



HUMECOAL
PROJECT



VOLUME 1

Hume Coal Project
Environmental Impact Statement
Main Report

Prepared for Hume Coal Pty Limited
March 2017



VOLUME 1 Main Report

VOLUME 2 Appendices A to C

Appendix A Schedule of lands
Appendix B Secretary's Environmental Assessment Requirements
Appendix C Study team

VOLUME 3A Appendix D

Appendix D Berrima Rail Project Environmental Impact Statement
— Main report
— Appendices A to D

VOLUME 3B Appendix D

Appendix D Berrima Rail Project Environmental Impact Statement
— Appendices E to H

VOLUME 3C Appendix D

Appendix D Berrima Rail Project Environmental Impact Statement
— Appendices I to J

VOLUME 3D Appendix D

Appendix D Berrima Rail Project Environmental Impact Statement
— Appendices K to M

VOLUME 4A Appendix E

Appendix E Water Impact Assessment Report
— Main report
— Appendices A to E

VOLUME 4B Appendix E

Appendix E Water Impact Assessment Report
— Appendices F to O

VOLUME 5 Appendices F and G

Appendix F Soil and Land Assessment Report
Appendix G Agricultural Impact Statement

VOLUME 6 Appendix H

Appendix H Biodiversity Assessment Report

VOLUME 7 Appendices I to L

Appendix I Noise and Vibration Assessment Report
Appendix J Health Impact Assessment Report
Appendix K Air Quality and Greenhouse Gas Assessment Report
Appendix L Subsidence Assessment Report

VOLUME 8 Appendices M to O

Appendix M Traffic and Transport Assessment Report
Appendix N Visual Amenity Assessment Report
Appendix O Rehabilitation and Closure Strategy

VOLUME 9 Appendices P to R

Appendix P Hazard and Risk Assessment Report
Appendix Q Economic Impact Assessment Report
Appendix R Social Impact Assessment Report

VOLUME 10 Appendices S to U

Appendix S Aboriginal Cultural Heritage Assessment Report
Appendix T Statement of Heritage Impact
Appendix U Site Verification Certificate



DECLARATION

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979*

EIS prepared by

Paul Mitchell, OAM

Director

BA, MRegPlan, MAppSc, FPIA

Nicole Armit

Associate Environmental Engineer

BEnvEng, MEnvLaw

Mark Roberts

Senior Environmental Scientist

BEnvSc, PGDipEnv, PGDip
Bushfire Protection

EMM Consulting Pty Ltd

Ground Floor, 20 Chandos Street

St Leonards NSW 2065

PO Box 21

St Leonards NSW 1590

Applicant

Hume Coal Pty Limited

7/8 Clarence House

9 Clarence Street

Moss Vale NSW 2577

Proposed development

Hume Coal Project

Refer to Chapter 2 of this EIS for a description of the proposed development

Land to be developed

Refer to Appendix A of EIS

Declaration

We confirm that we have prepared this EIS in accordance with the Secretary's environmental assessment requirements issued for the Hume Coal Project on 20 August 2015 and supplementary Secretary's environmental assessment requirements issued 18 January 2016 and that the:

- EIS has been prepared in accordance with Schedule 2 of the EP&A Regulation 2000;
- EIS contains all available information that is relevant to the environmental assessment of the proposed development; and
- information in the EIS is neither false or misleading.



Paul Mitchell
8 March 2017



Nicole Armit
8 March 2017



Mark Roberts
8 March 2017



Hume Coal Project

Environmental Impact Statement

Prepared for Hume Coal Pty Limited | 8 March 2017

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

T +61 2 9493 9500

F +61 2 9493 9599

E info@emmconsulting.com.au

www.emmconsulting.com.au

Hume Coal Project

Final

Report J12055RP1 | Prepared for Hume Coal Pty Limited | 8 March 2017

Prepared by	Mark Roberts	Nicole Armit	Approved by	Paul Mitchell
Position	Senior Environmental Scientist	Associate Environmental Engineer	Position	Director
Signature			Signature	
Date	8 March 2017	8 March 2017	Date	8 March 2017

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

© Reproduction of this report for educational or other non-commercial purposes is authorised without prior written permission from EMM provided the source is fully acknowledged. Reproduction of this report for resale or other commercial purposes is prohibited without EMM's prior written permission.

Document Control

Version	Date	Prepared by	Reviewed by
1	18 November 2016	Mark Roberts and Nicole Armit	Paul Mitchell
2	29 November 2016	Mark Roberts and Nicole Armit	Paul Mitchell
3	8 March 2017	Mark Roberts and Nicole Armit	Paul Mitchell



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

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

www.emmconsulting.com.au



Executive summary



Executive Summary

ES1 Introduction

Hume Coal Pty Limited (Hume Coal) is seeking development consent for a State significant development project (SSD 7172) - the construction and operation of the Hume Coal Project (the project), an underground coal mine and associated mine infrastructure in the Southern Coalfield of New South Wales (NSW). The mine will produce metallurgical coal with a secondary thermal coal product. Around 50 million tonnes (Mt) of run-of-mine coal will be extracted from the Wongawilli Seam, resulting in approximately 39 Mt of saleable coal over a project life of 23 years. The product split will be about 55% metallurgical coal and 45% thermal coal.

Hume Coal is a wholly-owned subsidiary of POSCO Australia (POSA), the Australian subsidiary of POSCO. POSCO is a leading multinational steel manufacturer and one of the largest buyers of Australian coal and iron ore. Hume Coal acquired Authorisation 349 (A349) in December 2010, and began exploration drilling in May 2011. Since then the project has evolved progressively following detailed geological, engineering, environmental, financial and other technical investigations to define the mineable resource; and to address identified environmental and technical constraints. The project has been designed to extract coal efficiently within identified environmental constraints, while minimising adverse environmental impacts. The large investment proposed to construct and operate the project will provide substantial economic stimulus and benefits to the Australian, NSW and local economies.

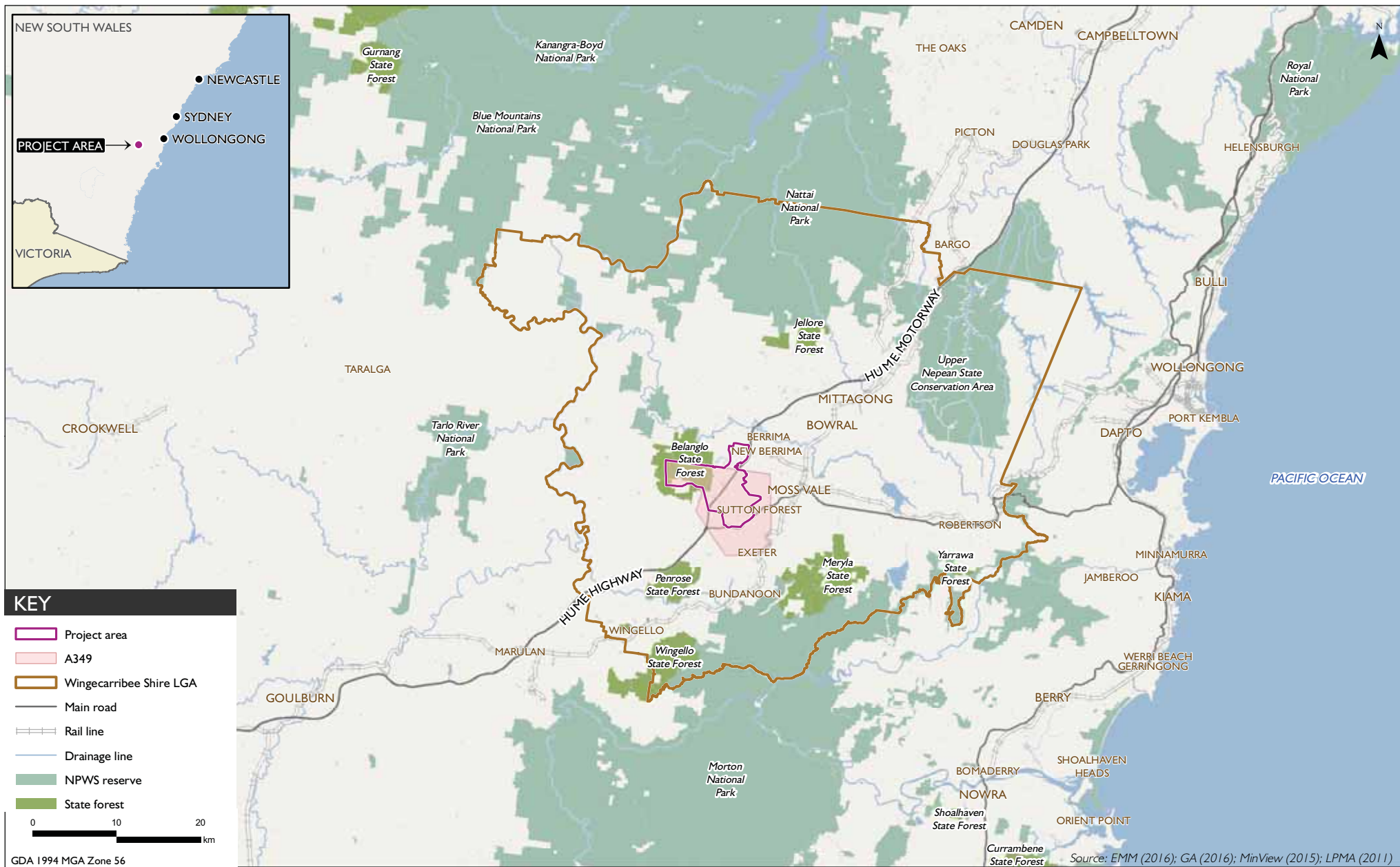
In designing the project particular attention has been given to avoiding potential environmental impacts wherever possible, or otherwise minimising them. A low impact, first workings mining system will be used that will leave pillars of coal in place so that the overlying strata are supported, rather than collapsing into the mined-out void. Therefore surface subsidence impacts will be negligible. By minimising disruption to the overlying strata, associated groundwater impacts will also be minimised. The surface facilities and infrastructure have been designed specifically to avoid areas of environmental value, and to minimise off-site impacts as far as practicable.

Product coal will be transported by rail, mainly to Port Kembla Coal Terminal for export, and possibly to domestic customers depending on market demand. Rail works, including construction and use of a new rail loop and rail line connected to the existing Berrima Branch Line, form a separate development application (the Berrima Rail Project, SSD 7171).

ES2 Project area

The project area is in the Southern Highlands region of NSW, approximately 100 kilometres (km) south-west of Sydney in the Wingecarribee Local Government Area (LGA). The mine surface infrastructure area will be around 7 km north-west of the Moss Vale town centre (see Figure ES1). The project is also located in the Southern Coalfield which is one of the Sydney-Gunnedah Basin's five major coalfields. The Southern Coalfield is the only coalfield in NSW which is a major source of hard metallurgical (or coking) coal used in steel production (Department of Planning 2008).

The project area, comprising the surface infrastructure area and underground mine footprint, covers approximately 5,051 ha. The vast majority of this is freehold land, covering around 5,039 ha, of which 1,253 ha is owned by Hume Coal and its subsidiaries. Hume Coal's total landholding within the local area is approximately 1,765 ha, some of which is outside the project area. The north-western portion of the project area is in the Belanglo State Forest, which includes both plantation radiata pine and native forest and is controlled by the Forestry Corporation of NSW. Belanglo State Forest covers approximately 1,296 ha within the project area (see Figure ES2). Over half of the project area comprises cleared freehold land that is, and will continue to be, used for livestock production, cropping and small-scale farm businesses.

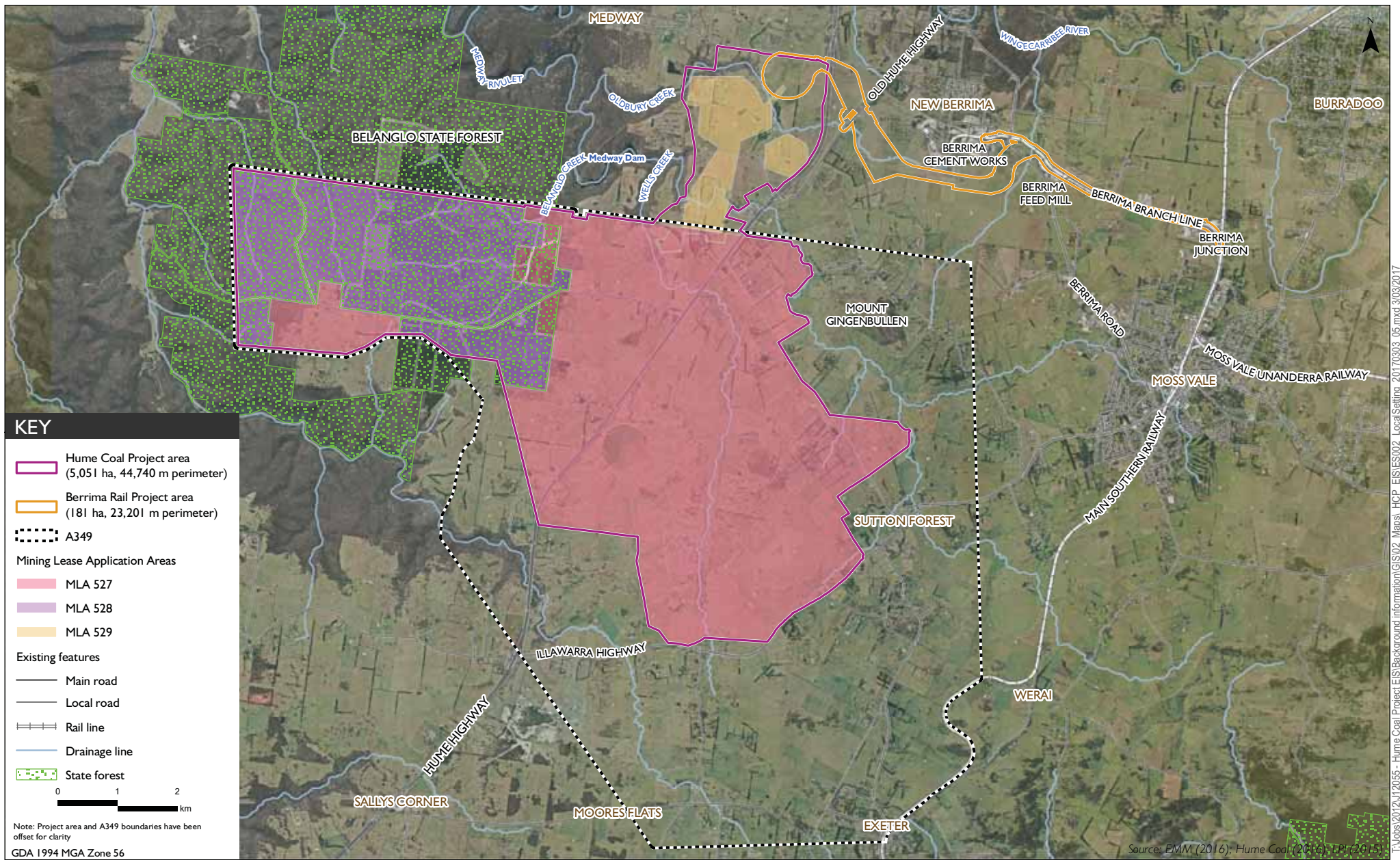


T:\Jobs\2012\12065 - Hume Coal Project EIS\Background information\GIS02_Maps_HCP_EIS\ES001_SiteLocation_20170201_03.mxd 10/2/2017

Regional context

Hume Coal Project
Environmental Impact Statement

Figure ES1



Local context

Hume Coal Project
Environmental Impact Statement
Figure ES2

Approximately 117 ha, or 2%, of the project area will be occupied by the mine surface infrastructure area and associated facilities, on land owned by Hume Coal. The proposed location of the surface infrastructure area was carefully chosen following evaluation of a number of alternatives. The surface infrastructure is located on mainly cleared land, and was sited where the topography will shield much of the infrastructure from public view insofar as is possible. Above the underground mine, the only material surface disturbance will be drilling sites, ventilation infrastructure, mine access points and access tracks linking various facilities. These will generally be on Hume Coal owned or controlled land, or land where an access agreement is in place with the landowner.

ES3 Project overview

The key aspects of the project are summarised below.

- Ongoing resource definition activities, along with geotechnical and engineering testing and other fieldwork to enable detailed design.
- Establishment of temporary construction offices and a temporary construction accommodation village.
- Development and operation of an underground coal mine, involving approximately two years of construction and 19 years of mining, followed by closure and rehabilitation occupying up to two years, leading to a total project life of 23 years. Some coal extraction will commence during the second year of construction and hence there will be some overlap between the construction and operational phases.
- Extraction of approximately 50 Mt of run-of-mine (ROM) coal from the Wongawilli Seam, at a rate of up to 3.5 million tonnes per annum (Mtpa). Low impact mining methods will be used resulting in negligible subsidence impacts.
- Following processing of ROM coal in the coal preparation plant (CPP), production of up to 3 Mtpa of metallurgical and thermal coal for sale to international and domestic markets.
- Construction and operation of associated mine infrastructure, mostly on cleared land, including:
 - one personnel and materials drift access and one conveyor drift access from the surface to the coal seam;
 - ventilation shafts, comprising one upcast ventilation shaft and fans, and up to two downcast shafts installed over the life of the mine, depending on ventilation requirements as the mine progresses;
 - a surface infrastructure area, including administration, bathhouse, washdown and workshop facilities, fuel and lubrication storage, warehouses, laydown areas, and other facilities. The surface infrastructure area will also include the CPP and ROM and product coal stockpiles, and coal reject handling infrastructure and a temporary (emergency) reject stockpile;
 - surface and groundwater management and treatment facilities, including storages, pipelines, pumps and associated infrastructure;
 - overland conveyors;
 - rail load-out facilities;
 - a small explosives magazine;
 - ancillary facilities, including fences, access roads, car parking areas, helipad and communications infrastructure; and
 - environmental management and monitoring equipment.

- Establishment of site access from Mereworth Road, and construction of minor internal roads.
- Relocation of some existing utilities.
- Coal reject emplacement underground in the mined-out voids.
- Peak workforces of approximately 414 full-time equivalent employees during construction and approximately 300 full-time equivalent employees during operations.
- Decommissioning of mine infrastructure and rehabilitating the area once mining is complete, so that it can support land uses similar to current ones.

Three separate approvals will be required under the EP&A Act for the Hume Coal mine to operate. Hume Coal is therefore seeking:

- development consent for the mine and associated facilities (SSD 7172, the project the subject of this EIS) under Part 4, Division 4.1 of the EP&A Act;
- development consent for the construction and use of a new rail spur and loop (the Berrima Rail Project, the subject of a separate development application (SSD 7171) under Part 4, Division 4.1 of the EP&A Act; and
- an activity approval for proposed electricity supply works under Part 5 of the EP&A Act from Endeavour Energy.

Therefore, in addition to the application for the Hume Coal Project, separate applications will be made by Hume Coal under Part 4 of the EP&A Act for the rail works, which are broadly described in Section 2.9, and under Part 5 of the EP&A Act for the electricity supply works, which are broadly described in Section 2.12.

All three projects are inextricably linked, in that one will not be developed without the other two. Approval for the three projects is being sought separately and in parallel, and construction will occur concurrently.

Separate development consent is being sought for the Hume Coal Project and the Berrima Rail Project because the rail infrastructure will be used by others in addition to Hume Coal. The Berrima Branch Line, to which the Hume Coal rail line will be connected as part of the Berrima Rail Project, is owned by Boral Cement Ltd (Boral) and is currently used by Boral to transport material to and from the Berrima Cement Works. It is also used by Inghams Enterprises Pty Limited (Inghams) to carry goods to its feed mill east of the cement works, and by Omya (Australia) Pty Ltd (Omya) to haul material to their Moss Vale plant at the Berrima Junction. The rail project has therefore been separated from the Hume Coal Project so that the Hume Coal mine development consent, if granted, will not apply to the rail line.

ES4 Impact assessment

Thorough assessments of all potential environmental impacts associated with the project have been undertaken and where material impacts were identified the project design was amended to address them. Consequently, it is not anticipated that the proposed project will cause any significant adverse impacts to the local environment or community. The findings of the detailed environmental assessments are given in the body of this EIS and the appendices. The following sub-sections provide an overview of the main findings; however, to gain a proper understanding of the project, the detailed assessments should be read in their entirety.

ES4.1 Water resources

Water-related technical studies included development of a water balance and numerical groundwater model for the project, and assessments of surface water quality, surface water flow and geomorphology, flooding, groundwater and hydrogeochemistry.

An iterative process was adopted for the design of the project's water management system, which meant it periodically incorporated new information from baseline monitoring and early model outputs, along with results of surface water and groundwater modelling. Two water sharing plans (WSPs) apply to the project area; the *Water Sharing Plan for the Greater Metropolitan Region, Unregulated River Water Sources 2011* (Metropolitan surface water WSP), and the *Water Sharing Plan for the Greater Metropolitan Region, Groundwater Sources 2011* (Metropolitan groundwater WSP). Relevant provisions of these WSPs have been incorporated into the project's water management system.

The resulting mine design and associated water management system will minimise water take, conserve and reuse water, minimise evaporation losses, and minimise the potential for managed release of water to surface water systems. The system is based on diverting clean water around the surface disturbance areas, retaining water that falls within disturbed areas on site for recycling and reuse, and injecting groundwater into sealed voids after coal extraction is complete enabling a faster groundwater recovery rate and reduced drawdown. The water management system also minimises evaporation losses by storing excess water in underground voids to accelerate the groundwater recovery time and/or for use in operations.

An extensive baseline data set informed the assessment of project related surface water and groundwater impacts. A surface water quality and flow monitoring network was established in and around the project area, providing baseline data over four years (2012 – 2016, inclusive). Installation of the groundwater monitoring network occurred between September 2011 and October 2014, and includes 54 groundwater monitoring bores at 22 locations, 11 vibrating wire sensors within three piezometers, and three landholder bores.

ES4.1.1 Surface water

The project area is located mostly within the catchment of the Wingecarribee River which is part of the Upper Nepean and Upstream Warragamba Water Source.

The primary objectives of the project's water management system will be to reuse water and minimise the potential for managed releases to surface waters. The water management system has been designed to reuse as much mine water as possible, with it first being used to meet operational demands. If demand cannot be fully met from water handled by the mine's water management system, supplies will be supplemented by groundwater from the sealed underground mine voids. Surface water runoff from areas of the site in direct contact with coal will be fully contained to prevent discharge of this water to local waterways.

During the construction phase, sediment dams will be constructed based on the recommended criteria in the guidelines *Managing Urban Stormwater - Soils and Construction - Volume 2E Mines and Quarries* (Landcom 2004), and will be managed to achieve a neutral or beneficial effect (NorBE) on the receiving environment.

During operations, the overarching water management philosophy involves the following:

- Runoff from undisturbed areas will be diverted around or away from the infrastructure into natural watercourses via clean water diversion drains.
- Runoff from disturbed areas within the mine infrastructure footprint will be directed to stormwater basins (SBs), mine water dams (MWDs) and the primary water dam (PWD) for storage and reuse.
- Runoff from areas where there is a low risk of coal contact (ie runoff from areas that do not contain coal stockpiles or processing plant but that could contain small amounts of coal due to mine vehicle traffic) may be discharged to local creeks but only after the "first flush" has been diverted into storage and reuse dams, and monitoring shows that post first flush runoff is of an acceptable quality to discharge.
- Runoff from areas where there is a low risk of coal contact that does not meet the adopted first flush criteria will be transferred to the PWD for storage.

- Sewage from the administration and workshop area will be treated and reused on site. Grey water will be subject to primary treatment and used for drip irrigation of landscaped areas. Black water will be subject to tertiary treatment and harvested for reuse in the CPP.

Strategies for managing surplus water are as follows:

- releases from areas where there is a low risk of coal contact (captured by stormwater basins) to Oldbury Creek after first flush runoff collection and water quality monitoring parameters are met;
- pumping to underground sealed panels; and
- storage in the primary water dam.

Treatment and release to Oldbury Creek was also considered as an option for managing surplus water, although water balance modelling demonstrates this strategy will not be required. However, if climatic conditions (rainfall) increase beyond the range of conditions experienced over the last 117 years, treatment and release to Oldbury Creek may be required for those years where surpluses occur.

The project's impacts on surface water resources will be minimal. All potential impacts to surface water users and stream environments have been assessed as insignificant in accordance with the *Significant impact guidelines* (DoE 2013).

There will be a minimal reduction, of approximately 94.2 ha (0.8%), of the total catchment of Medway Rivulet (including Oldbury Creek) in which the surface infrastructure area will be located. This reduction in catchment area will have almost imperceptible consequences.

During both construction and operations, the potential concentrations of water quality parameters in Oldbury Creek, including total suspended solids and nutrient loads, show discharge from sediment basins, stormwater basins and other sediment control measures will be consistent with the Sydney Catchment Authority's Neutral or Beneficial Effect (NorBE) criteria.

Changes in flood levels as a result of the project on land not owned by Hume Coal are minor or negligible, and will be acceptable with reference to applicable criteria in the NSW Floodplain Development manual (the Floodplain Manual DIPNR 2005). Similarly, changes to flood peak velocities will be acceptable when compared to criteria in the Floodplain Manual.

ES4.1.2 Groundwater

A regional numerical groundwater flow model was prepared using MODFLOW-SURFACT Version 3 (Hydrogeologic) as a basis for assessment of potential impacts. The model was independently reviewed by two pre-eminent hydrogeologists (Dr Noel Merrick and Dr Frans Kalf). The peer reviewers agreed that the model objectives have been satisfied, the model calibration is satisfactory, the model predictions conform to leading practice and the model is fit for purpose.

Groundwater inflows to the mine will occur during its operational life and for three years after coal extraction ceases (ie for approximately 22 years' duration in total). This will lower the groundwater level - called a "drawdown" - and it is predicted that 93 private landholder bores on 71 properties will experience a drawdown of 2 m or more due to the project. The average duration of drawdown on the 93 affected bores is predicted to be 36 years, with the maximum duration being 65 years. However, most of the recovery will occur in a far shorter time period; on average, a bore will recover by 75% within 23 years after it is first impacted.

A “make good” assessment was conducted in accordance with the *Aquifer Interference Policy* (AIP) (NOW 2012b) to identify potential measures to mitigate unavoidable project impacts on the 93 bores. All bores drawn-down by more than 2 m due to the project will be eligible for compensation (financial or otherwise). Around a third of the affected bores will experience increased pumping costs but no other capital works or supplementary measures are expected to be necessary to maintain their proper functioning. Another third of the bores have been assessed as potentially needing their submersible pump intake depths repositioned for certain periods of time, and the final third may need redrilling, or repositioning to maintain water supply; typically these bores are either shallow, or screened in, or below the coal seam itself, or within close proximity to the top of the seam.

Predicted impacts to other groundwater users (including groundwater dependant ecosystems, watercourses, drainage lines, and swamps that receive baseflow) have been assessed as insignificant.

As to the groundwater quality requirements of the AIP, it is not anticipated the project will reduce the beneficial use category of the groundwater source. Also, it is not anticipated that cumulative water quality impacts will occur as a result of the project and other mining activities using the AIP criteria as a reference point.

ES4.1.3 Water licensing

Hume Coal will need to obtain water licences under the *Water Management Act 2000* for both surface water and groundwater “taken” by the proposed development. Hume Coal will acquire the water licence volumes required to cover not only the water handled by the mine’s water management system, but also the water that remains in the sealed areas of the mine, in voids. This water remains in the groundwater source and will account for about two thirds of the total volume of water inflow to the mine workings.

The peak volume of water required to be licensed will be 2,290.5 ML/yr in year 15. Hume Coal has already secured in excess of approximately 60% of the peak water licence requirement for the project, and has a clear pathway for how the remaining licence volume will be secured so that all groundwater is adequately licensed.

Most of the remaining licence volume will be acquired via market trading. The majority of the volume required will be secured from Nepean Management Zone 1. The small licence volumes required from Nepean Management Zone 2 of the Sydney Basin Nepean Groundwater Source and from the Sydney Basin South Groundwater Source are likely to be sourced during a controlled allocation process. Trading of the small licence volume required from the Medway Rivulet Zone of the Upper Nepean and Upstream Warragamba Unregulated River Water Source is proposed to secure the remaining required licence volume for surface water.

ES4.2 Soil and land resources

The soil and land assessment included a desktop review of existing information, a detailed soil survey with laboratory analysis of collected soil samples, and both a biophysical strategic agricultural land (BSAL) and land and soil capability (LSC) assessment of the project area and its surrounds.

The BSAL assessment was undertaken in accordance with the requirements of the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSWG 2013) (the interim protocol). No BSAL was found to be present in the project area, and a Site Verification Certificate (SVC) confirming this was issued for the project by the Department of Planning and Environment (DP&E) on 22 April 2016.

Given the underground nature of the project and the first workings mining method with negligible associated subsidence, impacts on soil resources will be limited to the surface disturbance footprint, covering around 2% of the project area. The LSC class for the vast majority of the project area (ie 4,993 ha or 99%) will remain unchanged post mining.

When mining has finished, all surface infrastructure will be removed and the area rehabilitated to a condition that is stable and supports the proposed post-mining land use, which is grazing with improved pasture, consistent with the existing land use. Some 94% of the soil to be stripped in the disturbance footprint is a Dystrophic Yellow Kandosol, which will be the most useful soil for rehabilitation due to its structure and depth. This soil is most suited for grazing and occasional cultivation as long as suitable soil conservation measures are implemented.

When mining ceases there will be a change to the LSC class over 58 ha of land disturbed within the former surface infrastructure area. The original land classes in this area (3 ha of Class 3, 37 ha of Class 4 and 18 ha of Class 5) will change to Class 6 largely due to a change in soil depth. However, Class 6 land will still be suitable for grazing and improved pasture, allowing reinstatement of agricultural uses similar to those present prior to mining.

ES4.3 Agricultural resources

The agricultural impact statement assessed potential impacts of the project on agricultural resources and/or industries within and surrounding the project area. It included detailed database searches and mapping review, consultation with relevant specialists and reviews of other relevant assessments made as part of the EIS.

All identified potential risks to agricultural resources were assessed as being low provided the specified mitigation measures are implemented. Potential disturbance of agricultural land will be limited to the surface infrastructure area which, with the exception of the downcast ventilation shaft location in the Belanglo State Forest, is on land owned by Hume Coal. After mining is complete and the land rehabilitated, it will be returned to agricultural use for livestock production on improved pasture.

There will be some agricultural production losses during the construction and operation of the project, estimated at approximately \$2 million in net present value over the 23 year life of the project. These losses will be somewhat offset by the increase in productivity on other properties Hume Coal owns by the application of leading practice management techniques by the licensee, Princess Pastoral, when compared to the previous management regime.

The highest potential risk to agriculture was identified as the potential loss of groundwater for agricultural users, resulting from groundwater drawdown. However, Hume Coal will implement the necessary 'make good' arrangements with reference to the AIP to effectively compensate landholders for drawdown related impacts. Therefore, no uncompensated (financial or otherwise) loss of water availability for agriculture will occur, and the residual level of risk was assessed as low.

ES4.4 Biodiversity

The biodiversity assessment included a detailed literature review, database searches and hundreds of hours of ecological surveys mainly targeted at detecting the presence of threatened or endangered species. Potential impacts to groundwater dependent ecosystems (GDEs) were also assessed using the results of the ecological, surface water and groundwater studies. This resulted in a dynamic and accurate assessment of the project's impacts on GDEs at several stages of its life.

Impacts on biodiversity from an underground mining project can occur as a result of vegetation clearance for surface infrastructure, subsidence-related impacts, and groundwater drawdown. The first workings method with negligible associated subsidence means that subsidence related impacts on biodiversity will be negligible. The primary direct impact from the project is clearing vegetation to construct surface infrastructure. Careful placement of surface infrastructure has largely avoided the need to clear native vegetation, resulting in only a small amount being affected. Assessments of significance were completed for threatened species and communities. The project is not expected to cause any significant impacts on any of these species and communities.

Residual or unavoidable impacts include the removal of 64 paddock trees which may provide habitat for some threatened species. Offset calculations have been made using the BioBanking Calculator to determine the number of credits required to compensate for the project's residual surface impacts. A total of 582 species credits and 101 ecosystem credits will be required to compensate for the removal of vegetation and habitats. A biodiversity offset strategy has been proposed to source offset areas containing the required ecosystem and species credits, and will be drafted into a biodiversity offset package to be submitted to the DP&E within 12 months of development consent. Implementation of the biodiversity strategy will result in a net positive effect on biodiversity.

Areas of terrestrial vegetation along Belanglo Creek and Wells Creek were identified as having some vulnerability to drawdown impacts from underground mining. However, these areas have a facultative (opportunistic) dependence on groundwater, and will be able to respond to changes in the water table apart from during periods of prolonged drought. As a mitigation measure, monitoring of this vegetation will be undertaken during prolonged drought periods and an appropriate response will be determined if the condition of EECs along the creeks is observed to decline, and the decline is attributable to mining.

ES4.5 Noise

The noise and vibration assessment considered 74 potentially noise sensitive receivers or 75 dwellings (location 14 was identified as having two dwellings on the property) surrounding the project area, and, in particular, around the proposed surface infrastructure site. Noise was monitored using both "attended" and "unattended" techniques to establish representative ambient or background noise levels.

The operational noise assessment identified that during adverse weather conditions and with all feasible and reasonable mitigation applied:

- eight assessment locations (nine dwellings) are predicted to experience residual noise levels of between 3 dB and 5 dB above project-specific noise levels (PSNL) and are therefore entitled to voluntary mitigation upon request; and
- two assessment locations are predicted to experience residual noise levels greater than 5 dB above PSNLs and are therefore entitled to voluntary acquisition upon request.

Hume Coal will either comply with the above mitigation measures (upon request by landowners) or will enter into amenity agreements with the affected landholders.

No privately owned land parcels are predicted to exceed the 25% area voluntary land acquisition criteria as defined in the *Voluntary Land Acquisition and Mitigation Policy* (NSW Government 2014b).

The noise assessment also concluded that the predicted internal noise levels at relevant locations will be well below those likely to cause sleep disturbance.

During construction, some noise will be above relevant noise management levels (NMLs). This will be confined to properties to the north-west of the project area and will mostly be from 1 dB to 3 dB above NMLs. This is not uncommon for construction projects, and it is important to note that an NML is not an acceptability criterion (as are operational noise limits), but a trigger for when construction noise management measures warrant consideration. The key management measure that will be adopted is generally limiting construction activities to standard working hours (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or public holidays). This will be with the exception of drift and shaft construction, work inside enclosed buildings/structures, and the construction of the accommodation village, which will all occur 24 hours a day, 7 days a week.

The 'highly affected' NML of 75 dB will not occur at any assessment location. The construction noise management methods will be detailed in the project's construction environmental management plan (CEMP). Construction noise levels from proposed out-of-hours activity are predicted to satisfy the evening and night NML at all assessment locations, with mitigation in place.

Road traffic noise has been assessed for all public roads that may be used for the operation and construction phases of the project. All roads that will be used to access the project area where nearby assessment locations exist will experience zero to negligible (1–2 dB) noise level increases, which satisfies the *Road Noise Policy* (EPA 2013) requirements.

ES4.6 Vibration

Underground mining is the primary potential source of vibration impacts. Mining will occur at depths greater than approximately 110 m under the Hume Highway. Based on the structural vibration screening criterion of 7.5 mm/s and the identified vibration levels from similar activities (typically 0.1 mm/s or less at such distances), it is highly unlikely vibration levels will cause structural vibration impacts to the highway.

The assessment demonstrates that no other structures will be affected by potentially damaging sources of vibration and that vibration levels are likely to be well below the level of human perception.

ES4.7 Air quality

A network of air quality and meteorological monitoring equipment is in place within and around the project area and includes real-time measurements of meteorological conditions and particulate matter concentrations (PM₁₀ and PM_{2.5}). Equipment owned by Hume Coal will form the basis for air quality monitoring during the life of the project.

The underground nature of the project is a significant avoidance measure in relation to potential air quality impacts as most of the major emissions sources normally associated with mining projects will not be present. The highest potential sources of total suspended particulates (TSP), PM₁₀ and PM_{2.5} emissions from the project have been identified as:

- wind erosion from coal stockpiles;
- ventilation shaft emissions from underground operations, incorporating both fugitive emissions from coal extraction and transportation, and diesel fuel combustion;
- conveyor belt and transfer stations, from both wind erosion and coal transfer emissions; and
- stacking and reclaiming coal.

Including all of the project and neighbouring emission sources added to ambient background levels, the potential for an exceedance of applicable NSW EPA impact assessment criteria to occur due to the project is negligible. The criteria would be more likely to be exceeded because of other events not associated with the project, particularly bushfires and dust storms.

A review of the proposed project dust control measures found that they are consistent with or above accepted industry leading practices. Proposed mitigation measures will effectively control emissions to minimise impacts on the surrounding environment, and to levels that are well below the applicable criteria.

The construction phase of the project will generally generate higher impacts in the immediate surrounding environment than its operational phase because most surface earthworks and truck transportation of soil and other construction materials will occur then. Appropriate dust control measures will be outlined in the project's CEMP.

ES4.8 Greenhouse gases

The likely greenhouse gas (GHG) emissions from the project will be minimal, only making minor contributions to the total GHG emissions from NSW and Australia.

A total of 1,795,965 t CO_{2-e} (scope 1 and 2) GHG emissions will be emitted over the life of the project. The annual average scope 1, 2 and 3 emissions (excluding the end use of coal) from the project represent approximately 0.068% and 0.017% of total GHG emissions for NSW and Australia, respectively, based on the latest available National Greenhouse Gas Inventory being that for 2014.

ES4.9 Subsidence

The proposed first workings mining method will offer a significant level of protection to both existing surface features and the groundwater system, by preventing overburden caving and its associated mining-induced fracturing of the overlying Hawkesbury Sandstone. This mining method and the associated mine layout will reduce the levels of surface and sub-surface subsidence to the lowest practical impact level, whilst still allowing economic recovery of the coal resource. The predicted maximum level of subsidence is so low that subsidence related impacts on surface features will be imperceptible. Further, with maximum surface settlement across the project area predicted to be less than 20 mm (and significantly less in many areas), the potential for significant three-dimensional horizontal shear effects to occur as a direct result of mining subsidence is also negligible.

As the coal seam is hydraulically connected to the overlying Hawkesbury Sandstone, some level of drawdown due to depressurisation of the target coal seam will occur. However, once again, surface settlements will be negligible.

The design principles and stability criteria used in developing the mine plan are consistent with the need for long-term stability based on a suitably low probability of failure. In addition to the mine layout and the design of the coal pillars being left in place, stability will be further enhanced by the emplacement of rejects back into the mined-out voids, and the post-mining flooding of the mined workings and associated re-establishment of full hydrostatic water pressures. Whilst these factors should each have a positive effect on stability, they have not been relied upon to achieve suitably low probabilities of failure of the coal pillar system.

Survey verification of mine workings, monitoring and surface feature-specific subsidence management and monitoring will be implemented as part of ongoing subsidence management strategies.

ES4.10 Traffic and transport

The traffic assessment examined the project's potential impacts on the safety and efficiency of the local and regional road network. It identified no significant adverse traffic impacts as a result of traffic movements to be generated by the project during both the construction and operation phases.

During construction, all non-local employees and contractors will live in the on-site accommodation village and will travel to and from the worksites in mini-buses or other pooled vehicles, thus mitigating the risk of significant impacts on the local road network. During operations, it is anticipated that around 85% of the workforce will live in the Wingecarribee LGA, with a maximum commute time of 45 minutes imposed to reduce the risk of fatigue-related accidents.

All vehicles will normally access the mine site via Mereworth Road during construction and operation, which will be upgraded to accommodate the project-related traffic volumes. The intersection at the Mereworth Road/Hume Highway northbound off-ramp will be reconfigured to realign the future traffic priority to Mereworth Road, due to the increased traffic volumes travelling along Mereworth Road to the mine site. This will make the intersection more intuitive for drivers as it will function as a normal "T" intersection, rather than a right turn priority as it does currently. No other road or intersection upgrades will be required.

With the exception of the intersections along Argyle Street in Moss Vale, all assessed intersections to be used by project-related traffic will remain operating at a high level of service, that is either A or B (the two highest levels). Although the traffic assessment found that the future peak hourly intersection traffic conditions at the two Argyle Street intersections will be congested (in particular at the Lackey Road intersection), as they are now, there will be no significant worsening of intersection traffic operations at these intersections in Moss Vale with the addition of project-related traffic.

ES4.11 Visual amenity

Being an underground mine, the potential for visual impact is limited to the surface infrastructure area. No significant new landforms, such as permanent surface coal reject waste emplacements, form part of the project.

The project will not have significant adverse visual impacts on the locality. Due to existing mature vegetation in the locality and the area's topography, most components of the project will be shielded or partially shielded from view. The project will cause some changes to the landscape, especially in the early stages before the tree screens around the surface infrastructure area - already planted by Hume Coal - mature. During the early period such changes will be noticeable to viewers from certain viewpoints surrounding the project area, particularly from Medway Road.

Two viewpoints, viewpoint 3 (private residence along Medway Road) and viewpoint 4 (also along Medway Road), were assessed as having the potential to experience a moderate to high visual impact from the project assuming no mitigation actions were taken. However, once the tree screens that have been planted mature, visual impacts will be reduced to moderate, and moderate to low, respectively.

Elsewhere, measures have been proposed to reduce the exposure of project elements at viewer locations, and/or minimise the contrast between the element concerned and the surrounding landscape. Some of these measures, particularly vegetation screening, will take time to become established and be fully effective but, once established, the measures will mitigate visual impacts for both local residents and motorists.

ES4.12 Closure and rehabilitation

The project's rehabilitation and closure strategy's overarching objective is to restore the land to its pre-mining land use, that is, agriculture for livestock production on improved pasture. Being an underground mine, there will be limited need for progressive rehabilitation during the operational phase. However, wherever possible, disturbed areas no longer required for mining activities, such as drill pads and access tracks, will be progressively rehabilitated. In addition, areas disturbed during the construction phase that are not required during mining, such as the temporary construction accommodation village, will be dismantled and the land rehabilitated when no longer in use.

Underground voids will be progressively partially backfilled as mining progresses. This will help with groundwater recovery, as well as eliminate the need for large surface reject emplacements that would otherwise require rehabilitation at mine closure. As coal extraction will be limited to first workings only, no noticeable subsidence will occur and thus no land above underground workings is expected to require rehabilitation.

Final rehabilitation and project closure requirements will be devised and documented as part of a detailed mine closure plan, which will be produced within five years of when closure begins, and will take into account input from government agencies and relevant stakeholders at the time.

ES4.13 Hazards and risks

The hazard and risk assessment considered if the project will be a hazardous or offensive development under the *State Environmental Planning Policy No 33 (Hazardous and Offensive Development)* (SEPP 33).

It determined that the project will not involve transport, storage and use of hazardous materials in sufficient quantities and/or proximity to publicly accessible areas to qualify it as hazardous industry under SEPP 33. It also determined that the project will not qualify as offensive industry under SEPP 33 as it is likely the project will be granted an environment protection licence and all licence requirements complied with.

ES4.14 Economics

BAEconomics assessed the project's net benefit to both the NSW and local communities. In general, a project is economically beneficial if its benefits exceed its costs measured in today's values (known as net present value - NPV). The cost benefit analysis determined that the project's total net direct and indirect economic benefit to NSW will be \$368 million in NPV terms.

In terms of direct economic benefits, the project is expected to generate \$316 million for NSW, comprising:

- royalty payments, which are estimated at \$114 million in NPV terms;
- net employment benefits being the additional disposable income that NSW residents will receive, as well as the shares of personal and company income taxes that will go to NSW, that is:
 - \$134 million of net disposable income benefits; and
 - \$48 million of the NSW share of personal and company income taxes.
- incremental payroll taxes, council rates and various levies, amounting to around \$20 million.

To determine the net direct economic benefit, costs associated with GHG emissions and the foregone agricultural value added due to land being removed from agricultural production, collectively estimated at \$21 million, were deducted. This reduces the net direct benefits to \$295 million.

A number of indirect (or flow-on) effects will also occur as a result of the project's capital and operating expenditure, and job creation. At the NSW level at least \$73 million in additional value added, discounted at 7%, will occur as an indirect benefit. There will also be an average indirect benefit of 62 full-time jobs added in each year of the life of the project.

A 'local effects analysis' was also undertaken in accordance with the requirements of the NSW government's "Guidelines for the economic assessment of mining and coal seam gas projects".

Local economic effects were considered to be those that will occur in the Southern Highlands SA3 statistical area structure, which closely aligns with the Wingecarribee LGA. Here the net direct benefits of the project are expected to amount to approximately \$84 million in NPV terms.

Locally, at the Wingecarribee LGA level, indirect benefits of at least \$44 million in disposal income and an average 34 FTE jobs each year will be added, bringing the total direct and indirect benefits of \$128 million for the local area.

ES4.15 Social impacts

The social impact assessment examined changes that are likely to occur as a result of the project. The assessment considered measures to enhance social opportunities from the project as well as measures to mitigate negative impacts during all its phases. During the planning phase, the project will create a modest increase in job opportunities and contribute to strengthening the skills base of the local workforce as a result of Hume Coal's apprenticeship and traineeship program. Investment generated from Hume Coal's Charitable Foundation will also result in improvements to community facilities and services.

The project's construction phase will provide numerous job opportunities. The potential for negative social impacts during construction will be largely eliminated by the provision of a well-managed accommodation village, which will house non-local construction workers.

The principal social consequences of the project's operations phase will be the creation of approximately 300 long-term employment positions, most of which will be filled by locals, and a substantial economic stimulus to the area from greater local expenditure. Other benefits will be skills improvements through training and continued investments in community facilities through a Voluntary Planning Agreement. During operations the project area will experience noticeable change but no impacts will be of a level that will be unacceptable, and substantial social benefits will occur.

The final closure and decommissioning phase will have net social costs. It will result in a loss of jobs and a consequent decline in economic activity. Despite this, benefits will continue as disturbed land will be rehabilitated and there will be an ongoing legacy from the project's contribution to the community during the life of the project through a Voluntary Planning Agreement.

A set of mitigation and management measures will be put in place that have been designed to address specific impacts that will coincide with each phase of the project. All of the measures will be developed and detailed in a social impact management plan, which will include periodic monitoring of the effectiveness of measures and will be revised as necessary throughout the life of the project.

The overall net outcome is that the project will be socially beneficial.

ES4.16 Aboriginal heritage

An Aboriginal cultural heritage assessment found the project's impact on Aboriginal cultural heritage values at a landscape level will be relatively small. Of the 206 sites identified in the project area, 20 sites will be disturbed to some degree by the surface infrastructure area, comprising:

- six sites of moderate significance, two of which are of higher moderate significance (HC_135 and HC_151); and
- 14 sites of low significance.

No sites of high significance will be directly impacted by the project.

Of the 20 sites to be disturbed, three will be totally disturbed, 10 partially lost and seven totally lost. Taking the negligible risk of subsidence impacts into account, it is very likely that the rest of the sites in the project area assessed as part of the Aboriginal heritage assessment will not be impacted.

The surface infrastructure facilities have been specifically designed to avoid the areas of highest archaeological sensitivity and linear project elements will only partially impact the more significant deposits. The archaeological deposits present are generally disturbed to some degree from the historic agricultural land use.

Mitigation measures have been identified to mitigate impacts to the Aboriginal sites identified within the surface infrastructure footprint of the project, including test excavation and artefact collection.

An Aboriginal Cultural Heritage Management Plan will be developed in consultation with the DP&E and the registered Aboriginal parties. It will detail the management measures for the project, including provisions for the active and passive management of Aboriginal sites, ongoing monitoring requirements and site salvage procedures.

ES4.17 Historic heritage

A total of eight historic heritage items scheduled in the Wingecarribee LEP are located, either wholly or partially, in the project area. One scheduled property occurs within the surface infrastructure area but the listed item itself (*Mereworth house and garden*) will not be directly affected and is owned by Hume Coal. The other seven items are over the underground mining area and will not be affected because only negligible subsidence will occur. In addition to the listed heritage items, there are two potential archaeological sites that (if present) may reach the threshold of “relics” (HC_127 and Mereworth 1).

The existing house at *Mereworth* was built in 1965. It is a two-storey brick building with outbuildings, and is accessed by a long driveway lined with conifers and golden elms ending at a porte-cochere. The house was not fit for occupation at time of its purchase by Hume Coal due to its state of disrepair, and remains so, although ongoing repairs and maintenance are now being made. The house is vacant and the gardens are being maintained by professional horticulturalists engaged by Hume Coal.

The design of the project avoids physical impacts to the majority of the heritage items, with the exception of part of the broader property of Mereworth, where the main surface infrastructure area will be located. However, the actual house and garden of Mereworth will not be subject to physical impacts, nor will any significant heritage structures in the project area be affected.

A conservation management plan will be prepared and implemented for *Mereworth House and Garden*. The plan will record the significance of the house site in more detail than is presently available and will identify areas that require immediate repairs which will guide maintenance and management of the property, leading to a positive transformation.

ES5 Justification and conclusion

The project is justified on economic, social and environmental grounds. This is demonstrated by its consistency with key objects of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The project will enable development of a valuable, publically owned natural resource – the Wongawilli Seam coal. At the same time, valuable environmental and cultural resources will be managed effectively and protected. When the economic and social benefits of the project are also taken into account, it is evident that community welfare will increase. This means the project will achieve “proper management, development and conservation of resources ... and promote social and economic welfare”, in accordance with the first object of the EP&A Act.

The mine will produce both metallurgical and thermal coal, extracting around 50 Mt of run-of-mine coal over its life and approximately 39 Mt of saleable coal. Metallurgical coal is one of the two primary ingredients used to make iron for steel, the other being iron ore. Steel is an essential engineering and construction material used in most industry sectors and is a basic component of many materials and structures people use everywhere and every day. The global demand for steel has grown substantially and is forecast to increase even further in the future. The World Steel Association estimates that demand will grow by 50% above current levels by 2050 (World Steel Association 2015). Global annual per capita steel use increased from 150 kg in 2001 to 217 kg in 2014. This occurred despite the development of stronger steel alloys that reduced the volume of steel needed to manufacture individual structures. Thermal coal is used to generate electricity. Electricity is fundamental for peoples’ daily lives as their main source of energy for heating, cooling, lighting, mobility, communications and industry.

The project's design adopts leading practice and avoids most potential environmental impacts. Where unavoidable (or residual) impacts occur, they will be effectively managed to meet the applicable regulatory standards. The project's design and proposed management procedures are based on a comprehensive understanding of environmental conditions in and around the project area, substantiated by the results of baseline monitoring undertaken since 2011. The design avoids threats of serious or irreversible environmental damage. The project will also achieve inter-generational equity by transforming natural capital (coal) into economic and social capital, in the form of greater income and employment, and material capital, in the form of steel and other products that are essential for everyday life. The project is, therefore, consistent with the principles of ecologically sustainable development.

For the reasons given above the project will serve the public interest.



Table of contents



Table of Contents

Executive Summary	ES.1
PART A The Project	
Chapter 1 Introduction	1
1.1 Background	1
1.2 Project overview	4
1.3 Project objectives	5
1.4 Purpose of this document	5
1.5 Other approvals required under the EP&A Act	6
1.6 The applicant	6
1.7 Need for the Hume Coal Project	7
Chapter 2 The proposal	9
2.1 Overview	9
2.2 Project planning	15
2.3 Leading practice innovations	15
2.3.1 Mine design and process	15
2.3.2 Underground reject emplacement	16
2.3.3 Groundwater management	17
2.3.4 Covering rail wagons	17
2.3.5 Advanced high performance locomotives	17
2.4 Construction phase	17
2.4.1 Overview	17
2.4.2 Construction schedule	18
2.4.3 Site establishment and construction footprint	18
2.4.4 Surface infrastructure, drift and shaft construction	24
2.4.5 Construction equipment	24
2.5 Operational phase	24
2.5.1 Mining	24
2.5.2 Mining fleet	26
2.5.3 Gas drainage	27
2.5.4 Ventilation	27
2.6 Mining schedule	27
2.7 Surface infrastructure	27
2.8 Coal washing and processing	30
2.9 Coal transport	31
2.10 Water management	32
2.10.1 Water demand and supply	32
2.10.2 Mine water management	35
2.10.3 Wastewater treatment and release	39
2.11 Waste management	41

Table of Contents *(Cont'd)*

2.12	Utilities and services	41
2.12.1	Electricity supply	41
2.12.2	Telecommunications	45
2.13	Workforce	45
2.13.1	Construction	45
2.13.2	Operations	45
2.14	Decommissioning and Rehabilitation	45
<hr/>		
PART B	Legislative, policy and stakeholder considerations	
<hr/>		
Chapter 3	Legislation	49
3.1	Introduction	49
3.2	NSW Environmental Planning and Assessment Act 1979	49
3.2.1	Overview	49
3.2.2	State significant development provisions	50
3.2.3	Permissibility	51
3.2.4	Objects of the Act	54
3.2.5	Section 79C matters for consideration	57
3.2.6	Other relevant sections of the EP&A Act	60
3.3	Requirements of other NSW legislation	61
3.3.1	Mining Act 1992	61
3.3.2	Mine Subsidence Compensation Act 1961	62
3.3.3	Protection of the Environment Operations Act 1997	62
3.3.4	Roads Act 1993	62
3.3.5	Pipelines Act 1967	62
3.4	Exemptions from other NSW approval requirements	62
3.4.1	Fisheries Management Act	63
3.4.2	Heritage Act 1977	63
3.4.3	National Parks and Wildlife Act 1974	64
3.4.4	Native Vegetation Act 2003	64
3.4.5	Rural Fires Act 1997	64
3.4.6	Water Act 1912 and Water Management Act 2000	64
3.5	Other relevant NSW legislation	65
3.5.1	Threatened Species Conservation Act 1995	65
3.5.2	Dams Safety Act 1978	65
3.5.3	Forestry Act 1916	65
3.5.4	Crown Lands Act 1989	65
3.5.5	Local Government Act 1993	66
3.5.6	Work Health and Safety Act 2011 and Work Health and Safety (Mines) Act 2013	66
3.6	Planning instruments and policies	66
3.6.1	State Environmental Planning Policies	66
3.6.2	Wingecarribee Local Environmental Plan 2010	72
3.6.3	Strategic policies	72

Table of Contents *(Cont'd)*

3.7	Commonwealth legislation	75
3.7.1	Environment Protection and Biodiversity Conservation Act 1999	75
3.7.2	Native Title Act 1993	75
3.8	Summary of approval requirements	76
Chapter 4	Consultation and issue identification	77
4.1	Introduction	77
4.2	Overview	77
4.3	Consultation requirements	77
4.4	Stakeholder engagement process	78
4.4.1	Stakeholder identification	78
4.4.2	Stakeholder engagement tools	78
4.5	Stakeholders	81
4.5.1	Government	81
4.5.2	Community and special interest groups	85
4.5.3	Stakeholder surveys	88
4.5.4	Private landholders and registered bores	89
4.5.5	Aboriginal community consultation	90
4.5.6	Ongoing stakeholder consultation	90
4.6	Preliminary risk assessment	90
4.6.1	Method	90
4.6.2	Issue prioritisation	92
4.7	Conclusion	92
PART C	Existing environment and project evolution	
Chapter 5	Site and surrounds	95
5.1	Project location and character	95
5.2	Biophysical factors	97
5.2.1	Baseline monitoring overview	97
5.2.2	Climate	97
5.2.3	Topography	101
5.2.4	Geology	101
5.2.5	Hydrogeology	106
5.2.6	Surface water resources	107
5.2.7	Soils	109
5.2.8	Biodiversity	112
5.3	Socio-economic factors	114
5.3.1	Land ownership	114
5.3.2	Existing land uses	116
5.3.3	Community profile	120
5.4	Cultural factors	120
5.4.1	Aboriginal heritage	120
5.4.2	Historic heritage	121
5.5	Other development	121

Table of Contents *(Cont'd)*

Chapter 6	Project evolution and alternatives	123
6.1	Introduction	123
6.2	Mining method and mine plan	123
6.2.1	Alternative 1 – Longwall	125
6.2.2	Alternative 2 – Miniwalls and Wongawilli method	125
6.2.3	Alternative 3 – Low impact mining methods	126
6.2.4	The proposal – first workings with slender pillar system	126
6.3	Surface infrastructure and equipment	127
6.3.1	Locations considered	127
6.3.2	Designs considered	130
6.4	Reject emplacement	131
6.5	Water management	131
6.6	Site access	132
6.7	Workforce accommodation	132
6.8	'Do nothing' alternative	133
PART D	Impact assessment	
Chapter 7	Water resources	137
7.1	Introduction	137
7.1.1	Assessment requirements and guidelines	137
7.1.2	Study area	139
7.2	Existing environment	139
7.2.1	Water sharing plans	139
7.2.2	Baseline monitoring program	140
7.2.3	Surface water resources	144
7.2.4	Groundwater resources	147
7.3	Methods	153
7.3.1	Assessment criteria	153
7.3.2	Surface water and site water balance	156
7.3.3	Surface water quality modelling	158
7.3.4	Flood modelling	158
7.3.5	Groundwater numerical model	159
7.4	Impact assessment – surface water	162
7.4.1	Water quantity	162
7.4.2	Water quality	165
7.4.3	Flooding	168
7.4.4	Predicted impacts on surface water users	171
7.4.5	Cumulative impacts	171
7.5	Impact assessment – groundwater	172
7.5.1	Inflows to the underground mine	172
7.5.2	Groundwater levels	173
7.5.3	Reduction in baseflow	173

Table of Contents *(Cont'd)*

7.5.4	Groundwater quality	176
7.5.5	Predicted impacts on groundwater users	177
7.5.6	Cumulative impacts	180
7.6	Licensing	181
7.6.1	Approach to licensing	181
7.6.2	Summary of licence volumes required	182
7.6.3	Licences held by Hume Coal	183
7.7	Management and mitigation	185
7.7.1	Avoidance and mitigation measures	185
7.7.2	Make good provisions	187
7.7.3	Monitoring	187
7.7.4	Management measures	188
7.7.5	Groundwater model validation	189
7.7.6	Water management plan	189
7.8	Conclusion	190
Chapter 8	Soil and land resources	191
8.1	Introduction	191
8.1.1	Assessment requirements and guidelines	191
8.2	Existing environment	193
8.2.1	Soil landscape units	193
8.2.2	Soil types	194
8.2.3	Land and soil capability	197
8.2.4	Agricultural suitability	200
8.2.5	Biophysical Strategic Agricultural Land	200
8.3	Impact assessment	201
8.3.1	Direct disturbance	201
8.3.2	Post-mining land capability	203
8.4	Management and mitigation measures	205
8.4.1	Erosion and sediment control	205
8.4.2	Topsoil stripping	205
8.4.3	Topsoil stockpile management	207
8.4.4	Methods to achieve successful rehabilitation	208
8.5	Conclusion	209
Chapter 9	Agricultural resources	211
9.1	Introduction	211
9.1.1	Assessment requirements and guidelines	211
9.1.2	Adoption of leading practice	213
9.2	Methods	214
9.3	Existing environment	214
9.3.1	Regional agricultural resources and enterprises	214
9.3.2	Project area agricultural resources and enterprises	215

Table of Contents *(Cont'd)*

9.4	Impact assessment	219
9.4.1	Potential impacts on agricultural land resources	219
9.4.2	Consequential productivity effects on agricultural enterprises and support infrastructure	221
9.4.3	Local and regional employment impacts	223
9.5	Avoidance, management and mitigation	223
9.5.1	Avoidance	223
9.5.2	Management and mitigation	224
9.6	Conclusions	224
Chapter 10	Biodiversity	225
10.1	Introduction	225
10.1.1	Assessment guidelines and requirements	225
10.1.2	Adoption of leading practice	230
10.1.3	Project area and study area	230
10.2	Methods	230
10.2.1	Literature review and database search	233
10.2.2	Terrestrial field surveys	233
10.2.3	Aquatic field surveys	235
10.2.4	Identification of groundwater dependent ecosystems	235
10.3	Existing environment	236
10.3.1	Landscape values	236
10.3.2	Biodiversity values in the project area and study areas	240
10.3.3	Biodiversity values in the surface infrastructure area	249
10.4	Impact avoidance and mitigation	258
10.4.1	Avoidance and minimisation	258
10.4.2	Mitigation	260
10.4.3	Justification for avoidance and mitigation measures	263
10.5	Impact assessment	264
10.5.1	Surface infrastructure	264
10.5.2	Underground mining	266
10.5.3	Matters requiring further consideration	275
10.5.4	Summary of potential impacts on threatened species and communities	277
10.5.5	Cumulative impacts	277
10.6	Biodiversity credit report	278
10.6.1	Quantification of impacts	278
10.7	Biodiversity offset strategy	279
10.7.1	Strategy	279
10.7.2	Offset security	280
10.8	Conclusions	280
Chapter 11	Noise and vibration	283
11.1	Introduction	283
11.1.1	Assessment requirements and guidelines	283

Table of Contents *(Cont'd)*

11.2	Existing environment	285
11.2.1	Properties surrounding the project	285
11.2.2	Background noise monitoring	287
11.2.3	Noise catchment areas	289
11.2.4	Meteorology	291
11.3	Noise criteria	292
11.3.1	Construction noise	292
11.3.2	Operational noise	293
11.3.3	Voluntary land acquisition and mitigation policy	294
11.3.4	Low frequency noise	295
11.3.5	Sleep disturbance	295
11.3.6	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007	296
11.3.7	Road traffic noise	297
11.3.8	Operational and construction vibration	298
11.3.9	Construction blasting	299
11.4	Impact assessment	300
11.4.1	Modelling methodology	300
11.4.2	Operational noise	300
11.4.3	Privately owned land assessment	304
11.4.4	Sleep disturbance	304
11.4.5	Cumulative noise	306
11.4.6	Road traffic noise	306
11.4.7	Construction noise	306
11.4.8	Vibration	309
11.4.9	Construction blasting	310
11.4.10	Health impacts	311
11.5	Management and mitigation	312
11.5.1	Operational noise – feasible and reasonable measures	312
11.5.2	Construction noise	313
11.5.3	Vibration	313
11.6	Conclusions	314
Chapter 12	Air quality	315
12.1	Introduction	315
12.1.1	Assessment requirements	315
12.2	Existing environment	316
12.2.1	Nearest receptors	316
12.2.2	Meteorology	316
12.2.3	Baseline air quality environment	320
12.3	Air quality methodology and assessment criteria	327
12.3.1	Methodology	327
12.3.2	Air quality criteria	329

Table of Contents *(Cont'd)*

12.4	Air quality impact assessment	332
12.4.1	Particulate matter	332
12.4.2	Gaseous pollutants	334
12.4.3	Odour concentrations	335
12.5	Health impact assessment	335
12.5.1	Background	335
12.5.2	Relevant project-related emissions	336
12.5.3	Health risk assessment	336
12.6	Management and monitoring	337
12.6.1	Best practice dust mitigation	337
12.6.2	Further mitigation measures	339
12.6.3	Air quality monitoring	340
12.7	Conclusions	340
Chapter 13	Greenhouse gas	343
13.1	Introduction	343
13.2	Emission sources and GHG inventory	343
13.2.1	Scope 1, 2 and 3 emissions	343
13.2.2	Emission inventory	345
13.3	Impact assessment	345
13.4	Management and mitigation	348
13.5	Conclusion	348
Chapter 14	Subsidence	349
14.1	Introduction	349
14.2	Existing environment	351
14.2.1	Geological environment and rock unit material properties	351
14.2.2	In situ stress environment	351
14.2.3	Major geological structures and hydrogeological features	352
14.2.4	Natural and built surface features	352
14.3	Subsidence predictions	355
14.3.1	Mine design parameters	355
14.3.2	Strata compression effects	356
14.3.3	Groundwater depressurisation effects	357
14.3.4	Maximum surface settlement	357
14.3.5	Maximum tilt, curvature and horizontal strain	357
14.3.6	Angle of draw and far-field horizontal movements	358
14.4	Subsidence impact assessment	358
14.4.1	Overview	358
14.4.2	Impacts on built and man-made surface features	359
14.4.3	Impacts on natural surface features	361
14.4.4	Long-term subsidence impacts	362
14.5	Management and mitigation	362

Table of Contents *(Cont'd)*

14.6	Conclusion	363
Chapter 15	Traffic and transport	365
15.1	Introduction	365
15.2	Existing environment	366
15.2.1	Overview of the existing road network	366
15.2.2	Level of service	369
15.2.3	Intersections	370
15.2.4	Road safety	377
15.2.5	Public transport	378
15.3	Impact assessment	378
15.3.1	Traffic related impacts during construction	379
15.3.2	Traffic related impacts during operation	383
15.4	Impacts on the rail network	388
15.4.1	Project-related rail movements	388
15.4.2	Impacts on the Berrima Branch Line	389
15.4.3	Impacts on the Main Southern Rail Line	389
15.5	Management and monitoring	390
15.5.1	Construction traffic	390
15.5.2	Operational traffic	390
15.5.3	Intersection improvement	390
15.5.4	Oversize vehicle movements and hazardous materials	391
15.6	Conclusions	391
Chapter 16	Visual amenity	393
16.1	Introduction	393
16.2	Existing environment	394
16.3	Method	395
16.4	Impact assessment	397
16.4.1	Critical viewpoint	397
16.4.2	Viewpoint analysis	397
16.4.3	Cumulative assessment	412
16.5	Mitigation and monitoring	413
16.5.1	Screening	413
16.5.2	Lighting	416
16.5.3	Building colours and material	416
16.6	Conclusions	416
Chapter 17	Closure and rehabilitation	417
17.1	Introduction	417
17.1.1	Assessment requirements and guidelines	417
17.2	Decommissioning and rehabilitation objectives	421
17.3	Final landform and land use	421
17.4	Rehabilitation domains	424

Table of Contents *(Cont'd)*

17.4.1	Primary domains	424
17.4.2	Secondary domains	426
17.5	Preliminary completion criteria	426
17.6	Rehabilitation and decommissioning activities	429
17.6.1	Overview	429
17.6.2	Infrastructure domain	429
17.6.3	Water management domain	431
17.6.4	Stockpiled material domain	431
17.6.5	Underground mining area	432
17.7	Rehabilitation methods	432
17.7.1	Soil management	432
17.7.2	Landform re-profiling	433
17.7.3	Soil spreading	433
17.7.4	Public safety	433
17.8	Rehabilitation trials, monitoring and post-closure maintenance	433
17.9	Conclusion	434
Chapter 18	Hazards and risk	435
18.1	Introduction	435
18.1.1	Assessment requirements and guidelines	435
18.2	Hazardous and offensive development	436
18.2.1	Hydrocarbons	436
18.2.2	Gases	437
18.2.3	Explosives	437
18.2.4	Radioactive material	438
18.2.5	Coal dust	438
18.2.6	Transport	439
18.2.7	Offensive development	439
18.2.8	Will the project be hazardous or offensive?	440
18.3	Risks from the project	440
18.3.1	Risk assessment method	440
18.3.2	Preliminary risk assessment results	440
18.3.3	Hazard and risk criteria	442
18.3.4	Assessment conclusions	442
18.4	Subsidence risks	442
18.5	Contamination risks	443
18.5.1	Overview	443
18.5.2	Historic land use	444
18.5.3	Potential for contamination to occur	447
18.5.4	Evidence of contamination	447
18.5.5	Contamination characterisation	449
18.5.6	Suitability of the mine	449
18.6	Bushfire risks	450

Table of Contents *(Cont'd)*

18.6.1 Overview	450
18.6.2 Environmental management	450
18.6.3 Impacts	450
18.7 Conclusions	451
Chapter 19 Economic assessment	453
19.1 Introduction	453
19.2 Assessment guidelines and requirements	453
19.3 Costs and benefits of the project	454
19.3.1 Analytical framework	454
19.3.2 Alternative and project scenarios	454
19.3.3 Net benefits of the project for NSW	456
19.3.4 Gross operating surplus attributable to NSW	457
19.3.5 Other taxation benefits attributable to NSW	459
19.3.6 Valuing externalities	459
19.3.7 Change in economic surplus in other NSW industries	464
19.3.8 Economic benefit to existing landholders	465
19.3.9 Net public infrastructure costs	465
19.3.10 Net direct benefits of the project for NSW	465
19.4 The project's local economic effects	466
19.4.1 Local income benefits	466
19.4.2 Other net local benefits	467
19.4.3 Other matters raised in the 2015 guidelines	467
19.4.4 Local direct benefits of the project	468
19.5 Flow-on benefits of the project	468
19.5.1 Advantages and limitations of input-output analysis	469
19.5.2 Implications for the LEA	470
19.5.3 Flow-on effects of the project for NSW	470
19.5.4 Flow-on effects for Wingecarribee LGA	471
19.6 Significance of the resource	471
19.7 Conclusion	472
Chapter 20 Social assessment	473
20.1 Introduction	473
20.1.1 Assessment guidelines and requirements	473
20.1.2 Adoption of leading practices	473
20.1.3 Local partnerships and procurement	474
20.2 Assessment method	474
20.3 Existing social environment	475
20.3.1 Existing socio-economic character	477
20.3.2 Community services and facilities	480
20.3.3 Housing and short-stay accommodation	484
20.4 Community issues and values	485

Table of Contents *(Cont'd)*

20.4.1 Stakeholder engagement and community consultation	485
20.4.2 Community surveys	485
20.5 Social aspects of the project	486
20.5.1 Planning, feasibility and approvals phase	486
20.5.2 Construction phase	487
20.5.3 Operations phase	488
20.5.4 Closure and decommissioning phase	493
20.5.5 Concurrent development projects	493
20.6 Impact assessment	493
20.6.1 Planning, feasibility and approvals phase	495
20.6.2 Construction phase	496
20.6.3 Operations phase	498
20.6.4 Closure and decommissioning	501
20.6.5 Overall social impacts	503
20.7 Management and mitigation measures	503
20.7.1 Population and demographics	504
20.7.2 Labour Market	504
20.7.3 Economic change	504
20.7.4 Community services and facilities	505
20.7.5 Housing and accommodation	505
20.7.6 Community liveability	505
20.7.7 Closure and decommissioning	506
20.7.8 Social impacts management plan	506
20.7.9 Multi-stakeholder approach	506
20.7.10 Monitoring	507
20.8 Conclusion	507
Chapter 21 Aboriginal heritage	509
21.1 Introduction	509
21.1.1 Assessment guidelines and requirements	509
21.1.2 Overview of assessment methods	510
21.2 Aboriginal consultation	511
21.2.1 Stage 1 – notification and registration of Aboriginal parties	511
21.2.2 Stages 2 and 3 – presentation of information and gathering cultural information	511
21.2.3 Stage 4 – review of draft Aboriginal Cultural Heritage Assessment	512
21.3 Existing environment	513
21.3.1 Landscape overview	513
21.3.2 Archaeological background	513
21.4 Fieldwork methods	515
21.4.1 Predictive model of Aboriginal site location	515
21.4.2 Archaeological survey	515
21.4.3 Test excavation	516
21.5 Results	516

Table of Contents *(Cont'd)*

21.5.1	Survey coverage results	516
21.5.2	Survey site results	519
21.5.3	Test excavation results	527
21.5.4	Archaeological sensitivity model	527
21.6	Significance assessment	530
21.6.1	Overview	530
21.6.2	Socio-cultural and historic value: significance for the Aboriginal community	530
21.6.3	Scientific values	530
21.7	Impact assessment	531
21.7.1	Measures to minimise harm and alternatives	531
21.7.2	Sources of impact	531
21.7.3	Overview of impacts	532
21.7.4	Direct impacts from surface infrastructure development	532
21.7.5	Impacts on archaeologically sensitive areas	533
21.7.6	Potential subsidence impacts	534
21.7.7	Cumulative impacts	535
21.8	Management measures	536
21.8.1	Overview	536
21.8.2	Avoidance	537
21.8.3	Collection	537
21.8.4	Salvage excavation	537
21.8.5	Unmitigated impacts	537
21.8.6	Condition monitoring	537
21.8.7	Special procedures	538
21.9	Conclusion	544
Chapter 22	Historic heritage	545
22.1	Introduction	545
22.1.1	Assessment guidelines and requirements	545
22.2	Methods	546
22.2.1	Study area	546
22.2.2	Assessment approach	546
22.3	Existing environment	548
22.3.1	Historical context	548
22.3.2	Listed heritage items	549
22.3.3	Unlisted heritage values	550
22.3.4	Site survey and analysis	553
22.4	Statement of heritage impact	559
22.4.1	Overview	559
22.4.2	Mereworth House and Garden	559
22.4.3	Evandale	561
22.4.4	Other heritage properties in the underground mine area	562
22.4.5	Summary	562

Table of Contents *(Cont'd)*

22.5	Mitigation, management and monitoring	564
22.5.1	Approach to heritage management	564
22.5.2	Mitigation and management measures	564
22.5.3	Historic heritage management plan	565
22.6	Conclusion	566
<hr/>		
PART E	Outcomes and justification	
<hr/>		
Chapter 23	Summary of commitments	571
23.1	Introduction	571
23.2	Environmental management system	571
23.2.1	Construction Environmental Management Plan	571
23.2.2	Operational Environmental Management Plan	572
23.2.3	Annual review	572
23.3	Summary	573
<hr/>		
Chapter 24	Project justification and conclusion	579
24.1	Introduction	579
24.2	Significance of the resource	579
24.3	Economic justification	579
24.3.1	Benefits and costs	580
24.3.2	Economic stimulus	580
24.4	Social justification	580
24.5	Environmental justification	581
24.6	Ecologically sustainable development	585
24.7	Conclusion	587
<hr/>		
Abbreviations		589
<hr/>		
References		597
<hr/>		
Glossary of Terms		607
<hr/>		

Appendices

A	Schedule of lands
B	Secretary's Environmental Assessment Requirements
C	Study team
D	Berrima Rail Project Environmental Impact Statement
E	Water Impact Assessment Report
F	Soil and Land Assessment Report
G	Agricultural Impact Statement
H	Biodiversity Assessment Report
I	Noise and Vibration Assessment Report
J	Health Impact Assessment Report
K	Air Quality and Greenhouse Gas Assessment Report
L	Subsidence Assessment Report
M	Traffic and Transport Assessment Report
N	Visual Amenity Assessment Report
O	Rehabilitation and Closure Strategy
P	Hazard and Risk Assessment Report
Q	Economic Impact Assessment Report
R	Social Impact Assessment Report
S	Aboriginal Cultural Heritage Assessment Report
T	Statement of Heritage Impact
U	Site Verification Certificate

Tables

2.1	Project overview	9
2.2	Groundwater bores available for water supply in the project area	32
2.3	Summary of water management structures	36
2.4	Non-production waste streams and management	41
3.1	Schedule 2 requirements for an EIS	58
3.2	Summary of required licences, approvals and permits	76
4.1	Consultation tools	79
4.2	Stakeholders and engagement activities	80
4.3	Matters raised by government, service providers and agencies	81
4.4	Matters raised by community and special interest groups	86
5.1	Summary of climate data recorded at Moss Vale BoM station 068045	98
5.2	Description of the soil landscapes in the project area	110
5.3	Land tenure in the project area	114
5.4	Other developments considered in cumulative impact assessments	122
6.1	Alternative surface infrastructure locations considered	128
7.1	Water related SEARs	138
7.2	Defined study areas for each technical assessment	139
7.3	Sewerage treatment discharges within Wingecarribee LGA	146

Tables

7.4	Water management zones and users	146
7.5	Hydraulic conductivity for hydrogeological units in the project area	148
7.6	Summary of baseline water quality data per groundwater system	150
7.7	Surface water assessment criteria	154
7.8	Minimal impact criteria for 'highly productive' porous fractured rock water source	155
7.9	Reduction in catchment areas associated with project dams and basins	163
7.10	Mean annual loads in Oldbury creek during existing and operation scenarios, and NorBE criteria	166
7.11	Mean annual loads from access road catchments during existing and operation scenarios, and NorBE criteria	167
7.12	Maximum rate of release of groundwater from groundwater storage as a result of the Hume Coal Project	172
7.13	Maximum rate of baseflow reduction from surface water sources as a result of the Hume Coal Project	175
7.14	Summary statistics of landholder bore impacts – comparing project and total impact exceeding AIP criteria	178
7.15	Water licences currently held by Hume Coal	184
7.16	Secured water licences and remaining volumes required	185
7.17	Mitigation and avoidance measures and benefits	185
7.18	Potential impacts and management measures	188
8.1	Land and soils resources related SEARs	191
8.2	DRE's assessment recommendations – soil and land resources	192
8.3	OEH assessment recommendations – soil and land resources	192
8.4	WaterNSW's assessment recommendations – soil and land resources	192
8.5	Soil landscapes in the project area	193
8.6	Soil types in the project area	195
8.7	Land and soil capability classes in the project area	197
8.8	Soil types to be disturbed	201
8.9	LSC class pre- and post-mining	203
9.1	Agriculture related SEARs	211
9.2	DRE assessment recommendations	211
9.3	AIS requirements	212
9.4	Distribution of property sizes and landholders	216
10.1	Biodiversity related SEARs	226
10.2	Agency assessment recommendations relating to biodiversity	227
10.3	Summary of flora survey effort	234
10.4	Summary of fauna survey effort	235
10.5	Native vegetation in the assessment circles before and after development	240
10.6	Threatened ecological communities in the study area	246
10.7	Dependence of potential GDEs	249
10.8	Vegetation zones in the surface infrastructure area and survey effort by zone	250
10.9	Ecosystem credit species	253
10.10	Species credit species	254
10.11	Fish habitat in the surface infrastructure area	256
10.12	Mitigation measures	260
10.13	Ecosystem credits required	278
10.14	Species credits required	279

Tables

10.15	Available species credits	279
10.16	Credits generated vs credits required	280
11.1	Noise and vibration-related SEARs	284
11.2	RMS requirements relating to noise and vibration	284
11.3	Summary of existing background and ambient noise levels, dB(A)	287
11.4	Noise catchment areas – adopted RBLs and estimated existing industrial noise levels	289
11.5	Percentage occurrence of wind speeds between 0.5 to 3 m/s (vector at 22.5° intervals)	291
11.6	Percentage occurrence of stability class	292
11.7	Construction noise management levels for residential land uses	292
11.8	Construction noise management levels	293
11.9	Project-specific noise levels, dB(A)	294
11.10	Characterisation of noise impacts and potential treatments	295
11.11	Privately owned land voluntary acquisition criteria	295
11.12	Sleep disturbance criteria, residential assessment locations	296
11.13	Road traffic noise assessment criteria for residential land uses	297
11.14	Relative increase criteria for residential land uses	297
11.15	Acceptable vibration dose values for intermittent vibration	298
11.16	Transient vibration guide values – minimal risk of cosmetic damage	299
11.17	Airblast overpressure and ground vibration limits	300
11.18	Indicative operations equipment quantities and sound power levels	300
11.19	Predicted operations noise levels	302
11.20	Residual Noise Impacts at Assessment Locations	304
11.21	Recommended safe working distances for vibration intensive plant	310
12.1	Air quality-related SEARs and assessment recommendations	316
12.2	Summary of gaseous air pollutant concentrations (NSW OEH Bargo monitoring station)	326
12.3	Ambient baseline air quality data summary	327
12.4	Particulate matter control measures – construction scenario	328
12.5	Particulate matter control measures – operational scenario	329
12.6	Impact assessment criteria for particulate matter	330
12.7	Impact assessment criteria for dust deposition	330
12.8	Impact assessment criteria for combustion pollutants	331
12.9	OEH Odour performance criteria	331
12.10	Maximum particulate matter and deposition rates – Project only emissions	332
12.11	Maximum particulate matter and deposition rates – Project only plus neighbouring industrial sources	333
12.12	Predicted annual cumulative particulate concentrations and deposition rates	334
12.13	Maximum predicted incremental and cumulative NO ₂ and VOC concentrations	335
12.14	Best practice dust control measures review	338
13.1	Greenhouse gas related SEARs	343
13.2	Annual ROM coal production schedule and activity data	345
13.3	Estimated GHG emissions (tonnes CO _{2-e})	346
13.4	Scope 1, 2 and 3 emission sources (tonnes CO _{2-e})	347
14.1	Subsidence related SEARs	349
14.2	DRE assessment recommendations	350
14.3	RMS assessment recommendations	350
14.4	Fisheries NSW assessment recommendations	350

Tables

14.5	Summary of major stratigraphic properties in the project area	351
14.6	Pillar and panel geometries for the maximum working height of 3.5 m	355
14.7	Mining geometry used to assess subsidence predictions	356
14.8	Surface settlement estimates due to strata compression by coal pillar type	356
14.9	Maximum surface settlement due to the project	357
15.1	Traffic and transport related SEARs	365
15.2	Transport for NSW's assessment requirements	365
15.3	RMS assessment requirements	366
15.4	Definitions of level of service for rural roads (RTA 2002)	369
15.5	Current level of service of roads around the project area	370
15.6	Light and heavy vehicle movements to and from the project area during construction	379
15.7	Project construction stage daily heavy vehicle traffic	379
15.8	Summary of predicted year 2020 traffic increases for early stage construction	382
15.9	Hourly traffic generation summary for project operations	384
15.10	Summary of predicted year 2020 traffic increases for project operations	386
15.11	Intersection level of service during project operations	387
15.12	Existing and future usage of Berrima Branch Line	389
16.1	SEARs related to visual amenity	393
16.2	RMS assessment recommendations	393
16.3	Evaluation of significance matrix	397
16.4	Viewpoint analysis results	399
16.5	Species of tree planting for visual screening	415
17.1	Closure and rehabilitation related SEARs	417
17.2	DRE comments: standard and project-specific assessment recommendations	418
17.3	Surface Infrastructure disturbance by primary domain	424
17.4	Interim completion criteria at each phase of decommissioning and rehabilitation	427
18.1	Noise and vibration-related SEARs	435
18.2	Review of historical aerial imagery	444
19.1	Hume and Berrima Rail projects – predicted external effects	460
19.2	Current livestock enterprises on the properties in the project area	463
19.3	Agricultural gross margins, \$ per hectare (A\$ 2016)	463
19.4	Foregone agricultural value added (NPV A\$ 2016, '000s)	464
19.5	Direct economic benefits of the project for NSW (NPV A\$ 2016)	466
19.6	Net direct benefits of the project in Wingecarribee LGA (NPV A\$ 2016)	468
19.7	Initial flow-on effects for the project – NSW (NPV ² A\$ 2016)	470
20.1	Relevant SEARs for this assessment	473
20.2	Student to teacher ratios in the Wingecarribee LGA	480
20.3	Wingecarribee sporting, recreational and cultural facilities	482
20.4	Household growth forecasts for the Wingecarribee LGA.	484
20.5	Ratings of towns against all location preference factors	491
20.6	Residential distribution of re-locating operations workers	492
20.7	Distribution of total population change associated with the project	492
20.8	Concurrent development projects	493
20.9	Typical social consequences of mining projects and associated impacts	494
20.10	Assessment criteria for determining significance of potential impacts	494

Tables

20.11	Planning, feasibility and approvals phase impacts	495
20.12	Construction phase impacts	497
20.13	Operations phase impacts	499
20.14	Closure and decommissioning phase impacts	502
21.1	Aboriginal heritage related SEARs	509
21.2	OEH's comments: standard and project-specific assessment recommendations	510
21.3	List of registered Aboriginal parties (RAPs) for the project	511
21.5	Site significance and levels of impact	532
21.6	Direct impacts of surface infrastructure development	532
21.7	Site management summary	536
22.1	Historic heritage-related SEARs	545
22.2	OEH's comments: Standard and project-specific assessment recommendations	545
22.3	Listed historic heritage items in the project area	552
22.4	Potential relics identified in the project area	552
22.5	Summary table of impacts on heritage items	563
23.1	Summary of management and mitigation measures	573
24.1	Summary of environmental impacts	582

Figures

ES1	Regional context	ES.2
ES2	Local context	ES.3
1.1	Regional context	2
1.2	Local context	3
2.1	Indicative project layout	12
2.2	Indicative surface infrastructure footprint	13
2.3	Indicative surface infrastructure layout	14
2.4	Conceptual illustration of panel progression, reject emplacement and groundwater reinjection	19
2.5	Internal road and carpark layout	22
2.6	Indicative mine layout showing different coal pillar types	26
2.7	Indicative underground mine progression	29
2.8	Project water demands	34
2.9	Project water demand and supply (combining rainfall-runoff and sump water)	35
2.10	Water management infrastructure	37
2.11	Water management schematic	38
2.12	Proposed electricity works to be subject to separate Part 5 approval under the EP&A Act	44
3.1	Planning approval process	52
3.2	Land zoning	53
4.1	Issues raised during consultation between September 2015 and September 2016	88
4.2	Issues of concern raised during stakeholder surveys, by focus	89
4.3	Groundwater bore make good consultation and negotiation process with landholders	91
5.1	Baseline monitoring network – meteorology, air quality and noise	99

Figures

5.2	Baseline monitoring network – surface water and groundwater	100
5.3	Topography of the project area and surrounds	102
5.4	Typical stratigraphic profile of the project area	104
5.5	Conceptual cross-section: north to south	105
5.6	Land tenure	115
5.7	Mining tenements in the Southern Coalfield	117
5.8	Historical mining activity in the region	118
6.1	Surface infrastructure locations considered	129
7.1	Surface water management zones	142
7.2	Groundwater management zones	143
7.3	Landholder bores and DPI Water monitoring bores	152
7.4	Water balance model flow schematic	157
7.5	Conceptual hydrological model	160
7.6	Numerical groundwater model domain	161
7.7	Predicted flooding extent (1 in 100yr) – operation	169
7.8	Predicted flooding extent (1 in 100yr) - rehabilitation	170
7.9	Project impact water table drawdown – year 17	174
7.10	Project impact and proposed make good provisions	179
7.11	Expected inflow volumes over time	181
7.12	Yearly licence requirements	183
7.13	Project groundwater licence requirements as a portion of total LTAAEL in each groundwater source	183
8.1	Soil types in the project area	196
8.2	Land and soil capability classes – pre-mining	199
8.3	Soil types in the project surface disturbance footprint	202
8.4	Land and soil capability – post-mining	204
8.5	Topsoil stripping depths	206
9.1	Current land use in the project area	217
9.2	Land temporarily removed from agriculture and returned following construction and operation	220
10.1	Project area and terrestrial and aquatic study areas	232
10.2	Biodiversity assessment site map – overview	237
10.3	Biodiversity assessment location map - overview	238
10.4	Native vegetation in the project area	242
10.5	Threatened species locations	243
10.6	Threatened ecological communities in the project area and terrestrial study area	245
10.7	Stream order in the aquatic study area and surrounds	247
10.8	Plant community types and threatened species in the surface infrastructure area	251
10.9	Areas requiring offset – surface infrastructure area	252
10.10	Areas not requiring offset – surface infrastructure area	257
10.11	Ecosystem drawdown risk assessment	267
10.12	Potential ecosystem impacts – 17 years after start of mining	269
10.13	Potential ecosystem impacts – 30 years after start of mining	270
10.14	Project induced groundwater table drawdown at Year 17 of mining	271
10.15	Project induced groundwater table drawdown at Year 30 of mining	272
10.16	Differential drawdown at the water table at virtual piezometer sites (source: Water Assessment, Appendix E)	273

Figures

10.17	Black Gum records in the terrestrial study area	276
11.1	Representative sensitive receptor locations	286
11.2	Noise catchment areas and noise monitoring locations	290
11.3	Summary of worst case operational noise impacts	305
12.1	Wind roses – comparison of concurrent wind data (October 2015 to July 2016) (Ramboll Environ 2017)	318
12.2	Annual wind roses (2013) – Hume No. 1, BoM Moss Vale AWS and Boral's Berrima Cement Works weather stations	319
12.3	Annual average TSP concentrations	322
12.4	Time series plot of daily varying 24-hour average PM ₁₀ concentrations – January 2010 to December 2014 (Ramboll Environ 2017)	323
12.5	Annual average PM ₁₀ concentrations – local and regional monitoring locations - 2010 to 2014 (Ramboll Environ 2017)	324
12.6	Time series plot of daily varying 24-hour average PM _{2.5} concentrations – October 2012 to December 2014 (Ramboll Environ 2017)	325
12.7	Annual average dust deposition levels - Project area - 2012 to 2015	326
14.1	Existing built and man-made features in the project area	353
14.2	Existing natural features in the project area	354
15.1	Regional road network	367
15.2	Intersections relevant to the project	371
15.3	Hume Highway and Medway Road ramp intersection east side (top) and west side (bottom)	372
15.4	Hume Highway and Mereworth Road ramp intersection east side (top) and west side (bottom)	373
15.5	Hume Highway and Golden Vale Road access intersection (top) and Old Hume Highway and Medway Road roundabout intersection (bottom)	374
15.6	Berrima Road and Taylor Avenue Y intersection (top) and Berrima Road and Douglas Road T intersection (bottom)	375
15.7	Argyle Street and Waite Street intersection in Moss Vale (top) and Argyle Street and Lackey Road intersection in Moss Vale (bottom)	376
15.8	Recent five-year accident history for all roads in the Wingecarribee LGA	378
15.9	Daily traffic movements – early project construction	380
15.10	Daily generated traffic – peak project construction	381
15.11	Daily traffic movements – project operation	385
16.1	Viewpoint, photomontage and photograph locations	398
16.2	Viewpoint 3 photomontage – existing and unmitigated view	403
16.3	Viewpoint 3 photomontage – year 5 and year 15	404
16.4	Viewpoint 4 photomontage – existing and unmitigated view	405
16.5	Viewpoint 4 photomontage – year 5 and year 15	406
16.6	Viewpoint 5 photomontage – existing and unmitigated view	407
16.7	Viewpoint 5 photomontage – year 5 and year 15	408
16.8	Viewpoint 6 photomontage – existing and year 5	409
16.9	Viewpoint 7 photomontage – existing and unmitigated	410
16.10	Viewpoint 7 photomontage – year 5 and year 15	411
16.11	Tree planting	414
17.1	Conceptual final landform	422
17.2	Existing topography and indicative final rehabilitated landform	423
17.3	Primary rehabilitation domains	425
18.1	SEPP 33 criteria for Class 3PGII & III flammable liquids (DoP 2011b)	437

Figures

18.2	SEPP 33 criteria for Class 1.1 explosives (DoP 2011b)	438
18.3	Historic aerial imagery 1949 – Project area	445
18.4	Historic aerial imagery 1997 – Project area	446
19.1	Project area within the context of statistical area boundaries	455
20.1	Summary of SIA method	476
20.2	Population distribution of the Wingecarribee LGA and NSW, 2013	478
20.3	Summary of current community issues	486
20.4	Workforce catchment area	490
20.5	Balance of social impacts	503
21.1	AHIMS results and locations of previous surveys	514
21.3	Aboriginal heritage survey coverage and results overview	518
21.5	Aboriginal site results – Belanglo State Forest (east)	522
21.6	Aboriginal site results – Evandale	523
21.7	Aboriginal site results – Mereworth	524
21.8	Aboriginal site results – Wongonbra	525
21.9	Aboriginal site results – outside project area in Berrima Rail Project area	526
21.11	Areas of archaeological sensitivity – surface infrastructure area	529
21.12	Management measures – Belanglo State Forest (west)	539
21.13	Management measures – Belanglo State Forest (east)	540
21.14	Management measures – Evandale	541
21.15	Management measures – Mereworth	542
21.16	Management measures – Wongonbra	543
22.1	Identified heritage items and values in the historic heritage study area	551
22.2	Identified heritage items and values in the surface infrastructure area	560

Photographs

2.1	Existing intersection approach view from the Hume Highway off ramp	21
5.1	The project area in the foreground - looking east from the Mereworth property towards the Hume Highway	95
5.2	The project area from the edge of Mereworth garden - looking north-east towards the proposed train load-out area	96
5.3	The project area looking south from Medway Road	96
5.4	The project area, looking south towards the product stockpile area from south of Oldbury Creek on 'Mereworth'	97
16.1	The project area, looking south towards the product stockpile area from south of Oldbury Creek on 'Mereworth'	395
16.2	Viewpoint 1 – Hume Highway looking north towards the surface infrastructure area	401
16.3	Typical view from the Hume Highway adjacent to the project area, travelling north with vegetated buffers on the western side of the highway (source: Google streetview)	401
16.4	Viewpoint 2 – Belanglo Road looking north-east towards the surface infrastructure	402
22.1	The rear of Mereworth House with the cold climate garden behind. View south	554
22.2	The grounds of Mereworth on the southern side of the dwelling. View north-west.	554

Photographs

22.3	Rows of golden elms and flowering cherries lining the avenue to the house at <i>Mereworth</i> . View north-north-east.	555
22.4	The ha-ha on the northern side of the <i>Mereworth</i> garden. This view is to the south, facing the house.	555
22.5	The core residential and garden components of <i>Mereworth</i> (behind the trees). View north-west.	556
22.6	The view from <i>Mereworth</i> 's master bedroom balcony to the north across the ha-ha to the paddocks beyond	556
22.7	View north-west to the <i>Mereworth</i> driveway at the junction where it meets the avenue of trees	557
22.8	HC_127 (also an Aboriginal site) with a ceramic tea cup handle, a plate fragment and a metal buckle.	558



Part A

The Project

Chapter 1: Introduction
Chapter 2: The proposal



1 Introduction

1.1 Background

Hume Coal Pty Limited (Hume Coal) is seeking development consent to construct and operate the Hume Coal Project (the project), an underground coal mine and associated mine infrastructure in the Southern Coalfield of New South Wales (NSW). Figure 1.1 illustrates the location of the project at a regional scale.

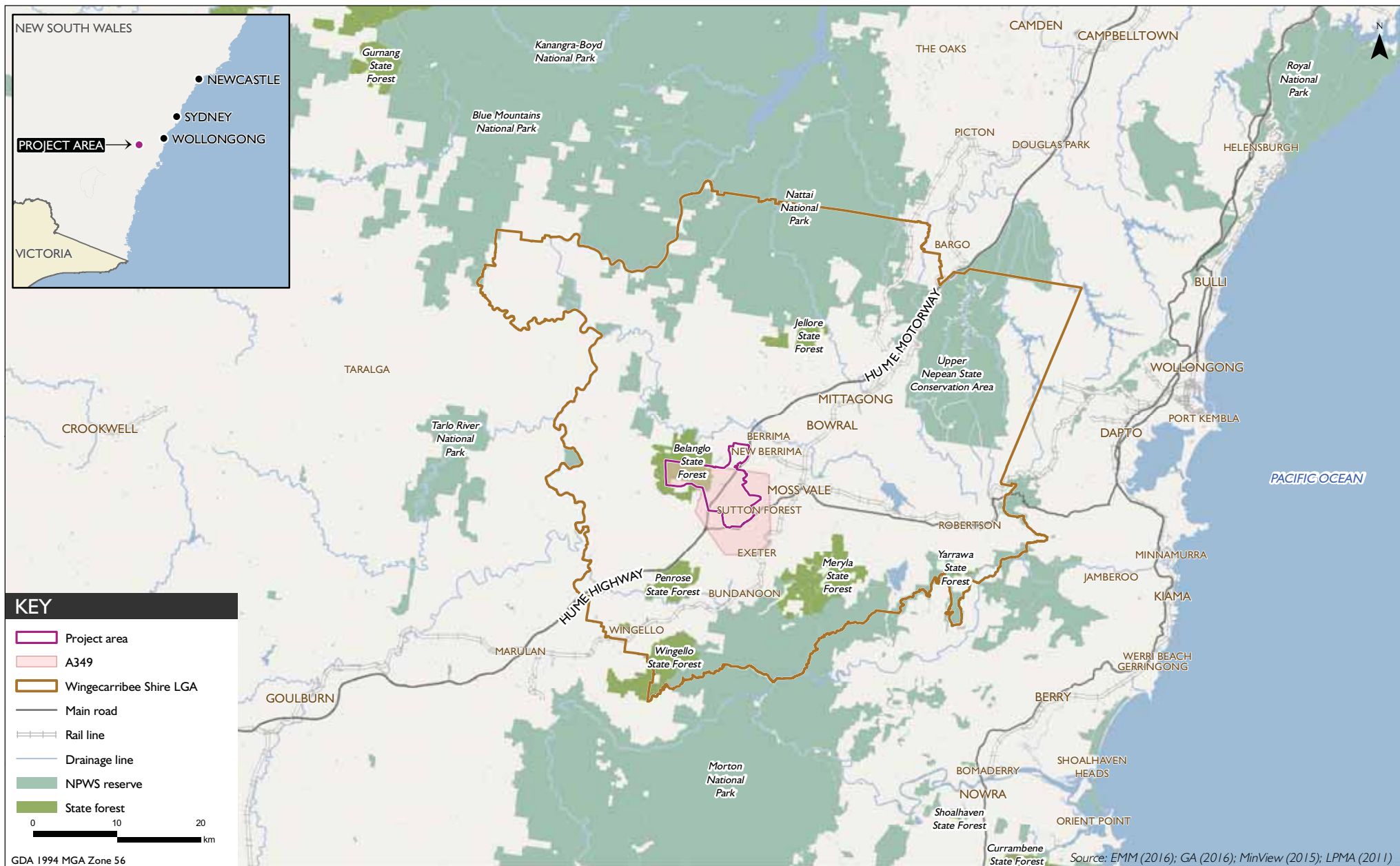
Hume Coal holds exploration Authorisation 349 (A349) located to the west of Moss Vale, in the Wingecarribee local government area (LGA). A349 covers approximately 8,900 hectares (ha), although mining is not proposed across its full extent. The proposed underground mining area is approximately 3,474 ha. The project area boundary is illustrated in Figure 1.2, and covers the combined Mining Lease Application (MLA) areas for the project that have been submitted under the NSW *Mining Act 1992*, (MLA 527, MLA 528 and MLA 529), as well as the parts of the project that do not require a mining lease. The project area is therefore larger than the combined MLA area.

The Southern Highlands has a long history of coal mining, with coal exploration and mining occurring since the 19th century. There are two short adits in the north western part of A349, in the valley of Longacre Creek, indicating historical mining activity there. Murrimba Colliery and Belanglo Extended Colliery operated from adits near Black Bobs Creek just to the west of A349, with Murrimba Colliery closing in the 1970s. The Southern Colliery also operated in the 1950s and 1960s near Canyonleigh, south-west of A349. To the north, the Wongawilli Seam was mined at Loch Catherine from 1923 until the 1950s, and the Wongawilli Seam was mined at Berrima Colliery until 2013. The Berrima Colliery mining lease (CCL748) lies immediately north of A349.

Today, the mining leases associated with Dendrobium and Wongawilli Collieries extend into the north-west of the Wingecarribee LGA, with Dendrobium extracting longwall panels within the shire.

Hume Coal acquired A349 from Anglo Coal in December 2010, and commenced exploration drilling in May 2011. Since this time the project has been developed following detailed geological, engineering, environmental, financial and other technical investigations to define the reserve and resource and to identify and address environmental and other constraints. Numerous alternative designs have been prepared and evaluated, as discussed in detail in Chapter 6. This process has allowed a well-considered, practical and economic project to be designed that will efficiently recover resources, while minimising environmental impacts and potential land use conflicts, and delivering socio-economic benefits to the local and broader communities.

The project incorporates leading practice innovations, some of which set a new benchmark for underground coal mining in NSW. For example, the rail wagons that will transport product coal will be covered, both when full of coal and on the return route when empty. All coal reject material (the stone that is separated out of the coal during processing) will be returned underground to partially backfill the mined-out void, reducing potential visual and other environmental impacts that could be associated with a permanent surface emplacement area. A first-workings mining system will be used which leaves pillars of coal in place so that the overlying strata is supported, rather than collapsing into the mined-out void, and therefore surface subsidence impacts will be negligible. By minimising disruption to the overlying strata, associated groundwater impacts will also be minimised.



Regional context

Hume Coal Project
Environmental Impact Statement

Figure I.1