Muswellbrook Coal Continuation Project

Statement of Environmental Effects

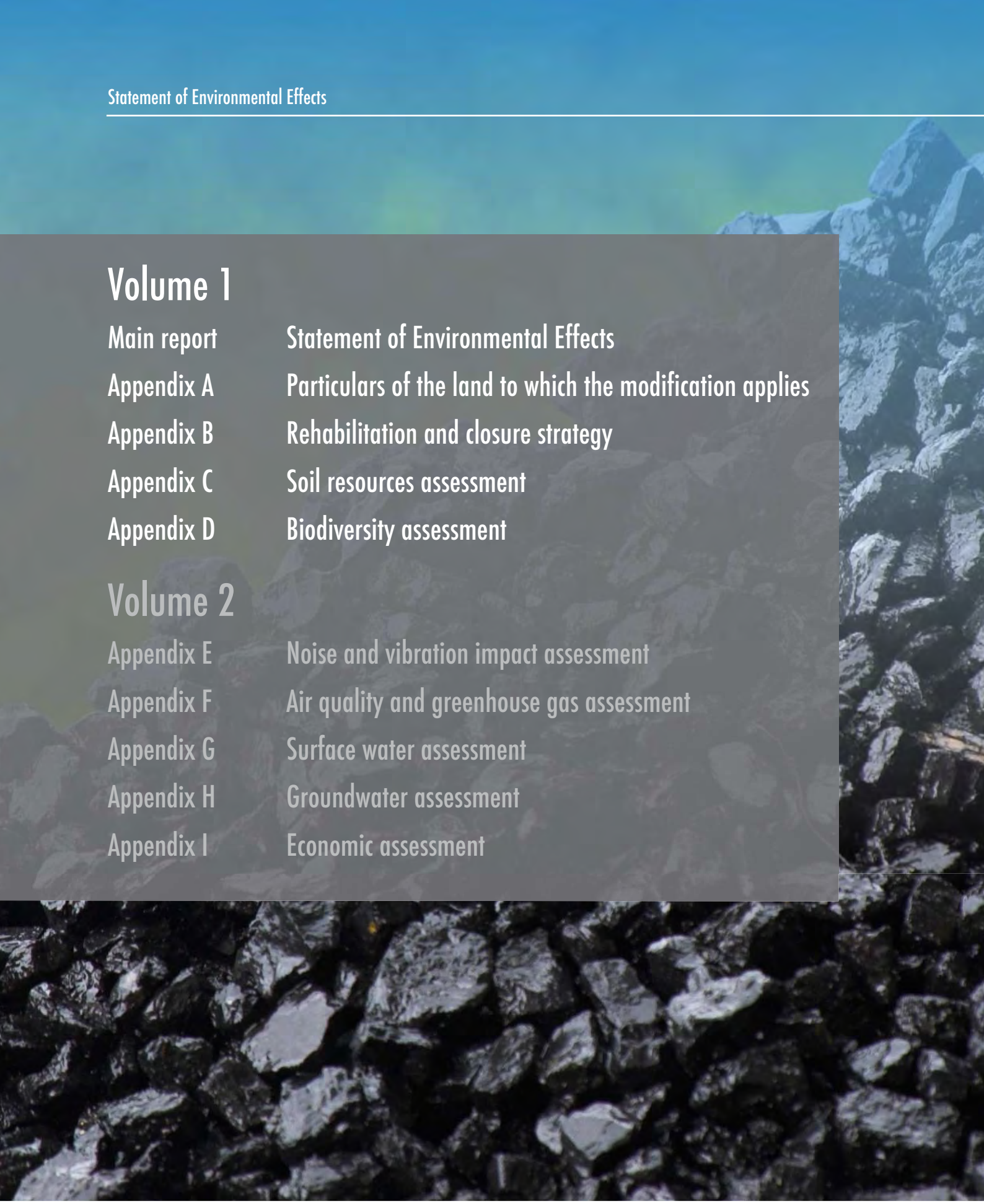
Prepared for Muswellbrook Coal Company Limited | April 2016

1

ESTABLISHED 1907

Muswellbrook Coal Company Limited

EMM



Volume 1

Main report	Statement of Environmental Effects
Appendix A	Particulars of the land to which the modification applies
Appendix B	Rehabilitation and closure strategy
Appendix C	Soil resources assessment
Appendix D	Biodiversity assessment

Volume 2

Appendix E	Noise and vibration impact assessment
Appendix F	Air quality and greenhouse gas assessment
Appendix G	Surface water assessment
Appendix H	Groundwater assessment
Appendix I	Economic assessment

Muswellbrook Coal Continuation Project

Statement of Environmental Effects

Prepared for Muswellbrook Coal Company Limited | 28 April 2016

Level 5, 21 Bolton Street
Newcastle NSW 2300

T +61 (0)2 4927 0506
F +61 (0)2 4926 1312
E info@emmconsulting.com.au

www.emmconsulting.com.au

Muswellbrook Coal Continuation Project

Final

Report J16011RP1 | Prepared for Muswellbrook Coal Company Limited | 28 April 2016

Prepared by	**Kate Cox**	**Nicole Armit**	Approved by	**Brett McLennan**
Position	Associate Environmental Scientist	Services Manager- Environmental Assessment & Management	Position	Director
Signature			Signature	
Date	28 April 2016	28 April 2016	Date	28 April 2016

Document Control

Version	Date	Prepared by	Reviewed by
2	22 April 16	Nicole Armit Kate Cox	Brett McLennan
3	28 April 2016	Nicole Armit Kate Cox	

T +61 (0)2 4927 0506 | F +61 (0)2 4926 1312

Level 5 | Suite 01 | 21 Bolton Street | Newcastle | New South Wales | 2300 | Australia

www.emmconsulting.com.au

Executive Summary

ES1 Overview

Muswellbrook coal mine (MCM) is an open cut coal mine operated by Muswellbrook Coal Company Limited (MCC), 3 kilometres (km) north-east of the township of Muswellbrook, in the Muswellbrook local government area (LGA) in New South Wales (NSW).

MCC has development consent from Muswellbrook Shire Council (MSC) to mine within the No. 1 Open Cut Extension Area (Open Cut 1) (Development Consent No. DA 205/2002, as modified), with operations to be completed by 2020.

Additional coal resources have been identified under a previously rehabilitated area adjacent to Open Cut 1. While this area is within the development consent boundary, a modification to the development consent is required to allow mining of these additional resources, as well as extending the approved mine life and modifying the conceptual final landform (the modification). The modification would maximise the recovery of coal resources at MCM and would enable the recovery of approximately 4.2 million tonnes (Mt) of additional coal resources.

The modification involves:

- extension of open cut mining operations in Open Cut 1;
- extension of the mine life, with operations to cease by the end of 2025;
- changes to the conceptual final landform within the modification area; and
- overburden emplacement in both Open Cut 1 and Open Cut 2, so as to achieve the conceptual final landform.

As the modification involves the continuation of mining into a previously disturbed area there would be no direct impact to undisturbed land. No changes are proposed to the currently approved maximum production rate of 2 Mtpa, mining methods, coal processing, blasting methods, water management, waste management and handling, coal transport, access to site, employee numbers, and hazardous substances and dangerous goods management.

Modification to Development Consent DA 205/2002 is sought under the provisions of Section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). MSC is the consent authority for the application.

ES2 Predicted impacts, management and mitigation

The potential environmental, social and economic impacts of the modification have been identified and assessed in accordance with the EP&A Act, current industry standards, guidelines and policies, and in consultation with MSC and relevant stakeholders. The key findings and conclusions of the environmental assessment presented in this SEE are summarised in Table E.1

Table E.1 Summary of predicted impacts of the modification

Aspect	Where addressed in SEE
Noise and vibration	
• Noise modelling of the worst case scenario (based on the elevated heights of equipment locations and the hauling of overburden under adverse weather conditions) was completed. Of the 34 assessment locations (nearest potentially affected privately owned dwellings) modelled, noise emissions are predicted to result in: - a negligible impact (up to 2 dB above the project specific noise levels (PSNLs)) at eight assessment locations; - a moderate impact (3-5 dB above the PSNLs) at six assessment locations; and - a marginal exceedance of the current development consent limits by 1 dB at locations R13 and R16 and 2 dB at locations R7 and R15. • Predicted noise emission levels satisfy the relevant acquisition criteria at all assessment locations. • Cumulative noise impacts – cumulative noise from the modification and surrounding mines is anticipated to satisfy the night amenity criteria of $L_{Aeq,night}$ 40 dB at all assessment locations. • Blast vibration and overpressure – the blast emissions criteria would continue to be met throughout the life of the modification. • Noise monitoring and mitigation – attended noise monitoring would be increased from the current bi-annual program to be undertaken quarterly (ie every 3 months). Attended noise monitoring would continue at R13, R15, R17 and R20. Monitoring would also be undertaken at R25, the closest residential dwelling to the modification area, instead of R7.	Section 7.1
Air quality and greenhouse gas	
• An air quality and greenhouse gas assessment was prepared by Todoroski Air Sciences Pty Limited to assess the potential air quality impacts of the modification. • Incremental impacts – one exceedance of the incremental 24-hour average PM_{10} concentrations at one assessment location, R25, is predicted. Up to an 11 µg/m³ exceedance (total of 61 µg/m³) is predicted to occur at this location on three days of the modelled year. No exceedances of incremental $PM_{2.5}$ concentrations are predicted. • Cumulative impacts – there is potential for exceedance of the cumulative 24-hour average PM_{10} criterion in the area immediately north of MCM (assessment locations R24 and R25) on two to three additional days of the year due to the modification. These exceedances are predicted on days when the background level is elevated. No exceedances of the cumulative 24-hour average $PM_{2.5}$ criterion are predicted. • Due to predicted incremental impacts at assessment location R25, this residence would be entitled to mitigation measures, which may include the installation of air conditioning, insulation, first flush water systems and cleaning of rainwater tanks. • Air quality monitoring – an existing air quality monitor (Site 2) would be relocated to near assessment location R25, north of MCM, to provide an indication of the ambient air quality levels for this area and enable the performance of dust mitigation measures to be measured. To further supplement the air quality monitoring network, an air quality monitor would be established to the south-southeast of the mine, near assessment location R32, to monitor air quality contributions from MCM when wind is blowing from the north-west.	Section 7.2

Table E.1 Summary of predicted impacts of the modification

Aspect	Where addressed in SEE
Surface water	
• A surface water assessment was prepared for the modification to assess the potential impacts of the modification which may influence surface water or affect the operation of the existing site water management system. • As the mine progresses to the north and north-east, the catchment of Open Cut 1 would increase while the catchment of Dams 1 and 2 would decrease. No additional works, beyond the existing mining activity, would occur outside of the catchments of Open Cut 1, Open Cut 2 and Dams 1 and 2. As mining would be fully contained within the existing internally draining catchments, there would be no impact to local watercourses. • No impacts to the quality of offsite surface water resources are anticipated to occur due to the modification. As the modification does not involve any changes to externally draining catchments there would be no impact on local or regional flooding.	Section 7.3
Groundwater	
• A groundwater assessment was prepared for the modification to assess the potential impacts of the modification on groundwater resources. • The modelling predicts a maximum radius of drawdown of approximately 1 km, which is consistent with the monitoring data to date. No privately registered bores will be affected by this drawdown, as is currently the case, with the majority of registered bores at least 2 km from MCM. • The total inflow during operations including the modification is estimated to be within the range of those previously estimated in the original development application for DA 205/2002 (HLA 2002). All predicted inflows are within the current licences held by MCC. • The Open Cut 1 void is estimated to reach 90% equilibrium (at 190 m AHD) within approximately 25 years and reach equilibrium (at 192 m AHD) in approximately 60 years. The Open Cut 2 void is estimated to reach 90% equilibrium (at 162mAHD) within approximately 30 years and reach equilibrium (at 165 m AHD) in approximately 90 years. • These final void water levels represent a standing water level of 26 m and 33 m in Open Cut 1 and Open Cut 2 respectively, which are below the background standing water level of 210 m AHD. Therefore the final voids would remain a groundwater evaporative sink and would not contribute water to the groundwater system(s), which is consistent with the original development application for DA 205/2002 and other previous groundwater assessments at MCM. • Cumulative groundwater inflow to the recovered final voids is estimated to be approximately 36.5 ML/yr from bedrock aquifers. • Based on the final landform, the spill levels for each open cut pit are approximately 210m AHD for Open Cut 1 and 200m AHD for Open Cut 2. This provides approximately 18m freeboard in Open Cut 1 and 34m freeboard in Open Cut 2, which will hold rainfall from the calculated catchments for the Probable Maximum Precipitation rainfall event. • The groundwater in the coal seams are the only water bearing zones assessed to be impacted during and after mining operations. As the groundwater quality of the coal seams is poor (brackish to saline), and final voids are expected to remain as evaporative sinks, no adverse offsite impacts to the groundwater quality are expected during and after mining operations.	Section 7.4

Table E.1 Summary of predicted impacts of the modification

Aspect	Where addressed in SEE
Ecology	
• A biodiversity assessment was prepared by EMM. The biodiversity assessment considers the biodiversity values present on the site and assesses the potential impacts of the modification on the biodiversity values. • The modification would disturb vegetation from an area of partially completed rehabilitation. An estimated 45.2 ha of rehabilitated woodland and pasture would be impacted. No significant habitat features would be disturbed. The modification would not impact on significant or high condition fauna habitat. • While the modification would disturb an area of partially completed rehabilitation, the modification area would be progressively rehabilitated following mining in accordance with the MOP.	Section 7.5
Visual	
• An assessment of potential visual amenity impacts of the modification was completed to determine the likely visual significance to people living and working in, or travelling through, the landscape surrounding MCM. • The modification would enable an extension of mining in Open Cut 1, thus prolonging the views already possible of the active mining by up to five years. • The modification would have a negligible incremental visual impact on people living in, and travelling through, the area around MCM over and above currently approved operations, with existing views from receptor locations remaining substantially the same.	Section 7.6
Economic	
• An economic assessment of the modification was prepared by Gillespie Economics. The assessment included both a cost benefit analysis and a local effects analysis. • The modification would result in total royalties (based on a 7% discount rate) estimated at $18 Million (M). • The modification would enable the continuation of employment of up to 95 full time equivalent workers, plus contractors, for up to an additional five years. • The modification would contribute annual incremental values to the regional economy for up to three years of: - $155 M in annual direct and indirect regional output or business turnover; - $57 M in annual direct and indirect regional value added; - $16 M in annual direct and indirect household income; and - 204 direct and indirect jobs.	Section 7.7

Table E.1 Summary of predicted impacts of the modification

Aspect	Where addressed in SEE
Social	
• An assessment of the potential social impacts associated with the modification was completed, focusing on Muswellbrook LGA in which MCM is located as well as the surrounding LGAs of Singleton and Upper Hunter. • Visual, noise, odour and air quality impacts have the potential to affect the amenity of the local area. These impacts have been assessed and appropriate management and mitigation measures for these impacts have been provided in the relevant technical studies. • The local community would continue to benefit from the operation of the mine through ongoing contributions to local organisations and groups. • The modification would enable to continuation of employment and associated flow-on economic benefits of the current workforce at MCM by up to an additional five years; a significant benefit during the current mining downturn. It is expected that these social benefits would outweigh the negative social impacts to generate net positive benefits for the local community and economy.	Section 7.8
Soil and land capability	
• Land classed as LSC Class 6 would be temporarily removed during the term of mining in the modification area. This would not result in long term impacts as the land would be rehabilitated to the same LSC class following completion of mining. • The soils in the modification area would remain spolic anthroposols once rehabilitated. The modification is not predicted to result in an overall change in the LSC classes of the final landform.	Section 7.9
Rehabilitation and mine closure	
• No changes to the approved rehabilitation objectives are proposed under the modification. There would also be no change to completed rehabilitation outside of the modification area. • The modification would disturb the partially rehabilitated overburden emplacement area between Open Cut 1 and Open Cut 2. • There would be some changes to the shape of the conceptual final landform in the modification area as a result of the changes to the conceptual mine plan; however there would be no changes to the maximum RL heights. • The final landform would be shaped such that it would form an integrated landform with the rest of the rehabilitation in the development consent boundary.	Section 4.5

ES3 Conclusion

A modification is sought by MCC to Development Consent DA 205/2002 (as modified) to extend mining of Open Cut 1. This would enable the extraction of additional resources in a previously disturbed area within the development consent boundary.

The modification is considered to be substantially the same development as that which is approved. The modification, while involving changes to the conceptual mine plan and life of mine, maintains the existing development consent boundary, maximum production rate of 2 Mtpa of coal, the mining method, and equipment fleet. There are no changes to the approved maximum level of overburden emplacement. Other operational methods relating to operational water management, waste management and handling, coal transport, access to site and employee numbers would also remain unchanged.

The continuation of operations at MCM is considered to be in the public interest due to:

- the continuation of employment of the MCM workforce;
- the continued economic benefits to the Muswellbrook community in terms of indirect economic impacts; and
- the broader economic benefits to the State of NSW from indirect benefits and taxes and royalties which would be derived.

The modification is considered to be justified on the basis of environmental, social, and economic grounds.

Table of contents

Table of contents *(Cont'd)*

Table of contents *(Cont'd)*

Table of contents *(Cont'd)*

Appendices

Tables

Figures

Plates

1 Introduction

1.1 Background

Muswellbrook coal mine (MCM) is an open cut coal mine operated by Muswellbrook Coal Company Limited (MCC). MCM is located 3 kilometres (km) north-east of the township of Muswellbrook, in the Muswellbrook local government area (LGA) in New South Wales (NSW) (see Figure 1.1).

MCC has a long history of mining in the Muswellbrook area, with underground operations commencing at MCM in 1907 and open cut operations commencing in 1944. Underground operations ceased in the late 1990s; however open cut mining continues. MCC has development consent from Muswellbrook Shire Council (MSC) to mine within the No. 1 Open Cut Extension Area (Open Cut 1) (Development Consent No. DA 205/2002, as modified), with operations to be completed by 2020. Existing operations within the development consent boundary are illustrated in Figure 1.2.

Additional coal resources have been identified under a previously rehabilitated area adjacent to Open Cut 1. While this area is within the development consent boundary, a modification to the development consent is required to allow mining of these additional resources, as well as extending the approved mine life and modifying the conceptual final landform (the modification).

The modification would maximise the recovery of coal resources at MCM and would enable the recovery of approximately 4.2 million tonnes (Mt) of additional coal resources.

1.2 Modification overview

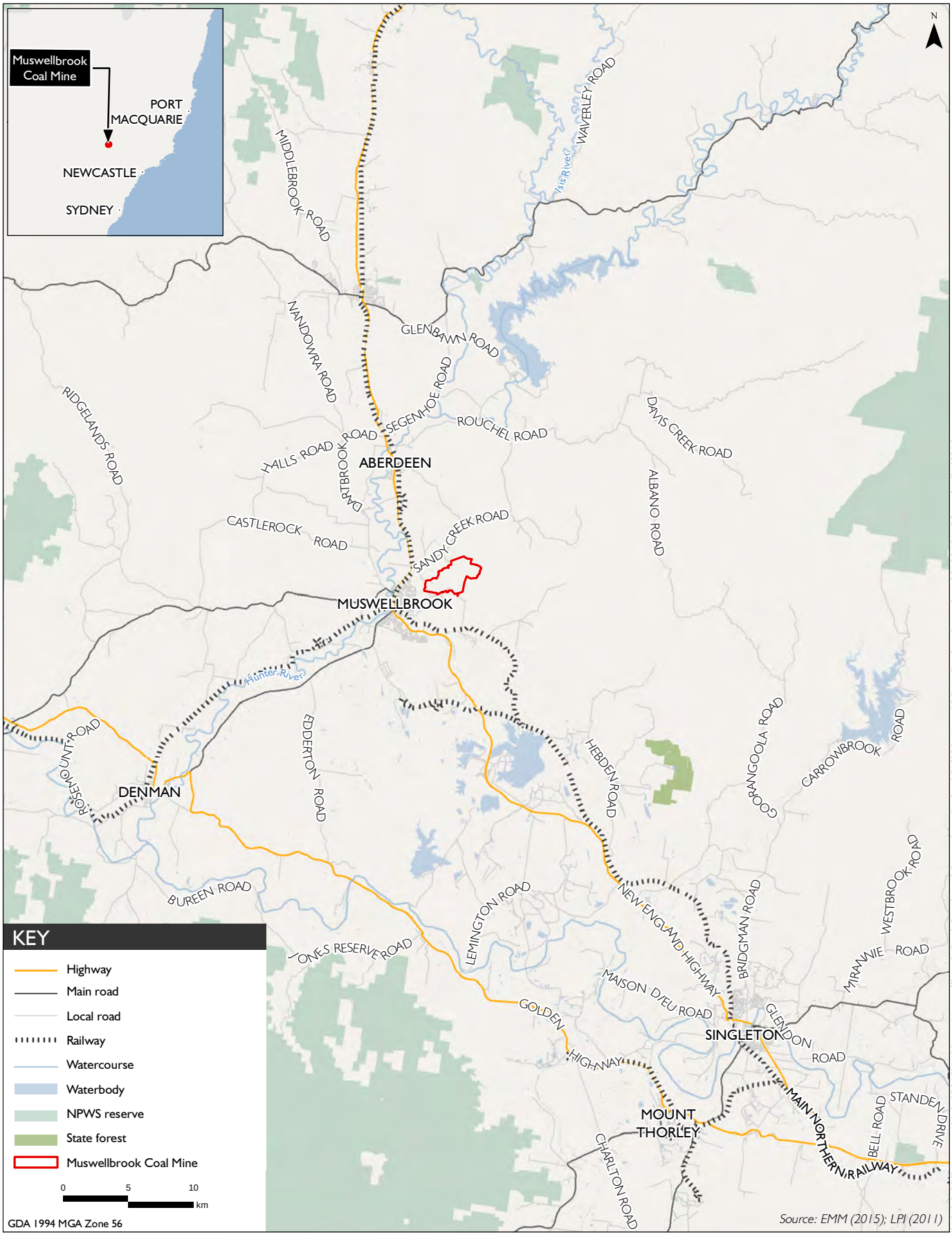
In summary the modification involves:

- extension of open cut mining operations in Open Cut 1;
- extension of the mine life, with operations to cease by the end of 2025;
- changes to the conceptual final landform within the modification area; and
- overburden emplacement in both Open Cut 1 and Open Cut 2, so as to achieve the conceptual final landform.

The modification area is illustrated in Figure 1.3.

As the modification involves mining of a previously disturbed area that was used as an overburden emplacement area, there would be no direct impact to undisturbed land.

No changes are proposed to the currently approved maximum production rate of 2 million tonnes per annum (Mtpa), mining methods, coal processing, blasting methods, water management, waste management and handling, coal transport, access to site, employee numbers, hazardous substances and dangerous goods management.

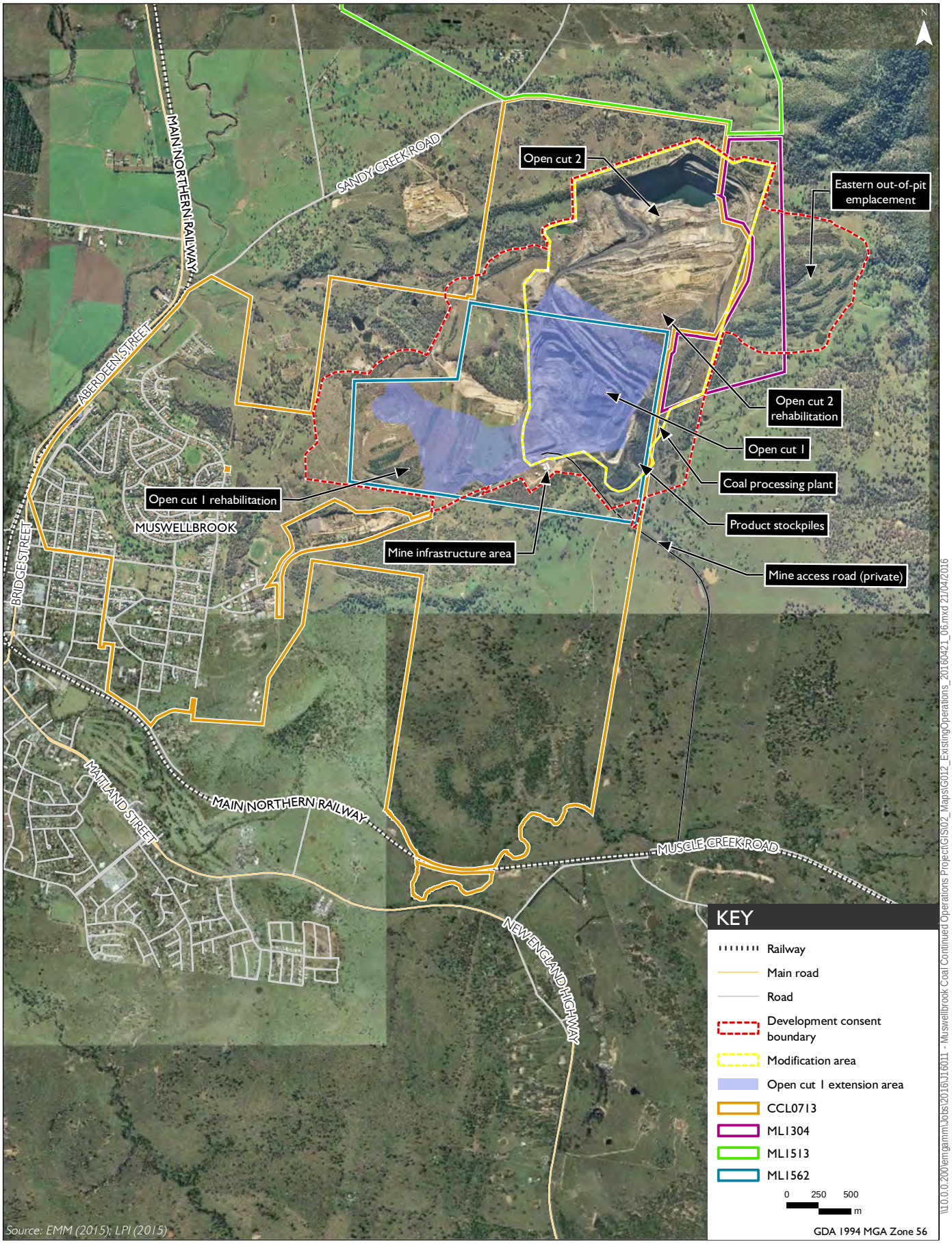


\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G011_RegionalLocation_20160401_02.mxd 1/04/2016

Regional setting

Muswellbrook Coal Continuation Project
Statement of Environmental Effects

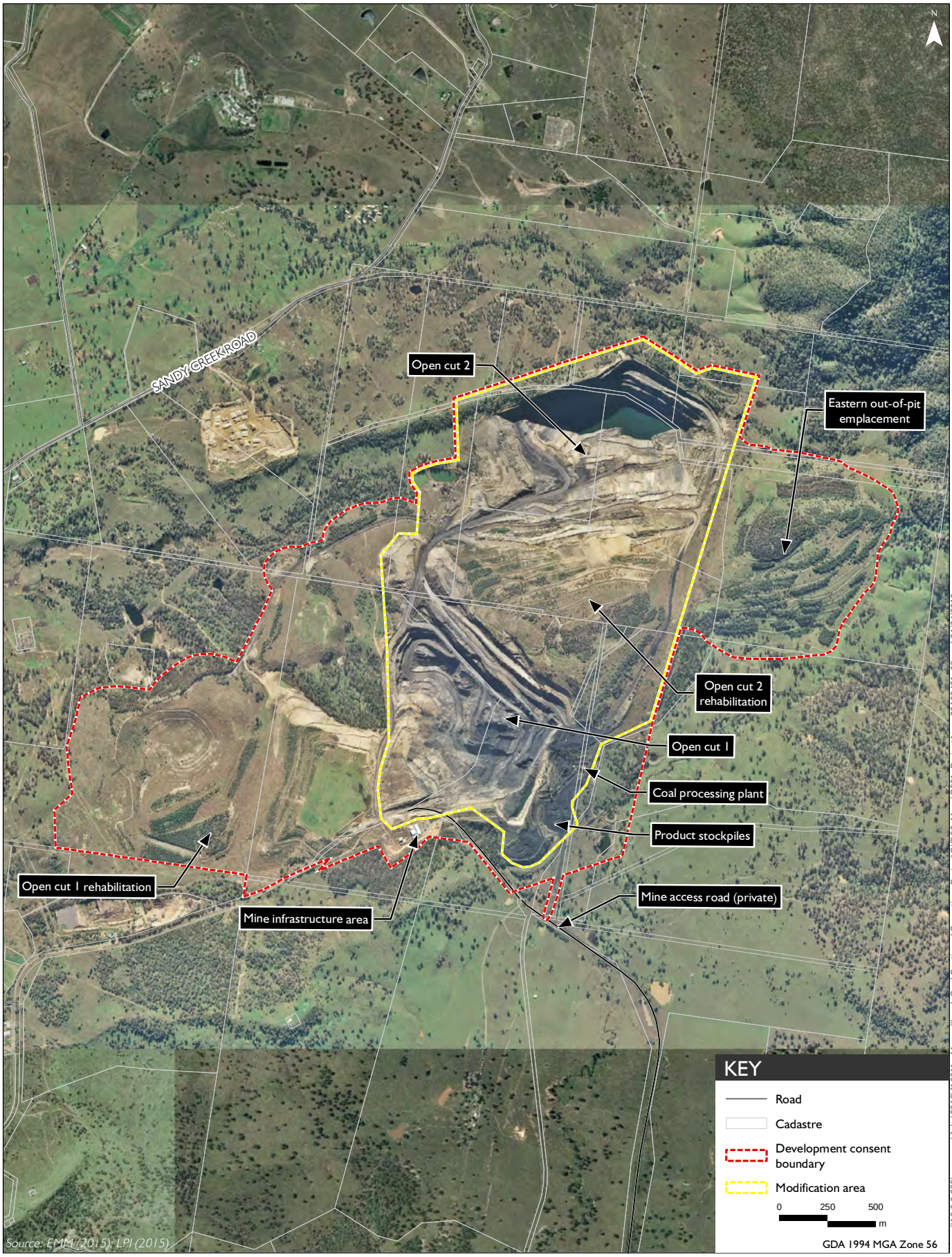
Figure 1.1



\\10.0.0.200\emgamm\Jobs\2016\16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G012_ExistingOperations_20160421_06.mxd 21/04/2016

Existing operations

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 1.2



Modification area

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 1.3

1.3 The proponent

MCM is owned and operated by MCC. MCC is the proponent of the modification.

MCC is a wholly owned subsidiary of Idemitsu Australia Resources Pty Limited (IAR). IAR has been operating in Australia since 1978 and is an Australian subsidiary of Japanese company Idemitsu Kosan Co. Ltd. IAR also has part ownership in other mining operations in NSW and Queensland. IARs combined operations attribute to more than 1,000 jobs and 12 Mtpa of thermal and semi-soft coal for export.

1.4 Purpose of the document

This Statement of Environmental Effects (SEE) has been prepared by EMM Consulting Pty Limited (EMM) in behalf of MCC to support an application to modify Development Consent No. DA 205/2002 (as modified) under section 96(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the SEE is to provide information on the modification and allow MSC to assess the projects merits and impacts in order to make a determination on application, and conditions of such approval if approval is granted. The SEE is also intended to inform the public about the modification so that they can make submissions in its merits or impacts. Such submissions are an important information source for MSC's assessment process.

1.5 Document structure

This SEE is provided in two volumes. Volume 1 comprises the main report (this document), and sets out the modification in the context of the existing environment, planning considerations, key environmental issues, potential impacts, and mitigation measures. It is informed by the technical assessments contained in Volumes 1 and 2, and provides a concise, integrated summary of these specialist assessments.

Table 1.1 Structure and content of the SEE

Structure and content of the SEE	
Preliminaries	Statement of validity and executive summary
Chapter 1	Introduces the project, the applicant, the study team, and the approval pathway. Gives a brief overview of the contents of the SEE
Chapter 2	Provides a detailed description of the site including locality, land ownership, surrounding land uses climate, geology, hydrology and vegetation
Chapter 3	Provides details of the approved operations at MCM
Chapter 4	Provides a detailed description of the modification
Chapter 5	Describes the regulatory framework for the modification
Chapter 6	Summarises consultation completed for the modification
Chapter 7	Assessment of the potential environmental impacts relevant to the modification
Chapter 8	Presents the justification for the modification

2 Site and context

2.1 Geographical context

MCM is located 3 km north-east of the township of Muswellbrook, in the Muswellbrook LGA with access via Muscle Creek Road (see Figure 1.2). The site has an irregular development consent boundary which includes current mining operations and associated infrastructure as well as previously rehabilitated areas from historical mining operations (primarily Open Cut 1 and 2 rehabilitation areas and the eastern out-of-pit emplacement (the eastern emplacement)) (see Figure 1.2).

2.2 Land ownership

Land within the development consent boundary is wholly owned by MCC. MCC also owns significant buffer land surrounding MCM.

A small section of the development consent boundary adjoins a parcel of Crown land to the west. Land beyond MCC's ownership is a combination of freehold and Crown land. Land ownership is shown in Figure 2.1.

2.3 Assessment locations

There are privately-owned dwellings on the eastern outskirts of the Muswellbrook township (along Queen Street) that are within approximately 600 m of the development consent boundary. There are also privately-owned dwellings located north-east of the township along Sandy Creek Road which are within 2 km of the development consent boundary. Dwellings to the south and south-east are generally greater than 2.5 km from the development consent boundary.

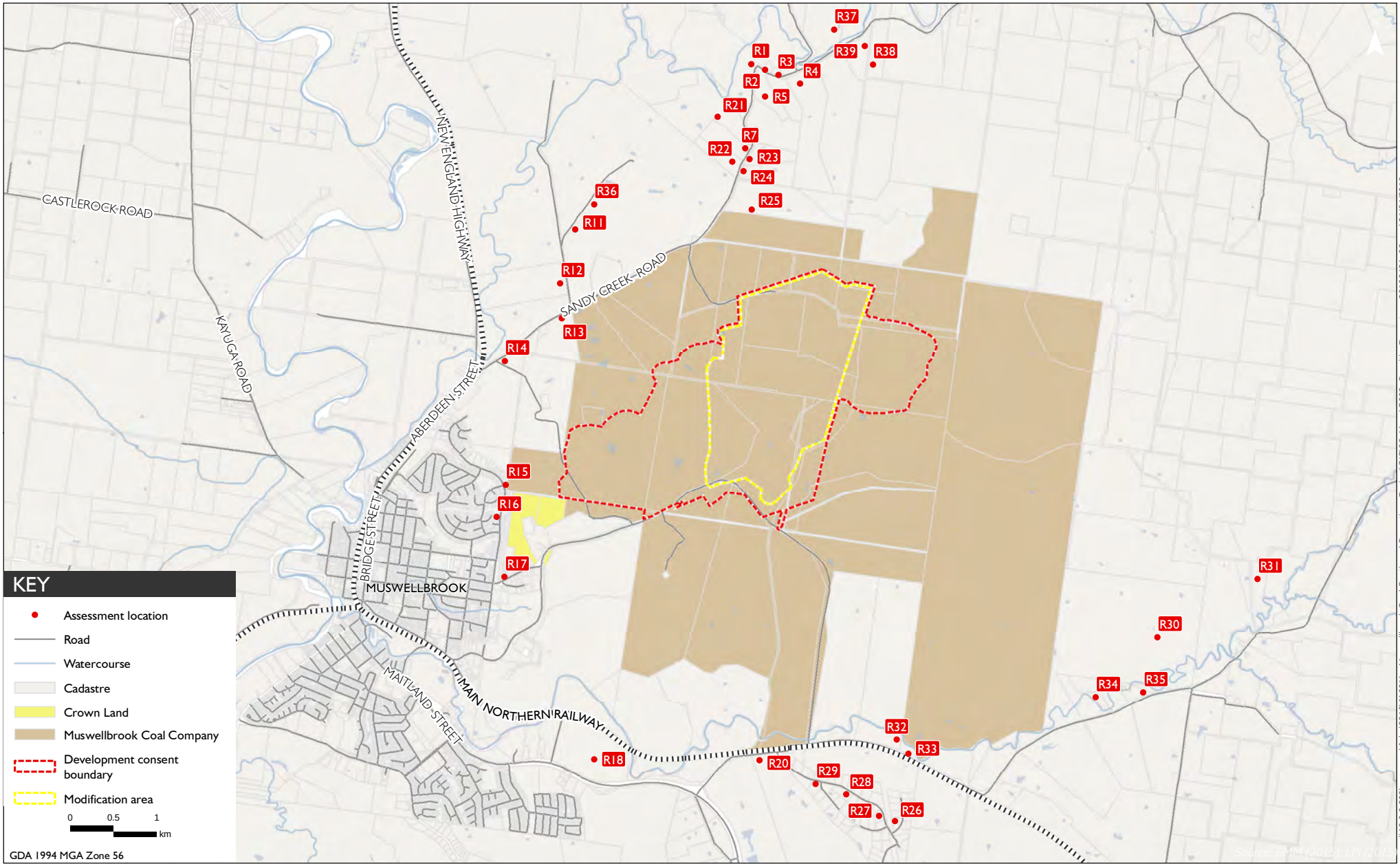
For the purposes of this SEE, a total of 34 privately-owned dwellings surrounding MCM have been selected as assessment locations. The assessment locations are illustrated in Figure 2.1.

2.4 Surrounding land use

Land uses surrounding MCM include agricultural activities, light industrial land uses and residential areas (Figure 2.2). Agricultural activities are located on properties surrounding MCM and primarily include grazing of beef cattle. Light industrial and special land uses include Muswellbrook Quarry to the north-west (owned by MCC and leased to Daracon), St Heliers correctional centre to the north-west and Muswellbrook Waste Management Facility to the south. Muswellbrook township is to the west, with other notable rural-residential areas along Sandy Creek Road to the north, Woodland Ridge Estate to the south and along Muscle Creek Road to the south-east.

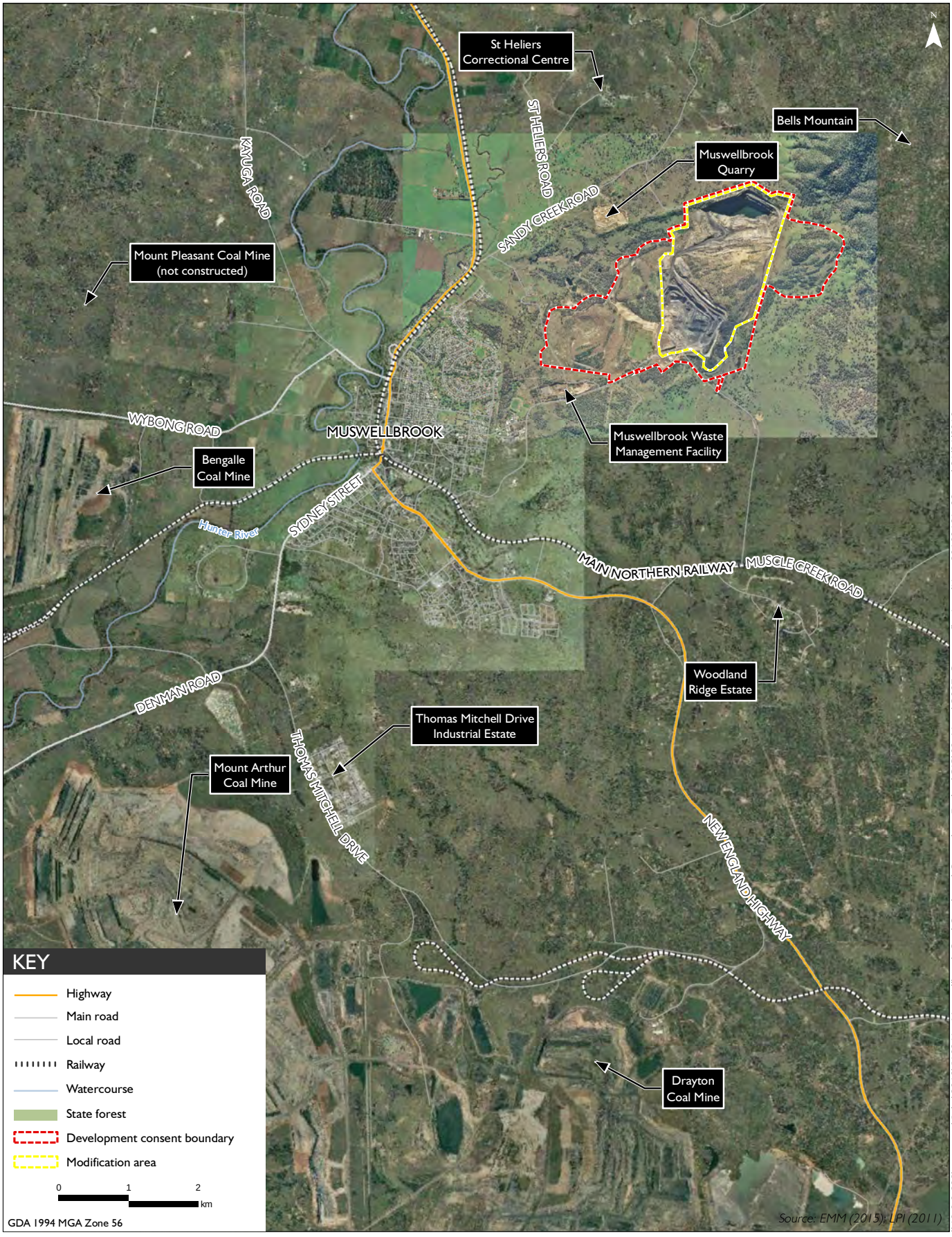
Other significant features surrounding MCM include the Main Northern Rail Line and the New England Highway, which run to the west through Muswellbrook township and to the south towards Singleton. Numerous other mining operations and power-generating facilities exist between Muswellbrook and Singleton.

Land use zoning under the provisions of the *Muswellbrook Local Environmental Plan 2009* (Muswellbrook LEP) within the MCM development consent boundary is a combination of RU1 Primary Production, E3 Environmental Management and SP2 Infrastructure (Figure 2.3). The SP2 Infrastructure zoning relates to the existing void in the Open Cut 1 rehabilitation area (refer Figure 3.1) for which a memorandum of understanding (MoU) is in place between MCC and MSC for the future use of the void by Council as a waste management facility, as well as a classified road which includes the proposed Muswellbrook bypass.



Land ownership and assessment locations

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 2.1

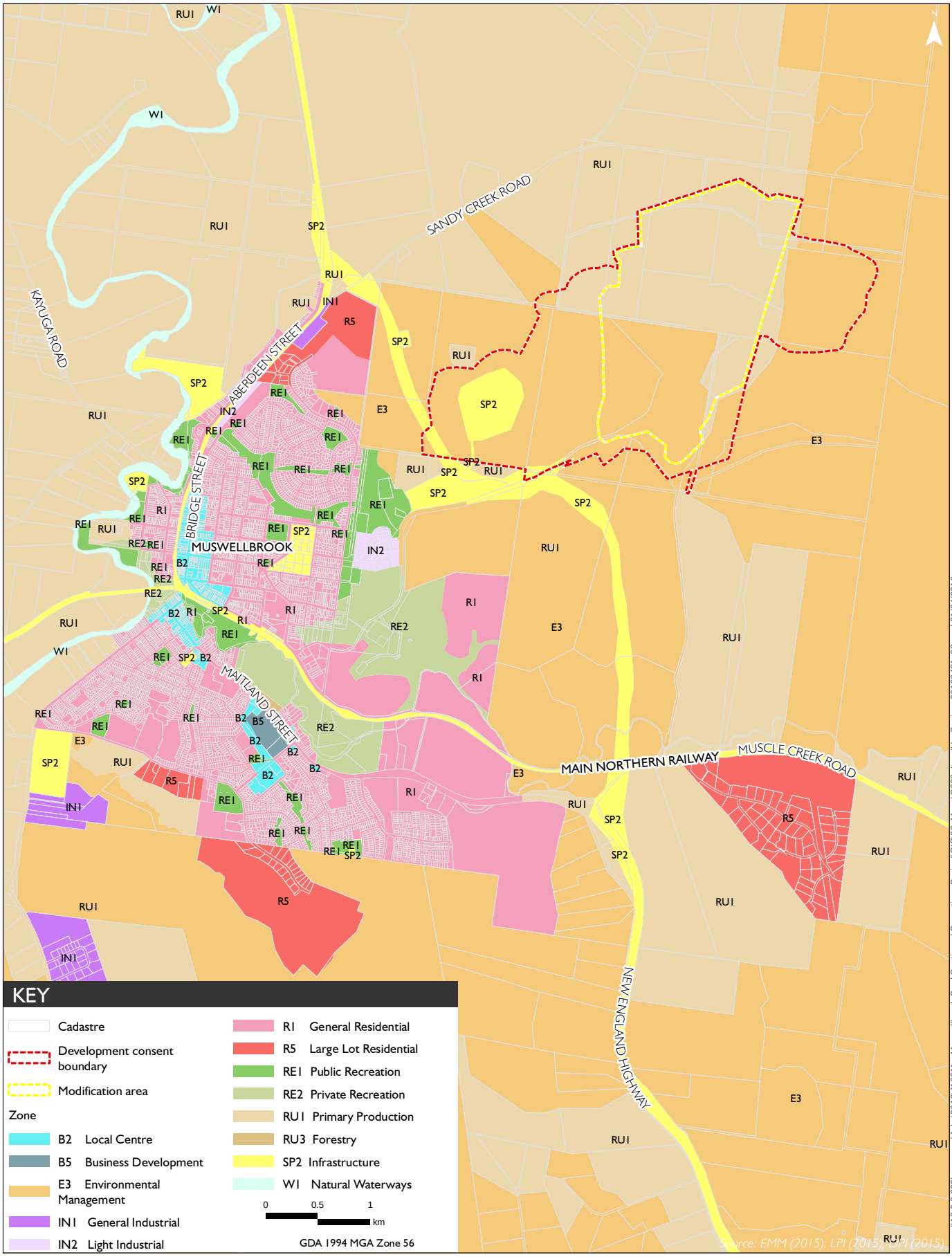


\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G027_SurroundingLandUse_20160421_02.mxd 21/04/2016

Surrounding land use

Muswellbrook Coal Continuation Project
Statement of Environmental Effects

Figure 2.2



Land use zoning

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 2.3

3 Existing operations

3.1 Background

MCC has a history of coal mining operations in the Muswellbrook area since 1907 beginning with the No. 1 Colliery (underground) which operated until 1980. This was one of three underground mines operated by MCC, with other underground operations including St Heliers Colliery which operated from 1923 to 1966 and No. 2 Underground Colliery which operated from 1980 to 1997.

Open cut mining at MCM commenced in 1944 with the No. 1 Open Cut. This was one of the first open cut coal mining operations in the southern hemisphere. Approval for the No. 1 Open Cut Extension Area (referred to as Open Cut 1) was granted in 2003 and operations commenced in 2005. The No. 2 Open Cut (Open Cut 2) operated from 1965 to 2013, and the Common Open Cut operated in 1992.

All mining operations have concluded except for mining in Open Cut 1 and selective placement of overburden and waste materials in Open Cut 2.

3.2 Existing approvals, licences and authorities

Development Consent No. DA 205/2002 was granted by MSC on 1 September 2003 and has been subsequently modified on five occasions. The modifications are summarised in Table 3.1.

Table 3.1 Modifications to Development Consent No. DA 205/2002

Approval	Date approved	Approved changes
Amendment to Condition 1.1	19 December 2005	Power line relocation and additions to workshop. SEE entitled *Section 96(1A) Application to Modify Development DA 205/2002* (Parsons Brinckerhoff, 2005).
Amendment to Condition 1.1 and 11.3	13 July 2009	Relocation of office buildings, workshop and bath-house. SEE entitled *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects* (Hansen Bailey 2009) (2009 Modification SEE).
Amendment to Condition 11.1	23 December 2010	Extension of open cut mining onto land referred to as Area C. SEE entitled *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects* (Hansen Bailey 2010) (2010 Modification SEE).
Amendment to Condition 1.1(a), 31, 33, 39, 45 and 58	29 October 2013	Revision to mining infrastructure building requirements and rehabilitation plan revision to permit the continuation of operation of mining for an additional five years. SEE entitled *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects* (Hansen Bailey 2013a) (2013A Modification SEE).
Amendment to Condition 1.1, 1.2 and 6.3.2. Addition of Condition 59 and 60.	12 December 2013	Modification to permit the continuation of mining operations for an additional five years. SEE entitled *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects* (Hansen Bailey 2013b) (2013B Modification SEE).

MCM is operated in accordance with a number of mining authorities and other licences, listed in Table 3.2. Mining authorities are illustrated in Figure 1.2.

Table 3.2 Mining authorities and other licences

Title	Regulatory authority	Date granted	Anniversary/ expiration date
Mining authorities			
Consolidated Coal Lease (CCL) 713	Division of Resources and Energy (DRE)	5 May 1990	24 Nov 2024
Mining Lease (ML) 1304	DRE	12 Jan 1993	24 Nov 2024
ML 1562	DRE	16 Feb 2005	16 Feb 2026
ML 1513	DRE	20 Mar 2002	20 Mar 2023
Licences			
Environment Protection Licence (EPL) 656	Environment Protection Authority (EPA)	6 Dec 2000	Not applicable
Dangerous Goods Licence (DGL) 35/021999	Workcover NSW	15 Mar 2016	15 Mar 2017
Water Licence (WL) 20BL169014	DPI - Water	16 Jan 2014	15 Jan 2019
WL 20BL169037	DPI - Water	5 Apr 2014	5 Apr 2019
WL 20BL169038	DPI - Water	5 Apr 2014	5 Apr 2019
WL 20BL170473	DPI - Water	24 Aug 2015	24 Aug 2016
WL 20WA211598	DPI - Water	1 Aug 2009	31 Jul 2022

3.3 Resource

The coal seams mined at MCM are part of the Greta Coal Measures, the lowermost coals of the Sydney Basin. Seams mined in Open Cut 1 are the Fleming Seam, Hallet Seam, Muswellbrook Seam, St Heliers Seam, Upper Lewis Seam, Lower Lewis Seam and Loder Seam.

MCC produces thermal coal. The resource has predominately low ash and medium moisture content.

3.4 Mining

Within Open Cut 1, mining operations are truck and excavator multi-seam coal mining with a maximum approved coal production rate of 2 Mtpa.

Mining involves removal of vegetation and stripping of topsoil, and if required, drilling and blasting overburden material. Overburden is removed using a fleet of excavators and trucks, and re-used as fill in mine voids. Once overburden is removed, coal is extracted from the exposed coal seams by excavator or front end loader (FEL), and transported by dump trucks to the run-of-mine (ROM) coal receival area.

ROM coal is crushed on-site at the coal crushing plant, after which the coal is sorted into high and low ash. High ash coal is washed in the coal preparation plant (CPP) prior to stockpiling, while low ash coal is stockpiled as product coal ready for transport. The location of the CPP and product stockpiles is shown in Figure 1.3.

Overburden emplacement is generally within Open Cut 1. Inert capping material is placed in Open Cut 2 where required for spontaneous combustion management and landform shaping.

3.5 Spontaneous combustion

MCC mine the Greta Coal Measures (the coal seams), which include coal, carbonaceous shale (interburden) and overburden. The interburden and overburden are both considered reactive spoil. Incidences of spontaneous combustion have taken place over a number of years at MCM because of the reactive spoil, resulting in smoke and odour which in the past has created amenity issues for neighbours to the mine.

Spontaneous combustion at MCM has been noted in the spoil emplacement area on the western side of Open Cut 1, which has been encapsulated with 10 m of non reactive overburden to exclude oxygen and rainfall infiltration, and in the No.2 underground roadway. MCC has reduced the potential for spontaneous combustion at the mine by using the following strategies during mining:

- removing fuel by mining the coal and using the coal washery to increase the recovery of carbon shale and remnant coal;
- cooling heated areas with water before mining (water infusion);
- minimising areas of coal exposed to the air prior to mining;
- retaining 5 m of non reactive overburden above workings to exclude oxygen from areas not immediately required for mining operations;
- sealing of decommissioned underground workings with clay or non reactive overburden to exclude oxygen;
- rapidly burying of reactive overburden to minimise the time that it is exposed to oxygen and rainfall infiltration;
- selective placement of reactive overburden so that it is in the lower portions of the spoil emplacement areas for deep burial (encapsulation) to exclude oxygen and rainfall infiltration; and
- limiting spoil emplacement area lifts, under normal conditions, to a height of 10 – 15 m to exclude oxygen and rainfall infiltration.

3.6 Transport

Product coal is transported by truck to Ravensworth Coal Terminal (RCT), approximately 27 km south-east of MCM. The transport route taken by trucks is via Muscle Creek Road and the New England Highway. MCC has approval for 2 Mtpa of coal transported by road. Coal is transported from RCT by rail to the Port of Newcastle for export.

3.7 Mine life

MCM has approval for mining operations and rehabilitation until the end of 2020.

3.8 Site infrastructure and services

Primary infrastructure at MCM includes the mine infrastructure area (MIA) and CPP, coal crushing plant and product stockpiles (see Figure 2.1).

3.9 Water management

MCC manage water in accordance with a suite of management plans, discussed in Section 3.14. Primary water management infrastructure includes Dams 1 and 2 and the Final Settling Pond, and associated pumping infrastructure. Mine water is also stored in Open Cut 1 and 2, and in the underground workings.

3.10 Hours of operation

Mining operations are permitted 24 hours a day, seven days a week. Blasting is limited to between 9.00 am and 5.00 pm Monday to Friday.

3.11 Employment

MCC has a current approved workforce of up to 95 employees, plus contractors as required. Employees are a mix of full time, contract and casual positions. MCC predominately employs a local workforce to support the Muswellbrook community.

3.12 Rehabilitation and final landform

Rehabilitation activities are generally undertaken on a progressive basis to achieve the approved rehabilitation objectives, final landform and final land use. Rehabilitation is undertaken in accordance with the approved Closure Mining Operation Plan (MOP).

There are three main areas of completed or partially completed rehabilitation at MCM (see Figure 3.1):

- Open Cut 1 rehabilitation area - located in the western portion of the development consent boundary;
- Open Cut 2 rehabilitation area - a former overburden dump located between Open Cut 1 and Open Cut 2; and
- the eastern emplacement - a rehabilitated out-of pit emplacement located in the north-eastern portion of the development consent boundary.

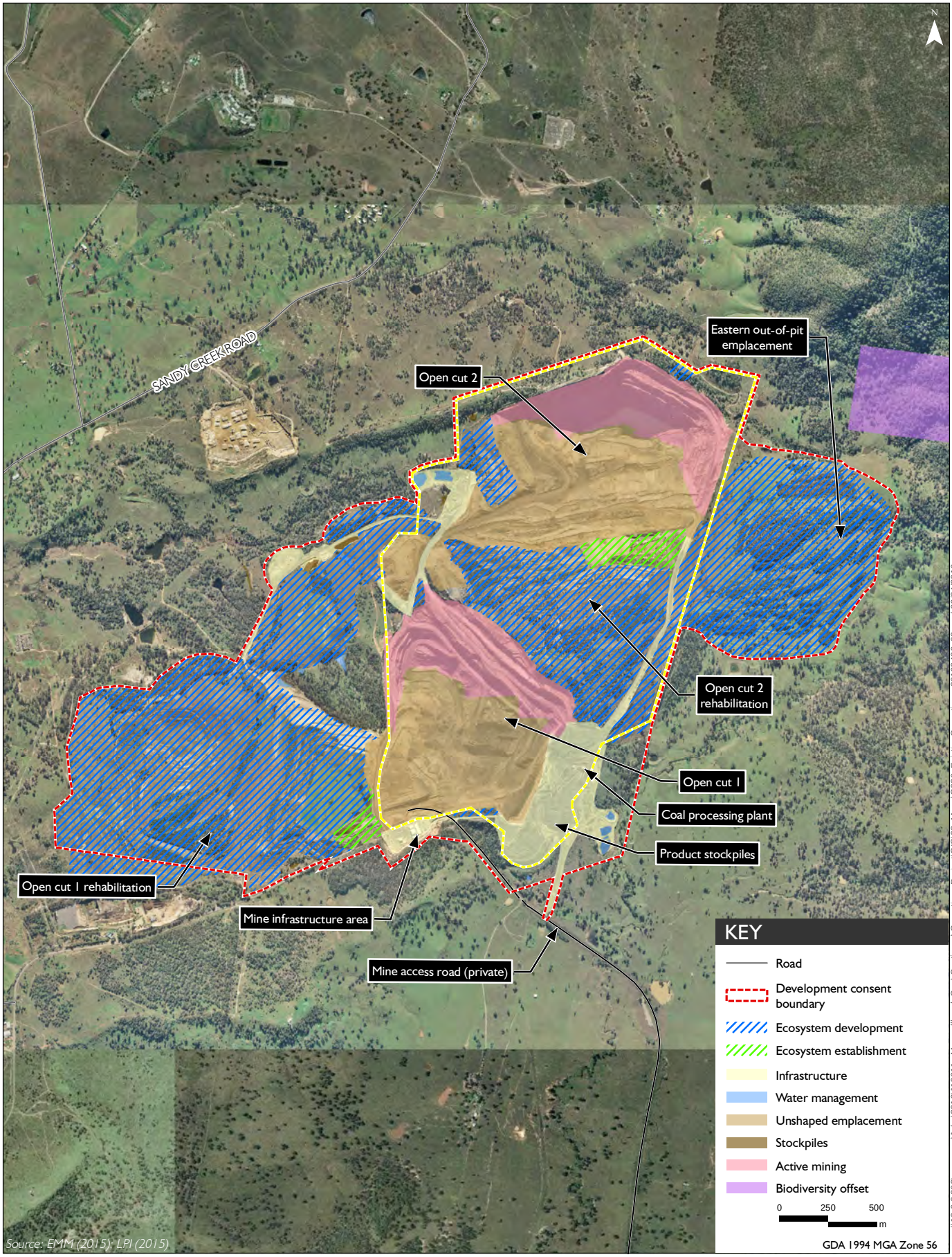
Rehabilitation activities are completed progressively, and include filling mined voids with overburden material, planting a combination of pasture and native trees so that vegetation is consistent with the local area, establishment of a vegetation corridor, weed control and rehabilitation monitoring. Rehabilitation aims to make the site compatible with the surrounding land, and have safe and stable final voids, in accordance with the approved MOP.

MCM has an obligation to undergo rehabilitation works during the life of the mine with time for completion after mining has ceased. Rehabilitation will be undertaken in accordance with the approved MOP.

3.12.1 Rehabilitation objectives

The objective of rehabilitation following mine closure at MCM is to establish a stable, self-sustaining landform of pasture and native woodland that fulfil designated land uses including sustainable grazing (pasture) and native vegetation corridors. The rehabilitation framework includes:

- developing an integrated, free-draining final landform that is consistent with the principles of the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (Department of Mineral Resources 1999);
- representing what can be achieved using cost-effective rehabilitation procedures that reflect mining industry current best practice;
- reflecting the composition of pre-mining communities and representative unmined reference sites;
- providing habitat for a range of fauna species;
- reflecting the findings of on-site and other relevant research into the establishment of biodiversity and ecosystem function;
- being compatible with MCC's overall whole-of-lease land management approach and management plans, which includes sustainable grazing on pasture areas, management of remnant bushland on the mining lease and the use of corridors to link remnant vegetation;
- taking into account the views of the Community Consultative Committee (CCC) and other relevant stakeholders; and
- resulting in no measurable or no unacceptable off-site impacts, including the protection of water quality.



Existing operations - 2016

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 3.1

3.12.2 Conceptual final landform

The approved conceptual final landform comprises shaped areas of overburden with the majority of slopes less than 10 degrees, steeper in localised areas of up to 14 degrees, excluding the final void batters which are slopes of up to 18 degrees. The maximum heights of the approved conceptual landform is reduced level (RL) 310 m in the Open Cut 2 rehabilitation area and RL 340 m in the eastern emplacement.

The approved conceptual final landform is illustrated in Figure 3.2.

3.12.3 Final voids

The approved conceptual final landform includes a total of three final voids. An MoU exists between MCC and MSC for the potential future use of the void in the Open Cut 1 rehabilitation area for waste management. The remaining two voids in Open Cut 1 and Open Cut 2 would fill with water and act as sinks as part of the final landform.

Management of the final voids is in accordance with a Final Void Management Plan. The potential future uses considered for the final void in the current Final Void Management Plan include:

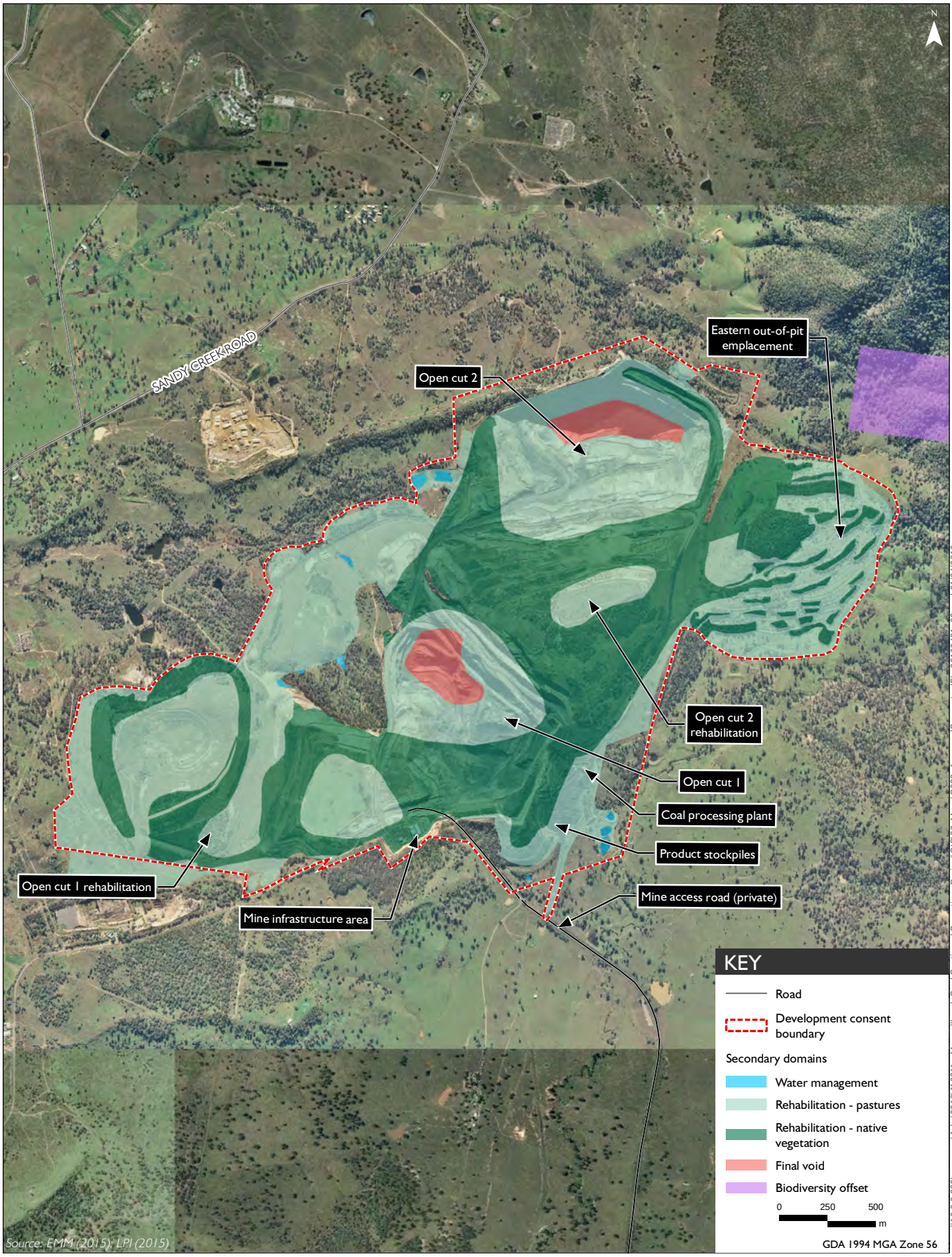
- underground entry point to Sandy Creek Colliery reserves (from Open Cut 2) – while Sandy Creek Colliery is approved, there are no current plans to commence mining in this area;
- a waste management facility for MSC – an MoU is in place for the potential use of the void in the Open Cut 1 rehabilitation area;
- a regional waste management facility – there are currently no plans in place for this option; and
- a passive recreational facility – there are currently no plans in place for this option.

3.12.4 Final land use

The final land use includes a combination of approximately 50% pasture and 50% native vegetation (see Figure 3.2), with a vegetation corridor between Bells Mountain and Skelletar Ridge.

3.13 Decommissioning and mine closure

A decommissioning and demolition strategy will be developed for the site prior to closure and will include engaging structural engineers and appropriate technical experts with experience in demolition and the application of relevant Australian Standards and guidelines. A detailed investigation of all structures will be completed to determine the appropriate techniques, equipment required, and the sequence for decommissioning and removal required to execute the demolition activities safely.



Conceptual final landform - approved

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 3.2

3.14 Environmental management and monitoring

Environmental management is in accordance with the approved Environmental Management System (EMS), which provides the core framework for managing environmental issues and a suite of management plans providing specific guidance for environmental management. Management plans include:

- Archaeology and Cultural Heritage Management Plan;
- Blast-Vibration Management Plan;
- Bushfire Management Plan;
- Dust Management Plan;
- Erosion and Sediment Control Plan;
- Final Void Management Plan;
- Flora and Fauna Management Plan;
- Land Management Plan;
- Lighting Management Plan;
- Site Water Management Plan and Surface and Groundwater Monitoring Program;
- Soil Stripping Management Plan;
- Spontaneous Combustion Management Plan;
- Visual Amenity and Landscape Management Plan; and
- Waste Management Plan.

MCC is in the process of reviewing the suite of management plans required under Development Consent DA 205/2002 (as modified) in consultation with MSC. It is likely that management plans may be consolidated into either the MOP or may no longer be required in the future. Accordingly, references this document relating to updates to existing management plans as a result of the modification refer to the relevant management plan at the time of the update, which may be the MOP, an EMP or other management plan.

Environmental monitoring is undertaken in accordance with the suite of approved management plans and the EPL. The environmental monitoring program includes:

- meteorological monitoring;
- eight dust deposition gauges;
- three high volume air samplers (HVAS) measuring total suspended particulates (TSP) and one HVAS measuring PM_{10};
- two tapered element oscillating microbalance (TEOM) units measuring PM_{10};

- one beta attenuation mass (BAM) unit measuring PM_{10};
- four blast monitoring locations;
- 12 surface water monitoring locations;
- 11 groundwater monitoring locations;
- five attended noise monitoring locations; and
- rehabilitation monitoring.

4 Proposed modification

4.1 Overview

The modification involves an extension of open cut mining operations in the development consent boundary to maximise the recovery of coal resources within ML 1304, ML 1562 and CCL 713. The extension would enable recovery of approximately 4.2 Mt of additional coal resources.

In summary the project involves:

- extension of open cut mining operations in Open Cut 1;
- extension of the mine life, with operations to cease by the end of 2025;
- changes to the conceptual final landform within the modification area; and
- overburden emplacement in both Open Cut 1 and Open Cut 2, so as to achieve the conceptual final landform.

As the modification involves mining of a previously disturbed area that was used as an overburden dump, there would be no direct impact to previously undisturbed land.

No changes are proposed to the currently approved maximum production rate of 2 Mtpa, mining methods, coal processing, blasting methods, water management, waste management and handling, coal transport, access to site, employee numbers, and environmental management.

An overview of the approved operations at MCM and key changes proposed as part of the modification are in Table 4.1 and illustrated in Figure 4.1.

Table 4.1 Overview of approved operations (Development Consent No. DA 205/2002) and the modification

Aspect	Original approval (2002 EIS)	Approved operations, as modified	Modification
Mine life	Completion of coal mining in 2015.	Completion of operations by 1 September 2020.	Completion of operations by 2025.
Annual production	Up to 2 Mtpa of product coal.	As per original approval, up to 2 Mtpa of product coal.	No change.
Mining method	Open cut using a shovel/excavator and truck fleet.	Open cut using an excavator and truck fleet.	No change.
Mining footprint	Mining within the Open Cut 1 Pit Extension (Area A and B).	Mining within the approved extraction area, including Area C.	Extension of mining in Open Cut 1 to include mining of around 16.5 ha beyond the approved No. 1 Open Cut Extension Area of 160.1 ha. No change to the approved development consent boundary.

Table 4.1 Overview of approved operations (Development Consent No. DA 205/2002) and the modification

Aspect	Original approval (2002 EIS)	Approved operations, as modified	Modification
Coal processing	ROM coal crushed on-site at the CCP. No washing required and coal sold as ROM coal. All coal is stockpiled prior to transport off site.	ROM coal is crushed on-site in the CCP. High ash coal is washed in the CPP. All product coal is stockpiled prior to transport off site.	No change.
Coal rejects	No coal rejects generated to be disposed of.	Belt press filter used at the CPP to treat fines. Coarse and fine reject material then stockpiled and trucked back to the open cut for disposal with overburden.	No change to the currently approved disposal method. Rejects would continue to be co-disposed with overburden.
Overburden	Overburden generally emplaced within the Open Cut 1 void. Inert capping material may be emplaced in the Open Cut 2 void where required for spontaneous combustion management.	Overburden generally emplaced within the Open Cut 1 void. Inert capping material may be emplaced in the Open Cut 2 void where required for spontaneous combustion management.	Overburden emplacement to occur sequentially in the voids of both Open Cut 1 and 2.
Key site infrastructure	MIA, coal crushing plant and CPP (although not used).	MIA, coal crushing plant and CPP. MIA in relocated position from that in the original 2002 EIS.	No change.
Coal transport	Transport of product coal by road to RCT.	Transport of product coal by road to RCT.	No change.
Site access	Access via Muscle Creek Road off the New England Highway and private access road into the mine site.	Access via Muscle Creek Road off the New England Highway and private access road into the mine site.	No change.
Hours of operation	Mining approved 24 hours per day, seven days per week.	Mining approved 24 hours per day, seven days per week. Blasting Monday-Friday, 9,00 am-5.00 pm.	No change.
Employee numbers	Approximately 69 permanent positions and 39 contractors.	Up to 95 full-time equivalents (FTEs) with additional contractors as required.	No change. It is noted that the expected workforce is predicted to be approximately 75 permanent positions with additional contractors to meet operational requirements.
Conceptual final landform and final voids	Final land use comprises a mixture of grazing and woodland, with a vegetation corridor between Bells Mountain and Skelletar Ridge. Two final voids, in Open Cut 1 and 2, with Open Cut 2 remaining open for future access to the Sandy Creek reserves.	Shaped landform with maximum RL of 340 m (Open Cut 2 rehabilitation) and 340 m (eastern emplacement) supporting a combination of approximately 50% pasture and 50% native trees, with a vegetation corridor between Bells Mountain and Skelletar Ridge. Two final voids in Open Cut 1 and 2. Slope of 18 degrees into Open Cut 2 void, with the void remaining open for future access to the Sandy Creek reserves.	Shaped landform with maximum RL of 340 m supporting a combination of approximately 50% pasture and 50% native trees, with a vegetation corridor between Bells Mountain and Skelletar Ridge. Two smaller final voids in Open Cut 1 and 2. Change proposed to the low wall slope into Open Cut 2 void to 14 degrees. Only one highwall will remain in the final landform (in Open Cut 2).

4.2 Mining

The modification would increase the approved extraction area in the Open Cut 1 by around 16.5 ha, an increase to the Open Cut 1 extension area of approximately 10%. The modification would also extend the life of open cut mining operations by five years.

Mining operations in Open Cut 1 would generally advance in a north-easterly direction from the existing workings (see Figure 4.1). The general sequencing of mining is presented in Figures 4.2 to 4.6, which shows the location of the active pit and overburden emplacement areas for each year of the mine life as proposed under the modification, which would be as follows:

- Year 1 (indicatively 2017) – soil stripping and overburden removal would continue in a north-easterly direction. Overburden emplacement occurs in Open Cut 1 and 2.
- Year 2 (indicatively 2018) – mining progresses to the north-east. Overburden emplacement occurs in Open Cut 1 and 2.
- Year 3 (indicatively 2019) – mining progresses to the north. Overburden emplacement occurs in Open Cut 1 and 2. Rehabilitation is commenced in the south of the modification area.
- Year 4 (indicatively 2020) – mining progresses to the north. Overburden emplacement occurs in Open Cut 1 and 2. Rehabilitation progresses north in the south of the modification area.
- Year 5 (indicatively 2021) – mining progresses to the most northern point. Overburden emplacement occurs in Open Cut 1 and 2.

Overburden emplacement would continue sequentially in the void of Open Cut 1 and Open Cut 2. There are no changes to the approved minimum and maximum RL of overburden emplacement as a result of the modification. Consideration would be given to the carbonaceous content and likelihood of spontaneous combustion, which would continue to be managed in accordance with the MOP and Spontaneous Combustion Management Plan. Selective stockpiling of inert materials with no carbonaceous content would continue for use as cover material in the final voids to aid in the prevention of potential spontaneous combustion, as discussed further below.

4.3 Spontaneous combustion management

The potential for spontaneous combustion would continue to be managed on site as per the existing management measures described in Section 3.5. Reactive overburden would be identified during mining by:

- examining the surface for any physical effects of spontaneous combustion such as brown or dying vegetation and increased surface temperature;
- using infra-red photography, where appropriate, to show areas of increased temperature;
- measuring borehole temperatures; and
- measuring ground surface temperatures.

If an increased risk of spontaneous combustion is identified during the mining of the modification area, then it would be managed by the following additional management strategies to those already described for the current operation:

- any blast hole which shows signs of spontaneous combustion or is allowing air into areas of spontaneous combustion would be bagged off or backfilled;
- water infusion or water sprays would be used in accordance with the relevant safe work procedure;
- coal subject to active spontaneous combustion would be removed, and spread out on the ground surface to allow it to cool; and
- loose heaps of coal that are subject to spontaneous combustion would be spread out and compacted with a dozer and saturated with water from the water cart.

The modification would not disturb the western spoil emplacement area in Open Cut 1, and therefore would not increase the potential risk of spontaneous combustion being reactivated at this location. After rehabilitation, exposed coal and reactive overburden in Open Cuts 1 and 2 would be encapsulated by the final landform, which is to be formed by partially backfilling the voids and dozing the slope angle down to 14 degrees. Coal and reactive overburden would be encapsulated in the void walls by at least 15 m of non reactive overburden. In addition, the groundwater assessment for the modification (SLR 2016, refer Section 7.4) confirmed that both Open Cut 1 and Open Cut 2 voids would act as groundwater sinks, and as such groundwater recharge in both voids would flood the base of the voids saturating exposed coal and reactive overburden in the walls of the void. Water saturation would remove oxygen thereby removing the potential for spontaneous combustion.

The risk of spontaneous combustion in the final landform would be further managed by:

- selective placement of reactive overburden so that it is in the lower portions of the spoil emplacement areas for deep burial (encapsulation) to exclude oxygen and rainfall infiltration, noting that some of the reactive overburden will be flooded by groundwater recharge into the void;
- limiting spoil emplacement area lifts, under normal conditions, to a height of 10 – 15 m to exclude oxygen and rainfall infiltration; and
- encapsulating reactive overburden and remnant coal in non reactive overburden.

During shaping of the final landform, the volume of inert material required to cover the carbonaceous material at the completion of mining is estimated to be 24.2 Mbcm. It is estimated that a surplus of inert material, in the order of 32.7 Mbcm, would be available. Therefore, there is sufficient inert material available for the final landform.

4.4 Mine life

The modification would result in an extension in the mine life by five years, with an extension of activities until the end of 2025. The proposed staging of mining operations and rehabilitation activities are shown in Figures 4.2-4.6.

4.5 Rehabilitation and conceptual final landform

No changes to the approved rehabilitation objectives (see Section 3.12.1) are proposed under the modification. There would also be no change to completed rehabilitation outside of the modification area.

The modification would disturb the partially rehabilitated overburden dump between Open Cut 1 and Open Cut 2, which would generate additional overburden to be shaped as part of the final landform. The staging of bulk re-shaping and rehabilitation following completion of mining is illustrated in Figure 4.7.

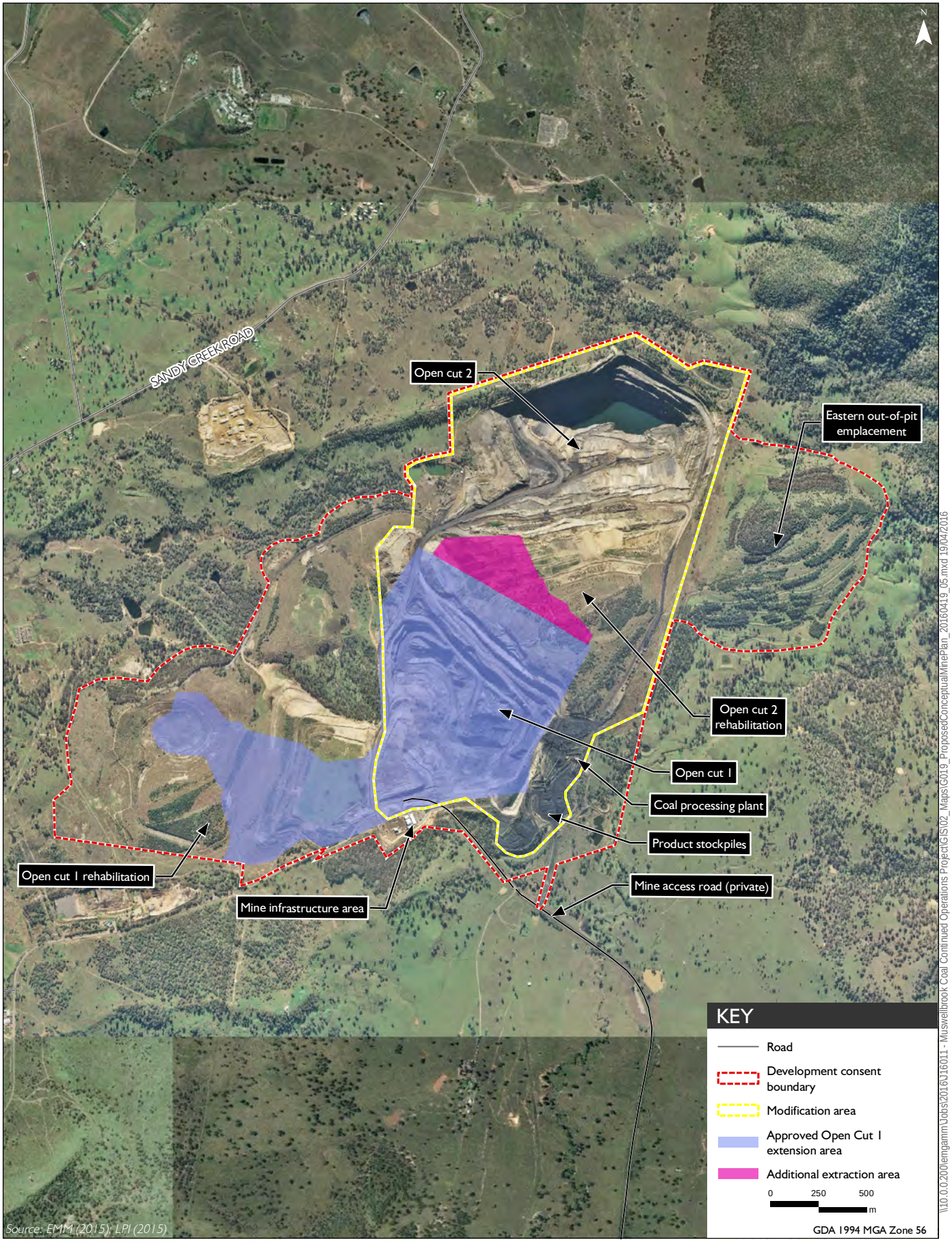
4.5.1 Re-shaped landform

There would be modest changes to the shape of the conceptual final landform in the modification area as a result of the changes to the conceptual mine plan; however there would be no changes to the maximum RL heights. The landform would be shaped such that it would form an integrated landform with the rest of the rehabilitation and final landform features in the development consent boundary (Figure 4.8).

The proposed conceptual final landform has been modified such that all slopes, including final void batters, would be equal to or less than 14 degrees. One highwall will remain, in Open Cut 2, which will be appropriately treated with the installation of a safety fence and/or berms, as well as capping of exposed coal seams.

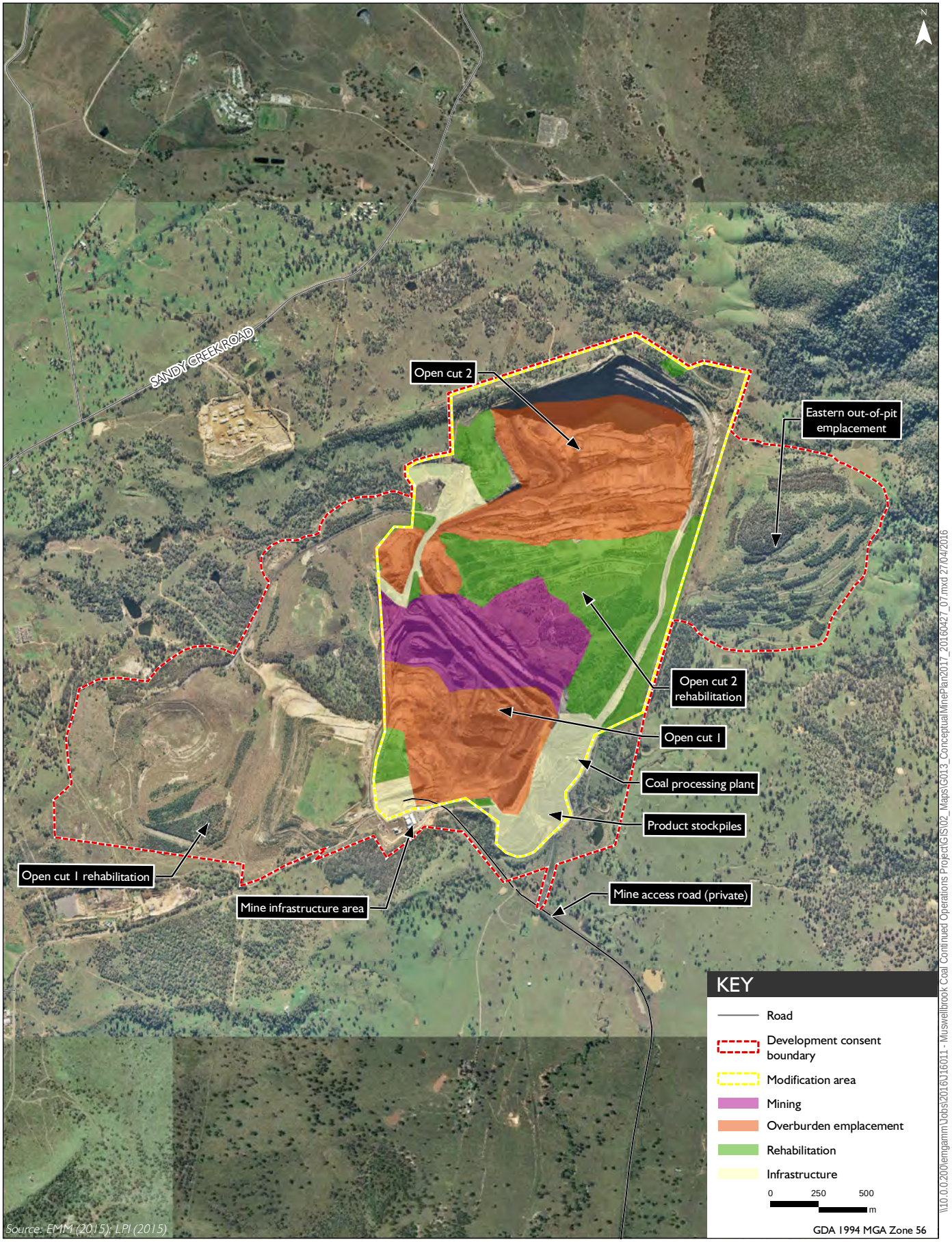
Rehabilitation would continue to be undertaken progressively, as soon as reasonably practicable. Notwithstanding, opportunities for progressive rehabilitation with the modification area would be reasonably limited. As mining operations progress north into the partially rehabilitated overburden dump, some of the overburden would be hauled to Open Cut 2 for emplacement, and the remainder to Open Cut 1. As mining operations move north in Open Cut 1, small areas would become available for rehabilitation on the southern end of the overburden dump. However, the available areas would be limited due to the inert material having to be stockpiled at the top of the dumps to be bulk pushed over the carbonaceous material that would be emplaced in the pit at the end of active mining, in approximately Year 4 of the modification.

The remaining overburden material to be disposed of would be hauled to Open Cut 2, with the last of the required material dumped into the pit in Year 4 after which bulk pushing for rehabilitation can commence.



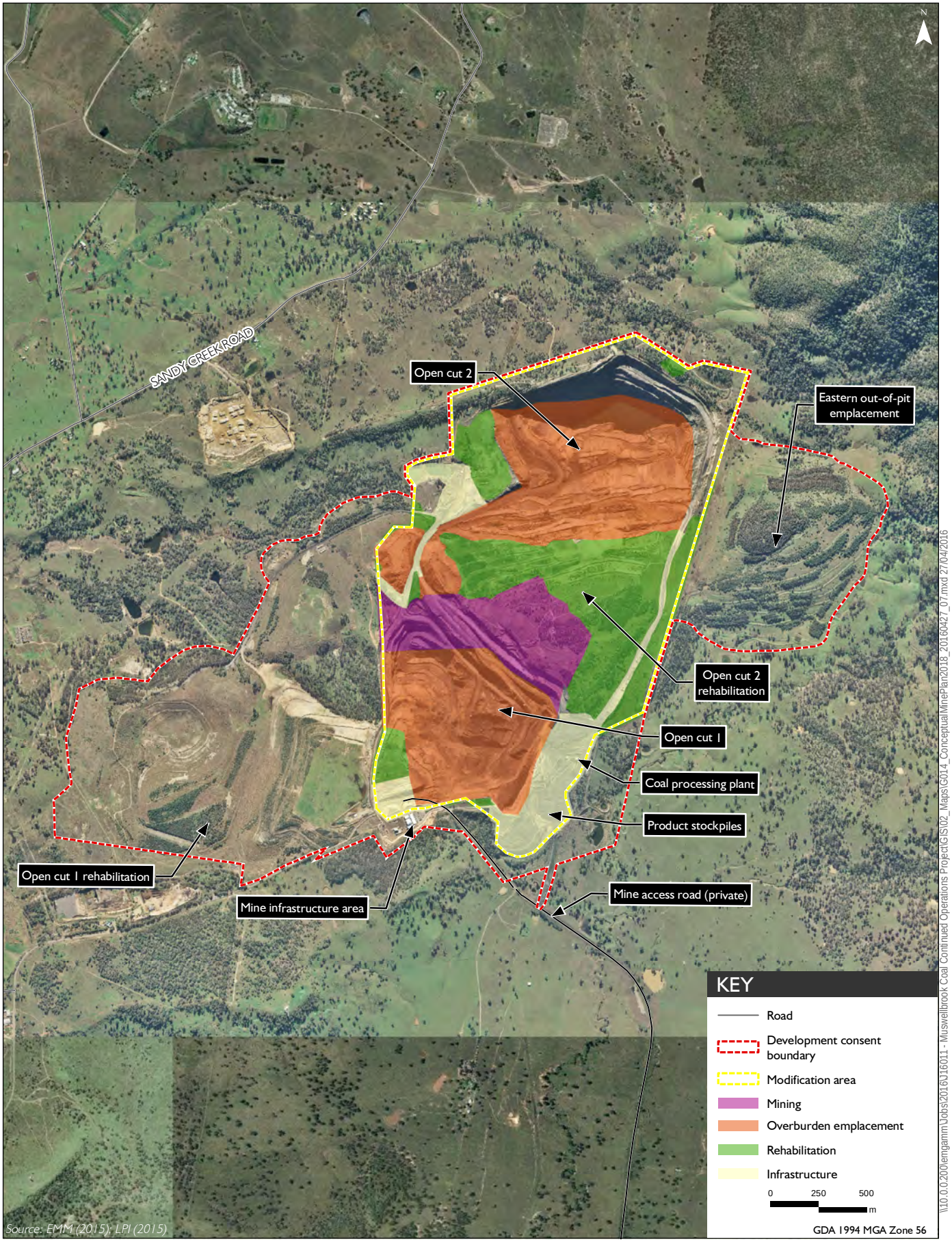
Proposed conceptual mine plan

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.1



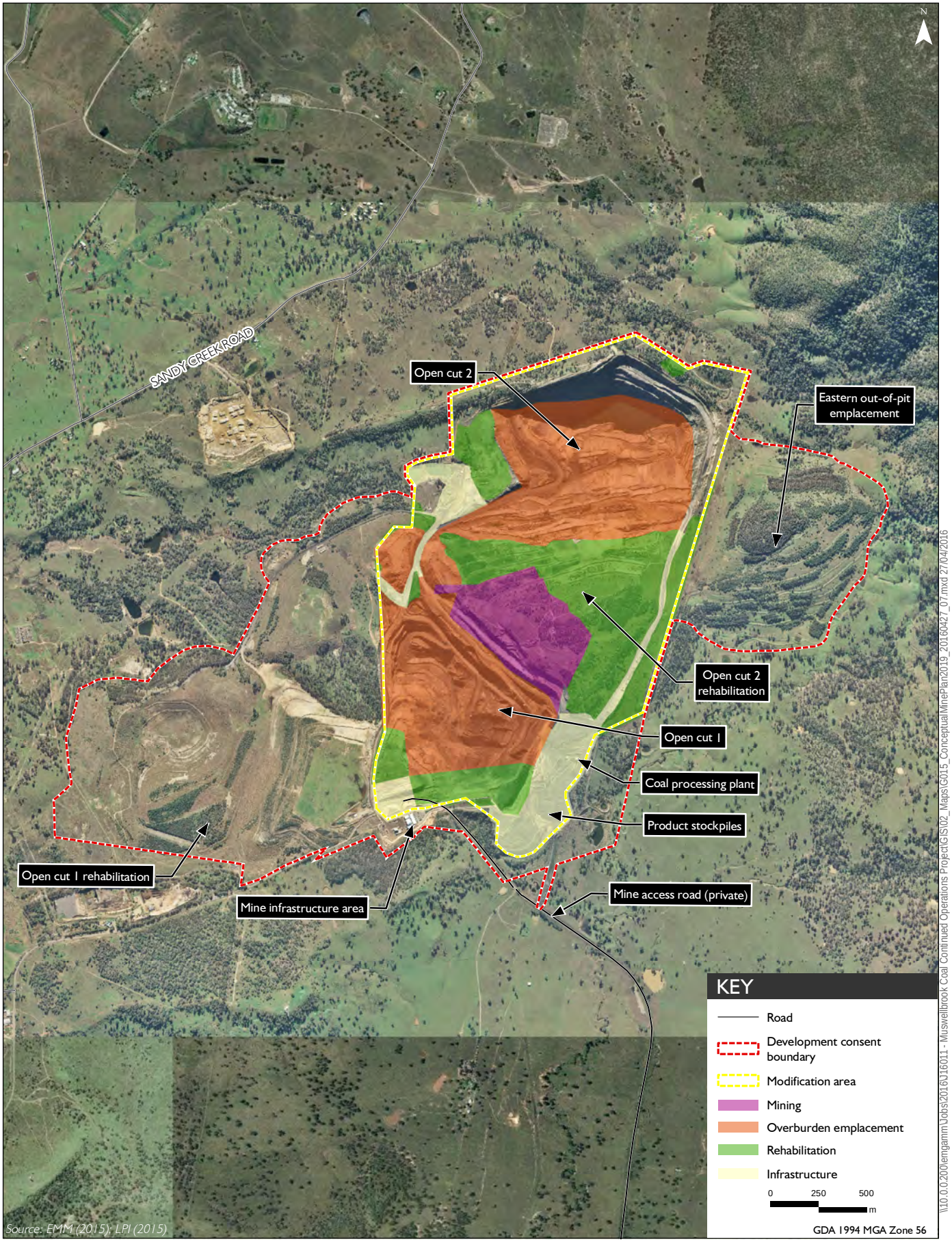
Conceptual mine plan - Year 1

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.2



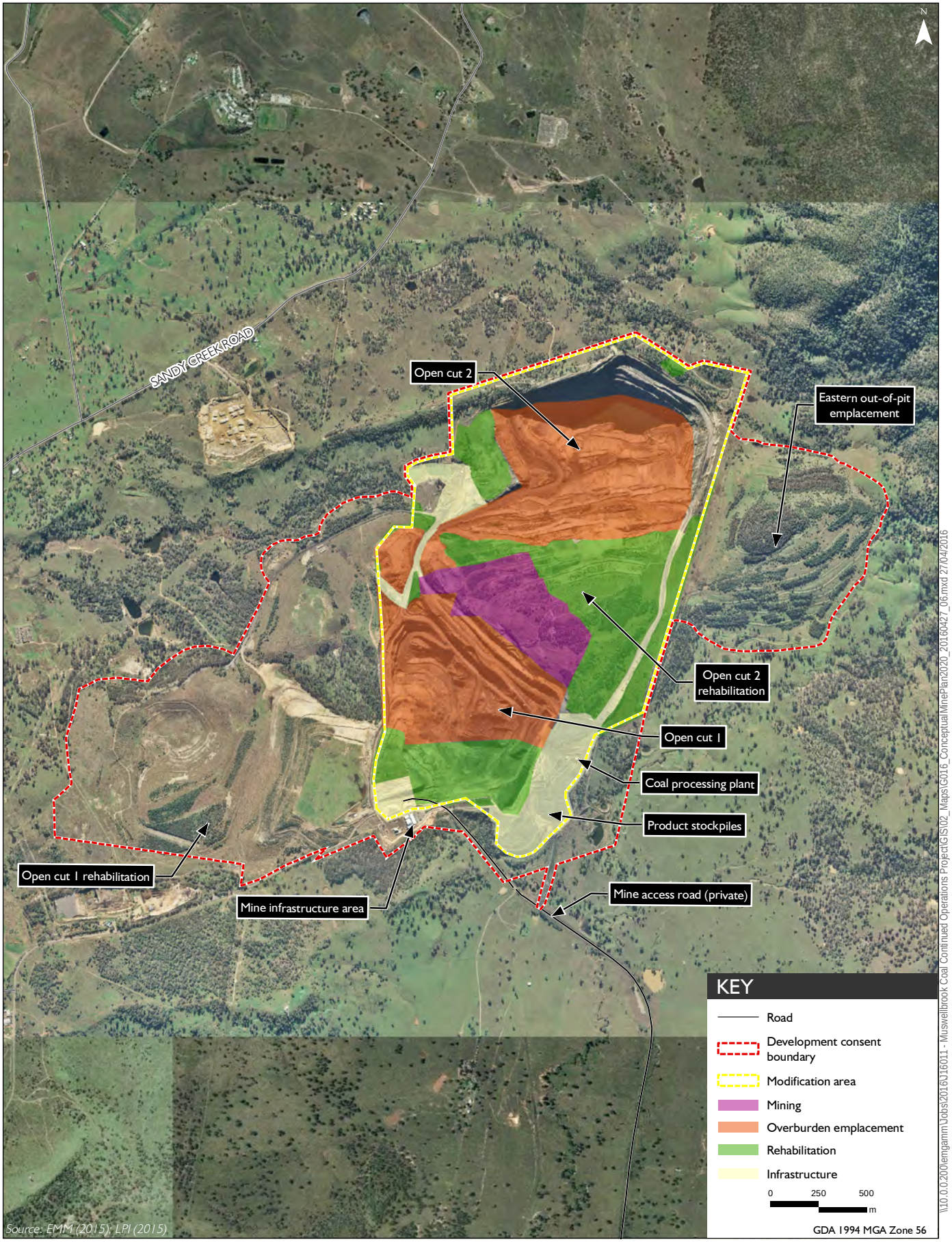
Conceptual mine plan - Year 2

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.3



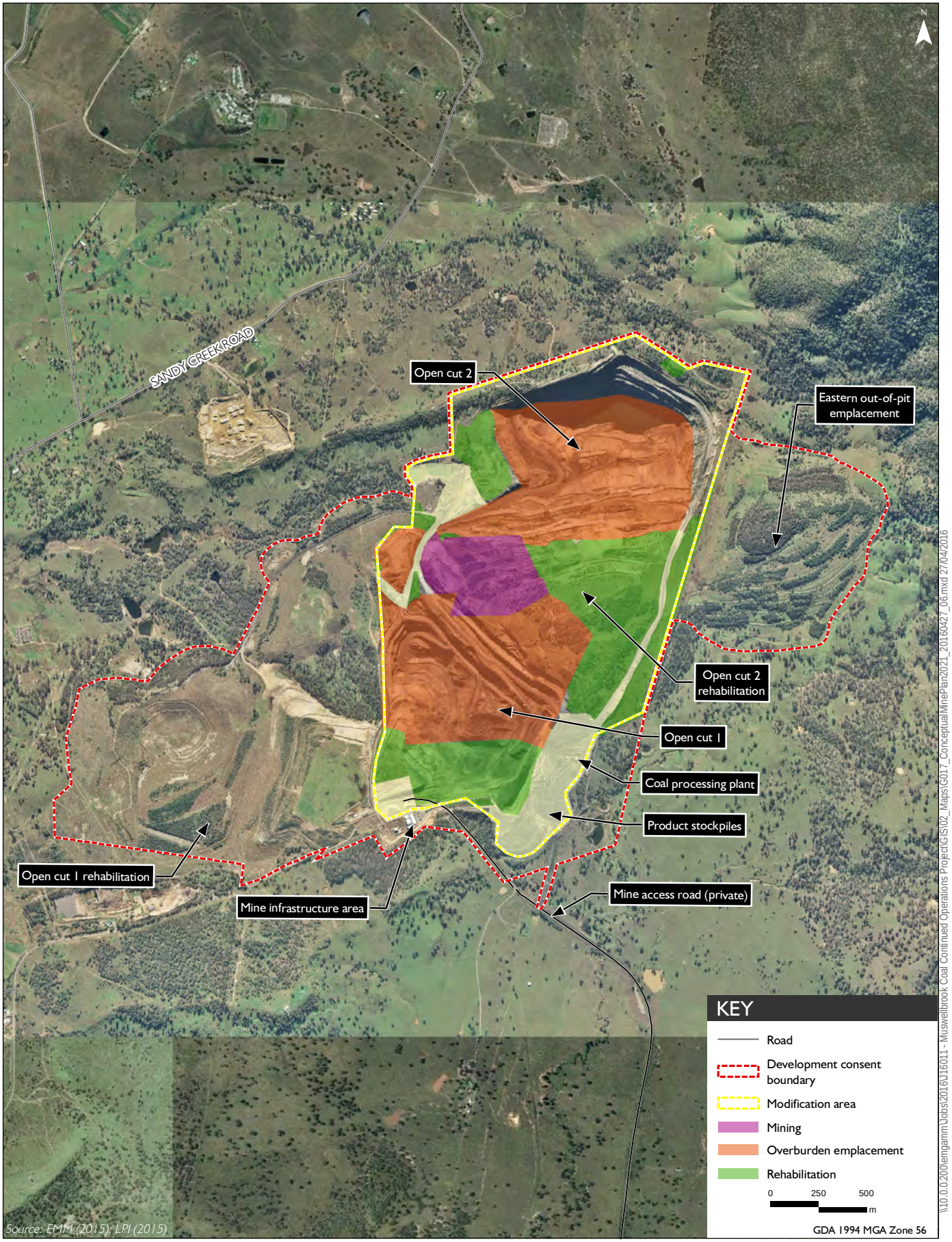
Conceptual mine plan - Year 3

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.4



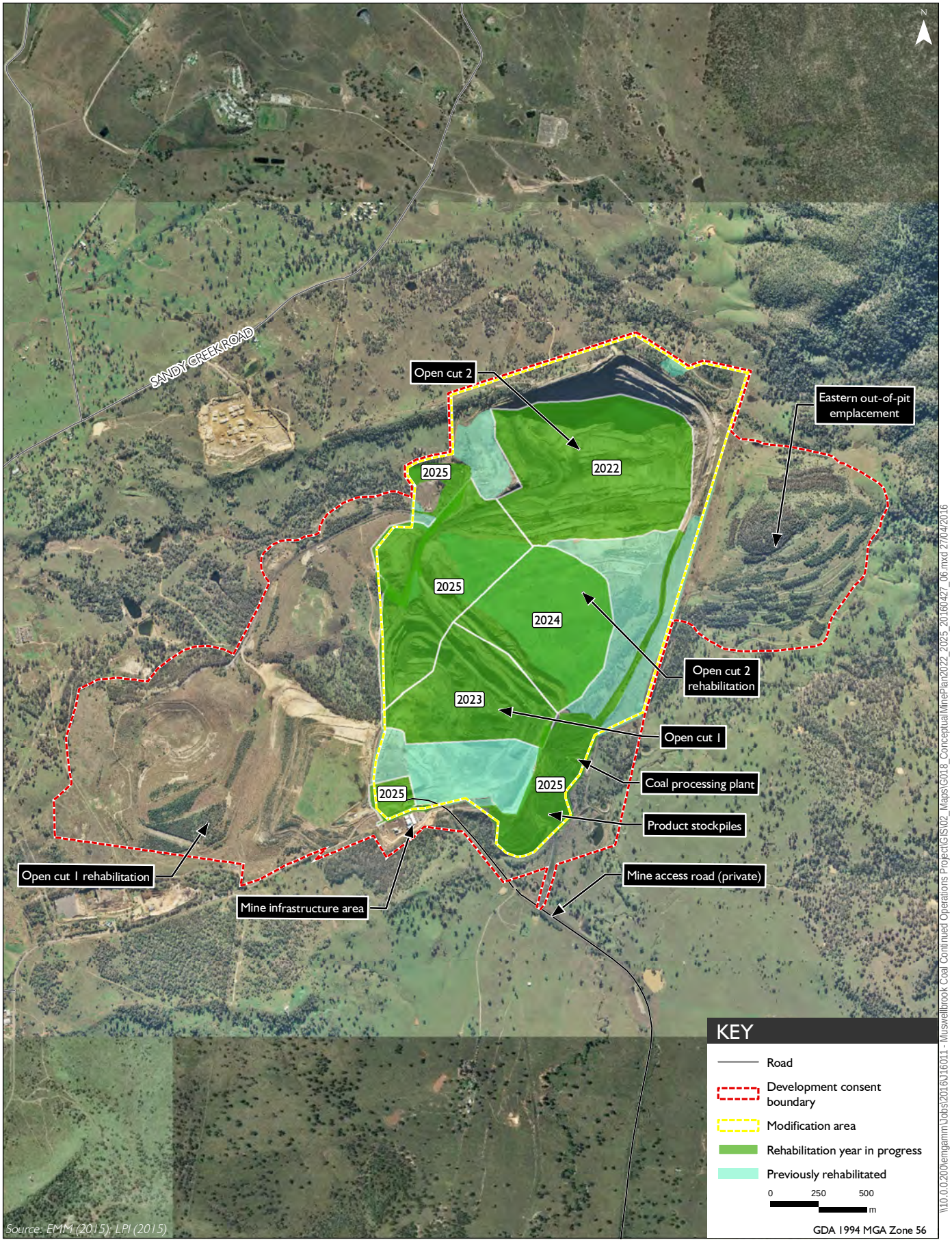
Conceptual mine plan - Year 4

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.5



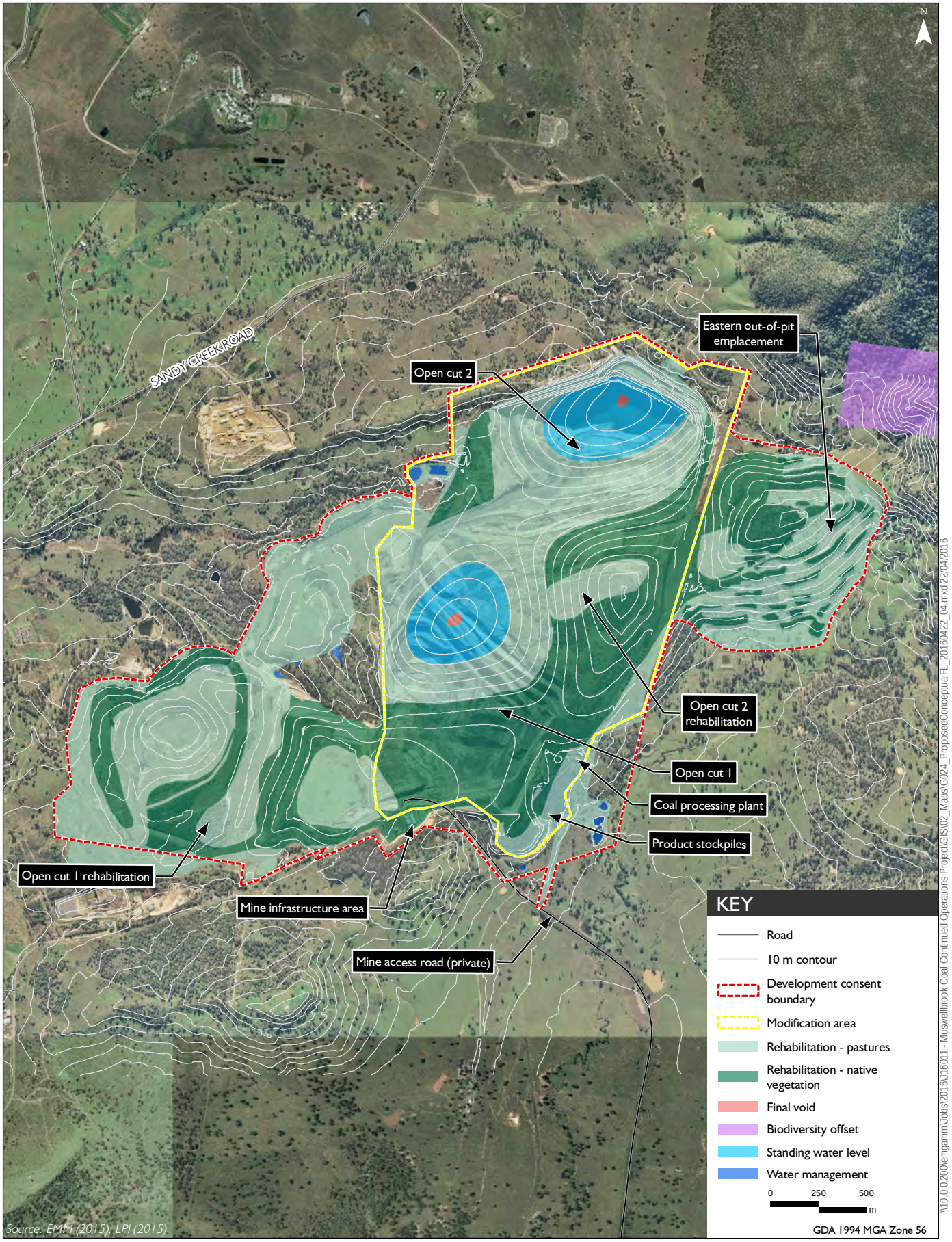
Conceptual mine plan - Year 5

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.6



Conceptual mine plan - rehabilitation

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.7



Conceptual final landform - proposed

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.8

4.5.2 Drainage and micro relief

The final landform would be internally draining since it is lower than the original landform. The drainage pattern of the final landform would be designed to be compatible with the drainage of the surrounding area. It would include permanent diversion drains and contour drains constructed over the life of the mine.

MCC would seek to enhance the final landform at the mine by designing the landform so that it sympathetic to the adjoining natural landscape and avoids using bench and drop drains.

The final landform would be hydrologically, geomorphically and visually compatible with the surrounding topography. Nature provides analogues landscapes for landforms in terms of hill slope forms and gradients. In nature, hill slopes have a convex upper profile with a concave profile lower down slope. Therefore, where practical concave slopes (microrelief) for the landform would be adopted.

While it is recognised that conventional landforms, ie straight slopes with bench and drop drains, can reduce erosive potential, very few straight slopes with benches are observed in nature. In landscapes it is well understood that linear slopes would erode to microrelief profiles over time, thus increasing the sediment loss of the profile until a stable microrelief has been achieved. Also, over the long term, benches are prone to failure, and once failure has occurred they channel water in concentrated flow paths, leading to severe gullying (Gyasi-Agyei and Willgoose 1996).

Successful landform design sympathetic to the surrounding landscape would be centred on sustainable water management and erosion control using microrelief. Water management of the landform would focus on reducing the surface runoff potential which would decrease the potential for erosion instability. Water management would govern landform design where final landform shaping alters the landscape catchment. For example, landform perimeters defined by landscape features such as ridges would be extended, particularly where this allows rainfall runoff from the landform to follow a natural drainage line in the landscape maximising overland flow, reducing the overall velocity of runoff and avoiding the need for bench and drop drain structures.

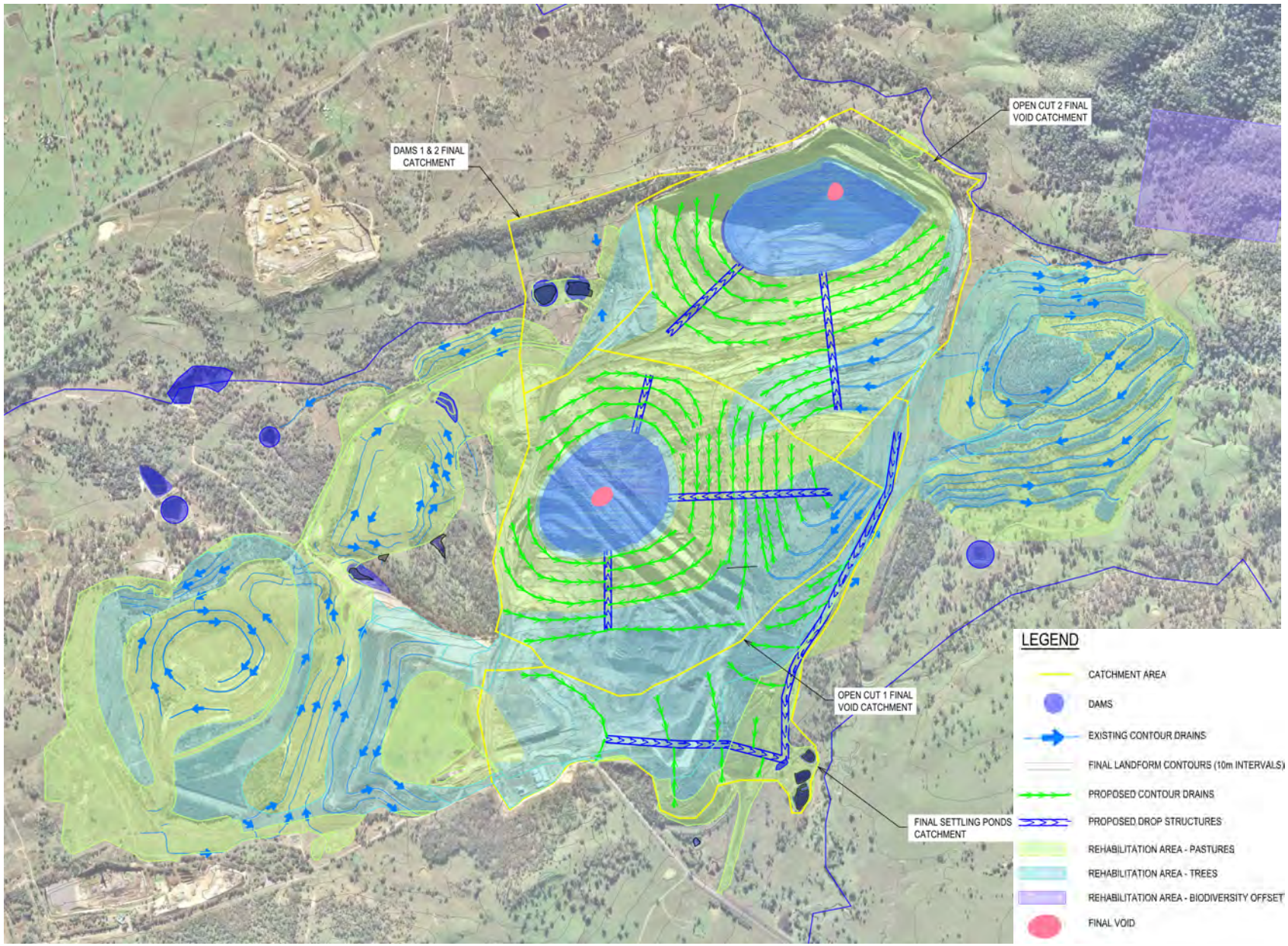
The conceptual final landform drainage design is illustrated in Figure 4.9, and further discussed in Section 7.3.4vi.

4.5.3 Cover

No changes to the type of cover for the final landform are proposed under the modification, which would be a combination of pasture and native vegetation. There would be some changes to distribution of pasture and native vegetation species based on changes to the shape of the final landform; however, it would generally be consistent with the approved final landform.

Revegetation would continue to be undertaken consistent with current practices at the mine. Where possible, exposed areas are covered with up to 0.1 m of soil and seeded with maintenance done as required. Erosion and sediment control measures would be implemented if required.

Selected grass and tree species would be supported by soil conditions and would be consistent with the final land use. Completion criteria for revegetated pasture and native vegetation are presented in Appendix B.



Source: SLR (2016a)

T:\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G032_FLDrainage_20160428_01.mxd 28/04/2016

Conceptual final landform drainage

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 4.9

4.5.4 Final voids

The approved conceptual final landform includes three final voids as described in Section 3.11.3. The modification would not result in a change to the number of final voids. However, as part of the modification, changes are proposed to the bulk shaping of the final voids to reduce the size of the Open Cut 1 and Open Cut 2 voids compared to the approved conceptual final landform. The bulk shaping would also result in both voids having slopes of less than 14 degrees, compared to 18 degrees in the approved conceptual final landform. As noted above in Section 4.4.1, one highwall would also remain, in Open Cut 2.

In order to facilitate the widest possible range of options for future land use of the approved open cut mining operation and the modification, the preferred rehabilitation strategy is to maximise backfilling of the voids during operation which would improve the land and soil capability (LSC) post rehabilitation.

The conceptual final landform would involve the backfilling and reshaping of around 14 million bank cubic metres (Mbcm) which would result in smaller residual voids and lower slope angles than the approved final landform. The slope angles within the rehabilitated voids in Open Cut 1 and 2 would not exceed 14 degrees from the crest of the slope to the floor of the backfilled void. This represents a decrease in the overall slope of these voids compared to the approved conceptual landform. The voids in Open Cut 1 and Open Cut 2 would be stabilised and allowed to fill with water.

The third final void in the Open Cut 1 rehabilitation area (outside the modification area) has a potential future use as a waste management facility, as discussed in Section 3.11.1. The modification would not affect this void.

Management of the final voids in the modification area would continue to be in accordance with the relevant management plans. Any change to the potential future uses of the final voids would be reviewed as part of an updated to the MOP or relevant management plans.

Final voids would be established as safe and stable for closure and would be designed to prevent the likelihood of spontaneous combustion in accordance with DRE guidelines.

4.6 Post mining land use

The approved conceptual final land use of the site comprises a combination of approximately 50% pasture and 50% native trees with a vegetation corridor between Bells Mountain and Skelletar Ridge. No significant changes are proposed to the final land use under the modification. The proposed conceptual final landform, showing the distribution of pasture and native vegetation is shown in Figure 3.2.

After rehabilitation, the modification area would have an LSC of Class 6 (refer to Section 7.9 and Appendix B and C). Future land uses which are described for LSC Class 6 include:

- grazing – the final land use includes approximately 50% pasture, which would be suitable for grazing;
- forestry – the final land use objectives are aimed at achieving vegetated linkages between rehabilitation at the mine and other remnant vegetation in the surrounding area and have favoured establishment of native woodland vegetation rather than forestry; and

- nature conservation – the final land use objectives are aimed at achieving native vegetation linkages between rehabilitation at the mine and other remnant vegetation in the surrounding area (Bells Mountain and Skelletar Ridge) consistent with the *Synoptic Plan – Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW* (Department of Mineral Resources 1999).

Based on the LSC of Class 6, it is unlikely that the rehabilitated land would capable of supporting intensive industries such as horticulture. As such, these have not been considered further.

Other future land use options would be limited but might include:

- Landfill for the neighbouring Muswellbrook and Singleton townships – as discussed in Section 3.11.1, a MoU is in place with MSC regarding use of the void in Open Cut 1 rehabilitation area for use a waste management facility. The life of this void as a waste facility would be sufficient such that consideration of the remaining voids for landfilling is not necessary.

- Future industrial development – future industrial use would require areas of relatively flat land with good access to the local and regional road network. MSC's Land Use Development Strategy (MSC 2013) identifies the potential for future industrial development opportunities in conjunction with the development of Muswellbrook bypass road. This would be dependent on the location of the bypass, as well as consideration of demand for industrial land, and potential opportunities for well serviced land with good access and other features as identified in the LUDS.

4.7 Alternatives considered

Alternatives considered as part of the development of the modification included:

- do nothing – proceed with closure and rehabilitation by 2020 in accordance with the development consent; and

- final landform – alternative options for the final landform under the modification.

4.7.1 Do nothing

This option would sterilise a known coal resource resulting in the loss of social and economic benefits to the community. It would also result in a missed opportunity to improve environmental outcomes for the final landform, in particular the size and depth of the final voids.

4.7.2 Final landform

Numerous final landform options were considered in the project planning phase of the modification, with the final landform being the key driver in determining the conceptual mine plan, overburden emplacement schedule and the sequencing of mine progression.

The objectives considered in determining the final landform included:

- achieving acceptable slopes in both Open Cut 1 and Open Cut 2 (ie less than 18 degrees);

- minimising the haulage distance of overburden;

- minimising the amount of bulk shaping required after the cessation of coal extraction; and

- minimising the size and depth of the voids remaining at the end of mine life.

To achieve these objectives, four final landform options were considered, as described below.

i Option 1 – Economic option

This option was considered as it would be the most economic option for MCC, involving the shortest haul routes for overburden emplacement. The majority of overburden under this scenario would be emplaced in Open Cut 2, resulting in the smallest void in Open Cut 2 of the four options considered. However, this would mean a large void remaining in Open Cut 1, with this void comprising slopes of greater than 20 degrees. Despite the economic benefits of this option, it was considered unacceptable due to this steep final slope in Open Cut 1.

ii Option 2 – Open Cut 2 at 10 degrees

This option was based on achieving an optimal final slope of 10 degrees in Open Cut 2. As per option 1, this would also result in a large void remaining in Open Cut 1 with final slopes once again greater than 20 degrees. This option would also require significant bulk shaping of 13 Mbcm at the end of coal extraction.

iii Option 3 – Open Cut 2 at 14 degrees

This option would enable slopes of less than 14 degrees to be achieved in both Open Cut 1 and 2, resulting in smaller voids in both open cuts. This option would have the disadvantage of requiring bulk shaping of 14 Mbcm at the cessation of mining to achieve the 14 degree final slope in Open Cut 1 (compared with 9.5 Mbcm to achieve a slope of 18 degrees).

iv Option 4 – Open Cut 2 at 18 degrees

The final option considered would result in the smallest void in Open Cut 1 compared with the other options considered; however would leave a steep slope of 18 degrees into Open Cut 2. It would also result in an increased height of the Open Cut 1 overburden emplacement of greater than RL 264m.

After consideration of all four options, Option 3 was determined to be the most favourable on the basis that it would result in slopes of less than 14 degrees in both open cuts, and would leave smaller voids than the other options considered.

5 Regulatory framework

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

5.1 Environmental Planning and Assessment Act 1979

Development consent under the EP&A Act may be modified under section 96. There are three types of modifications under section 96:

- section 96(1) modifications involving minor errors, misdescriptions or miscalculations;
- section 96(1A) modifications involving minimal environmental impact; and
- section 96(2) other modifications.

This application has been prepared under the provision of Section 96(2).

A development consent may be modified under Section 96 provided it is substantially the same development as the development for which consent was originally granted. The modification is considered to be substantially the same development as that currently approved. The modification, while proposing changes to the conceptual mine plan and life of mine, maintains the existing development consent boundary. There would be no change to the maximum production rate of 2 Mtpa of coal, the approved mining method, or the truck and excavator fleet. There are no changes to the approved maximum level of overburden emplacement as a result of the modification. Other operational methods relating to water management, waste management and handling, coal transport, access to site and employee numbers would also remain unchanged.

When assessing a modification application under Section 96, the consent authority is required to take into consideration the relevant matters given in section 79C of the EP&A Act. These are:

> (1) Matters for consideration – general
>
> In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:
>
> (a) the provisions of:
>
> (i) any environmental planning instrument, and
>
> (ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and
>
> (iii) any development control plan, and
>
> (iiia) any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F, and

(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and

(v) any coastal zone management plan (within the meaning of the Coastal Protection Act 1979),

that apply to the land to which the development application relates,

(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

(c) the suitability of the site for the development,

(d) any submissions made in accordance with this Act or the regulations,

(e) the public interest.

The relevant section 79C matters are considered in the following sections and Chapter 8.

5.2 Relevant provisions

This section describes the relevant provisions of the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation), environmental planning instruments (EPIs) and development control plans (DCPs) as required by section 79C(1)(a) of the EP&A Act.

5.2.1 NSW Environmental Planning and Assessment Regulation 2000

An application for modification of a development consent under section 96 must contain the information stipulated in clause 115 of the EP&A Regulation. The required information and where it has been addressed in this report is detailed in Table 5.1 below.

Table 5.1 Clause 115 requirements for a Section 96 application

Requirement	Where addressed in this report
The name and address of the applicant.	Appendix A
A description of the development to be carried out under the consent (as previously modified).	Chapter 3
The address, and formal particulars of title, of the land on which the development is to be carried out.	Appendix A
A description of the proposed modification to the development consent.	Chapter 4
A statement that indicates either: (i) that the modification is merely intended to correct a minor error, misdescription or miscalculation, or (ii) that the modification is intended to have some other effect, as specified in the statement.	Section 5.1
A description of the expected impacts of the modification.	Chapter 7
An undertaking to the effect that the development (as to be modified) will remain substantially the same as the development that was originally approved.	Section 5.1
If the applicant is not the owner of the land, a statement signed by the owner of the land to the effect that the owner consents to the making of the application (except where the application for the consent the subject of the modification was made, or could have been made, without the consent of the owner).	Not applicable.

Table 5.1 Clause 115 requirements for a Section 96 application

Requirement	Where addressed in this report
A statement as to whether the application is being made to the Court (under section 96) or to the consent authority (under section 96AA).	Not applicable.

5.2.2 Environmental planning instruments

i State environmental planning policies

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

The State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) aims to provide proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of the State. The Mining SEPP also aims to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and establishes appropriate planning controls to encourage ecologically sustainable development (ESD).

Clause 7(1) of the Mining SEPP outlines mining activities which may be permitted with consent. The policy states:

> (1) Mining
>
> Development for any of the following purposes may be carried out only with development consent:
>
> (a) underground mining carried out on any land,
>
> (b) mining carried out:
>
> (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or
>
> (ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the *Mining Act 1992* or a mining licence under the *Offshore Minerals Act 1999*,

The modification involves operations wholly located within the existing development consent boundary and on land the subject of mining leases under the NSW *Mining Act 1992* that were in place prior to the commencement of clause 7(1), and is therefore permissible in accordance with this clause.

Clause 12 of the Mining SEPP outlines provisions relating to the compatibility of proposed mining activities with other land uses. The modification would result in changes to the conceptual mine plan and mining of a former overburden emplacement area, and therefore would not affect the existing land use. The extension area is located fully within the existing development consent boundary. Therefore, the modification is consistent with this clause.

Clause 15 of the Mining SEPP provides requirements regarding the efficiency of resource recovery. The modification would allow an additional 4.2 Mt of coal to be extracted, and would maximise coal resource recovery an existing coal mining operation and is, therefore, consistent with this clause.

b. State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) outlines requirements relating to the provision of infrastructure and services for new development.

No changes are proposed to the maximum production rate of 2 Mtpa, mining methods, coal processing, coal transport, access to site or employee numbers under the modification. As such, the modification would not result in any additional use of existing infrastructure on or surrounding the site.

c. State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) encourages the proper conservation and management of areas of natural vegetation that provide habitat for koalas. The modification would not impact on vegetation that has the potential to provide habitat for koalas. A biodiversity assessment is provided in Appendix D.

d. State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) provides a state-wide approach to the remediation of contaminated land for the purpose of minimising the risk to human health and the environment. Under clause 7(1) of SEPP 55, prior to granting consent to the carrying out of any development on land a consent authority is required to give consideration as to whether land is contaminated and, if the land is contaminated, whether the land is suitable for the purpose of the development or whether remediation is required.

ii Muswellbrook Local Environmental Plan 2009

MCM is subject to the Muswellbrook LEP. Land within the development consent boundary is a combination of RU1 Primary Production, E3 Environmental Management and SP2 Infrastructure land use zones.

The consent authority must give regard to the objectives for development in a zone when determining a development application in respect of land within the zone.

The objectives of the RU1 Primary Production zone are as follows:

> To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
>
> To encourage diversity in primary industry enterprises and systems appropriate for the area.
>
> To minimise the fragmentation and alienation of resource lands.
>
> To minimise conflict between land uses within this zone and land uses within adjoining zones.
>
> To protect the agricultural potential of rural land not identified for alternative land use, and to minimise the cost to the community of providing, extending and maintaining public amenities and services.
>
> To maintain the rural landscape character of the land in the long term.

To ensure that development for the purpose of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines from the surface of the flood plain), will not:

(a) destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface, or

(b) detrimentally affect in any way the quantity, flow and quality of water in either subterranean or surface water systems, or

(c) visually intrude into its surroundings, except by way of suitable screening.

To protect or conserve (or both):

(a) soil stability by controlling development in accordance with land capability, and

(b) trees and other vegetation, and

(c) water resources, water quality and wetland areas, and their catchments and buffer areas, and

(d) valuable deposits of minerals and extractive materials by restricting development that would compromise the efficient extraction of those deposits.

Open cut mining is permitted with consent on land zoned RU1 Primary Production.

The objectives of the E3 Environmental Management zone under the Muswellbrook LEP are as follows:

To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.

To provide for a limited range of development that does not have an adverse effect on those values.

To maintain, or improve in the long term, the ecological values of existing remnant vegetation of significance including wooded hilltops, river valley systems, major scenic corridors and other local features of scenic attraction.

To limit development that is visually intrusive and ensure compatibility with the existing landscape character.

To allow agricultural activities that will not have an adverse impact on the environmental and scenic quality of the existing landscape.

To promote ecologically sustainable development.

To ensure that development in this zone on land that adjoins land in the land zoned E1 National Parks and Nature Reserves is compatible with the objectives for that zone.

Open cut mining is not listed in the permissible uses for land zoned E3 Environmental Management. However, the provisions of the Mining SEPP preside over the provisions of Muswellbrook LEP. Clause 7 of the Mining SEPP allows for mining to be carried out on land where development for the purposes of agriculture may be carried out. The Muswellbrook LEP permits agricultural uses within the E3 Environmental Management zone.

The modification is consistent with the existing land use zoning of the site and is permissible under the Muswellbrook LEP.

5.3 Other legislation

5.3.1 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) is the principal environmental protection legislation in NSW and is administered by the EPA. MCM has an existing EPL (EPL 656) issued under the POEO Act. The EPL authorises coal works to a maximum scale of 2 Mt handled and mining for coal to a scale of less than 0.5 – 2 Mt produced.

As previously mentioned, no changes in production would occur as a result of the modification. MCC can continue operations under EPL656.

5.3.2 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) aims to conserve biological diversity in NSW through the protection of threatened and endangered flora and fauna species and endangered ecological communities (EECs). The TSC Act requires that any vulnerable, endangered or critically endangered species, population or ecological community associated with a proposed development are identified. It also requires that acceptable recovery and management strategies are implemented, if a project is likely to have a significant impact.

The modification is unlikely to have any significant impacts on threatened species or EECs. TSC Act listed species and communities are discussed in Section 7.5 and Appendix D.

5.3.3 Mining Act 1992

The NSW *Mining Act 1992* regulates the granting of mining leases and mining activities generally. The mining leases that apply to MCM are:

- CCL 713 – Valid 5 May 1990 – 24 November 2024;
- ML 1304 – Valid 12 January 1993 – 24 November 2024; and
- ML 1562 – Valid 16 February 2005 – 16 February 2026.

MCC has a MOP in place for its approved operations. A modification to the MOP would be required under the NSW *Mining Act 1992* to incorporate changes in mining operations.

5.3.4 Water Management Act 2000 and Water Act 1912

The NSW *Water Act 1912* and NSW *Water Management Act 2000* (WM Act) regulate water resources and use and outline provisions for the licensing of water capture and use.

MCC holds four water licences under the *Water Act 1912* listed in Table 3.2.

Table 5.2 Water licences held by MCC

Licence Number	Pertaining To:	Extraction Entitlement (ML/year Limit)
20BL169014	Borehole RDH529	1000
20BL169037	Open Cut 1	2000
20BL169038	Open Cut 2	
20BL170473	Borehole RDH607	3000

The WM Act governs the issue of new licences and the trade of water licences and allocation for those water sources (rivers, lakes and groundwater) in NSW where water sharing plans (WSPs) have commenced. There are two WSPs commenced and two draft WSPs for the water sources near MCM:

- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*;
- *Water Sharing Plan for the Hunter Regulated River Water Source 2003*;
- Draft Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources; and
- Draft Water Sharing Plan for the Hunter Regulated River Water Source.

As described in Section 7.4, it is anticipated that there would be no observable changes in the inflow of groundwater to mine workings. Additionally, no significant alterations to surface water management infrastructure are proposed that would lead to significant changes in surface water flows or quality. Accordingly, the modification would not impact water sources regulated under these acts or WSPs.

Under the NSW *Water Act 1912* and WM Act, landholders in NSW are permitted to collect a portion of the rainfall runoff on their property and store it in dams. This rainfall harvesting right is typically 10% of the total rainfall runoff for the property and is known as the Maximum Harvestable Right Dam Capacity (MHRDC). Where dams exceed this capacity or a certain size, they must be licensed. Exclusions to this licensing requirement exist for dams used to control pollution or effluent. All dams at MCM are used for pollution control purposes (sediment dams) and as such, are exempt from MHRDC licensing requirements at the current time. Consideration of licensing requirements post-closure would be considered as part of detailed closure planning.

5.4 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect matters deemed to be of national environmental significance (NES) that is:

- 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;

- nuclear actions (including uranium mining); and
- actions of development for coal seam gas or large coal mining on water resources.

If an action (or proposal) would, 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 would or is likely to be a controlled action, an action may be referred to the Commonwealth Department of the Environment (DoE).

The matters of NES that have the potential to be impacted by the modification include threatened flora and fauna species and ecological communities and water resources. A biodiversity assessment has been completed for the modification (see Appendix D) and concluded that the modification is unlikely to significantly affect matters of NES. Accordingly, a referral to the Commonwealth DoE is not required.

6 Stakeholder engagement

6.1 Introduction

As outlined in the subsequent sections, consultation has been completed with government and community stakeholders in respect of the modification. The nature and extent of these stakeholder consultation activities reflect the minor nature and scale of the modification and its potential impacts.

6.2 Consultation with government

A summary of consultation undertaken with government agencies regarding the modification is given in Table 6.1. The outcomes of this consultation are reflected in the modification's scope and matters addressed in this SEE.

Table 6.1 Summary of agency consultation

Date	Description	Key issues for consideration	Section addressed in this SEE
MSC			
4 December 2015	Meeting with MSC personnel at Council's offices to give an introductory presentation on the modification and to get initial feedback on the proposal.	Key issues raised – rehabilitation and final landform including voids and spontaneous combustion management. The matters raised by MSC at this meeting were detailed in subsequent written correspondence, and are considered in Table 6.2.	Final landform and land use – Section 4.5 and 4.6 and Appendix B. Spontaneous combustion – Section 3.5 and 4.3.
15 January 2016	Meeting with MSC personnel at Council's offices to recap on meeting on 14 January and to discuss approvals process and timeline.	-	-
18 February 2016	Meeting with MSC at Council's offices to discuss the options assessment for the final landform and MCC's preferred final landform.	Alternative final landform options.	Section 4.7.2
22 February 2016	Presentation to MSC councillors and senior staff at Council's chambers to give an introductory presentation on the modification and final landform development.	Key issues raised – ongoing access to Sandy Creek operation, would modification affect RMS bypass, current staffing level, tailing dam location (none on site).	No change to access to Sandy Creek compared to approved. Modification would not affect the bypass, with the area zoned SP2 for the bypass outside of the modification area. Staffing levels - Section 4.1. There is no tailings dam on site.

Table 6.1 Summary of agency consultation

Date	Description	Key issues for consideration	Section addressed in this SEE
DRE			
21 January 2016	Meeting with DRE personnel in Maitland offices to give an introductory presentation on the modification and to get initial feedback on the proposal.	Key issues raised – visual impacts of operation including final landform, request for natural and useable final landform, aim for 10^{o} slopes in overburden areas, detailed rehabilitation designs in SEE, include basic economic assessment and resource utilisation information, not looking at significance of resource due to small nature of modification.	Visual impacts – Section 7.6. Final landform – Section 4.5, 4,6 and Appendix B Economic impacts – Section 7.7 and Appendix I.
18 March 2016	Meeting with DRE personnel in Maitland offices to provide information on options assessment for the final landform and MCC's preferred final landform.	Key issues raised – proposed final land use (no change to currently approved land use), final water level in voids, management of spontaneous combustion in highwalls, drainage controls on rehabilitation and clearly defined detail around the final landform.	Final landform and land use – Section 4.5 and 4.6 and Appendix B Spontaneous combustion – Section 3.5 and 4.3
Multi-agency meetings			
14 January 2016	Meeting with MSC, EPA and DPI-Water personnel on site to give an introductory presentation on the modification and to get initial feedback on the proposal.	Key issues raised by DPI-Water – compliance with Aquifer Interference Policy, impacts on other users, detailed groundwater model, cross-section of hydrogeology/water levels, water take and associated licences. Key issues raised by EPA – air, noise and spontaneous combustion modelling, surface water management.	Sections 7.4, 7.2 and 7.1.

MSC raised a number of aspects it would like to see addressed in the environmental assessment process in correspondence dated 22 December 2015, and considered in Table 6.2.

Table 6.2 Summary of matters raised by MSC in correspondence

Matter	Requirement	Where addressed in this SEE
Dust management	The EIS is to consider in detail dust that may be generated as a result of the additional works and especially the potential increase in the generation of dust due to: • Any increase in strip ratio as compared to that anticipated in the remaining years of the operations under the existing consent; • Any additional dust generation potential due to the excavation of previously disturbed material; and • And propose how that will be managed and monitored.	Section 7.2 and Appendix F
Noise management	The EIS is to consider in detail noise that may be generate as a result of the additional works and especially in relation to any sensitive receptors.	Section 7.1 and Appendix E
Spontaneous combustion	The EIS is to consider in detail and propose management proposals to address the potential for spontaneous combustion that may occur as a result of the additional works and especially in relation to: • Preventative action that may be possible; • Increased risk due to the uncovering of existing underground workings; and • Increased risk due to the uncovering of previously disturbed material. In the period 2012 to current time almost 50% of complaints made in relation to the open cut mine were regarding odour and smoke issues from spontaneous combustion. The EIS is to consider in detail additional measured that may be implemented to manage this issue more effectively.	Section 3.5 and 4.3
Surface water management	The EIS is to consider in detail and determine how surface waters are to be managed. In particular the following are to be considered: • The ability of surface waters to enter external water systems needs to be considered; and • The storm event capacity of water management structures.	Section 7.3 and Appendix G
Rehabilitation	The EIS is to consider in detail and determine a plan for the rehabilitation of all disturbed areas that have not been rehabilitated at the time of any modified consent. The rehabilitation proposal is to be in accordance with the latest best practice in mine site rehabilitation and adequately describes the rehabilitation process and includes but is not limited to details such as; • Species richness; • Micro-relief; • Natural drainage lines (and the avoidance of linear drop structures); • Sustainability/robustness of the ecology in the short, medium and longer term; • The level of monitoring especially to ensure nutrient cycling is occurring; and • The use of local seeds.	Section 4.5 and Appendix B

Table 6.2 Summary of matters raised by MSC in correspondence

Matter	Requirement	Where addressed in this SEE
Final void	The EIS is to consider in detail the final void design with specific consideration of; • Maximising to the greatest extent practicable the final void landform being in keeping with the natural terrain features of the surrounding landscape; • Minimising to the greatest extent practicable: - The size and depth of the final void; and - The drainage catchment of the final void.	Section 4.4 and Appendix B.
Social impacts	The EIS is to consider in detail the social impacts of the proposed extension of the operations.	Section 7.8
Mine closure	The application documentation is to include a detailed plan with timeline for mine closure.	Section 4.5
Voluntary Planning Agreement	The application documentation is to detail the type, scope and quantity of contributions that are proposed for consideration for inclusion in a voluntary planning agreement.	The details of a voluntary planning agreement, if required, would be discussed with MSC following lodgement of the development application and review of potential environmental, social and economic impacts.

6.3 Consultation with community

MCC operates a CCC which meets on a quarterly basis and includes members from the community, MSC and MCC. The CCC is an independent committee which provides regular mine updates to the broader community. All minutes from CCC meetings are publically available on the MCM website.

As noted above, community consultation in respect of the modification is ongoing. Information specific to the modification has been presented to the CCC at its meetings on 1 December 2015 and 8 March 2016. A summary of the information presented as recorded in the minutes from the CCC meetings is provided in Table 6.3.

Table 6.3 Summary of consultation with the CCC

Date	Summary of matters discussed
1 December 2015	A presentation was provided on the modification that MCC are discussing with MSC. In summary: • The project would extend the footprint of Open Cut 1 towards Open Cut 2. • The preliminary modelling on the new pit shell indicates there is approximately 4.1 Mt of coal and 31 Mbcm of waste in the area. • At the current rate of mining, this would extend the mine production life from 2018 to 2022 with the final closure work completed in 2025. • Positive outcomes include: removal of coal seams that are prone to spontaneous combustion, reducing the visual and odour impact potential in the future; and ongoing employment for workers at MCC in a time of industry downturn and major job losses impacting the Muswellbrook community.
8 March 2016	An update was provided on the progress of consultation and assessment process: • Meetings have been held with MSC, EPA, DPI - Water and DRE to discuss project and to understand their expectations. • A consultant has been engaged to assist with the preparation of the environmental assessment. This is to be based on feedback from the regulators and guidelines for environmental assessments. Technical studies likely to include: noise and blasting, air quality, land and soil, rehabilitation, biodiversity, water resources, visual, economics and social impact assessment.

Further updates regarding the modification would continue to be presented at future CCC meetings which are held quarterly.

The broader community will be notified of the modification through an advertisement placed in a local newspaper following lodgement of the application and through the public exhibition process where community members would be invited to make comment by way of formal submissions.

7 Environmental assessment

7.1 Noise and vibration

7.1.1 Introduction

EMM assessed potential noise and blasting related impacts of the modification. The full technical report is provided in Appendix E, with the findings and recommendations summarised in this section.

The noise and vibration impact assessment (NVIA) was prepared with reference to the following policies, standards and guidelines:

- NSW EPA (2000) *NSW Industrial Noise Policy* (INP);
- NSW Department of Environment, Climate Change and Water (DECCW) (2011) *NSW Road Noise Policy* (RNP);
- Australian Standard (AS) 1055-1997, Acoustics - Description and Measurement of Environmental Noise; and
- Australian and New Zealand Environment Council (ANZEC) (1990) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*.

7.1.2 Existing environment

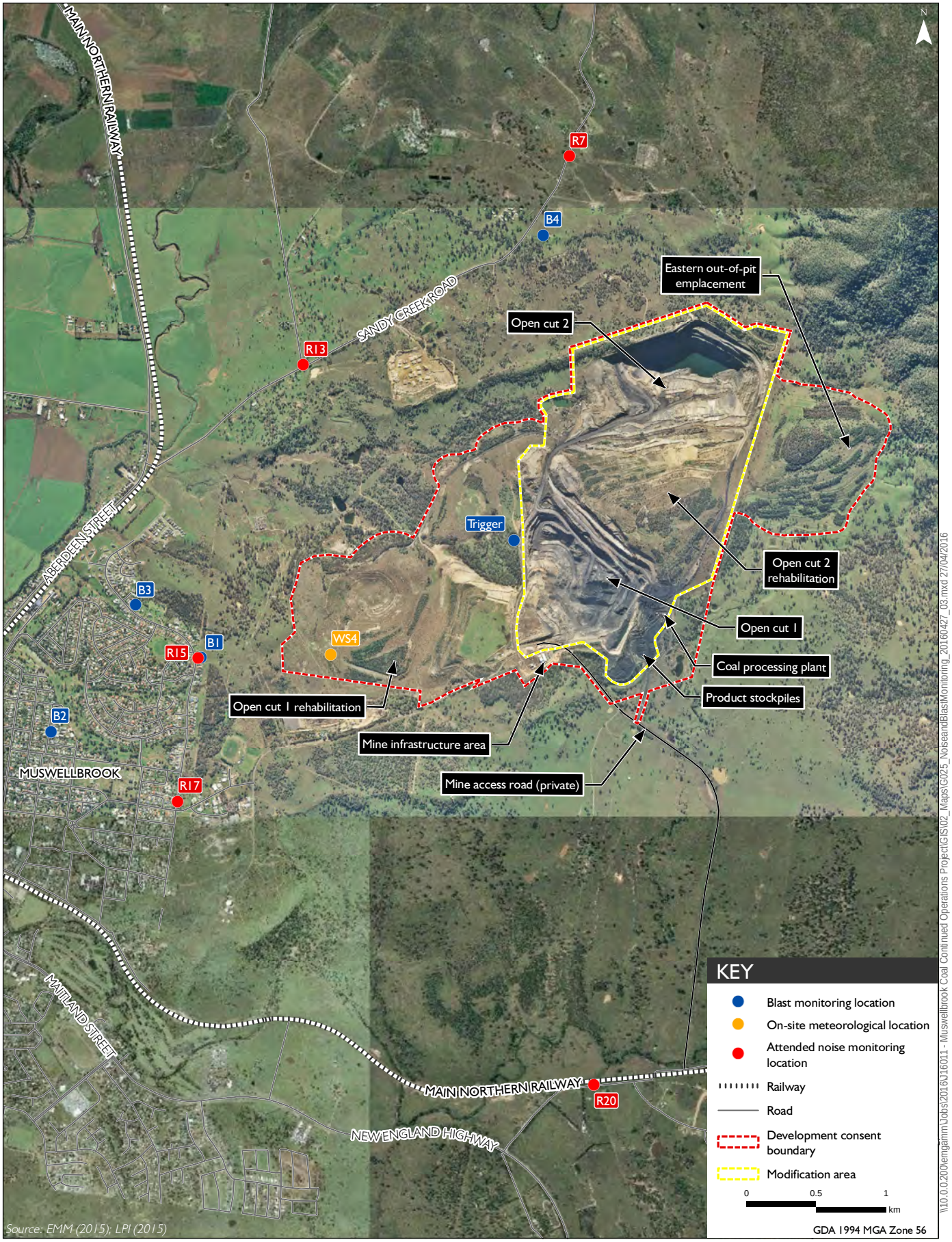
MCM is located in a rural setting and is surrounded by undulating terrain. Land uses surrounding the mine include agricultural activities, light industrial land uses and residential areas. As described in Chapter 2, nearby light industrial and special land uses include Muswellbrook Quarry to the north-west, St Heliers correctional centre to the north-west and Muswellbrook waste management facility to the south.

i Existing noise and blasting emissions from MCM

Noise emissions from mining operations at MCM are currently managed in accordance with the approved Noise Management Plan (MCC 2015a), which includes operator-attended noise monitoring on a bi-annual (six monthly) basis. A review of historical noise monitoring results showed that noise levels from mining operations generally satisfied the relevant limits specified in Development Consent No. DA 205/2002 at all noise monitoring locations. The exceptions were during the night-time monitoring surveys in June 2012 (at R15) and June 2013 (at R13), where noise contributions averaged over a 15 minute period ($L_{Aeq(15\text{-}min)}$) were marginally above the relevant limits by 2 decibels (dB) and 1 dB, respectively. Noise levels changes of 1 to 2 dB are generally imperceptible to humans.

Very few complaints have been received in relation to noise from MCM since January 2013. Two were received in April 2013 in relation to general mine noise and one on 23 May 2014 relating to dozer tracks and reversing alarms; broadband reversing alarms have subsequently been fitted to relevant plant. Another was received in October 2015 and a subsequent investigation found that the source was unlikely to have been mine related.

Blasting is currently managed in accordance with the approved Blast-Vibration Management Plan (MCC 2015b). Noise and blast monitoring locations are shown in Figure 7.1.



Existing noise and blast monitoring locations

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 7.1

There were 85 blasts at MCM between July 2011 and December 2015. Results of blast emissions monitoring during this time are summarised as follows:

- ground vibration levels from blasting were less than the most stringent criteria of 5 millimetres per second (mm/s) on all occasions at all monitoring locations;
- airblast (overpressure) criterion of 115 dB, linear peak was marginally exceeded (by up to 2 dB) at location B4 in November 2011, June and October 2013; and
- airblast levels have never been recorded above the upper criterion of 120 dB, linear peak.

Based on information supplied by MCC, seven complaints in relation to noise and vibration from blasting at MCC have been received since January 2013; 2 April 2013, 9 and 19 September 2013, 6 November 2014, 14 and 16 January 2015 and 30 March 2015. All of these complaints were related to being able to 'feel' the blast. Blast overpressure and ground vibration levels satisfied the relevant criteria during all blast events that were the subject of complaint.

ii Existing ambient noise levels

Background noise levels referenced in the original noise assessment prepared to support DA 205/2002 (HLA-Envirosciences 2002) were referenced for the purpose of the NVIA for the modification (refer Table 7.1). It is anticipated that these background noise levels would have remained the same for the majority of the monitoring locations and therefore are deemed representative of the current background noise environment. Background noise levels for some of these noise catchments, in particular for those closer to the town of Muswellbrook, may have increased since 2002 and therefore are deemed conservative.

Table 7.1 Measured ambient noise levels (HLA-Envirosciences 2002)

Location (previous ID)	$L_{Aeq(day)}$	$L_{Aeq(evening)}$	$L_{Aeq(night)}$	RBL Day	RBL Evening	RBL Night
R7 (N1)	53	52	45	32	34	33
R15 (N2)	51	54	43	31	34	30
R16 (N3)	47	49	51	32	37	29
R17 (N4)	47	49	45	36	40	37
R20 (N5)	55	55	53	40	33	32

Notes: Day: 7.00 am to 6.00 pm (*8.00 am on Sundays and public holidays), Evening: 6.00 pm to 10.00 pm, Night: 10.00 pm to 7.00 am* (*8.00 am on Sundays and public holidays).*

iii Nearest sensitive receptors

Nearest and potentially affected privately-owned dwellings were identified as assessment locations for the NVIA, and are illustrated in Figure 2.1 (refer Chapter 2). A total of 34 privately-owned dwellings surrounding MCM were assessed.

Six of the locations identified in Figure 2.1 were assessed as part of the original noise assessment prepared by HLA-Envirosciences (2002), and are referenced in Development Consent No. DA 205/2002 with noise criteria assigned. Nearest receptors were also identified as part of the noise assessment conducted for previous modifications to Development Consent No. DA 205/2002. Furthermore, newly identified privately-owned dwellings were adopted for the purpose of the assessment.

iv Meteorology

Detailed analysis of climatic data was undertaken using weather data from the MCM on-site weather station.

The prevailing winds analysis was undertaken in accordance with INP methods and considered weather data over a one year period (January 2014 to December 2014). The analysis determined that prevailing winds were present during the day period, ranging from the east-south-east to south.

The frequency of temperature inversions was analysed based on supplied sigma-theta data from the MCM on-site weather station. F or G class temperature inversions were found to occur for greater than 30% of the night-time period, and were therefore considered in the prediction and assessment of noise emissions from the modification.

7.1.3 Assessment criteria

i Operational noise criteria

The relevant amenity criteria and instructiveness noise criteria is identified in Table 7.2 for each of nearest assessment locations. In accordance with the INP, the intrusiveness criteria were determined by adding 5 dB to the rating background levels (RBLs) at each assessment location. The RBLs utilised were based on the background noise monitoring results presented in the original noise assessment (HLA-Envirosciences 2002) for assessment locations in the vicinity of those monitoring locations. As noted in Section 7.1.2, these monitoring results are considered to be conservative. Where assessment locations were distant from the previous monitoring locations, the INP minimum RBL of 30 dB was adopted for all assessment periods.

The project specific noise levels (PSNL) applied is the more stringent of the intrusiveness and amenity criteria, which, as evident in Table 7.2, is the intrusiveness criterion for all assessment periods and receptors. The noise criteria currently specified in Development Consent No. DA 205/2002 is presented in brackets for the assessment locations.

Table 7.2 Project specific noise levels

Assessment locations (previous ID)	Indicative area (for amenity criteria)	Intrusive criteria, $L_{Aeq(15\text{-}min)}$, dB			Amenity criteria, $L_{Aeq(period)}$, dB		
		Day	Evening	Night	Day	Evening	Night
R1	Rural	35	35	35	50	45	40
R2	Rural	35	35	35	50	45	40
R3	Rural	35	35	35	50	45	40
R4	Rural	35	35	35	50	45	40
R5	Rural	35	35	35	50	45	40
R7 (N1)	Rural	37(36)	37(36)	37(36)	50	45	40
R11	Rural	35	35	35	50	45	40
R12	Rural	35	35	35	50	45	40
R13	Rural	37(40)	37(40)	37(40)	50	45	40
R14	Rural	37	37	37	50	45	40
R15 (N2)	Suburban	36(35)	36(35)	35(35)	55	45	40
R16 (N3)	Suburban	37(35)	37(35)	35(35)	55	45	40

Table 7.2 Project specific noise levels

Assessment locations (previous ID)	Indicative area (for amenity criteria)	Intrusive criteria, $L_{Aeq(15\text{-}min)}$, dB			Amenity criteria, $L_{Aeq(period)}$, dB		
		Day	Evening	Night	Day	Evening	Night
R17 (N4)	Suburban	36(35)	36(35)	35(35)	55	45	40
R18	Rural	45	38	37	50	45	40
R20 (N5)	Rural	45(38)	38(38)	37(38)	50	45	40
R21	Rural	35	35	35	50	45	40
R22	Rural	37	37	37	50	45	40
R23	Rural	37	37	37	50	45	40
R24	Rural	37	37	37	50	45	40
R25	Rural	37	37	37	50	45	40
R26	Rural	35	35	35	50	45	40
R27	Rural	35	35	35	50	45	40
R28	Rural	35	35	35	50	45	40
R29	Rural	35	35	35	50	45	40
R30	Rural	35	35	35	50	45	40
R31	Rural	35	35	35	50	45	40
R32	Rural	35	35	35	50	45	40
R33	Rural	35	35	35	50	45	40
R34	Rural	35	35	35	50	45	40
R35	Rural	35	35	35	50	45	40
R36	Rural	35	35	35	50	45	40
R37	Rural	35	35	35	50	45	40
R38	Rural	35	35	35	50	45	40
R39	Rural	35	35	35	50	45	40

ii Sleep disturbance criteria and acquisition criteria

MCM currently operates during the night period and sleep disturbance ($L_{A1(1\text{-}min)}$) noise limits exist in Development Consent No. DA 205/2002. MCM would continue to operate during the night period.

Acquisition noise criteria for some assessment locations around MCM have been defined in Development Consent No. DA 205/2002. The acquisition noise criteria for all assessment locations were also determined based on guidance provided in the NSW Government's Voluntary Land Acquisition and Mitigation Policy by adding 5 dB to the relevant PSNLs for all assessment locations. These are higher compared to the current acquisition criteria for assessment locations R7, R13, R15, R16, R17 and R20. Acquisition applies if the stated levels are exceeded.

The sleep disturbance and acquisition criteria are presented in Table 7.3. The sleep disturbance and noise acquisition criteria currently specified in Development Consent No. DA 205/2002 is presented in brackets for the relevant receptors.

Table 7.3 Sleep disturbance and noise acquisition criteria

Assessment location	Sleep disturbance	Noise acquisition criteria, dB		
	L_{Amax} criteria, dB	Day $L_{Aeq(15\text{-}min)}$	Evening $L_{Aeq(15\text{-}min)}$	Night $L_{Aeq(15\text{-}min)}$
R1	45	40	40	40
R2	45	40	40	40
R3	45	40	40	40
R4	45	40	40	40
R5	45	40	40	40
R7	47 (44)	42 (41)	42 (41)	42 (41)
R11	45	40	40	40
R12	45	40	40	40
R13	47 (51)	42 (45)	42 (45)	42 (45)
R14	47	42	42	42
R15	45 (46)	41 (40)	41 (40)	40 (40)
R16	45 (46)	42 (40)	42 (40)	40 (40)
R17	45 (46)	41 (40)	41 (40)	40 (40)
R18	47	50	43	42
R20	47 (48)	50 (43)	43 (43)	42 (43)
R21	45	40	40	40
R22	47	42	42	42
R23	47	42	42	42
R24	47	42	42	42
R25	47	42	42	42
R26	45	40	40	40
R27	45	40	40	40
R28	45	40	40	40
R29	45	40	40	40
R30	45	40	40	40
R31	45	40	40	40
R32	45	40	40	40
R33	45	40	40	40
R34	45	40	40	40
R35	45	40	40	40
R36	45	40	40	40
R37	45	40	40	40
R38	45	40	40	40
R39	45	40	40	40

Notes: Night: 10.00 pm to 7.00 am Monday to Saturday; 10.00 pm to 8.00 am Sundays and public holidays.

iii Blasting criteria

The maximum level for airblast is 115 dB linear peak. This level may be exceeded up to 5% of the total number of blasts over 12 months. However, the level should not exceed 120 dB linear peak at any time.

Peak particle velocity (PPV) from ground vibration should not exceed 5 mm/s for more than 5% of the total number of blasts over 12 months. Further, the maximum level should not exceed 10 mm/s at any time.

7.1.4 Impact assessment

The NVIA modelled Year 3 of the modification (refer Figure 4.4), which was identified as being the worst case scenario for noise emissions based on the elevated heights of equipment locations and the hauling of overburden into Open Cut 2. It is anticipated that operations associated with this acoustically worst-case scenario would occur for a period of approximately two months. Noise levels from MCM operations for the majority of the extended five year life-of-mine are anticipated to be the same or lower than the predicted noise emissions for Year 3.

i Operational noise levels

Predicted noise emission levels as a result of the modification at all assessment locations are provided in Table 7.4. Noise emission levels predicted to be above the PSNLs are indicated by shading, and levels above Development Consent No. DA 205/2002 limits are indicated by bold text.

Table 7.4 Predicted operational noise levels

Assessment location	Predicted operational $L_{Aeq(15\text{-}min)}$ noise levels, dB				Noise criteria, $L_{Aeq(15\text{-}min)}$, dB					
	Day	Day	Evening/Night	Night	PSNLs			Development Consent		
	Calm	Wind	Calm	Inversion[2]	Day	Evening	Night	Day	Evening	Night
R1	31	33	32	34	35	35	35	-	-	-
R2	31	33	32	34	35	35	35	-	-	-
R3	32	34	33	35	35	35	35	-	-	-
R4	32	34	33	35	35	35	35	-	-	-
R5	33	35	34	36	35	35	35	-	-	-
R7	35	**37**	36	**38**	37	37	37	36	36	36
R11	35	37	37	39	35	35	35	-	-	-
R12	36	38	37	39	35	35	35	-	-	-
R13	37	40	38	**41**	37	37	37	40	40	40
R14	34	37	36	38	37	37	37	-	-	-
R15	34	**36**	35	**37**	36	36	35	35	35	35
R16	33	35	34	**36**	37	37	35	35	35	35
R17	31	33	33	35	36	36	35	35	35	35
R18	<30	<30	<30	31	45	38	37	-	-	-
R20	30	<30	32	34	45	38	37	38	38	38
R21	33	36	35	37	35	35	35	-	-	-
R22	35	38	36	39	37	37	37	-	-	-
R23	36	38	37	39	37	37	37	-	-	-
R24	37	39	38	40	37	37	37	-	-	-
R25	39	41	39	42	37	37	37	-	-	-
R26	<30	<30	<30	31	35	35	35	-	-	-
R27	<30	<30	30	31	35	35	35	-	-	-
R28	<30	<30	31	32	35	35	35	-	-	-
R29	30	<30	31	33	35	35	35	-	-	-

Table 7.4 Predicted operational noise levels

Assessment location	Predicted operational $L_{Aeq(15\text{-}min)}$ noise levels, dB				Noise criteria, $L_{Aeq(15\text{-}min)}$, dB					
	Day	Day	Evening/Night	Night	PSNLs			Development Consent		
	Calm	Wind	Calm	Inversion[2]	Day	Evening	Night	Day	Evening	Night
R30	<30	<30	<30	<30	35	35	35	-	-	-
R31	<30	<30	<30	<30	35	35	35	-	-	-
R32	<30	<30	31	33	35	35	35	-	-	-
R33	<30	<30	31	33	35	35	35	-	-	-
R34	<30	<30	<30	<30	35	35	35	-	-	-
R35	<30	<30	<30	<30	35	35	35	-	-	-
R36	35	37	36	38	35	35	35	-	-	-
R37	<30	31	31	32	35	35	35	-	-	-
R38	31	32	32	34	35	35	35	-	-	-
R39	30	32	31	33	35	35	35	-	-	-

Notes: 1. Maximum predicted level based on wind speed of 2.6 m/s and wind directions 112.5°, 135°, 157.5°, 180° from north (0°) based on data from the MCM on-site weather station.

2. F class temperature inversion.

The results presented in Table 7.4 show that:

- noise emissions are predicted to meet the PSNLs at 20 of the 34 assessed locations;
- a negligible impact (up to 2 dB above the PSNLs) is predicted at eight assessment locations;
- a moderate impact (3-5 dB above the PSNLs) is predicted at six assessment locations;
- predicted noise emission levels satisfy the relevant acquisition criteria at all assessment locations; and
- noise emissions are predicted to only marginally exceed the current development consent limits by 1 dB at locations R13 and R16 and 2 dB at locations R7 and R15.

Further discussion is provided in Section 7.1.5 regarding consideration of feasible and reasonable mitigation measures.

ii Sleep disturbance

Noise levels are predicted to satisfy the adopted sleep disturbance criteria at all assessed receptor locations.

iii Cumulative noise assessment

Three other coal mines currently operate in the area surrounding MCM; namely Bengalla, Mt Arthur and Drayton. Mining operations at Drayton are currently approved until 31 December 2017 after which time rehabilitation activities may still occur. Further, Mt Pleasant coal mine to the west of MCM also has development consent; however mining operations have not yet commenced. Mt Pleasant and Drayton have been conservatively included in the cumulative assessment.

Potential noise levels from these four mines (three operating and one approved) were quantitatively reviewed based on their current approval documentation. The noise limit from each of the other coal mines at residences to the south and west of the MCM is $L_{Aeq,15\text{-}min}$ 35 dB. The highest predicted noise level from MCM including the modification at residences to the west or south of MCM is $L_{Aeq,15\text{-}min}$ 41 dB. The NVIA (EMM 2016) notes that based on experience at similar sites, the $L_{Aeq,night}$ is at least 4 dB lower than the predicted worst case $L_{Aeq,15\text{-}min}$ during adverse weather. The cumulative noise assessment summary is provided in Table 7.5, and shows that cumulative noise from the modification and surrounding mines is anticipated to satisfy the night amenity criteria of $L_{Aeq,night}$ 40 dB at all assessment locations.

Table 7.5 Cumulative noise assessment

Predicted MCM $L_{Aeq,night}$	Allowable noise emission limit, $L_{Aeq,night}$				Total predicted night amenity level, $L_{Aeq,night}$
	Bengalla	Mt Arthur	Drayton	Mt Pleasant	
37 dB	31	31	31	31	40

iv Blasting assessment

A blasting assessment was conducted to determine the limiting factors to the blast design for the modification, with the aim of achieving the relevant criteria outlined in Section 7.1.3. Calculations were conducted using the respective blast emissions site law equations developed based on measured data from MCM, in order to determine the allowable maximum instantaneous charge (MIC) and the resulting potential impacts at surrounding sensitive receptors.

The results of the MIC calculations are presented in Table 7.6.

Table 7.6 Ground vibration and airblast results

Assessment location	Airblast criteria (dB(L)peak)	Ground vibration criteria PPV (mm/s)	Approx. distance to potential blasting (m)	Limiting MIC (kg) based on	
				Vibration	Airblast
Nearest residence (R25)	≤115	≤5	1,700	>10,000	2,100

The results presented in Table 7.6 indicate that there would be no significant restrictions to the MIC of blasts at MCM. The existing average MIC used is 500 kg. The ground vibration and airblast levels predicted for this average MIC at the nearest residence are 0.7 mm/s and 111 dB, respectively. Therefore, by maintaining the current approach to blast design and blast emission management, it is anticipated that the blast emissions criteria would continue to be met throughout the life of the modification.

7.1.5 Mitigation and monitoring

i Monitoring

In accordance with the recommendations of the NVIA, attended noise monitoring would be undertaken at the receptor predicted to be most affected by the modification (R25). R25 is not currently monitored, with monitoring taking place at R7; however this location is no longer the nearest receiver and monitoring at R25 would replace that currently undertaken at R7. Attended noise monitoring would continue at R13, R15, R17 and R20.

In addition, attended noise monitoring would be increased from the current bi-annual program to be undertaken quarterly (ie every 3 months).

ii Feasible and reasonable noise management and mitigation

The INP Application Notes state that if PSNLs are not achieved from existing operations, a preliminary review of feasible and reasonable mitigation measures should be undertaken to identify potential opportunities to reduce existing operational noise levels.

As discussed in section 7.1.4, some exceedances of the PSNL are predicted to occur. Results of noise modelling indicate the combination of excavators, the haul truck fleet and dozers are the main contributors to offsite noise levels at most assessment locations, in particular the most affected locations. Feasible mitigation measures were subsequently investigated including the restriction of certain operational activities to certain areas of the mine (for example, within pit or at lower benches) during adverse weather or to the less sensitive day-time period. The results of these investigations indicated that the reduction in total offsite noise levels at the most affected locations was in the order of 1 dB. Given the very small reduction in noise of 1 dB (ie imperceptible change), the operational restrictions required to achieve this were considered unreasonable.

Furthermore, noise reduction from adding noise attenuation kits to the haul truck fleet was considered. The overall reduction in total offsite noise levels with this mitigation in place was in the order of up to 1 dB at some of the assessment locations. This reduction was evaluated along with other economic factors and was deemed unreasonable for the modification due to the significant overall cost to implement the measure given the relatively short extension of mine life (ie five years).

iii Negotiation process

Where noise emissions are predicted to be above the PSNL, the INP and the NSW Government's Voluntary Land Acquisition and Mitigation Policy provide guidance regarding a process for negotiation with the relevant regulating authority and/or affected community. Main items for consideration in this process include the following:

- demonstrating that all feasible and reasonable avoidance and/or mitigation measures have been implemented (as discussed Section 7.1.5ii);
- potential broader social and economic benefits of the proposal (as discussed in Sections 7.8 and 7.7 respectively);
- the magnitude of predicted noise emission levels and noting that not all exceedances of the PSNLs will equate to unacceptable impacts (refer Section 7.1.4);
- characteristics of the area and receivers likely to be affected including existing measures of community impact (eg complaints, refer Section 7.1.2i);
- characteristics of the proposal and its noise and vibration emissions (refer Section 7.1.4); and
- the package of benefits negotiated with potentially affected residences may include installation of glazing, insulation or air-conditioning, payment of compensation or contributions to improve community facilities and infrastructure.

7.1.6 Conclusion

Noise and vibration emissions from mining operations at MCM typically satisfy the relevant criteria at all monitoring locations. Furthermore, only a small number of complaints with regard to noise or blasting have been received over the last three years. Noise emissions for the modification are predicted to be substantially the same at assessment locations for which noise limits currently apply under Development Consent No. DA 205/2002. Noise levels are predicted to only marginally exceed the current development consent limit by 1 dB at R13 and R16 and 2 dB at assessment locations R7 and R15.

A moderate noise impact (3-5 dB above the PSNLs) is predicted at six assessment locations. Predicted noise emission levels satisfy the relevant acquisition criteria and sleep disturbance criteria at all assessment locations.

Mitigation measures considered have included the restriction of certain operational activities to more acoustically shielded areas (eg within pit or at lower benches) and the addition of noise attenuation kits to the haul truck fleet. The potential noise reduction at the most affected locations was predicted to be in the order of 1 dB (ie imperceptible change). Given the limited noise reduction and the relatively short extension of life (ie 5 years) associated with the modification these options were not considered feasible or reasonable.

The frequency of attended noise monitoring would be increased from twice a year to quarterly, and would continue to be undertaken at five assessment locations, with R25 replacing R7 as the nearest receiver.

The current approach to blast design and blast emission management would be maintained, and it is anticipated that the blast emissions criteria would continue to be met throughout the life of the modification.

7.2 Air quality and greenhouse gas

7.2.1 Introduction

Todoroski Air Sciences Pty Limited assessed the potential air quality impacts of the modification. The full technical report is provided in Appendix F, with the findings and recommendations summarised in this section.

7.2.2 Existing environment

i Topography and climate

Topography surrounding MCM is elevated to the north-east and east of MCM (Bells Mountain). There is an open valley to the south and east, which forms the Hunter Valley region and has a significant effect on local wind distribution.

The local climate was characterised using long term data from the Scone Airport automatic weather station (AWS). The data showed the following climate characteristics for the region:

- January is the hottest month with a mean maximum temperature of 31.3 °C and July is the coldest month with a mean minimum temperature of 3.4 °C.
- December is the wettest month with an average rainfall of 78.9 mm over 6.7 days and September is the driest month with an average rainfall of 34.7 mm over 4.7 days.

- Mean 9.00 am relative humidity levels range from 62% in October to 86% in June. Mean 3.00 pm relative humidity levels vary from 41% in January to 58% in June.

- Mean 9.00am wind speeds range from 7.0 km/h in May and July to 12.7 km/h in October and November. The mean 3.00 pm wind speeds vary from 16.0 km/h in June to 20.6 km/h in November.

An on-site weather station is operated at MCM to assist environmental management of operations. According to data from the weather station, dominant winds are from the south-east on an annual basis, with few winds from the north-west, though winds from the north-west do occur more frequently during autumn and winter compared to other seasons.

ii Ambient air quality

a. Types and sources of particulates

The main sources of particulate matter in the region include active mining, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities including power generation associated with the Liddell and Bayswater stations. Particulate matter consists of dust particles of varying size and composition, which are referred to as deposited dust, total suspended particulate matter (TSP), and TSP particles which have a diameter of 10 micrometres (µm) or less (PM_{10}) or 2.5 µm or less ($PM_{2.5}$).

b. Air quality goals and criteria

Air quality goals are benchmarks set to protect the general health and amenity of the community in relation to air quality. The air quality goals relevant to MCM are outlined in the *EPA Approved Methods* and summarised in Table 7.7. These are consistent with the air quality goals in Development Consent No. DA205/2002. The EPA does not have impact assessment criteria for $PM_{2.5}$ concentrations. However, the National Environment Protection Council (NEPC) has released a variation to the *National Environment Protection Measure* (NEPC 2003) to include advisory reporting standards for $PM_{2.5}$, which are also in Table 7.7.

Table 7.7 Impact assessment air quality goals

Pollutant	Averaging period	Impact	Criterion
TSP	Annual	Total	90 µg/m^3
PM_{10}	Annual	Total	30 µg/m^3
	24 hour	Total	50 µg/m^3
Deposited dust	Annual	Incremental	2 g/m^2/month
		Total	4 g/m^2/month
$PM_{2.5}$	24 hours	-	25 µg/m^3
	Annual	-	8 µg/m^3
Carbon monoxide (CO)	15 minute	-	100 mg/m^2
Nitrogen dioxide (NO_2)	1 hour	-	246 µg/m^3
	Annual	-	62 µg/m^3

Source: Approved Methods (DEC 2005) and National Environment Protection Measure (NEPC 2003).

c. Local air quality monitoring

Data from a number of air quality monitoring stations at MCM and in the Upper Hunter valley (part of the Upper Hunter Air Quality Monitoring Network) have been analysed to characterise ambient air quality. The air quality monitoring has demonstrated the following:

- PM_{10}:
  - MCM – annual average PM_{10} concentrations for each of the monitoring stations were below the relevant criterion of 30 µg/m³ for all relevant years. The maximum 24-hour average PM_{10} concentrations recorded at the monitors were on occasion above the 50 µg/m³ criterion, which typically correspond to regional dust events and/or surrounding activities not related to MCM. PM_{10} concentrations follow a seasonal trend and are nominally highest in the spring and summer months when the incidence of windblown dust, bushfires and pollen levels is higher.
  - Upper Hunter Air Quality Monitoring Network – annual average PM_{10} concentrations for each monitoring station were below the relevant criterion of 30 µg/m³. The maximum 24-hour average PM_{10} concentrations recorded at these stations were found to occasionally exceed the relevant criterion of 50 µg/m³. This is a similar trend to the MCM data.
- TSP data was only available for MCM. Annual average TSP concentrations were less than the criterion of 90 µg/m^3. 24-hour average TSP concentrations at each monitor are generally consistent and follow a similar seasonal trend to the PM_{10} concentrations with nominally highest levels during spring and summer periods which can be generally attributed to an increased potential of bushfires, dust storms, pollen and other localised sources and dust emissions as a result of mining activity.
- Annual average dust deposition concentrations are below the relevant criterion of 4 g/m^2/month.
- $PM_{2.5}$ is only monitored at the Upper Hunter Air Quality Monitoring Network's Muswellbrook site. Annual average $PM_{2.5}$ concentrations were consistently above the NEPM advisory reporting standard of 8 µg/m³ in 2013 to 2015. 24-hour average $PM_{2.5}$ concentrations were at times above the 24-hour advisory reporting standard of 25 µg/m³ in 2013 to 2015. Ambient $PM_{2.5}$ levels are likely to be governed by many non-mining background sources such as wood heaters and motor vehicles.

7.2.3 Impact assessment

i Method

The potential for the modification to adversely affect air quality at surrounding assessment locations was assessed using air dispersion modelling. The air quality assessment used the assessment locations shown in Figure 2.1 (see Chapter 2). Estimated maximum dust emissions from the modification and nearby mines were added to the ambient air quality data, with estimated concentrations compared to the air quality criteria in Table 7.7 to determine compliance with criteria.

a. Dispersion modelling

The modelling approach used was a combination of the CALPUFF Modelling System for dispersion modelling and The Air Pollution 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 an hourly varying time step. The CALPUFF approach is accepted by the EPA as an appropriate modelling system for open cut coal mines in NSW. The potential impacts of the modification were modelled using local topographical and meteorological data.

The assessment considered one indicative mine plan year (scenario), being Year 1, which represented one of the highest levels of dust-generating activity for future years under the modification. The conceptual mine plan for Year 1 is illustrated in Figure 4.2.

Dust emissions were estimated by analysing the various types of dust generating activities and using suitable emission factors sourced from both local and United States (US) EPA sources. The estimated dust emissions assume a mining operation using reasonable and feasible best practice dust mitigation applied where applicable.

The 'Level 2 assessment - Contemporaneous impact and background approach' in *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DEC, 2005) was used to predict cumulative 24-hour average $PM_{2.5}$ and PM_{10} impacts as maximum background levels have in the past reached levels near the 24-hour average PM_{10} criterion and the $PM_{2.5}$ advisory reporting standard. The ambient dust concentration data for January 2014 to December 2014 from the TEOM and BAM stations were used in the calculations as these represent the prevailing measured background levels in the vicinity of MCM and surrounding assessment locations.

b. Cumulative assessment

Emissions from all nearby approved mining operations were modelled in addition to the estimated dust emissions from the modification to assess potential cumulative dust effects. Emissions estimates from these sources were derived from information provided in the 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.

Emissions from nearby mining operations would contribute to the background level of dust in the area surrounding MCM, and these emissions were explicitly included in the assessment. Additionally, there would be numerous smaller or very distant sources that contribute to the total background dust level. Modelling these sources explicitly is impractical; however, the residual level of dust due to all other such non-modelled sources has been included in the cumulative results.

ii Predicted impacts

a. Dispersion modelling

The modification only (incremental – ie the dust generation associated with the operation of MCM under the modification) and total impact (cumulative – ie dust generation from MCM plus background sources) results for the relevant air quality parameters (Table 7.7) are summarised below.

One exceedance of incremental 24-hour average PM_{10} concentrations at one assessment location, R25, is predicted. Up to an 11 µg/m³ exceedance (total of 61 µg/m³) was predicted to occur at this location on three days of the modelled year.

There is potential for exceedance of the cumulative 24-hour average PM_{10} criterion at the assessment locations. Potential cumulative PM_{10} impacts are predicted in the area immediately north of MCM (assessment locations R24 and R25). At these locations, the criterion may be exceeded on two to three additional days of the year due to the modification. These exceedances are predicted on days when the background level is elevated, and may have been influenced by activity occurring at the Muswellbrook Quarry. The implementation of reactive operational dust mitigation strategies in the dispersion modelling would likely demonstrate that the short term PM_{10} impacts predicted could be effectively managed. The predicted 24-hour average PM_{10} concentrations for the modification are conservative in this regard and would overstate the actual impact in reality.

No exceedances of the cumulative 24-hour average $PM_{2.5}$ criterion were predicted.

b. Diesel emissions

It is generally accepted that the quantity of emissions generated from diesel powered equipment used for mining activity is too low to generate any significant off-site concentrations. This is due to the relatively small individual sources, the large distance between the sources and assessment locations, and the wide distribution of sources across mine sites. This is confirmed when it is considered that NO_2 is a significant pollutant emitted from the combustion of diesel, yet NO_2 levels at the monitoring stations in the Upper Hunter Valley are low relative to the criteria.

Fine particulates (ie $PM_{2.5}$) are a significant pollutant emitted from diesel combustion and vehicle and industry sources make up approximately 8% and 17% in Muswellbrook and Singleton, respectively. It should be noted that the contribution of emissions of fine particulate from diesel combustion in mining equipment is already included in the assessment of mine dust.

The modification would not affect the quantity of diesel powered equipment and operating hours at MCM. Given this and the above, NO_2 and $PM_{2.5}$ generated from diesel combustion associated with the modification are not predicted to significantly impact air quality at all assessment locations.

c. Blast fume emissions

Blasting impacts associated with NO_2 are rare, but are possible when there are unforeseeable complications with a blast that cause high levels of NO_2 or dust emission, and when this corresponds to unfavourable air dispersion conditions. As blasting is currently permitted, and there has been no significant incident in this regard at MCM, it is expected that this would remain the case in the future.

No changes are proposed to the scale or permitted hours of blasting at MCM. Air quality impacts of blast operations at MCM are managed in accordance with a Blast-Vibration Management Plan, which establishes procedures for the management of blasting operations. Operations under the modification would continue to be in accordance with the Blast-Vibration Management Plan.

d. Spontaneous combustion

Spontaneous combustion is managed in accordance with the Spontaneous Combustion Management Plan. This includes both preventative and control measures for spontaneous combustion. Management of spontaneous combustion is discussed in Sections 3.5 and 4.3.

As part of the measures for managing spontaneous combustion, high risk areas are identified during preparation for mining by examination of previous records for occurrences of spontaneous combustion, visual examination of the surface such as the presence of brown or dying vegetation, and the measurements of borehole and surface temperatures including the use of infra-red photography.

The use of water is one of the main measures to manage spontaneous combustion. Water is applied to cool areas affected by spontaneous combustion before mining. Water sprays are also used to saturate spread-out loose heaps of material with water to prevent oxidation.

It is also important to minimise areas of exposed coal or carbonaceous material to prevent and control occurrences of spontaneous combustion. This measure can be incorporated in many mining operations such as in drilling for blast holes, mining of coal, and rehabilitation. Blast holes are not to be drilled through major coal seams. The time for drilling and loading for holes and the sleep time for blasting are to be minimised. Blast holes showing signs of spontaneous combustion or allowing air into areas of spontaneous combustion are to be bagged off or backfilled. Coal affected by spontaneous combustion is to be removed. High carbonaceous waste materials are to be selectively placed in the lower portions of the emplacement areas and are to be rapidly buried. Materials with potential for spontaneous combustion are to be covered with inert material.

7.2.4 Greenhouse gas emissions

GHG emissions were predicted in accordance with the National Greenhouse Accounts (NGA) Factors document published by the DoE (DoE 2015). The NGA Factors document defines three scopes (Scopes 1, 2 and 3) for different emission categories based on whether the emissions generated are from 'direct' or 'indirect' sources. Scope 1 emissions encompass the direct sources from an activity and Scope 2 and 3 emissions occur due to indirect sources.

Calculations of GHG emissions for the modification are in Table 7.8. They are based on an upper limit of the assumed maximum production at MCM.

Table 7.8 Summary of CO_2-e emissions per scope (t CO_2-e)

Period	Scope 1	Scope 2	Scope 3
2017	9,848	4,663	14,511

The estimated annual GHG emissions for Australia between February 2014 to March 2015 was 545.1Mt CO_2-e (DoE 2015b). In comparison, the maximum estimated annual average greenhouse emissions for the modification is 0.015 Mt CO_2-e (Scope 1 and 2). Therefore, the annual contribution of GHG emissions from the modification in comparison to the Australian GHG emissions is conservatively estimated to be 0.003%.

At a state level, the estimated GHG emissions for NSW in 2013 was 141.8 Mt CO_2-e (DoE 2015c). The maximum estimated annual contribution of GHG emissions from the modification in comparison to the NSW GHG emissions is conservatively estimated to be 0.01%.

7.2.5 Management and monitoring

Based on guidance provided in the NSW Government's Voluntary Land Acquisition and Mitigation Policy (NSW Government, 2014), assessment location R25 would be entitled to voluntary mitigation. Mitigation measures may include the installation of air conditioning, insulation, first flush water systems and cleaning of rainwater tanks.

The existing air quality management system described in MCM's Dust Management Plan would continue to be implemented under the modification. This includes the implementation of both reactive and proactive management techniques to reduce dust. Reactive measures include utilising the maximum availability of dust suppression equipment, staff guidance for the visual identification and hence control of dust, and alarms based on monitoring to manage rising dust levels to help prevent or reduce potential impacts. Operational measures such as enforcing cessation of particular operations during periods of high dust provide additional assistance in reducing the potential dust impacts.

Proactive operational dust mitigation strategies implemented at MCM are primarily based on forecast weather data and modelling. This information provides an indication of the potential extent of air quality impacts into the future and would be primarily used as an alert of possible elevated air quality levels due to MCM. Forecast air quality predictions, up to 48 hours in advance, are reviewed daily and used to plan ahead for periods of potential impact, allowing time to prepare and better respond to any actual issue based on measured data and to react quickly where conditions or performance deteriorates due to the changing weather conditions.

The network of monitors surrounding the mine are generally positioned in areas representative of the assessment locations. This network is augmented by ambient air quality monitoring stations operated under the Upper Hunter Air Quality Monitoring Network and provide an extensive network of stations from which to measure ambient air quality. These monitors are intended for use as a warning tool for mine operations and provide advance warning of degrading air quality which serves to prompt appropriate actions.

On the basis of the predicted modelling results in this assessment, there is little potential for air quality impacts at MCC's existing Site 2 air quality monitor. MCC would relocate this monitor to the north of MCM, near assessment location R25. A monitor in the vicinity of R25 would provide an indication of the ambient air quality levels for this area and would enable the performance of dust mitigation measures to be measured.

To further supplement the air quality monitoring network, it recommended that an air quality monitor be established to the south-southeast of the mine. A monitor near to assessment location R32, ideally between the residence and the mine, would be useful to indicate the potential air quality effects arising from MCM when wind is blowing from the northwest and to estimate the air quality contribution due MCM at receptors to the north by acting as an upwind monitor under south-easterly wind flows. R32 represents the most affected location to the south-southeast of the mine.

7.2.6 Conclusion

Air quality impacts have been assessed using conservative dust emission estimation and dispersion modelling for a representative conceptual mine plan year (Year 1). The modification is predicted to result in incremental exceedances of the 24-hour average PM_{10} criterion at a single assessment location (R25) to the north of MCM. The contemporaneous assessment of cumulative impacts has predicted impacts at two assessment locations, R24 and R25, on two to three additional days which correspond to days where background levels are already elevated.

A comprehensive air quality management system, including an extensive monitoring network, is currently in place at MCM which incorporates best practices for the control of dust emissions from coal mines. Relocation of an existing monitor to the north of MCM (near R25) and installation of a new monitor to the south-southeast of MCM are proposed to supplement the existing air quality monitoring network.

Existing blast fume management practices are expected to be adequate for continued operations under the modification.

Estimated annual average GHG emissions for the modification would be insignificant compared to total NSW and national GHG generation.

7.3 Surface water

7.3.1 Introduction

A surface water assessment was prepared by SLR Consulting. It assesses the potential impacts of the modification which may influence surface water or affect the operation of the existing site water management system.

A summary of the findings of this report is provided in the following sections. The report is provided in full in Appendix G.

7.3.2 Existing environment

i Regional and local hydrology

MCM is located in the Upper Hunter Valley in the catchment of the Hunter River, which is approximately 3 km to the west. The Hunter River is an important water resource for industry, agriculture, mining, ecological, environmental and social purposes.

There are two catchments within the vicinity of MCM including Sandy Creek and Muscle Creek which are both ephemeral tributaries of the Hunter River.

Local topography is dominated by elevated terrain to the east and south. Natural ground elevations at MCM range between RL 230-260 m. There is an overall fall in topography in a westerly direction towards the Hunter River.

Water quality in the Hunter River is generally characterised by elevated salinity (expressed as electrical conductivity (EC)) and total suspended solids (TSS). Off site water quality monitoring indicates that water quality in surrounding watercourses (Sandy Creek and Muscle Creek) varies in EC according to rainfall and is slightly alkaline.

ii Site water management

a. Water classifications

MCM is divided into two distinctly separate catchment types:

- rehabilitated areas – historic overburden emplacement or disturbance areas which have undergone rehabilitation; and
- operational areas – areas currently utilised for operational activity or undergoing rehabilitation. Runoff associated with these catchment types includes both mine water and dirty water depending upon the use of the area.

Water management at MCM is based on the following water classifications:

- Clean water – clean water runoff is runoff produced from undisturbed, clean catchments or catchments which have been fully rehabilitated to a level suitable for release of surface water runoff. Clean water is diverted around disturbed areas and released to surrounding catchments.

- Dirty water – surface water runoff produced from disturbed catchment areas where runoff is expected to exhibit a high TSS or turbidity and sediment loading but is not impacted by coal resources. This water is directed to pollution control dams (sediment dams) and pumped back into the Mine Water Management System.

- Saline water – runoff produced from areas impacted by coal resources (ie haul roads, CPP and mine open cut pits) which is typically characterised by an elevated EC. Saline water is contained within the mine open cut pits and mine water dams for reuse by the operations.

- Potable water – MSC supply pipeline.

- Sewage wastewater – produced by amenities associated with the mine. Sewage waste water is trucked offsite for disposal by a third party contractor.

b. Catchment areas

The overall water strategy for the mine is based on the use of Open Cut 1 and Open Cut 2 as storage for surface runoff. The mine is characterised by four major catchment areas (with respect to the modification) as follows:

- the area surrounding the CPP, coal stockpiles, and the eastern haul road drains to the final settling ponds;

- the MIA, Open Cut 1 and rehabilitation areas immediately surrounding Open Cut 1 all drain into Open Cut 1;

- the majority of the rehabilitation area between Open Cut 1 and Open Cut 2 drains to Dam 1 and Dam 2. Water collected in these dams is pumped to Open Cut 1 or the CPP for use in coal processing, management of spontaneous combustion, dust suppression and other operational activities; and

- Open Cut 2 and the areas immediately surrounding Open Cut 2 drain into Open Cut 2.

No discharge to surface water occurs at MCM.

c. Erosion and sediment control

MCM operates in accordance with an approved Erosion and Sediment Control Plan (ESCP) which applies to all mine operations and activities. The major provisions of the ESCP include:

- restricting the extent of disturbance to the minimum that is practical and in accordance with the MOP;

- progressive rehabilitation of disturbed land, where possible, and the construction of drainage controls to improve the stability of rehabilitated land;

- protection of natural drainage lines and watercourses by the construction of erosion control devices such as diversion banks and channels and sediment retention dams as necessary;
- restriction of access to rehabilitated areas;
- management of erosion and sediment control of affected surface watercourses/water bodies, including creek lines within or adjacent to the development consent boundary; and
- regular inspection of dams to monitor their efficiency and any required maintenance.

d. Chemical and hydrocarbon management

All oils, lubricants, fuels and chemicals are stored within bunded storage facilities at the workshop, stores, CPP and blasting facilities. Activities undertaken on site to minimise hydrocarbon contamination include:

- above ground fuel storage tanks are self-bunded to contain any spillage which may occur;
- waste oil from the workshop is stored in a bunded waste oil tank and is removed as required; and
- runoff from the hardstand wash-down bay passes through a three-staged silt trap and an oil/water separator.

e. Dam water level management

The Final Settling Dams and Dams 1 and 2 have pumping infrastructure installed to transfer water around site for operational and environmental purposes. These dams are maintained at a level which provides for sufficient storage for future rainfall events. In the unlikely event that Dam 1 and 2 were to overflow, water would enter the adjacent ephemeral drainage line and would report into Dam 3 further downstream. Downstream from Dam 3, the ephemeral drainage line continues to the west and joins Sandy Creek immediately west of the junction between Sandy Creek and the New England Highway.

By monitoring the water level within these dams and adjusting accordingly (through the use of existing pumping infrastructure), MCC will maintain a water level within these dams which minimises the risk of overflow.

iii Water quality

On site water testing indicates that mine water is characterised by a neutral pH, generally low TSS and high EC levels.

iv Water demand, supply and reuse

Operational water is sourced from groundwater bores and pumped to Dams 1 and 2 where it mixes with surface water runoff from the local catchment. Water is then pumped around MCM for operational and environmental purposes. Potable water is supplied to the operations via pipeline from MSC for use in the office/amenities, workshop and CPP.

Typical inputs and outputs to the water balance model are reported in MCM's annual environmental management report (AEMR). The water inputs and outputs reported for the 2015 period are provided in Table 7.9.

Table 7.9 Typical water inputs and outputs

Source	Volume (ML/yr)
Inputs	
Groundwater inflows to the open cut pits	0.0
Surface water runoff into site dams	178.8
Pumping water from the underground workings	2,041
Entrainment in coal	127.5
Supply of potable water from MSC	2.7
Outputs	
Discharge offsite	0.0
Water cart for dust suppression	1,150.3
Water infusion for spontaneous combustion management	351.5
Evaporation from dams	126.2
Entrainment in coal leaving site	138.6
Pumped to council void	0.0
Septic pump out	1.0
Total input	**2,350.0**
Total output	**1,767.6**

The calculated water balance for the 2015 reporting period indicated that MCM operated in water surplus for the reporting period. A review of historical water balance results (as reported in the AEMRs) indicate that MCM has operated at a water deficit for all years except for the 2015 reporting period.

7.3.3 Impact assessment

Activities under the modification would be wholly contained within the existing catchment areas of Open Cut 1, Open Cut 2 and Dams 1 and 2. There would be no disturbance or mining activity beyond the development consent boundary.

The key aspects of the modification which may have potential to impact upon surface water resources are detailed below.

i Changes to surface water volumes

As the mine progresses to the north and north-east, the catchment of Open Cut 1 would increase while the catchment of Dams 1 and 2 would decrease. No additional works, beyond the existing mining activity, would occur outside of the catchments of Open Cut 1, Open Cut 2 and Dams 1 and 2.

As the continuation of mining would be fully contained within the existing internally draining catchments, there would be no impact to local watercourses.

While an increase in catchment area represents an increase in the volume of runoff entering Open Cut 1, there is very little potential that any overflow could occur due to the significant storage capacity of the void.

ii Changes to surface water quality

No impacts to the quality of offsite surface water resources are anticipated to occur due to the modification. Some changes in water quality are expected within existing water storages as a result of the disturbance of the existing overburden emplacement. Importantly, the final voids would remain sinks and therefore no offsite impacts on water resources are anticipated.

iii Regional and local flooding

As the modification does not involve any changes to externally draining catchments there would be no impact on local or regional flooding. Locally within the mine, surface water runoff would continue to be directed to the relevant open cut voids/dams and pumped around MCM for operational and environmental purposes.

iv Operational water quality

Operational water is sourced from Dams 1, 2 and 3 and the Final Settling Ponds. Dams 1 and 2 are supplied with water sourced from the groundwater bores and each dam has a local catchment contributing surface runoff. No significant change to water quality around the site is expected to occur as a result of the modification.

v Potable water usage

There are no changes to the workforce requirements or facilities and amenities layout. As such, no change to potable water supply or demand is anticipated.

vi Contamination and chemical spills

The modification would not create any additional risk of contamination or spills compared to approved operations.

7.3.4 Management and monitoring

i General water management

All changes proposed as part of the modification would occur within the catchments of Open Cut 1, Open Cut 2 and Dams 1 and 2. Surface water would continue to be managed in accordance with the existing SWMP. With the exception of relocating the existing raw water supply tanks (and associated pipelines) and redistribution of the catchment areas between Open Cut 1, Open Cut 2 and Dams 1 and 2 no significant changes to the water management system would occur as part of the modification.

ii Operational water management

Operational water would continue to be sourced from Dams 1 and 2, Dam 3 and the Final Settling Ponds (among others) for dust suppression, infusion sprays and coal processing. No change to the existing supply arrangement is proposed.

iii Erosion and sediment control

Erosion and sediment control would continue to be managed in accordance with the ESCP for the mine, as well as the Blue Book (Managing Urban Stormwater, Soils and Construction, Volume 1, (NSW Government, 2004) and Volume 2E, Mines and Quarries (DECC, 2008)).

iv Wash down water and hydrocarbon management

Potentially contaminated water produced in the wash bay would continue to be treated in the three stage silt, oil and water separator. The collected oil and silt would be regularly cleaned out and treated accordingly. No changes to hydrocarbon management would occur as part of the modification.

v Monitoring and reporting

Water quality and flow volume monitoring would continue to be undertaken in accordance with the approved SWMP.

Flow monitoring would continue to be carried out to confirm that the water management system is effective. Results of water quality monitoring and water flow monitoring would continue to be reported on an annual basis in accordance with the currently approved SWMP and SWGMP.

vi Final landform drainage and rehabilitation

The design of the final void drainage system would assist in reducing the surface water input into the final void. Where feasible, clean water runoff would continue to be diverted around the voids to minimise catchment area. Where possible, the detailed design of the final landform would incorporate micro-relief to better mimic natural flow patterns and integrate the final landform with the surrounding topography. While an attempt has been made to incorporate the principles of micro-relief into the drainage design in and around the final voids, the volume of overburden material to be emplaced within the modification area, spatial constraints, and the resulting overall shape of the voids limits the potential for micro-relief and as such, traditional drainage control structures would be required to safely convey runoff over the final landform.

Based on the principles of the Blue Book (Landcom 2004), disturbed landforms require benching in the form of contour drains and drop structures to safely convey runoff and reduce the potential for erosion (rilling and gullying) to develop. The final landform would have maximum slope gradients of up to 14 degrees within the final shaped voids with slope lengths of between 200 – 700 m from the void crest to the base of the void. It is noted that the lower portion of the voids would fill with water over time, and therefore the slope lengths would be reduced to a maximum length of approximately 600 m.

In accordance with the Blue Book, contour banks would be required at a spacing of 60 – 100 m (depending upon the slope gradient) within the voids to safely convey runoff down the slopes. Subsequently, drop structures would also be required to convey concentrated flow captured by these contour banks into the base of the final voids. Without such drainage control structures, it is expected that rilling and gullying would occur on the landform which would destabilise the soils and reduce the overall effectiveness of rehabilitation.

A conceptual final landform drainage design is provided in Appendix G (SLR 2016a) and illustrated in Figure 4.9. This design incorporates existing water management structures along with the proposed drainage control structures. As discussed in Section 7.4.3iv, the final standing water levels in each void are estimated to be 192 m AHD in Open Cut 1 and 165 m AHD in Open Cut 2, representing a standing water level of 26 m and 33 m respectively.

The conceptual drainage design is indicative and will require further detailed design as part of detailed closure planning prior to cessation of coal extraction activities. The number, location and size of the proposed drainage control structures may change slightly following a detailed assessment, however; the overall principles of safe and stable water management structures would be maintained.

Once successful rehabilitation has been achieved the various sediment dams at MCM would no longer be considered pollution control dams under the WMA and consideration would need to be given to the MHRDC. Where the capacity of the dams exceeds 10% of the harvestable rights of the contributing catchment, additional works may be required to reduce the capacity of dams to provide environmental flows and meet the requirements of the MHRDC or divert water away from these dams.

7.3.5 Conclusion

No changes to the currently approved water management system are proposed with the exception of minor alterations to the catchment areas of Open Cut 1, Open Cut 2 and Dams 1 and 2.

No additional disturbance is proposed beyond the current approved disturbance boundary and all other activities would continue to be undertaken in accordance with the existing approvals. The key parts of the modification which have the potential to impact upon the surrounding environment remain consistent with those potential impacts relating to the existing approved mining activity including:

- management of water levels within Dams 1 and 2;
- management of water levels within the Final Settling ponds; and
- storage and use of lubricants, oil and chemicals.

All currently approved management plans will continue to be utilised and maintained throughout the continuation of mining with the existing water monitoring points remaining in use. The environmental management, mitigation and monitoring programs identified in the Site Water Management Plan will continue to be implemented. No impacts to local surface water resources are expected to occur as part of the modification.

7.4 Groundwater

7.4.1 Introduction

A groundwater assessment was prepared by SLR Consulting. The groundwater assessment considers the potential impacts of the modification which may influence groundwater or affect the operation of the existing water management system.

A summary of the findings of this report is provided in the following sections. The report is provided in full in Appendix H.

7.4.2 Existing environment

i Hydrogeological setting

The geological setting of MCM and surrounds is summarised in Table 7.10.

Table 7.10 Summary of geological setting

Age	Group	Strata	Description
Recent		Alluvial Deposits	Clays, silts, sands and gravels.
Middle Permian	Maitland	Branxton Formation	Sandstone, conglomerate, and siltstone.
Early to Middle Permian	Greta Coal Measures		Sandstones, siltstones, mudstones and coal seams (Fleming – 2 m thick, Hallet – 1 m thick, Muswellbrook – 5m thick, St Heliers – 9.5 m thick, Upper Lewis – 2 m thick, Lower Lewis – 7 m thick and Loder – 1.5 m thick) occurring over a stratigraphic interval of approximately 60 m at the base of the Greta Coal Measures). Include numerous igneous dykes and sills.
Early Permian	Dalwood	Gyarran Volcanics	Basic lavas, breccias, rhyolite, and ignimbrite.

The closest alluvial deposits to MCM are approximately 2 km from the site and are typically patchy, thin and localised to the lower reaches of Muscle and Sandy creeks, and within the Hunter River floodplain. Alluvial deposits are absent at MCM.

In the immediate vicinity of MCM, the Greta Coal Measures are approximately 110 m thick, and dip to the north-west at angles ranging between 4 and 11 degrees. Available information indicates a complex nature of geological structures which is described in detail in Appendix H.

ii Hydrogeology

Two aquifers are present within and in the immediate vicinity of MCM:

- shallow bedrock (regolith) aquifer; and
- Permian bedrock (Greta Coal Measures).

Groundwater is also present within remaining (historic) flooded underground workings of the No. 2 Underground and St Heliers Colliery. Significant water inflows have been noted at the contact between the Gyarran Volcanics and Greta Coal Measures, suggesting that this contact may form a groundwater pathway below MCM.

iii Existing groundwater levels and flow

Existing groundwater levels and flow has been determined based on a review of groundwater data, as well as a review of previous groundwater studies:

- *Muswellbrook Coal Company Limited No. 1 Open Cut Extension Water Management Study Project No. U888-7* (HLA-Envirosciences 2002). This study was completed as part of the original development application for the Open Cut 1 Extension Area.
- *Muswellbrook Coal Company Limited Final Void Management Plan Groundwater Study* (Coffey 2005). This study was completed in order to assess the fully recovered water levels and rate of water level rise following cessation of all mining and rehabilitation activities at MCM, including the No. 1 Open Cut Extension Area.

- *Muswellbrook Coal Mine Development Consent Modification Groundwater Impact Assessment Project G1504* (AGE 2010). This assessment was completed to support the extension of mining operations within the Open Cut 1 Extension Area.

- *Groundwater Management Study* (SLR 2015) conducted to support MCM's updated MOP in 2015.

Based on pre-mining baseline groundwater contours (HLA-Envirosciences 2002), groundwater flows across MCM and surrounding areas were originally towards Sandy Creek (to the west and north-west) and Muscle Creek (to the south). Predicted groundwater elevations ranged between RL 220 m to the immediate east of MCM, and RL 150 m to the west of MCM, adjacent to Sandy Creek and Muscle Creek at the eastern fringes of Muswellbrook.

Representative current conditions (based on mining at the end of 2015), have been assessed based on groundwater monitoring data which is collected from an extensive network of locations within and surrounding MCM. The network comprises 15 bores installed within:

- the Permian bedrock aquifer at or in the immediate vicinity of MCM; and

- private bores within the Sandy Creek alluvial and bedrock aquifers to the north-west and west of MCM.

Sump water levels within the voids of Open Cut 1 and Open Cut 2 have also been considered as they reflect groundwater elevations within the Permian bedrock aquifer.

Based on a review of hydrographs from the bore network and comparison with the predicted pre-mining groundwater contours, current groundwater flow is taking place radially towards the current voids within Open Cut 1 and 2. The flow pathways include drainage via the flooded underground mine workings associated with the No. 2 Underground and St Heliers Colliery mine workings, diffuse flow via mine spoil that has been used to infill and rehabilitate/restore the voids, and fracture-dominated flow within the in-situ Permian bedrock surrounding MCM.

MCC holds four licences issued under Part 5 of the *Water Act 1912* to extract groundwater. A summary of volumes extracted for the previous 5 years is provided in Table 7.11.

Table 7.11 Summary of historic groundwater extraction volumes

Licence No.	Extraction entitlement (ML/Annum)	2010-2011 (ML)	2011-2012 (ML)	2012-2013 (ML)	2013-2014 (ML)	2014-2015 (ML)
20BL169014 (Borehole RDH529)	1,000	300	498	448	31	4.5
20BL169037 (Open Cut 1)	2,000 (combined)	168	0	134	563	0
20BL169038 (Open Cut 2)		930	975	97	702	591.3
20BL170473 (Borehole RDH607)	3,000	780	837	923	987	2,036.5

iv Other groundwater users and groundwater dependent ecosystems

A review of the DPI - Water website (http://allwaterdata.water.nsw.gov.au/water.stm) identified a number of private registered bores at varying distances from MCM. This review found that most of the registered bores are concentrated in the alluvial area at the confluence of Sandy Creek and the Hunter River alluvial plain. The majority of the bores are at least 2km from the mine, and are primarily licensed for irrigation or industrial use with one or two for stock or domestic use.

The potential presence of groundwater dependent ecosystems (GDEs) was considered in accordance with the *NSW State Groundwater Dependent Ecosystem Policy* (Department of Land and Water Conservation, 2002). It is expected that only wetland or terrestrial vegetation GDE types may occur in proximity to MCM. The Bureau of Meteorology's *Atlas of Groundwater Dependant Ecosystems* does not identify *known* GDEs occurring on or in close proximity to MCM. There are a number of areas surrounding MCM which show medium to high potential for certain GDE types, however; no potential GDEs have been identified within or close to, the modification area.

7.4.3 Impact assessment

i Modelling approach

As described in Section 7.4.2iii, numerous groundwater assessments involving analytical modelling have been undertaken previously for MCM. An analytical model was again used by SLR (2016b) to confirm that the assumed parameters adopted within previous groundwater studies for MCM, together with the resulting model predictions, are applicable to the modification. This approach is considered appropriate (compared with numerical modelling) because:

- monitoring to date has shown that the previous modelling is reasonably accurate;
- the modification is relatively small and adjacent to currently approved mining associated with Open Cut 1;
- the modelling approach has previously been accepted as part of the AGE 2010 assessment of impacts to groundwater supporting a development consent modification; and
- water balance modelling by SLR has further confirmed that analytical modelling can provide similar results to that measured at site for water make.

The water balance model was developed (where possible) by comparison of:

- pumped volumes;
- analytical modelling of groundwater inflows;
- estimated groundwater throughflows from the rainfall recharge area to the east of MCM;
- surface water inflows estimated from pit catchment areas and model calibrated runoff rates; and
- evaporation rates from open water.

Particular focus was given to the long term steady state water levels in the mine voids post closure.

The outcomes of the modelling, and aspects of the modification which would have the potential to impact groundwater resources, are summarised below.

ii Groundwater inflow

The HLA-Envirosciences (2002) numerical model estimated a combined inflow of approximately 116.5 ML/yr for Open Cut 1 and 2. Recent water balance estimates by SLR (2015) confirm a groundwater inflow of approximately 100 ML/yr. The total inflow under the modification is estimated to be within the range of those previously estimated by the HLA-Envirosciences (2002) modelling and the water balance estimates.

Cumulative groundwater inflow to the recovered final voids is estimated to be approximately 36.5 ML/yr from bedrock aquifers.

All predicted inflows are within the current licences held by MCC.

iii Groundwater drawdown

The extent of the modification in Open Cut 1 is minor enough that the analytical modelling methods used previously (AGE 2010; SLR 2015) are insensitive to the minor change, due to the need to simplify the mining footprint to an effective radius. In addition, pit floor elevation during mining is not expected to change from that previously assessed. Therefore, previous groundwater assessments for radius of impacts remain valid for the modification, which predict a maximum radius of drawdown of approximately 1 km. These estimates are consistent with the monitoring data to date.

iv Final void water levels

The results of the modelling process show that the estimated final water surface elevation in the final voids would be:

- RL 192 m in Open Cut 1; and
- RL 165 m in Open Cut 2.

These levels represent a standing water level of 26 m and 32 m respectively. These levels are below the background standing water level of RL 210 m. Therefore the final voids are expected to remain a groundwater evaporative sink and would not contribute water to the groundwater system(s). Based on the final landform, the spill levels for each final void are such that adequate freeboard would be maintained with approximately 18 m of freeboard in Open Cut 1 and 34 m of freeboard in Open Cut 2. The voids would therefore hold rainfall from the calculated catchments for the Probable Maximum Precipitation rainfall event.

The Open Cut 1 void is estimated to reach 90% equilibrium (190 m AHD) within approximately 25 years and reach equilibrium (192 m AHD) in approximately 60 years. The Open Cut 2 void is estimated to reach 90% equilibrium (162 m AHD) within approximately 30 years and reach equilibrium (165 m AHD) in approximately 90 years.

The updated final void water levels are similar to those estimated in 2005 (Coffey 2005) which was used as part of development of the Final Void Management Plan. Coffey (2005) estimated water levels of RL 181 m for Open Cut 1 and RL 158 m for Open Cut 2. The revised estimates are predicted to be higher than those estimated by SLR (2015), which estimated final void water levels to be RL 155 m for Open Cut 1, and RL 95 m for Open Cut 2. The difference between the current estimate and SLR (2015) is due to the change in the final landform surface, in particular the raising of the base elevation of the voids due to overburden emplacement.

All estimates to date have consistently predicted that the voids would act as groundwater evaporative sinks and would not contribute water to the groundwater system(s).

v Groundwater quality

A review of available groundwater quality information was completed in order to assess the potential changes in water quality within the final voids as water levels within the voids reach equilibrium levels following completion of mine dewatering and rehabilitation. As previously mentioned in Section 7.4.3iv, the final voids would remain sinks and therefore no offsite impacts on water resources are anticipated.

The groundwater in the coal seams are the only water bearing zones assessed as impacted by the modification. As the groundwater quality of the coal seams is poor (brackish to saline), and final voids are expected to remain as evaporative sinks, no adverse impacts to the groundwater quality are expected.

vi Impacts to other users

The estimated radius of impacts (ie less than 1 km), along with current monitoring, indicates that alluvial aquifers and registered bore users would not be impacted as a result of the modification.

vii Groundwater dependant ecosystems

No significant changes to groundwater levels are predicted as a result of the modification. No GDEs have been identified within the area surrounding MCM and as such, there are no foreseeable impacts to GDEs.

7.4.4 Management and monitoring

No changes to the groundwater monitoring program are proposed. All currently approved management plans would continue to be utilised and maintained throughout the continuation of mining with the existing groundwater monitoring points remaining in use. Monitoring would be carried out to confirm that the water management system is effective, and that the impacts of mining are consistent with the predictions made in the groundwater assessment. Results of water quality monitoring and water flow monitoring would continue to be reported in the AEMR on an annual basis.

7.4.5 Conclusion

The groundwater assessment for the modification predicts the incremental groundwater impacts as a result of the modification would be negligible.

The modification would result in changes to the catchment areas of Open Cut 1, Open Cut 2 and Dams 1 and 2. Groundwater inflows to MCM under the modification are expected to be in the range of previous predictions for approved operations. A maximum radius of drawdown of approximately 1 km is estimated, which is consistent with the monitoring data to date. At the completion of mining and rehabilitation, final voids are expected to remain as evaporative sinks; therefore, no adverse offsite impacts to groundwater quality are expected. Final void water levels, which are predicted to be RL 192 m AHD and RL 165 m AHD in Open Cut 1 and Open Cut 2 respectively, would be higher than that associated with the approved final landform as a result of additional overburden emplacement in the Open Cut 1 and 2 voids. However, adequate freeboard would remain in the voids to prevent spills from the voids.

No significant changes would occur to the existing water management system on the site as a result of the modification.

7.5 Ecology

7.5.1 Introduction

A biodiversity assessment was prepared by EMM. The biodiversity assessment considers the biodiversity values present on the site and assesses the potential impacts of the modification on the biodiversity values.

A summary of the findings of the report is provided in the following sections. The report is provided in full in Appendix D.

7.5.2 Existing environment

The modification area is within the development consent boundary of MCM and has been subject to mining operations. No extant or remnant native vegetation would be impacted by the modification.

For the purposes of the biodiversity assessment, a study area within the modification area was adopted based on the extent of partially completed rehabilitation between Open Cut 1 and Open Cut 2. The study area is illustrated in Figure 7.2.

i Vegetation communities

Prior to mining-related disturbance, historical mapping classed the vegetation of the study area as non-native (OEH 2012). However, rehabilitation of the study area over the last five to 10 years has allowed a number of native species to colonise the study area. Rehabilitation of the study area has been undertaken in accordance with the MOP, with rehabilitation objectives aiming to achieve approximately 50% of pasture and 50% native woodland vegetation.

Rehabilitated forested areas are comprised of a canopy of non endemic species including Spotted gum (*Corymbia maculata*) and Sugar Gum (*Eucalyptus cladocalyx*). The midstorey is dominated by Golden Wreath Wattle (*Acacia saligna*) while the groundcover is mostly exotic. There is negligible shrub cover across the study area which consists of mostly colonised exotic grasses and forbs.

A number of threatened ecological communities (TECs) are mapped in areas adjacent to the study area. However due to the high degree of disturbance, absence of representative species and low native flora diversity and complexity, the vegetation in the study area does not fit the description of any native plant community types (PCTs). The species composition does not meet any of the listing descriptions or condition thresholds of TECs.

ii Threatened flora

Though 12 threatened flora species are recorded within 10 km of the study area (locality) or are predicted to occur within the locality, no threatened flora species are likely to occur within the study area. The vegetation within the study area has not been well established and is at an early stage of rehabilitation. The study area also lacks any associated species or preferable habitat features required by threatened flora in the locality.

iii Fauna habitat

Fauna habitat in the study area is limited due to the early stage of rehabilitation. Plantings in the study area have occurred over the last five to ten years and therefore have not had sufficient time to develop important shelter habitats for fauna including tree hollows and fallen logs. Better foraging, roosting and nesting habitat exists in adjacent remnant woodland.

Pasture areas are dominated by introduced plant species which provide little value to native fauna species.

iv Threatened fauna

Thirty-nine threatened fauna species have been recorded or are predicted to occur within 10 km of the study area.

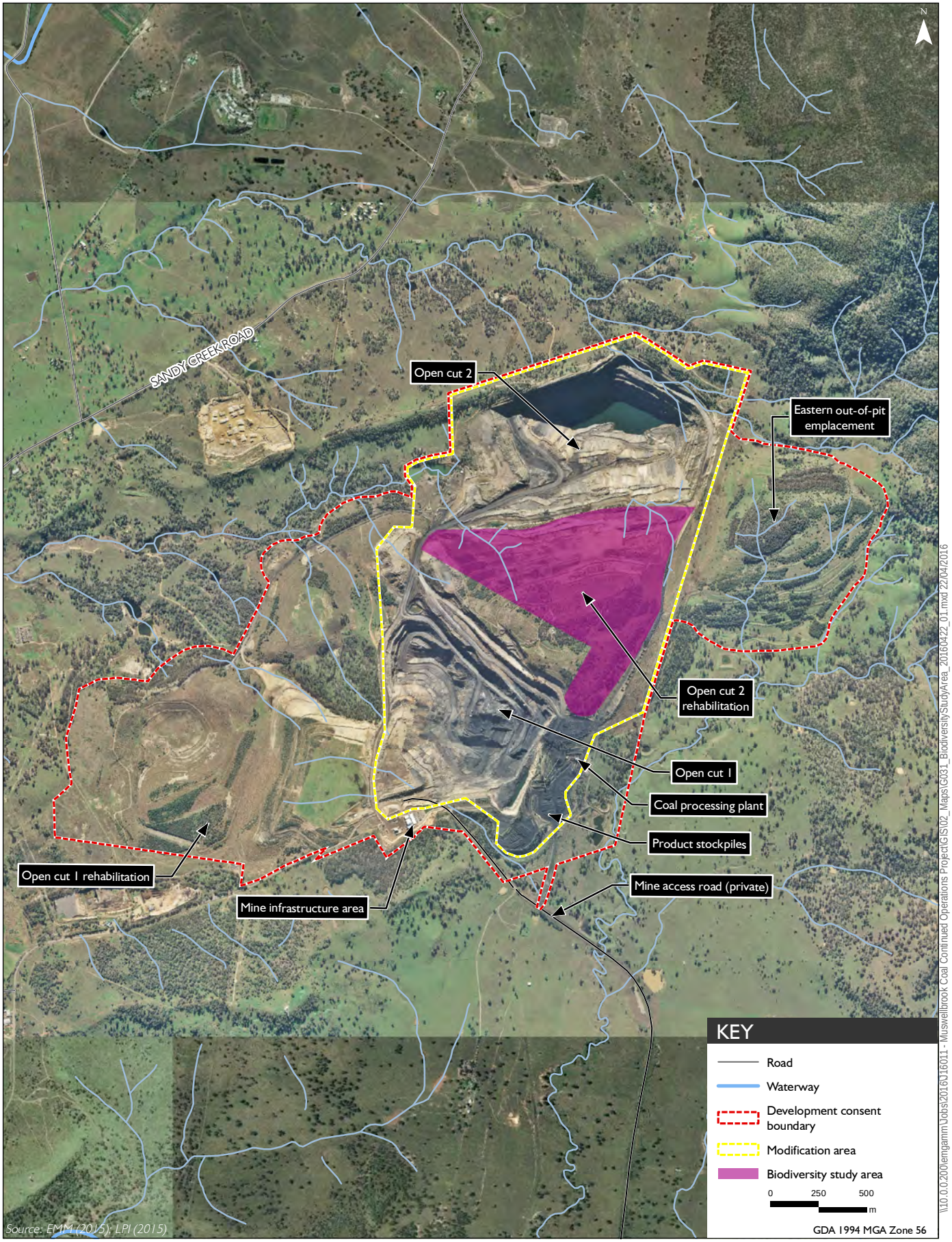
The Speckled Warbler (*Chthonicola sagittatus*) was recorded in a rehabilitation site to the east of the study area. Relatively undisturbed remnant vegetation is required for the species to persist in the area and the sightings are likely to be foraging individuals from adjacent remnant woodland. The species has a low potential to periodically forage in the study area and due to unsuitable habitat and no records in the study area.

Bird of prey species including the Spotted Harrier (*Circus assimilis*), Little Eagle (*Hieraaetus morphnoides*) and the Square-tailed Kite (*Lophoictinia isura*) may utilise the open grassland to forage as potential prey (the Hare) is present in the study area. However, there are limited records of their occurrence and no large trees or stags in the study area for roosting or nesting. The study area is not deemed as preferred habitat and better condition habitat is available in remnant vegetation in the greater area.

The study area is not considered important habitat for threatened fauna.

A number of common native bird and mammal species use the study area (EcoLogical Australia 2016). Monitoring of adjacent rehabilitation areas at MCM found the presence of other native and exotic fauna.

Native bird and mammal diversity was similar in rehabilitated woodland and adjacent remnant woodland areas. However, reptiles and microchiropteran bats (microbats) preferred remnant woodland, and did not appear to utilise rehabilitated areas. Exotic species diversity in remnant woodland were also found to be approximately double that of rehabilitated areas (EcoLogical Australia 2016).



Biodiversity assessment study area

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 7.2

v Migratory fauna

Twelve migratory bird species are recorded within or are predicted to occur within the locality.

There are no migratory fauna that have a moderate to high likelihood to occur in the study area due to the lack of preferred habitat. Some species may fly over but are unlikely to utilise the study area as habitat. The study area is not considered important habitat for any migratory species.

vi Aquatic habitat

Open Cut 2 void to the north of the study area is filled with water and does not have any ecological values or provide habitat to threatened aquatic species. No threatened aquatic species have been recorded or are predicted to occur in the locality.

vii Critical habitat

The study area is not considered critical habitat and the modification would not impact on registered critical habitat.

7.5.3 Impact assessment

i Vegetation communities

Vegetation in the modification area is limited to the study area. The modification would remove an estimated 45.2 ha of rehabilitated woodland and pasture from the study area. Clearing would remove immature native canopy species not endemic to the area or representative of local vegetation communities. Shrub cover in the study area is negligible, hence only midstorey species would be removed.

While the modification would result in clearing of partially completed rehabilitation, it is noted that the modification area would be progressively rehabilitated in accordance with the MOP and development consent (as modified).

ii Fauna

The modification would remove potential foraging habitat for a number of common native birds and mammals. No significant habitat features would be disturbed. The study area is adjacent to remnant woodland in better conditions with more suitable habitat for native fauna. The modification would not impact on significant or high condition fauna habitat.

Clearing of vegetation within the study area may cause direct injury or mortality to native fauna foraging in the study area. Clearing and would continue to be undertaken in accordance with the approved Flora and Fauna Management Plan. Native fauna identified during clearing would be encouraged to relocate to areas outside the impact area.

iii Threatened and migratory fauna

No important habitat currently utilised by threatened or migratory fauna would be impacted by the modification. Most threatened and migratory fauna are unlikely or have a low likelihood to occur in the study area.

The clearing of exotic pasture may remove potential foraging habitat for the Spotted Harrier, Little Eagle and Square-tailed Kite. An assessment of significance concluded that the modification would not have a significant impact on these species.

The modification would not impact any important habitat for migratory fauna.

iv Aquatic habitat

No aquatic habitat would be impacted as a result of the modification.

7.5.4 Mitigation and monitoring

The activities under the modification would be conducted in accordance with the MOP and relevant management plans. Vegetation clearing, weed management, erosion and sediment controls, before and during mining operations are guided by the MOP. Rehabilitation of the site is to be carried out in accordance with the MOP to achieve the approved final landform.

The following safeguards are recommended for the modification to avoid, minimise and mitigate potential impacts to biodiversity:

- relevant management plans would be updated to reflect the changes to operations as a result of the modification;
- the boundaries of vegetation clearing would be clearly marked to prevent areas outside of the modification being impacted, and the adjacent remnant woodland and rehabilitation areas remain intact;
- debris and stockpiles must also remain within the boundaries of the modification;
- any native fauna encountered during the works would be encouraged to relocate to remnant woodland a safe distance from the study area; and
- erosion and sediment controls are implemented prior to the commencement of clearing.

7.5.5 Conclusion

The modification is unlikely to significantly impact biodiversity values. The modification is located within a rehabilitated area of MCM. The vegetation of the study area is in poor condition with a sparse, stunted canopy of non-endemic species or species not characteristic of adjacent remnant vegetation. There is a negligible shrub layer within the study area and groundcover in woodland and pasture areas.

Fauna habitat is limited in the study area, and no significant habitat features are present. The modification would remove an estimated 45.2 ha of rehabilitated woodland and pasture.

Erosion and sedimentation controls would continue to be implemented in accordance with ESCP to avoid impacts to water quality.

While the modification would disturb an area of partially completed rehabilitation, the modification area would be progressively rehabilitated following mining in accordance with the MOP.

7.6 Visual

7.6.1 Introduction

Potential visual amenity impacts of the modification have been assessed to determine the likely visual significance to people living and working in, or travelling through, the landscape surrounding MCM. The objectives of the visual assessment were to assess the existing visual character of MCM including the modification area, to determine the extent and nature of the potential visual significance over and above mining operations approved under Development Consent No. DA 205/2002, and to identify measures to mitigate potential impacts as required. The visual amenity assessment therefore included the following:

- desktop study to assess the visual character of the modification area and identify view locations within the surrounding landscape;
- photography of the modification area and surrounds;
- viewshed analysis from identified viewpoints; and
- an assessment and determination of visual amenity impacts.

The visual significance of the modification on surrounding view locations would primarily result from a combination of the visibility of mine elements and the characteristics of the landscape between, and surrounding, any view locations and MCM. The potential degree of visibility and resultant visual significance is partly determined by a combination of factors, including:

- the distance between view location and the modification area;
- the duration of view from assessment locations towards MCM;
- the nature of the predicted impact of the modification over and above that approved on the existing visual amenity; and
- the visual sensitivity of locations from which views towards MCM exist.

7.6.2 Existing environment

MCM is located 3 km north-east of the township of Muswellbrook, with access via Muscle Creek Road off the New England Highway. The development consent boundary associated with MCM covers around 680 ha, and comprises current open cut mining operations and associated infrastructure, as well as previously rehabilitated areas from historical mining operations (primarily Open Cut 1 and 2 rehabilitation areas and the eastern emplacement).

As described in Chapter 2, land use zoning around MCM under the provisions of the Muswellbrook LEP is a combination of RU1 Primary Production, E3 Environmental Management and SP2 Infrastructure. Surrounding land uses include agricultural activities, light industrial and special land uses and residential areas as shown in Figure 2.2.

The land immediately surrounding the mine is predominately agricultural land which is primarily used for grazing of beef cattle. Light industrial and special land uses include Muswellbrook Quarry to the north-west, St Heliers correctional centre also to the north-west and Muswellbrook waste management facility adjacent to the south-west section of the MCM development consent boundary. Muswellbrook township is to the south-west, with other notable rural-residential areas along Sandy Creek Road to the north, Woodland Ridge Estate approximately 3.5 km to the south, and along Muscle Creek Road around 4 km to the south-east.

Other significant features surrounding MCM include the Main Northern Rail Line and the New England Highway, which both run to the west of MCM through Muswellbrook township and to the south towards Singleton. Numerous other mining operations and power-generating facilities exist in the Muswellbrook LGA, notably Bengalla mine to the west of Muswellbrook and Mt Arthur Coal and Drayton Coal to the south (refer Figure 2.2).

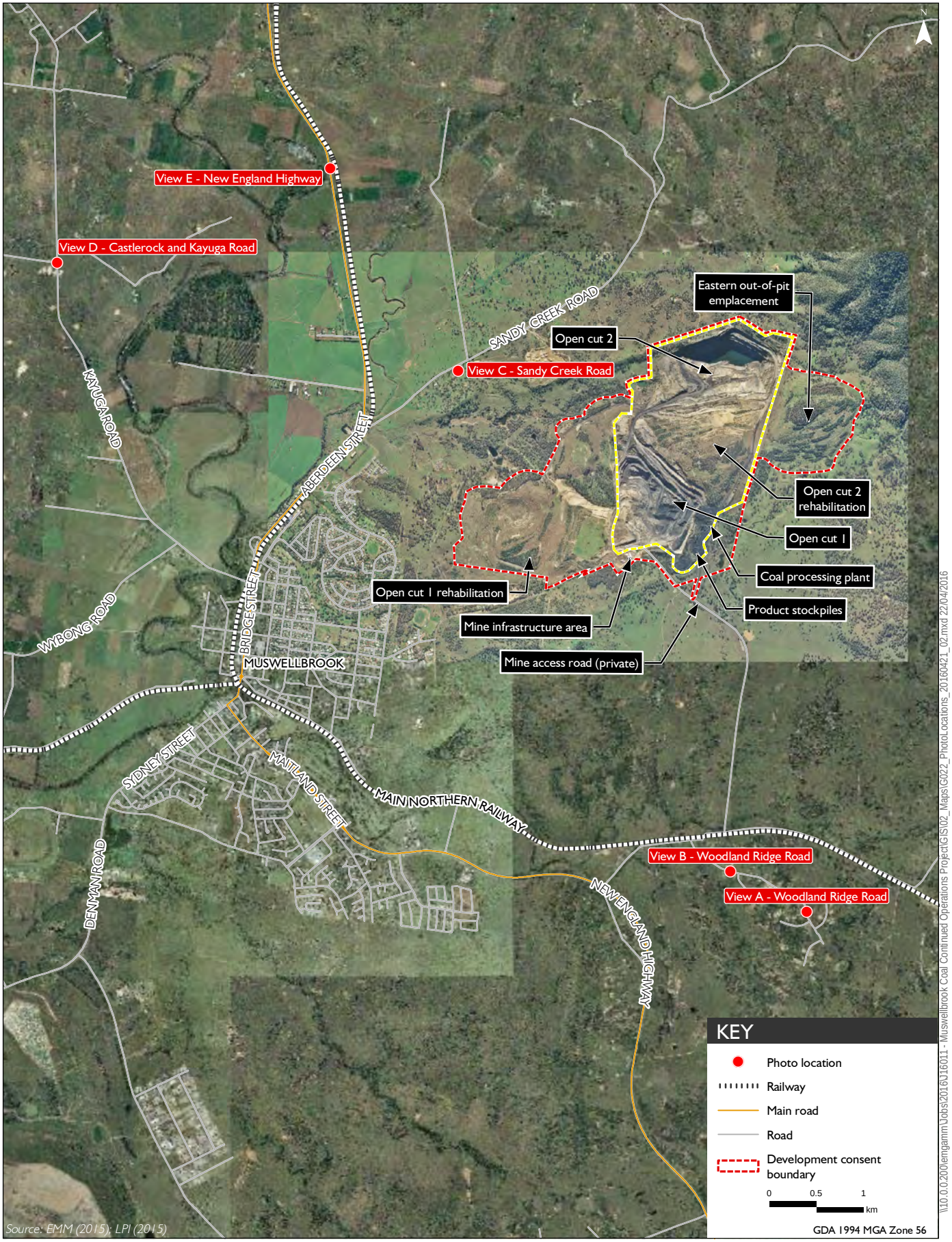
The natural topography shields the majority of views to MCM. However, the mine can be seen from a number of locations, and photos were taken from these areas to illustrate the existing visual character of MCM within the landscape, as follows:

- Woodland Ridge Estate, to the south (refer Plate 7.1 and 7.2).
- the corner of Castlerock Road and Kayuga Road, to the west of Muswellbrook (refer Plate 7.3); and

the New England Highway on approach to Muswellbrook, approximately 4 km north of the centre of Muswellbrook (refer Plate 7.4).Figure 7.3 illustrates where these photos were taken from.

As evident in Plates 7.1, 7.2, and 7.3, MCM can also be seen in the distant background from Woodland Ridge Estate and from the Castlerock Road/Kayuga Road/Wybong Road area west of Muswellbrook. Open Cut 1 and the eastern emplacement are distantly visible from all of these locations.

As shown in Plate 7.4, MCM can also be seen in the distant background from the New England Highway, travelling south towards Muswellbrook. However, when travelling at speed on the highway the landform associated with MCM can be difficult to distinguish from the surrounding landscape.



Visual assessment - location of photos

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 7.3

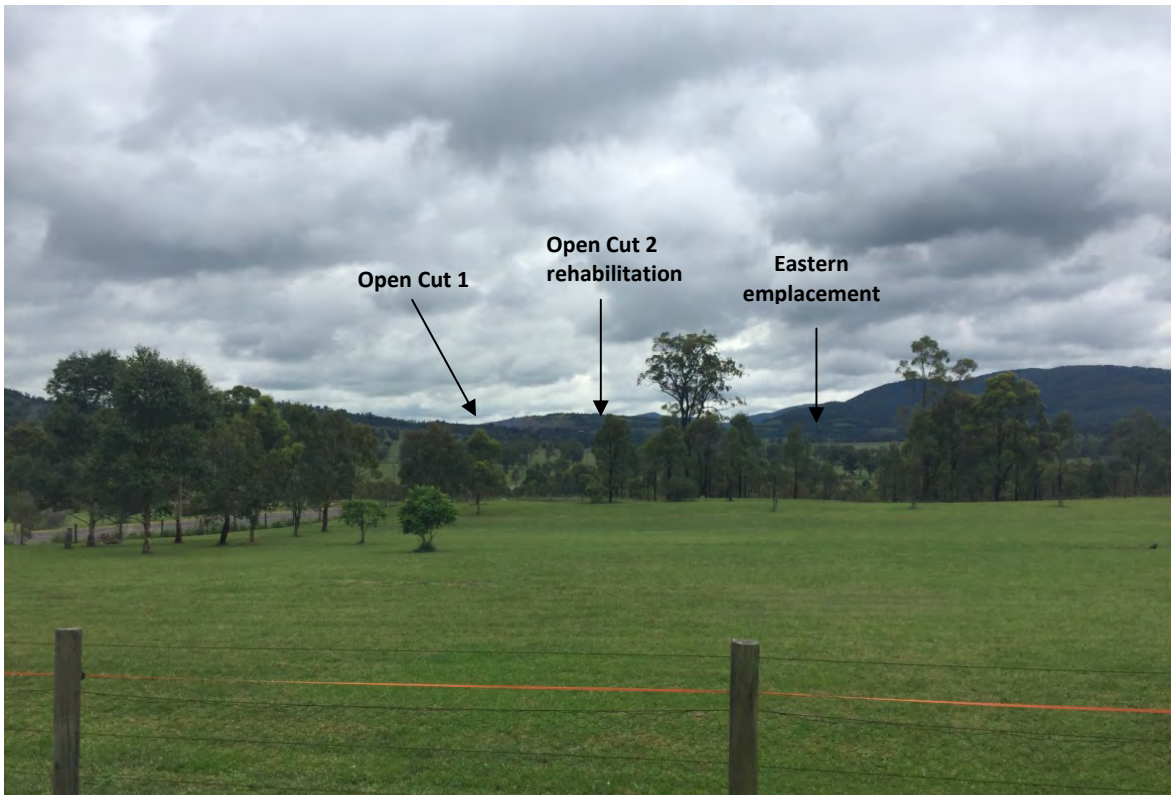


Plate 7.1 View A – view towards MCM from Woodland Ridge Road, near assessment location R29

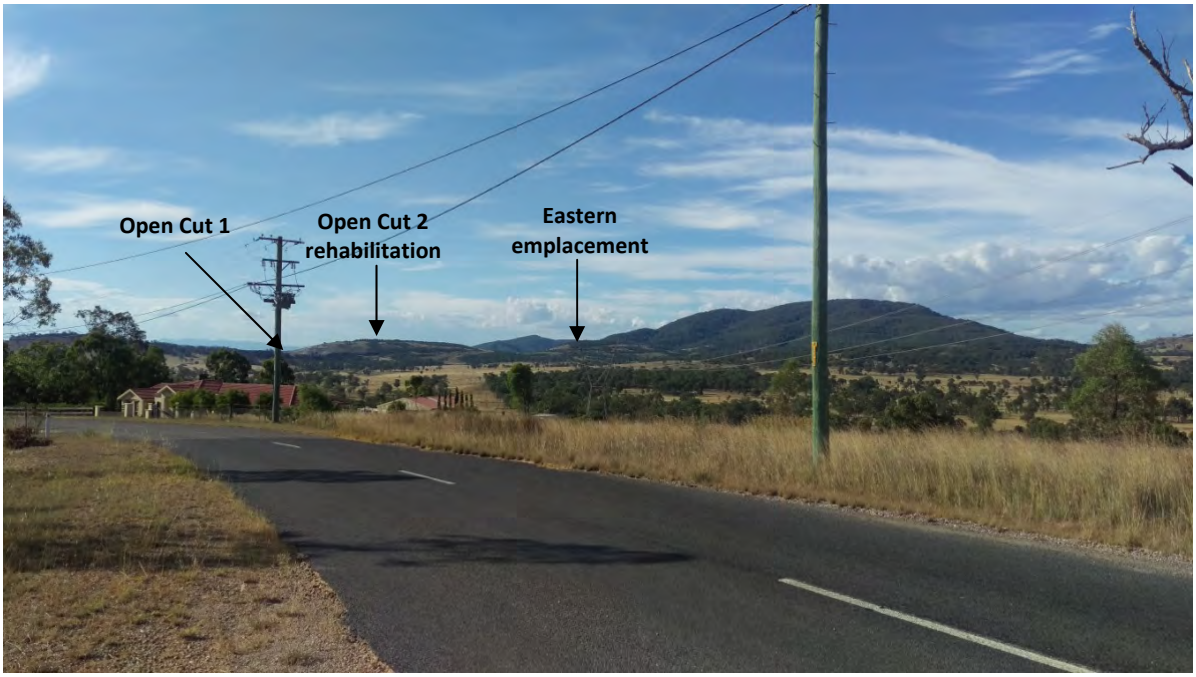


Plate 7.2 View B – view towards MCM from Woodland Ridge Road, near assessment location R27

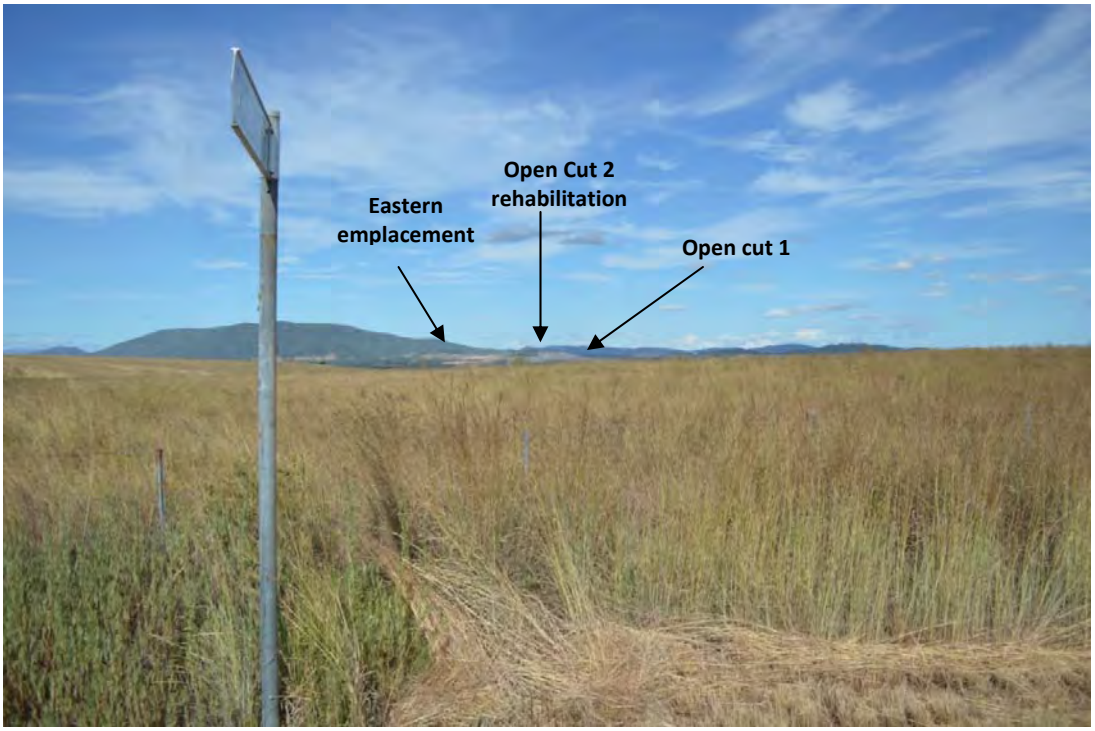


Plate 7.3 View D – view towards MCM from the corner of Castlerock and Kayuga Road, west of Muswellbrook

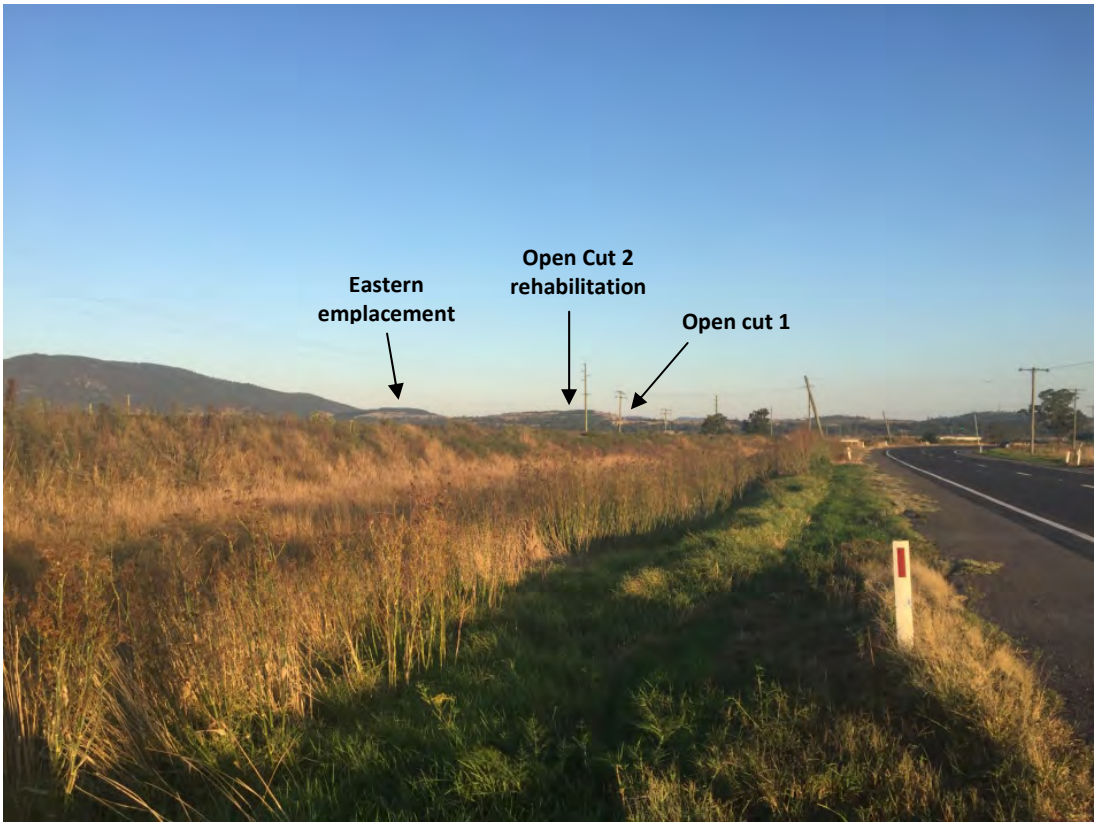


Plate 7.4 View E – view towards MCM from New England Highway, 4 km north of Muswellbrook town centre

7.6.3 Impact assessment

Potential impacts with regard to visual amenity may result from two aspects of the modification. Firstly, as described in Chapter 4, the modification involves progression of Open Cut 1 to the north and north-east, prolonging the mine life by five years over that currently approved. Secondly, the modification would involve small changes in the approved final landform; however no changes are proposed to the approved maximum final height of the rehabilitated landform.

To determine potential visual impacts, an initial desktop review was undertaken to determine relevant viewpoints from which MCM is currently visible and from where the modification area may be visible. A detailed viewshed analysis was then undertaken of views during Year 3 and Year 6 of the modification and of the proposed final landform from these view locations (refer Figure 7.3), as listed below:

- **View A** - Woodland Ridge Estate on Woodland Ridge Road near assessment location R29 (representing nearest receptors to the south of MCM).
- **View B** - Woodland Ridge Estate on Woodland Ridge Road, near assessment location R27 (again representing nearest receptors to the south of MCM).
- **View C** - Sandy Creek Road (representing receptors immediately north of MCM).
- **View D** - Corner of Kayuga Road and Castlerock Road (representing receptors to the west of MCM within an elevated area to the west of Muswellbrook).
- **View E** - New England Highway approaching Muswellbrook from the north (representing transient receptors travelling along the Highway into Muswellbrook).

The viewsheds were then compared with the approved final landform to determine the extent of incremental change in the visual amenity associated with MCM as a result of the modification. The results of the analysis for views A-E are presented in Figures 7.4 to 7.8, respectively.

As described in Section 7.6.2 and evident on Figures 7.4 to 7.8, views of Open Cut 1 and the area into which mining would extend as part of the modification are currently possible from all viewpoints assessed, with the exception of View C (from Sandy Creek Road to the north); as described below.

The modification would enable progression of mining in Open Cut 1, thus prolonging the views already possible (from viewpoints A, B, D and E) of the active mining in this area by up to five years.

The majority of the partially rehabilitated area into which Open Cut 1 would progress would require some reshaping as part of final rehabilitation works to achieve the conceptual final landform, including integrating the landform between Open Cut 1 and Open Cut 2 (refer Figure 4.8 in Chapter 4). With views currently possible of this rehabilitated emplacement area (views A, B, D and E), the earthworks required to reshape this dump upon completion of mining would also be visible during final rehabilitation works. With no changes proposed to the final landform height, negligible impacts are anticipated on visual amenity in relation to the final landform in addition to that already approved.

The modification would also involve overburden emplacement in Open Cut 2 and changes to the final landform associated with this area, as described in Chapter 2. However, Open Cut 2 is shielded from views from surrounding receptor locations by either natural topography or other elements of MCM, and as such there would be no change in visual impact associated with works in Open Cut 2 over and above that currently approved.

Potential impacts on visual amenity could also arise from the occurrence of spontaneous combustion at MCM. In this regard, the modification would remove coal seams that are prone to spontaneous combustion which may assist in reducing related impacts. The management of spontaneous combustion is discussed in further detail in Section 4.3.

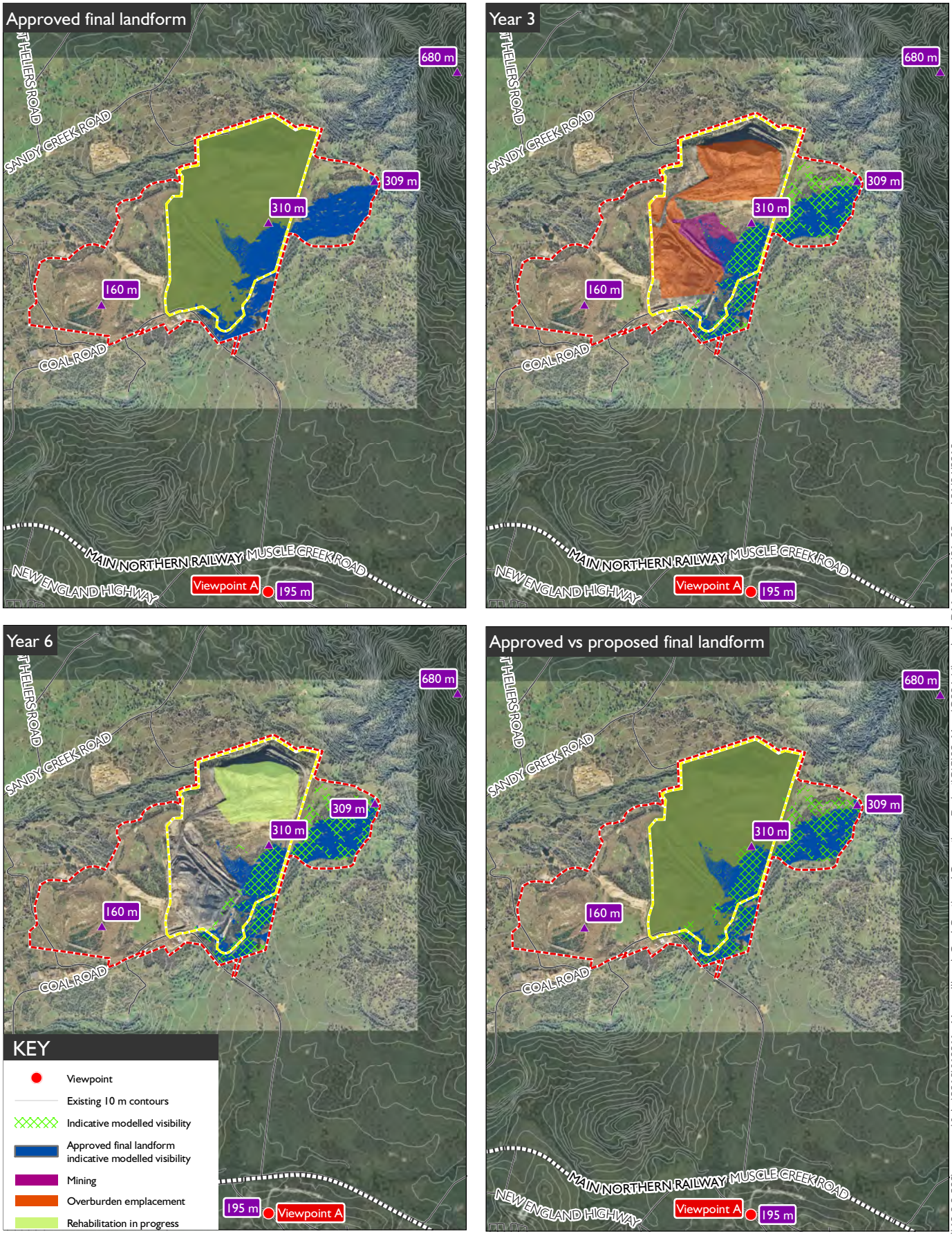
7.6.4 Mitigation and management

MCC would continue to employ measures to minimise the potential for visual related impacts on nearest receptors by:

- undertaking rehabilitation progressively where possible; and
- orientating lights away from sensitive receptors where practical.

With regards to progressive rehabilitation, opportunities would be limited within the modification area. As discussed in Chapter 4, as mining operations progress in Open Cut 1, some of the overburden would be hauled to Open Cut 2 for emplacement, and the remainder to Open Cut 1. As mining operations move north in Open Cut 1, small areas would become available for rehabilitation on the southern end of the overburden dump. However, the available areas would be limited due to the inert material having to be stockpiled at the top of the dumps to be bulk pushed over the carbonaceous material that would be emplaced in the pit at the end of active mining, in approximately Year 5 of the modification. The remaining overburden material to be disposed of would be hauled to Open Cut 2, with the last of the required material dumped into the pit in Years 4 and 5 after which bulk pushing for rehabilitation can commence.

Spontaneous combustion would continue to be managed in accordance with the site Spontaneous Combustion Management Plan, which aims to minimise the occurrence and manage the effects of spontaneous combustion during mining operations. Management measures include using dedicated in-pit sprinklers supplied by water pumped in from Dams 1 and 2. Further discussion on the management of spontaneous combustion is provided in Section 4.3.



\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G004_Viewshed_RA1_20160421_08.mxd 21/04/2016

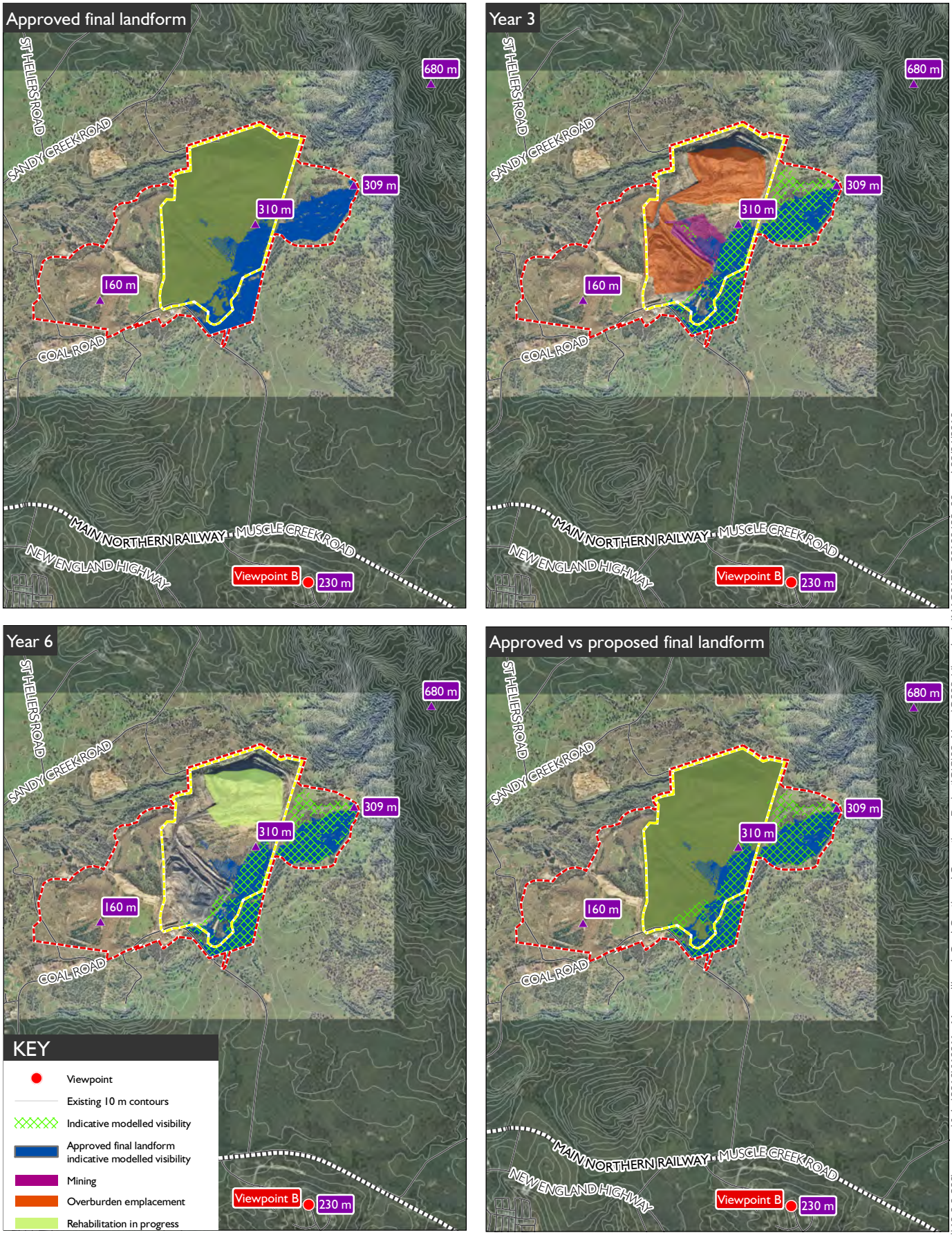
Viewshed analysis - View A

Muswellbrook Coal Continued Operations Project

Statement of Environmental Effects

Figure 7.4

EMM



\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G008_Viewshed_IMAG0172_20160422_06.mxd 22/04/2016

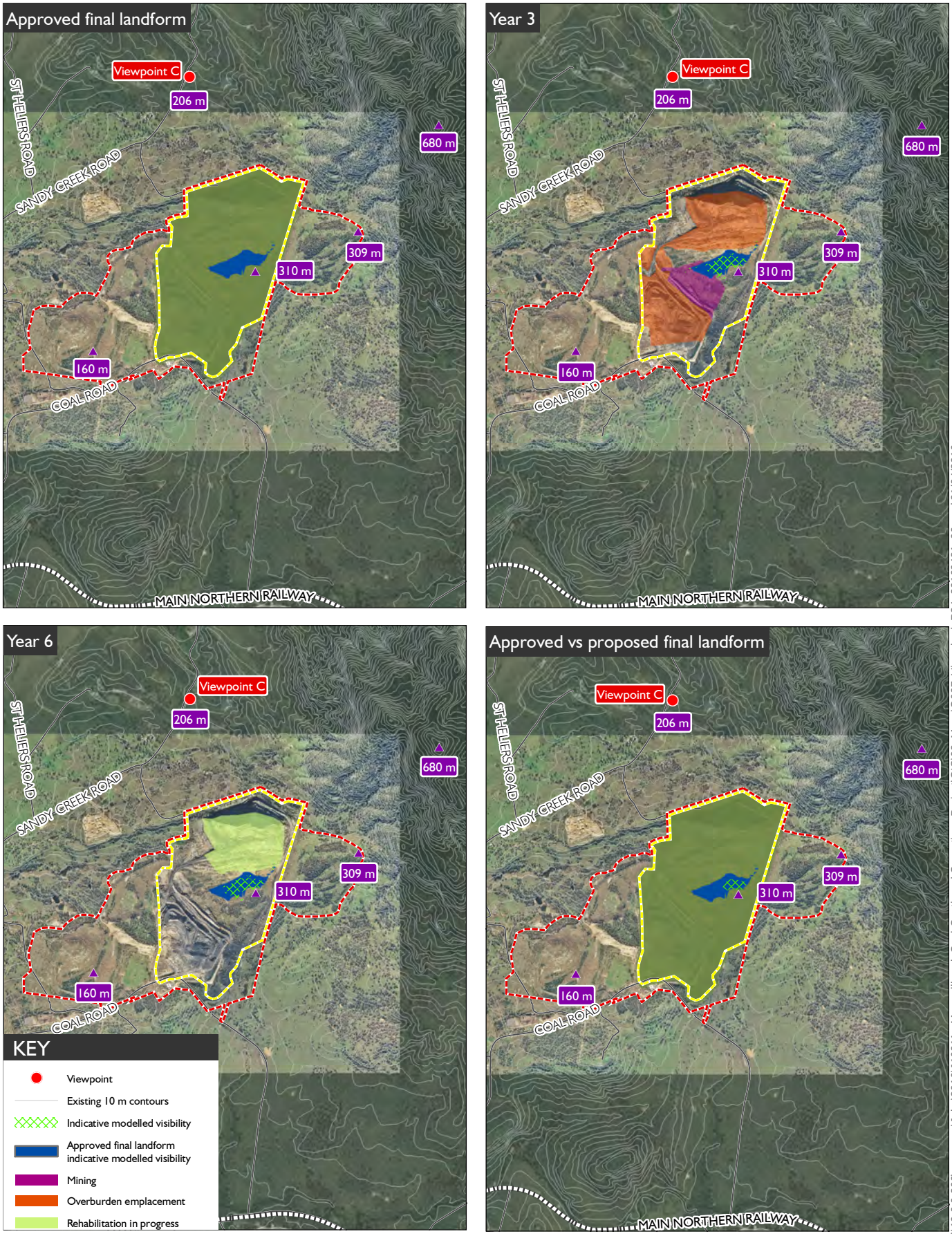
Viewshed analysis - View B

Muswellbrook Coal Continued Operations Project

Statement of Environmental Effects

Figure 7.5

EMM



\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G007_Viewshed_R24_20160421_06.mxd 21/04/2016

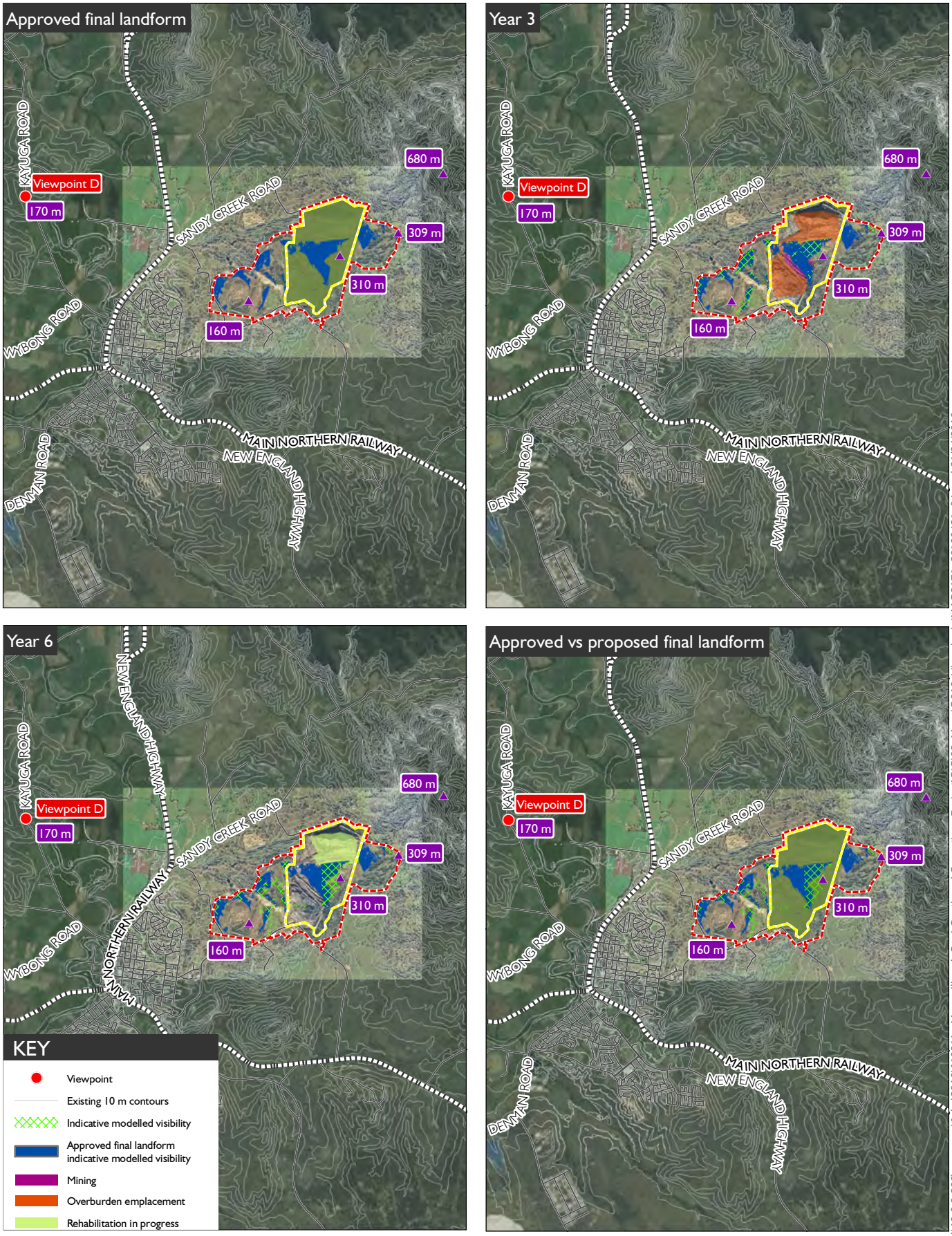
Viewshed analysis - View C

Muswellbrook Coal Continued Operations Project

Statement of Environmental Effects

Figure 7.6

EMM



\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G010_Viewshed_IMAG0171_20160421_04.mxd 21/04/2016

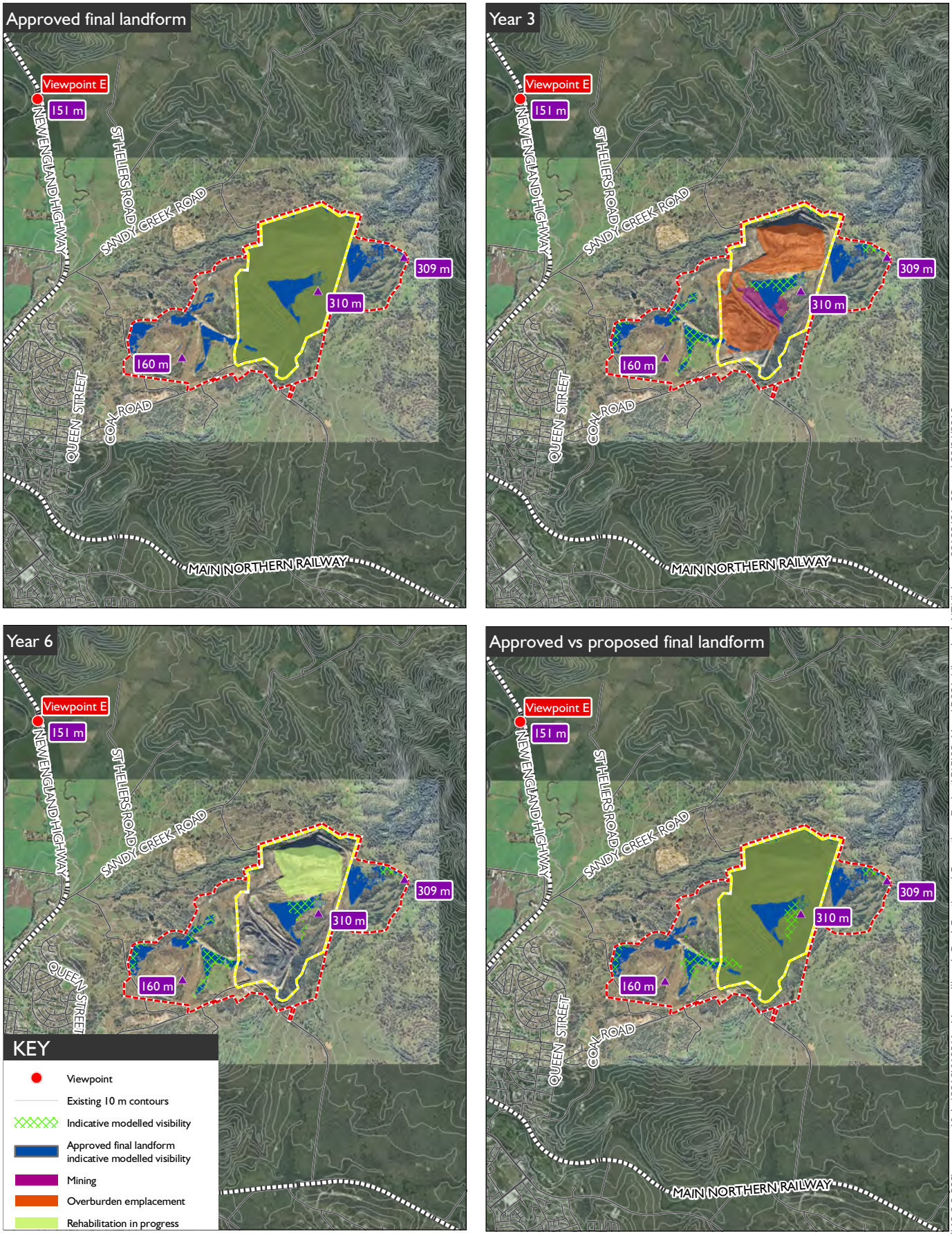
Viewshed analysis - View D

Muswellbrook Coal Continued Operations Project

Statement of Environmental Effects

Figure 7.7

EMM



\\10.0.0.200\emgamm\Jobs\2016\J16011 - Muswellbrook Coal Continued Operations Project\GIS\02_Maps\G021_Viewshed_NEHighway_20160421_03.mxd 22/04/2016

Viewshed analysis - View E

Muswellbrook Coal Continued Operations Project

Statement of Environmental Effects

Figure 7.8

EMM

7.6.5 Conclusion

The modification would have a negligible incremental visual impact on people living in, and travelling through, the area around MCM over and above currently approved operations, with existing views from receptor locations remaining substantially the same. This is primarily due to the following:

- existing vegetation and topography shield the view from receptors to the north and east, and many to the south and west in the township of Muswellbrook;
- the modification involves progression of Open Cut 1 to the north and north-east. Parts of Open Cut 1 are currently visible from the south of MCM, along the New England Highway to the north-west, and from areas to the west of Muswellbrook. The modification would prolong these views by up to five years;
- views of MCM that are possible from receptor locations are distant (generally greater than 3 km away). This distance also means that views are likely to be influenced by atmospheric conditions which may further reduce visibility; and
- no change is proposed to the maximum height of the final landform to that currently approved.

7.7 Economic

7.7.1 Introduction

An economic assessment of the modification was prepared by Gillespie Economics. The assessment included both a cost benefit analysis (CBA) and a local effects analysis (LEA).

The economic assessment was carried out in accordance with the following:

- Section 79C of the EP&A Act which requires the following two matters to be taken into consideration by the consent authority in determining a development application:
  - the public interest (taken as the collective public interest of households in NSW); and
  - the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.
- Clause 7(1)(f) of Schedule 2 of the EP&A Regulation, which requires environmental assessments to provide “the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations …”. The note to Clause 7 (1)(f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure." While this SEE is not an EIS prepared in accordance with Schedule 2 of the EP&A Regulation, it has been used as a guide.

- The following standards, guidelines and policies:
    - NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*; and
    - NSW Treasury (2007) *NSW Government Guidelines for Economic Appraisal*.

The full technical report is contained within Appendix I, with the findings summarised in the sub-sections below.

7.7.2 Cost benefit analysis

CBA is concerned with a single objective of the EP&A Act, being the economic efficiency of a proposal. The CBA therefore assessed whether the incremental benefits of the modification would exceed the incremental costs, and therefore, whether the community would be better off 'with' the modification compared to 'without' it.

The CBA for the modification was undertaken in 2016 real values, with discounting at 7% and sensitivity testing at 4% and 10%, in accordance with policy directions from the NSW Government (2015) and NSW Treasury (2007).

In order to conduct the CBA the base case scenario was identified, to which the modification scenario was compared. Under the development consent (the base case), MCM has approval to mine up to 2 Mtpa of ROM coal until the end of 2018, with subsequent decommissioning and rehabilitation of the site until 2020. Under the modification scenario, mining of up to 2 Mtpa of ROM coal would continue until the end of approximately 2022, with completion of rehabilitation activities by 2025. It is noted that 2022 was nominated for the completion of coal extraction for the purposes of the assessment, based on the optimal proposed conceptual mine plan. However, the exact timing of mining activities may be subject to changes due to operational requirements as the mine progresses. On this basis, approval is sought for activities to continue until 2025, to allow sufficient time for mining activities to be completed as well as the required rehabilitation works.

i Net production benefit

The modification would result in incremental ROM coal and product coal production in the order of 4.2 Mt and 3.9 Mt, respectively. Based on a consensus price of between AU$80/t and AU$83/t in the years 2019 to 2021, and an effective royalty rate of 7.83% of gross revenue, the modification would generate total royalties of $25 Million (M). Using a 7% discount rate the present value of royalties from the modification are estimated at $18 M. This is a minimum estimate of the net production benefits of the modification to NSW and provides a minimum threshold value against which the environmental, social and cultural costs of the modification, after mitigation, offsetting and compensation, can be compared.

ii Market benefit to workers

The modification would enable the continuation of employment of up to 95 FTE workers, plus contractors, for up to an additional five years.

Whilst MCC currently has approval to operate with a workforce comprising 95 FTE positions, for the purposes of the economic assessment a full time workforce of 75 plus 38 contractors (totalling 113 workers) was used, based on existing employment levels, to conservatively calculate the market benefit to workers, as well as flow-on effects.

If it were assumed that 50% of the direct and contractor workforce at MCM would otherwise be unemployed for three years, and that the reservation wage for these workers was $52,440 compared to an annual mine wage of around $135,000, then the market employment benefit of the modification in terms of income would be $10 M present value, using a 7% discount rate. Alternatively, if the economic benefit to workers is taken as the difference between the median wage in the region of $31,741 (ABS 2016) and a mine wage of around $135,000 over the life of the modification, then the potential economic benefit to workers would be $25 M, present value using a 7% discount rate.

The likelihood of wage benefits from the modification are increased by the current downturn in the mining sector and subsequent closure or downsizing of a number of mines in the Hunter Region, and hence the reduced likelihood of current labour at MCM obtaining alternative mining employment without the modification. Unemployment rate for the locality has increased from 3% in September 2012 to 9% in December 2015 (Department of Employment 2015).

iii Net social benefit

For the modification to be questionable from an economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the modification to NSW, after mitigation, offset and compensation, would need to be valued by the community at greater than the estimate of the minimum net production benefits (ie greater than $18 M).

iv Sensitivity analysis

A sensitivity analysis was conducted to take into account uncertainty around production levels and coal prices to determine the possible effect on the net present value associated with the modification. The minimum threshold value approach used in the analysis was based on annual production of 1.5 Mt, 1.0 Mt and 1.4 Mt in the years 2019 to 2021, respectively, and thermal coal prices in these years of AU$79.9, AU$83.2 and AU$82/t.

The estimated minimum threshold value of the modification was tested for changes at a 4%, 7% and 10% discount rate to the following variables:

- a 30% decrease in annual product coal production;
- an increase to maximum production coal production; and
- a 30% increase or decrease in coal price.

The sensitivity analysis results are presented in Table 7.12, and show that the minimum threshold value is sensitive to a change in production levels and price. However, a 30% decrease in production, or 30% decrease in coal price, would both still result in a net present value of $12 M.

Table 7.12 Modification minimum threshold value sensitivity resting (net present value $M)

Parameter	4% discount rate	7% discount rate	10% discount rate
Core result	$20	$18	$16
Decrease 30% production	$14	$12	$11
Max production	$29	$25	$22
30% price decrease	$14	$12	$11
30% price increase	$27	$23	$20

7.7.3 Local effects analysis

LEA aims to address the consequences of a proposal, such as the modification to Development Consent No. DA 205/2002, in its "locality" as required by section 79C of the EP&A Act. It is intended to complement the CBA by translating effects at the NSW level to impacts on the communities located near MCM.

The local effects as a result of the modification analysed were:

- local employment and income effects;
- other local industry effects, for example on suppliers; and
- environmental and social change in the local community.

The local community in this context is defined as the LGAs of Muswellbrook, Singleton and Upper Hunter, within which MCM is located and in which most employees and contractors reside.

A summary of the local effects of the modification is presented in Table 7.13.

Table 7.13 Summary of local effects of the modification

	Modification direct	**Modification direct: local**	**Net effect**	**Total net effect**
Employment related				
Assuming otherwise employed				
Employment (FTE)	113	93	65	178
Disposable income (per annum)	$10.9	$9.0	$6.5	$11.5
Assuming otherwise unemployed				
Employment (FTE)	113	93	79	216
Disposable income (per annum)	$10.9	$9.0	$7.7	$13.6
Other non-labour expenditure	$18.9			
Second round and flow-on effects	See Table 7.13			
Contraction in other sectors	No material impact			
Displaced activities	Not applicable			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact**		
Greenhouse gas impacts	Local and NSW households	No material impacts		
Agricultural impacts	MCC	No material impacts - LSC Class 6 land impacted		
Noise impacts	Adjoining landholders	Six landholders moderately impacted - management measures implemented to minimise impacts		
Blasting	Adjoining landholders	No properties impacted by exceedances		
Air quality impacts	Adjoining landholders	Two landholder impacted cumulatively on two to three days - additional monitor installed to manage impacts		
Surface water	MCC	WALs already in MCC ownership and would be held for a longer period of time		
Groundwater	MCC	WALs already in MCC ownership and would be held for a longer period of time		

Table 7.13 Summary of local effects of the modification

	Modification direct	Modification direct: local	Net effect	Total net effect
Ecology	Local and NSW households who value the revegetation	Impacts on biodiversity values unlikely to be significant		
Road transport impacts	Local residents	No impacts identified		
Indigenous and non-Indigenous heritage	Aboriginal people and other local and NSW households who value heritage	No impacts identified		
Visual impacts	Adjoining landholders and people travelling through	Unlikely to be significant		
Net public infrastructure costs	NSW Government and NSW households	No material impacts		
Loss of surplus to other industries	Local industries adversely impacted by the modification	No material impacts		

The results in Table 7.13 demonstrate that the local environmental and social impacts (or externalities) impacts are not significant. There would be annual flow on effects of $18.9 M associated with net direct employment and income (ie non-labour expenditure). Other industries are not predicted to be impacted.

The total and disaggregated annual impacts of the modification on the local economy (in 2016 dollars) were also calculated, and are presented in Table 7.14.

Table 7.14 Economic impacts of the modification on the local economy

	Direct effect	Production induced	Consumption induced	Total flow-on	Total effect
Output ($'000)	119,686	26,422	9,241	35,663	155,349
Type 11A Ratio	1.00	0.22	0.08	0.30	1.30
Value added ($'000)	41,049	11,068	5,104	16,172	57,222
Type 11A Ratio	1.00	0.27	0.12	0.39	1.39
Income ($'000)	8,899	5,093	1,777	6,870	15,769
Type 11A Ratio	1.00	0.57	0.20	0.77	1.77
Empl. (No.)	75	92	37	129	204
Type 11A Ratio	1.00	1.23	0.50	1.73	2.73

The results in Table 7.14 show that the modification would contribute annual incremental values to the regional economy for up to three years of:

- $155 M in annual direct and indirect regional output or business turnover;
- $57 M in annual direct and indirect regional value added;
- $16 M in annual direct and indirect household income; and
- 204 direct and indirect jobs.

7.7.4 Conclusion

The modification would allow production of an additional 3.9 Mt of product coal, generating minimum total royalties (at present value) of $18 M to NSW and Australia. The net social benefit to Australia and NSW of a minimum of $18 M means that the modification is desirable and justified from an economic efficiency perspective.

The modification would also provide direct and indirect economic activity to the local, regional, State and national economies for up to five years. Flow-on economic activity would arise from production expenditure during operation of MCM, and expenditure of employees who mainly reside within the region; a benefit that would be enhanced in light of the current downturn in the mining sector.

7.8 Social

7.8.1 Introduction

This section considers the potential social impacts associated with the modification. It describes the current community profile of the local area including socio-economic characteristics, housing supply and current community issues related to mine operations. The section then documents the likely social implications of the modification in order to identify positive and negative impacts on the local community. A range of management and mitigation measures are then provided to both enhance social opportunities and mitigate negative impacts.

This assessment focuses on the Muswellbrook LGA in which MCM is located as well as the surrounding LGAs of Singleton and Upper Hunter.

7.8.2 Assessment area

The Muswellbrook LGA is located in the Hunter Valley, approximately 285 km north north-west of the Sydney central business district. The LGA covers approximately 3,405 km^2. The Muswellbrook LGA is bound by the Upper Hunter LGA to the north, Singleton LGA to the east and Mid-Western Regional LGA to the west.

The main urban centre in Muswellbrook LGA is the town of Muswellbrook, with a population of 11,791 people as of 2011. Other centres include Denman (1,902 people) and Sandy Hollow (401 people) (ABS 2011). Muswellbrook is the nearest major urban centre to MCM, approximately 3 km south-west of the site. Other large centres in the surrounding LGAs include Singleton (13,961 people) and Branxton (1,926 people) in Singleton LGA and Scone (5,478 people) and Merriwa (1,790 people) in the Upper Hunter LGA (ABS 2011).

7.8.3 Community profile

i Socio-economic profile

a. Population size, growth and future change

Muswellbrook LGA has experienced strong population growth over the last decade, with an increase in population of 10.7% to an estimated 17,045 people in 2014 (ABS 2015b). This was consistent with population growth for the Upper Hunter LGA at 10.8% to 14,658 people, and higher than Singleton LGA at 9.1% growth to a population of 23,884 over the same time period. All LGAs experienced lower population growth than NSW overall at 13.0% over the same time period.

The NSW Department of Planning and Environment (DP&E) forecasts suggest there would be an 18.3% increase from 2011 levels in the total population in Muswellbrook LGA by 2031 (see Table 7.15). This represents an additional 3,000 people. Both Singleton and Upper Hunter LGAs are also expected to experience population growth albeit at lower rates than Muswellbrook LGA. The forecast population growth rates for all LGAs are lower than that predicted for the whole of NSW at 27.8% (DP&E 2014).

Table 7.15 Population forecasts

Area	2011 population	2031 population	Total change	% change
Muswellbrook LGA	16,350	19,350	3,000	18.3%
Singleton LGA	23,500	27,350	3,850	16.4%
Upper Hunter LGA	14,200	15,750	1,550	10.9%
NSW	7,218,550	9,228,350	2,009,900	27.8%

Source: DP&E 2014.

b. Population structure and characteristics

The age distribution of the population for the relevant LGAs and NSW is shown in Figure 7.9. It can be seen that Muswellbrook and Singleton LGAs generally have a younger population with a higher proportion of people aged 0 - 24 and a lower proportion of people aged 55 years and over compared to the Upper Hunter LGA and NSW (ABS 2011). The population profiles for Upper Hunter LGA and NSW are indicative of an ageing population.

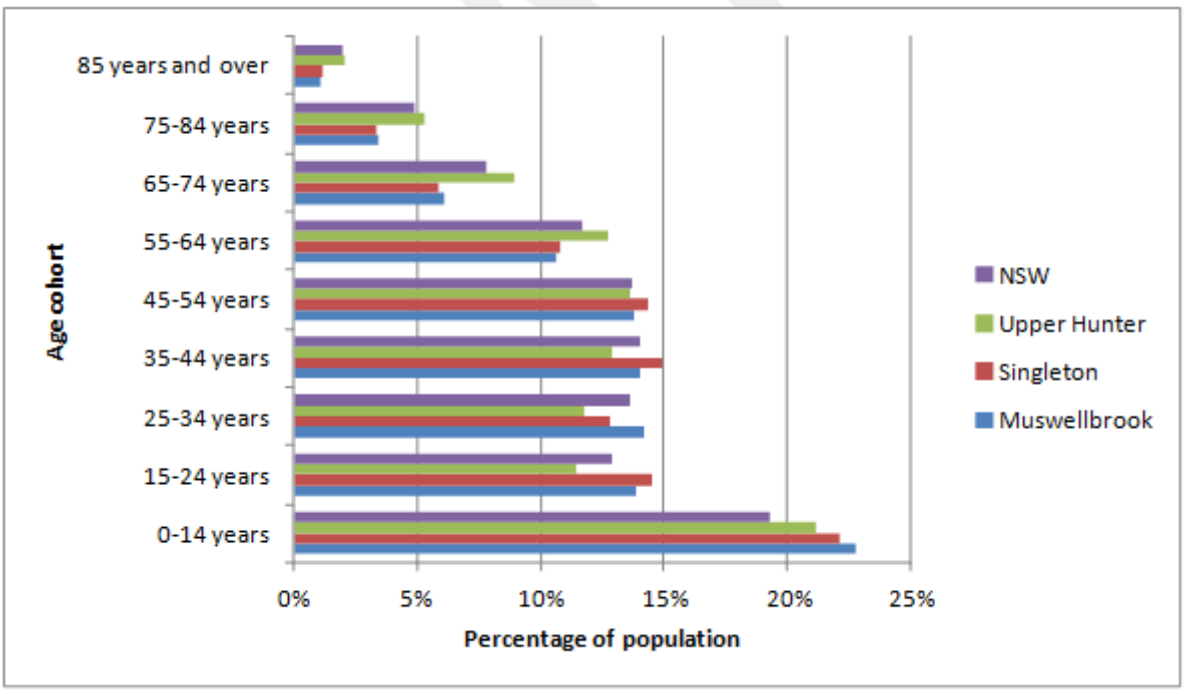


Figure 7.9 Population distribution, 2011

Residents born overseas make up a much smaller percentage of the population within the Muswellbrook LGA (7.7%), Singleton LGA (8.6%) and Upper Hunter LGA (7.1%) than that of NSW (27.3%), indicating lower cultural diversity in the region. However, the Muswellbrook, Singleton and Upper Hunter LGAs have larger indigenous populations (5.4%, 3.7% and 3.9% of the total population, respectively) compared with NSW (2.5%).

c. Education and training

Muswellbrook is ranked the sixth most disadvantaged of the 153 LGAs in NSW for education (ABS 2013), with the level of school and post-school education being consistently lower than the state averages, as seen in Table 7.16 and Table 7.17. Just 28.1% of the Muswellbrook LGA population had achieved Year 12 or equivalent in 2011 compared with 33.2% for Singleton LGA, 31.5% for Upper Hunter LGA and 49.2% for the state. Despite such low rates of completion for Year 12, the proportion of the population completing Year 12 in the Muswellbrook LGA increased by 7% between 2006 and 2011. The percentage of the population that achieved Year 10 or equivalent within the Muswellbrook LGA was significantly greater than the state at 36.1% of the population compared with 23.9% for the state (ABS 2011).

Table 7.16 Highest year of school completed by people aged 15 years and over in 2011

School year	Muswellbrook LGA	Singleton LGA	Upper Hunter LGA	NSW
Year 12 or equivalent	28.1%	33.2%	31.5%	49.2%
Year 11 or equivalent	7.1%	7.9%	5.9%	5.0%
Year 10 or equivalent	36.1%	37.2%	35.0%	23.9%
Year 9 or equivalent	10.2%	9.2%	10.5%	6.6%
Year 8 or below	6.6%	5.3%	8.0%	5.6%
Did not go to school	0.3%	0.4%	0.3%	1.0%
Highest year of school not stated	11.7%	6.8%	8.7%	8.6%

Source: ABS 2011.

Within the Muswellbrook LGA, 11.7% of adults have completed a bachelor degree. This is generally consistent with the level of educational attainment in Singleton LGA (14.6%) and Upper Hunter LGA (14.4%) but lower than the state (24.6%). Certificate level qualifications are much higher in the Muswellbrook (48%), Singleton (51.3%) and Upper Hunter LGAs (46.5%) compared with the state (30.9%) (ABS 2011). This is consistent with the most common industries of employment within the region being mining, labouring, trade and agriculture, which generally require certificate level qualifications.

Table 7.17 Highest level of post-school education attainment by people aged 15 years and over

Level of educational attainment	Muswellbrook LGA	Singleton LGA	Upper Hunter LGA	NSW
Postgraduate degree level	1.6%	2.1%	2.0%	7.5%
Graduate diploma and graduate certificate level	1.6%	1.6%	1.5%	2.6%
Bachelor degree level	11.7%	14.6%	14.4%	24.6%
Advanced diploma and diploma level	10.5%	12.4%	11.4%	14.5%
Certificate level	48.1%	51.3%	46.5%	30.9%
Level of education inadequately described	1.9%	2.2%	2.8%	3.1%
Level of education not stated	24.6%	15.8%	21.3%	16.9%

Source: ABS 2011.

d. Workforce and occupation structure

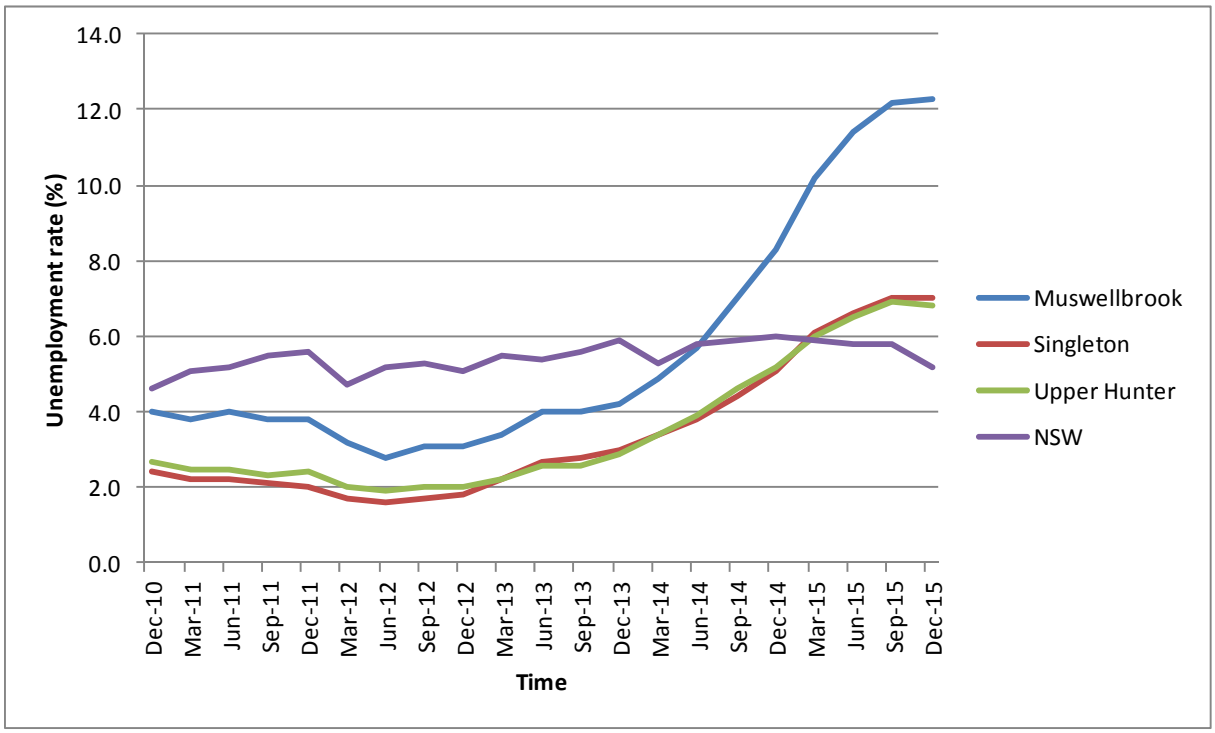
In December 2015, the unemployment rate in Muswellbrook LGA was 12.3%, or approximately 1,140 people (see Table 7.18). This was significantly higher than surrounding LGAs (7.0% in Singleton LGA and 6.8% in Upper Hunter LGA) and NSW (5.8%) (Department of Employment 2016).

Table 7.18 Labour force statistics, December 2015

Labour force indicator	Muswellbrook LGA	Singleton LGA	Upper Hunter H LGA	NSW
Unemployment rate (%)	12.3%	7.0%	6.8%	5.8%
Total unemployed	1,140	944	523	226,900
Labour force	9,248	13,432	7,734	3,939,100

Source: Department of Employment 2016.

The unemployment rate in Muswellbrook LGA has increased by approximately 10% over the last four years, from a low of 2.8% in June 2012 (Department of Employment 2016) (see Figure 7.10). Muswellbrook and Singleton LGAs have also experienced increases in the unemployment rate over the same time period (see Figure 7.10). These increases in the unemployment rate are largely associated with job losses in the mining industry (ABC News, 2015). The NSW unemployment rate has remained relatively stable over the same time period (ABS 2016).



Source: Department of Employment 2016, ABS 2016.

Figure 7.10 Unemployment trends

The most common occupations in Muswellbrook LGA are technicians and trade workers (20.2%), machinery operators and drivers (17.6%) and labourers (13.0%). This is relatively consistent across the Singleton and Upper Hunter LGAs (see Table 7.19). In contrast, the most common occupations across NSW were professionals (22.7%), clerical and administrative workers (15.1%), managers (13.3%) and technicians and trade workers (13.2%) (ABS 2011). Such differences between the most common occupations within the relevant Hunter Valley LGAs and the state reflect the dominance of employment in the mining industry and associated sectors in these LGAs.

Table 7.19 Occupation of workforce

Occupation	Muswellbrook LGA	Singleton LGA	Upper Hunter LGA	NSW
Managers	10.1%	10.9%	16.6%	13.3%
Professionals	10.8%	12.4%	11.5%	22.7%
Technicians and trade workers	20.2%	18.8%	17.0%	13.2%
Community and personal service workers	7.9%	8.5%	7.6%	9.5%
Clerical and administrative workers	10.8%	11.9%	9.6%	15.1%
Sales workers	7.9%	7.0%	6.8%	9.3%
Machinery operators and drivers	17.6%	19.0%	13.3%	6.4%
Labourers	13.0%	9.6%	15.8%	8.7%
Inadequately described/not stated	1.6%	1.9%	1.8%	1.8%

e. Business and economy

In 2011, the main industries of employment in Muswellbrook LGA were mining (21.3%), retail trade (9.2%) and accommodation and food services (7.0%) (see Table 7.20). Employment in mining increased by 103.4% between 2001 and 2011 (ABS 2011). All of the Hunter LGAs reported higher levels of employment in mining compared with NSW.

Table 7.20 Industry of employment

Industry of employment	Muswellbrook LGA	Singleton LGA	Upper Hunter LGA	NSW
Agriculture, forestry and fishing	7.1%	3.9%	19.0%	2.2%
Mining	21.3%	24.6%	10.9%	1.0%
Manufacturing	5.5%	7.0%	6.2%	8.4%
Electricity, gas, water and waste services	4.5%	2.3%	2.1%	1.1%
Construction	6.7%	6.2%	6.4%	7.3%
Wholesale trade	3.3%	3.0%	2.8%	4.4%
Retail trade	9.2%	8.2%	8.4%	10.3%
Accommodation and food services	7.0%	6.6%	6.5%	6.7%
Transport, postal and warehousing	3.0%	3.1%	3.6%	4.9%
Information media and telecommunications	0.4%	0.5%	0.3%	2.3%
Financial and insurance services	1.1%	1.1%	1.2%	5.0%
Rental, hiring and real estate services	1.3%	1.6%	0.9%	1.6%
Professional, scientific and technical services	2.9%	3.6%	3.9%	7.9%
Administrative and support services	3.1%	3.5%	1.8%	3.3%
Public administration and safety	4.0%	5.3%	4.1%	6.1%
Education and training	4.8%	5.0%	6.6%	7.9%
Health care and social assistance	6.9%	6.4%	7.7%	11.6%
Arts and recreation services	1.0%	0.5%	1.5%	1.5%
Other services	4.5%	5.2%	3.4%	3.7%
Inadequately described	2.4%	2.4%	2.6%	2.5%

ii Housing supply

In 2011, there were approximately 6,224 dwellings in Muswellbrook LGA. Of these, 79.1% comprised detached dwellings. This was similar to the rate of detached dwellings in Singleton LGA (79.7%) and Upper Hunter LGA (78.0%) but significantly higher than NSW (62.8%). Just 5.1% of the housing stock in Muswellbrook LGA, 4.1% in Singleton LGA and 3.2% in Upper Hunter LGA comprised flats, units or apartments compared with 17.0% across NSW. Therefore, there are low levels of housing diversity across the relevant Hunter Valley LGAs compared with NSW (ABS 2011).

In the year to March 2016, the median sale price of houses in Muswellbrook LGA was $296,000. This was lower than the median sale price of houses across NSW ($430,000) for the same time period. It was also lower than the median sale price of houses in surrounding LGAs including Singleton ($436,000) and Upper Hunter ($305,000). Therefore, housing in Muswellbrook LGA is relatively affordable compared with surrounding LGAs and NSW (RP Data 2015).

iii Community issues

MCC operates a toll free 24-hour environmental contact line where community members can leave details about an enquiry or complaint. This contact line also helps MCC to identify and monitor community concerns, values and issues associated with the operation of the mine. In 2015, 50 complaints were received. This is an increase on the number of complaints received in previous years with less than 20 complaints received per year since 2009. In 2015, the most common concerns raised by the community were regarding odour from the mine (see Figure 7.11).

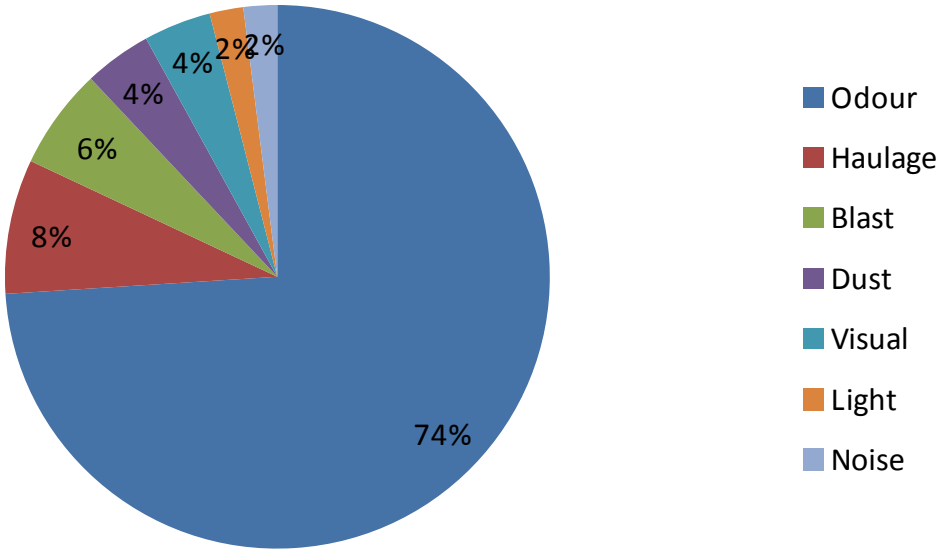


Figure 7.11 Community concerns regarding mine operations

7.8.4 Impact assessment

This section describes both the negative and positive social impacts associated with the continued operation of the mine.

i Workforce and employment

The modification would provide ongoing employment for up to 95 FTE workers plus contractors for up to an additional five years. The modification would also help to maintain flow-on employment from the mine through ongoing demand for goods and services by MCM and its employees. This, in turn, would provide continued economic stimulus to local businesses including hotel, cafes, restaurants and mining related services.

MCM employees largely reside in the Muswellbrook, Singleton and Upper Hunter LGAs. As discussed in Section 7.8.3i, these LGAs have experienced significant increases in unemployment in recent years, with unemployment increasing by approximately 10% over the last four years in the Muswellbrook LGA, largely as a result of the current mining downturn and job losses in the mining industry. Therefore, the provision of ongoing employment for mine workers represents a benefit of the modification to the local economy and community. Alternatively, if the modification is not approved mining at MCM would cease in 2018, and would likely to contribute to further increases in unemployment rates in the area.

The modification does not require any additional workers and therefore is not anticipated to generate any direct population growth in the Muswellbrook and surrounding LGAs. As a result, the modification would not create any additional pressure on local services, housing or infrastructure in the local area.

ii Amenity

MCM is located approximately 3 km north-east of Muswellbrook, the nearest major town, in a region currently characterised by mining, agricultural, rural residential and light industrial land uses. Due to the location of the mine, there is potential for amenity impacts on surrounding sensitive receptors related to visual, noise, dust and odour impacts.

The mine is generally well shielded from the local road network and adjacent residences by existing overburden emplacements, vegetation and the natural topography of the area. In addition, MCC undertake a program of progressive rehabilitation of disturbed areas. This assists in reducing the visual amenity impacts of the mine. To date, MCC has rehabilitated more than 360 ha of land which included establishment of a habitat corridor linking Bells Mountain and Skelletar Ridge. Further, the modification does not include a change in the approved height of the final landform. A visual assessment of the modification is provided in Section 7.6, and generally for the reasons outlined in this section, concluded that the incremental impact on visual amenity as a result of the modification would be negligible, with existing views from receptor locations remaining substantially the same.

The modification would result in increased noise impacts at sensitive receptors immediately north of current mine operations, predominantly due to emplacement of overburden into Open Cut 2. Six receptors would experience moderate noise impacts which would require mitigation and the remaining 28 assessed receptors would experience negligible or no impacts. All potential noise impacts from the modification have been assessed in Section 7.1 and relevant mitigation and management measures have been provided. These include an increase in regular attended noise monitoring from bi-annual to quarterly, or provision of noise mitigation measures at individual residences such as window glazing or installation of air conditioning.

The modification also has the potential to prolong existing air quality impacts from the operation of the mine such as odour and dust. However, the magnitude of impacts is not predicted to be significantly over and above that currently approved. In relation to air quality, there is a predicted exceedance of the 24-hour average PM_{10} criterion at one receptor to the north of the site for up to three days a year. For other receptors to the north and north-west of the site, it is predicted that there would be exceedance of the cumulative 24-hour average PM_{10} levels for one to three days a year. This is however would largely be due ambient air quality and may be influenced by quarry operations. Appropriate measures to manage this have been identified in the air quality assessment contained in Appendix F. For receptors to the south and west of the site, the predicted incremental and cumulative 24-hour average PM_{10} levels would meet relevant criterion.

As noted in section 7.7.3iii, the majority of complaints received by MCC from the local community last year were in relation to odour. The emission of odour from the site is as a result of spontaneous combustion. The modification would remove coal seams that are prone to spontaneous combustion which may assist in reducing potential odour impacts. In addition, MCM would continue to operate in accordance with MCM's spontaneous combustion management plan which aims to minimise the occurrence and manage the effects of spontaneous combustion during mining operations.

The groundwater assessment undertaken for the modification indicates that no registered bore users would be impacted as a result of the modification given that none are located within the estimated radius of groundwater impacts, as is currently the case with the approved operations.

It is important to note that the modification involves an extension of current mine operations that would enable maximisation of the operating life of the existing mine. Therefore, the modification would prolong existing amenity impacts from the current operation of MCM; impacts that are currently managed and mitigated through relevant management plans and procedures in place at the site. In addition, it would enable MCC to continue to meet the demand for thermal coal without the need to develop a greenfield site, thereby avoiding additional amenity impacts in an as yet undeveloped site.

iii Community benefits

MCM is a historic coal mine which has been operating in the community for more than 100 years. During this time, MCC has provided significant economic and social benefits to the local community. For example, in 2015 alone, MCC provided support to several organisations including:

- Westpac rescue helicopter;
- Muswellbrook High School;
- Muswellbrook Public School;
- Muswellbrook South Public School;
- St. James Primary School;
- Muswellbrook Christian School;
- Rotary Club of Muswellbrook;
- Hunter Research Foundation;
- Wybong Wild Dog Annual Support; and
- Hebden Wild Dog Support.

MCC has also contributed to the Upper Hunter Education Foundation to establish a scholarship to assist young people in regional areas attend university. MCC has also established an animal husbandry program with St Joseph's Aberdeen School whereby agricultural students are provided access to agricultural land to run cattle.

The modification would be of benefit the local community who would continue to benefit from the operation of the mine through ongoing contributions to local organisations and groups. This represents a positive impact to the community of continued operations at the mine.

iv Economic benefits

As discussed in Section 7.7, the modification would allow production of an additional 3.9 Mt of product coal, generating royalties and delivering a net social benefit of $18M (at present value) to NSW and Australia. The Project would also provide direct and indirect economic activity to the local, regional, State and national economies for up to five years. Flow-on economic activity would arise from production expenditure during operation of MCM, and expenditure of employees who mainly reside within the region; a benefit that would be enhanced in light of the current downturn in the mining sector.

7.8.5 Management and Monitoring

This section describes the mitigation measures that MCC propose to implement to address the potential social impacts that have been identified for the modification. These measures both enhance social opportunities and mitigate any negative impacts.

i Amenity

Visual, noise, odour and air quality impacts have the potential to affect the amenity of the local area. These impacts have been assessed and appropriate management and mitigation measures for these impacts have been provided in the relevant technical studies. Notwithstanding, MCC would continue to adhere to all conditions and restrictions imposed on the operation of the mine in order to minimise its impacts on amenity. In addition, MCC would continue to operate the mine in accordance with relevant management plans approved by MSC. These plans would be updated to reflect the modification where required. MCC would also continue its program of progressive rehabilitation which seeks to restore mined areas to their previous state including pasture and native vegetation.

ii Community engagement

MCC is committed to developing and maintaining strong relationships with all relevant stakeholders to the project. Therefore, MCC would continue to actively engage with the local community and affected individuals and groups. This would include the provision of regular updates through meetings, telephone contact and the environmental contact line.

The environmental contact line is advertised regularly in the Hunter Valley News and the Muswellbrook Chronicle. On receiving a complaint, MCC staff investigate the complaint, take action to reduce the impact if required, and report back to the complainant with the findings. The environmental complaint line is maintained and conducted in accordance with the EPL and development consent conditions.

MCC would also continue to operate its CCC, which meets on a quarterly basis and includes members from the public, MSC and MCC. The CCC is an independent committee which provides regular mine updates to the community. All minutes from CCC meetings are publically available on the MCM website.

7.8.6 Conclusion

The modification would provide ongoing employment for approximately 95 people plus contractors, for up to an additional five years. This would help to maintain economic activity in the local area through the provision of wages and indirect or flow-on employment opportunities during a time of downturn and job losses within the mining sector.

MCM is located in a predominately rural setting and has the potential to impact on local amenity through visual, noise, odour and air quality impacts. These impacts have been assessed in the relevant technical assessments and adequate mitigation measures have been identified to minimise these impacts. In particular, in relation to air quality and visual amenity no significant or limiting factors over and above that currently approved have been identified. Where incremental impacts have been identified such as in relation to noise, a mitigation strategy has been presented. Importantly, no changes are proposed to production levels, operation hours, transport or employee numbers.

MCC is committed to ongoing stakeholder consultation to keep local community members informed of the operation of the mine. Therefore, MCC would continue to operate its CCC and would undertake regular communication with stakeholders through meetings, telephone calls and the environmental contact line.

The modification would enable to continuation of employment and associated flow-on economic benefits of the current workforce at MCM by up to an additional five years; a significant benefit during the current mining downturn. It is expected that these social benefits would outweigh the negative social impacts to generate net positive benefits for the local community and economy.

7.9 Soils and land capability

7.9.1 Introduction

EMM assessed the soils and land and soil capability in the modification area (Appendix C). This chapter describes the existing soils environment including soil type and land and soil capability, and the potential impacts of the modification.

7.9.2 Existing environment

i Land use and topography

The modification area consists of rehabilitated pasture and woodland. Land uses surrounding MCM are a mix of agricultural activities, rural-residential, light industrial and special uses (ie correctional facility). Agricultural activities comprise grazing of beef cattle.

Elevation generally declines in a westerly direction from MCM, where the elevation on the flood plain adjacent to the Hunter River is approximately 150 m. Notable topographic features include Skelletar Ridge to the south of MCM (333 m) and the ridge to the east which includes Bells Mountain (690 m). Natural ground elevations within MCM range between 230 m and 260 m, while some rehabilitated areas exceed 300 m.

ii Soils

Soils in the modification area were sampled at five locations (Figure 7.12) and soil types determined under the *Australian Soil Classification Scheme* (Isbell 1996). The soil types were spolic anthroposols, which are man-made soils that have been moved by earthmoving equipment as a result of mining activities.

The physical and chemical characteristics of the soils at each survey site are summarised below:

1. Fine sandy loam across all depths. It was slightly plastic and non-sticky. Segregations and mottling was absent. The soil was highly saline, non sodic and neutral. Salinity and alkalinity increased with depth.

2. Fine sandy loam across all depths. It was slightly plastic and non-sticky. Segregation and mottling was absent. The soil was extremely saline, non sodic and neutral to mildly alkaline. Alkalinity and salinity did not correlate with depth.

3. Fine sandy loam across all depths. It was slightly plastic and non-sticky. Segregation and mottling was absent. The soil was highly saline after the first 0.1 m below ground surface (bgs), non sodic and neutral. Salinity increased with depth while alkalinity had no correlation.

4. Fine sandy loam across all depths. It was slightly plastic and non-sticky. Segregation and mottling was absent. The soil was extremely saline, non sodic and strongly acidic. Acidity and salinity did not correlate with depth.

5. Sandy clay loam transitioning to clayey sand at depth. Segregation and mottling was absent. The soil was saline, non sodic and mildly alkaline or moderately alkaline. Salinity slightly increased with depth while alkalinity had no correlation.

iii Land and soil capability

LSC was assessed in accordance with *Land and soil capability assessment scheme* (OEH 2012). The process comprises comparison of the soils and landscape characteristics determined during soil surveys against eight limitation/hazard criteria (water erosion, wind erosion, soil structural decline, soil acidification, salinity, waterlogging, shallow soils and rockiness and mass movement) to allocate land to classes based on limitations or hazards. There are eight classes which range from extremely high capability land (Class 1) to extremely low capability land (Class 8).

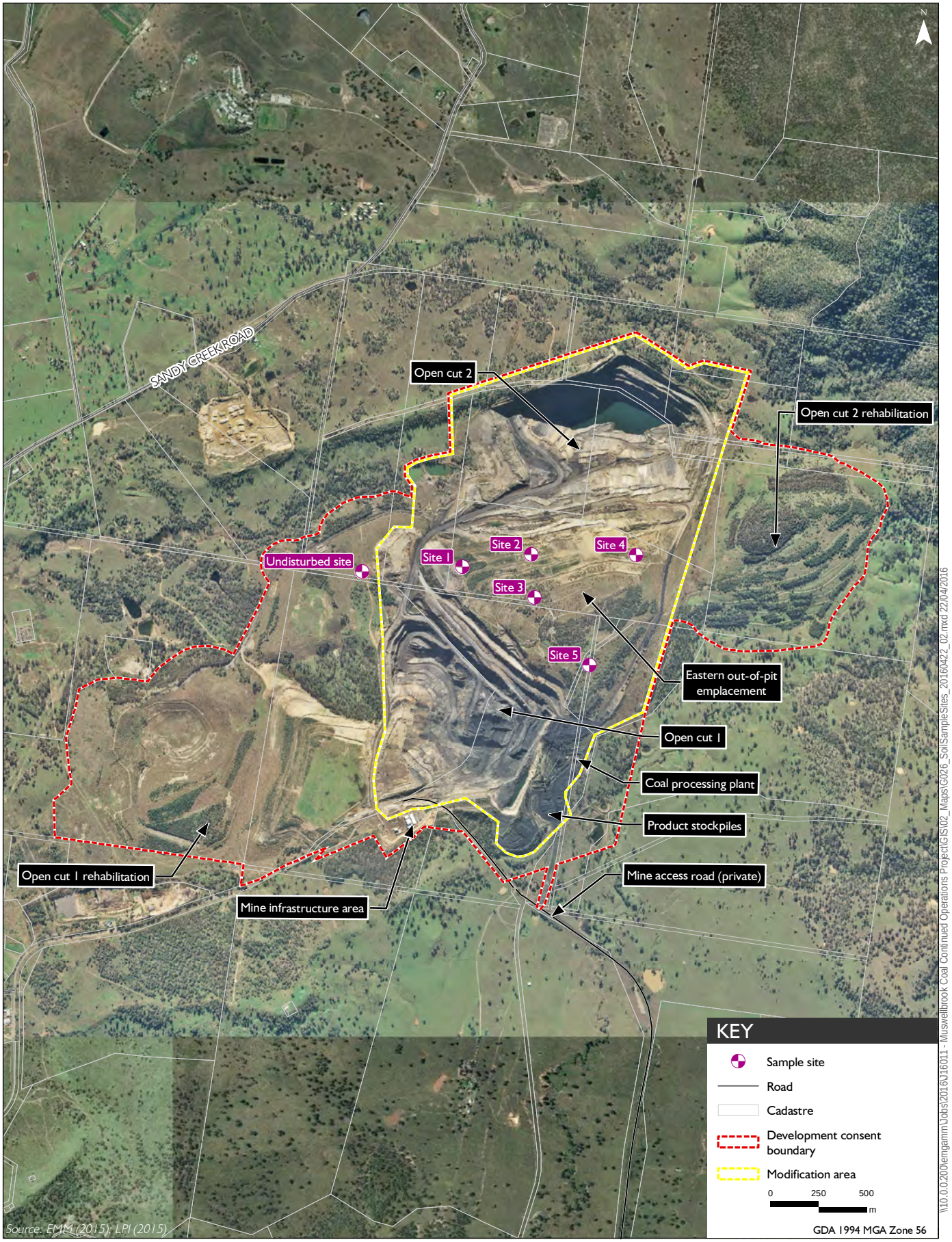
The survey sites were determined to be LSC Class 6 (low capability land), which is most suited for grazing, forestry and conservation.

iv Inherent soil fertility

The inherent soil fertility (Stace et al 1968) classes range from low (1) soil fertility through to moderately high (4) fertility. NSW mapping shows that all soils in the modification area have a moderately low (2) fertility.

v Biophysical strategic agricultural land

Biophysical strategic agricultural land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. As of March 2016, the modification area is not formally recognised by the NSW Government as potential BSAL (DPI 2016).



Soil survey locations

Muswellbrook Coal Continued Operations Project
Statement of Environmental Effects
Figure 7.12

7.9.3 Impact assessment

No disturbance of previously undisturbed soils is proposed. Soils in the modification area are spolic anthroposols, which are manmade. As described in Section 4.5, the partially completed rehabilitated dump in the modification area would be rehabilitated to similar to its current condition, which would include the spolic anthroposols soil type. The remainder of the modification area is subject to mining operations, but would also comprise the spolic anthroposols soil type once rehabilitated.

i Potential acid generating material

The potential for acid generation from the topsoil and subsoil (regolith) within the modification area is low. Acid sulphate soil, which is the main cause of acid generation within the soil mantle, is commonly found less than 5 m above sea level. There has been little history of acid generation from regolith material from the Muswellbrook area.

Water quality in the mine water management system is regularly tested, with mine water exhibiting relatively neutral pH levels.

ii Strategic agricultural land

As described in Section 1.1.5, there is no BSAL in the modification area. Therefore, the modification would not impact BSAL.

iii Land and soil capability

The current land and soil capability of the modification area is Class 6, which is low capability land capable of sustaining grazing, forestry and conservation activities. As described in Section 4.4 and 4.5, the modification area would be rehabilitated to a combination of pasture and native vegetation.

7.9.4 Management and monitoring

Management of land and soil capability would continue to be in accordance with the MOP and relevant management plans. These plans have been developed in accordance with industry best practice with consideration given to the range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks.

These plans include management and monitoring strategies which would continue to be implemented under the modification to achieve the desired post-mining land capability outcomes.

Successful landform design in sympathy to the surrounding landscape would be centred on sustainable water management and erosion control using micro relief. Where possible, landform features such as ridges would be extended particularly where this allows for rainfall runoff to follow natural drainage line features in the landscape to maximise overland flow, reducing the overall velocity of runoff and avoiding the need for bench and drop structures.

Existing rehabilitation areas utilise traditional water management structures including a series of contour banks, rock rip rap drop structures and sediment dams to manage surface water runoff. Where these areas appear stable, the existing water management structures shall be maintained and incorporated into the final landform design. Surface water shall continue to be managed in accordance with relevant management plans.

7.9.5 Conclusion

Land classed as LSC Class 6 would be temporarily removed during the term of mining in the modification area. This would not result in long term impacts as the land would be rehabilitated to the same LSC class following completion of mining. The soils in the modification area would remain spolic anthroposols once rehabilitated.

The modification is not predicted to result in an overall change in the LSC classes of the final landform.

7.10 Other matters

The modification would have a minimal or negligible effect on a number of environmental matters which have been addressed in Table 7.21.

Table 7.21 Consideration of other matters

Matter	Consideration
Indigenous and non-Indigenous heritage	The modification involves the extension of mining in Open Cut 1 into a partially rehabilitated area formerly used an overburden emplacement area. This area has been extensively disturbed as part of historical mining operations. Accordingly, no impacts to Indigenous or non-Indigenous heritage are predicted.
Traffic and transport	The modification would not result in changes to the approved volumes of coal produced or transported from MCM.
Waste management	The modification would not generate any new waste streams. The existing waste management procedures would continue to be implemented in accordance with MCC's (2015) Waste management plan. Waste streams would continue to be segregated and removed from site by licensed waste contractors.

8 Justification and conclusion

8.1 Introduction

This chapter considers the modification against the relevant provisions of section 79C and objects of the EP&A Act, and provides a justification for its approval.

8.2 Site suitability

MCM is an existing mine which has successfully operated since 1907 and continues to do so within its existing mining authorities and development consent boundary. The modification represents a logical continuation of the approved mining sequence to facilitate the extraction of mineable coal from a known resource that would otherwise be sterilised with the expiry of approved operations under Development Consent No. DA 205/2002. The modification would use the approved workforce, infrastructure and equipment and the same mining methods to produce the same maximum levels of annual coal production. Mining operations would also continue to be within the approved development consent boundary.

8.3 Public interest

The continuation of operations at MCM is considered to be in the public interest due to:

- the continuation of employment of the MCM workforce;
- the continued economic benefits to the Muswellbrook community in terms of indirect economic impacts; and
- the broader economic benefits to the State of NSW from indirect benefits and taxes and royalties which would be derived.

As described in Section 7.7, the modification would contribute annual incremental values to the regional economy for up to three years of:

- $155 M in annual direct and indirect regional output or business turnover;
- $57 M in annual direct and indirect regional value added;
- $16 M in annual direct and indirect household income; and
- 204 direct and indirect jobs.

The modification would allow production of an additional 3.9 Mt of product coal, generating minimum total royalties (at present value) of $18 M to NSW and Australia. The net social benefit to Australia and NSW of a minimum of $18 M means that the modification is desirable and justified from an economic efficiency perspective.

8.4 Environmental, social, economic and built environment

The potential environmental, social and economic impacts and impacts on the built environment have been assessed in this SEE. The modification involves continued implementation of MCM's existing suite of environmental management plans and monitoring network. The impacts of the modification are described in Chapter 7.

8.5 Objects of the Environmental Planning and Assessment Act 1979

The relevant objects of the EP&A Act are presented below, followed by a discussion on their application with regard to the modification.

(a) to encourage

(i) 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.

The modification represents a logical continuation of operations at MCM which would maximise the efficiency of resource extraction from an area that has already been highly disturbed by mining activities. The changes to the shaping of the final landform would also have positive outcomes for the size and shape of the final void, which would be shallower than the approved final landform due to the emplacement of additional waste from mining of the additional resources.

The modification would enable the continued employment of approximately 75 full time people, plus additional contractors. Positive direct and in-direct (or flow-on) socio-economic impacts would arise as a consequence of continued employment, revenue contributions at a local, regional, state and national level, and community support.

The potential environmental impacts associated with the modification would be managed in accordance with MCM's development consent and the additional commitments identified in Chapter 7 of this report.

As substantiated above, the modification encourages the proper management and development of a natural resource for the purpose of promoting the social and economic welfare of the community and a better environment.

(ii) the promotion and co-ordination of the orderly and economic use and development of land

The modification is a minor alteration to an approved coal mine operation which represents an orderly and economic use of a resource approved for extraction for export uses and use in domestic power generation. The modification would not impinge on land uses within and surrounding MCM.

(vi) 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 modification would result in clearing of partially completed rehabilitation (estimated 45.2 ha) within the modification area. This would not significantly impact on native animals and plants, including threatened species, populations and ecological communities and their habitats.

(vii) 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. The consistency of the modification with each of these principles is discussed below.

Precautionary principle:

The precautionary principle, in summary, holds that if there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The modification has been assessed for impacts relating to noise, vibration and blasting, soil and land resources and rehabilitation, visual, social, biodiversity, air quality including spontaneous combustion management, GHG, economics, and surface and ground water resources. This SEE, combined with the consultation undertaken with relevant government agencies, has enabled MCC to understand the potential implications of the project and subsequently confirm the mitigation measures required.

Inter-generational equity:

The principle of inter-generational equity puts an onus on society to ensure that the health, diversity and productivity of the environment are maintained, or enhanced, for the benefit of current and future generations. The modification has negligible potential to adversely affect the health, diversity or productivity of the environment and, therefore, would not adversely impact the current or future generations. The management practices and mitigation measures identified in Chapter 7 together with the existing suite of environmental management plans identified in Section 3.13 would minimise the risk of project resulting in a significant impact or risk to the local environment or surrounding populace. These measures would assist in ensuring that current and future generations can enjoy equal and equitable access to social, environmental and economic resources.

Conservation of biological diversity and maintenance of ecological integrity:

The modification does not pose a significant threat to local biological diversity or ecological integrity. The modification would occur within the approved development consent boundary in areas previously disturbed by mining activities. Management practices and mitigation measures would be implemented to manage potential impacts to the surrounding environment.

Improved valuation and pricing of environmental resources:

The cost associated with using or impacting upon an environmental resource is seen as a cost incurred to protect that resource. The application of this principle remains in its infancy and, to date, there are few widely accepted methods by which monetary values are attributed to environmental factors.

Continued operation of MCM in accordance with its development consent is logical and orderly and would maximise extraction of coal resources. Furthermore, positive outcomes would be realised for the design of the final landform, in which the final void sizes and depth would be reduced consistent with relevant local policies.

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

The preparation of this SEE has involved engagement with relevant State and local government bodies as described in Chapter 4.

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The CCC has been consulted during the preparation of the SEE through the provision of briefing information, and would continue to be involved and consulted through the quarterly CCC meetings. The community would also have the chance to comment on the application during the public exhibition process.

8.6 Conclusion

The modification is considered to be substantially the same development as that which is approved. The modification, while involving changes to the conceptual mine plan and life of mine, maintains the existing development consent boundary, maximum production rate of 2 Mtpa of coal, the mining method, and equipment fleet. There are no changes to the approved maximum level of overburden emplacement. Other operational methods relating to water management, waste management and handling, coal transport, access to site and employee numbers would also remain unchanged.

The continuation of operations at MCM is considered to be in the public interest due to:

- the continuation of employment of the MCM workforce;
- the continued economic benefits to the Muswellbrook community in terms of indirect economic impacts; and
- the broader economic benefits to the State of NSW from indirect benefits and taxes and royalties which would be derived.

The modification is considered to be justified on the basis of environmental, social, and economic grounds.

References

ABC News. (2015, September 30). *Mining industry unemployment soars*. Retrieved from http://www.abc.net.au/news/2015-09-30/mining-industry-unemployment-soars/6815406

ABC News 2015, 'Mining industry unemployment soars', *ABC News Online,* 30 September.

Australian Bureau of Statistics (ABS) 2011, *Census of Population and Housing 2011,* Australian Government.

Australian Bureau of Statistics (ABS) 2013, *Socio-economic Indexes for Areas (SEIFA), 2011*, Australian Government.

Australian Bureau of Statistics (ABS) 2015a, *National Regional Profile, 2009-2013,* Australian Government.

Australian Bureau of Statistics (ABS) 2015b, *Regional population growth, Australia*, Australian Government.

Australasian Groundwater & Environmental Consultants Pty Ltd (AGE) 2010, *Muswellbrook Coal Mine Development Consent Modification Groundwater Impact Assessment Project G1504*. Report prepared by AGE for MCC.

Australian and New Zealand Environment Council (ANZEC) 1990, *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*.

Department of Employment 2015, *Small Area Labour Markets – December Quarter 2015,* Australian Government.

Department of Planning and Environment (DP&E) 2014, *New South Wales State and Local Government Area Population, Household and Dwelling Projections: 2014 Final,* NSW Government.

Department of Mineral Resources 1999, *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales,* NSW Government.

EcoLogical Australia 2016, 2015 Rehabilitation Monitoring Reporting, MCC.

EMM Consulting Pty Limited (EMM) 2016, *Noise and Vibration Assessment*. Report prepared by EMM for MCC.

Hansen Bailey 2009, *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects.* Report prepared by Hansen Bailey for Muswellbrook Coal Company Limited.

Hansen Bailey 2010, *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects*. Report prepared by Hansen Bailey for Muswellbrook Coal Company Limited.

Hansen Bailey 2013a, *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects.* Report prepared by Hansen Bailey for Muswellbrook Coal Company Limited.

Hansen Bailey 2013b, *Muswellbrook Coal Mine Development Consent Modification Statement of Environmental Effects.* Report prepared by Hansen Bailey for Muswellbrook Coal Company Limited.

HLA-Envirosciences Pty Limited 2002, *No. 1 Open Cut Extension Environmental Impact Statement*. Report prepared by HLA-Envirosciences for MCC.

Isbell RF 2002, *The Australian soil classification, CSIRO Publishing, Melbourne.*

Muswellbrook Shire Council (MSC) 2013, *Land Use Development Strategy,* MSC.

Muswellbrook Coal Company Limited (MCC) 2015a, *Noise Management Plan*.

Muswellbrook Coal Company Limited (MCC) 2015b, *Blast-Vibration Management Plan*.

NSW Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy*, NSW Government.

NSW Department of Environment, Climate Change and Water (DECCW) 2011, *NSW Road Noise Policy*, NSW Government.

NSW Government 2004, *Managing Urban Stormwater: Soils and Construction, Volume 1: Blue book*, NSW Government.

NSW Department of Environment and Climate Change (DECC) 2008, *Managing Urban Stormwater: Soils and Construction, Volume 2E: Mine and Quarries,* NSW Government.

NSW Department of Land and Water Conservation (DLWC) 2002, T*he NSW State Groundwater Dependent Ecosystem Policy*, NSW Government.

New South Wales Office of Environment and Heritage (NSW OEH) 2012a, *The land and soil capability scheme; second approximation*. Prepared by NSW OEH.

New South Wales Department of Planning and Environment (DPI) 2016, *Biophysical strategic agricultural land maps*, accessed 25 February 2016, http://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/Safeguarding-our-Agricultural-Land.

OEH 2012, *Greater Huner Native Vegetation Mapping.*

Parsons Brinckerhoff 2005, *Section 96(1A) Application to Modify Development DA 205/2002.* Report prepared by Parsons Brinckerhoff for Muswellbrook Coal Company Limited.

RP Data 2015, Property Value, viewed 15 March 2016, http://www.propertyvalue.com.au/

SLR 2015 *630.11194D3 MCC Surface Water Study*. Report prepared by SLR for MCC.

SLR 2016a, *630.11575 MCC Continuation Project Surface Water Impact Assessment*. Report prepared by SLR for MCC.

SLR 2016b, *630.11575 MCC Continuation Project Groundwater Impact Assessment*. Report prepared by SLR for MCC.

Appendix A

Particulars of the land to which the modification applies

A

Appendix B

Rehabilitation and closure strategy

B

Appendix C

Soil resources assessment

C

Appendix D

Biodiversity assessment

D

SYDNEY
Ground Floor, Suite 1, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 5, 21 Bolton Street
Newcastle NSW 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Level 4, Suite 1, 87 Wickham Terrace
Spring Hill Queensland 4000
T 07 3839 1800 F 07 3839 1866