based on the outcomes of the extensive literature review and surveys, it is considered likely that the Pine Donkey Orchid could occur in Cypress Pine, Ironbark and Box Gum Woodlands of the study area as it was recorded in similar habitat during the MCP Stage 1 assessment (Moolarben Biota 2006). Therefore, it has been conservatively assumed as present in these habitat types. Potential habitat also exists for the Scant Pomaderris in Shrubby White Box Forest, however, this species is readily detectable, and was not recorded during targeted surveys. Therefore, it is not considered likely to occur in the study area.

The occurrence of GDEs was assessed in accordance with relevant NSW policies. 'The Drip', an important local seepage feature located to the north of the Goulburn River, represents the only significant seep/spring GDE within the locality, with vegetation reliant on this surface expression of groundwater clearly evident within the cliff line of 'The Drip'. It is also noted that scattered individuals of River Red Gums, known for their groundwater dependence, were recorded approximately 500 m west of the proposed Open Cut 2 extension along Moolarben Creek.

'The Drip' is located approximately 6 km to the north of the proposed extension areas. The groundwater impact assessment (AGE 2013) prepared for the proposed modification concluded that there would be negligible change in flows to surface water features including Moolarben Creek and no change to 'The Drip'. Therefore, there will be no impact on the River Red Gums along Moolarben Creek or vegetation supported by 'The Drip'. As there are no other identified GDEs within or in the relative vicinity of the proposed extension areas, the proposed modification will not impact on GDEs.



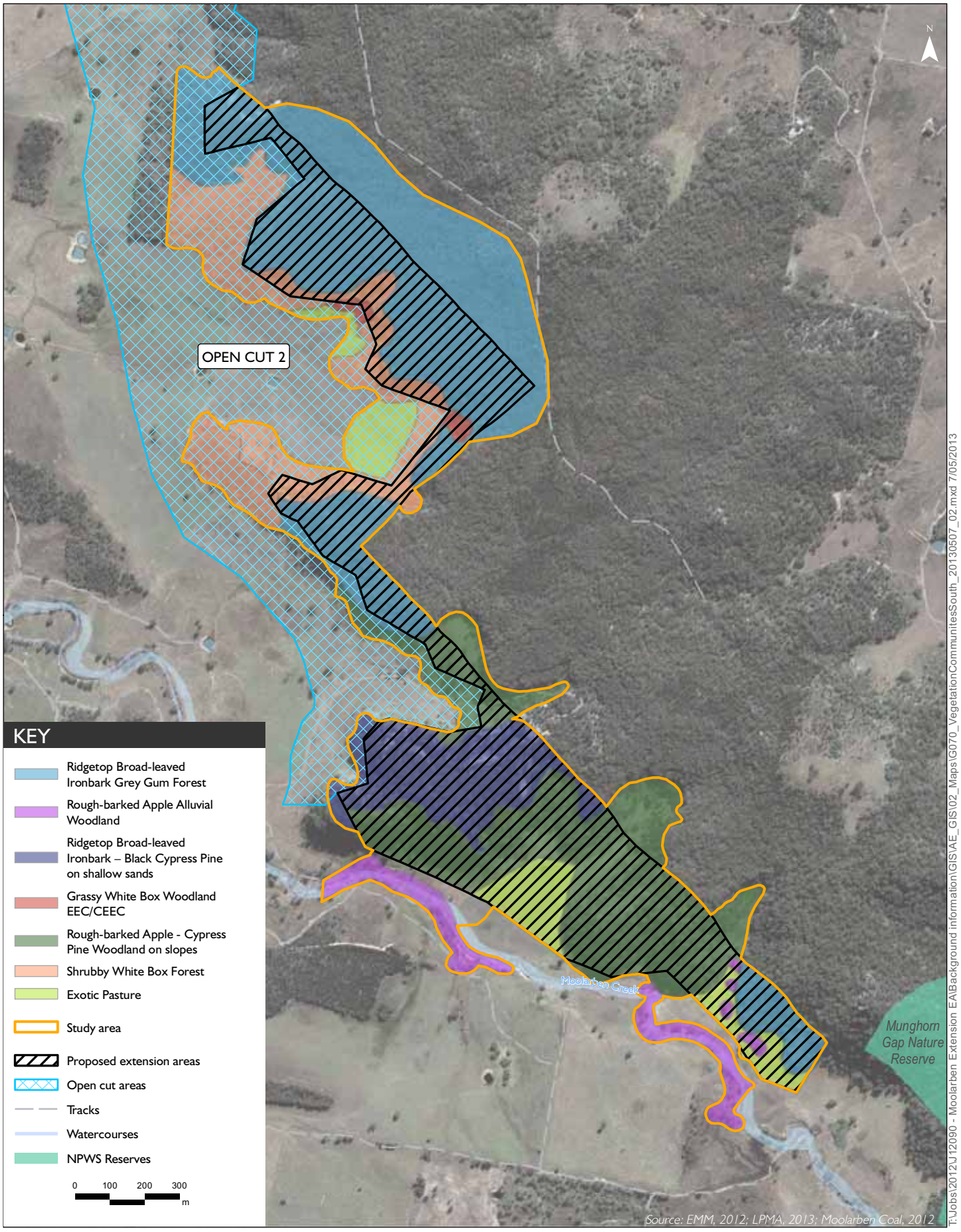
EMM

MOOLARBENCOAL

Vegetation types - north

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.1



Vegetation types - south

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.2

ii Fauna

The study area contains a variety of habitat types including open forests on hillsides and ridges, footslope grassy woodlands, riparian grassy woodlands and exotic pasture. A variety of fauna habitat resources were also recorded during surveys including tree hollows, fallen timber, rocky outcrops and bushrock, dense shrubs, and flowering and fruiting plants.

Two amphibian, five reptile, 53 diurnally-active bird, three nocturnally-active bird, five arboreal and ground-dwelling mammal, 11 microbat and four pest species were recorded in the study area during EMM surveys. A number of these were regionally significant, comprising the Common Death Adder, Turquoise Parrot, Common Koel, Emu, Brown Treecreeper, Jacky Winter, Eastern Yellow Robin, Rufous Whistler and Diamond Firetail.

Three threatened diurnally-active birds, namely, the Brown Treecreeper, Diamond Firetail and Turquoise Parrot were recorded in the study area. The study area was also considered to contain potential habitat for a number of other threatened diurnally-active bird species, including the Regent Honeyeater.

Two threatened forest owls, the Powerful Owl and Masked Owl, were recorded in the study area, which was also considered to contain potential habitat for the Barking Owl.

No threatened non-flying mammal species were recorded in the study area, nor was evidence of their presence. Three tree species that are recognised as secondary and supplementary feed trees in the region (Department of Environment and Climate Change (DECC) 2008) were recorded. Habitat is considered to be limited for threatened non-flying mammals, comprising the Squirrel Glider, Spotted-tail Quoll and Koala which were not recorded during surveys.

Two threatened microbats, the Eastern Bentwing Bat and Eastern Cave Bat, were recorded in the study area, which is considered to contain potential habitat for a number of other threatened cave and tree-roosting bat species previously recorded nearby.

10.3.3 Potential impacts

i Timing and duration

Under the proposed modification, Stage 1 operations will continue to 2033. The removal of vegetation and fauna habitat will occur progressively over the life of the operation, with rehabilitation occurring concurrent with this process.

Management of offsets for biodiversity outcomes will occur, subject to approval of the proposed modification, as soon as practicable after approval is granted. The biodiversity offsets will be managed in accordance with the Biodiversity Offset Management Plan, which covers each of the offset properties (refer to Section 10.5).

ii Direct impacts

The proposed modification will disturb 178 hectares ha of land, comprising 171 ha of native forest and woodland, including 17.2 ha of the White Box Yellow Box Blakely's Red Gum Woodland which is listed as endangered ecological community under the TSC Act (containing 16.5 ha of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is listed as a critically endangered ecological community under the EPBC Act), 154.2 ha of other non-threatened native vegetation communities and 6.6 ha of cleared land or exotic pasture.

The White Box Yellow Box Blakely's Red Gum Woodland EEC exists in both a disturbed woodland and a derived grassland (cleared of trees) form that are low in floristic value due to previous clearing for agricultural activities and edge effects including weed invasion and grazing. The area of the EEC that will be removed for the proposed modification represents approximately 10% of native vegetation in the proposed extension areas. While this is relatively small in comparison with the total area of vegetation to be removed and is in poor condition, it is considered significant due to the status of this community in the region (estimated at 90% of woodland cleared, DECC 2008a). These impacts will be compensated for by revegetation activities in the proposed modification footprint and by offsets to provide a long-term improvement in the quality and quantity of this TEC in the region.

The proposed modification is also likely to result in a significant impact (as defined by NSW, DECC 2007a, and Commonwealth guidelines, Department of the Environment, Water, Heritage and Arts (DEH) 2006) on one threatened bird, Brown Treecreeper, and one threatened cave-roosting microbat, Eastern Cave Bat.

Two significant and limiting fauna habitat features, hollow-bearing trees and rocky outcrops, will be directly impacted by the proposed modification. Collectively, approximately 178 ha of potential threatened species habitat will be removed gradually over the life of the proposed modification.

These habitat resources occur outside the disturbance footprint, with abundant similar habitat available in wooded areas to the east, and in the connected corridor with Goulburn River National Park to the north, which is approximately 404 times the size of the proposed extension areas, and Munghorn Gap Nature Reserve to the south of the study area, which is approximately 34 times the size of the proposed extension areas. Further, open forest and woodland to be cleared and then re-established represents less than 0.5% of the remnant forest and woodland habitat outside of conservation areas in the Hunter-Central Rivers CMA. Therefore, the overall removal of vegetation and threatened fauna habitat is considered to be minor in the regional context.

iii Indirect impacts

The ecological impact assessment provides consideration of indirect impacts including noise, dust, fragmentation, edge effects, connectivity, impacts to conservation reserves and pest species on flora and fauna. The assessment (Appendix E) concluded that indirect impacts were not considered significant.

iv Cumulative impacts

The proposed modification is also likely to result in cumulative impacts for the loss of vegetation communities, threatened flora and fauna species and benefits by adding to the regional network of offset areas managed for conservation management.

10.4 Management and monitoring

Management of potential impacts have been addressed according to the hierarchy of avoid, mitigate then compensate. This section provides the avoidance and mitigation measures and an overview of proposed rehabilitation. A detailed biodiversity offset strategy has been prepared to compensate for residual adverse ecological impacts and is summarised in Section 10.5.

10.4.1 Avoidance

Avoidance measures for coal mines are difficult as resources are in fixed locations. Notwithstanding, ecological constraints were considered in the mine optimisation process. Avoidance measures considered in the mine design included:

- exclusion of Moolarben Creek from the proposed modification boundary to protect riparian zones and the habitats that these areas provide;
- modification of the proposed extension area footprints to maintain connectivity between forested areas to the north and south of the MCP and to ensure substantial vegetation is retained to the east. Rehabilitation will occur progressively as the mine develops to promote connectivity and provide additional habitat; and
- adoption of a two-stage gradual clearing protocol where non-habitat trees are cleared 24 hours prior to any habitat trees being cleared, to encourage fauna to move out of an area prior to impact.

These avoidance measures are considered to provide a substantial reduction in potential worst case ecological impacts.

10.4.2 Mitigation

Potential impacts to ecology at MCP are managed in accordance with MCO's LMP. The LMP comprises three sub-plans, namely:

- rehabilitation and offset management plan;
- final void management plan; and
- mine closure plan.

The LMP also addresses the Stage 1 EPBC approval (EPBC 2007/3297) requirement for a rehabilitation and offset strategy.

The LMP includes a biodiversity mitigation strategy that aims to achieve a 'maintain and enhance' ecological outcome, resulting in a net positive biodiversity benefit in the post-development landscape. The broad objectives of the strategy are to:

- avoid impacts on areas of high ecological value;
- enhance local vegetation cover;
- increase utilisation of isolated vegetation patches by local biodiversity such as woodland birds;
- improve connectivity between Munghorn Gap Nature Reserve and Goulburn River National Park;
- improve connectivity between Dexter Mountain and Munghorn Gap Nature Reserve through revegetation and management; and
- secure the local conservation of EECs, their habitats and important local biodiversity.

The LMP details specific management goals, the means of achieving the abovementioned objectives, assessment criteria and monitoring requirements.

Measures of particular relevance to the proposed modification contained within MCO's management regime include:

- preparation of a Ground Disturbance Permit to be approved by the Environment and Community Relations Manager (or delegate) prior to the commencement of clearing activities;
- implementation of MCO's vegetation clearance protocol which requires the delineation of areas to be cleared, pre-clearance surveys to identify hollow-bearing trees, ground debris and caves occupied by fauna or that provide fauna habitat and procedures for minimisation of adverse impacts to fauna and flora;
- collection and stockpiling of habitat features important to threatened fauna species for reinstatement in rehabilitation areas in accordance with the LMP;
- use of native, locally sourced seed for propagation for rehabilitation activities where possible; and
- adoption of a two-stage clearing protocol where non-habitat trees are cleared 24 hours prior to any habitat trees being cleared, to encourage fauna to move out of an area.

In addition to the measures that are already contained within MCO's existing ecological management regime MCO commits to the investigation of artificial roosting structures for microbats to compensate for the loss of rocky outcrops.

The LMP will be reviewed and updated as required to accommodate the proposed extension areas.

10.4.3 Rehabilitation

As discussed in Section 4.3.3, MCO is committed to returning areas disturbed by mining operations to their pre-mining land use or as otherwise agreed with relevant stakeholders. Rehabilitation at MCO is undertaken in accordance with a MOP and the LMP. Proposed extension areas will be mostly rehabilitated for biodiversity outcomes, with vegetation to be planted/seeded to include Grassy White Box Woodlands and Broad-leaved Ironbark Forests. A principal objective is to enhance vegetation cover and connectivity. Species will be chosen to improve faunal biodiversity and habitat. The approach to achieving its rehabilitation objectives, information on assessment criteria and monitoring program are detailed in the LMP and reinforced in the MOP.

10.5 Biodiversity offset strategy

10.5.1 Introduction

A biodiversity offset strategy (BOS) was prepared to compensate for the unavoidable residual impacts outlined in Section 10.3. The BOS includes a proposed biodiversity offset package (BOP) which identifies the biodiversity offset properties and provides a preliminary assessment of their ecological characteristics. The BOS is given as Appendix D of the ecological impact assessment report.

The BOS has been prepared to provide "*a comprehensive offset strategy to ensure that the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term*" in general recognition of the NSW Offsetting Principles (OEH 2008) and the Office of Environment Heritage (OEH) Interim Policy on assessing and offsetting impacts of Part 3A, State Significant Development (SSD) and State Significant Infrastructure Projects (OEH 2011).

The BOS also considered the EBPC Act Offset Policy requires "*offset measures to be considered for residual impacts that cannot be mitigated to ensure the protection of MNES in perpetuity*" (SEWPaC 2012). As noted in Section 5.4, a separate referral to SEWPaC is being prepared under the EPBC Act for impacts to matters of NES. This will be specifically for, but not necessarily limited to, 16.5 ha of White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands.

The proposed offset strategy has been designed to meet the principles of both the NSW and Commonwealth policies.

The OEH (2011) Policy uses a three-tiered approach to achieving offset outcomes. Tier 1 full 'improve or maintain' outcome, Tier 2 'negotiated no net loss' outcome and Tier 3 'mitigated loss' outcome. It is noted that a Tier 1 outcome is not possible for the proposed modification given the disturbance of 17.2 ha of the White Box Yellow Box Blakely's Red Gum Woodland which is a 'red flag' community under the policy. The OEH (2011) policy specifically acknowledges that proposals assessed as Major Projects under the EP&A Act do not have to meet the 'maintain or improve' standard which is required under the biobanking scheme, however, the impacts should be quantified using the biobanking assessment methodology (BBAM) for benchmarking purposes. The approach taken by MCO is consistent with this policy. The BBAM was used to 'inform' the quantum of offset required for the proposed modification, and whilst it is OEH's preference that a Tier 1 'maintain or improve' outcome is achieved, the policy provides a structured approach for assessing proposals that meet one or two alternative standards (Tier 2 'no net loss' and Tier 3 'mitigated loss'), which take into consideration the environmental, social and economic benefits provided by the proposed modification.

The BOS and proposed BOP provide:

- a 'maintain or improve' quantification of the impacts of the proposed modification informed by the BBAM to guide the development of the offset strategy;
- offset properties to be permanently protected via an appropriate conservation mechanism such as registration of a Conservation Agreement under s.69B of the NPW Act or other equivalent measure, including possible transfer to the national parks estate subject to the agreement of the NSW Minister for the Environment, to ensure the protection, enhancement and conservation management of biodiversity values; and
- long term biodiversity management of these properties.

10.5.2 Proposed offset package

ELA investigated the availability and suitability of potential offset sites on behalf of MCO. This included identifying lands with appropriate conservation values in proximity to the MCP including land owned by MCO, land for sale or landowners who had expressed interest in managing their properties for conservation, identifying where these lands have potential to provide 'like for like' vegetation and threatened species habitat (consistent with the provisions of the OEH's (2011) Policy), and where cost effective management can be implemented to improve the overall conservation value of the land.

Where possible, focus was directed to land adjacent to existing conservation areas including Goulburn River National Park, Munghorn Gap Nature Reserve, approved Stage 1 and proposed Stage 2 offsets, thereby adding to the overall extent and connectivity of conserved land in the area. The approach also focused on increasing the strategic value of MCO's offsets for the MCP in its entirety.

Following extensive investigations the BOP was formed. Table 10.2 below lists the seven properties that comprise the BOP. All properties are either owned by MCO or are in process of being purchased. The locations of these properties, together with offset areas approved under Stage 1, proposed under Stage 2 and approved for other mines' in locality, are shown in Figure 10.3.

Table 10.2 Offset properties and areas of mapped native vegetation

Property	Lot and DP	Area of mapped native vegetation (ha)
Clifford	Lot 288 DP 704081	102.23
Elward	Lot 84 DP 704077	170.77
Property #5	Lot 237 DP 755442	63.97
Properties #24 and #25	Lot 31 DP 633148, Lot 8 DP 626648	63.50
Bobadeen	Lot 5 DP 750736, Part Lot 1 DP 593639, Lot 1 DP 110465, Part Lot 6 DP 750736, Lot 5 DP 750750, Lot 2, 3, 4 and 5 DP 111560	184.15
Moolarmoo	Lots 184 and 221 DP 755442	44.49
Total		**629.11**

Combined, these seven properties provide a direct offset of 629 ha and an offset ratio of 3.67:1 (offset: impact). It is noted that areas of highly disturbed or poor quality vegetation, including areas of derived native grasslands (DNG) have been excluded from the offset area calculations due to the risks and time delays associated with enhancing these areas.

Figures 10.4 to 10.9 show the mapped vegetation types at each of the offset properties.

A comparison of the mapped vegetation types with those being impacted and the threatened species habitat has been undertaken in accordance with the Offset Principles and Offset Policy (OEH 2008, 2011). Each property has the appropriate vegetation types, area, threatened species habitats and also contribute to regional conservation priorities and landscape connectivity (Table 2 of Appendix D of the ecological impact assessment report).

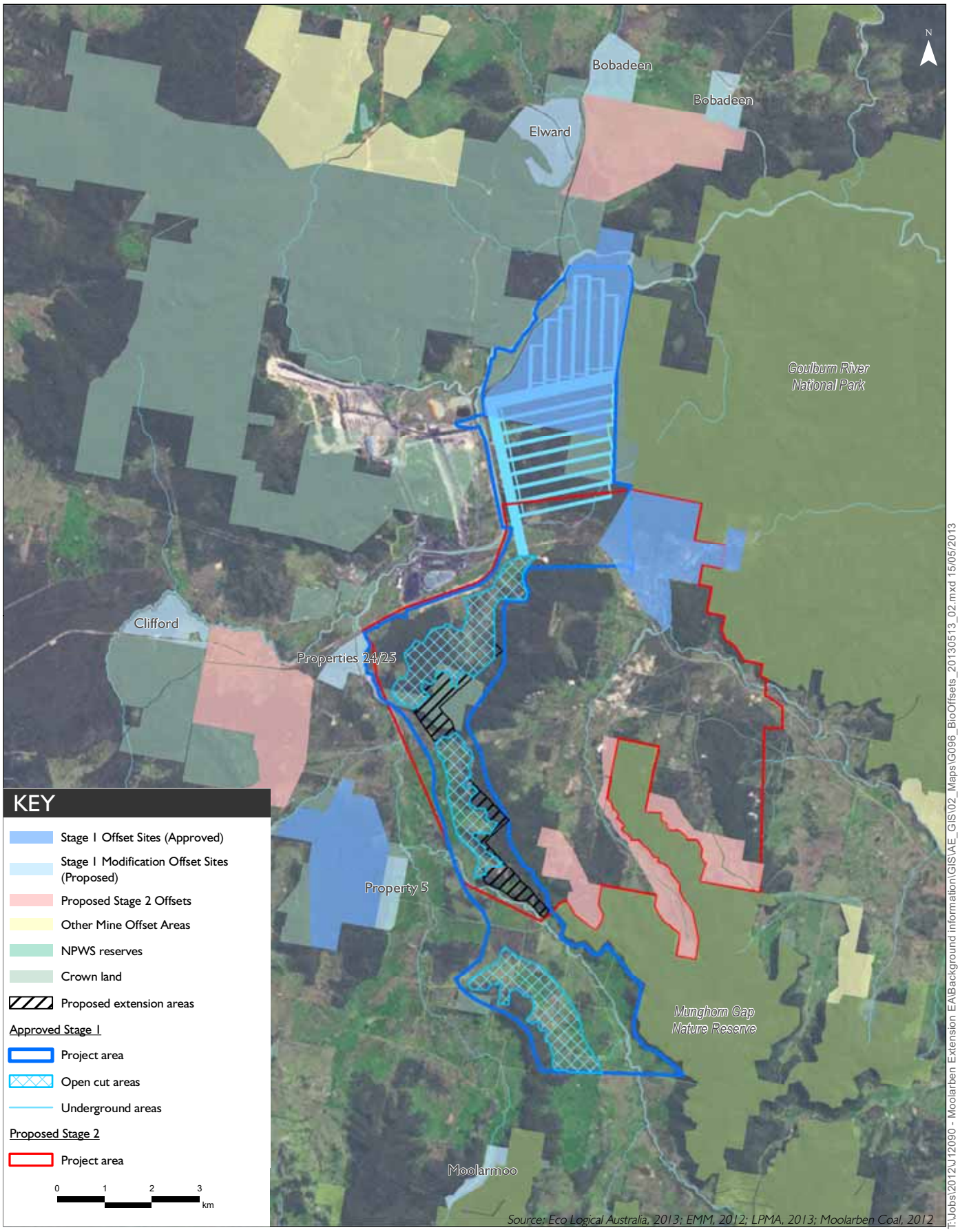
All of the 629 ha of mapped vegetation is in moderate-good biometric condition, including approximately 250 ha of DNG and all but 4.17 ha provides 'matching/like for like' or 'better' conservation values.

In particular, the properties include 330 ha of equivalent vegetation types to the 17.2 ha of White Box – Yellow Box grassy woodland being impacted including 154 ha of White Box –Yellow box grassy woodland and 144 ha of Blakely's Red Gum – Yellow Box –grassy woodland (equivalent to the NSW and Commonwealth listed Box Gum Woodland) providing an offset ratio of 19:1 for impacts to this EEC.

In addition, the preliminary fauna assessment undertaken by ELA at each of the proposed offset properties (Table 4 of Appendix D of the ecological impact assessment report) has confirmed records (or potential habitat) for each of the impacted threatened fauna species and confirmed and potential habitat for various other threatened fauna species.

As per the commitments in Section 10.5.3, the rehabilitation and offset management plan (ROMP) will be prepared to guide the management, monitoring and reporting of the effectiveness of the additional offset areas.

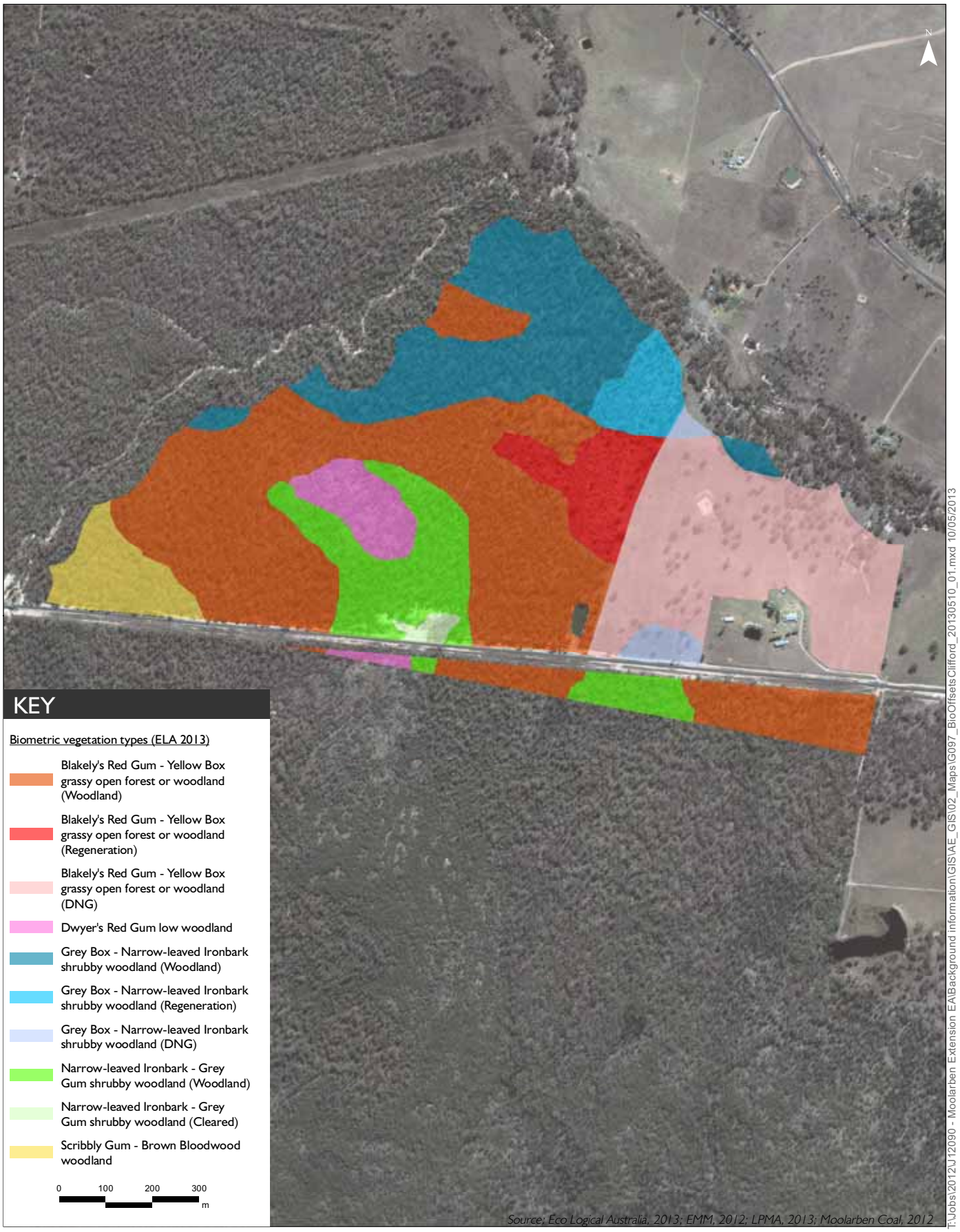
The BOP significantly exceeds a Tier 3 'mitigated loss' outcome (almost double) and meet 66% of a Tier 2 'no net loss' outcome.



Existing and proposed offset areas

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.3



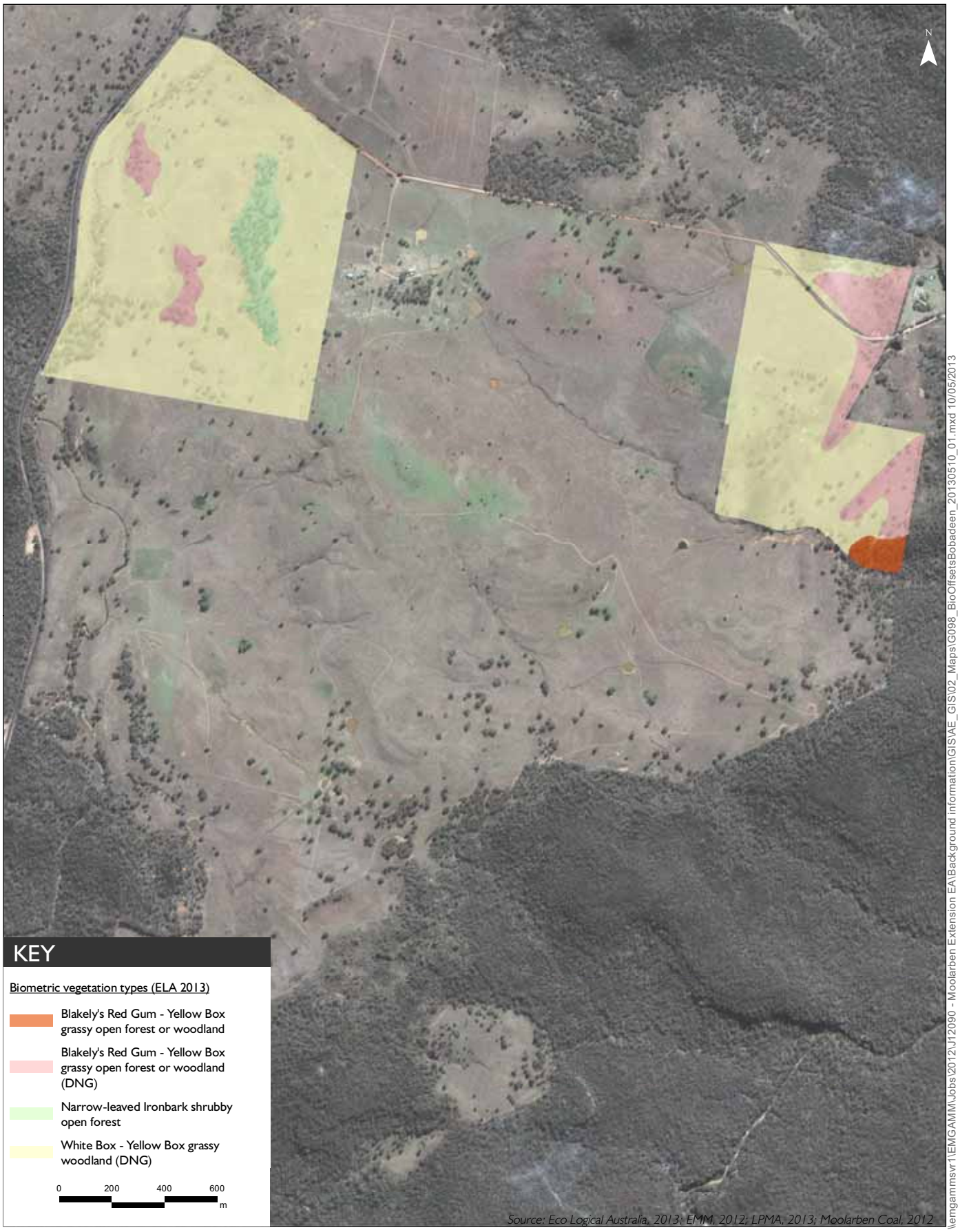
EMM

MOOLARBENCOAL

Mapped vegetation of the Clifford property

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.4



\\emgammsvr1\EMGAMM\Jobs\2012\J12090 - Moolarben Extension EA\Background information\GIS\AE_GIS\02_Maps\G098_BioOffsetsBobadeen_20130510_01.mxd 10/05/2013

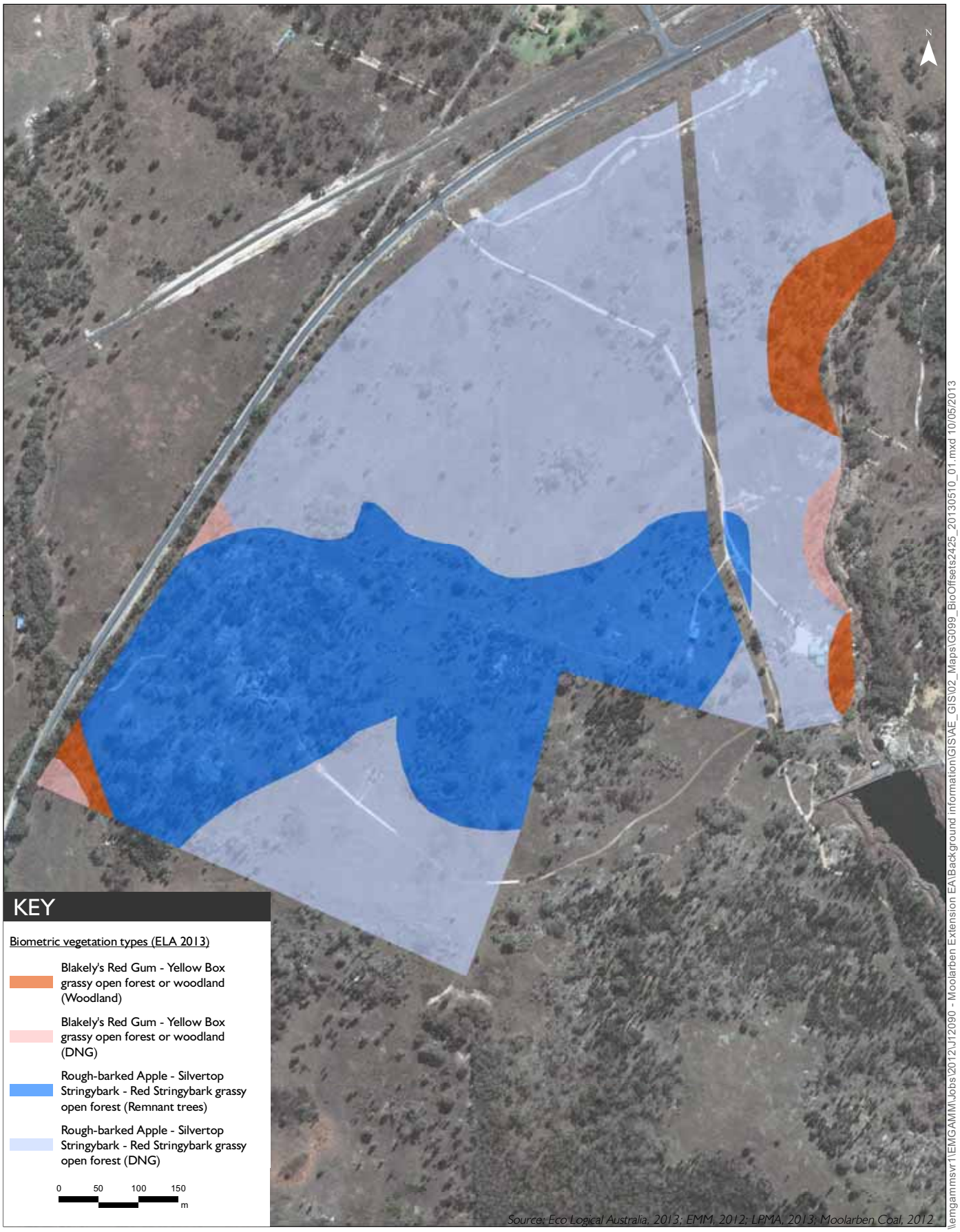
EMM

MOOLARBENCOAL

Mapped vegetation of the Bobadeen property

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.5



\\emgammsvr1\EMGAMM\Jobs\2012\J12090 - Moolarben Extension EA\Background information\GIS\AE_GIS\02_Maps\G099_BioOffsets2425_20130510_01.mxd 10/05/2013

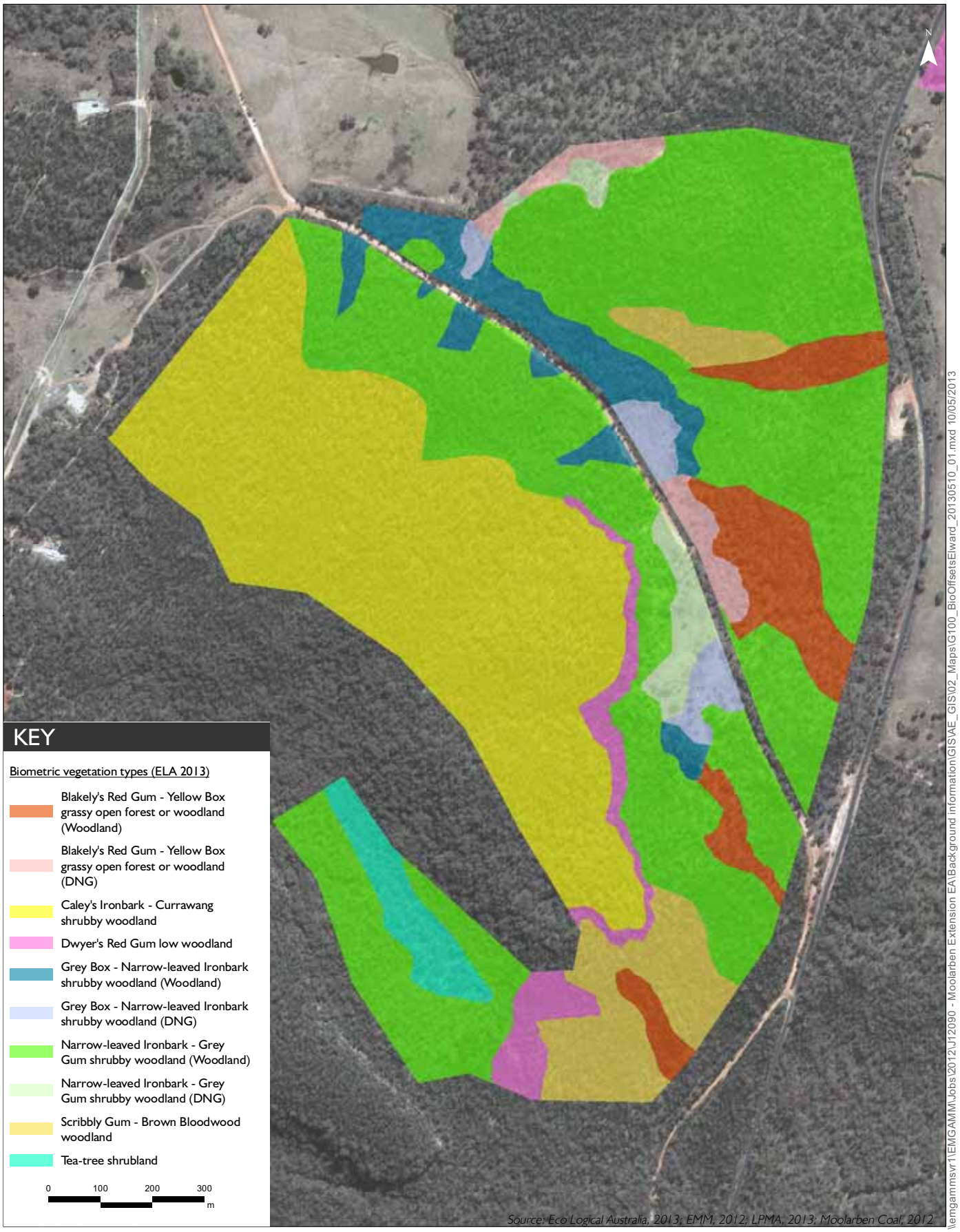
EMM

MOOLARBENCOAL

Mapped vegetation of properties number 24 and 25

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.6



\\emgammsvr1\EMGAMM\Jobs\2012\J12090 - Moolarben Extension EA\Background information\GIS\AE_GIS\02_Maps\G100_BioOffsetsElward_20130510_01.mxd 10/05/2013

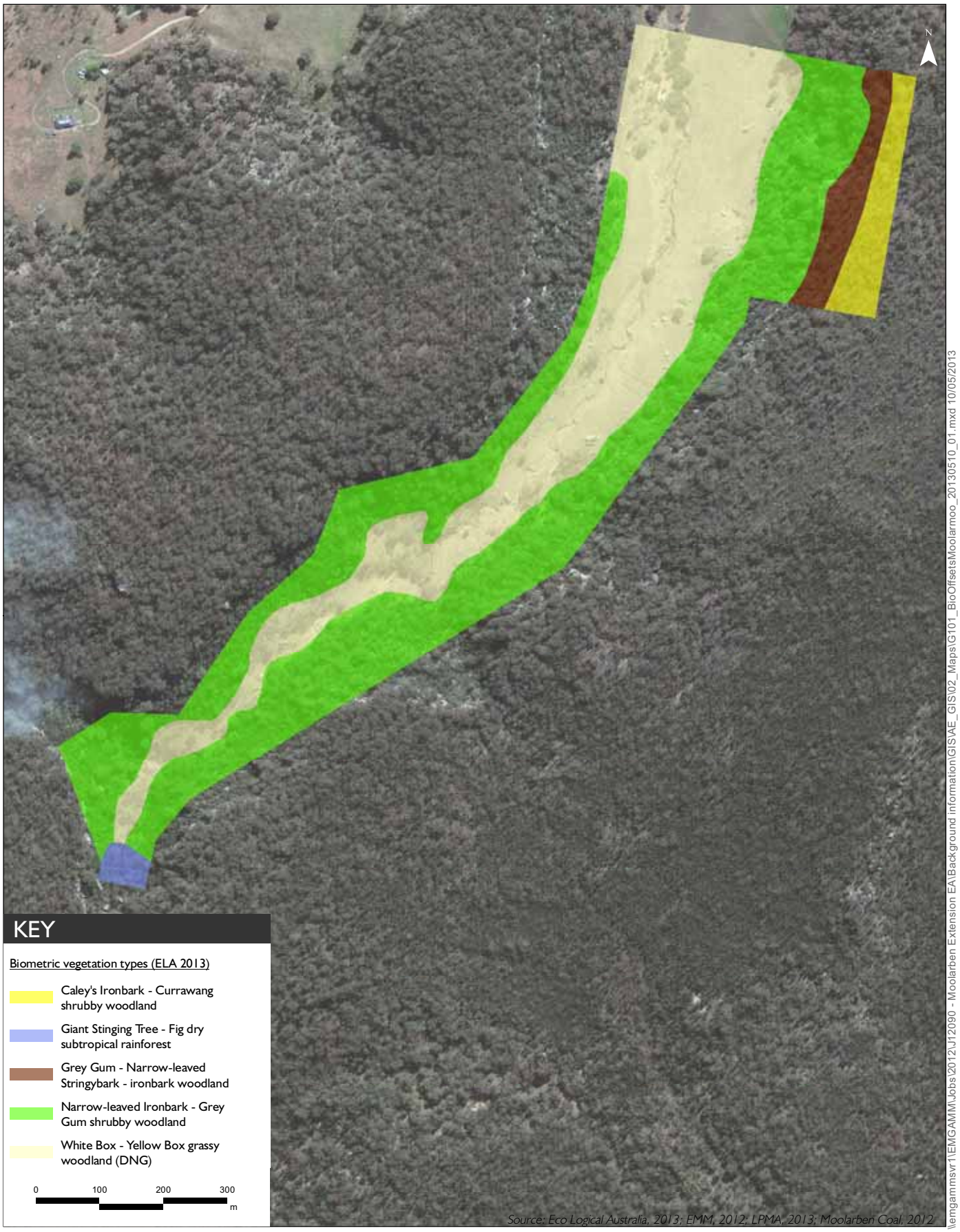
EMM

MOOLARBENCOAL

Mapped vegetation of the Elward property

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.7



\\emgammsvr1\EMGAMM\Jobs\2012\J12090 - Moolarben Extension EA\Background information\GIS\AE_GIS\02_Maps\G101_BioOffsetsMoolarmoo_20130510_01.mxd 10/05/2013

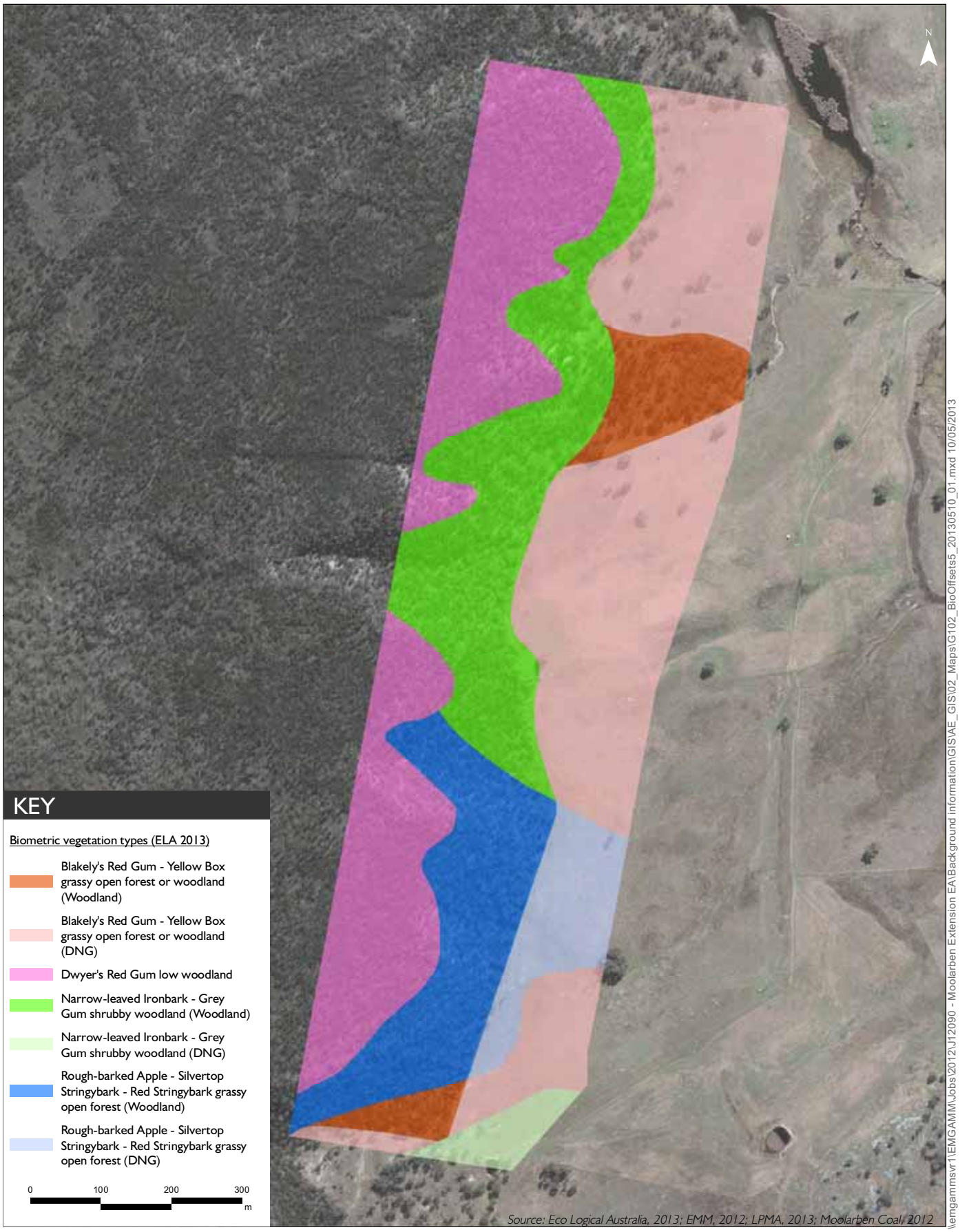
EMM

MOOLARBENCOAL

Mapped vegetation of the Moolarmoo property

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.8



\\emgammsvr1\EMGAMM\Jobs\2012\J12090 - Moolarben Extension EA\Background information\GIS\AE_GIS\02_Maps\G102_BioOffsets5_20130510_01.mxd 10/05/2013

EMM

MOOLARBENCOAL

Mapped vegetation of property number 5

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 10.9

10.5.3 Commitments

The BOS and BOP is MCO's biodiversity offset commitment for the proposed modification. In accordance with the BOS, MCO will:

- prepare and register a conservation covenant under Section 69B of the NPW Act (or equivalent conservation protection measure including the option to transfer land to the Minister for the Environment with agreement) to cover all seven properties referred to in Section 10.5.2 to provide long term protection of the offset areas following approval of the proposed modification;
    - should any of the nominated properties not be available for long term conservation protection, alternative offset sites of equivalent area and biodiversity values required by this BOS will be identified, and secured for long term conservation protection;
- undertake a detailed flora and fauna inventory and mapping of the vegetation types and threatened species present on each offset property and identify the management issues to prepare a ROMP for the total offset package as a whole (with incorporation into the Stage 1 ROMP);
- prepare a ROMP that includes each property and clearly outlines the responsible parties for the implementation of the plan, the works required to improve and maintain the biodiversity values (including but not restricted to fire management, weed and feral animal control, erosion and sediment control, restrictions on access, revegetation), performance criteria and a reporting and monitoring program. The management plan will be prepared by MCO and reviewed by an appropriately qualified and experienced ecologist and will be incorporated into a single management plan covering the already approved Stage 1 offsets;
- implement the management actions specific to each property and provide an annual report on the implementation of the plan and the results (changes in biodiversity values) to the DP&I/OEH and SEWPaC;
- provide adequate funds to implement the management plan on an annual basis; and
- arrange for the independent review of the adequacy and implementation of the ROMP every three years.

10.6 Conclusion

Numerous ecological studies have been undertaken within the study area and surrounds. These studies have enabled ecological risks to be incorporated into the mine design for the proposed modification, limiting its potential adverse impacts.

Previous studies were supplemented by detailed surveys of the areas with the potential to be directly and indirectly impacted by the proposed modification.

The proposed modification requires the progressive removal of approximately 171.4 ha of native vegetation and 6.6 ha of exotic pasture, with a total impact area of approximately 178 ha, including 17.2 ha of an endangered ecological community under the TSC Act (containing 16.5 ha of a critically endangered ecological community listed under the EPBC Act). Likely significant impacts are predicted for one threatened bird and cave-roosting microbat.

Habitat resources do occur outside the disturbance footprint, with abundant similar habitat available in wooded areas to the east, and in the connected corridor with Goulburn River National Park to the north, which is approximately 404 times the size of the proposed extension areas, and Munghorn Gap Nature Reserve to the south of the study area, which is approximately 34 times the size of the proposed extension areas.

Management of potential impacts have been addressed according to the hierarchy of avoid, mitigate then compensate. Avoidance measures principally related to the modification of the mine design to be offset from the Moolarben Creek riparian zone and to ensure connectivity between forested areas to the north and south was maintained. Mitigation includes implementation of measures to prevent adverse impacts to fauna during progressive clearing, maximisation of seed collection where practical and restoration and enhancement of fauna habitat.

A BOS and BOP have been prepared to compensate for unavoidable residual impacts. The BOP comprises seven strategically located properties that will be permanently protected via an appropriate conservation mechanism and managed for conservation outcomes. The BOP accords with both NSW and Commonwealth offsetting principles and achieves a maintain or improve biodiversity outcome.

As with vegetation disturbance, rehabilitation will take place progressively as mining advances. It is also noted that offsets will be conserved and enhanced for biodiversity outcomes once secured, subject to the proposed modification's approval.

The proposed avoidance, mitigation and compensation measures will provide a net positive biodiversity outcome.

11 Aboriginal cultural heritage

11.1 Introduction

South East Archaeology Pty Ltd prepared an Aboriginal cultural heritage assessment (ACHA) for the proposed modification. The associated report is given in Appendix F. The findings of the report are summarised in this chapter.

11.2 Existing environment

11.2.1 Environmental context

A project area's environmental context is important in assessing potential impacts on Aboriginal cultural heritage. Of particular relevance are water resources, ecology, geology, landforms and soils. The project area's geological and environmental context is described in Chapter 2, with water resources described in detail in Chapter 14 and 15, ecology in Chapter 10, and soils in Chapter 16.

Of note, the geology of the proposed extension areas includes conglomerate comprising rhyolitic tuff, quartz and quartzose inclusions which would have provided a good range of raw materials suitable for the manufacturing of Aboriginal stone artefacts. Sandstone from the Triassic era Narrabeen Group occurs typically on or near ridge crests and has formed boulders, shelters, overhangs and open surfaces. Caves and overhangs may have been used for shelter or as a medium for rock art, while exposed bedrock or isolated boulders may have been used as grinding grooves for Aboriginal stone tools.

The proposed extension areas are predominantly within an erosional soil context (as it primarily contains mid and upper portions of slopes). The dynamic nature of soil formation processes can remove, obscure or affect the integrity of archaeological evidence, particularly stone artefacts.

11.2.2 Ethnographic context

The proposed extension areas are within the north-eastern portion of the territory of the Wiradjuri people as defined by Tindale (1974) and Horton (1994, 2000), close to the boundary with the Kamilarioi to the north, and the Gewawegal and Wonnarua further to the east. A wide variety of subsistence resources were available in the past to local Aboriginal people and would have included possum, kangaroo, wallaby, wombat, kangaroo rat, platypus, lizards, snakes, goanna, tortoise, fish, mussels, birds, insects and plants (Pearson 1981:335).

The local Aboriginal population would have procured a range of items relating to subsistence, cultural and social activities and shelter. Few of these items have the potential to be preserved in the archaeological record. Despite the impacts on Wiradjuri culture brought by European settlement, Aboriginal community members take an interest in the management of their heritage.

11.2.3 Archaeological context

Extensive Aboriginal cultural heritage investigations have been completed within the vicinity of the project area. These have primarily been undertaken for environmental impact assessments relating to Stages 1 and 2 of the MCP (Hamm 2006a, Hamm 2008a, Hamm and Foley 2010) and the adjacent Ulan and Wilpinjong Coal Mines. These studies have provided information on the types of Aboriginal sites present, their distribution throughout the landscape, and assist with the construction of a predictive model of site location for the proposed extension areas.

Archaeological investigations at Moolarben, Ulan and their surrounds have identified rock shelter sites with archaeological deposits and/or rock art or grinding grooves, along with many potential shelters with potential deposits. Rock shelter sites vary in terms of topographical context, contents, nature and archaeological potential. The high record of shelter sites can partially be attributed to underground mining related surveys that have predominantly targeted sandstone rock formations within elevated terrain. Rock art occurs infrequently in the recorded shelters and are predominantly red ochre hand stencils. Open artefact sites are frequent and vary from dense stone artefact concentrations to sporadic isolated finds. The higher density open artefact sites are associated with elevated, well-drained and low gradient flats, terraces, spur crests, ridge crests and simple slopes adjacent to watercourses, particularly higher order watercourses. Stone artefacts identified are generally flakes, with some evidence of microblade and microlith production assumed to have been used for working plant and animal materials, food preparation or tool maintenance. Grinding grooves occur in sedimentary bedrock along watercourses, and on open surfaces of sandstone in other contexts (simple slopes) and on smaller sandstone slabs or surfaces in rock shelters (Kuskie 2009).

Other less frequent Aboriginal site types identified in the region include scarred trees, ochre quarries, lithic quarries, stone arrangements. One possible burial site has also been identified in the Ulan locality. Sites of traditional or cultural significance to Aboriginal people (for example, ceremonial areas) have also been reported within the locality.

Prior to the current assessment, one open artefact site and two rock shelters with potential archaeological deposits (PADs) were recorded within or immediately adjacent to the proposed extension areas.

11.2.4 Aboriginal heritage management systems register search

Two extensive searches of the AHIMS register were conducted on 7 November 2012 for an area of 36 km^2 centred on the proposed extension areas. A total of 145 registered Aboriginal sites were identified, which are predominantly open artefact sites, and to a lesser extent, scarred trees and rock shelters with art.

One Aboriginal site (an open artefact site), along with two rock shelters with PADs listed on the AHIMS register fall within or immediately adjacent to the proposed extension areas as shown in Table 11.1.

Table 11.1 AHIMS registered sites within the proposed extension areas

Site name	OEH AHIMS #	Site type	Recorder	Current management status	Notes
SIMC077	36-3-0882	Isolated find	Hamm	Insitu ongoing risk for MCO	The PPR (AECOM 2011a) recommends surface collection. Stage 1 approval specifies conservation
PAD 6 Moolarben Coal	36-3-0885	PAD	Hamm	Insitu ongoing risk for MCO	AHIMS listed with incorrect datum (should be GDA not AGD). PPR states that test excavation is required where monitoring indicates impacts are likely. Stage 1 approval specifies conservation
PAD 12 Moolarben Coal	36-3-0958	PAD	Hamm	Insitu ongoing risk for MCO	AHIMS listed with incorrect datum (should be listed as using the GDA coordinate system not AGD)

11.3 Impact assessment

11.3.1 Methodology

The ACHA for the proposed modification was undertaken in accordance with the OEH draft *Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC 2005). The methods employed for the ACHA included:

- AHIMS database searches and other relevant heritage registers and planning instruments;
- review of existing archaeological investigations at a regional and local level;
- landscape analysis;
- field survey inspection;
- Aboriginal community consultation;
- significance assessment;
- impact assessment; and
- management and mitigation measures development.

Detailed research into the environmental, cultural and archaeological background was undertaken for the proposed modification, building on the work already completed by South East Archaeology over the past decade at the adjacent Ulan Coal Mine and, more recently, for MCO.

A field survey of the proposed extension areas was undertaken over nine days between 12 November and 29 November 2012, by representatives of South East Archaeology, assisted by representatives of the registered Aboriginal stakeholders. The survey covered 164.5 ha (92.4%) of the total 178 ha proposed extension areas. Some of the proposed extension areas were not surveyed due to access limitations (10 ha) and previous land disturbance that had rendered archaeological potential to be negligible (3.5 ha). An additional 12.2 ha of land immediately bordering the proposed extension areas was surveyed prior to the revision of its boundaries after completion of the field survey. The survey was undertaken by sampling 133 survey areas, each representing a specific combination of landform unit and class of slope (following McDonald *et al* 1984). The areas traversed by foot within each survey area were defined as survey units. Each survey area was inspected for Aboriginal cultural heritage evidence.

11.3.2 Aboriginal consultation

Consultation for the ACHA was undertaken in accordance with the *Interim Community Consultation Requirements for Applicant* (DEC 2004) policy and the consultation process undertaken for the Stage 1 and 2 EAs.

The registered Aboriginal stakeholder organisations consulted included were:

- Mudgee Local Aboriginal Land Council (Mudgee LALC);
- Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC);
- Murong Gialinga Aboriginal and Torres Strait Islanders Corporation (MGSTSIC); and

- North-East Wiradjuri Company Ltd (NEWCO).

The individual registered stakeholders are;

- Mr Craig McConnell;
- Ms Aleisha Lonsdale; and
- Ms Warranha Ngumbaay.

MCO established Aboriginal Stakeholder Group Meetings in November 2010 to openly discuss the management of Aboriginal cultural heritage issues at the MCP. The registered Aboriginal stakeholder organisations have been the primary parties consulted in relation to ongoing Aboriginal cultural heritage issues associated with the MCP. Stakeholders were provided with the ACHA methodology and representatives from the registered Aboriginal stakeholder organisations were included in field survey.

Copies of the ACHA were provided to the Aboriginal stakeholders for their review and comment. The ongoing involvement of registered Aboriginal stakeholder organisations will remain an integral component of the management and investigation of Aboriginal cultural heritage at the MCP.

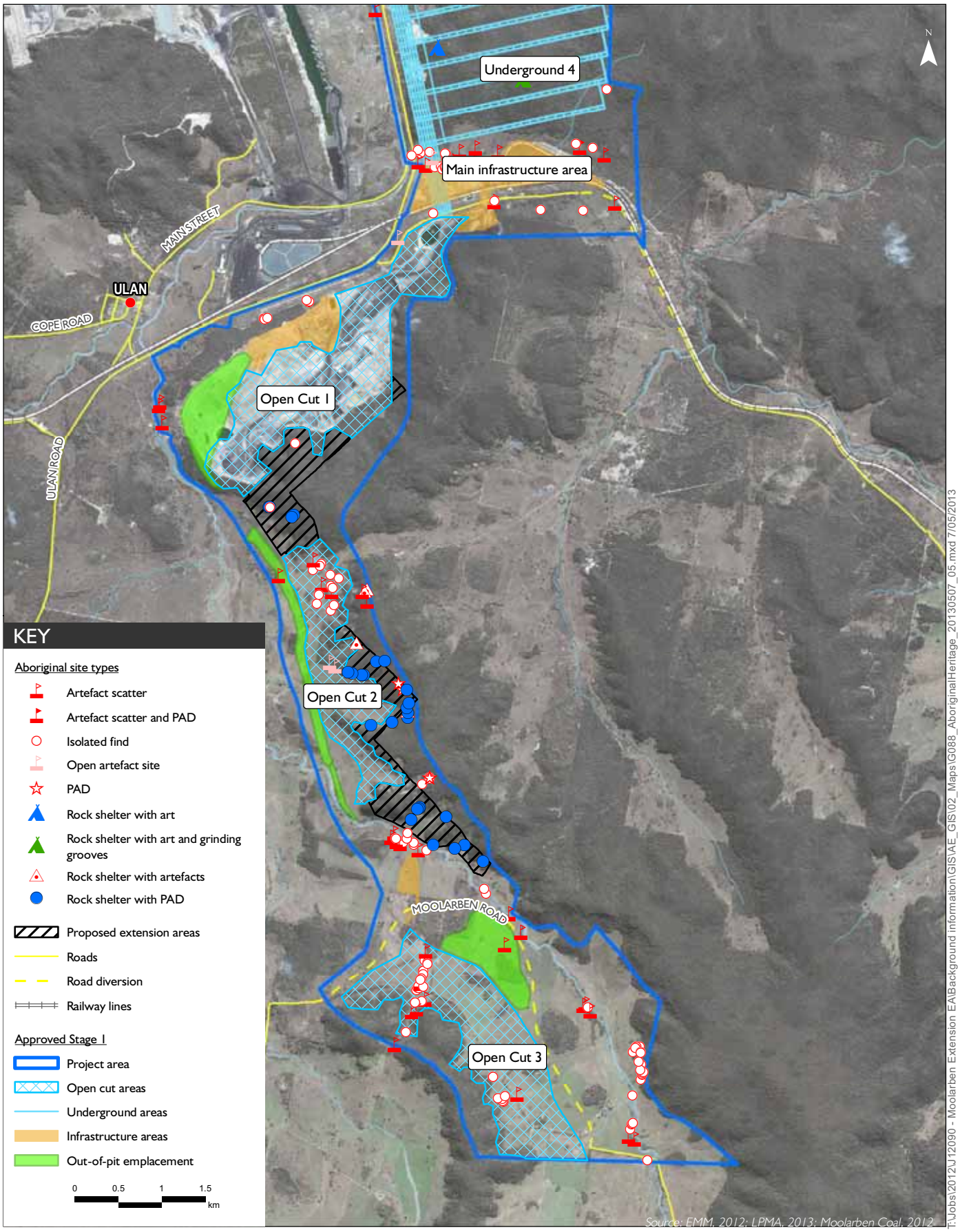
11.3.3 Results

The field survey identified 30 Aboriginal sites comprising open artefact sites and rock shelters. These sites were in addition to the three previously recorded Aboriginal sites within or immediately adjacent to the proposed extension areas. As a result, a total of 33 sites are known to occur directly within or immediately adjacent to the proposed extension area. The recorded sites are listed in Table 11.2 and shown in Figure 11.1.

The assessment of significance of the Aboriginal cultural heritage evidence was undertaken in accordance with relevant criteria of the International Council on Monuments and Sites (ICOMOS) *Burra Charter* (refer to Chapter 7 of Appendix F for a full description of criteria). Both the local and regional significance of sites were considered.

All sites were identified as being of low regional significance. This is because the size of the impact areas is relatively small within a regional context and no places/values exist that are unique or rare within the region. Two rock shelter sites with artefacts and one rock shelter with a PAD were assessed as being of moderate local significance. All of the sites were identified as being of low local significance. It is noted that the assessment of significance of any rockshelter with a PAD, irrespective of the assessed level of potential, can only be adequately achieved through controlled excavation to identify sub-surface deposits. Controlled excavation of any PAD may lead to a revision of the assessment of significance.

The Aboriginal community has disclosed a number of associations with the MCP area of contemporary cultural significance and identified the contemporary value of the archaeological evidence (refer to Hamm 2006a, 2008a, 2008b and AECOM 2011a). These areas include the Moolarben Ridge south of Carr's Gap, an area that extends to within the proposed Open Cut 2 extension area.



Location of Aboriginal heritage sites

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 11.1

11.3.4 Potential impacts

The potential impacts of the proposed extension on Aboriginal cultural heritage can be summarised as:

- direct impacts from disturbance associated with mining in the proposed extension areas; and
- indirect impacts from associated activities such as blasting.

The cumulative effects of impacts on Aboriginal cultural heritage at a regional level takes into consideration the principle of intergenerational equity and the precautionary principle (DECCW 2009b). Assessing cumulative impacts on Aboriginal cultural heritage at a broader scale involves:

- the comparison of the 'identified resource' (ie archaeological evidence and cultural values identified within the ACHA) with other heritage studies in the region (and known site databases); and
- examination of topographic mapping and aerial photographs to identify if comparable environmental contexts exist elsewhere in the region, in which a similar 'potential resource' (ie predicted archaeological evidence and cultural values) may occur.

No specific aspect of the identified resource within the proposed extension areas is rare or unique at a local or regional context. The analysis of the potential resource in the region also supports that the impacts of the proposed modification on Aboriginal cultural heritage will be very low within a regional context.

The potential impacts on Aboriginal cultural heritage are summarised Table 11.2, together with site notes, including the proposed management regime where applicable.

Table 11.2 Summary of Aboriginal site type, significance, potential impacts and notes

Site Name	Site type	Overall significance	Scale/ level of potential impacts	Type of harm	Notes
S1MC077	Isolated find	Low L[1], Low R[2]	Broad-scale high level	Direct	Surface impacts likely; low significance
S1MC325 and S1MC328	Isolated artefact	Low L, Low R	Broad-scale high level	Direct	Surface impacts likely; low significance
S1MC326, S1MC327, S1MC329, S1MC330, S1MC332-334, S1MC336-342, S1MC346-351, S1MC353, S1MC354, PAD6 and PAD12	Rock shelter with PAD	Low L, Low R	Broad-scale high level	Direct	Surface impacts likely; low significance; low research potential; offset by testing and potential salvage of site S1MC331
S1MC331	Rock shelter with artefacts	Mod L, Low R	Broad-scale high level	Direct	Surface impacts likely; moderate significance; moderate research potential; testing and potential salvage to adequately assess significance, mitigate impacts for representative sample across extension area

Table 11.2 Summary of Aboriginal site type, significance, potential impacts and notes

Site Name	Site type	Overall significance	Scale/ level of potential impacts	Type of harm	Notes
S1MC335	Rock shelter with PAD	Low L, Low R	Broad-scale high level	Possibly direct	Surface impacts possible (on margin of extension areas); low significance; relatively low research potential; offset by testing and potential salvage of site S1MC331
S1MC343	Rock shelter with PAD	Mod L, Low R	Nil proposed (marginally outside proposed extension areas)	Possibly indirect (blasting) or none	No direct surface impacts proposed; potentially indirect impacts from blasting; moderate significance; moderate research potential; assessment of potential blasting impacts required; if substantial impacts probable, testing and potential salvage to adequately assess significance and mitigate impacts
S1MC344	Rock shelter with artefacts	Mod L, Low R	Nil proposed (marginally outside proposed extension areas)	Possibly indirect (blasting) or none	No direct surface impacts proposed; potentially indirect impacts from blasting; moderate significance; moderate research potential; assessment of potential blasting impacts required; if substantial impacts probable, testing and potential salvage to adequately assess significance and mitigate impacts
S1MC345 and S1MC352	Rock shelter with PAD	Low L, Low R	Nil proposed (marginally outside proposed extension areas)	Possibly indirect (blasting) or none	No direct surface impacts proposed; potentially indirect impacts from blasting; low significance; low research potential; offset by blasting assessment and potential testing and salvage of sites S1MC343 and S1MC344
Proposed extension areas	Cultural area/value	Low L, Low R	Broad-scale high level	Direct	Overall impacts of extension very low within regional context; substantial conservation areas/offsets nearby
Use of subsistence and other resources	Cultural area/value	Low L, Low R	Broad-scale high level	Direct	Overall impacts of extension very low within regional context; substantial conservation areas/offsets nearby
Moolarben Ridge south of Carr's Gap	Cultural area/value	Low L, Low R	Broad-scale high level	Direct	Overall impacts of extension very low within regional context; substantial conservation areas/offsets nearby

Notes: 1 – L = Local; 2 – R = Regional

11.4 Management and monitoring

South East Archaeology has prepared a draft ACHMP - *Aboriginal Cultural Heritage Management Plan: Moorlarben Coal Project Stage 1* for the entire MCP Stage 1. This is currently being considered by DP&I. If the modification is approved, the draft ACHMP will be updated to include the management of the sites listed in Table 11.2 in consultation with the Aboriginal community stakeholders. The draft Stage 1 ACHMP includes the recommendation for additional survey of potential impact areas that could not be sampled during the present investigation (currently totalling 10 ha).

Management strategies, where applicable, and the primary rationale for each strategy for each Aboriginal site are summarised in Table 11.2. Management measures that will be implemented to minimise impacts to Aboriginal cultural heritage comprise:

- test excavation and potential salvage of Aboriginal sites SIMC331 and SIMC344;
- offsetting impacts to Aboriginal sites by test excavation and potential salvage;
- assessing potential blasting impacts on Aboriginal sites SIMC343, SIMC352, SIMC344 and SIMC345. Sub-surface testing and potential salvage of these sites will be implemented for affected sites;
- any previously unrecorded Aboriginal cultural heritage evidence found during extension works will be managed in accordance with the procedures outlined in Section 4.5 of the draft Stage 1 ACHMP (see below); and
- in the unlikely event that skeletal remains are found during any works, work must cease immediately in the area and the NSW Police Coroner called to determine if the material is of Aboriginal origin. If determined to be Aboriginal, the OEH and relevant Aboriginal community stakeholders must be contacted to determine management for the remains in accordance with the procedures outlined in the draft Stage 1 ACHMP.

The draft Stage 1 ACHMP will be reviewed and updated as required to include the proposed extension areas and the measures listed above.

11.5 Conclusion

An ACHA was prepared to identify, assess and manage the Aboriginal cultural heritage values associated with the proposed extension. This was achieved through desktop research and field survey in consultation with registered Aboriginal stakeholders. A total of 33 Aboriginal sites (including PADs) were identified.

The ACHA determined that the impacts from the proposed modification, subject to management and monitoring, will be generally low within a local context and very low within a regional context.

Management and monitoring of Aboriginal cultural heritage will be conducted in accordance with the draft Stage 1 ACHMP which will be reviewed and updated to include the management of the additional sites.

12 Historic heritage

12.1 Introduction

EMM prepared a historic heritage impact assessment for the proposed modification. The associated report is given in Appendix G. The findings of the report are summarised in this chapter.

12.2 Existing environment

Detailed assessments were prepared for the MCP Stage 1 and Stage 2 EAs. Collectively, these studies assessed all areas within the Stage 1 and Stage 2 project areas and to the west, to include the settlement of Ulan, and to its south, to include the headwaters of Moolarben Creek.

The first study was completed by Veritas Archaeology and History Service in 2005 in support of the Stage 1 EA. In this study, 41 items of heritage significance were identified including houses, farms and graves. A brief record was made of each, including historical notes. Of these 41 items, seven were identified as potentially impacted by the project. Mitigation measures for these items were proposed including archival recording for all items and exhumation for two burials located in the Open Cut 3 footprint. As a result of this assessment recommendations were also made for archival recording of a number of heritage items in the lease but which were not directly affected by mining activities. Archival recording of these items was completed in 2009.

Impacts on all of the items identified by Veritas (2005) will remain unchanged as a result of the proposed modification.

A second study was completed by Heritas Architecture in 2008 for the Stage 2 EA. The study assessed the footprint and associated infrastructure of the Stage 2 development including additional open cut (Open Cut 4) and underground (Undergrounds 1 and 2) mining areas, generally located to the east of the proposed extension areas. Heritas Architecture's (2008) study reported an increase to impacts on eight items identified within the Veritas (2005) report. In addition, three further items were identified which would be impacted by the proposed development. Recommendations for mitigation of impacts to historic heritage included archival recording, historical research, archaeological assessment and conservation.

No items identified by Heritas Architecture (2008) will be impacted by the proposed modification.

There were no historically significant heritage items identified within the proposed extension areas. The closest European heritage item of significance is the Carr's Gap Road located over 500 m to the south-east from the proposed Open Cut 1 extension area and 600 m north of the proposed Open Cut 2 extension area.

12.3 Impact assessment

12.3.1 Methodology

Detailed literature and database reviews and site investigations were completed to assess potential impacts on European heritage from the proposed modification. The study included:

- a review of the United Nations Educational Scientific and Cultural Organisation (UNESCO) world heritage register, Australian National Heritage List, Commonwealth Heritage Register and NSW State Heritage Register;
- a review of previous heritage reports in the area; and
- a field survey completed on 4 and 5 December 2012 by EMM archaeologists.

12.3.2 Results

No new items of historical significance were identified in database reviews or discovered during the survey. Impacts to all previously identified heritage items will remain unchanged. As such, no European heritage items will be impacted by the proposed modification.

12.4 Management and monitoring

No additional management or monitoring measures are warranted as a result of the proposed modification.

Management and monitoring of known heritage items in the vicinity of the proposed extension will continue under MCO's Heritage Management Plan. Protocols for the identification of unknown heritage sites are contained in the Heritage Management Plan.

12.5 Conclusion

The entire project area has been the subject of previous historic heritage assessments. Additional database searches, review of relevant literature and additional surveys were undertaken to verify the relevant outcomes from the previous assessments and to support the current study.

No historic heritage items will be impacted by the proposed modification. The measures described in the Heritage Management Plan, including protocols for identification of previously unidentified sites, will be implemented to ensure the continued protection of historic heritage items.

13 Visual

13.1 Introduction

EMM prepared a visual impact assessment for the proposed modification. The associated report is given in Appendix G. The findings of the report are summarised in this chapter.

13.2 Existing environment

As part of the EAs for the Stage 1 and Stage 2 proposal, the following qualitative visual assessments were undertaken:

- Visual & Lighting Impact Assessment Moolarben Coal Project prepared by O'Hanlon Design Pty Ltd (O'Hanlon) (2006); and
- Visual & Lighting Impact Assessment Stage 2 Moolarben Coal Project prepared by O'Hanlon (2008).

The O'Hanlon (2006) visual assessment prepared for the Stage 1 EA selected 11 viewpoints considered to be representative of views to the mine activities from a particular area and/or due to the potential impact on a specific receiver. Selection of the viewpoints had regard for landscape, sensitivity of viewer location and the nature of mine activities visible from a given point.

To ensure consistency and ease of comparison between the visual impacts of the approved Stage 1 project, the EMM visual impact assessment utilised the same visual receptor locations, where still relevant to the proposed modification (refer to Figure 13.1). The impacts of the Stage 2 proposal have not been included in this visual impact assessment as the operations applicable to that proposal will not be visible from any of the viewpoints assessed for the proposed modification.

13.3 Impact assessment

13.3.1 Methodology

The visual impact assessment was based on a qualitative analysis of viewpoints which are considered to have potential to be impacted by the proposed modification, or were considered to be representative of views of mining activities at the MCP from private residences or public roads in the surrounding areas.

The methodology used in the visual impact assessment included:

- a desktop review of the viewpoints identified in previous visual assessments for operations at MCP for relevance in respect of the proposed modification;
- a visual survey involving a line of site analysis from each viewpoint to assess view type/context and determine visual absorption capacity;
- an assessment of the significance of the visual impact of the proposed modification from each of the identified viewpoints; and
- a review of mitigation measures previously employed in the original approval and subsequent modifications to determine their adequacy and whether additional measures are considered necessary.

i Visual survey

It was determined from the visual survey that two of the previously assessed viewpoints (VP10 - Moolarben Road at Moolarben Creek crossing and VP11 - Wollar Road) were not relevant to the proposed modification. However, an additional viewpoint located to the west of the Ulan settlement on Cope Road (VP 12 – Cope Road) was selected for assessment due to its potential for direct visual and lighting impacts from the proposed modification.

ii Viewpoint photomontages

Following desktop analysis, visual survey and viewpoint analysis, three locations were chosen to have photomontages prepared. These three locations were chosen as they are considered to have the greatest potential visual impact due to exposure to active mining areas and were accessible from public roads.

The photomontages demonstrate the difference between the existing visual landscape, the worst case visual impact during mining and the final landform (refer to Figures 13.2 to 13.10).

13.3.2 Viewpoint assessment methodology

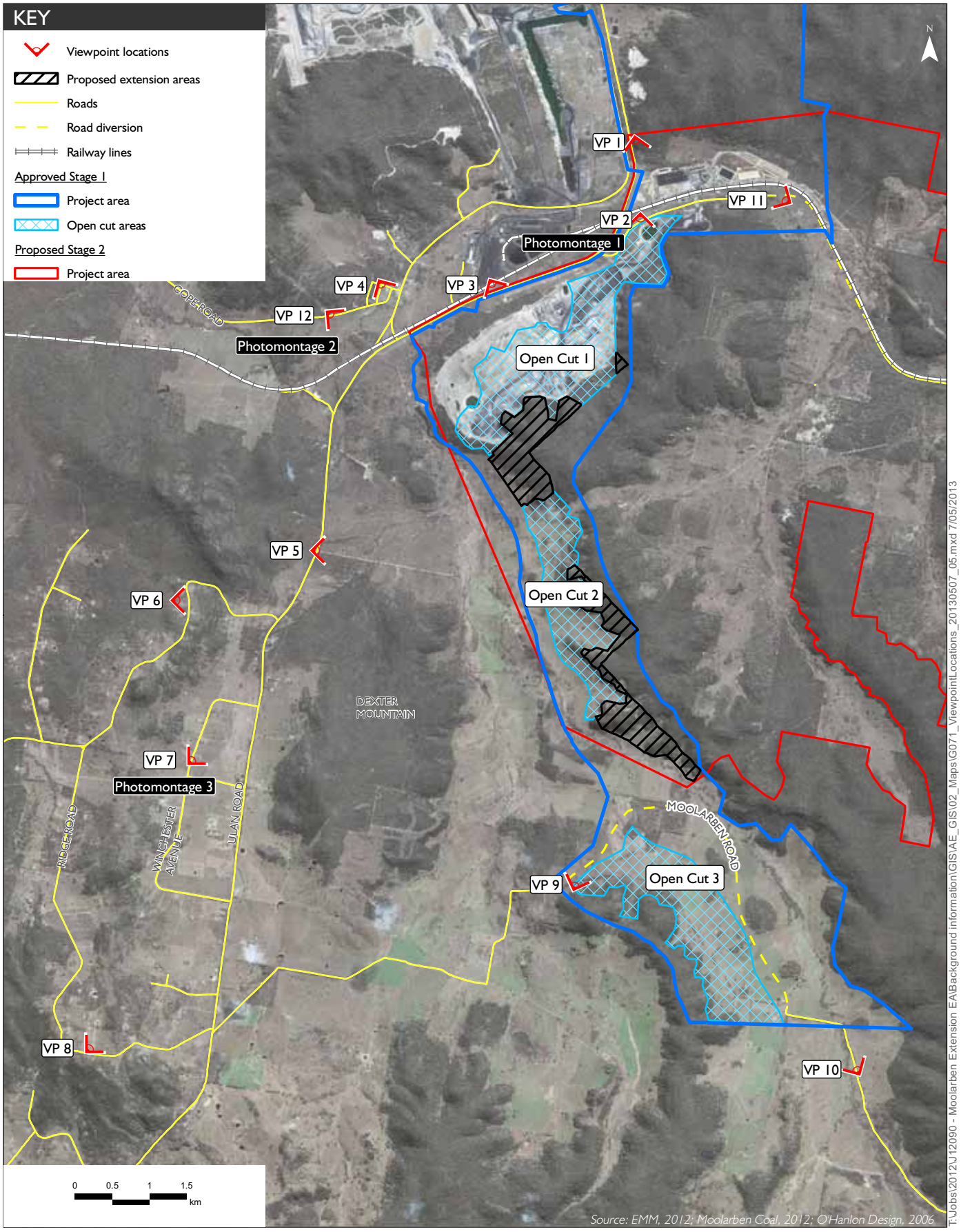
Consideration of the viewpoint type and context; an assessment of the visual impacts and the lighting impacts of the proposed modification; and an evaluation of the duration and significance of the impacts were completed for each viewpoint.

The magnitude of change on the visual landscape is an important factor in determining the significance of visual impacts from a proposal. Using criteria provided in *The Landscape Institute of Environmental Management and Assessment (2002); Guidelines for Landscape and Visual Impact Assessment*, the assessment considered the magnitude of change on the visual landscape for each of the 12 viewpoints as a result of the proposed modification. Table 13.1 illustrates how the magnitude of a change in the landscape is assessed, and its significance rated, against the sensitivity of a receptor.

Table 13.1 Evaluation of significance matrix

Magnitude of change	**Visual sensitivity**		
	High	**Moderate**	**Low**
High	Substantial	Moderate/ Substantial	Moderate
Medium	Moderate/ Substantial	Moderate	Slight/ Moderate
Low	Moderate	Slight/ Moderate	Slight
Negligible	Slight	Slight/ Moderate	Negligible

Key: Significant Not significant



Viewpoint locations

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.1

13.3.3 Assessment of visual impacts

The table below, using the sensitivity criteria in Table 13.1, provides a summary of the assessed level of visual and light impact of each viewpoint as a result of the proposed modification, prior to the implementation of suggested mitigation measures as outlined in the following Section 13.4.

Table 13.2 Assessment of significance

Viewpoint	Viewer Type	Visual sensitivity	Magnitude of change	Significance of impact
VP1 – Visual impact	Motorists	Low	Low	Slight
VP1 – Lighting impact	Motorists	Low	Negligible	Negligible
VP2 – Visual impact	Motorists	Low	Medium	Slight
VP2 – Lighting impact	Motorists	Low	Medium	Moderate
VP3 - Visual impact	Motorists	Low	Negligible	Negligible
VP3 – Lighting impact	Motorists	Low	Negligible	Negligible
VP4 – Visual impact	Residents/ motorists	Moderate	Medium	Moderate
VP4 – Lighting impact	Residents/ motorists	Moderate	Medium	Moderate
VP5 – Visual impact	Motorists	Moderate	Low	Slight
VP5 – Lighting impact	Motorists	Moderate	Low	Slight
VP6 – Visual impact	Residents	High	Medium	Moderate/ substantial
VP6 – Lighting impact	Residents	High	Medium	Moderate/ substantial
VP7 – Visual impact	Residents/ motorists	Moderate	Medium	Moderate
VP7 – Lighting impact	Residents/ motorists	Moderate	Medium	Moderate
VP8 – Visual impact	Residents/ motorists	Moderate	Negligible	Slight
VP8 – Lighting impact	Residents/ motorists	Moderate	Negligible	Slight
VP9 – Visual impact	Motorists	Moderate	Negligible	Slight
VP9 – Lighting impact	Motorists	Moderate	Negligible	Slight
VP10 – Visual impact	N/A	N/A	N/A	N/A
VP10 – Lighting impact	N/A	N/A	N/A	N/A
VP11 – Visual impact	N/A	N/A	N/A	N/A
VP11 – Lighting impact	N/A	N/A	N/A	N/A
VP12 – Visual impact	Motorists	Low	Medium	Moderate
VP12 – Lighting impact	Motorists	Low	High	Moderate

Key: Significant Not significant

Of the 12 viewpoints the majority were deemed to have slight to moderate impacts. Only one viewpoint, VP6 – Ridge Road, was deemed as having a moderate/substantial significant impact. Photograph 13.1 shows the view from VP6 looking east toward the MCP.

Photograph 13.1 View from VP6 looking east towards the MCP

VP6 is located at the northern end of Ridge Road. The most significant visual impacts from the proposed extension areas will be experienced by some residents along Ridge Road due to more direct views from this location and given there are no topographical or vegetative elements to help screen the proposed mining. At a distance of approximately six kilometres from these properties on Ridge Road to Open Cut 1, views to mining operations will be distant, albeit unimpeded.

As a consequence, viewers are likely to be exposed to workings in Open Cut 1 for a period of approximately six years, being dependent on the rate of mining. Views of mining within the proposed Open Cut 2 extension area will be present for approximately ten years for the worst effected properties, again, dependent on the rate of mining. The visual impacts of mining within the proposed Open Cut 2 extension area will progressively reduce as mining will be continually moving away from Ridge Road and the intervening topography will increasingly provide a visual barrier for private residents.

Given the potential exposure to the proposed modification and cumulative impacts for some private residents along Ridge Road, it is considered that the visual and lighting impacts of the proposed modification on those properties are moderate/substantial**.**

Photomontage 1: Existing (Ulan Road - rail overpass)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.2

Photomontage 1: Indicative Year 6 (Ulan Road - rail overpass)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.3

Photomontage 1: Indicative final landform (Ulan Road - rail overpass)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.4

Photomontage 2: Existing (Winchester Crescent)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.5

Photomontage 2: Indicative Year 11 (Winchester Crescent)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.6

Photomontage 2: Indicative final landform (Winchester Crescent)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.7

Photomontage 3: Existing (Cope Road)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.8

Photomontage 3: Indicative Year 6 (Cope Road)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.9

Photomontage 3: Indicative final landform (Cope Road)

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 13.10

13.4 Management and monitoring

Although mine planning design and staging has had consideration for minimising visual impacts of the proposed modification on private receptors, changes in the landscape and some visual impacts are unavoidable, especially in the early phases of mining prior to the commencement of rehabilitation.

The visual impact assessment developed various mitigation measures to address impacts both generally and from specific viewpoints surrounding the project area. These are consolidated below and are considered to be generally consistent with requirements and commitments associated with previous Stage 1 approvals.

Activities will be scheduled to give priority to the establishment of the most exposed faces of overburden emplacements, so that they can be stabilised and then rehabilitated as soon as practical.

13.4.1 Progressive rehabilitation

Early and progressive rehabilitation of disturbed areas is generally the most effective way of minimising visual impacts. MCO has proven through existing activities that it is committed to undertaking rehabilitation as an integral component of mining operations. MCO's approach to rehabilitation is outlined in Section 4.3.3.

13.4.2 Visual screening

Screening in the form of foreground and mid-ground tree and shrub planting is an effective way of reducing exposure of a receptor to various aspects of the mine operation and/or infrastructure. Once established, such planting provides a permanent and natural screen to the various elements of the mine from either roadways or private landholdings.

The specific areas where screen planting is recommended to occur, subject to landowner consent, are as follows:

- along the southern edge of Cope Road, where views of the proposed Open Cut 1 extension area will be possible. Quantification of the extent of planting will be confirmed on site, however, given the indicative timing of the impacts, planting should include semi-mature trees with a planted height of at least 2 m; and

- where properties on Ridge Road will have direct views from the residence to both the proposed Open Cut 1 and Open Cut 2 extension areas, MCO will investigate the feasibility of targeted vegetative planting for affected properties along Ridge Road, to mitigate the visual and lighting impacts of the proposed modification.

13.4.3 Operational screening procedures

Operational measures implemented by MCO to limit external viewers exposure to mine operations and lighting is an effective way to minimise impacts associated with the proposed modification. Where possible, MCO will implement the following measures:

- out-of-pit embankments should be built up first so that continued operation are obscured by the embankment. Outer faces of the embankments should be seeded and grassed as soon as possible to soften the view to exposed workings;

- workings on out-of-pit emplacements benches should be staged so that outer embankments are created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement. The outer perimeter should be to a height sufficient to conceal direct light spill from mobile equipment; and

- MCO will, wherever possible, maintain a strip of vegetation along the leading face of the ridgeline associated with the proposed Open Cut 1 extension area for as long as practical, to provide a visual screen to workings behind and thereby limiting the time viewers will be exposed to workings and lighting in this area. This will be undertaken wherever it can be accommodated without affecting efficient mining sequencing which would have the effect of slowing extraction and thereby prolonging visual impacts.

13.4.4 Night lighting

Operational measures will be adopted to reduce light spill generally and provide shielding from exposed work areas in the form of protocols for the use of mobile lighting plant and lighting associated with mobile mine machinery. The protocols will meet the requirements of AS 4282 – *Control of Obtrusive Effects of Outdoor Lighting* and *AS/NZS 1158 – Lighting for Roads and Public Spaces*, unless such compliance is practically impossible. In the unlikely event that any requirement cannot be met, special measures will be implemented in consultation with affected parties.

MCO will develop lighting protocols that will:

- establish operational protocols for setting up of mobile lighting plant such that lighting is directed away from external private receptors;

- establish design and operational protocols such that lighting sources are directed below the horizontal to minimise potential light spill;

- design light systems that minimise wastage; and

- avoid lighting of light coloured surfaces which have greater reflectivity.

In addition to the above, MCO will adopt the following commitments made for the Stage 1 approval for the proposed modification:

- all floodlights will be shielded in the open cut areas to the maximum extent practicable; and

- lighting will be screened to viewers where possible but will always be selected to initially meet safe working practices.

13.5 Conclusion

The proposed modification will result in both temporary and permanent changes in the visual landscape. Changes will be more prevalent in the early stages of mining prior to the full establishment of rehabilitated areas and maturation of screen landscaping.

Of the 12 viewpoints assessed as part of the visual impact assessment, only one viewpoint, VP6 – Ridge Road, was considered to have a moderate/significant visual impact. However, a number of commitments have been made that will reduce the impacts to a level that is considered acceptable.

Where operational mitigation measures are considered inadequate to reduce impacts to an acceptable level, MCO will investigate the feasibility of targeted vegetation planting to screen visual and lighting impacts on privately-owned properties along Ridge Road that have unimpeded lines of sight to the proposed extension areas. Where appropriate, impacts deemed will be of a short to medium term in nature, until vegetative screening is established. Once an effective visual screen is established, the significance of impacts in these instances will reduce to negligible.

14 Surface water

14.1 Introduction

WRM Water & Environment (WRM) prepared a surface water impact assessment for the proposed modification. The associated report is given in Appendix I. The findings of the report are summarised in this chapter.

14.2 Existing environment

14.2.1 Regional drainage network

The MCP is within the upper Goulburn River catchment. As noted in Section 2.4, the upper Goulburn River has a catchment area of approximately 2,455 km^2 to the Ulan-Cassilis Road Bridge. Moolarben Creek is a tributary of the upper Goulburn River catchment. Moolarben Creek flows in a northerly direction along the western project area boundary and joins Sportsman's Hollow Creek at the settlement of Ulan to form the headwater of the Goulburn River. Moolarben Dam is located on Moolarben Creek, approximately 1.5 km upstream of the Sportsman Hollow Creek confluence.

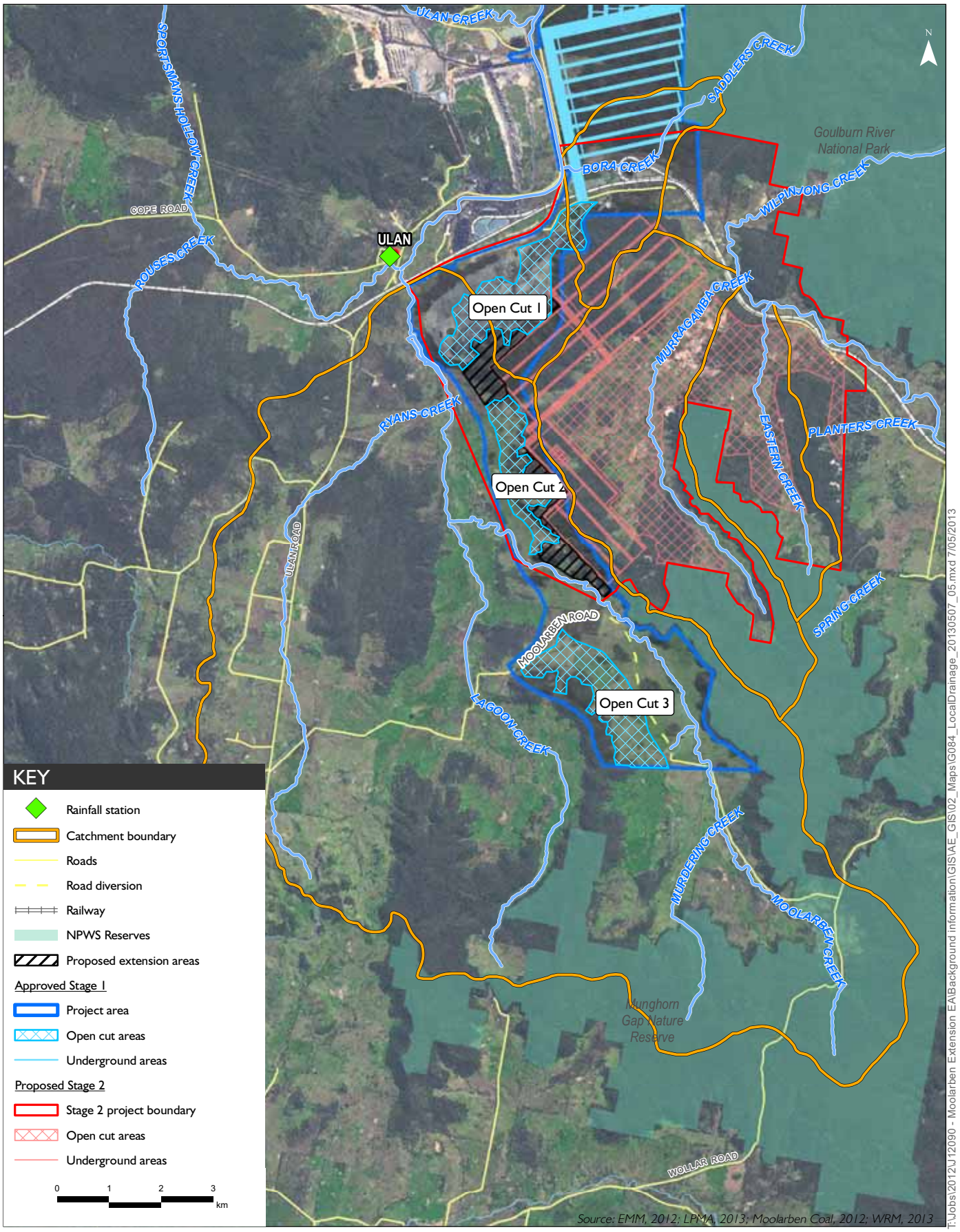
Wilpinjong Creek drains in a south-easterly direction along the eastern project area boundary and joins Wollar Creek, before joining the Goulburn River approximately 26 km downstream of the project area. The Goulburn River flows in an easterly direction, eventually joining the Hunter River approximately 150 km downstream of the project area.

14.2.2 Local drainage network

The local drainage network in the vicinity of the project area is shown in Figure 14.1. The majority of Stage 1 mining operations, including Open Cuts 1, 2 and 3, are located within the Moolarben Creek catchment which includes the Moolarben Dam, constructed in 1957 to supply water to the Ulan Power Station (decommissioned in 1968). This dam is considered to provide limited flow attenuation during large floods. The majority of the Stage 1 infrastructure area including the CHPP, product stockpile pad and the rail loop are located within the Bora Creek Catchment which is a small tributary of the Goulburn River. Moolarben Creek is an ephemeral creek that is located between 100 m and 1 km to the proposed extension areas.

There are no surface waterbodies in the proposed extension area footprints.

The majority of the mining operations proposed under Stage 2, including Open Cut 4, are located within the Murragamba and Eastern Creek catchments.



Local drainage network

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 14.1

14.2.3 Rainfall and evaporation

Daily rainfalls have been recorded at the 'Ulan Water' rainfall station located at the Ulan Post Office (BoM Station No. 062036), about 1 km from the project area, since 1906. In order to extend the rainfall dataset for the water balance calculations, a synthetic rainfall dataset was also obtained using the Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA's) Data Drill service (Jeffrey et al. 2001). Mean annual rainfalls from the BoM (Ulan Water) rainfall station and Data Drill, as well estimated evaporation from Data Drill, are presented below.

BoM - Ulan Water Station – Mean annual rainfall (1906 to 2012)	639 mm
Data Drill - Mean annual rainfall (1889 to 2012)	633 mm
Data Drill - Mean annual pan evaporation (1889 to 2012)	1,421 mm

14.2.4 Streamflow

The nearest NOW streamflow gauging station is in the Goulburn River at Coggan (gauge no. 210006), located approximately 70 km downstream of the project area. MCO has collected streamflow data between February and October 2010 at three monitoring sites: Moolarben Creek at Ulan-Cassilis Road (SW05), Bora Creek at Ulan-Cassilis Road (SW11) and Wilpinjong Creek at Red Hill (SW15). Streamflow monitoring has also been conducted at Moolarben Dam, with data available from October 2011. The recorded flow data for Moolarben Creek at Moolarben Dam is presented in Figure 14.2. Figure 14.3 shows water quality monitoring locations.

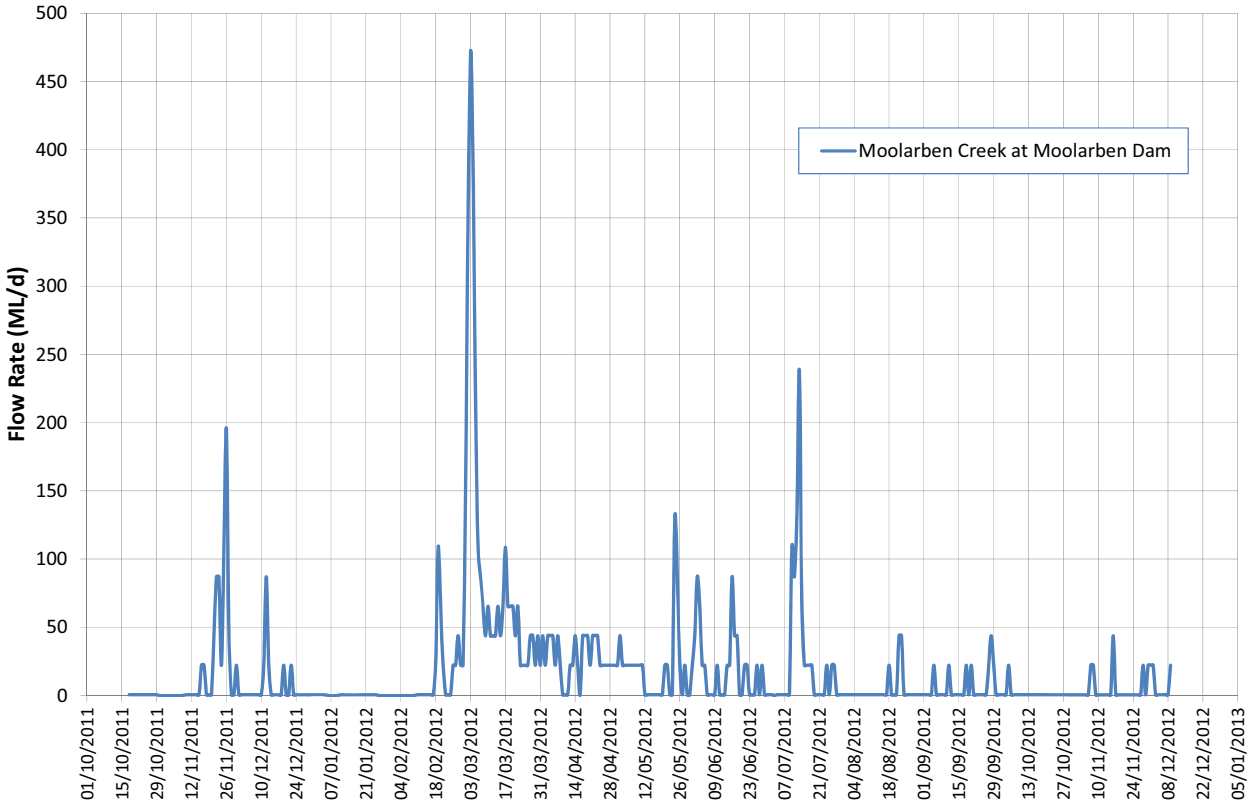


Figure 14.2 Recorded streamflow data, Moolarben Creek at Moolarben Dam

14.2.5 Surface water quality

i Overview

MCO has undertaken a water quality monitoring program since 2005 at various locations, including on-site dams and receiving waters. A summary of the water quality sampling results for dams and receiving waters is presented in the following sections.

ii On-site dams

The dams at MCP are generally classified as mine water dams or sediment dams. Mine water dams hold mine affected water, including pit water and tailings return water. Sediment dams capture runoff from disturbed areas such as spoil dumps and rehabilitation, but not mine affected water. This is reflected in the water quality observed in each of the two storage types.

Review of monitoring data from three mine water dams and eight sediment dams indicates the following:

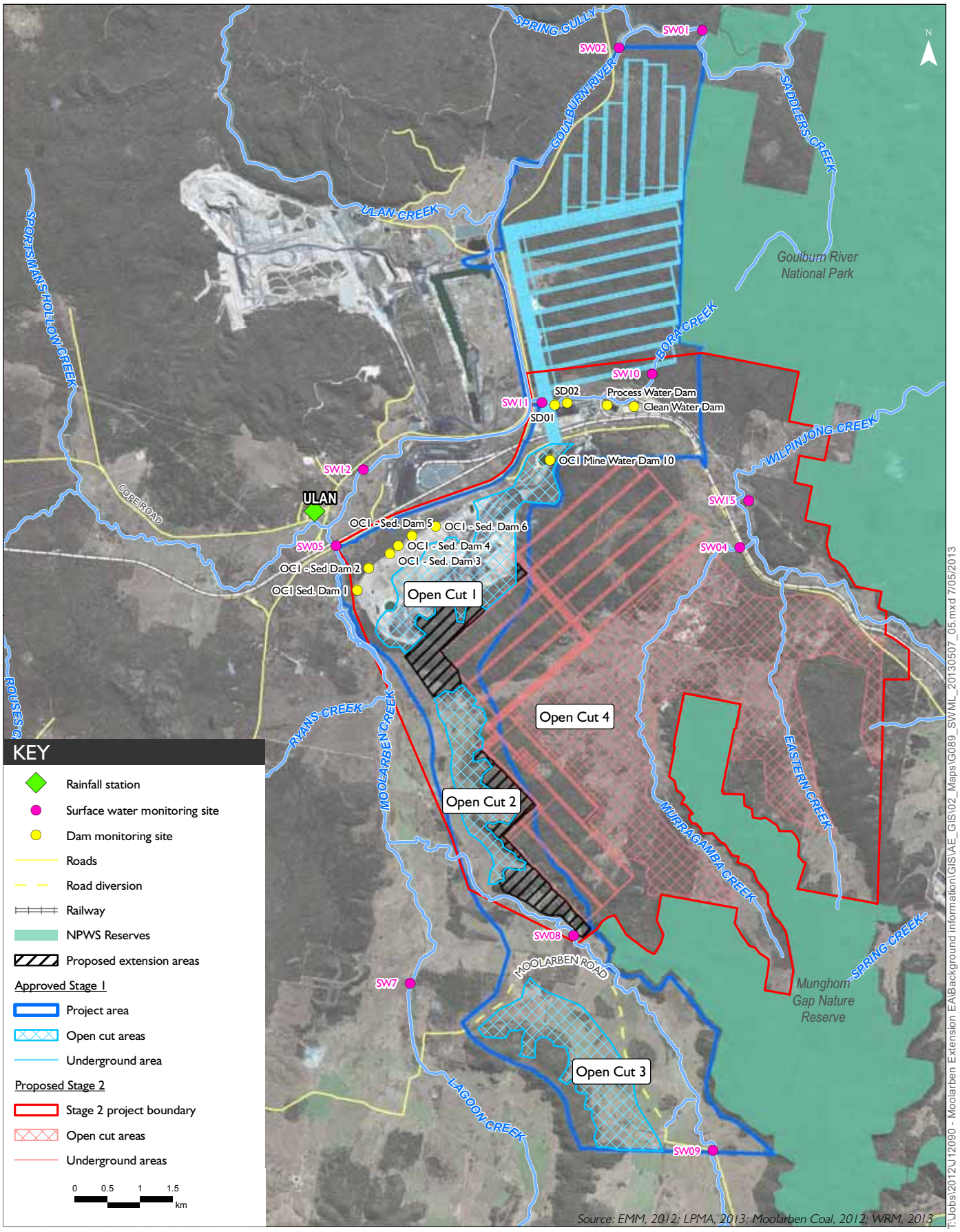
Mine water dams

- pH readings range between 3.6 and 8.5, with average readings between 5.3 and 7.1;
- Electrical Conductivity (EC) readings range between 70 and 2,420 µs/cm, with average readings between 500 and 1,700 µs/cm; and
- Total Suspended Solids (TSS) readings range between 2 and 140 mg/L, with average readings between 5 and 34 mg/L.

Sediment dams

- pH readings range between 5.3 and 7.3, with average readings between 5.3 and 7.2;
- EC readings range between 95 and 890 µs/cm, with average readings between 180 and 890 µs/cm; and
- TSS readings range between 5 and 11,310 mg/L, with average readings between 16 and 8,474 mg/L.

Note that average readings relate to the readings at a given dam, so a range of averages gives the spectrum of averages across the dams that were monitored.



Surface water monitoring locations

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 14.3

iii Receiving waters

In accordance with MCO's WMP, the pH, EC, TSS and total dissolved solids (TDS) levels in the receiving watercourses are monitored on a monthly basis. Additional samples are also taken from these locations following rainfall events larger than 30 mm over a 24-hour period.

Additional parameters: copper (Cu), lead (Pb), zinc (Zn), nickel (Ni), iron (Fe), manganese (Mn), arsenic (As), selenium (Se), cadmium (Cd), chromium (Cr), lithium (Li), barium (Ba), and strontium (Sr) are monitored on a six-monthly basis.

Comparison of the recorded baseline monitoring data with ANZECC (2000) trigger values has been undertaken and is discussed below. ANZECC (2000) recommends that wherever possible site-specific data is used to define trigger values for physical and chemical factors which can adversely impact the environment. However, the default values provided by ANZECC (2000) can be used where there is insufficient baseline data available. Trigger values are not regarded as assessment criteria; rather they are used to initiate investigations into the surface water quality as reported by the monitoring program.

Review of the baseline monitoring data indicates that the receiving waters around the project area have water quality attributes as follows:

- slightly acidic, with minimum pH readings as low as 4.4, median readings between 6.3 to 7.1, and maximum readings of up to 8.8;
- generally fresh, with ECs ranging from 10 to 2,520 µS/cm, with a median value between 70 and 1,020 µS/cm, with the exception of the upstream monitoring points on Moolarben Creek and Lagoon Creek (SW07, SW08 and SW09). These sites have median EC concentrations of up to 3,900 µS/cm;
- TDS, calcium, sulphate, sodium, chloride levels mostly below the ANZECC trigger values, with the exception of the upstream locations SW07, SW08 and SW09;
- magnesium levels below the ANZECC trigger value, with the exception of the upstream locations SW07, SW08 and SW09;
- turbidity generally exceeds the turbidity ANZECC trigger values, with the exception of SW7 and SW10; and
- total nitrogen and total phosphorus generally exceed the ANZECC trigger values.

In general, the water quality parameters are fairly consistent between the upstream and downstream waterway monitoring locations. However, almost all of the water quality parameters at the upstream monitoring locations on Moolarben Creek and Lagoon Creek (SW07, SW08, SW09) are elevated in comparison to the other locations. On this basis, the water quality results indicate that the existing operations are not adversely affecting the quality of receiving waters.

14.3 Impact assessment

14.3.1 Methodology

Relevant literature, databases and surface water models were reviewed to gain a detailed understanding of the regional and local surface water environment. The information review informed the development of the surface water assessment scope and the preparation of a risk assessment based on the preliminary mine design. As an outcome of the risk assessment, the mine design was modified to ensure no disturbance of Moolarben Creek or its floodplain.

The potential for increase in site water demand under the proposed modification is an important consideration in the assessment of surface water impacts. Previous investigations of the site water balance have been undertaken using several different methodologies and models. A water balance assessment was previously undertaken by Worley Parsons (WP, 2012) for the water management strategy as part of the Stage 2 proposal, and it also formed the basis of the water balance modelling for the Stage 2 PPR. As such, it was based on different production rates and site demands than those adopted for the proposed modification.

A new site water balance model was developed for the proposed modification using the OPSIM software which incorporated the revised configuration of the site water management system and proposed water demands. The water balance model includes the Stage 2 proposal as documented in the Stage 2 PPR.

The OPSIM model provides a high level of flexibility in assessing the behaviour of the site water management system under a wide range of climatic conditions. Full details of the methodology and results of the water balance modelling are provided in Section 5 of the WRM 2013 report. The modelled results for surface water parameters, such as site water inventory, correlate well with actual measurements, as illustrated in Figure 14.4.

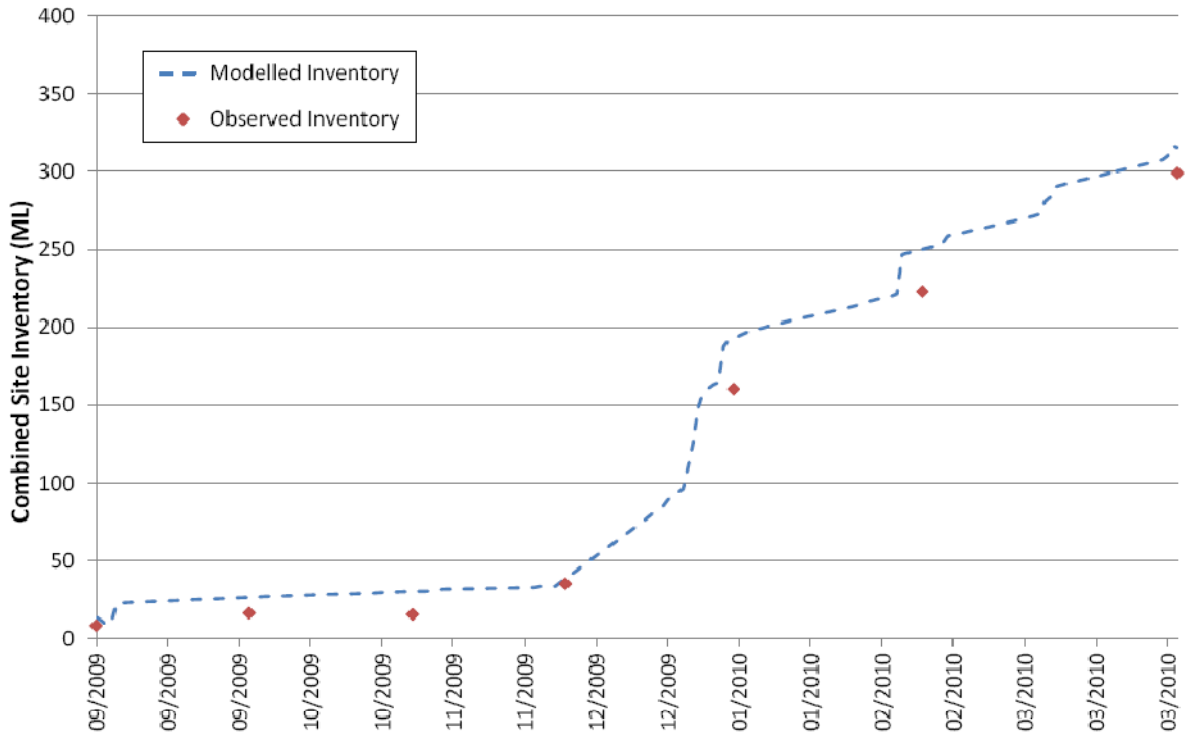


Figure 14.4 Comparison of modelled and observed combined site inventory

Two separate models (with and without the modification) were developed to assess the impacts of the proposed modification on the surface water system. In order to accurately represent the overall performance of the water management system, both models included mining development and infrastructure associated with the Stage 2 proposal.

14.3.2 Predicted surface water impacts

An assessment of the potential impacts of the proposed modification, based on the methodology outlined above, is provided in the following sub-sections.

i Mine site water requirements

The proposed modification will increase the site water demand to 200 ML/year (on average) as a result of the additional dust suppression demand. The maximum annual imported water requirement, taking into account the total site demand including the proposed modification is around 1,940 ML/year. Note that this maximum annual volume includes the combined site demands associated with Stage 1, the proposed Stage 1 modification, and the Stage 2 proposal. MCO currently has access to the following external water sources:

- Surplus mine water from the Ulan Coal Mine through a water sharing agreement (Ulan Water Sharing Agreement - UWSA) – obligation to take a minimum of 1,000 ML/year with no defined upper limit;
- Northern borefields – up to 2,400 ML/year; and
- Southern borefields – up to 450 ML/year.

On this basis, the maximum external water requirement can be satisfied from current water sources (UWSA and borefields).

ii Surface water quality

Water on the mine site will consist of:

- runoff from undisturbed area (clean runoff);
- runoff from disturbed areas (sediment-laden runoff); and
- water that has been affected by contact with coal or other potential contaminants (mine water).

Wherever possible, clean runoff will be diverted around disturbance areas using diversion drains. This will minimise the volume of water collected in onsite storages and also minimise the impacts on downstream catchments.

Sediment-laden runoff will be collected and settled in sediment dams. If the quality of this water is not suitable for release to receiving waters, it will be pumped back into the mine water management system. This water will only be released from site in accordance with the EPL.

The mine water management system will be operated to fully contain mine water on the mine site and to preferentially reuse this water to meet mine site demands. The results of the mine water balance modelling show that under the full range of historical rainfall conditions, the proposed mine water management system will have sufficient capacity to contain all mine water on the site without uncontrolled releases.

iii Loss of catchment area

The additional disturbance area associated with the proposed modification removes some of the catchment draining to Moolarben Creek. The loss of catchment area has been calculated at 1.1% of the Moolarben Creek catchment area. Such a small reduction in catchment area will have a negligible impact on the flow characteristics of the ephemeral Moolarben Creek.

iv Impact on Moolarben Creek flooding

A detailed flood study of Moolarben Creek was undertaken as part of the Stage 1 EA (Parsons Brinkerhoff (PB) 2006a). The proposed modification will extend Open Cut 2 to the south, adjacent to the Moolarben Creek floodplain. As noted in Chapter 7 (Table 7.2), the mine design was modified during its development to ensure no impact to Moolarben Creek or its floodplain from the mine. Figure 4.1 of Appendix I shows the 100 year ARI flood extent for Moolarben Creek in relation to the nearest proposed area to be mined under the proposed modification. The proposed extension area is clearly above the extent of flooding and hence the proposed modification will have no additional impact on flood behaviour in Moolarben Creek up to the 100 year ARI flood event.

14.4 Management and monitoring

Surface water impacts associated with Stage 1 operations are managed under MCO's WMP, developed in consultation with NOW, OEH, and DTIRIS. The primary objectives in respect of surface water of the WMP are to:

- ensure that the water quality leaving the mine site meets the appropriate quality standards under the EPL;
- define the structures, strategies and procedures to be implemented to ensure that all environmental impacts associated with site water management are minimised;
- define a program to monitor and assess impacts on surface water;
- define how the mine will mitigate and respond to potential impacts from mining activities on surface water;
- divert upslope clean surface water runoff around disturbed areas where feasible;
- maximise the reuse of treated dirty water onsite;
- maximise water sharing with other mines; and
- ensure that groundwater make is stored and treated on-site and re-used as needed.

The WMP includes a Surface Water Monitoring Program and a Surface Water Response Plan that provide guidance on the monitoring and management for the surface water management system, including details of management response actions.

The proposed modification results in an additional imported water requirement of 200 ML/year (on average), with a maximum total requirement of around 1,940 ML/year. MCO will maintain its existing UWSA and borefield supply, in accordance with the WMP, and it has the ability to access additional water under the UWSA.

The WMP and relevant sub-plans will be reviewed and updated as required to accommodate the proposed modification.

14.5 Conclusion

The proposed extension areas have been designed to be offset from the ephemeral Moolarben Creek and its floodplain. There are no surface water bodies within the proposed extension area footprints.

The proposed modification will remove a small area of catchment draining to Moolarben Creek, namely 1.1% of the Moolarben Creek catchment area. However, this small reduction in catchment area will have a negligible impact on the flow characteristics of Moolarben Creek.

The water balance model shows that an additional 200 ML/year (on average) of imported water is required to sustain site demands, as a result of the proposed modification. A total maximum of approximately 1,940 ML/year, including the proposed modification, approved Stage 1 operations and Stage 2 proposal, is modelled to be required. This maximum external water requirement can be satisfied from current water sources (UWSA and Northern and Southern Borefields). This will ensure no adverse impacts on water availability for other licensed water users.

The mine water balance model also shows that under the full range of historical rainfall conditions, the proposed mine water management system will have sufficient capacity to contain all mine water on the site without uncontrolled releases, when operated in accordance with the proposed release conditions specified in MCO's EPL. The proposed mine site water management strategy and infrastructure will ensure that the proposed modification has a negligible impact on the quality of surface runoff and receiving waters. The existing receiving water quality data indicates that the current operation has had no measurable impact on receiving water quality.

The potential impacts which result from the proposed modification will be managed under the existing surface water management system and in accordance with the WMP. The WMP and relevant sub-plans will be reviewed and updated as required to accommodate the proposed modification.

15 Groundwater

15.1 Introduction

Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) prepared a groundwater impact assessment for the proposed modification. The associated report is given in Appendix J. The findings of the report are summarised in this chapter.

15.2 Existing environment

15.2.1 Groundwater investigations to date

Extensive groundwater investigations have been undertaken for the Stage 1 and Stage 2 EAs. Information from these investigations has been applied to the groundwater assessment for the proposed modification. Field investigation programs for Stage 1 and Stage 2 have included the following:

- installation of over 100 groundwater monitoring bores and test production bores;
- monitoring of groundwater levels and water quality;
- collection of data on privately-owned groundwater bores, natural springs, soaks and seepages; and
- testing of aquifer properties such as permeability.

Additionally, hydrogeological reports in the public domain produced for the Ulan and Wilpinjong Coal Mines have been reviewed for pertinent information.

As a result of previous groundwater investigations, regional and local groundwater systems are well understood.

15.2.2 Geological setting

The topography and drainage of the project area and the surrounds are described in Section 2.4 and a general overview of geology and soils is described in Section 2.6.

Specifically, in relation to the elevated areas surrounding the project area and parts of the proposed extension areas, groundwater levels are relatively deep and this means there is limited saturated thickness in some of these areas. The elevated areas have steeper gradients along the creek lines that reduce the deposition of sediment, with alluvial aquifers largely limited to the lower lying landscape to the west of the project area adjacent to Lagoon Creek, Moolarben Creek and the Goulburn River.

The geology of the project area and surrounds is shown in Figure 2.2 and comprises predominantly the Permian Illawarra Coal Measures and to a lesser extent the Narrabeen Group. No alluvium is present within or proximal to the proposed extension areas.

Drilling data from the Stage 1 and Stage 2 EAs indicate that the weathered profile varies in depth from around 4 m to 18 m, but is generally restricted to depths of less than 10 m. Along valley floors, in the south and central south parts of the project area, the coal measures have been eroded and overlain by Tertiary palaeochannel deposits comprising dominantly alluvium. Palaeochannel deposits have been intersected during Stage 1 pit development. In places, these palaeochannel deposits have been eroded and superimposed by more recent weathering and Quaternary sedimentation associated with the Moolarben and Lagoon creeks and the Goulburn River.

The Quaternary alluvium occurs in association with, and is connected to, the present day streams and rivers; whereas the Tertiary alluvium occurs in a palaeochannel system that is not coincident with the present drainages, and is generally considered hydraulically disconnected from them. On the western margin of the project area the Carboniferous Ulan Granite basement outcrops. As shown in Figure 2.2 mapped Quaternary alluvium is not present within reaches of the Moolarben Creek. The proposed extension area has greater than 170 m separation from alluvium to the west and greater than 300 m separation from alluvium to the south.

Marine sediments of the Shoalhaven Group (fine-grained silty sandstones), have been intersected in some drill holes in the southern part of the project area. The Ulan Granite outcrops extensively directly to the west of the MCP.

15.2.3 Hydrogeological setting

The hydrogeology of the project area and surrounds has been extensively investigated in previous Stage 1 and Stage 2 studies. The proposed modification is located within an area between Stage 1 open cuts and Stage 2 underground and open cuts, meaning the results from the previous modelling are applicable to this study. Based on recent monitoring results, the predictions of the previous modelling studies are validated. Recent groundwater level data has been studied from relevant monitoring bores in the area of the proposed modification. In the context of the proposed modification the most relevant points to note are:

- the Ulan Seam is the only geological unit that could be termed an aquifer within the sequence that may discharge to, or be impacted by, the proposed modification. Permeabilities within the Ulan Seam are generally one to two orders or more higher than other underlying and overlying formations (for example, Permian and Tertiary deposits);

- groundwater is present to varying extents of saturation within overlying Permian and Triassic deposits, however, these deposits are generally not considered to contain aquifers due to the low permeability and storage capacity of the material;

- groundwater is present within Tertiary palaeochannel deposits with minor seeps noted when this channel was encountered during Stage 1 pit development. Field observations indicate that the limited storage and transmissive capacity of these deposits results in seeps drying up soon after excavation;

- in a large proportion of the proposed extension area between Open Cut 1 and parts of Open Cut 2, the mined formations are elevated in the landscape, with the floor of the Ulan Seam ‘dry’ before mining commenced;

- dewatering of the Ulan Seam and overlying formations prior to development of the MCP, is evident from historical groundwater level monitoring data and supported by Stage 1 and Stage 2 model calibrations. Negligible impact to date on groundwater levels is evident from current mining operations in Open Cut 1. There have not been any measurable inflows of groundwater to Open Cut 1 during current operations;

- the groundwater within the project area is generally brackish and the main beneficial use is for stock watering; and

- groundwater is present within thin heterogeneous alluvial deposits associated with Moolarben and Lagoon Creeks with moderate salinity and low potential yields. Connection from the alluvium to the proposed extension area is considered to be limited due to the low permeability of the sediments and the presence of a granitic basement.

The permeability and storativity of the Permian coal measures within the project area is variable. Permeability is generally higher in the coal seams, but is occasionally enhanced within the interburden sediments (generally sandstone, siltstone and mudstone) due to localised fracturing. As stated above, the Ulan Seam is an aquifer. The interburden sandstones, siltstones and mudstones are of significantly lower permeability than the Ulan Seam (by one or more orders of magnitude) and they generally act as aquitards. The sandstones of the overlying Triassic Narrabeen Group and the underlying Shoalhaven Group have been shown by the field investigations to have poor aquifer properties.

15.2.4 Groundwater quality

Groundwater quality across the project area is variable in terms of salinity and pH (RPS Aquaterra 2011). TDS concentrations vary considerably, with recorded values ranging from less than 200 mg/L to more than 11,000 mg/L. Recorded pH values indicate the majority of groundwater to be mildly acidic, with pH values typically around 5 to 6 although the total range is 5.0 to 8.5.

Laboratory analyses indicate moderately elevated concentrations of dissolved metals in groundwater across the project area. Major ion analysis is of a broadly similar type being typically dominated by sodium and potassium cations, and a combination of carbonate / bicarbonate and chloride anions (RPS Aquaterra 2011).

15.2.5 Existing groundwater users

The NOW groundwater database indicates 130 registered bores and wells within 10 km of the project area. The closest of these bores, located to the west and south-west, are installed within groundwater bearing strata distant to the proposed modification. There are no private water bores (other than those owned by MCO) in close proximity to the project area that would have the potential to be impacted by the proposed modification.

15.2.6 Groundwater Dependent Ecosystems

As noted in Chapter 10, 'The Drip', an important local seepage feature located approximately 6 km north of the proposed extension areas, represents the only significant seep/spring GDE within the locality. The Drip is a spring sourced from seepage from Triassic sediments located to the north of the Goulburn River and the proposed modification. The proposed modification is assessed to have no impact on The Drip.

15.2.7 Licensing

MCO holds licences under Part 5 of the Water Act which entitle MCO to take the following volumes of groundwater from the Permian formations (ie non Water Storage Plan managed water sources):

- up to 150 ML/ year mine dewatering water licence. This licensed amount equates to the maximum predicted inflows from the latest Stage 2 modelling (RPS Aquaterrra 2011). This license currently apples to Open Cut 1 only; and
- 2,850 ML/ year from the southern and northern borefields.

It is noted that maximum pit inflows simulated from Stage 2 modelling include Stage 1.

Licence allocations on Water Sharing Plan water sources are being finalised for the Stage 2 application. The purchase of a water license for 218 ML/year from the Wollar Creek water source has recently been finalised. MCO is in the process of purchasing a water licence for 9 ML/year from the Goulburn River water source to account for predicted reductions in baseflow as a result of Stage 1 and Stage 2 operations on this water source. Stage 2 modelling simulated an impact on the water source at a maximum of 7 ML/year with the additional 2 ML/year accounting for security of supply and minor increases in baseflow reduction due to the proposed modification.

15.3 Impact assessment

15.3.1 Methodology

A semi-quantitative assessment was undertaken to determine the potential impacts of the proposed modification. The study drew upon previous groundwater investigations and up-to-date monitoring data to make predictions of the effects of the proposed extension areas on the groundwater regime. The study included:

- a review of previous groundwater investigations;
- site investigations and observations;
- a groundwater risk assessment;
- importing calibration and predictive data sets from previous numerical models into GIS;
- comparing previous conceptual models, numerical models and predictive results against up-to-date groundwater level data;
- confirming that previous numerical models were fit for use in the groundwater study;
- determining if previous predictions apply to the proposed modification and using hydrogeological principles to infer effects on the wider groundwater environment; and
- an assessment against the recently introduced Aquifer Interference Policy (AIP).

The initial data review indicated that the proposed modification will be in areas that are either unsaturated or partially saturated and which have similar hydraulic characteristics to those already assessed. The initial data review also indicated that the previous numerical models had been gradually refined over time as new data was collected, had been subject to both peer and independent reviews, and were showing good agreement with field data. Further numerical modelling was therefore not considered warranted for the study.

15.3.2 Predicted groundwater impacts

Predicted groundwater impacts are set out below. These are based on the application of the methodology outlined above.

i Mine inflows

Mine inflows for the majority of the proposed modification are likely to be within the same ranges as those predicted for the approved Stage 1 project. A large proportion of the proposed extension areas are within landscapes that are 'dry' or contain limited saturated thickness of groundwater above the base of the Ulan Seam. The main Stage 1 model used for project approval presents the conservative potential inflows and associated impacts. It is considered any groundwater impact from the proposed extension areas would already be accounted for in the modelled predictions for Stage 1.

Based on Stage 2 model predictions (which includes Stage 1), inflows into the proposed extension areas for the indicative Year 2 open cut mine plan will be 220 m^3/day. As Open Cut 1 advances further down-dip to the north-east, as per the indicative Year 6 open cut mine plan, inflows will increase progressively to 413 m^3/day. Inflows for indicative open cut mine Year 11 to Year 16 as the pit extends to Open Cut 2 are estimated from Stage 2 predictions to be 58 m^3/day to 27 m^3/day. Towards the end of mining, as in the indicative mine Year 21 open cut scenario, groundwater inflows are considered to remain within the predicted range from previous modelling (27 m^3/day). As pits will be progressively backfilled, no increase is expected in pit inflows, rather a continuation of inflows at previously modelled inflow rates. Therefore, no additional licensing is required.

ii Piezometric levels

Minor changes are expected to the piezometric (water pressure) levels in response to the proposed modification, although these are anticipated to be within the margin of error for the current numerical models. Figure 15.1 shows existing and predicted piezometric levels in the Ulan Seam through a typical cross section ('AA' Figure 15.1) of the proposed extension area and Open Cut 1.

iii Groundwater users

The closest bores to the proposed modification that are used by others are installed within groundwater bearing strata distant to the proposed modification. These bores will not be affected by the proposed modification.

iv GDEs

The proposed modification will have a nil impact on the 'The Drip', the only significant seep/spring GDE within the locality. It is noted that Stage 2 groundwater modelling predicted nil impact on The Drip due to its relative distance from and limited hydraulic connection. The proposed modification will not change the groundwater drawdown in the vicinity of The Drip. Therefore, there will be no impact on vegetation supported by The Drip.

v Moolarben Creek flows

As described in Section 2.4, the proposed extension areas are within the Moolarben Creek catchment. No quaternary alluvium will be intersected, as shown on Figure 2.2 and supported by bore data. The proposed extension areas have greater than 170 m separation from alluvium to the west and greater than 300 m separation from alluvium to the south. The alluvium that is present is expected based on drilling information to be less than 15 m in thickness and dominated by clay and silt deposits.

Previous modelling concluded that mining would have a maximum effect of 5.5 ML/year reduction in baseflow in Moolarben Creek and a total maximum effect of 7 ML/year for Goulburn River water supply (including Moolarben Creek). There will be negligible further impact on Moolarben Creek and negligible alluvial water take from the proposed modification.

vi Licensing

MCO holds an existing water licence for up to 150 ML/ year to account for predicted inflows to mine pits to account for take from the Permian Coal Measures. This entitlement will be transferred to Open Cuts 2 and 3 as mining progresses. As there is no predicted increase in pit inflows due to the proposed extension, the 150 ML/ year licence will remain adequate.

As discussed in Section 15.2.7 above, impacts from the MCP (Stage 1, proposed modification and Stage 2) on Water Sharing Plan water sources are all within licensed allocations being finalised for the MCP complex. MCO is in the process of purchasing a further water licence for 9 ML/year from the Goulburn River water source to account for predicted reductions in baseflow as a result of Stage 1 and Stage 2 operations. Stage 2 modelling simulated an impact on the water source at a maximum of 7 ML/year with the additional 2 ML/year accounting for security of supply and minor increases in baseflow reduction due to the proposed modification.

vii Aquifer Interference Policy

a. Overview

Although an interference approval is not required for the proposed modification, the proposed modification has been assessed against the NSW AIP (NSW Department of Primary Industries – Office of Water 2012).

The Aquifer Interference Policy states that '*all water taken by aquifer interference activities, regardless of quality, needs to be accounted for within the extraction limits defined by the water sharing plans. A water licence is required under the WM Act (unless an exemption applies or water is being taken under a basic landholder right) where any act by a person carrying out an aquifer interference activity causes:*

- *the removal of water from a water source; or*
- *the movement of water from one part of an aquifer to another part of an aquifer; or*
- *the movement of water from one water source to another water source, such as:*
  - *from an aquifer to an adjacent aquifer; or*
  - *from an aquifer to a river/lake; or*
  - *from a river/lake to an aquifer.'*

Predictions need to be carried out to assess the likely volume of water taken from a water source(s) as a result of an aquifer interference activity. These predictions need to occur prior to project approval. After project approval and during operations these volumes need to be measured and reported in annual reviews of environmental data. The water access licence must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

The Policy states that a water licence is required for the aquifer interference activity regardless of whether water is taken directly for consumptive use or incidentally. Activities may induce flow from adjacent groundwater sources or connected surface water. Flows induced from other water sources also constitute take of water. In all cases, separate access licences are required to account for the take from all individual water sources.

In water sources where water sharing plans do not yet apply, an aquifer interference activity that takes groundwater is required to hold a water licence under the Water Act. It is possible for the Water Act to apply in a groundwater source and the WM Act to apply in a connected surface water source or vice versa. Where this occurs and the aquifer interference activity is taking water from both water sources then licences will be required under each Act.

In particular, the Policy describes minimal impact considerations for aquifer interference activities based upon whether the water source is highly productive or less productive and whether the water source is alluvial or porous / fractured rock in nature. In general the policy applies a predicted 2 m drawdown maximum limit at existing groundwater users.

Highly productive aquifers are termed with TDS less than 1,500 mg/L contains water supply works that can yield water at a rate greater than 5 L/sec. Less productive aquifers are termed with TDS more than 1,500 mg/L and water supply works that can yield water at a rate less than 5 L/sec.

b. Assessment against policy

Based on the AIP the groundwater system impacted by the proposed modification can be separated into two systems, as follows:

- porous and/or fractured consolidated sedimentary rock of the Permian Coal Measures and overlying Triassic sequence; and

- groundwater within alluvium associated with Moolarben Creek.

Water quality and yields vary in both groundwater systems, but can be considered less productive aquifers according to the AIP. The AIP requires that aquifer interference activities do not induce a decline of more than 2 m in the water table or water pressure at any water supply work, i.e. a bore or a well in both highly and less productive groundwater sources. No private bores are captured within the zone of drawdown indicating the proposed modification complies with this requirement of the AIP.

To protect surface water the AIP requires ‘no increase of more than 1% per activity in the long term average salinity in a highly connected surface water source at the nearest point to the activity’. Dewatering due to pit development is expected to reduce the volumes of baseflow to local streams as has been previously assessed and approved. MCO seeks hence to account for this take. This effectively reduces the discharges of more saline groundwaters into the streams and, therefore, it is considered improbable that the proposed modification would increase the stream salinity.

Water licensing under the AIP has been covered by the following:

- inflows to the proposed modification from the Permian to Triassic formations is not expected to be greater than previously simulated (refer to Section 15.3.2 i). A current water license (20BL172300) for 150 ML/year is held by MCO to account for groundwater inflows to pits (refer to Section 15.3.2 vi). No further water licences are necessary to account for this take according the AIP; and

- the ephemeral Moolarben Creek and the minor associated alluvium is the only water course and alluvial aquifer that requires assessment against the AIP. The Stage 2 modelling predicted the maximum take from the Moolarben Creek baseflow to be 5.5 ML/year. MCO is in the process of purchasing 9 ML/year from the Upper Goulburn Water supply (refer to Section 15.3.2 vi). This license will account for impacts predicted for Stage 1 and the Stage 2 proposal and the proposed modification.

A WMP, including a groundwater monitoring regime, is implemented at the MCP. This monitoring regime, discussed further in Section 15.4 below, will confirm the accuracy of modelled predictions or otherwise.

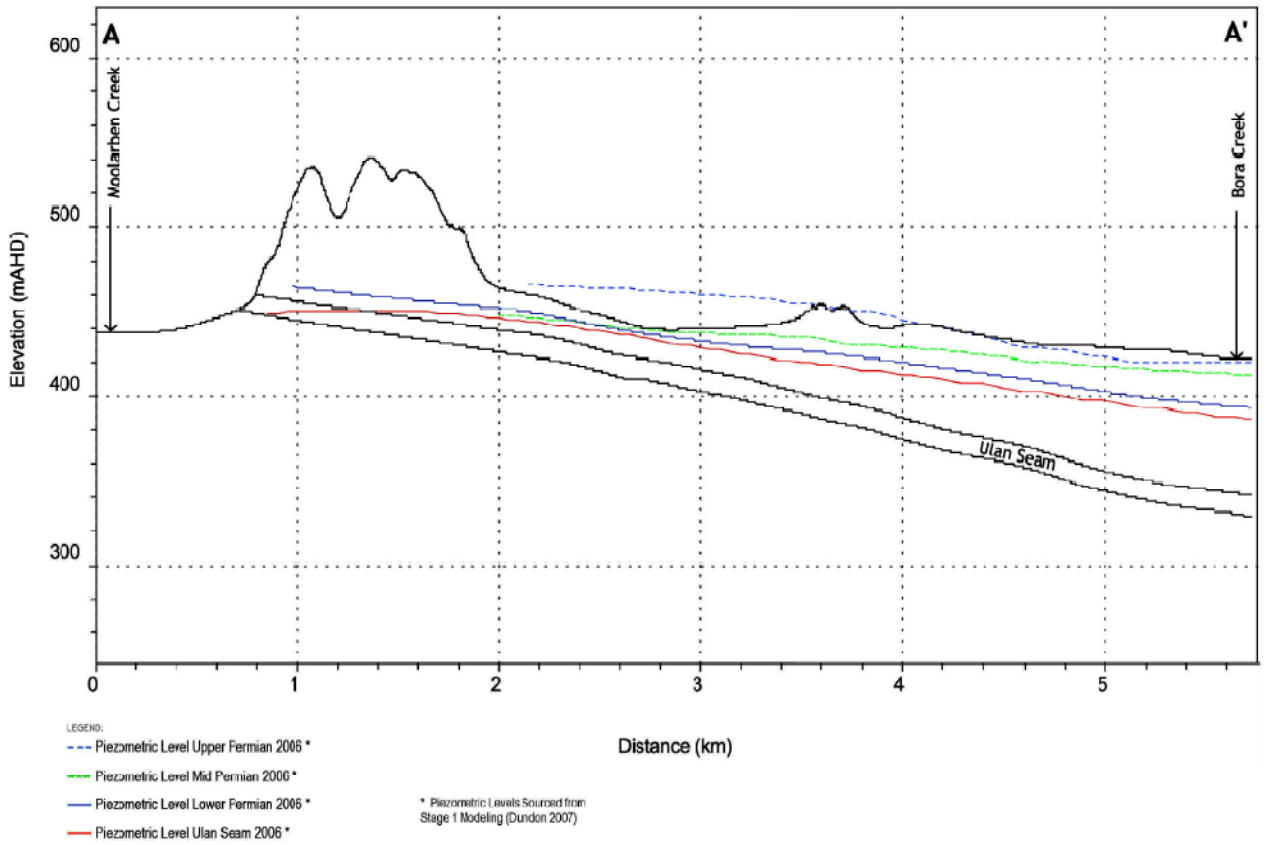


Figure 15.1 Piezometric levels in the Ulan Seam

15.4 Management and monitoring

Groundwater impacts associated with Stage 1 operations are managed under MCO's WMP, developed in consultation with NOW, OEH and DTIRIS. The objectives of the WMP for groundwater comprise:

- instituting a program to monitor and assess groundwater impacts;
- defining how the mine will mitigate and respond to potential impacts from mining activities on groundwater; and
- ensuring that groundwater make is stored and treated on-site and re-used as needed.

The WMP includes a Groundwater Response Plan that provides details of management response actions.

The WMP and relevant sub-plans will be reviewed and updated as required to accommodate the proposed modification.

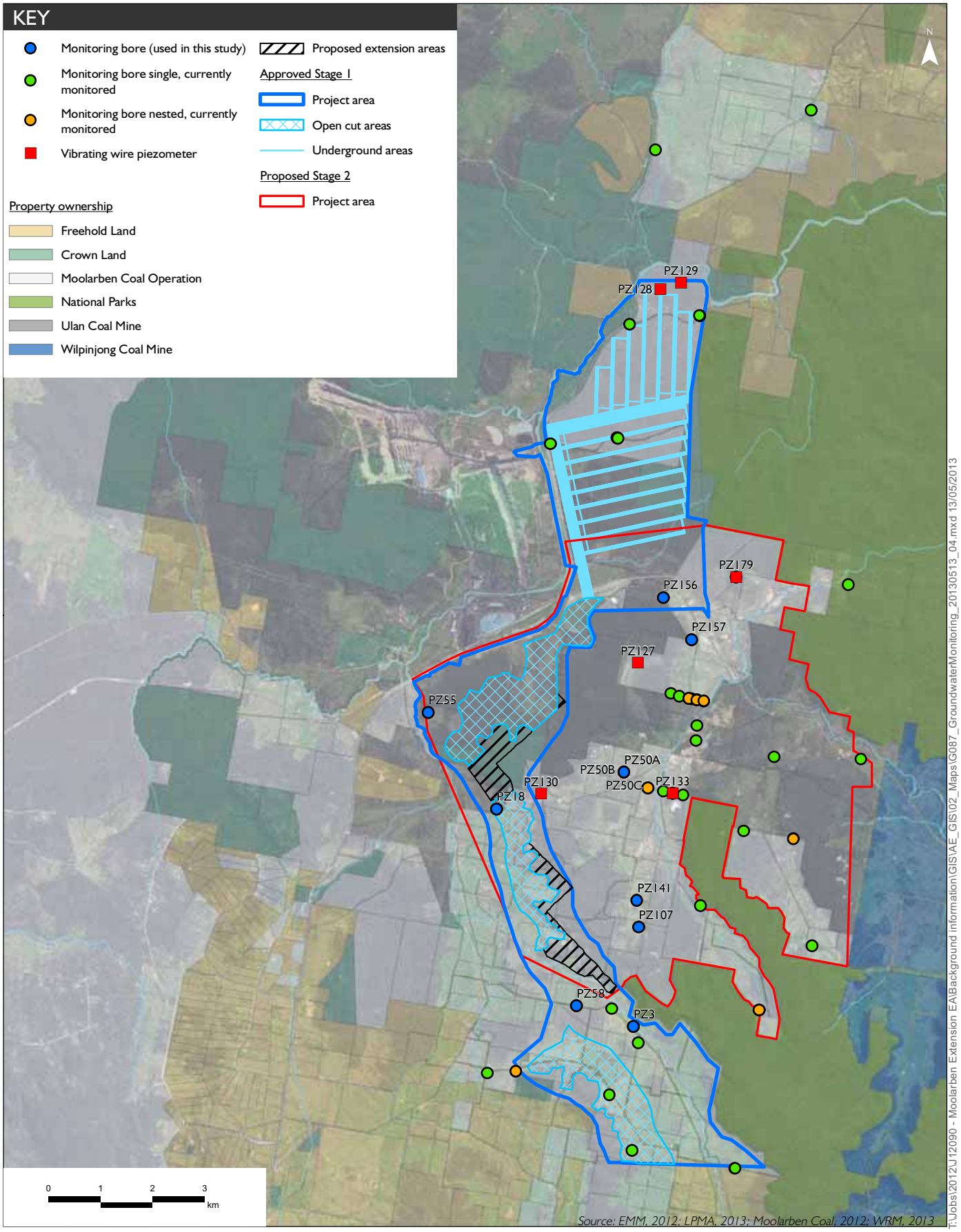
As noted, over 100 groundwater monitoring bores have been drilled and constructed during the Stage 1 and Stage 2 investigations. Monitoring commenced in February 2005 from some of the earliest constructed Stage 1 bores. Groundwater levels are currently monitored in approximately 60 bores, as shown in Figure 15.2.

Groundwater levels are measured manually on a monthly basis and groundwater quality measured biannually to assess trends and fluctuations within the different aquifers. Six bores are fitted with vibrating wire pressure transducers that monitor groundwater levels at multiple levels (See Figure 15.4 for the location of these).

The bores in the current monitoring network that are in close proximity to the proposed modification area and which intersect all relevant geological formations are indicated in Figure 15.2.

Groundwater samples are collected annually from selected bores for laboratory analysis of major cations, major anions, nutrients and heavy metals.

The current monitoring regime of groundwater levels and water quality is sufficient to monitor the effects of the proposed modification.



Groundwater monitoring network bore locations

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 15.2

15.5 Conclusion

The groundwater systems within and surrounding the MCP are well understood. The Ulan Seam is the only geological unit that could be termed an 'aquifer' within the sequence that may discharge to, or be impacted by, the proposed modification. It is essentially dry either naturally or from the historical dewatering from the Ulan Coal Mine.

The proposed modification will result in a negligible increase in seepage rates to the mine and 'nil' impact on the surrounding groundwater regime over the approved impacts from Stage 1. As there is no predicted increase in pit inflows due to the proposed extension, MCO's water licence of 150 ML/year will remain adequate to account for the take from the Permian Coal Measures.

Piezometric levels are expected to change little in response to the proposed modification and no impacts to external bores or GDEs are expected from the proposed modification.

The proposed modification is consistent with the objectives of the AIP.

Groundwater will continue to be managed under the existing groundwater management system and in accordance with the WMP. Present monitoring arrangements for groundwater levels and water quality will suffice for the proposed modification.

16 Soils and agriculture

16.1 Introduction

EMM prepared a soils and agricultural impact assessment for the proposed modification. The associated report is given in Appendix K. The findings of the report are summarised in this chapter.

The soils and agricultural impact assessment addresses the Strategic Regional Land Use Policy (DP&I 2012a), which requires state significant development applications for mining projects to submit an agricultural impact statement (AIS) as part of the environmental impact statement.

For context, it is important to note that the proposed extension areas are mostly wooded with slopes generally greater than 15%, presenting a severe constraint to agricultural production. The extension areas have small portions of gentler terrain in their south-western sections.

16.2 Existing environment

The soil resources, land capability and agricultural suitability of the region have previously been classified by the following studies and publications at the specified broad scale:

- Landscapes of the Dubbo 1:250,000 Sheet (Department of Land and Water Conservation (DLWC) 1998);
- 1:100,000 Land Capability Series Sheet 8833 - Gulgong (Conservation Service of NSW 1982); and
- Agricultural Land Classification of Mudgee Shire (unpublished) (NSW Agriculture undated).

An overview of these aspects derived primarily from the above is given in the following sub-sections.

16.2.1 Soil resources

The Soil Landscapes of the Dubbo 1:250,000 Sheet (DLWC 1998) identifies four main soil landscapes in the surrounding region that also intercept the project area, namely:

- Lees Pinch;
- Ulan;
- Bald Hill; and
- Munghorn Plateau.

The same soil landscapes are found in the proposed extension areas, with the exception of Bald Hill. The Lees Pinch soil landscape covers the majority of the proposed extension areas. Typical Lees Pinch soil landscapes include shallow siliceous sands, shallow acid soils, yellow earths, yellow podzolic soils with limitations such as steep slopes, high erosion hazard when cover is low, low fertility, acidic surface soils, low water holding capacity and high permeability (adapted from DLWC 1998).

16.2.2 Land capability

The DLWC report (1998) describes regional soil attributes and land capability in accordance with the standard NSW eight class system (Cunningham et al undated). The report identifies the following land capability classes for the regional soil landscapes that intersect the proposed extension areas as shown in Table 16.1 and in Figure 16.1.

Table 16.1 Soil landscapes (DLWC 1998)

Soil landscapes	Type	Class
Lees Pinch	Shallow siliceous sands	Class VI to VIII
	Yellow earths	Class V to VI
	Yellow podzolic soil	Class VI
Ulan	Yellow podzolic soil	Class III to Class IV
	Yellow solodic soil	Class IV
Munghorn Plateau	Silceous sands	Class V to Class VI
	Yellow earths	Class V to Class VI
	Yellow podzolic soil	Class VI

The system is based on the assessment of biophysical soil properties, with categories of land based on limitations such as erosion hazard, climate and slope. Table 16.2 describes the relevant classes for the proposed extension areas and potential impact of on-site and off-site management practices and land capability that may apply to the region.

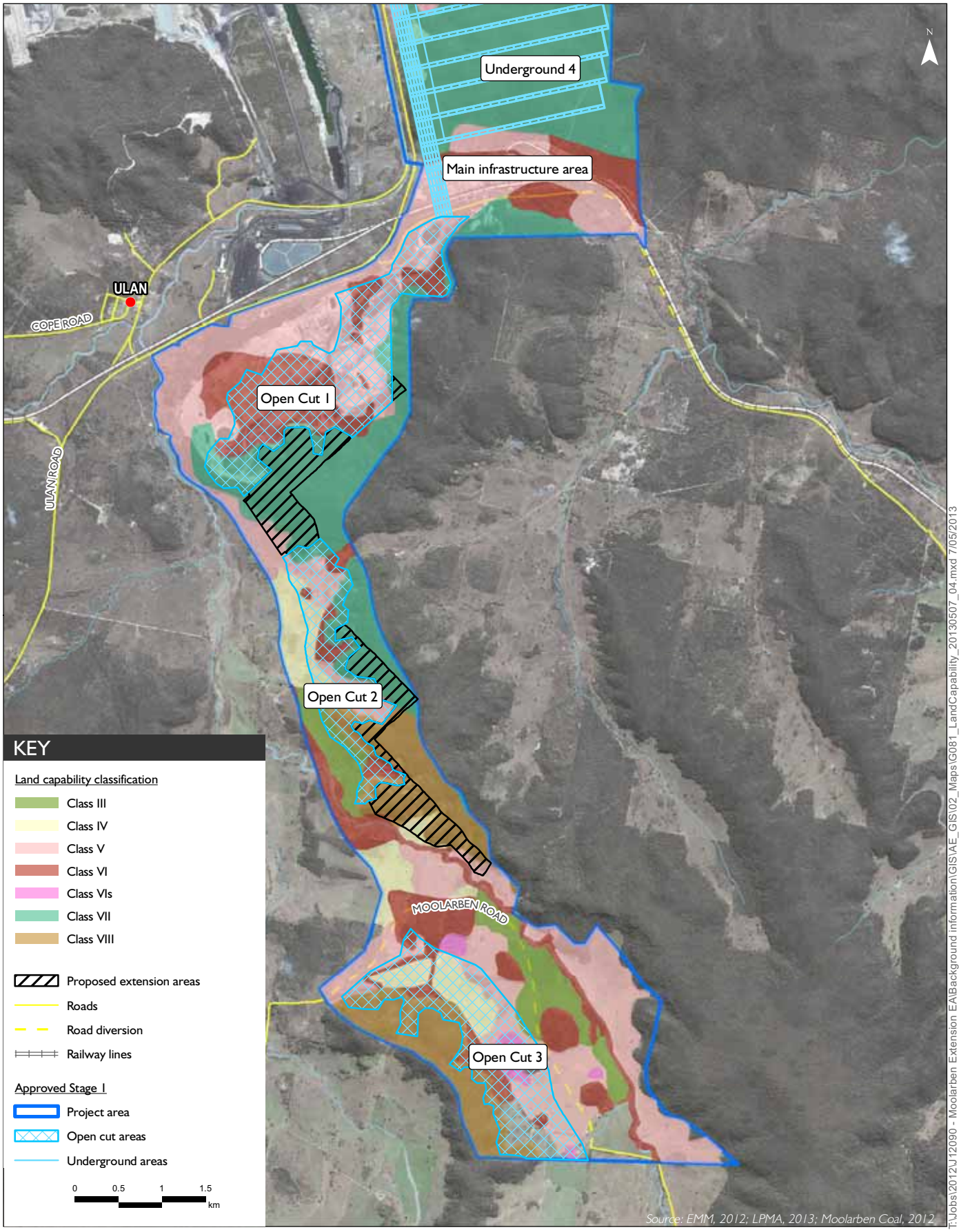
Table 16.2 Land capability class within the proposed extension areas

Class	Description	Management practices
IV	• **Moderate to severe limitations –** for higher impact land management practices (eg cropping). Limitations can only be managed by specialised management practices with high level of knowledge, expertise, inputs, investment and technology. • Land is capable of a range of land uses (eg cropping with minimal or no cultivation and specialised practise, grazing, forestry and nature conservation). However, for some land uses (eg cropping and intensive grazing), practices need to be able to manage the limitations.	• **On-site impact** on soil and land condition can be moderate if limitations are not managed. Soil and land condition can deteriorate because of water erosion, wind erosion, soil acidification, organic matter decline, soil structure decline and salinisation. • **Off-site impact** of land management practices can be significant if limitations are not managed (eg salinity, leachate from acid sulphate soils, water erosion and water quality, wind erosion and air quality).
V	• **Severe limitations –** for higher impact land management practices (eg cropping) there are few methods available to overcome limitations. Highly specialised land management practices can overcome some limitations for high value crops/products. • Land capable of some land uses (grazing, forestry and nature conservation) and practices are available to manage the limitations.	• **On-site impact** on soil and land condition can be severe if not managed. Soil and land conditions can deteriorate as a consequence of water erosion, wind erosion, soil acidification, organic matter decline, soil structure decline or soil salinisation. • **Off-site impact** of land management practices can be severe if limitations not managed (eg salinity, leachate from acid sulphate soils, water erosion and water quality, wind erosion and air quality).

Table 16.2 Land capability class within the proposed extension areas

Class	Description	Management practices
VI	• **Very severe limitations –** no management practices available to overcome limitations for a wide range of land uses (eg cropping, moderate to high intensity grazing, horticulture). Highly specialised practices can overcome some limitations for some high value products. No management practices are available to overcome limitations for a wide range of land uses (eg cropping, moderate to high intensity grazing, horticulture). Highly specialised land management practices can overcome limitations for some high value products. • This land is capable of a limited range of land uses (low impact grazing, forestry and nature conservation). Practices need to be able to manage the limitations.	• **On-site impacts** can be very severe if not managed. Soil and land condition can deteriorate as a consequence of water erosion, wind erosion, soil acidification, organic matter decline, soil structure decline or soil salinisation. • **Off-site impacts** can be very severe if limitations are not managed (eg salinity, leachate from acid sulphate soils, water erosion and water quality, wind erosion and air quality).
VII	• **Extremely severe limitations –** most land uses are restricted. Limitations cannot be overcome.	• **On-site** and **off-site** impacts of land management practices can be extremely severe if limitations not managed.

Figure 16.1 shows that the proposed extension areas include land capability Class IV to VIII, with the majority Class V and VI.



Land capability class within the Stage 1 project area

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 16.1

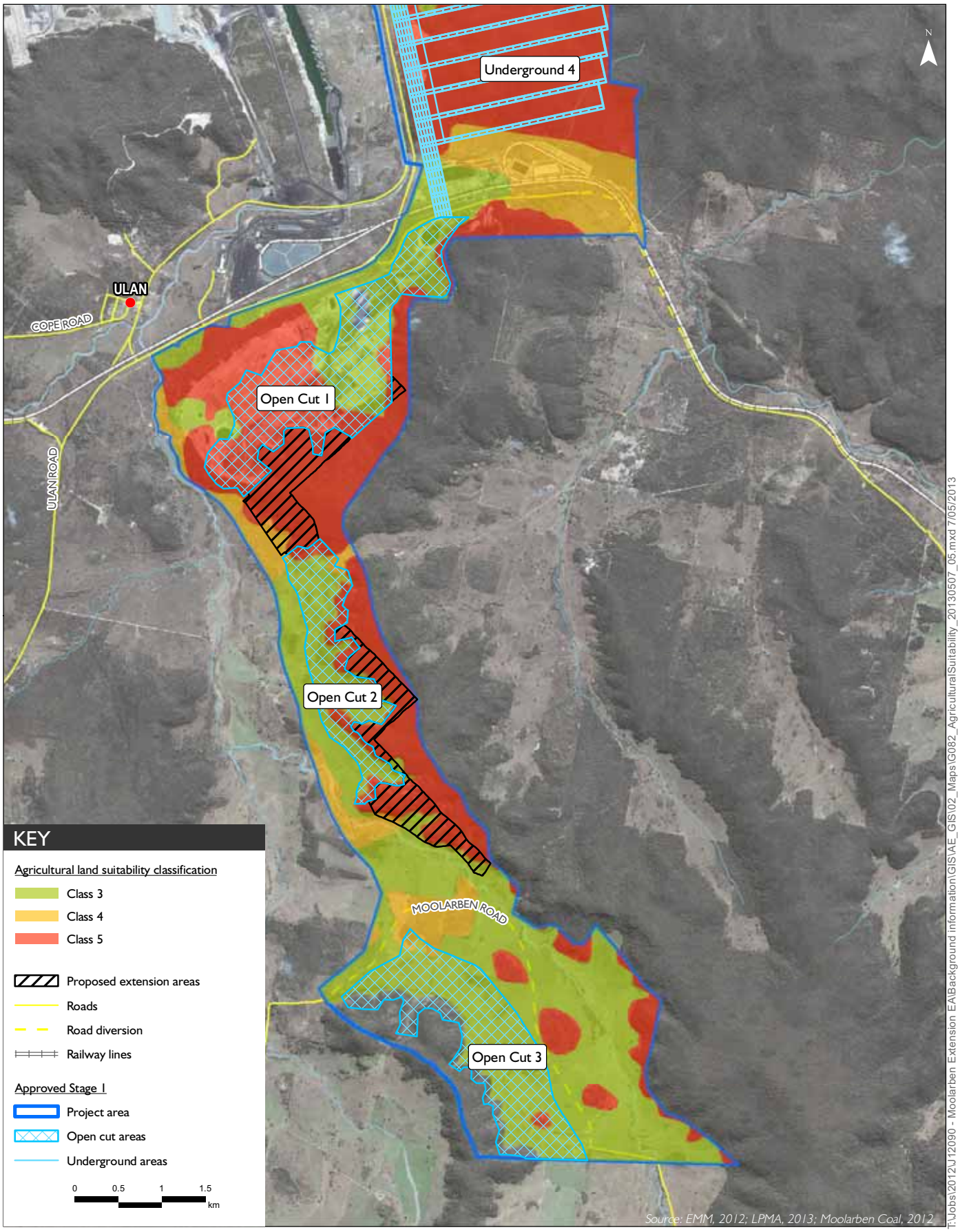
16.2.3 Agricultural suitability

Agricultural suitability was used as a tool for describing alternative agricultural land use (grazing) potential for the proposed extension areas. An agricultural suitability assessment was conducted in accordance with the five class system (Riddler 1996), which classifies land according to its productivity for a wide range of agricultural activities. Based on the Agricultural Land Classification of Mudgee Shire (unpublished) (NSW Agriculture, undated), the proposed extension areas comprise Class 3, 4 and 5 agricultural land, as shown in Figure 16.2. Table 16.3 provides a description of the class types within the proposed extension areas.

Table 16.3 Agricultural suitability class within the proposed extension areas

Class type	Characteristics
Class 3	Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture.
	Predominantly on the valley floor and lower slopes of the project area. Small areas of farming for cereal crop production occur. However, the dominant land use is primarily cattle and sheep grazing on pastures (improved and native). Erosion hazard, soil structural breakdown and climatic factors limit the capacity for cultivation.
	Limited occurrence at the southern extent of the Open Cut 2 extension area.
Class 4	Land suitable for grazing but not for cultivation. Production may be seasonally high, but the overall production level is low as a result of major environmental constraints.
	Occurs in small locations throughout the valley floors and the lower slopes of the project area, and a small portion at the southern extent of the proposed extension areas. These areas are represented by either shallow/sandy or dispersible (sodic) soils or land with steep slopes. In conjunction with their edaphic limitation also have moderate to high erosion hazard restricting the agricultural productivity.
Class 5	Land unsuitable for agriculture or at best suited to only light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude land improvement.
	Associated with the escarpments and lower hills within and adjacent to the project areas and the majority of the proposed extension areas. Generally characterised by steeper slopes shallow soils and lower fertility land.
	Negligible agricultural production is derived from these lands due to the significant constraints of slope, soil and location.

The assessment addressed the Strategic Regional Land Use Policy (DP&I 2012a). Given that the NSW Government has not yet released a SRLUP relevant to the vicinity of the project area, a site verification to determine the presence of SAL in the proposed extension areas was undertaken. Within SRLUPs, SAL is defined as either biophysical strategic agricultural land (BSAL) or critical industry clusters (CIC). The assessment considered criteria in the nearby Upper Hunter SRLUP (DP&I 2012b) for this verification process.



Agricultural suitability within the Stage 1 project area

Moolarben Coal Project - Stage 1 Optimisation Modification

Figure 16.2

i Biophysical strategic agricultural land

The DP&I introduced criteria for identifying biophysical SAL land in a draft interim protocol for site verification and mapping of BSAL (DP&I 2012d). The criteria were developed to reliably and consistently identify NSW land with rare combinations of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

The criteria relevant for the proposed extension areas are described in Table 16.4. Verification was completed by applying the criteria described in Table 16.3 to the 33 full profile soil descriptions from the Stage 1 *Soil, Rural Land Capability and Agricultural Suitability Assessment of the Moolarben Coal Project (Jammel 2005*) and utilising laboratory results also derived as part of the study for the Stage 1 EA.

It is important to note that the DP&I's protocol is designed so that as soon as a criterion fails to meet BSAL conditions, the relevant site area is not taken to be BSAL and no further assessment is needed.

Table 16.4 Summary of criteria for identifying BSAL (DP&I 2012d)

Criteria	Criteria and thresholds	Attributes
(a) water	Reliable water	• ≥ 350 mm rainfall per year • Land is underlain by a groundwater aquifer with a yield rate greater than 5 L/s and total dissolved solids of less than 1,500 mg/L
(b) slope	Slope ≤ 12% Slope ≤ 5%	• Slope in per cent (%) – artificial features such as contour banks and tracks, should be ignored in slope measurements
(c) rock outcrop	≤30% rock outcrop	• Abundance of rock outcrop
(d) soil type	Moderate or high fertility	• For each soil type, a combination of factors such as inherent fertility, soil permeability, soil structure, tilth and typical soil depth determine soil fertility. • The ranking is based on soil classification.
(e) surface rockiness	≤ 20% of area have unattached rock fragments >60 mm diameter	• Abundance and size of surface rocks
(f) gilgai	≤ 50% of the area have gilgais >500mm deep	• Density of gilgai depressions • Depth of gilgai
(g) total soil depth	≥750mm	• Depth to a physical or chemical barrier
(h) drainage	drainage better than very poor/poor	• Colour of the matrix • Presence and colour of mottles • Presence of a conspicuous bleach overlying bedrock
(i) pH	5 – 8.9 if measured in water or 4.2 – 8.1 if measured in calcium chloride	• Soil pH • Depth of sample
(j) soil salinity	≤4dS/m or are chlorides <800 mg/kg when gypsum is present	• Electrical conductivity or chloride content • Depth of sample
(k) soil water storage	≥75mm to a soil depth or physico-chemical limitation of ≤1000 mm	• Field texture • Presence of physico-chemical barriers • Determination of whether the soil is rigid or non-rigid • Drained upper limit – determined in the field • Lower limit – determined in a laboratory
(l) minimum area	≥20 ha	

A comparison with the BSAL criteria of the 33 full profile descriptions, based on the suitability of samples taken from six representative locations undergoing laboratory analysis, was completed. It is noted that profile descriptions were mostly not within the proposed extension areas which are generally much steeper than the areas listed. This is considered a conservative approach to the assessment and appropriate for site verification purposes.

Each of the soil samples analysed failed the BSAL assessment due to one of three reasons:

1. Fertility (b) – this was assessed from field data and interpretation of Appendix 2 of BSAL Interim Assessment Protocol;

2. Soil depth (g) - If auger refusal occurred at a depth less than 750 mm then it was assumed that soil at this location failed the soil depth criteria; and

3. Drainage (h) - If soil was defined as imperfectly drained it was assumed that water is removed from the soil slowly in relation to supply, to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major supply. In this case if mottling were described as gray or pale and greater than 20% then it was assumed that the soil profile failed the drainage criteria.

Therefore, the site does not contain any BSAL.

ii Critical industry clusters

As noted in Section 16.2.3 i, the NSW Government has not yet released a SRLUP relevant to the vicinity of the project area. However, consistent with the Upper Hunter SRLUP (DP&I 2012b), a CIC has been defined as a localised concentration of interrelated productive industries based on agricultural product that provides significant employment opportunities and contributes to the identity of the region for the purposes of this assessment.

The proposed extension areas are within the project approval boundary of the current operations. The majority of these areas are currently wooded, sloped in excess of 15%, do not require additional water supply, and are not currently used for viticulture or equine-related activities or enterprises. The nearest viticultural enterprise is in Gulgong approximately 25 km to the south-west, and the nearest equine-related enterprise is located approximately 20 km to the south-east in Wollar. Therefore, the proposed modification will not impact CICs and no further verification of CICs is required.

16.3 Impact assessment

16.3.1 Methodology

The assessment used a desktop analysis based on the Stage 1 soil survey (Jammel 2005) and relevant literature. The survey from Jammel (2005) was designed to provide sufficient information on land resources to allow the determination of soil family, land capability and agricultural suitability. While the assessment pre-dates the introduction of the Strategic Regional Land Use Policy and consideration of SAL, the field survey contains sufficient detail for interpretation and verification of SAL and assessment of potential agricultural impacts from the proposed modification.

16.3.2 Results

The proposed extension areas will result in a total disturbance of approximately 178 ha. The potential impacts of the proposed modification on soils and land classes and the potential impact on agricultural activities is considered below.

i Land capability

A comparison of the areas of each land capability class impacted by the proposed modification is provided in Table 16.5.

Table 16.5 Land capability class impacted by proposed modification

	Open cut 1 extension area		Open cut 2 extension area	
Land capability class	**(ha)**	**(%)**	**(ha)**	**(%)**
Class IV	0	0	5.7	6.1
Class V	6.3	7.4	4.7	5.0
Class VI	0.1	0.1	1.0	1.0
Class VII	78.1	92.5	27.8	29.8
Class VIII	0	0	54.5	58.1

ii Agricultural suitability

A comparison of the areas of each agricultural suitability class impacted by the proposed modification is provided in Table 16.6.

Table 16.6 Agricultural suitability class impacted by proposed modification

	Open cut 1 extension area		Open cut 2 extension area	
Agricultural suitability class	**(ha)**	**(%)**	**(ha)**	**(%)**
Class 3	0	0	15.7	16.7
Class 4	6.1	7.2	1.8	1.9
Class 5	78.3	92.8	76.3	81.4

iii Other impacts

Other potential impacts of the proposed modification on agricultural land relate to surface and groundwater impacts and potential noise and air quality impacts. The proposed modification will have negligible impact on the rate and volume of groundwater seepage to the open cut pits, Moolarben Creek catchment, the quality of surface runoff and on receiving waters (refer to Chapters 14 and 15). Furthermore, the requirement for additional water can be satisfied from current water sources and MCO's existing licences.

Predicted noise and air quality impacts are below relevant criteria. It is noted, however, that six lots located near to the edge of the project area boundary are predicted to receive noise levels of greater than 40 dB(A), on more than 25% of the land. These six lots are owned by two landowners. Notwithstanding, the assessment found that no private landholders are predicted to experience noise levels of greater than 40 dB(A), on more than 25% of their total land area.

An assessment of the proposed modification against the SAL criteria identified in the SRLUP for biophysical SAL and CICs has been undertaken. No SAL has been identified within the project area or the proposed extension areas. As the project does not intercept BSAL or CICs no impacts to biophysical SAL, viticultural SAL and equine SAL, are expected.

16.4 Management and monitoring

As discussed in Section 4.3.3, MCO is committed to returning areas disturbed by mining operations to their pre-mining land use. Rehabilitation at the MCP is undertaken in accordance with MCO's MOP and LMP.

As detailed in Section 3.1.3 and Chapter 10 (ecology), together with the LMP, the MOP provides the mechanism for rehabilitation. There are no revisions to the objectives and assessment criteria warranted as a result of the soils and agricultural impact assessment.

16.5 Conclusion

With the exception of a small area within the proposed Open Cut 2 extension area, the current landform presents a severe constraint to agricultural production.

The land capability class of the proposed extension areas is between Class IV and VII, with the majority Class VII 'extremely severe limitations' where most land uses are restricted and limitations cannot be overcome.

The agricultural suitability of the proposed extension areas are classified as Class 3, 4 and 5, with the majority being Class 5, land unsuitable for agriculture or best suited to only light grazing.

Verification assessments of the proposed extension areas, demonstrate that the areas do not contain BSAL or CIC. Therefore, an AIS has not been completed as part of this report.

Consistent with MCO's commitment to returning areas disturbed by mining operations to their pre-mining land use, the majority of the proposed extension areas will be rehabilitated for biodiversity outcomes. Small areas currently used for agriculture will be reinstated with overriding principles of stability, sustainability and minimal maintenance.

MCO's LMP and MOP will be extended where required to accommodate any changes in management that might be required as a result of mining activity within the proposed extension areas.

17 Waste

17.1 Introduction

This chapter describes and assesses the potential impacts of the proposed modification on waste.

17.2 Existing environment

Waste streams generated at the MCP include both non-mineral and mining wastes. Table 17.1 provides a summary of these waste streams.

Table 17.1 Waste streams generated at the MCP

Non-mineral wastes	Mining wastes
Construction waste	Overburden waste rock
General rubbish	Rejects from the CHPP
Sewage from offices	Related operational waste
Workshops and bathhouses	
Scrap timber from pallets and boxing	
Waste batteries and tyres	
Waste oil, effluents and filters	
Empty drums and scrap metals	

Non-mineral wastes are generally managed using the principles of the *Waste Avoidance and Resource Recovery Act 2001* and in accordance with the hierarchy of controls below:

- avoidance;
- reduction;
- reuse;
- recycling or reclamation;
- waste treatment; and
- disposal.

Waste rock from overburden and interburden and waste reject materials from the beneficiation of coal are emplaced on site and are used in the development of the final landform.

17.3 Impact assessment

Previous environmental assessments for Stage 1 have addressed waste generation and its management. Wastes generated and their management will not change under the proposed modification. Mining and associated activities will remain within the existing approved and licensed limits, which will be extended for a further five years to allow for the proposed modification.

MCO's target to reuse and/ or recycle a minimum of 70% of all general solid waste material generated during the operation of the MCP, thus achieving up to 70% waste reduction/avoidance, will continue to apply under the proposed modification.

17.4 Management and monitoring

Waste generated at the MCP is managed in accordance with its waste management plan. The objectives of the waste management plan are to:

- address the relevant conditions of MP 05_0117;
- address the relevant requirements of the EPL;
- outline processes and procedures for the management of waste generated during the construction and operational phases for the mine; and
- outline protocols for any non-compliance or complaints with respect to waste management.

The MCP has a waste monitoring program in place which generally includes, but is not limited to, documenting the storage, removal and disposal of waste in accordance with waste management plan objectives. This monitoring program is continually reviewed to ensure the process operates effectively and efficiently and will continue under the proposed modification. Volumes will continue to be reported in MCO's AEMR.

No additional waste management measures are warranted as a result of the proposed modification.

17.5 Conclusion

The proposed modification will not change the wastes generated from the MCP or the approach to their management. Non-mineral will continue to be managed in accordance with MCO's waste management plan.

18 Transport

18.1 Introduction

This chapter describes and assesses the potential impacts of the proposed modification on the local traffic and transport network.

For the purpose of context, it is noted that the proposed modification does not seek to increase the number of road or rail movements beyond those currently approved.

18.2 Existing environment

18.2.1 Existing roads

The MCP is located east of the intersection of two designated main roads, main road (MR) 214 (Ulan to Cassilis Road) which connects Mudgee with Cassilis and MR598 (Gulgong to Ulan Road) also known as Cope Road, which links Gulgong to Ulan. The MCP is located either side of the Ulan to Wollar Road where it meets MR214.

MR214 is a two lane road with a speed limit of 100 km/hour. In 2011, MR214 had daily traffic volumes in the range of 1,703 to 2,302 vehicle movements (SKM 2011). This decreases to 898 daily vehicle movements north of the Ulan Coal Mine entrance, on the section towards Cassilis. Traffic growth on the MR214 route near Ulan in recent years has been primarily determined by the traffic generating characteristics of the various mining projects in the area.

MR598 (Gulgong to Ulan) is a two lane road with a speed limit of 100 km/hour. In 2011, in the vicinity of the Ulan settlement, MR598 had average daily traffic volumes of 655 and 997 vehicle movements respectively, west and east of the Ulan settlement (SKM 2011). The daily traffic volumes are higher at the Gulgong end of the route. At the level crossing east of Gulgong, the MR598 route had average daily traffic of 1677 vehicles in 2005 (RTA 2005).

The Ulan to Wollar Road generally follows the Sandy Hollow to Gulgong rail line. This road, east of MR214, is sealed to varying widths for approximately 12 km to just east of the Wilpinjong Coal Mine entrance.

The local road network is shown in Figure 1.1.

18.2.2 Public transport network

School bus services operate along several routes around and within Mudgee, Ulan and Gulgong, including along MR214 and MR598. Bus times generally fall between 08:15 and 09:00, and 15:15 and 16:00, operating Monday to Friday during school terms. Apart from these school buses there are no other public transport services in the area.

18.2.3 Road safety

For the previous Stage 1 and 2 EAs, both the NSW Roads and Traffic Authority (RTA now RMS) and MWRC required that a road safety assessment of the key routes that would be used by staff to access the MCP should be undertaken. Road Safety Audits were undertaken by consultancy company SKM on two roads, namely:

- MR214 between Mudgee (corner Church Street and Short Street) and Ulan (MR214 bridge over railway line); and
- MR598 between Gulgong (corner Station Street and Nandoura Street) and MR214 at Ulan.

The Road Safety Audits identified two areas that required further consideration, being road edge delineation and road edge formation and shoulder provision. In accordance with its voluntary planning agreement stipulated in Appendix 4 of MP 05_0117, MCO must make a minimum road maintenance monetary contribution for Ulan and Cope Roads and roads in general of $1M and $1.25M, respectively. In addition, while not required under MP 05_0117, MCO participated in, and committed to contribute to, a joint road upgrade strategy for Ulan Road together with the Ulan and Wilpinjong Coal Mines, as required under both mines' planning approvals.

To minimise potential cumulative traffic impacts, Condition 58 of MP 05_0117 requires that shift changes are scheduled to occur outside the school bus hours and that MCO coordinate shift changes on site with shift changes of the adjoining Ulan and Wilpinjong Coal Mines.

18.2.4 Rail network

There are several rail lines in the region. These include the Wallerawang to Gwabegar Railway which passes through Mudgee and Gulgong, not currently in regular use, and the Sandy Hollow to Gulgong (via Ulan) Railway which connects with the Main Northern Railway.

The Sandy Hollow to Gulgong rail line runs in a generally east to west direction north of Ulan to Wollar Road through the northern part of the project area. This line continues to Muswellbrook where it joins the main Northern rail line, about 146 km east of the MCP. The ARTC manages this line under lease from the state government.

This latter railway is used currently for the transport of coal from the three coal mines at Ulan, Moolarben and Wilpinjong. There are no regular passenger services in operation. The rail line is also used to transport other freight between western areas of NSW and the eastern sea board, although less frequently. The rail line can generally accommodate all train types, except that locomotives and rolling stock with a 30 tonne axle load cannot travel west beyond the Ulan Mine rail loop junction.

The ARTC has recently revised its working timetable for the line with a new timetable effective 21 January 2013. The new timetable indicates that the rail line between Ulan and Muswellbrook has sufficient existing capacity to accommodate a total of 50 train movements a day (ie 25 in each direction) on both weekdays and weekends.

Approximately 16 of these train movements (ie eight in each direction) are timetabled to operate to and from the Mangoola Mine and Bengalla Mine rail loops. The remaining 34 train movements (ie 17 in each direction) are timetabled to operate to and from the Ulan area and can be utilised by any of the coal mines in the Ulan area.

18.2.5 Rail crossings

As part of the EA for the Stage 2 proposal a report on the condition and operation of all public road level crossings on the lines between Ulan and Muswellbrook and Ulan and Wallerawang was undertaken. The physical condition of the crossings inspected as part of the study were assessed to be within ARTC maintenance standards. The majority of the public road crossings surfaced with bitumen were fitted with automatic warning lights and bells. The crossings encountered that had unsealed approach roads had various forms of protection, from 'give way' signs to automatic warning lights and bells. These existing protection arrangements were considered adequate and no modifications were required.

A total of 18 crossings on the Sandy Hollow to Gulgong rail line were inspected as part of the rail traffic assessment for the Stage 2 EA. Level crossings along the line are progressively being upgraded by ARTC with improved control and the sealing of road surfaces. At two level crossings in the Ulan, Moolarben and Wilpinjong areas (at Mogo Road – Ch 415.115 kms from Sydney and on the Ulan to Wollar Road near Cumbo Creek – Ch 420.062 kms from Sydney), the level crossing safety control has been upgraded by ARTC since 2009. Warning lights and barrier controls have been installed at both of these crossings and also by the sealing of the road surface (at the Ulan to Wollar Road crossing near Cumbo Creek).

The ARTC program of level crossing safety improvements on the Sandy Hollow to Gulgong rail line is ongoing. Each year more safety improvements are implemented to the level crossings on the Sandy Hollow to Gulgong rail line, between Muswellbrook and Gulgong. These improvements are continuing to improve the existing level of public road and rail traffic safety at these level crossings, even with the increasing volumes of road and rail traffic using the transport networks in the area.

18.3 Impact assessment

18.3.1 Road

The proposed modification does not seek approval to increase employee numbers or change traffic conditions. There will be no increase to existing or estimated traffic volumes on road networks from those currently approved under the MP 05_0117 and no construction or modification works are required. All vehicle movements for coal and overburden haulage will remain on internal haul roads.

The proposed modification seeks to extend mining operations by five years, from 2028 to 2033. This will consequently extend the use of previously approved traffic and transport routes and the impacts assessed and approved under MP 05_0117.

18.3.2 Rail

The proposed modification does not seek approval to increase current production levels and, therefore, no additional train movements will be required.

The proposed modification seeks to extend mining operations by five years, from 2028 to 2033. This will consequently extend the use of previously approved rail movements and impacts assessed and approved under MP 05_0117.

18.4 Management and monitoring

Management and monitoring of potential road and rail impacts from the MCP will continue to be undertaken in accordance with MCO's existing commitments. No additional measures are warranted as a result of the proposed modification.

18.5 Conclusion

This assessment has found that the proposed modification will have no additional impacts on road or rail networks utilised by the MCP; rather the current impacts will be experienced for a further five years. Accordingly, potential road and rail impacts will continue to be managed under MCO's existing management regime.

19 Social

19.1 Introduction

This chapter describes the existing social environment and presents potential impacts from the proposed modification on, amongst other aspects, employment, the local economy, community infrastructure and social amenity. It has been prepared in consideration of matters raised during community consultation and includes management and monitoring measures that will be implemented to enhance positive impacts and negate or minimise negative impacts.

19.2 Existing environment

Due to the relatively minor nature of the proposed modification, it is envisaged that potential social impacts would be localised. Therefore, the community profile details the characteristics of the nearest residential communities to the MCP, namely, Cook's Gap and Ulan settlement. The social assessment anticipates there will be negligible social impacts on the larger centres of Gulgong and Mudgee. However, these areas have been included, along with NSW, for context and comparison purposes.

19.2.1 Community profile

The MWR LGA is a large, predominantly rural area, with a total population of approximately 22,300 (Australian Bureau of Statistics (ABS) 2012). The main towns in the LGA are Mudgee, Gulgong, Kandos and Rylstone which support a diverse and growing economy. The agricultural sector produces a wide range of products including wool, viticulture, honey and thoroughbred horses which attract a number of tourists throughout the year. Mining is also an important industry with four large coal mines operating in the LGA. Mining provides employment for approximately 14% of the MWR LGA workforce (ABS 2012).

The MCP is 40 km north-east of Mudgee. Mudgee is the regional centre of the LGA and has a population of 9,800 (ABS 2012). It has a hospital, library, airport, as well as educational, sporting and shopping facilities. Mudgee is recognised for its high quality local produce especially wine, cheese and fresh produce (MWRC 2011).

Gulgong is located approximately 25 km south-east of the MCP and has a population of 2,383 (ABS 2012). Gulgong's association with the goldfields in 1866 is evident with historic buildings throughout the town, including the Pioneers Museum and the Henry Lawson Centre. A range of important services are also available in the town with a library, two primary schools, a high school, an environment education centre and a multi-purpose health service centre (under construction) which provides accident and emergency services.

Closer to the MCP, Cook's Gap is a collection of rural residential lots, approximately 5 km west of the MCP. Cook's Gap has a population of 490 residents (ABS 2012). There is no retail centre or other services in Cook's Gap. Ulan district is within 1 km north of the MCP and has a population of 260 residents (ABS 2012). The residential population of Ulan district has been decreasing since 2001 due to an active land acquisition program by the Ulan Coal Mine and MCP. This has seen a decline in supporting local businesses and community services. Therefore, Gulgong is the closest commercial centre to service both Ulan settlement and Cook's Gap residents.

19.2.2 Workforce profile

The MCP has been in operation since 2009 and will employ up to 317 fulltime workers. The proposed modification will not alter the existing workforce numbers.

The majority of the workforce resides in Mudgee (approximately 62%) and nearly all within the MWR LGA (94%).

19.2.3 Key socio-economic characteristics

The latest ABS 2011 census data (released in 2012) was used and compared to 2006 census data for the community profile. Key socio-economic characteristics of the selected areas are summarised in Table 19.1.

It should be noted that ABS has removed census collection districts (CCDs) as a unit of measurement in the 2011 census, which have been replaced by Australia's statistical local areas (SLAs). ABS viewed that CCDs were not the most efficient method to capture the changing demographics of Australia. This has made comparisons between 2006 and 2011 data sets extremely difficult, especially for the smaller areas of Cook's Gap and Ulan settlement. In the recent ABS 2011 census, Ulan settlement has been combined with the Wollar district to the east. Therefore, it has been referred to as 'Ulan/Wollar District' in this chapter.

Table 19.1 Socio-economic characteristics summary

Socio-economic characteristic	Ulan District/ Wollar	Cook's Gap	Gulgong	Mudgee	MWR LGA	NSW
Population (2006)	304	297	2,918	8,726	21,086	6,549,178
Population (2011)	260	490	2,383	9,830	22,319	6,917,660
Population growth (2006-2011) (%)	-14.5	64.9	-18.3	12.7	5.85	5.6
Annual rate of population (2006-2011) (%)	-2.9	N/A	-3.7	2.5	1.2	1.1
Indigenous population (%)	5.4	6.1	5.0	4.3	3.9	2.5
Projected population growth (2011-2031) (%)	N/A	N/A	N/A	N/A	(see Table 19.2)	1.2
Younger age (0 to 4 years) (%)	3.1	6.5	7.4	7.6	7.6	6.6
Older children (5 to 14 years) (%)	10.4	12.6	14.2	13.9	12.7	12.6
Younger adults (15 to 19 years) (%)	9.7	7.6	7.0	6.9	6.5	6.4
Working adults (20 to 24 years) (%)	1.5	5.5	5.8	6.1	4.7	6.5
Working adults (25 to 44 years) (%)	19.3	21.0	22.3	25.8	23.0	27.7
Mature age (45 to 64 years) (%)	34.1	32.1	26.3	22.4	27.3	25.5
People aged 65 +years (%)	22.0	14.7	17.0	17.3	18.1	14.7
Median age (2006)	46	N/A	41	38	41	38
Median age (2011)	47	44	39	37	41	37

Table 19.1 Socio-economic characteristics summary

Socio-economic characteristic	Ulan District/ Wollar	Cook's Gap	Gulgong	Mudgee	MWR LGA	NSW
Industry structure (ABS 2011)	Mining/ Agriculture, forestry & fishing/ Education & training	Mining/ Retail trade/ Health care & social assistance	Mining/ Retail trade/ Health care & social assistance	Mining/ Retail trade/ Accommodation & food services	Mining/Retail trade/ Agriculture, forestry & fishing	Health care & social assistance/ Retail trade/ Manufacturing
Coal mine employment (persons) (2011)	14	29	160	572	1,184	29,798
Coal mine employment growth (2006-2011) (%)	75.0	N/A	107.8	253.1	174.1	56.6
Occupational structure (ABS 2011)	Managers/ Machinery operators/ Technicians & trades	Machinery operators/ Technicians & trades/ Labourers/ Professionals	Machinery operators/ Technicians & trades/ Labourers/ Professionals	Machinery operators/ Technicians & trades/ Labourers/ Professionals	Technicians & trade/ Managers/ Professionals	Professionals/ Clerical & admin/ Managers
Unemployment rate (ABS 2011) (%)	10.1	5.7	6.5	5.3	5.8	5.9
Average household size (persons)	2.1	2.5	2.4	2.4	2.4	2.6
Median weekly household income ($)	753	906	902	1,023	929	1,036
Median weekly rent ($)	100	200	200	240	200	300

Source: *ABS (2006 and 2011)*

Note: *percentages may have some discrepancies due to rounding*

i Population size and growth

The areas of Ulan/Wollar District, Cook's Gap, Gulgong and Mudgee had a combined population of 12,963 in 2011. This accounted for 61.5% of MWR LGA's total population. Mudgee is the largest centre, accounting for 44% of the LGA.

The MWR LGA had a relatively higher proportion of Indigenous people (3.9%) compared to the NSW average (2.5%). Cook's Gap had the highest proportion of Indigenous people (6.1%), followed by Ulan/Wollar District (5.4%), Gulgong (5.0%) and Mudgee (4.3%).

Population change across the MWR LG, between 2006 and 2011, is shown in Figure 19.1.

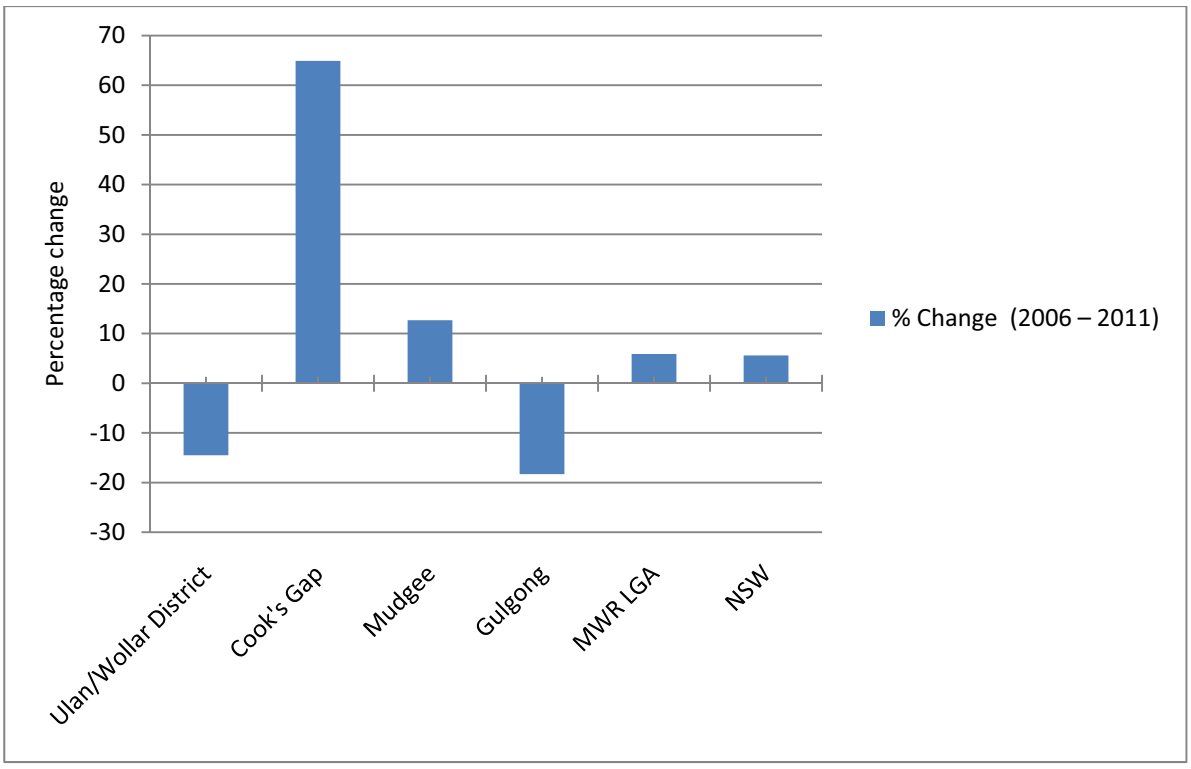


Figure 19.1 Population change across MWR LGA

Since 2006, the LGA's population had increased by 5.9% which is consistent with the NSW average (5.6%). Mining-related activities are seen as a primary driver for this growth across the LGA. Mudgee's population had increased by 12.7%, while Cook's Gap had a population increase of approximately 65%. Gulgong and Ulan/Wollar District experienced a significant decline in their population, 18.3% and 14.5% respectively. It should be noted that changes to ABS boundaries for Cook's Gap and Ulan/Wollar District have made comparisons between 2006 and 2011 data sets incompatible.

Taking the average between the three forecasts, population by year 2031 would be 27,697. This is an increase of 5,379 people, representing an annual growth rate of 1.2%. This estimate is consistent with the current annual growth rate for NSW (1.1%) and estimated growth rate to 2036 (ABS 2012 and DP&I 2010).

ii Population Structure

Compared to NSW average, the population of MWR LGA is characterised by an ageing population. Key statistics include:

- higher proportion of 0 to 4 year olds (7.6% compared to 6.6%);
- lower proportion of tertiary aged adults residing in the LGA (20 to 24 year olds – 4.7% compared to 6.5%);
- lower proportion of young working adults (20 to 44 year olds – 27.7% compared to 34.2%);
- higher proportion of mature working adults (45 to 64 year olds – 27.3% compared to 25.5%);
- higher proportion of people aged 65+ (18.1% compared to 14.7%); and
- higher median age (41 years compared to 38 years).

Compared to the MWR LGA, key population characteristics of areas within the LGA include:

- Ulan/Wollar District, Cook's Gap and, to a lesser extent Gulgong, are characterised by a 'mature aged' family structure (older school aged children with older working parents);
- Ulan/Wollar District (3.1%) and Cook's Gap (6.5%) had the lowest proportions of children aged 0 to 4 year olds;
- Mudgee is characterised by a 'younger' family structure (higher proportion of younger aged children and younger working parents);
- with the exception of Ulan/Wollar District (1.5%), all other areas recorded a higher proportion of tertiary aged adults remaining in the area (Cook's Gap – 5.5%, Gulgong – 5.8% and Mudgee – 6.1%); and
- Mudgee had the lowest median age (37 years) across the LGA, which was equal to the NSW median. The median age of Gulgong was 39 years, followed by MWR LGA (41 years), Cook's Gap (44 years) and Ulan/Wollar (47 years).

iii Household structure

All areas were marginally below the NSW average of 2.6 persons per household. Mudgee and Gulgong had an average household size of 2.4, while Cook's Gap had 2.5 persons per household. These areas were consistent with the MWR LGA (2.4). Ulan/Wollar District had 2.1 persons per household.

a. Housing demand

The current cost and recent trends in both the median house price and average new rental cost for dwellings in MWRC LGA are outlined below, based on the Quarterly Rent and Sales Report (Housing NSW 2012).

The median house prices for the MWR LGA compared to NSW is shown in Figure 19.2.

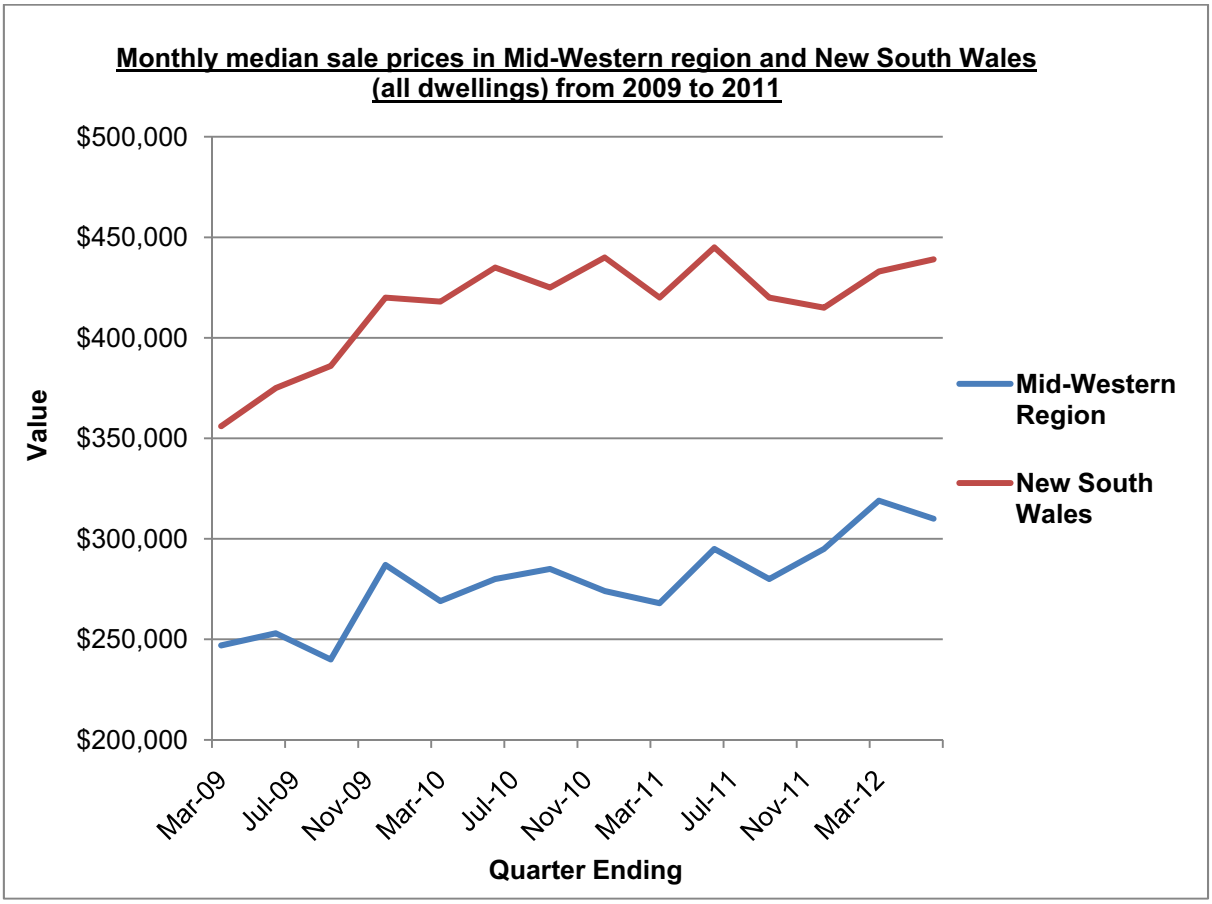


Figure 19.2 Median house prices across MWR LGA (2009 – 2011)

Residential building activity in the MWR LGA had declined markedly in recent years from 140 to 44 new dwellings constructed in 2005 and 2011, respectively. This has constrained housing supply. As a consequence, median house prices (between 2009 to 2012) have increased from $247,000 to $310,000 (Housing NSW Quarterly Sales and Rent report 2012). This represents a 26% increase. During the same period, median house prices for NSW have increased by 23%.

According to ABS 2011 census, housing stress, ie where households spend more than a third of their income on mortgage repayments, was approximately 10.2% of households. This was consistent with the NSW average (10.5%).

b. Rental housing

The median rents for the MWR LGA compared to NSW is shown in Figure 19.3.

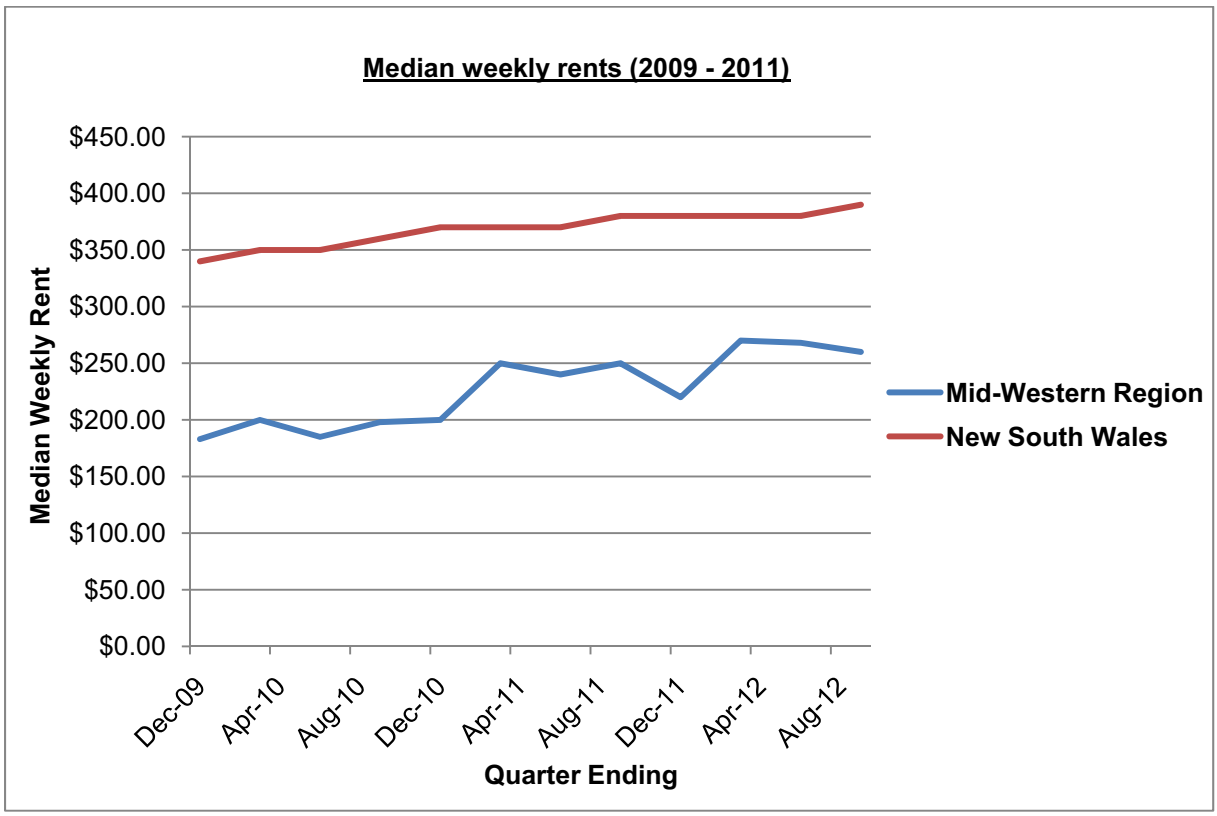


Figure 19.3 Median weekly rents across MWR LGA (2009 – 2011)

For the MWR LGA, the current rent for a three-bedroom dwelling is $268 per week (June quarter 2012). This is an 11.6% annual increase ($240 per week June quarter 2011) or a 44.8% increase since June 2010 ($185 per week).

According to ABS 2011 census, rental housing stress affected 12.5% of households. This was above the NSW average of 11.6%.

iv Economic structure

In terms of employment, mining is the largest industry in MWR LGA, with 13.8% of LGA workforce employed in the sector. This represents 4% of the total NSW workforce in the mining sector. Other major industries in the LGA include: retail trade (11.3%); agriculture (9.5%); health care and social assistance (9.2%); and tourism (8.2%). The high proportion of employment within these other industries demonstrates Mudgee's importance as a service and tourism centre and diverse industry base. While NSW's largest industries are health care and social assistance (11.6%), retail trade (10.3%), manufacturing (8.4%) and education and training (7.9%).

The main occupations in Cook's Gap and Ulan/Wollar District included machinery operators, technicians and trades, labourers and professionals. This was also reflected in Gulgong and Mudgee. The major occupations in the MWR LGA included managers, technicians and trade workers.

According to ABS census 2011, unemployment in the LGA is low, ranging from 5.3% (Mudgee) to 6.5% (Gulgong). The unemployment rate in MWR LGA was 5.8% in 2011. This is consistent with the NSW average (5.9%). Recent data from the Commonwealth Department of Education, Employment and Workplace Relations (DEEWR) (June 2012) estimated that the MWR LGA unemployment rate was 5.9% in the first half of 2012. This represents an annual change of 0.1%.

Amongst other factors, the recent drop in coal export prices and a high Australian dollar has seen a slowdown of the coal industry in Australia. This has impacted on MWR and the wider region with either postponement of mine expansion projects, or mine closures, causing job losses and job insecurity. According to NSW Mining and Sector Union South West Region, one mining job loss affects the viability of four other jobs in NSW (NSW Mining and Sector Union South West Region 2012). Projects affected include: Charbon Mine closure by the end of 2015 (loss of 50 jobs), Ulan Coal Mine (loss of 160 jobs), Airly underground mine (outside of MWR but employs workers from MWR) (loss of 40 jobs).

v Socio-economic status

The average household income across the MWR LGA is shown in Figure 19.4.

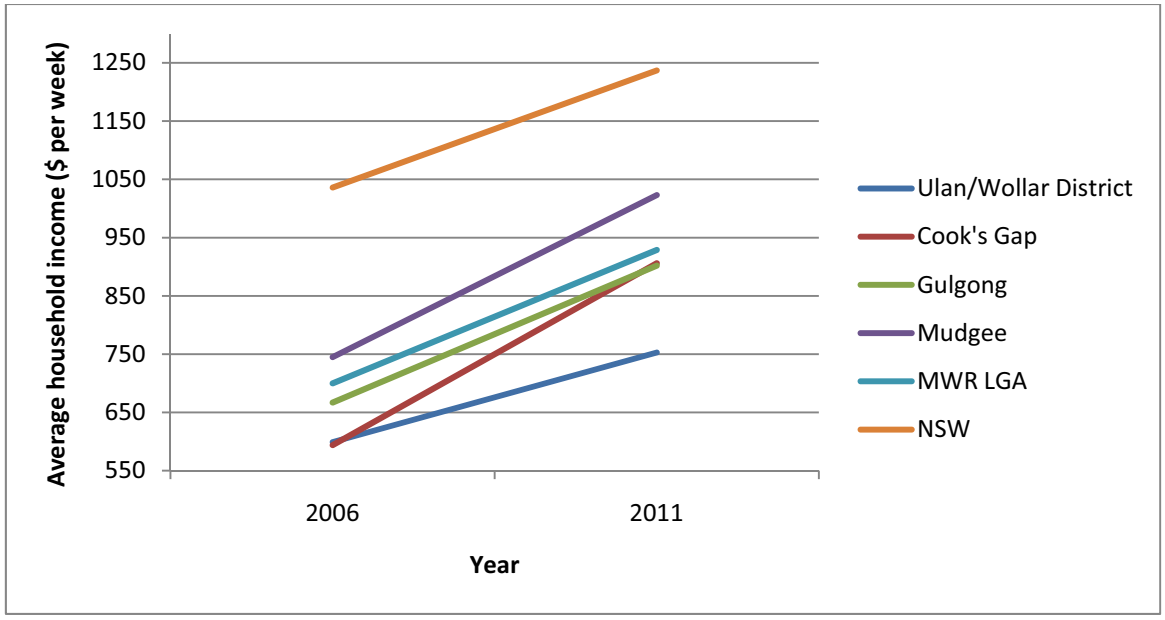


Figure 19.4 Average household income across MWR LGA

The average household income in MWR LGA was $929 per week compared to the NSW average of $1,237 per week. However, the MWR LGA average household income was $700 per week in 2006, which represents a 32.7% increase compared to the NSW average of 19.5%.

Mudgee had the highest weekly household income of $1,023, almost $100 greater than the MWR LGA average. This accounts for the higher mining population who reside in Mudgee.

Cook's Gap and Gulgong had very similar median weekly incomes, $906 and $902 respectively. The below average median income suggests there was a lower ratio of miners living in these communities. This is confirmed for the Ulan/Wollar District which had the lowest weekly household income ($753 per week) across all areas. This is almost $300 below the NSW average. The Ulan/Wollar District had a low representation of miners living in the area.

19.3 Community infrastructure and services

A key social indicator in a community is the quality and capacity of existing community facilities and services. As there will be no change in the existing workforce numbers from the proposed modification, it is anticipated that there will be no additional pressure on existing infrastructure and services. However, an overview of capacities of existing community infrastructure and services, including education (primary, secondary and tertiary), childcare, healthcare, emergency services, community facilities is detailed below based on consultations with agencies and key stakeholders and in reference to MWRC's Local Services Assessment (Manidis Roberts 2012).

19.3.1 Education

The closest primary school to the project area is Ulan public school in Ulan settlement. The school's 15 enrolments are drawn primarily from the nearby rural residential blocks. This was up from five students in 2012 (myschool.edu.au 2012). Currently, it has 1.3 (equivalent) fulltime teachers. Ulan public school is categorised as being located in a low-socio-economic community and is therefore supported by the Country Area Program and Priority Schools Funding Program and the Low Socio-economic Status School Communities National Partnership program. These programs provide additional educational resources to enable the school to provide extra supporting activities to aid learning for students (A. Furney, Assets Manager, pers comm., 20 January 2013).

There are a further 17 schools in the LGA comprised of 12 primary schools, three public high schools and two non-government schools. Discussions with DEC stated that school enrolments were generally stable and there was some capacity in some schools (ie Mudgee primary) to take on more students (A. Furney, Assets Manager, pers comm., 20 January 2013). This was confirmed in MWRC's Local Services Assessment (Manidis Roberts 2012).

There are no universities in MWR LGA. Charles Sturt University (Dubbo and Bathurst campus) services the region and is approximately 110 km and 160 km from Gulgong, respectively. Post secondary facilities in the LGA are mainly provided by the Mudgee TAFE College. In 2011, the Mudgee Skills Centre was opened at the TAFE. It is a partnership with local businesses and provides apprentice type courses to meet local workforce needs, including those for the mining industry.

19.3.2 Preschools and child care centres

The Ulan/Wollar District has a low proportion of 0 to 4 year olds and there are no child care centres in the area. The closest preschool and child care centres are in Gulgong and Mudgee.

Gulgong has one private childcare which caters for 0 to 6 year olds. This long day care facility has 25 places with no vacancies. Gulgong Preschool caters for 3 to 5 year olds and has 25 places but is at capacity.

Mudgee Preschool is the only preschool in Mudgee. It caters for 3 to 6 year olds. It had a waiting list of 40 students during 2012 (Manidis Roberts 2012). Mudgee has five privately run childcare centres (see Table 19.2) and a Family Day Care Centre Scheme. The Family Day Care centre is currently at capacity with the overflow being absorbed by the long day care centres (Manidis Roberts 2012).

The Commonwealth Government, in collaboration with all the State Governments, issued the National Quality Framework Guidelines for early childhood education which aims to improve the quality and standard of childcare services. One of the key requirements within the guidelines is the implementation of a one staff to four children ratio for 0 to 2 year olds (DEEWR 2009). This came into effect at the beginning of 2012.

Table 19.2 Childcare centres: Mudgee

Name	Sector	Age Group	Places	Availability
Imagination Early Learning Centre	Private	0-6 years	63	Limited availability for 0-2 years and 4-5 years
Puggles Long Day Care	Private	0-5 years	46	No availability
Mudgee Kidz	Private	0-5 years	30	No availability. Planned expansion with 15 more places
Squeakers Childcare	Private	2-5 years	No information available	Limited availability
Squeakers Childcare on Douro	Private	0-6 years	No information available	Limited availability

Source: Figures supplied by each preschool (January 2013)

Discussions with childcare providers have indicated that there is limited available capacity, with waiting lists for 0 to 2 year olds in all centres that cater for this age group. Some private centres did state they had to decrease the availability of places for 0 to 2 year olds to meet the Commonwealth guidelines.

19.3.3 Health

MWR LGA comes under the NSW Western Local Health District (LHD). There are three public health services providers in MWR LGA: Gulgong and Mudgee Health Service and Rylstone Multi Purpose Service (MPS). Gulgong Health Service is the closest facility to the project area.

Gulgong closed its hospital in 2010. The NSW Government built a 'HealthOne' facility in Gulgong in 2012 as part of a two-stage process to the MPS. HealthOne focuses on primary and preventative health. Construction is now underway for a new Multi Purpose Health Centre to be completed by mid 2013. The facility will provide primary and community care and an emergency care service, with four sub-acute beds, six high care residential aged care beds and flexible and clinical and operational support services (NSW Western LHD 2012). When completed, the Gulgong MPS will be the closest hospital to the MCP.

Mudgee health service includes Mudgee hospital. The hospital provides emergency, maternity, acute medical and surgical services. It has 52 acute beds and 57% of the beds are currently occupied (NSW LHD 2013). According to the National Health Performance Authority (NHPA), waiting times for general surgery at Mudgee hospital is approximately 72 days compared to the national average of 31 days for 2011/12 (NHPA 2013).

As detailed in the MWRC's local services assessment, NSW Health carried out a detailed assessment on the capacity of health facilities to absorb projected population increases in the LGA. NSW Health concluded that there will be capacity within existing health facilities to cater for projected population increase in Mudgee. However, MWRC believes there is a shortfall in health provision and further upgrade of the Mudgee hospital facility will be required (Manidis Roberts 2012).

19.3.4 Emergency services

Cook's Gap has a Rural Fire Service unit. In terms of police, the Mudgee Local Area Commands (LAC) is based at Mudgee and services MWR and Warrumbungle LGAs. There is one fire and one ambulance station in Mudgee and Gulgong, respectively.

There are aero-medical retrieval providers in the Central West District including the Royal Flying Doctor Service (RFDS) which operates from Dubbo airport. However, Mudgee airport is registered as suitable for RFDS operations.

19.3.5 Community facilities

i Cultural and recreational

MWR LGA has three libraries servicing Mudgee, Kandos and Gulgong. It also has one mobile library. The LGA has a range of cultural facilities; however these are mostly concentrated at Mudgee and Gulgong.

Council maintains 55 parks, gardens and oval/playing field areas. There are over 50 sporting clubs and associations within the LGA, with the majority located in Mudgee.

ii Youth facilities

The bulk of youth facilities and services are located at Mudgee, with limited facilities and services on offer at Gulgong. As noted in MWRC's local services assessment, MWR LGA does not have adequate youth facilities for a growing younger population (Manidis Roberts 2012).

19.4 Impact assessment

19.4.1 Project workforce and population change impacts

As stated in Section 4.3, the proposed modification will not increase the existing workforce. Therefore, it is envisaged population change in the region will not occur due to the proposed modification.

19.4.2 Community infrastructure and service impacts

MCO currently supports the local community through, amongst other means, contributions to public infrastructure and services by contributing more than $250,000 in community grants and sponsorships as part of its Community Support Program since 2010. Examples of organisations MCO has contributed to are Cook's Gap RFS, Mudgee Gymnastics, Mudgee North West Legacy, Newborn and Infant Emergency Transport Service.

As part of voluntary planning contributions, MCO has paid MWRC over $1.7M in accordance with the Voluntary Planning Agreement (VPA).

Although approval of the proposed modification will not increase the population in the area and increase demand for community services and infrastructure, it will result in the continued contribution of funding directly towards local community infrastructure and community projects.

19.4.3 Social amenity

Factors that can influence social amenity are predominantly dust, noise and visual impacts. Potential impacts associated with each of these are provided in Chapters 8, 9 and 13 respectively.

19.4.4 Economic impacts

The MCP is an important part of the local community as 62% of the workforce resides within Mudgee and 94% in the MWR LGA. Wells (2006) reported that in addition to the 317 full-time positions that would be created by MCP Stage 1, there would be an induced employment benefit of 593 jobs. In total, this equates to approximately 910 full-time equivalent positions created in the region. As detailed in Chapter 20, the proposed modification would continue to benefit the local area and provide benefits to the overall NSW economy through royalties payable to NSW of approximately $85M (present value). There are also additional benefits to NSW from the potential non-market employment benefits estimated at $39M.

19.4.5 Cumulative impacts

As considered in the respective chapters, there is the potential for cumulative impacts of the proposed modification with other proposed existing developments and operations on environmental aspects. Based on the results of these assessments, cumulative impacts of the proposed modification would be minor.

19.5 Management and monitoring

19.5.1 Strategies for impact management

i Community engagement

As discussed in Chapter 6, a stakeholder engagement strategy has been prepared and is being implemented for the proposed modification. Beyond the current application, MCO is committed to keeping the local community informed of the progress of its mining operations and performance by:

- maintaining open and constructive communication with affected individuals and groups;
- implementing and participating in the Community Consultative Committee; and
- providing environmental monitoring data and other relevant information in a timely manner via MCO's website.

ii Social amenity

There will be no potential impact on the amenity of Cook's Gap and surrounding areas as a result of population increase under the proposed modification.

Other amenity impacts could arise from dust, noise and visual impacts. All of these potential impacts have been investigated, adversely affected properties identified and measures adopted to provide for acceptable outcomes. Thus, with the measures either already implemented or proposed, amenity impacts around MCP will be managed to comply with existing Stage 1 approvals.

iii Monetary contribution

As noted in Section 18.2, MCO must make a minimum road maintenance monetary contribution for Ulan and Cope Roads and roads in general of $1M and $1.25M, respectively. In addition, MCO must make an open cut and underground produce coal minimum monetary contribution of $1M and $300,000, respectively. A minimum of $1M must also be provided by MCO for contribution towards community infrastructure. The appendix also sets out the funding timeframe and includes consideration of adjustment for the consumer price index.

MCO will continue to contribute funding directly towards local community infrastructure and community projects.

19.5.2 Monitoring

MCO will monitor and review potential impacts in accordance with its various management and monitoring plans, licences and other environmental compliance mechanisms associated with the proposed modification over time. An important component will be the continued implementation of its existing engagement tools to ensure:

- community issues and actual and/or perceived impacts from the MCP's activities are understood;
- working partnerships with stakeholders are maintained and established to address community needs; and
- effective management of the MCP's social impacts.

Key activities to be undertaken will include:

- regular liaison with relevant government agencies and council; and
- regular MCP updates with landowners and local residents through newsletters and community information sessions.

19.6 Conclusion

MCO is committed to continuing to work closely with the community to maximise the opportunities and benefits that the Stage 1 project and the proposed modification currently presents for the local area.

As the proposed modification will not directly increase the workforce numbers, continued operations will provide sustained income, ongoing employment and positive flow-on effects.

The proposed modification will not result in any direct increase in the region's population. Potential environmental impacts from the proposed modification will be managed by MCO to acceptable levels and are therefore unlikely to result in potential property acquisition. Therefore, adverse social impacts on community infrastructure and services will be negligible. However, the proposed modification will enable MCO to continue to support the local community as a local employer, economic contributor and community partner. This includes the continuation of the contribution from MCO's Community Support Program to improve public infrastructure and provide funding for community projects in the local region.

The proposed modification will have no noticeable effects on the social amenity of the surrounding area. MCO has implemented a range of measures to actively communicate and inform local stakeholders of its activities and to ensure it is able to identify opportunities to improve local amenity. MCO will continue to address any concerns with local stakeholders during the EA process and throughout the life of the mine.

20 Economics

20.1 Introduction

Gillespie Economics Pty Limited prepared an economic assessment for the proposed modification. The findings of the assessment are summarised in this chapter. The associated report is given in Appendix L.

20.2 Approach to economic assessment

20.2.1 Government guidelines

NSW Government's draft *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals* (2012) identifies benefit cost analysis (BCA) as the appropriate method for the economic assessment of mining proposals. In accordance with this guideline, a BCA has been conducted for the proposed modification. Additionally, the BCA has taken account of the former NSW Department of Planning and Infrastructure's draft *Guideline for economic effects and evaluation in EIA* (2002).

20.2.2 Purpose of a BCA

A BCA compares the present value of the aggregate benefits to society of a proposed project with the present value of its aggregate costs. The present value is determined by estimating benefits and costs over the life of the project, taking account of the changing value of money over time, and subtracting the costs from the benefits. A project is considered to improve the economic welfare of society if the present value of aggregate benefits to society exceeds the present value of aggregate costs. The analysis considers the 'with and without (base case) project scenario' to enable the comparison to be made.

20.3 Identification of benefits and costs and their dollar basis

For the proposed modification, the base case scenario involves the continuation of mining in accordance with the approved Stage 1 operations and for consistency with the approach to the assessment of potential environmental impacts, the Stage 2 proposal. The identified benefits and costs and the basis for their dollar estimates for the proposed modification are given in Table 20.1.

Table 20.1 Benefits, costs and their dollar basis

Category	Costs	Basis	Benefits	Basis
Net production benefits	Opportunity cost of land and capital	The proposed modification will require the use of approximately 178 ha of land that is not already required for continuation of operations under the 'without' the proposed modification scenario. While the majority of this land is already in MCO ownership, there is an opportunity cost of using this land for the proposed modification instead of an alternative use. The opportunity costs is given by its land value which is assumed to be $2,000 per ha.	Value of coal	This can be estimated from the increased thermal coal volumes that would be produced, together with an assumed export price of coal. The proposed modification is estimated to produce two qualities of thermal coal, 18% ash and 22.5% ash. The weighted export coal price for all the product coal is assumed to remain constant over time at USD$85/t. An exchange rate of 1.01 for AUD:USD was initially assumed with the long run average being 0.89.
	Additional capital costs	The capital costs of the proposed modification are estimated at $40M and are associated with sustaining capital and costs of environmental and social impact mitigation. These costs are only included in the years that they are expected to occur.	Residual value of capital and land at the cessation of the proposed modification	At the end of the proposed modification, capital equipment and land may have some residual value that could be realised by sale or alternative use. It is conservatively assumed that there is no additional residual value of capital and land as a result of the proposed modification.
	Operating costs, including administration, mining, coal handling and transportation to port	The annual operating costs of the proposed modification include costs associated with mining, CHPP operation, administration, rail, port, demurrage and marketing. These costs include labour costs, which reflect the value of labour resources in their next best use. The average annual operating cost of the proposed modification over a 20 year period (excluding royalties) is estimated at $48M.	-	-
	Any additional site infrastructure decommissioning costs	The proposed modification does extend the life of MP 05_0117, however compared to the base case of Stage 1 and Stage 2 the proposed modification includes only minor changes to surface water infrastructure and will not change the timing or extent of infrastructure decommissioning. Rehabilitation costs associated with the mining footprint are included in operating costs above.	-	-

Table 20.1 Benefits, costs and their dollar basis

Category	Costs	Basis	Benefits	Basis
Potential environmental, social and cultural impacts	Greenhouse gas generation	The economic analysis has conservatively included Scope 1, 2 and 3 emissions as a potential environmental cost of the proposed modification. For this analysis, a shadow price of AUD$23/t CO_2-e, rising at 2.5 per cent per year in real terms for three years and then remaining constant was used.	Any economic and social benefits of employment	The proposed modification, integrated with other approvals, would essentially result in an additional five years of employment for up to 317 people. The employment value has been estimated at $39M for the non-market employment benefits of the project. This value has been included in the BCA. In the context of a fully employed economy there may be some contention about the inclusion of this value. Consequently, sensitivity testing that excludes this value has also been undertaken.
	Operational noise impacts	The approach in this analysis is to use the costs of noise mitigation measures.	-	-
	Agricultural production	The agricultural suitability of the proposed extension areas are classified as Class 3, 4 and 5, with the majority being Class 5, land unsuitable for agriculture or best suited to only light grazing. In accordance with MCO's commitment to returning mining areas to their pre-mining land use, the small section of the proposed Open Cut 2 extension area suitable for agriculture will be reinstated following mining. No significant impacts to agricultural production will occur as a result of the proposed modification, and as such, no costs were included in the BCA.	-	-
	Air quality impacts	No additional privately-owned residences are predicted to be significantly impacted by dust from the proposed modification and hence no additional residences would be subject to acquisition upon request. Consequently, no additional economic costs were included in the BCA.	-	-
	Surface water impacts	An increase of 200 ML per annum is predicted as a result of additional dust suppression demand. The opportunity costs of water is assumed to be $2,000 per ML.	-	-

Table 20.1 Benefits, costs and their dollar basis

Category	Costs	Basis	Benefits	Basis
	Groundwater impacts	The only economic impact from groundwater is the opportunity cost of holding water licences for an additional five years. This cost has been estimated assuming a value of water of $2,000 per ML. Also 35 ML per annum in reduced catchment inflows to the Moolarben Creek is anticipated.	-	-
	Ecological impacts	The analysis is based on the premise that impacted biodiversity values are counterbalanced by the values for the biodiversity offset and, accordingly, no significant further economic cost would arise that would warrant inclusion in the BCA.	-	-
	Road transport impacts	No increase employee numbers or change traffic conditions are predicted. Continuation of the current level of road usage for a further five years is not considered to have any significant road transport impacts for inclusion in the BCA.	-	-
	Rail impacts	The proposed modification does not seek approval to increase current production levels and, therefore, no additional train movements will be required.	-	-
	Historic and Aboriginal heritage impacts	The implementation of mitigation measures specified in the ACHMP for Aboriginal heritage sites will minimise the impacts to Aboriginal cultural heritage. Consequently, no economic costs have been included in the BCA. No historic heritage sites present and hence no economic costs have been included in the BCA.	-	-
	Visual impacts	The costs of mitigation measures, including targeted planting and screening, has been used in the BCA.	-	-

The proposed modification, integrated with other approvals, would essentially result in an additional five years of employment for up to 317 people. A number of studies have been prepared by Gillespie Economics Pty Limited to quantify non-market employment benefits from mining projects. Applying the outcomes of more a conservative study for the Bulli Seam Operation employment value gives an estimated $39M for the non-market employment benefits of the project. This value has been included in the BCA. In the context of a fully employed economy there may be some contention about the inclusion of this value, particularly as it requires benefit transfer from a study of an underground mining operation in a region of NSW. Consequently, sensitivity testing that excludes this value has also been undertaken.

20.4 BCA

20.4.1 Quantification of aggregate benefits and costs

The estimated incremental production benefits and costs and estimated cost of foregone net production benefits due to earlier extraction of coal and the total incremental net production benefit are provided in Table 20.2. Consistent with NSW Treasury (2007), James and Gillespie (2002) and NSW Government (2002), the analysis has been undertaken in real values with discounting at 7%.

Table 20.2 Benefit cost analysis results of the proposed modification ($M present values at 7% discount rate)

	COSTS		BENEFITS	
	Description	**Value**	**Description**	**Value**
Net Production Benefits	Opportunity cost of land	$0	Value of coal	$997M
	Opportunity cost of capital equipment	$45M	Residual value of capital equipment at the cessation of the proposed modification	$0
	Development costs of the modification	$22M	Residual value of land at the cessation of the proposed modification	$0
	Operating costs, including administration, mining, coal handling, transportation to Port and Port charges	$499M		
	Additional surface infrastructure decommissioning and rehabilitation costs	$0		
	Production Sub-total	$567M	-	$974M
	Net Production Benefits		-	$430M ($188M)
Environmental, cultural and social impacts	Greenhouse gas emissions	$7M ($0.1M)	Non-market benefits of employment	$39M
	Agricultural production	Negligible	-	-
	Operational noise	Negligible. Mitigation measures included in capital costs	-	-
	Air quality	Negligible	-	-
	Surface water	Negligible	-	

Table 20.2 Benefit cost analysis results of the proposed modification ($M present values at 7% discount rate)

	COSTS		BENEFITS	
	Description	**Value**	**Description**	**Value**
	Groundwater	Negligible	-	-
	Flora and fauna	Some loss of values but offset. Cost of biodiversity offset included in capital and operating costs	-	-
	Road transport	Negligible		
	Road Rail transport	Negligible		-
	Historic and Aboriginal heritage	Negligible	-	-
	Visual impacts	Negligible. Costs of mitigation included in capital costs	-	-
	Externalities sub-total	$7M($0.1M)	-	$39M
NET SOCIAL BENEFITS (including employment benefits)				$462M ($227M)
NET SOCIAL BENEFITS (excluding employment benefits)				$422M ($188M)

Note: Totals may have minor discrepancies due to rounding. When impacts accrue globally, the numbers in brackets relates to the level of impact estimated to accrue to Australia

The proposed modification is estimated to have total net production benefits of $430M. Assuming 100% foreign ownership, $188M of these net production benefits would accrue to Australia. The estimated net production benefits that accrue to Australia can be used as a threshold value or reference value against which the relative value of the residual environmental impacts of the proposed modification, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the proposed modification. The threshold value indicates the price that the community must value the residual environmental impacts (be willing to pay) to justify in economic efficiency terms the no development option.

For the proposed modification to be questionable from an economic efficiency perspective, all incremental residual environmental impacts from the proposed modification, that impact Australia, would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $188M. This is equivalent to each household in the MWRLGA, NSW and Australia valuing residual environmental impacts of the proposed modification at $20,000, $70 and $23, respectively.

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to investigate and quantify the main residual environmental impacts of the proposed modification. It is evident that the main impact that is quantified in this analysis relates to greenhouse gas impact from the proposed modification. The global greenhouse gas costs are estimated $7M (present value), with $0.1M (present value) accruing to Australia. There will also be an opportunity cost of using water licences for the proposed modification and reducing catchment flow into Moolarben Creek. However, this opportunity cost is negligible. Other impacts, including the impacts on biodiversity, visual amenity and noise amenity, have been internalised into the production costs of the proposed modification by the inclusion of the capital and operating costs of noise and visual impact mitigation measures and biodiversity offsets.

Overall, the proposed modification is estimated to have net social benefits to Australia of between $188M and $227M (depending on whether non-market employment benefits are included) and hence is desirable and justified from an economic efficiency perspective.

While the major environmental, cultural and social impacts have been quantified and included in the project BCA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $188M and $227M for the proposed modification to be questionable from an Australian economic efficiency perspective.

20.4.2 Distribution of costs and benefits

The net production benefits of the proposed modification would be distributed between a number of stakeholders, including:

- the Commonwealth Government in the form of any company tax;
- the NSW Government via royalties ($85M);
- the local community through voluntary contributions to community infrastructure and services; and
- MCO in the form of any after tax profits.

The distribution of costs and benefits in terms of their quantum and reach is shown in Table 20.3.

Table 20.3 Distribution of total benefits and costs (present values at 7% discount rate)

Value		Distribution			
		Local/Regional	State	National	Global
Benefits					
Net production benefits to the proponent	$242M	-	-	-	✓
Net production benefits to Commonwealth Government – Company tax	$104M	✓	✓	✓	-
Net production benefits to NSW Government – Royalties	$85M	✓	✓	-	-
Social benefit of employment	$39M	✓	✓	-	-
Total	**$469M**				
Costs					
Greenhouse gas emissions rest of world1	$7M	-	-	-	✓
Greenhouse gas emissions Australia	$0.1M	✓	✓	✓	-
Agricultural production	Negligible	✓	-	-	-
Operational noise	Negligible. Mitigation measures included in capital costs	✓	-	-	-
Air quality	Negligible	✓	-	-	-
Surface water	Negligible	✓	-	-	-
Groundwater	Negligible	✓	-	-	-

Table 20.3 Distribution of total benefits and costs (present values at 7% discount rate)

Value		Distribution			
		Local/Regional	State	National	Global
Flora and fauna	Some loss of values but offset. Cost of biodiversity offset included in capital and operating costs	✓	✓	✓	-
Road transport	Negligible	✓	-	-	-
Road Rail transport	Negligible	✓	-	-	-
Historic and Aboriginal heritage	Negligible	✓	-	-	-
Total	**$7M**				
Net Social Benefits	**$462M**				

Note: Totals may have minor discrepancies due to rounding.

20.4.3 Sensitivity analysis

The BCA result was tested for changes to the following variables:

- opportunity cost of land and capital equipment;
- capital costs;
- operating costs;
- value coal;
- USD/AUD exchange rate;
- greenhouse gas impacts; and
- surface water impacts.

The sensitivity analysis indicated that the results of the BCA are not sensitive to reasonable changes in assumptions regarding any of these variables. In particular, significant increases in the values used for external impact, such as greenhouse gas costs, had little impact on the overall economic desirability of the proposed modification.

The results were most sensitive to decreases in the value of product coal, although substantial and sustained reductions in assumed coal prices would be required to make the proposed modification undesirable from an economic efficiency perspective.

20.5 Conclusion

The proposed modification is estimated to have total net production benefits of $188M to Australia. This is equivalent to each household in the Mid-Western Region Local Government Area (LGA), NSW and Australia valuing residual environmental impacts of the proposed modification at $20,000, $70 and $23, respectively.

The sensitivity analysis indicated that the results of the BCA are not sensitive to reasonable changes in assumptions. The results were most sensitive to decreases in the value of product coal.

The environmental, social and cultural costs of the proposed modification that are not already included in the calculation of net production benefits and accrue to NSW are estimated at less than $1M. These are considerably less than the net production benefits that directly accrue to NSW through royalties ($85M). NSW will obtain additional benefits through infrastructure and services provided with a share of Commonwealth Government Company tax from the proposed modification. There are also additional benefits to NSW from the potential non-market employment benefits ($39M). Consequently, as well as resulting in net social benefits to Australia the proposed modification would result in net social benefits to NSW.

21 Statement of commitments

Environmental management of the MCP is undertaken in accordance with MCO's EMS, which was prepared in compliance with Schedule 5, Condition 1 of MP 05_0117 and approved by DP&I.

Table 21.1 consolidates the commitments made throughout this EA, to prevent, minimise and/or offset potential adverse impacts from the implementation of the proposed modification. It is important to note that only commitments additional to those currently implemented under the existing EMS have been listed. Given that potential environmental impacts under the proposed modification are largely similar to those associated with the existing approved operation this regime would generally remain for the proposed modification.

The commitments will be implemented through the strategies, plans and programs, described in Section 3.1.3, which form part of the EMS framework.

Table 21.1 Commitments

Item	Commitment
Acoustics	Management and monitoring of noise will continue to be undertaken in accordance with MCO's NMP, including proactive and reactive management, which will be updated to reflect the outcomes of the proposed modification.
Air quality and greenhouse gases	Management and monitoring of air quality will continue to be undertaken in accordance with the best management practices set out in MCO's AQMP. To enhance the ability of the proposed modification to manage dust impacts and to verify the environmental performance over the life of the mine, MCO will make the following changes to the existing monitoring network: • include the addition or re-location of a TEOM to the south-west of the project area at the mid to late lifetime of the mine, to enable pro-active dust management at receptors to the south of the project area; and • install an upwind TEOM monitor to the north-east of the project area, in the event that measured dust impacts begin to occur. MCO will continue to report annually in the AEMR, the total amount of greenhouse gas emissions from the MCP and the effectiveness of the measures implemented under the ESAP, which will be updated to reflect the outcomes of the proposed modification.
Ecology	Management and monitoring of ecology will continue to be undertaken in accordance with the MCO's LMP, which will be reviewed and updated as required to incorporate the proposed extension areas. In addition, MCO commits to the investigation of artificial roosting structures for microbats to compensate for the loss of rocky outcrops. To compensate for residual impacts MCO commits to a biodiversity offset package comprising: • prepare and register a conservation covenant under Section 69B of the NPW Act (or equivalent conservation protection measure including the option to transfer land to the Minister for the Environment with agreement) to cover all seven properties referred to in Section 10.5.2 to provide long term protection of the offset areas following approval of the proposed modification; - should any of the nominated properties not be available for long term conservation protection, alternative offset sites of equivalent area and biodiversity values required by this BOS will be identified, and secured for long term conservation protection; • undertake a detailed flora and fauna inventory and mapping of the vegetation types and threatened species present on each offset property and identify the management issues to prepare a ROMP for the total offset package as a whole (with incorporation into the Stage 1 ROMP); • prepare a ROMP that includes each property and clearly outlines the responsible parties for the implementation of the plan, the works required to improve and maintain the biodiversity values (including but not restricted to fire management, weed and feral animal control, erosion and sediment control, restrictions on access, revegetation), performance criteria and a reporting and monitoring program. The management plan will be prepared by MCO and reviewed by an appropriately qualified and experienced ecologist and will be incorporated into a single management plan covering the already approved Stage 1 offsets;

Table 21.1 Commitments

Item	Commitment
	• implement the management actions specific to each property and provide an annual report on the implementation of the plan and the results (changes in biodiversity values) to the DP&I/OEH and SEWPaC; • provide adequate funds to implement the management plan on an annual basis; and • arrange for the independent review of the adequacy and implementation of the ROMP every three years.
Aboriginal heritage	Management and monitoring of heritage will continue to be undertaken in accordance with the MCO's Stage 1 ACHMP, which will be extended to include the proposed extension areas. Additional management measures comprise: • MCO will update the Stage 1 ACHMP to include test excavation and potential salvage of Aboriginal sites SIMC331 and SIMC344; and • assessing potential blasting impacts on Aboriginal sites SIMC343, SIMC352, SIMC344 and SIMC345. Sub-surface testing and potential salvage of will be implemented if assessment determines that site(s) will be adversely impacted.
Visual	Management of the visual impacts associated with the proposed modification will be undertaken in accordance with MCO's LMP. MCO will review and update the LMP to include the following additional management measures: • provide screening, subject to landowner consent, along the southern edge of Cope Road, where views of Open Cut 1 extension areas will be possible; • where properties on Ridge Road will have direct views from the residence to both the proposed Open Cut 1 and Open Cut 2 extension areas, MCO will investigate the feasibility of targeted vegetative planting for affected properties along Ridge Road, to mitigate the visual and lighting impacts of the proposed modification; • out-of-pit embankments should be built up first so that continued operation are obscured by the embankment. Outer faces of the embankments should be seeded and grassed as soon as possible to soften the view to exposed workings; • stage workings on out-of-pit emplacements, wherever possible, so that outer embankments are created first around the perimeter, providing a visual screen while work is undertaken in the central part of the emplacement; • maintain a strip of vegetation, where possible, along the leading face of the ridgeline associated with the proposed Open Cut 1 extension area for as long as practical, to provide a visual screen to workings behind and thereby limiting the time viewers will be exposed to workings and lighting in this area; • establish operational protocols for setting up of mobile lighting plant such that lighting is directed away from external private receptors; • establish design and operational protocols such that lighting sources are directed below the horizontal to minimise potential light spill; • design light systems that minimise wastage; and • avoid lighting of light coloured surfaces which have greater reflectivity.

Table 21.1 Commitments

Item	Commitment
Groundwater	Management and monitoring of groundwater will continue to be undertaken in accordance with the MCO's WMP and relevant sub-plans, which will be reviewed and updated, as required, to accommodate the proposed modification. No specific additional management measures have been identified.
Surface water	Management and monitoring of surface water will continue to be undertaken in accordance with MCO's WMP and relevant sub-plans. MCO will review and update the WMP to accommodate the proposed modification.
Soils and agriculture	Rehabilitation will be undertaken in accordance with the MCO's LMP and MOP, which will be reviewed and updated, as required, to accommodate the proposed modification. No specific additional management measures have been identified.
Social	MCO is committed to prevent or minimise negative social impacts due to the MCP and will endeavour to enhance positive social impacts in accordance with its Environment and Community Policy.

22 Justification and conclusion

22.1 Introduction

This EA has examined the potential environmental, social and economic impacts of the proposed modification. MCO has committed to measures to prevent, minimise and/or offset potential adverse potential impacts and enhance positive impacts. This chapter considers the proposed modification against the applicable objects of the EP&A Act and gives a conclusion to the EA.

22.2 Objects of the EP&A Act

The consistency of the proposed modification with the objects of the EP&A Act is considered below.

"To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment".

Stage 1 is an approved operation with a substantial coal resource estimated at 187 Mt. The proposed modification will enable the seamless extension of mining within the approved Stage 1 project boundary, utilising existing equipment, plant and workforce. The proposed modification will access substantial economic resources that are restricted by the current approval and provide an opportunity to greatly improve the efficiency of mining operations within Open Cuts 1 and 2, by increasing the available strike length and working face and, consequently, reducing extraction costs. The proposed modification will prevent the potential sterilisation of an important natural and economic resource that, as demonstrated by this EA, can be mined with minor environmental impacts beyond those currently approved under MP 05_0117.

The proposed modification will extend the substantial regional and local economic and social benefits from the Stage 1 operation. It will also promote the continuity of economic benefits to the local region from business expenditure, to the NSW Government in the form of royalties and to the Commonwealth Government in the form of company and income taxes.

MCO's important role in the social welfare of the local community is substantiated in Chapter 19. An example is the MCP's workforce of up to 317 fulltime staff. The proposed modification will extend this employment by a further five years.

The mine plan has been designed with consideration to potential environmental and social impacts. Where impacts have been identified, measures to avoid, minimise and/or offset have been developed. Residual impacts will be offset by social and economic benefits that will accrue to the locality, region, NSW and other stakeholders. This demonstrates the proper development of the natural mineral resource.

"To encourage the promotion and co-ordination of the orderly and economic use and development of land."

The proposed modification allows for the continued orderly and economic development of land and resource already approved for the purposes of mining. The mine plan has been designed to enable a seamless transition from the approved to the proposed mining areas utilising the existing infrastructure and workforce. The majority of predicted impacts are within existing criteria. Residual impacts that cannot be avoided or minimised can be licensed or offset in accordance with relevant government policies.

"To encourage the protection, provision and co-ordination of communication and utility services."

The proposed modification will not adversely impact communication and utility services. Existing services will be required at the approved level for a further five years.

"To encourage the provision of land for public purposes."

The proposed extension areas are within the approved Stage 1 project boundary. It is noted that some of this land is owned by the Crown. Given it is within the existing approved Stage 1 project boundary, it is considered that there will be no impact on the provision of land for public purposes. The proposed modification will, however, enable the continued support of the local community through ongoing MCO contributions to public infrastructure and services under its current VPA and through other initiatives such as its Community Support Program.

"To encourage the provision and co-ordination of community services and facilities."

The proposed modification will not result in additional employees and is therefore unlikely to increase the region's population. As such, there will be no demand for additional community services and facilities (such as childcare, health, education and emergency services) as a direct result of the proposed modification. Therefore, adverse social impacts on community infrastructure and services are considered to be negligible, if at all.

As noted above, the proposed modification will enable the continued contribution of funding towards local community infrastructure and services. There will also be considerable payments to the NSW Government in royalties and to the Commonwealth in company and minerals taxes. A proportion of these funds will be available to provide or finance the provision of necessary community services and facilities.

"To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats."

The proposed modification requires the progressive removal of 171 ha of native vegetation and 7 ha of exotic pasture, with a total impact area of approximately 178 ha. The overall removal of vegetation and fauna habitat is considered to be minor within the regional context. Open forest and woodland to be cleared and then re-established represents less than 0.5% of the remnant forest and woodland outside of conservation areas in the Hunter-Central Rivers CMA. Land use practices including previous clearing, ongoing grazing and more recently mining, in and adjacent to the proposed extension areas have contributed to the decline in condition of native vegetation communities and fauna habitats. Rehabilitation and offsets will contribute to land improvements and greater conservation outcomes.

Assessments of ecological significance were applied under section 5A of the EP&A Act, as well as assessments under the EPBC Act, which determined the significance of potential impacts to species, populations and communities that were recorded, or are likely to occur in the study area. Management of potential impacts have been addressed according to the hierarchy of avoid, mitigate then compensate. Avoidance measures principally related to the modification of the mine design to be offset from the Moolarben Creek riparian zone and to ensure connectivity between forested areas to the north and south was maintained. Mitigation includes implementation of measures to prevent adverse impacts to fauna during progressive clearing, maximisation of seed collection where practical and restoration and enhancement of fauna habitat.

Proposed extension areas will be mostly rehabilitated for biodiversity outcomes, with vegetation predominately comprising Grassy White Box Woodlands and Broad-leaved Ironbark Forests with stands of Forest Oaks, with a principal objective of enhancing vegetation cover and connectivity. Species will be chosen to improve faunal biodiversity and habitat.

The proposed offset strategy will compensate for any residual impacts and ensure that the proposed modification has a net positive biodiversity outcome.

"To encourage ecologically sustainable development"

The principles of ESD are outlined in Section 6 of the NSW *Protection of the Environment Administration Act 1991* and Schedule 2 of the EP&A Regulation 2000. The consistency of the proposed modification with each of these principles is discussed below.

Precautionary Principle: in practice this means that development should not cause serious or irreversible environmental impact. Such impact can be avoided by, firstly, understanding the potential for environmental impact to occur by undertaking a full environmental assessment and, secondly, ensuring effective mitigation or compensation measures are incorporated into development proposals.

The proposed modification was designed to find the appropriate balance between maximising resource extraction and minimising environmental impacts.

A preliminary risk assessment was undertaken based on the initial design to, amongst other purposes, enable identification of environmental risks and risk management controls that could be incorporated in the design of the proposed modification to avoid, eliminate or reduce the level of risk.

The EA was then prepared on the basis of the most recent and accurate scientific data relevant to the proposed modification. Technical studies adopted conservative assumptions to enable the upper limit of potential impacts to be determined. Following the initial findings of a number of studies, including surface water and noise, the mine design was modified to incorporate further amelioration measures.

Feedback received from the community and government stakeholders also guided the assessment process, ensuring that all potential matters of relevance associated with the proposed modification were identified. MCO has committed to measures to prevent, minimise and/or offset potential adverse environmental impacts from the proposed modification, and for the reasons given above, the proposed modification is consistent with the precautionary principle.

Social equity including intergenerational equity: Generally, potential impacts on amenity are limited and, as such, the proposed modification will not substantially disadvantage any stakeholder.

Land acquired for mining or 'buffer' impact land associated with the approved Stage 1 will either be made available for purchase post-mining or will be enhanced for long-term conservation value thereby providing intergenerational equity.

The proposed modification will produce GHG emissions which may contribute to climate change. The proposed modification is predicted to produce annual average Scope 1 emissions of 0.09 Mt CO_2-e. This annual average under the proposed modification in comparison to the Australia greenhouse gas emissions for the period of October 2011 to September 2012 is estimated at approximately 0.016%.

MCO has a range of policies and programs aimed at promoting social equity including, Indigenous, graduate and apprentice employment programs and equal opportunities policy.

As demonstrated in this EA, the proposed modification will result in minor adverse environmental impacts. The resource extracted, however, will be transformed into physical, human and financial capital.

Given the above, it is considered that the proposed modification will generally promote social equity.

Conservation of biological diversity and maintenance of ecological integrity: management and monitoring of ecological values will continue in accordance with MCO's LMP. The LMP will be updated to include additional measures developed as part of the assessment process. Any impacts on ecology will be addressed through a comprehensive offset strategy to ensure longterm conservation.

Improved valuation and pricing of environmental resources: resources should be carefully managed to maximise the welfare of society, both now and for future generations. In the past, some natural resources have been misconstrued as being free or underpriced, leading to their wasteful use and consequent degradation.

Consideration of economic efficiency, with improved valuation of the environment, aims to overcome the underpricing of natural resources and has the effect of integrating economic and environment considerations in decision making, as required by ESD. A full benefit cost analysis was prepared for the proposed modification.

While historically, environmental costs have been considered to be external to project development costs, improved valuation and pricing methods attempt to internalise environmental costs and include them within the project's costing. This includes assigning monetary values for a project's residual environmental impacts.

As demonstrated, the proposed modification will result in minor adverse environmental impacts, largely similar to those associated with the current Stage 1 approval. However, the resource will be transformed into physical, human and financial capital. Overall, the net social benefits to Australia of the proposed modification are estimated to be between $188M and $227M (when non-market value of employment is considered) and, therefore, desirable from an economic perspective.

The regional economic impact analysis estimated that the proposed modification would result in an additional contribution to the regional economy and NSW beyond the already approved Stage 1 project. Benefits include the extension of employment for the regional and NSW economies.

"To encourage the provision and maintenance of affordable housing."

The proposed modification will not change the existing Stage 1 workforce and, as such, will not increase housing pressures. Rather, the existing workforce will be required for a further five years.

"To promote the sharing of the responsibility for environmental planning between the different levels of government in the State."

All interested State and local government agencies have been consulted during the preparation of the EA. Further consultation will occur during the response to submissions following exhibition and pre-determination phases. Thus all levels of government have been involved to date and this will continue through to determination.

"To provide increased opportunity for public involvement and participation in environmental planning and assessment".

Consultation with the local community and interest groups has been undertaken and informed the preparation of the EA. The approvals process also has legislated steps requiring consultation, including the public exhibition of the EA and response to submissions.

It is concluded, therefore, that the proposed modification is consistent with this object of the Act.

22.3 Conclusion

The disturbance limit granted under MP 05_0117, as modified, is limiting potential access to substantial economically viable recoverable coal resources. The resource is approximately 30 Mt of ROM coal. Implementation of the proposed modification is primarily intended to enable these resources to be mined. The proposed modification's implementation will also greatly improve the efficiency of mining operations within Open Cuts 1 and 2, reducing extraction costs.

A preliminary risk assessment was undertaken based on the initial mine design to, amongst other purposes, enable identification of environmental risks and risk management controls that could be incorporated in the design of the proposed modification to eliminate or reduce the level of risk. The intent of the optimised mine plan is to maximise resource recovery, whilst minimising adverse environmental and social impacts. The optimised mine plan formed the basis for this EA.

The EA was prepared using the most recent and accurate scientific data relevant to the proposed modification. Feedback received from community and government stakeholder engagement also provided guidance to the assessment approach, ensuring that all potential matters of relevance associated with the proposed modification were assessed.

Technical studies adopted conservative assumptions, including the progression of the Stage 2 proposal, to enable the upper limit of potential environmental impacts to be determined.

Given that potential environmental impacts under the proposed modification are largely similar to those associated with the existing operations, this regime would generally remain for the proposed modification. MCO has committed to a range of management and monitoring measures that will be implemented throughout the life of the proposed modification to prevent and/or minimise adverse impacts. Following the implementation of these measures, all residual risks were determined as low to moderate. It is important to note that residual ecological impacts, that will occur where impacts are unavoidable, will be compensated by an offset package that will ensure the proposed modification has a net positive biodiversity outcome.

MCO's important role in the social wellbeing of the local community and its economic benefits are substantiated in Chapters 19 and 20, respectively. The proposed modification will extend the substantial regional and local economic and social benefits from the Stage 1 operation. It will also promote the continuity of economic benefits to the local region from business expenditure, to the NSW Government in the form of royalties and to the Commonwealth Government in the form of company and income taxes. Overall, the proposed modification will have net production benefits to Australia of between $188M and $227M.

As demonstrated above, the proposed modification is consistent with the objects of the EP&A Act. In conclusion, it is considered that potential environmental and social impacts are largely similar to those approved under Stage 1 and can be avoided, minimised and/or offset by the implementation of the measures included in the EA. The proposed modification will provide important benefits to the local, state and national economies.

References

AECOM 2011a, *Moolarben Preferred Project Report: Aboriginal Archaeological and Cultural Heritage* Addendum, Unpublished report to Hansen Bailey.

Australian and New Zealand Environment Conservation Council (ANZECC) 1990 *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.*

Australian Bureau of Statistics (ABS), 2006 *Census Community profiles*, viewed 21 November 2011, http://www.abs.gov.au/.

—2011, Data Series 3218.0, *Regional Population Growth Australia*, released 31 March 2011 viewed 23 November 2011, http://www.abs.gov.au/.

—2012 *Census 2011 Community profiles* (released June 2012), viewed 6 August 2012, http://www.abs.gov.au/.

Australian Groundwater and Environmental Consultants (AGE) 2013, *Moolarben Coal Project Stage 1 Optimisation Project – Groundwater Assessment,* Report to EMGA Mitchell McLennan.

Charman, P.E.V 1978, *Soils of New South Wales: Their Characterisation, Classification and Conservation, Tech Handbook No. 1*, Soil Conservation Services of NSW, Sydney.

Cunningham, G.M., Higginson, F.R., Riddler, A.M.H. and Emery, K.A., (undated), *Systems Used to Classify Rural Lands in New South Wales*, Soil Conservation Service of NSW and NSW Department of Agriculture.

DEC 2005, *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*, DEC: Sydney.

DECCW 2009b, *Operational Policy: Protecting Aboriginal Cultural Heritage,* DECCW: Sydney.

Department of Education, Employment and Workplace Relations (DEEWR) 2009, *The Early Years Learning Framework for Australia*. Report prepared by the Australian Government Department of Education, Employment and Workplace Relations.

Department of Environment and Climate Change (DECC) 2007a, *Threatened Species Assessment Guidelines: The assessment of significance,* Department of Environment and Climate Change, Hurstville.

—2008a, *Definitions of vegetation types for CMA areas (Hunter Central-Rivers CMA),* www.environment.nsw.gov.au/proposed modifications/biometrictool.htm, viewed 30 November 2012.

Department of Environment and Heritage (DEH) 2006a, *EPBC Act Policy Statement 1.1 Significant Impact Guidelines, Matters of National Environmental Significance,* Department of the Environment and Heritage, Canberra.

Department of Land and Water Conservation (DLWC) 1998, *Soil Landscapes of the Dubbo 1:250,000 Sheet*.

Department of Planning (DP&I) 2010, *NSW Statistical Local Area Population Projections, 2006-2036.* Prepared by Department of Planning.

—2012a, *Strategic Regional land Use Policy Guideline for Agricultural Impact Statements at the Exploration Stage [online] Available from* <http://www.resources.nsw.gov.au/environment/pgf/agricultural-impact-statements> [Accessed 21 November 2012].

—2012b, *Draft Strategic Regional Land Use Plan Upper Hunter* [online] Available from <http://haveyoursay.nsw.gov.au/document/show/192> [Accessed 21 January 2013].

—2012d, Department of Planning and Infrastructure (DP&I) 2012d, *Development of protocol for site verification and mapping of Biophysical Strategic Agricultural Land (BSAL)* [online] Available from < http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=IezttAjxABI%3D&tabid=205&mid=1081&language=en-AU> {Accessed 7 March 2013].

Global Acoustics January 2012, *Stage 2 Noise Modelling, Environmental Noise Assessment*.

Hamm, G. 2006a, *Moolarben Coal Project - Aboriginal* Cultural Heritage Assessment Report, Unpublished report to NSW Forestry Commission.

—2008a, *Moolarben Coal Project – Aboriginal Cultural Heritage Assessment Report Stage 2*, Unpublished report to Moolarben Coal Mines Pty Limited.

—2008b, Hamm, G. 2008b, *Aboriginal Cultural Heritage Plan for MCP Stage 1 Development Areas: Open Cut 1 and Main Infrastructure Area,* Unpublished report to Moolarben Coal Mines Pty Limited.

Hamm, G and Foley, L. 2010, *Cultural Heritage Management Report on Moolarben Coal Project Stage 1: Open Cut 1 & Main Infrastructure Area*, Unpublished report to Moolarben Coal Mines Pty Limited.

Heggies 2010, *Wilpinjong Coal Mine - 75W Modification Noise Impact Assessment*.

Heritas Architecture 2008*, Moolarben Coal Project, Ulan, NSW European Heritage Assessment of Identified Items within Stage 2 of the Moolarben Coal Project*, prepared for Moolarben Coal Pty Limited.

Horton, D. 1994, *Encyclopaedia of Aboriginal Australia,* Aboriginal Studies Press, Canberra.

—2000, *Map of Australia Showing the Names of Tribal/Language Groups that Traditionally Occupied that Area as Documented in The Encyclopaedia of Aboriginal Australia,* AIATSIS: Action, ACT.

Housing NSW 2012, *Quarterly Sales and Rent report*.

Jammel 2005, *Soil, Rural Land Capability and Agricultural Suitability Assessment of the Moolarben Coal Project* [online] Available from <http://www.moolarbencoal.com.au/> [Accessed 21 November 2012].

Jeffrey SJ, Carter JO, Moodie KM & Beswick AR 2001, *Using Spatial Interpolation to Construct a Comprehensive Archive of Australian Climate Data, Environmental Modelling & Software*, Vole 16/4. Pp 309-330, 2001.

Kuskie, P. 2009, *Ulan Coal Continued Operations: Aboriginal Heritage Assessment (Volumes A and B),* Unpublished report to Umwelt (Australia) Pty Ltd on behalf of Ulan Coal Mines Ltd.

Mid-Western Regional Council 2012, *Local Services* Assessment, prepared by Manidis Roberts.

Moolarben Biota 2006, *Moolarben Coal Project Appendix 11: Flora, Fauna and Aquatic Ecology Assessment,* report to Moolarben Coal Operations.

myschool.edu.au 2012, viewed on 14 January 2013.

NSW Department of Environment and Conservation (DEC) 2005, *Approved Methods for the Modelling and Assessments of Air Pollution in New South Wales*.

NSW EPA 2000, *NSW Industrial Noise Policy* (INP).

—2011, *Road Noise Policy* (RNP).

NSW EPA and DP&I 2007, *The Interim Guideline for Assessment of Noise from Rail Infrastructure Projects* (IGANRIP).

NSW National Parks and Wildlife Service (NPWS) 2000, *Environmental Impact Assessment Guidelines, Eucalyptus cannonii,* NSW National Parks and Wildlife Service, Hurstville.

O'Hanlon Design Pty Ltd 2006, *Visual & Lighting Impact Assessment Moolarben Coal Project*, prepared as part of the original EA for MCP.

—2008, *Visual & Lighting Impact Assessment Stage 2 Moolarben Coal Project*, prepared as part of Stage 2 EA for MCP.

PB 2006a, *Moolarben Coal Project, Flood Impact Assessment, Issue 3,* Patterson Britton & Partners Pty Ltd, May 2006.

Pearson, M. 1981, *Seen Through Different Eyes: Changing Land Use and Settlement Patterns in the Upper Macquarie River Region of NSW from Prehistoric Times to 1860,* Unpublished PhD Thesis, Sydney University.

Riddler, A.M.H. 1996, *Agfact SCG Agricultural Suitability Maps - Uses and Limitations,* NSW Agriculture, Orange.

RPS Aquaterra 2011, *Moolarben Complex Stage 2 - Preferred Project Report - Groundwater Impact Assessment*.

RTA 2005, *Traffic volume surveys for Western Region of NSW.*

SKM 2011, *Ulan Road Strategy.* Surveys undertaken to support development of the Ulan Road Strategy.

Spectrum Acoustics August 2006, *Noise and Vibration Impact Assessment, Proposed Moolarben Coal Mine, Ulan NSW.*

The Landscape Institute of Environmental Management and Assessment 2002, *Guidelines for Landscape and Visual Impact Assessment (Second Edition).*

Tindale, N.B. 1974, *Aboriginal Tribes of Australia*, ANU: Canberra.

Veritas Archaeology and History Service 2005, *Moolarben Coal Project Non-Aboriginal Heritage Assessment*, prepared for Moolarben Coal Pty Limited.

Wells Environmental Services 2006, *Moolarben Coal Project Environmental Assessment Report*, prepared for Moolarben Coal Pty Limited.

Wilkinson Murray 2009, *Ulan Coal – Continued Operations Noise and Vibration Impact Assessment*.

SYDNEY
Ground Floor Suite, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 1, 6 Bolton Street
Newcastle NSW 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Suite 1, Level 4, 87 Wickham Terrace
Spring Hill Queensland 4000
T 07 3839 1800 F 07 3839 1866

www.emgamm.com

EMM
EMGA Mitchell McLennan