AUSTAR COAL MINE
PART OF THE YANCOAL AUSTRALIA GROUP

AUSTAR COAL MINE
LWB1-B3 MODIFICATION
ENVIRONMENTAL ASSESSMENT

umwelt

NOVEMBER 2015

YANCOAL
兖煤澳大利亚有限公司

LWB1-B3 MODIFICATION ENVIRONMENTAL ASSESSMENT

Austar Coal Mine

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Austar Coal Mine Pty Ltd

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Executive Summary

Austar Coal Mine Pty Ltd (Austar) is seeking to modify DA 29/95 (the Bellbird South consent) to permit the transfer and processing of coal from three additional longwall panels within the Austar Coal Mine. This modification is referred to as the LWB1-B3 Modification and is sought under 75W of the *Environmental Planning and Assessment Act 1979*.

Mining operations within the Stage 3 area of the Austar Coal Mine have been suspended for the time being. This has caused a discontinuity to Stage 3 longwall operations. The LWB1-B3 Modification is required to address this discontinuity in longwall mining operations in the medium term and to maintain employment at Austar Coal Mine.

The key components of the LWB1-B3 Modification include an extension to the Bellbird South consent area to cover the three longwall panels, an extension to the life of the consent to allow for mining of the three longwall panels and application of a contemporary Extraction Plan condition to cover the new workings. No change to surface facilities or production rates is proposed.

The modification will facilitate the recovery of an addition of approximately 4.5 million tonnes of ROM coal using conventional longwall mining methods and maximises the use of existing infrastructure and facilities.

The LWB1-B3 Modification is located within an area surrounded by previous underground mine workings. The proposed longwalls are located beneath largely cleared land used for grazing and rural residential purposes. The modification area has no major constraints to the proposed deep underground operations, with specific assessment conducted in relation to all relevant natural, cultural and built surface features. This has included detailed assessment in relation residential and rural structures on relevant private properties, portions of local roads and other public infrastructure, and the biodiversity, water resource and cultural heritage features of the area.

The detailed impact assessments undertaken for the LWB1-B3 Modification conclude that the proposed modification is likely to result in only minor environmental impacts. This is primarily due to the significant depth of mining, which is a minimum of 480 metres below ground, the site characteristics and continued implementation of existing management and mitigation measures.

Predicted subsidence parameters are less than those previously approved in Stage 2 and Stage 3 mining areas that were extracted using Longwall Top Coal Caving methods. Extensive monitoring within these previously extracted areas has shown no significant impacts associated with underground mining, including no visible surface cracking, negligible impact to creeks or near surface aquifers, no observable impact on flora or fauna and no significant impacts to built features. The LWB1-B3 Modification is predicted to have similarly low impact on natural and built features and on existing land uses within the modification area.

Existing management measures implemented at the Austar Coal Mine will be extended to the LWB1-B3 Modification Area and additional monitoring is proposed to confirm potential subsidence impacts within the modification area. Management plans will be updated or prepared as part of the Extraction Plan process for the LWB1-B3 Modification Area.

This Environmental Assessment demonstrates that with the continued implementation of existing management and mitigation measures, the proposed modification can proceed within acceptable environmental standards.

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1.0 Introduction

Austar Coal Mine Pty Ltd (Austar), a subsidiary of Yancoal Australia Limited (Yancoal) operates the Austar Coal Mine, an underground coal mine located approximately 10 kilometres south of Cessnock in the Lower Hunter Valley in NSW (refer to **Figure 1.1**). The Austar Coal Mine incorporates the former Pelton, Ellalong, Cessnock No. 1 (Kalingo) and Bellbird South Collieries and includes coal extraction, handling, processing and rail and road transport facilities (refer to **Figure 1.2**).

Extensive mining has been undertaken within the Austar Coal Mine since 1916. Historical mining was predominantly via bord and pillar mining and more recently via conventional longwall mining and Longwall Top Coal Caving (LTCC) methods. Mining within the Bellbird South areas (Southland, Stage 1 and Stage 2, refer to **Figure 1.2**) was approved by the Minister for Urban Affairs and Planning in 1996 under DA 29/95, while mining of Stage 3 was approved by the Minister for Planning in 2009 under Project Approval 08_0111. Longwall mining commenced in the Ellalong Colliery area in 1983 and has subsequently progressed into the Bellbird South and the Stage 3 areas.

Mining within the Stage 1 and Stage 2 areas was completed in 2013. Since 2013, underground longwall mining has been progressing in the Stage 3 area, with the successful completion of longwall panel LWA8 in June 2015. Development operations have been suspended in the Stage 3 area for the time being. This has caused a discontinuity to Stage 3 longwall operations.

Austar has identified existing approved coal resources in the former Ellalong Colliery and Bellbird South areas. Three longwall panels, LWB1-B3, have been identified (refer to **Figure 1.2**) that can be accessed from the Bellbird South workings and be mined with minimal additional development work. The mining of these three longwalls, which contain approximately 4.5 million tonnes (MT) of ROM coal, will provide sufficient throughput for the Austar Coal Mine to maintain business continuity in the medium term.

Austar is proposing to modify DA 29/95 (the Bellbird South consent) to allow for the transfer and processing of coal from LWB1-B3 via the existing Bellbird South mains as shown on **Figure 1.3**. Further details of the proposed modification are provided in **Section 1.1** and **Section 3.0**.

The Bellbird South consent is a transitional Part 3A project and approval for the proposed modification is sought under the now repealed section 75W of the Environmental Planning and Assessment Act 1979 (EP&A Act). The operation of section 75W is continued under the transitional provisions provided in schedule 6A of the EP&A Act.

Umwelt (Australia) Pty Ltd (Umwelt) has prepared this EA on behalf of Austar to accompany an application to modify the Bellbird South consent. A statement of authorship for the EA is provided in **Appendix 1**.

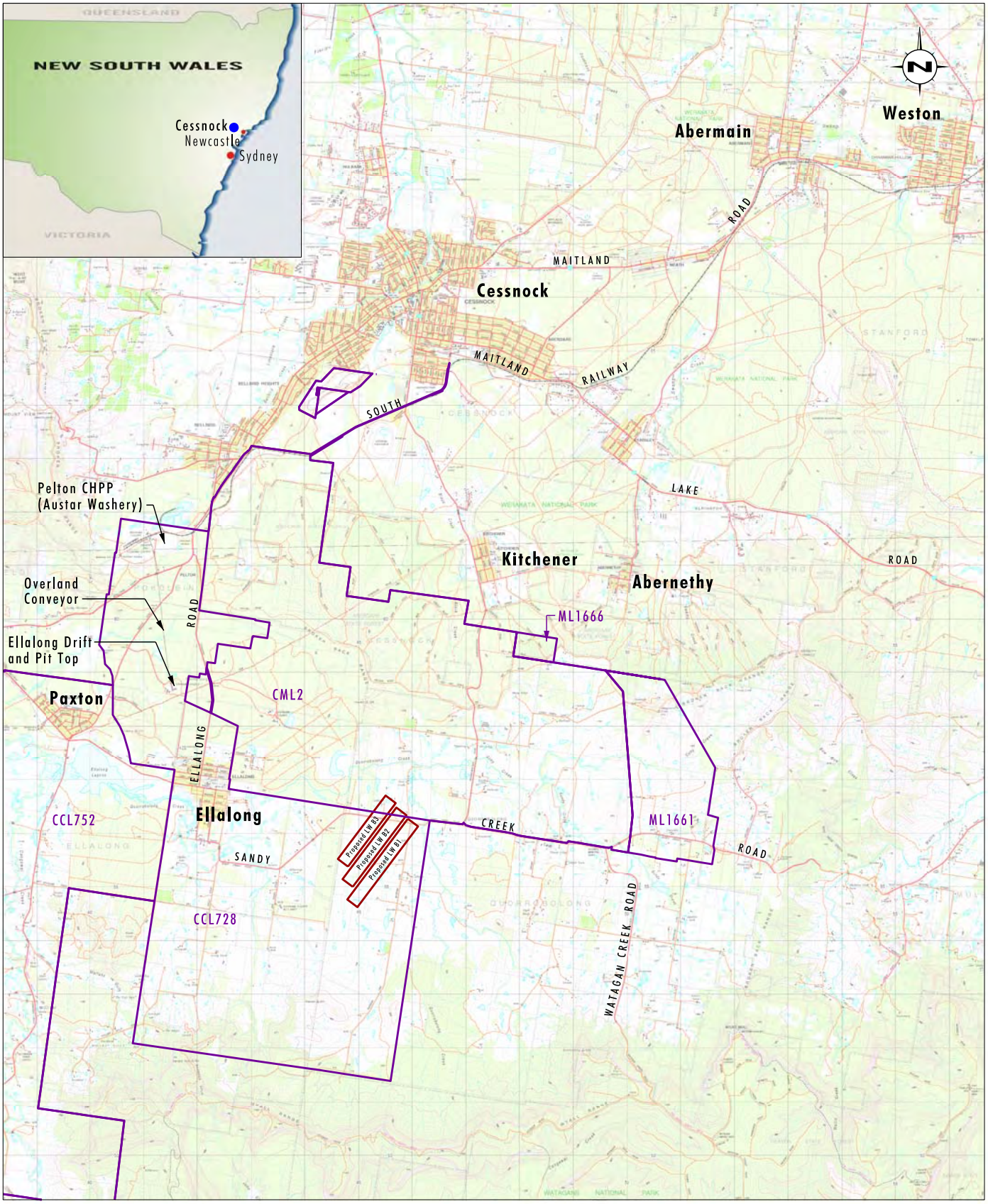

Image Source: LPI NSW (2009)
Data Source: Austar Coal Mine (2015)

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Legend

- Proposed LWB1-B3 Longwall Panels
- Mining Lease Boundary

FIGURE 1.1

Locality Plan

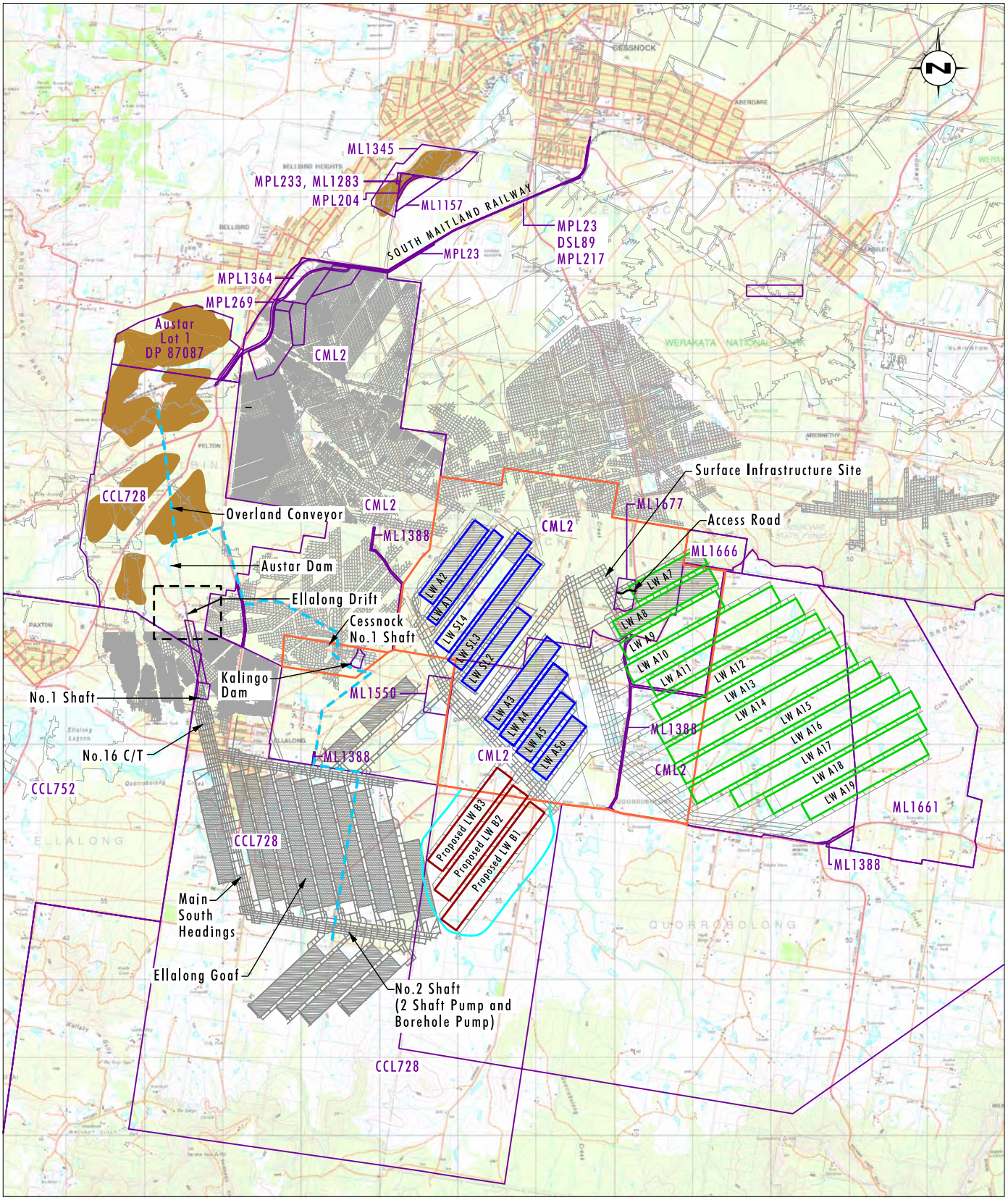

Image Source: LPI NSW (2009)
Data Source: Austar Coal Mine (2015)

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Legend

- Completed Bellbird South Stage 1, Stage 2 and Southland Longwall Panels (DA 29/95)
- Stage 3 Longwall Panels (PA08_0111) (In Progress)
- Proposed LWB1-B3 Longwall Panels
- Approved Reject Emplacement Areas
- Completed Underground Workings
- Mining Lease Boundary
- Austar owned CHPP Land
- Water Pipeline
- DA 29/95 Bellbird South Consent Area (Subsurface) - As Approved
- DA 29/95 Bellbird South Consent Area (Subsurface) - Proposed Extension

FIGURE 1.2

Austar Coal Mine and Proposed LWB1-B3

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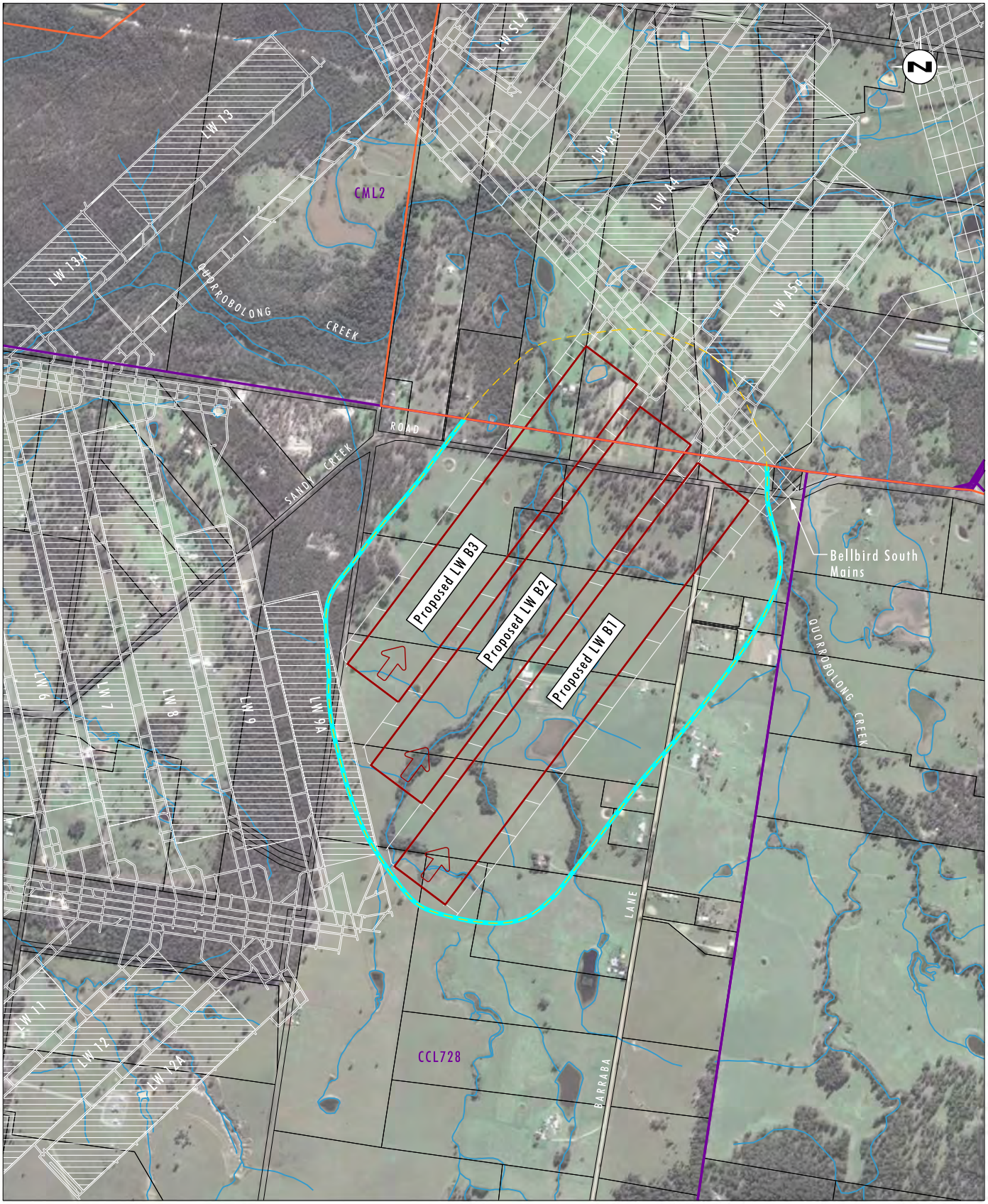

Image Source: Google Earth (2014)
Data Source: Austar Coal Mine (2015)

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- DA 29/95 Bellbird South Consent Area (Subsurface) - As Approved
- DA 29/95 Bellbird South Consent Area (Subsurface) - Proposed Extension
- Completed Underground Workings
- Mining Lease Boundary
- Direction of Mining
- Drainage Line

FIGURE 1.3

Proposed LWB1-B3 Modification

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1.1 Overview of Proposed LWB1-B3 Modification

Austar proposes to modify the Bellbird South Consent to permit the transfer and processing of coal from three proposed longwall panels (LWB1-B3) via the existing Bellbird South mains (refer to **Figure 1.3**). The proposed modification, referred to as the LWB1-B3 Modification, seeks to amend the Bellbird South Consent to:

- extend the development consent area to cover the three longwall panels (refer to **Figure 1.3**);
- extend the life of the Bellbird South Consent by a further 5 years to provide sufficient time for LWB1-B3 to be completed; and
- include a new Extraction Plan condition to cover the LWB1-B3 second workings, consistent with contemporary Extraction Plan requirements.

No other changes to the approved mining operations, associated surface facilities or production rates are proposed as part of the modification.

1.2 Proposed Modification Area

The environmental impacts of the proposed LWB1-B3 Modification have been assessed within the 20 millimetre subsidence contour for LWB1-B3. This area is referred to as the 'LWB1-B3 Modification Area' throughout this EA and is shown on **Figure 1.3.**

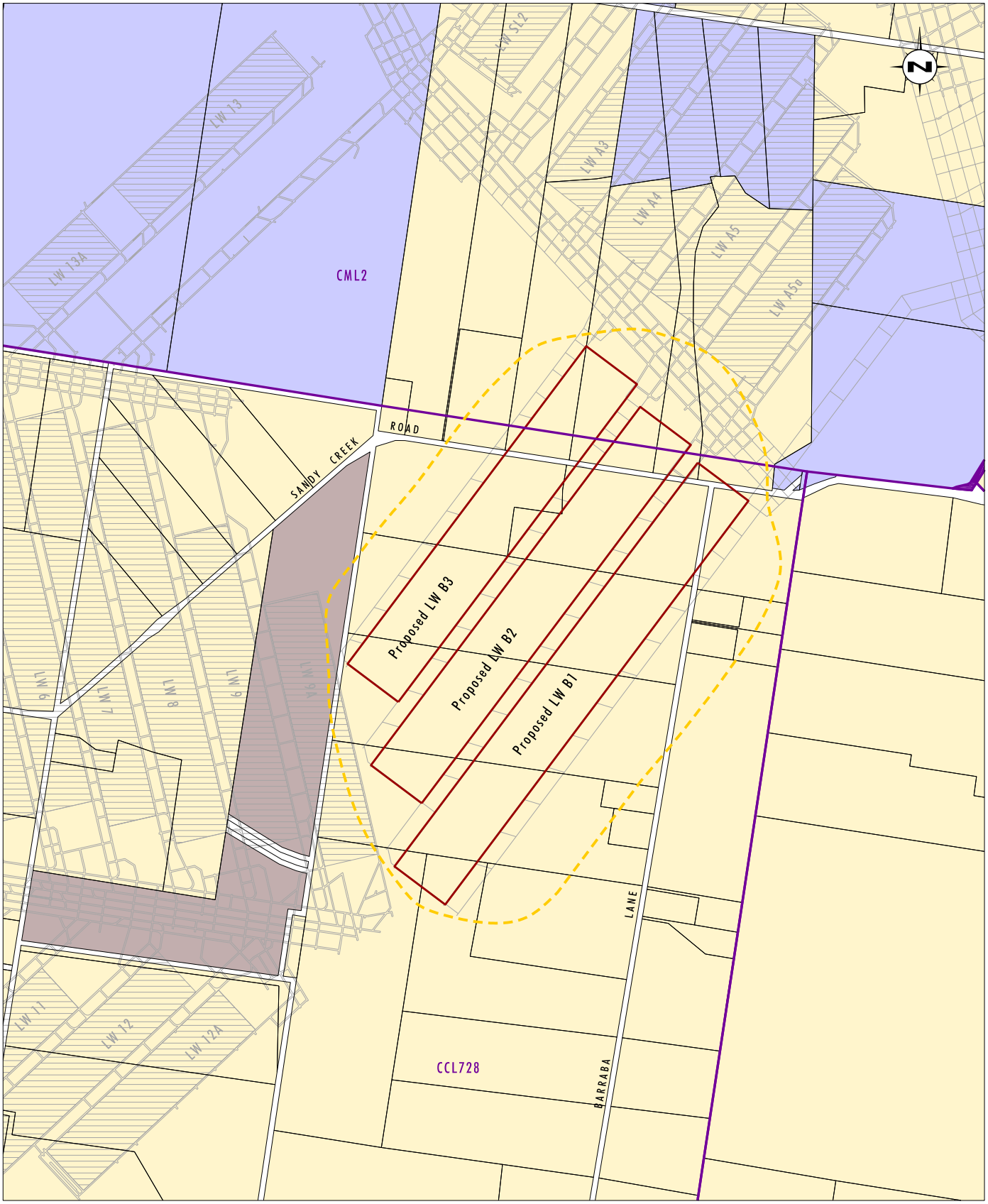
The 20 millimetre subsidence contour is considered the vertical limit of subsidence. While some far field horizontal movements may occur beyond the limit of the 20 millimetre subsidence contour, any natural or built surface features that could be sensitive to such movements have also been considered in this assessment.

1.3 Environmental Context and Land Use

The LWB1-B3 Modification Area is located in Quorrobolong; approximately three kilometres east of the township of Ellalong in the lower Hunter Valley of NSW (refer to **Figure 1.1**). The LWB1-B3 Modification Area is located largely within cleared private land used for agricultural and rural-residential purposes. Land ownership within and surrounding the LWB1-B3 Modification Area is shown on Figure 1.4.

The topography of the LWB1-B3 Modification Area is generally characterised by low undulating hills and creek flats associated with an un-named tributary of Quorrobolong Creek (refer to **Figure 1.5**). Elevations within the LWB1-B3 Modification Area range from approximately 130 metres to 150 metres (Australian Height Datum – AHD).

The LWB1-B3 Modification Area is situated within the Quorrobolong Creek Catchment, a sub-catchment to the larger Wollombi Brook and ultimately the Hunter River catchment. Quorrobolong Creek forms part of the Congewai Creek Management Zone of the Upper Wollombi Water Source within the Hunter Unregulated and Alluvial Water Sources Water Sharing Plan area. Quorrobolong Creek is located to the east and north of the LWB1-B3 Modification Area (refer to Figure 1.5) and flows north from the Myall Range then west into Ellalong Lagoon. An un-named tributary of Quorrobolong Creek runs from south to north across the proposed LWB1-B3 Modification Area, joining Quorrobolong Creek approximately 600 metres to the northwest (refer to **Figure 1.5**).



Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Completed Underground Workings
- Mining Lease Boundary
- Austar Owned Land
- Privately Owned Land
- Crown Land

FIGURE 1.4

Land Ownership

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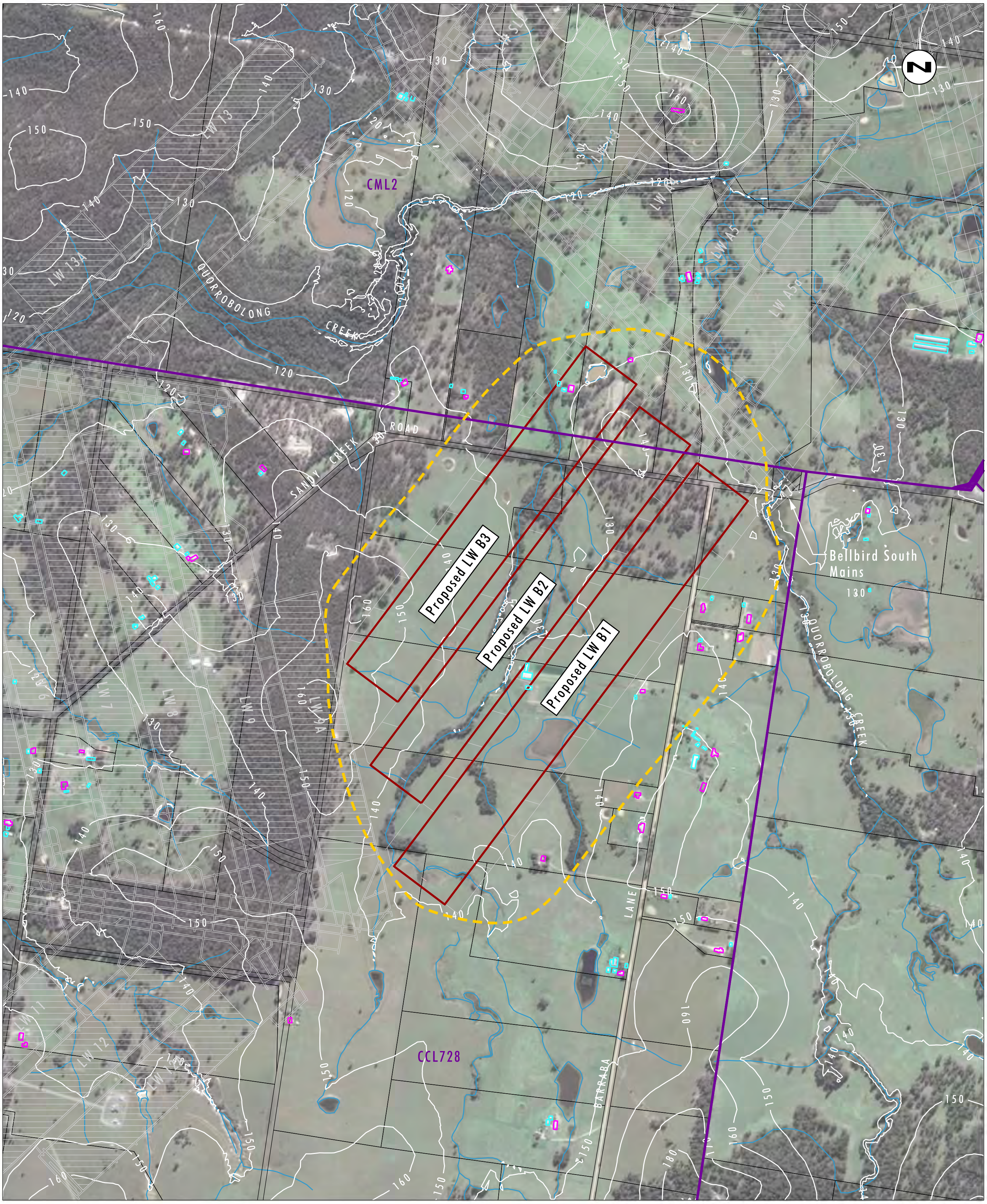

Image Source: Google Earth (2014)
Data Source: Austar Coal Mine (2015)
Note: Contour Interval 10m

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Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Completed Underground Workings
- Mining Lease Boundary
- Drainage Line
- Contour
- Dwelling
- Other Structure

FIGURE 1.5

Topography and Land Use Context

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One soil landscape type is found within the LWB1-B3 Modification Area, being the Quorrobolong soil landscape (Kovac and Lawrie 1991) (refer to Figure 1.6). The main soils within this landscape are prairie soils which form in alluvium and occur in drainage depressions and on lower slopes. They are generally poorly drained, have moderate permeability and the upper horizon has moderate erodability (Kovac and Lawrie 1991). The soils are moderately fertile and the main land use is generally grazing on unimproved pasture.

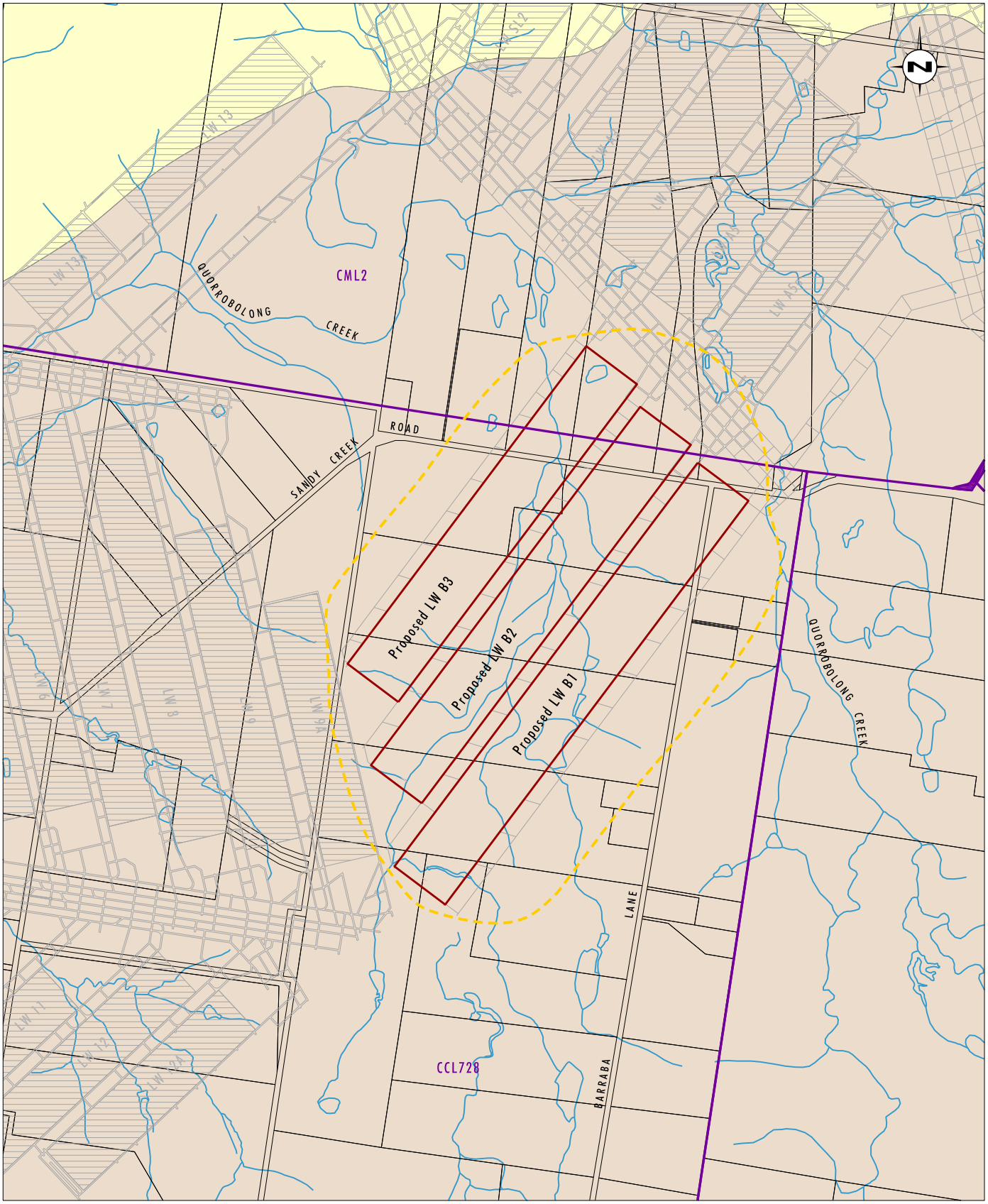
The Austar Coal Mine is located in the Newcastle Coalfield and targets coal extraction from the Greta Coal Seam within the Permian Age Greta Coal Measures. The depth of the cover directly above the proposed longwalls ranges from approximately 480 metres at the western edge of LWB3 to approximately 555 metres in the north-eastern corner of LWB1. The Greta Seam is the main economic coal seam in the Greta Coal Measures. The Greta Coal Measures are overlain by the Branxton Formation, which is comprised of a substantial thickness of sedimentary rocks and is up to 1300 metres thick in some locations (Geoscience Australia 1988).

Land use surrounding the LWB1-B3 Modification Area is primarily rural to the north, east and south, with vegetated parcels of Crown and Austar owned land to the west. The dominant land use within and surrounding the area is grazing, however also includes rural residential, vegetated land and underground mining and coal processing associated with the Austar Coal Mine. The villages of Kitchener, Abernethy, Ellalong, and Paxton are located within 4 km north and west of the LWB1-B3 Modification Area (refer to **Figure 1.1**). The Watagans National Park is located approximately 4 kilometres south of the LWB1-B3 Modification Area and the Werakata State Conservation Area is located approximately two kilometres to the north.

The LWB1-B3 Modification Area is located predominantly to the south of Sandy Creek Road, with the northern end of the proposed longwalls extending beneath Sandy Creek Road and Barraba Lane, both of which are local Council roads.

1.4 The Proponent

The proponent for the proposed LWB1-B3 Modification is Austar Coal Mine Pty Ltd (Austar). Austar is a wholly owned subsidiary of Yancoal Australia Ltd (Yancoal). Yancoal is a wholly owned subsidiary of Yanzhou Coal Mining Company Limited and is one of the largest coal mining companies in China.



Data Source: Austar Coal Mine (2015), Department of Natural Resources (2005)

0 0.25 0.5 1.0km

1:20 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Completed Underground Workings
- Mining Lease Boundary
- Drainage Line
- Quorrobolong Soil Landscape
- Aberdare Soil Landscape

FIGURE 1.6

Soil Landscapes

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1.5 Environmental Assessment Team

This EA was prepared by Umwelt (Australia) Pty Limited on behalf of Austar with specialist input provided by the following organisations/specialists. The specialist assessments prepared for this EA and their authors are presented in **Table 1.1**.

Table 1.1 Specialist Reports included within this EA

Report	Author
Mine Subsidence Impact Assessment	Mine Subsidence Engineering Consultants Pty Ltd
Groundwater Impact Assessment	Dundon Consulting Pty Ltd
Flooding and Drainage Assessment	Umwelt (Australia) Pty Limited
Ecological Assessment	Umwelt (Australia) Pty Limited
Aboriginal Cultural Heritage and Archaeological Assessment	Umwelt (Australia) Pty Limited

A full listing of the project team members and their respective roles are provided in **Appendix 1**.

1.6 Environmental Assessment Structure

This EA has been prepared in accordance with the EP&A Act and Regulation (refer to EA Statement of Authorship in Appendix 1). The EA comprises a main text component and supporting studies, which are included as appendices. An overview of the layout of the main text is presented in **Table 1.2** below.

Table 1.2 Environmental Assessment Structure

EA Section	Environmental Assessment Details
Executive Summary	Provides a brief overview of the proposed modification, the major outcomes of the environmental assessment and key project commitments to mitigate potential impacts.
Section 1.0	Provides the background and context for the proposed modification, key modification details, the proponent and environmental assessment team.
Section 2.0	Describes the existing Austar operations and approvals including environmental management and monitoring at the Austar Coal Mine.
Section 3.0	Describes the proposed modification.
Section 4.0	Provides a description of the current planning context for the proposed modification.
Section 5.0	Describes the stakeholder consultation process undertaken as part of the environmental assessment process.

EA Section	Environmental Assessment Details
Section 6.0	Provides a comprehensive analysis and assessment of the potential environmental and community impacts of the proposed modification, including the project specific and cumulative impacts.
Section 7.0	Provides a summary of proposed management and mitigation measures for the proposed modification
Section 8.0	Provides a conclusion and justification for the project, including how the proposed modification meets the principles of ecologically sustainable development.
Sections 9.0 and **10.0**	References and Abbreviations.

2.0 Overview of Existing Operations

2.1 Mine History

The Austar Coal Mine is an amalgamation of several older mines and operates within a number of mining leases under 14 separate development consents issued by Cessnock City Council between 1975 and 2012. Additionally, Austar operates under the Bellbird South consent granted by the NSW Minister for Urban Affairs and Planning in 1996 and Project Approval 08_0111 granted by the Minister for Planning in 2009. The Bellbird South consent was modified in 2006, 2008, 2009, 2010 and 2012 to provide for mining using Longwall Top Coal Caving (LTCC) technology in Stage 1 and 2 areas and changes to the longwall layout. Underground longwall mining ceased in the Stage 1 and 2 areas in 2013, and subsequently commenced in the Stage 3 area.

The Austar Coal Mine and its associated infrastructure has a long and productive history. A chronology of mining within the Greta Coal Seam at the site and related activities is presented in **Table 2.1**. The locations of previous underground workings in the area are shown on **Figure 1.2**. The location of infrastructure currently used in the handling and processing of coal from the Austar Coal Mine is also shown on **Figure 1.2**.

Table 2.1 Summary of Mining Activities and Approvals at Austar Coal Mine

Year	Historical Details
1916	Underground mining commenced at Pelton Colliery.
1921	Underground mining commenced at Cessnock No. 1 (Kalingo) Colliery.
1960/1961	Pelton Coal Handling Preparation Plant (CHPP) constructed.
1961	Underground mining ceased at Cessnock No. 1 Colliery.
Late 1960s	Cessnock No. 1 Colliery amalgamated into Pelton Colliery.
1975	1975 development consent for Ellalong Colliery granted under Part X11 of the Local Government Act 1919 as DA 74/75/79 (Ellalong Consent).
1978	Underground mining commenced at Ellalong Colliery with coal being delivered by overland conveyor to the coal preparation plant, raw and washed coal handling systems and train loading facilities at Pelton Colliery.
1983	Longwall production commenced at Ellalong Colliery.
1992	Underground mining ceased at Pelton Colliery.
1994	High levels of gas (primarily carbon dioxide) encountered in the underground workings at Ellalong Colliery, preventing further mining of additional seams to the south-east.
1994	Development consent for the extraction of two longwall panels as a minor extension to the Ellalong Colliery granted by Cessnock City Council.
1995	Pelton Open Cut Coal Mine established.

Year	Historical Details
1996	DA 29/95 approved by the Minister for Urban Affairs and Planning and underground operations from the Ellalong Colliery extended into the Bellbird South Colliery area (Bellbird South consent).
1998	Ellalong and Pelton Collieries amalgamated with Bellbird South Colliery and re-named Southland Colliery.
2003	Spontaneous combustion event resulting in a fire in the underground workings in Bellbird South. Mine placed in 'care-and-maintenance' for approximately 18 months.
2004	Yancoal purchased Southland Colliery and changed the name to Austar Coal Mine.
2005	Austar recommenced underground mining in the Bellbird South Colliery area.
2006	DA 29/95 modified to allow underground mining using LTCC technology in the Stage 1 area.
2008	DA 29/95 modified to allow underground mining using LTCC technology in the Stage 2 area.
2009	DA 29/95 modified to increase the size and dimensions of Longwalls A4 and A5 in the Stage 2 area.
2009	PA 08_0111 for underground mining using LTCC in the Stage 3 area approved by the Minister for Planning.
2010	DA 29/95 modified to allow extraction of one additional longwall panel (Longwall A5a) using LTCC technology in the Stage 2 area.
2010	PA 08_0111 wording of Condition 1 of Schedule 3 modified.
2012	PA 08_0111 modified to reorient Stage 3 longwalls and increase chain pillar width.
2012	DA 29/95 modified to increase the length of Longwall A5a.
2013	Mining completed in Stage 2 longwall A5a.
2013	Kitchener Surface Infrastructure Site ventilation shafts, services borehole, and services completed, and underground longwall mining commenced in Stage 3 area in Longwall A7.
2013	PA 08_0111 modified to extend the length of Longwalls A7 to A10.
2014	Stage 3 development works suspended.
2015	Underground longwall mining within the Stage 3 area encounters discontinuity following completion of Longwall A8. Austar relocates development operations to the Bellbird South and Ellalong Colliery areas to maintain business continuity in the medium term.

As set out in **Table 2.1**, underground mining commenced at Pelton Colliery in 1916. The Pelton CHPP was constructed in about 1960/1961 for the washing of Pelton Colliery coal. Pelton Colliery was amalgamated with the neighbouring Cessnock No. 1 Colliery in the late 1960s.

In 1975 development consent for Ellalong Colliery was granted under Part X11 of the Local Government Act 1919 and the mine was officially opened in July 1979. The 1975 development consent envisaged that coal from Ellalong Colliery would be transported by conveyor from the Ellalong Drift and Pit Top to the Pelton CHPP. Longwall production commenced at Ellalong Colliery in 1983. Mining within the Ellalong Colliery is still permissible under the 1975 consent.

In early 1994 high gas levels were encountered in the southern part of Ellalong Colliery. Development consent was granted by Cessnock City Council in June 1994 to allow extraction of two longwall panels within existing mining leases to the north of the Ellalong Colliery and allow continuity of operations whilst investigations into alternate mining options were undertaken for the Ellalong Colliery.

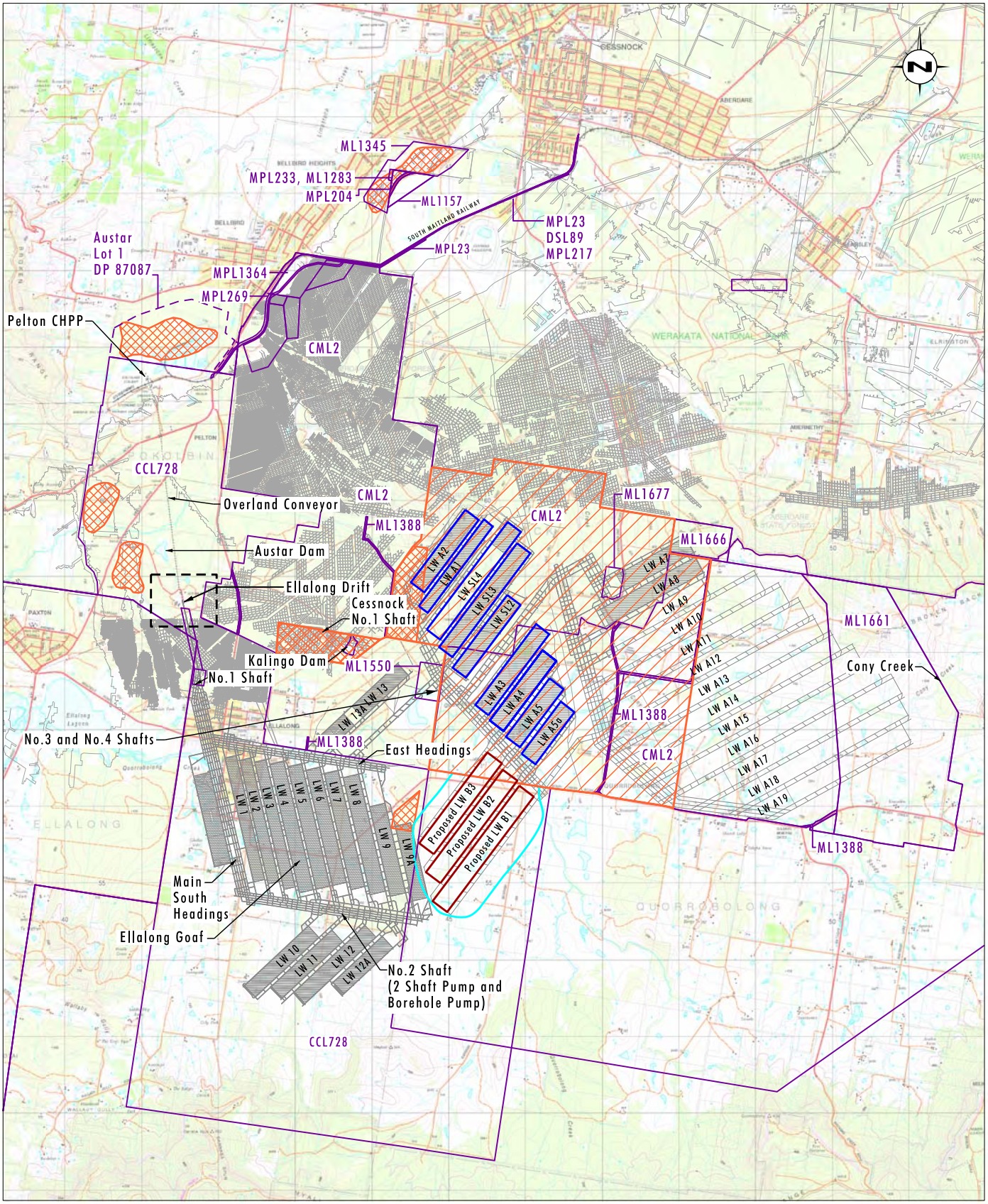
In 1996 the Bellbird South consent was granted by the Minister for Urban Affairs and Planning to extend Ellalong Colliery to the north-east into the Bellbird South area to allow development in an area not affected by high levels of coal seam gas. The Bellbird South consent allowed for mining within CML2 by conventional retreat longwall mining producing up to 3 million tonnes per annum (Mtpa) of product coal. The approved mining area that formed part of the Bellbird South consent is shown in **Figure 2.1**.

In 1998 Southland Coal Pty Limited acquired Ellalong and Pelton Collieries and amalgamated them with Bellbird South Colliery. Ellalong, Pelton and Bellbird South Collieries became known as the Southland Colliery. Southland Colliery was operated until 2003 when spontaneous combustion resulted in the mine ceasing operations and being placed on care and maintenance for a period of 18 months.

Southland Colliery and its associated infrastructure was acquired by Yancoal in December 2004 and was renamed Austar Coal Mine.

Austar recommenced development mining in the Bellbird South area in April 2005. A modification to the Bellbird South consent was approved by the Minister for Planning in 2006 to allow for the extraction of coal to a height of 6.5 metres using LTCC technology in the Stage 1 area (consisting of LWA1 and A2 as shown on **Figure 2.1**). A further section 96 Modification (Stage 2) was approved by the Minister for Planning in 2008 to allow LTCC extraction of LWA3 to A5 in Stage 2 (see **Figure 2.1**). A third minor section 96 (1a) modification to vary the length and widths of LWA4 and A5 was approved in 2009, and a fourth modification under Section 75W of the EP&A Act adding LWA5a to the Stage 2 area was approved in November 2010. Modification 5 was approved on 27 April 2012 to lengthen LWA5a. Mining of LWA5a was completed in February 2013.

A new Project Approval (PA 08_0111) was granted by the Minister for Planning in September 2009, enabling longwall mining using LTCC technology in the Stage 3 area and construction and operation of a new Surface Infrastructure Site and access road south of Kitchener (refer to Figure 1.2). The new Surface Infrastructure Site includes new pit top facilities including an access road, upcast and downcast ventilation shafts, main ventilation fans, winder house, bathhouse, workshop, electricity substation and distribution line, service boreholes, potable and reticulated sewerage services, telecommunication services, offices and store. Ventilation shaft/fans and ancillary services construction at the Kitchener Surface Infrastructure Site was substantially completed in June 2013, with underground longwall mining also commencing in the Stage 3 area in June 2013.



Data Source: Topo Maps: LPI NSW, Longwall Layouts: Austar Coal Mine

0 1 2 3 km
1:70 000

Legend

- Completed Bellbird South Stage 1, Stage 2 and Southland Longwall Panels (DA 29/95)
- Proposed LWB1-B3 Longwall Panels
- Mining Lease Boundary
- Austar owned CHPP Land
- Surface Application Area (DA 29/95)
- Subsurface Application Area (DA 29/95)
- DA 29/95 Bellbird South Consent Area (Subsurface) - Proposed Extension
- Completed Underground Workings

FIGURE 2.1

DA29/95 Approved Mining Area and Proposed LWB1-B3 Modification

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2.2 Current Mining Operations

Since 2013, underground mining within the Austar Coal Mine has been undertaken within the Stage 3 area under Project Approval 08_0111. Austar Coal Mine has approval to extract up to 3.6 million tonnes of run of mine (ROM) coal a year until 31 December 2030.

Coal mined from within the Stage 3 area (PA 08_0111) and from the Bellbird South consent area (DA 29/95) is bought to the surface at the Ellalong Drift and Pit Top via an underground conveyor through the Ellalong East and South Headings (refer to **Figure 1.2**). Coal is then conveyed to the Pelton CHPP via an overland conveyor system, processed and handled at the Pelton CHPP and railed to the Port of Newcastle via the Austar Rail Line, South Maitland Railway and Main Northern Rail Line. Up to 60,000 tonnes of specialty coal product is also transported by road from the Pelton CHPP.

Reject from the Pelton CHPP is emplaced at approved emplacement areas at the Pelton CHPP and Aberdare Extended Open Cut Voids and may be emplaced at other approved sites as shown on **Figure 1.2**.

Longwall mining within the Stage 3 area has progressed to the end of LWA8. Mining of LWA8 was completed in June 2015. Development operations have been suspended in the Stage 3 area for the time being. This has caused a discontinuity to Stage 3 longwall operations. Austar has made a business decision to relocate development operations to the Bellbird South and Ellalong Colliery areas to maintain business continuity in the medium term.

In June 2015 Austar recommenced first workings development in the Bellbird South and Ellalong Colliery areas (under the respective consents) in preparation for extraction of longwall panels LWB1-B3 following approval of the LWB1-B3 Modification Application.

2.3 Environmental Management of Existing Operations

The environmental management of existing operations at the Austar Coal Mine is undertaken within the framework of the Austar Environmental Management Strategy (Austar 2013) and supporting management plans, the Austar Mining Operations Plan (MOP) as amended (Austar 2015) and the Environment Protection Licence for the mine (EPL 416). This section provides an overview of the environmental management framework at the Austar Coal Mine and its current environmental performance.

2.3.1 Environmental Management and Monitoring

The Austar Environmental Management Strategy (2013) and supporting environmental management and monitoring plans provide a methodical and integrated approach to fulfilling Austar's environmental objectives and ensuring the ongoing management of the site in accordance with the principles of ecologically sustainable development.

An independent environmental audit of the Austar Coal Mine undertaken in 2014 found that Austar's Environmental Management Strategy provides a sound basis for the management of environmental aspects of the activities and operations within the Austar Coal Mine (AEMC 2015). It also found that Austar has generally demonstrated a high degree of compliance with conditions of consent and approval under the Bellbird South consent and Project Approval 08_0111 (AEMC 2015).

Current environmental management and monitoring plans include:

- Environmental Management Strategy
- Environmental Monitoring Program
- Subsidence Management Plans for the Stage 1 and Stage 2 areas including:
  - Property Subsidence Management Plans
  - Public Safety Subsidence Management Plan
  - Infrastructure Subsidence Management Plans
  - Subsidence Monitoring Strategy
- Extraction Plan/Subsidence Management Plan for Stage 3 LWA7 to LWA10 including:
  - Subsidence Monitoring Program
  - Land Management Plan
  - Biodiversity Management Plan
  - Built Features Management Plan
  - Heritage Management Plan
  - Public Safety Management Plan
- Noise and Vibration Management Plan
- Air Quality and Greenhouse Gas Management Plan
- Site Water Management Plan
- Bushfire Management Plan
- Pollution Incident Response Management Plan
- Aboriginal Cultural Heritage Management Plan
- Historic Heritage Management Plan
- Stage 2 Ecological Monitoring Program
- Stage 3 Surface Infrastructure Site – Traffic Management Plan
- Stage 3 Surface Infrastructure Site – Shaft Construction Environmental Management Plan
- Stage 3 Surface Infrastructure Site – Landscape Management Plan Kitchener Surface Infrastructure Site.

Austar's environmental management plans have been prepared and implemented in accordance with the conditions of the Bellbird South consent or Project Approval 08_0111, where appropriate.

Annual review and reporting of environmental performance is provided in the Annual Environmental Management Report (AEMR).

2.3.1.1 Subsidence Management and Monitoring

The monitoring, management and mitigation of subsidence is an integral component of current mining operations and requirements of the existing Austar Extraction Plans and Subsidence Management Plans (SMP).

There are a range of subsidence monitoring procedures implemented (in consultation with landholders) by Austar, which will continue to inform refinement of subsidence prediction and management as mining progresses, as informed by the monitoring program and ongoing consultation with stakeholders. These measures include:

- subsidence monitoring lines to be located as determined as part of the Extraction Plan process
- visual assessment of natural features and items of surface infrastructure before, during and following longwall mining to detect subsidence impacts such as surface cracking, irregularities in the subsidence profile, erosion, changes in drainage patterns or loss of water from drainage structures
- assessment of buildings and other relevant structures by a structural engineer before and after longwall mining
- verification and revision of subsidence predictions as mining progresses.

Verification and ongoing refinement and calibration of the subsidence predictive model are critical components of subsidence management. As the coal resource is extracted, verification of the model is undertaken by assessing measured subsidence against predictions. This monitoring information may then be incorporated into future iterations of subsidence predictions. This allows a continual refinement process for the assessment and management of subsidence impacts as operations progress.

Monitoring of subsidence parameters and subsidence induced impacts for the mining of two Top Coal Caving panels in Stage 1 confirmed that observed subsidence levels were within Maximum Predicted Subsidence for those panels. The same observation has been recorded for extraction of LWA3, A4, A5 and A5a in the Stage 2 area. Surface impacts associated with subsidence within the Stage 1 and Stage 2 areas have been minimal and have very rarely required surface remediation works.

The results of the Subsidence Monitoring Program are communicated on a regular basis to a range of stakeholders, including landholders over the mining area, the Austar Community Consultative Committee, infrastructure owners, and relevant Government authorities. In addition, results are regularly provided on the Austar website, and formally reported on an annual basis through the AEMR.

Austar will continue to communicate with surrounding stakeholders regarding the subsidence impact assessment, potential subsidence impacts, monitoring and management considerations using protocols established in the Extraction Plan (including Built Features Management Plan) over the life of current approved operations within the Austar Coal Mine.

2.3.2 Austar Mining Operations Plan

Operational aspects of the Austar Coal Mine, including environmental management and rehabilitation, are managed in accordance with the current Austar MOP as amended (Austar 2015), which was approved by the Department of Industry, Division of Resources and Energy (DRE), in 2015. The current MOP covers all mining operations at the Austar Coal Mine over a seven year period from 2008 to 2015. A new MOP will be prepared and submitted for approval prior to the expiry of the existing MOP. The MOP encompasses all mining activities within the Austar Coal Mine mining leases including:

- underground mining
- activities at Ellalong Drift and Pit Top
- overland transport of ROM coal from Ellalong Drift to Pelton CHPP
- processing and handling of coal at Pelton CHPP
- reject management and emplacement activities
- water management
- use and management of remote infrastructure sites (No. 1, 2, 3, 4, 5 and 6 shafts, the Kalingo site, and the Kitchener Surface Infrastructure Site
- rehabilitation activities.

Review and reporting of Austar's performance against the MOP is provided through AEMRs and DRE inspections.

3.0 Description of Proposed LWB1-B3 Modification

Austar proposes to modify the Bellbird South consent to permit the transfer and processing of coal from LWB1-B3 via the existing Bellbird South mains, and at the same time contemporise extraction management regulation. The proposed modification includes:

- extending the development consent area to encompass LWB1-B3 (refer **Figure 1.3**);
- extending the life of the Bellbird South Consent by a further five years to allow for extraction of LWB1-B3; and
- replacing the existing SMP condition on the Bellbird South Consent with a contemporary Extraction Plan condition which extends to the secondary extraction of ROM coal from LWB1-B3.

Austar holds mining authorities CCL728 and CML2 over the LWB1-B3 Modification Area. The LWB1-B3 Modification Area is located entirely within CCL728 and CML 2 and no change to Austar's existing mining authorities is required to accommodate the LWB1-B3 Modification (refer to **Section 4.1.2**).

The proposed modification will provide access to an additional approximately 4.5 MT of ROM coal and will provide sufficient throughput for the Austar Coal Mine to maintain business continuity in the medium term.

No other changes to the approved mining operations or existing surface facilities are proposed as part of the modification.

Further detail of the proposed modification is provided in the following sections.

3.1 Proposed Longwalls

Austar has identified existing approved resources in the former Ellalong and Bellbird Colliery areas. The proposed modification to the Bellbird South consent will provide for the transfer and processing of this coal accessed via the existing Bellbird South mains.

LWB1-B3 are located in an area with a depth of cover of approximately 480 to 555 metres. The void width of the proposed longwalls is approximately 237 metres with an extraction height of approximately 3.5 metres. LWB1-B3 will be mined using conventional longwall mining, not the LTCC method. The void length of LWB1 is approximately 1,880 metres, LWB2 is approximately 1,670 metres and LWB3 is approximately 1,480 metres, including first workings.

3.2 Extension of Consent Life

The Bellbird South consent will lapse in February 2017. In order to allow for the extraction and transfer of coal from LWB1-B3, Austar proposes extending the life of the Bellbird South Consent by a further five years. The proposed extension to the Bellbird South consent will not alter the approved life of the Austar Coal Mine which currently has approval for production until 2030 under the Stage 3 Project Approval (08_0111).

3.3 Extraction

From 1 July 2014, the former SMP process was replaced by a consolidated Extraction Plan process that provides for the joint regulation of subsidence under a single Extraction Plan. This change involved replacing existing SMP conditions on mining leases with a condition requiring lease holders to have an approved Extraction Plan in place which provides for the effective management of subsidence risks prior to undertaking underground mining operations that may cause subsidence. An 'approved Extraction Plan' is defined as being an Extraction Plan approved under the terms of a development consent.

The Bellbird South consent includes the requirement for an SMP which is now outdated. Hence it is proposed that the SMP condition be replaced with a contemporary Extraction Plan condition. This new condition would require an Extraction Plan for LWB1-B3 to be prepared, approved and implemented prior to commencement of any second workings.

3.4 Mining Method

Coal will be extracted from LWB1-B3 using conventional longwall mining techniques, not LTCC as is currently used within the Stage 3 area.

3.5 Surface Facilities and Infrastructure

No additional surface facilities or changes to existing surface infrastructure will be required to accommodate the LWB1-B3 Modification.

The proposed modification will utilise the existing and approved Austar Coal Mine infrastructure and facilities to handle, process and transport ROM coal from LWB1-B3. Access to LWB1-B3 is achieved via the existing Bellbird South mains and no additional surface infrastructure or facilities are proposed as part of the modification.

3.6 Employment

Austar Coal Mine currently employs a workforce of approximately 200 people. The proposed modification will allow for the continued employment of the current workforce and avoid the loss of staff that would otherwise be associated with a significant break in mining continuity at the site.

3.7 Hours of Operation

The underground mining of LWB1-B3 will be undertaken on a 24 hour, seven day a week basis, consistent with the current consent.

3.8 Project Timing

Approval for the modification is sought by early 2016 to provide for certainty of the continuation of mining operations within the Austar Coal Mine. First workings in the LWB1-B3 area commenced in June 2015 under existing approvals. Secondary extraction from LWB2 is currently scheduled to commence in Quarter 3 2016.

3.9 Project Justification and Alternatives

3.9.1 Business Continuity

Since 2013, longwall mining within the Austar Coal Mine has been progressing within the Stage 3 area. Development operations have been suspended in the Stage 3 area for the time being. This has caused a discontinuity to Stage 3 longwall operations.

The LWB1-B3 Modification provides the opportunity to maintain business continuity and extract readily accessible additional high quality coal resource that were not currently planned for extraction. Without the LWB1-B3 Modification, operations within the Austar Coal Mine would cease until such time as mining within Stage 3 recommences, potentially risking business viability in an already marginal economic environment and the associated loss of employment for the existing 200 employees.

3.9.2 Coal Tonnage and Surface Impact

The LWB1-B3 Modification will provide access to an additional approximately 4.5 MT of ROM coal.

As shown in **Figure 1.2**, there has been significant longwall mining undertaken surrounding the LWB1-B3 Modification Area over a long period of time. As a result, the potential subsidence impacts associated with mining in the local area are well understood, and as the proposed longwalls will be extracted from the same coal seam at similar depths as surrounding historical workings, it is expected that subsidence and associated surface impacts from the proposed longwalls will be similar to that previously experienced in adjacent areas and less than that previously experienced in the LTCC extracted areas. Surface impacts associated with subsidence within the surrounding area have been minimal and have very rarely required surface remediation works.

A detailed assessment of the extent and nature of surface impacts associated with the LWB1-B3 Modification has been completed and confirms the subsidence related impacts on the environment and built features will be minimal and are able to be readily managed in accordance with existing management practices for recent operations at Austar Coal Mine (refer to **Section 6.0**).

3.9.3 Efficient Resource Recovery

The LWB1-B3 Modification maximises the efficient use and management of resources through maximising resource utilisation within an area of historical underground workings and using well established surface facilities, with no changes required to existing surface infrastructure to support the proposed modification.

3.9.4 Ecologically Sustainable Development (ESD)

Austar has identified additional high quality coal within its existing mining leases that can be recovered without having a significant impact on built features or the environment.

The project has been assessed with consideration of the principles of ESD (refer to Section 8.3), including the precautionary principle, intergenerational equity, conservation of biological diversity and valuation and pricing of resources. These principles have been incorporated into the planning and assessment of the LWB1-B3 Modification so as to minimise the potential for serious irreversible environmental damage. This has been achieved through careful project design, identification and assessment of potential impacts, the development of appropriate management and mitigation measures to address identified risks and the implementation of monitoring and reporting mechanisms.

3.9.5 Project Alternatives

As noted in **Section 1.0**, the implication of not proceeding with the proposed LWB1-B3 Modification is significant business interruption as development operations have been suspended in the Stage 3 area for the time being. This has caused a discontinuity to Stage 3 longwall operations.

A significant business interruption would risk business viability in an already marginal economic environment. The alternative of not proceeding with the proposed LWB1-B3 Modification is therefore not considered viable.

4.0 Planning Context

This section provides details of the relevant State and Commonwealth legislation and planning provisions and a discussion of their application to the proposed modification.

4.1 NSW State Legislation

4.1.1 Environmental Planning and Assessment Act 1979

As outlined in **Section 1.0**, a modification to the Bellbird South consent is sought under Section 75W of the EP&A Act.

The Bellbird South consent was granted by the Minister for Urban Affairs and Planning on 14 February 1996 pursuant to section 91 of the EP&A Act and clause 8 of the State Environmental Planning Policy No. 34 – Major Employment prior to the commencement of the (now repealed) Part 3A provisions.

Clause 8J(8) of the Environmental Planning and Assessment Regulation NSW 2000 provides that:

For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent …

(b) a development consent granted by the Minister under State Environmental Planning Policy No 34—Major Employment-Generating Industrial Development,

Further Clause 12 of Schedule 6A of the EP&A Act provides that:

Section 75W of Part 3A continues to apply to modifications of the development consents referred to in clause 8J (8) of the Environmental Planning and Assessment Regulation 2000, and so applies whether an application for modification is made before or after the commencement of this clause.

Accordingly, the Bellbird South Consent is a transitional Part 3A project and may continue to be modified pursuant to Section 75W of the EP&A Act.

Section 75W is therefore an appropriate approval pathway for the LWB1-B3 Modification.

Permissibility

Environmental planning instruments, other than State Environmental Planning Policies (SEPPs), do not apply to projects assessed under Section 75W of the EP&A Act, except as regards to permissibility.

The LWB1-B3 Modification Area is located within the Cessnock local government area (LGA). Hence, the Cessnock Local Environment Plan (LEP) 2011 is relevant to the permissibility of this modification. Under the LEP the LWB1-B3 Modification Area is zoned RU2 Rural Landscapes (refer to **Figure 4.1**). Under the LEP, mining is permissible with consent on land zoned RU2.

The permissibility provisions of SEPP (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) also provide that 'underground mining carried out on any land' is permissible with development consent. Consequently, the Project is permissible with development consent under the Mining SEPP.

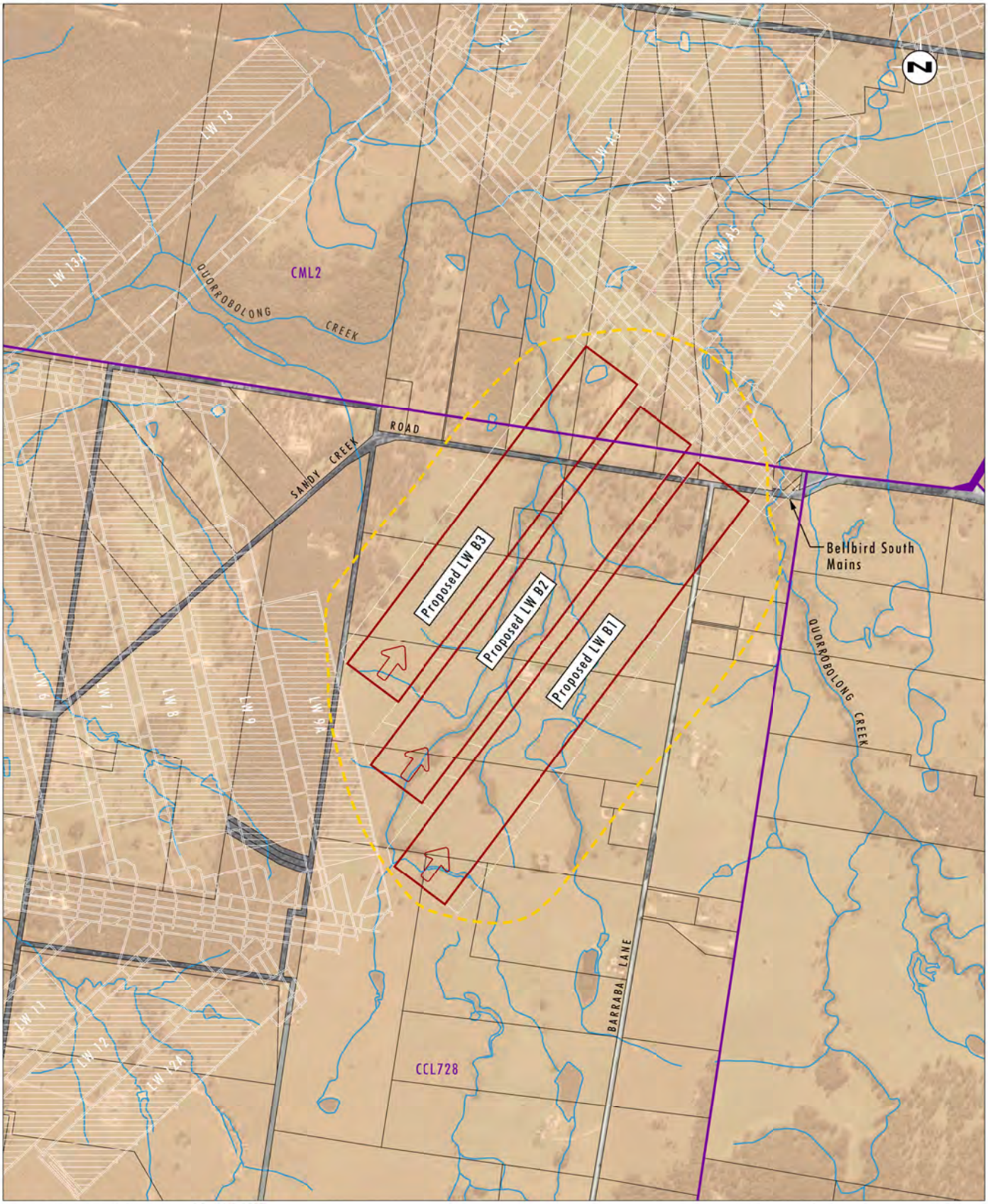

Image Source: Google Earth (2014)
Data Source: Austar Coal Mine (2015), Cessnock LEP (2011)

0 0.25 0.5 1.0km
1:20 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Completed Underground Workings
- Mining Lease Boundary
- Direction of Mining
- Drainage Line
- Cadastral Boundary
- RU2 Rural Landscape Zone (LEP)

FIGURE 4.1

Cessnock LEP 2011 Land Zoning

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4.1.2 Other State Legislation and Environmental Planning Instruments

A summary of the other State environmental and planning legislation potentially relevant to the Project is provided in **Table 4.1**.

Table 4.1 Summary of State Legislation and Relevance to the Project

Act	Comment	Further Approval Required for Proposed Modification
Mining Act 1992	Under this Act a ML is required before any mining or specified mining purpose can be carried out on the land. Austar currently holds mining leases CML2 and CL728 over the LWB1-B3 Modification Area, which provides Austar with the mining rights to the target seam for the proposed LWB1-B3 Modification. All mining operations must be subject to a Mining Operations Plan (MOP) and approved Extraction Plan.	No approvals required, however, Austar will be required to revise the existing approved MOP and prepare an Extraction Plan in accordance with the conditions of the existing mining leases
Work Health and Safety (Mines) Act 2013 and Regulation	The Work Health and Safety (Mines) Act 2013 commenced on 1 February 2015, replacing the Coal Mine Health and Safety Act 2002. The new laws align specific mine safety laws with general work health and safety laws. Under the Act, mine operators are required to notify the regulator of certain high risk activities, including secondary extraction by longwall methods. The approval of the regulator is however not required for these activities.	No, however Austar will be required to notify the regulator of all proposed high risk activities, including secondary extraction.
Protection of the Environment Operations Act 1997 (PoEO Act)	The PoEO Act is administered by the EPA and requires licences for environmental protection including waste, air, water and noise pollution control. Austar currently holds Environment Protection Licence (EPL) 416. No changes to surface operations, noise emissions, dust emissions or surface water management are proposed as a result of the Proposed LWB1-B3 Modification.	No
National Parks & Wildlife Act 1974 (NP&W Act)	An Aboriginal Heritage Impact Permit is required under section 90 of the NP&W Act to harm an Aboriginal object. An assessment of the proposed modifications potential to harm Aboriginal objects is provided in **Section 6.6.**	No, except in the unlikely event subsidence remediation works are required at the location of the identified Aboriginal site.

Act	Comment	Further Approval Required for Proposed Modification
Heritage Act 1977 (Heritage Act)	Approval is required under Section 60 of the Heritage Act to disturb an item listed on the State Heritage Register or the subject of an Interim Heritage Order. An excavation permit is required under section 140 to disturb or excavate other heritage items. No heritage items are located within the LWB1-B3 Modification Area, and no heritage items will be impacted by the proposed modification.	No
Roads Act 1993	The Roads Act 1993 is administered by Roads and Maritime Services (RMS), local council or the Department of Primary Industry - Lands depending on the classification of the road; the RMS has jurisdiction over major roads, the local council over minor roads, and the Department of Lands over Crown roads and Crown road reserves. The Act requires that applications for the closure of Crown roads be made to the Minister. Consent under Section 138 of the Roads Act 1993 is required in order to undertake works within a road reserve. Subsidence remediation works may be necessary along sections of Sandy Creek Road and Barraba Lane and approval for any such works will be required from Cessnock City Council under s138 of the Roads Act 1993. If any works are required, approvals would be obtained prior to such works being undertaken.	Yes, if subsidence remediation works required within any road reserve
Crown Lands Act 1989	The Act provides for the administration and management of Crown land in the eastern and central divisions of the State. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the Crown Lands (Continued Tenures) Act 1989. The LWB1-B3 Modification Area extends across a parcel of Crown Land along its western boundary. The approval of the Department of Primary Industries - Lands will be sought for any subsidence remediation works required within this area.	Yes, if subsidence remediation works required on Crown Land.

Act	Comment	Further Approval Required for Proposed Modification
Water Management Act 2000	This Act regulates the taking, interception, storage and use of surface water and groundwater within areas subject to water sharing plans. The Hunter Unregulated and Alluvial Water Sources Water Sharing Plan (Hunter Unregulated and Alluvial WSP) commenced on 1 August 2009 and applies to the 'Water Sources', as defined in the Hunter Unregulated and Alluvial WSP within the Modification Area. Therefore, the surface waters and any alluvial waters within the Modification Area are governed by the WM Act, whilst the groundwater associated with the hard rock aquifers (i.e. porous rock including coal seam aquifers) remain governed by the Water Act 1912 (Water Act). Any water extracted from water sources regulated by the Hunter Unregulated and Alluvial WSP will require licensing under the WM Act where they are in addition to extractions permitted under harvestable rights. Based on the findings of the subsidence assessment (refer to Section 6.2), surface water impact assessment (refer to Section 6.3) and groundwater impact assessment (refer to Section 6.4), no loss of surface water or water from the alluvium is expected as a result of the proposed modification. Therefore a water access licence is not expected to be required under the WM Act. As discussed in **Table 4.1**, the following approvals are not required under the WM Act for this Project: water use approval; water management work approval; or activity approval.	No
Water Act 1912	This Act applies to the licensing and regulation of water that is not covered by a water sharing plan under the WM Act. Austar currently holds Part 5 licences under this Act for the interception and extraction of groundwater as part of its mining operations. No change to this licence is anticipated as a result of the proposed modification.	No
Environmentally Hazardous Chemicals Act 1985	The EPA is granted power under *the Environmentally Hazardous Chemicals Act 1985* to assess and control chemicals and declare substances to be chemical wastes. A licence is required for any storage, transport or use of prescribed chemicals. The modification will not result in any changes to the storage, transport or use of prescribed chemicals.	No

Act	Comment	Further Approval Required for Proposed Modification
Mine Subsidence Compensation Act 1961	Under this Act, the approval of the Mine Subsidence Board (MSB) is required for the erection or alteration of improvements within a mine subsidence district. The erection or alteration of improvements is not proposed as part of the modification and the LWB1-B3 Modification Area is currently not a Declared Mine Subsidence District. Therefore approval under Section 15 of the *Mine Subsidence Compensation Act 1961* does not apply.	No
Dams Safety Act 1978	The Dams Safety Act 1978 requires that large dams that may constitute a hazard to human life and property must be periodically reviewed by the NSW Dams Safety Committee. These dams are known as prescribed dams and are listed in Schedule 1 of the Act. There are no prescribed dams within the LWB1-B3 Modification area, with the closest being Kalingo Dam approximately two kilometres to the northwest. The LWB1-B3 Modification will also not require the construction of any new dams. No approvals will be required under this Act.	No

Table 4.2 outlines the relevant SEPPs required to be considered in relation to the LWB1-B3 Modification.

Table 4.2 Relevant SEPPs for Consideration in Relation to the Project

NSW Legislation – Environmental Planning Instruments		
Planning Provision	**Comment**	**Relevance**
State Environmental Planning Policy (State & Regional Development) 2011	The LWB1-B3 Modification is of a class of development listed in the SEPP and would have been categorised as State significant development if s75W did not apply to the proposed modification.	The Project is categorised as State Significant Development but for the application of section 75W of the EP&A Act via schedule 6A of the EP&A Act.
State Environmental Planning Policy (Mining, Petroleum Production & Extractive Industries) 2007	Regulates the permissibility of mining and related development and specifies matters that must be considered in assessing mining developments requiring consent under Part 3A (repealed) and Part 4 of the EP&A Act.	The proposed modification is permissible with consent.
State Environmental Planning Policy 33 (Hazardous & Offensive Development) 1992	SEPP No. 33 requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. A preliminary hazard analysis is completed for potentially hazardous development to assist the consent authority to determine acceptability.	The existing Austar operations are not considered as hazardous or offensive. The Project will not result in any changes to the existing Austar operations which would alter this classification. No further consideration of SEPP No. 33 is required.
State Environmental Planning Policy 44 (Koala Habitat Protection)	SEPP No. 44 restricts a Council from granting development consent for proposals on land identified as core koala habitat without preparation of a plan of management.	No core koala habitat has been identified within the Modification Area. The provisions of SEPP 44 do not apply and koala plan of management is not required for the modification.
State Environmental Planning Policy 55 (Remediation of Land)	SEPP 55 restricts a consent authority from granting consent for the carrying out of development on land unless the consent authority has considered any potential contamination issues.	No potential contamination issues have been identified within the LWB1-B3 Modification Area.

Table 4.3 outlines the relevance of other NSW strategic policies in relation to the Proposed LWB1-B3 Modification.

Table 4.3 Potentially Relevant NSW Strategic Policies

NSW Strategic Policies		
Policy	**Comment**	**Relevance**
Upper Hunter Strategic Regional Land Use Plan	The Upper Hunter Strategic Regional Land Use Plan (Upper Hunter SRLUP) contains the detailed policy direction for assessing and managing strategic land use decisions in the Upper Hunter Valley. The objective of the Upper Hunter SRLUP is to balance the strong economic growth in Regional NSW with the protection of valuable agricultural land and the sustainable management of natural resources. In particular, the Upper Hunter SRLUP seeks to minimise land use conflicts arising from the growth of coal mining activities and the coal seam gas industry. Key to the implementation of the Upper Hunter SRLUP is the assessment of impacts from mining and coal seam gas development on land identified as being strategic agricultural land.	The Proposed LWB1-B3 Modification Area is not located in the boundary of the Upper Hunter SRLUP, accordingly this plan does not apply to the Proposed LWB1-B3 Modification.
Aquifer Interference Policy	The Aquifer Interference Policy requires mining activities to consider 'Minimal Impact Considerations' with respect to groundwater sources.	Predicted groundwater impacts associated with the Proposed LWB1-B3 Modification have been assessed against the Aquifer Interference Policy as part of this EA. This assessment concludes that the proposed modification adequately satisfies the minimal impact considerations for less productive groundwater sources defined by the NSW Aquifer Interference Policy (refer to Section 6.4).

4.2 Commonwealth Legislation

4.2.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance.

If an 'activity' is likely to have a significant impact on a matter of national environmental significance then it may be a 'controlled action' and should be referred to the Commonwealth Minister for consideration.

Matters of national environmental significance potentially relevant to the LWB1-B3 Modification are:

- Threatened Species and Ecological Communities
- Migratory Species
- Water Resources.

The water resources trigger relates to the protection of water resources from impacts of coal seam gas and large coal mining projects. According to Significant Impact Guidelines prepared by the Department of Environment (2013), an action is likely to have a significant impact on a water resource if there is a real chance or possibility that it will directly or indirectly result in:

- a substantial change to the hydrology of a water resource
- a substantial change in water quality of a water resource.

that is of sufficient scale or intensity as to reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes, or to create a material risk of such reduction in utility occurring.

Detailed assessment of surface water and groundwater resources has been prepared for the LWB1-B3 Modification and is discussed in **Sections 6.3** and **6.4**. These water resources impact assessments were undertaken with consideration of the key aspects of hydrological change listed by the Significant Impact Guidelines (Department of Environment 2013).

Detailed ecological assessment has also been conducted and is discussed in **Section 6.5**.

On the basis of the detailed subsidence assessment, water resources assessments and ecological assessment undertaken for the LWB1–B3 Modification, it is considered that the proposed modification will not have a significant impact on any of the matters of national environmental significance listed above. Details of the subsidence, water resources and ecological assessments undertaken for the LWB1-B3 Modification are provided in **Sections 6.2** to **6.5**.

Approval of the LWB1-B3 Modification under the EPBC Act is therefore not required.

4.2.2 Native Title Act 1993

The *Commonwealth Native Title Act 1993* (NT Act) is not directly relevant to the approval process for the proposed LWB1-B3 Modification, however it does have implications for the grant of mining leases under the *Mining Act 1993* where there is potentially claimable land within the lease application area.

The *Mining Act* 1992 must be administered in accordance with the NT Act. The primary effect of the NT Act on mining authorities is to provide native title parties with a 'right to negotiate' prior to the Minister (administering the NSW Mining Act) considering the grant or renewal of the mining authority. This process has already occurred with the grant of mining leases CML2 and CCL728, and no new mining leases will be required for the LWB1-B3 Modification.

5.0 Stakeholder Consultation

5.1 Agency Consultation

During the preparation of this EA, the following government agencies were consulted to assist in identifying the matters to be addressed in the EA:

- NSW Department of Planning and Environment
- Cessnock City Council
- Department of Industry - Resources and Energy.

The proposed approach to the environmental assessment, preliminary findings of relevant studies, and the approach to completing the assessment was confirmed. The approach to preparation of the proposed Extraction Plan and associated management plans was also discussed.

The key issues to be addressed by the EA as identified by the Department of Planning and Environment, Cessnock City Council and Department of Industry - Resources and Energy are outlined in **Table 5.1**.

Table 5.1 Key Environmental and Community Issues

Issue	EA Reference
Surface water ponding impacts	**Section 6.3**
Impacts on private land	**Section 6.2** and **6.8**
Impacts on agricultural use of the land	**Section 6.8**
Impacts on riparian vegetation	**Section 6.5**
Impacts on aquatic biodiversity	**Section 6.5**
Description of landform, objectives of post mining land use and future land use sustainability	**Section 6.8**

5.2 Stakeholder and Community Consultation

Austar maintains close relationships with neighbouring private landholders and nearby communities as part of normal business. As well as operating the Austar Community Consultative Committee, Austar regularly conducts formal and informal consultation with individual residents who live in areas potentially affected by the mine. Regular correspondence is provided to landholders within the Stage 2 and Stage 3 areas giving updates of underground mining operations and the results of subsidence and environmental monitoring.

The majority of the LWB1-B3 Modification Area is located outside the Stage 2 and Stage 3 areas, consequently Austar has not previously had direct contact with a number of the landholders within the modification area. A specific community consultation program has therefore been implemented for the LWB1-B3 Modification in order to introduce landholders to the operations of the Austar Coal Mine and the details of the proposed modification. This involved correspondence and meetings with individual landholders within the LWB1-B3 Modification Area. Ongoing consultation with affected landholders will be undertaken as part of the Extraction Plan process.

Austar has also provided regular briefings to the Community Consultative Committee and undertaken consultation with the Registered Aboriginal Parties as part of preparation of the Aboriginal Cultural Heritage and Archaeological Assessment for the LWB1-B3 Modification.

6.0 Environmental Assessment

6.1 Environmental Risk Analysis

A preliminary environmental risk analysis was undertaken for the proposed modification to identify the key issues that required detailed assessment as part of the EA process.

The LWB1-B3 Modification is for the extraction, transfer and processing of coal from the three proposed longwall panels and doesn't include any changes to surface infrastructure or production. The key issues requiring assessment therefore relate to the potential impacts of subsidence associated with the extraction of LWB1-B3. The identification of the key environmental issues that require assessment was based on consideration of:

- the scale and potential impact of the modification
- outcomes of the previous and current stakeholder consultation
- the planning and environmental context of the modification
- the findings of the previous environmental impact assessments (Umwelt 2008, 2011, 2013) and ongoing environmental monitoring of the existing Austar operations.

The outcomes of the preliminary environmental risk analysis are provided in **Table 6.1**. The following sections provide a detailed assessment of the key issues associated with the LWB1-B3 Modification.

Table 6.1 Review of Potential Environmental Impacts of LWB1-B3 Modification

Aspect	Environmental Assessment
Subsidence	The LWB1-B3 Modification will result in subsidence of the land surface. Based on previous experience of mining at similar depths of cover elsewhere within the Austar Coal Mine, subsidence impacts at the surface are likely to be minimal. A detailed subsidence impact assessment has been undertaken to confirm predicted impacts to built and natural features and inform proposed subsidence management. The subsidence assessment is included as **Appendix 3** and a summary of the findings of the subsidence assessment is provided in **Section 6.2**.
Surface Water Resources	Based on previous experience of mining at similar depths of cover elsewhere within the Austar Coal Mine, the LWB1-B3 Modification is unlikely to cause significant changes to flow regimes, flooding or ponding. However, given the presence of an unnamed tributary of Quorrobolong Creek and farm dams within the LWB1-B3 Modification Area, a review of the potential impacts of the LWB1-B3 Modification on the flooding and drainage regime was undertaken. The existing Austar flood model was amended to incorporate the cumulative effects of the modification. The assessment is included as **Appendix 3** and a summary of the results are provided in **Section 6.3**.

Aspect	Environmental Assessment
Groundwater Resources	A comprehensive groundwater assessment for the Austar Coal Mine was prepared by Connell Wagner in October 2007 and groundwater monitoring has confirmed that impacts are generally in accordance with previous predictions. Due to previous mining in the area being the Proposed Modification Area, the coal seam aquifer is largely depressurised in this locality. No material changes are expected in relation to groundwater impacts as a result of the LWB1-B3 Modification. An assessment of potential impacts of the proposed modification has been undertaken based on a review of the previous groundwater assessment and existing monitoring and impact verification data. The assessment is included as **Appendix 4** and a summary of the findings is provided in **Section 6.4**.
Ecology	The LWB1-B3 Modification will not result in any direct clearing of vegetation, however subsidence, potential subsidence remediation works and associated changes to landform or hydrological regimes have the potential to impact on ecological features within the LWB1-B3 Modification Area. An ecological survey and assessment has been undertaken within the LWB1-B3 Modification Area. The ecological assessment is provided as **Appendix 5**, with the results summarised in **Section 6.5**.
Aboriginal Archaeology and Cultural Heritage	Subsidence related surface cracking, subsidence remediation works and changes to landform or hydrological regimes have the potential to impact on archaeological features within the LWB1-B3 Modification Area. An Aboriginal Cultural Heritage and Archaeological Assessment has been undertaken in consultation with Registered Aboriginal Parties. The assessment is provided as **Appendix 6**, with the results summarised in **Section 6.6**.
Historic Heritage	No listed non-indigenous heritage items are located within the LWB1-B3 Modification Area. A review of the historical context of the modification area identified that it includes land previously associated with the Barraba Estate, an early 1830s estate and homestead. A Historic Heritage Assessment has therefore been undertaken to identify potential impacts of the modification on any potential items of historic heritage. The assessment is provided in **Section 6.7**.
Land Resources and Agriculture	The LWB1-B3 Modification will result in minor changes to the landform within the LWB1-B3 Modification Area. Subsidence impacts on land resources and agricultural use of the land were identified as having a low risk of significant environmental impacts given predicted subsidence is less than previously demonstrated to be compatible with existing land uses within the Austar Coal Mine. Further assessment of potential landform and land use impacts due to subsidence is provided in **Section 6.8**.

Aspect	Environmental Assessment
Greenhouse Gas	The LWB1-B3 Modification will result in the recovery of an additional approximately 4.5 MT of ROM coal. The extraction of this coal will change the greenhouse gas and energy profile of the existing approved operation, therefore a greenhouse gas and energy assessment has been undertaken to quantify the emissions associated with the modification. The assessment is presented in **Section 6.9**.
Vibration	Underground mining has the potential to create vibration events as the land subsides. The potential impacts of vibration from mining in the LWB1–B3 Modification Area are considered to be consistent with those previously assessed and approved under DA 29/95 and PA 08_0111. The monitoring results from the vibration monitoring undertaken during mining within the Stage 2 and Stage 3 areas indicate ready compliance with both human response and structural damage ground vibration criteria. Given the predicted subsidence and subsidence related impacts are expected to be less than those of the Stage 2 and approved Stage 3 LTCC extracted areas, no further assessment of vibration impacts has been undertaken. Vibration monitoring will be undertaken to monitor the potential vibration impacts of the LWB1–B3 Modification, subject to landholder access. Additionally, management measures to be implemented for the LWB1–B3 Modification will be consistent with those outlined in the existing Austar Noise and Vibration Management Plan.
Noise	The LWB1-B3 Modification does not involve any change to existing approved surface facilities, operations or production rates. Subsidence impacts on the land surface from underground mining are not predicted to require significant surface remediation. The LWB1-B3 Modification is therefore not predicted to result in any additional noise impacts. Based on this preliminary assessment, no further assessment of noise impacts has been undertaken.
Air Quality	The LWB1-B3 Modification does not involve any change to existing approved surface facilities, operations or production rates. Subsidence impacts on the land surface from underground mining are not predicted to require significant surface remediation. The LWB1-B3 Modification is therefore not predicted to change air quality impacts associated with existing approved facilities (including coal handling and transportation, ventilation facilities). Based on this preliminary assessment, no further assessment of air quality impacts has been undertaken.
Traffic	No change to existing approved traffic volumes, employee numbers, production levels, coal transport or access arrangements are proposed as a result of the LWB1-B3 Modification. As such no further assessment of traffic impacts has been undertaken.

Aspect	Environmental Assessment
Visual Amenity	The nature of the modification (i.e. underground longwall mining) and the existing undulating landform means there is very limited potential for visual impacts to occur as a result of the modification. Potential visual impacts are limited to minor changes in terrain associated with subsidence within the LWB1-B3 Modification Area. Based on this preliminary assessment, no further assessment of potential visual impacts has been undertaken.
Socio-Economic	There are no proposed changes to employment and no changes to existing surface facilities or operations associated with the LWB1-B3 Modification. Based on previous experience of mining at similar depths of cover elsewhere within the Austar Coal Mine, the LWB1-B3 Modification is also likely to have minimal impact on built and natural features on the surface associated with subsidence and will not cause any serious disruption to existing land uses. The modification is therefore unlikely to result in significant social impacts. By providing for business continuity and extraction of an additional 4.5 MT of ROM coal, while avoiding further reductions in the workforce associated with an extended discontinuity of mining, the LWB1-B3 Modification will have a positive economic benefit. No further assessment has been undertaken.
Waste Management	The proposed modification will not generate any additional waste streams or increase existing waste volumes, therefore no further assessment has been undertaken.
Hazard/Risk	Existing operations within the Austar Coal Mine are not considered as hazardous or offensive as they are authorised by an Environment Protection Licence under the PoEO Act. The proposed modification will not result in any changes to the existing operations which would alter this classification, therefore no further assessment has been undertaken.
Rehabilitation	Rehabilitation within the Austar Coal Mine is managed in accordance with the current approved Austar MOP. No change to the existing approved rehabilitation measures is considered necessary to accommodate the proposed modification, therefore no further assessment has been undertaken.

6.2 Subsidence

Mine Subsidence Engineering Consultants (MSEC) has undertaken an assessment of the potential subsidence impacts of the LWB1-B3 Modification, including predictions of subsidence related ground movements, impacts on natural and built features and management recommendations for preventative measures and monitoring. The assessment is provided in **Appendix 2** and a summary of findings presented below.

6.2.1 Prediction Methodology

MSEC has used the Incremental Profile Method to predict the incremental and total subsidence profiles resulting from the extraction of LWB1-B3. The Incremental Profile Method is based on a series of subsidence prediction curves derived from an extensive subsidence monitoring database from the Newcastle and Hunter Coalfields. Subsidence predictions were refined using local geological information and the model calibrated using monitoring results from completed longwalls within the Austar Coal Mine. The calibration process found that the Incremental Profile Method provided reasonable, if not slightly conservative, predictions of subsidence when compared to observed subsidence.

6.2.2 Subsidence Predictions

The predicted total subsidence contours following extraction of LWB1-B3 are shown in **Figure 6.1**. The maximum predicted subsidence parameters following extraction of LWB1-B3 are provided in **Table 6.2**. The maximum predicted subsidence parameters for the approved Stage 3 area are also provided in **Table 6.2** for the purpose of comparison.

Table 6.2 Maximum Predicted Subsidence Parameters for LWB1-B3 Modification and Comparison to Approved Stage 3 Maximum Predicted Subsidence Parameters

Layout	Maximum Predicted Total Conventional Subsidence (mm)	Maximum Predicted Total Conventional Tilt (mm)	Maximum Predicted Total Conventional Hogging Curvature (km^{-1})	Maximum Predicted Total Conventional Sagging Curvature (km^{-1})
LWB1-B3 [1]	925	3.5	0.03	0.05
Approved Stage 3 area [2] (MSEC 2011)	1800	6.5	0.05	0.09

Notes: 1 LWB1-B3 proposed to mined using conventional longwall mining techniques

2 Stage 3 area approved for mining using Longwall Top Coal Caving techniques

As shown in **Table 6.2**, the maximum predicted subsidence parameters for the LWB1-B3 Modification are less than those predicted to occur within the approved Stage 3 area (refer to **Figure 1.2**).

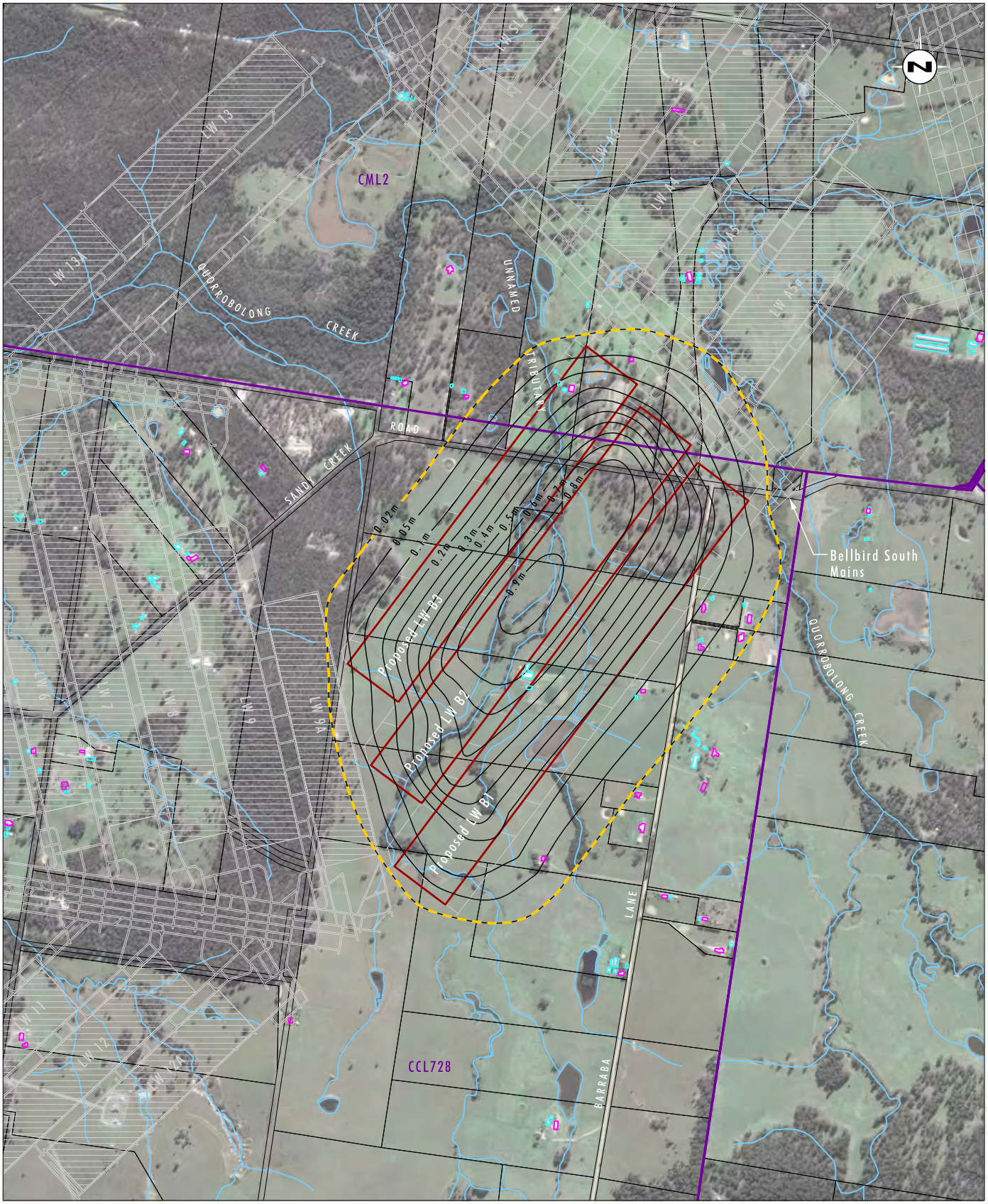


Image Source: Google Earth (2014)
Data Source: Austar Coal Mine (2015), MSEC (2015)

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- LWB1-B3 Predicted Subsidence Contour
- Completed Underground Workings
- Mining Lease Boundary
- Drainage Line
- Dwelling
- Other Structure

FIGURE 6.1

Predicted Total Subsidence LWB1-B3

File Name (A4): R06/3542_120.dgn
20151016 11.02

6.2.3 Subsidence Impacts

Subsidence induced impacts to the ground surface are dependent on a number of factors, including mine geometry, depth of cover, overburden geology and surface topography. Potential impacts include surface cracking, slope and bank instability and changes to the hydrological regime including changes in ponding, channel alignment, channel gradients and redirection of surface or groundwater flow due to subsidence induced cracking.

Potential changes in the ground surface resulting from subsidence have been assessed by MSEC. The subsidence assessment findings conclude that due to the depth of mining (greater than 480 metres), the small magnitude of predicted ground curvatures and strains and the absence of any steep slopes or cliffs within the modification area, the potential for surface cracking is low.

This conclusion is supported by monitoring evidence within the Stage 2 and 3 areas, where there has been no significant or visible surface cracking observed above previously extracted LWA3 to A8. Subsidence predictions for the LWB1-B3 Modification Area are less than that previously experienced in the LTCC extracted Stage 2 and Stage 3 areas, therefore subsidence impacts are also predicted to be less than those observed within the Stage 2 and Stage 3 areas.

Based on previous experience within the broader Austar Coal Mine, remediation of surface cracking is unlikely to be required within the LWB1-B3 Modification Area, however any surface cracking that does occur is expected to be minor and readily remediated by infilling with soil or other suitable material, or, if necessary, by locally regrading and recompacting the surface.

The height of discontinuous fracturing above the longwall panels is predicted to be in the order of 235 to 355 metres above the seam. Given the minimum depth of cover within the LWB1-B3 Modification Area of 480 metres, extension of the fracture zone to the surface is not predicted.

A summary of the potential impacts on key natural and built features within the LWB1-B3 Modification Area is provided in the following sections.

6.2.3.1 Watercourses

There are two ephemeral watercourses within the LWB1-B3 Modification Area, both characterised by shallow incisions into the ground surface. Quorrobolong Creek is located approximately 65 metres to the northeast of LWB1 and has an average gradient of less than 1mm/m. An unnamed tributary of Quorrobolong Creek drains in a northerly direction above LWB2 and LWB3 and has an average gradient of 5mm/m (refer to **Figure 1.3**).

Quorrobolong Creek is located outside the longwall footprint and will experience low levels of vertical subsidence (25mm). It is not expected to experience any significant tilts, curvatures or ground strains and is therefore unlikely to be adversely impacted as a result of subsidence.

The unnamed tributary of Quorrobolong Creek is located directly above LWB2 and LWB3 and could potentially experience changes to surface flows such as locally increased ponding. The potential changes in grade are small and not predicted to result in reversal of stream grade.

Loss of water from these watercourses is not expected as the height of connective or discontinuous fracturing above the longwall is not predicted to extend to the surface and surface cracking is not predicted to occur. Any surface cracking that does occur within the ephemeral watercourses would tend to be filled naturally by sediment during subsequent flow events.

Further assessment of the potential impacts of predicted subsidence on water resources (surface water and groundwater) is provided in **Sections 6.3** and **6.4**.

6.2.3.2 Steep Slopes

No broad areas of steep slopes occur within the LWB1-B3 Modification Area. That is, the natural grades are typically less than 1 in 3, apart from some isolated locations, such as along the banks of drainage lines.

6.2.3.3 Houses

Nine houses are located within the LWB1-B3 Modification Area. Eight of these houses are located outside the footprint of the proposed longwalls, at distances of between 100 metres and 300 metres, with one located above the northern end of LWB3.

The potential impacts on houses are more dependent on differential subsidence parameters such as tilt, curvature and ground strain, as opposed to vertical subsidence. Changes in vertical subsidence have the potential to affect the heights of houses above flood levels, as discussed further in Section 6.3.

The maximum predicted tilt experienced by houses within the LWB1-B3 Modification Area is 1.5 mm/m. Previous experience of longwall mining indicates that tilts of less than 7 mm/m generally do not result in significant impacts on houses. Therefore houses within the LWB1-B3 Modification Area are not expected to be significantly impacted. Houses may experience some minor serviceability impacts such as cracking of internal plasterboard or cornice, which can be readily repaired.

All houses are predicted to remain in a safe and serviceable condition throughout mining.

The maximum predicted subsidence parameters for the houses within the LWB1-B3 Modification Area are less than those for houses within the previously mined Stage 2 area where seven houses were mined directly beneath with no substantial impacts reported.

Consistent with the established processes undertaken for the existing Extraction Plan and Built Features Management Plan for the Stage 3 area, the management of the impacts on private houses will be the subject of an individual Built Features Management Plan to be developed in consultation with each landholder prior to subsidence impacts occurring.

6.2.3.4 Rural Structures and Land Uses

MSEC has identified 54 rural structures within the LWB1-B3 Modification Area, of which ten are located above the proposed longwall panels. These structures include farm shed, garages and tanks. Based on previous longwall mining experience and the magnitude of predicted tilts, MSEC has assessed that significant impacts on rural structures are unlikely. Some minor serviceability impacts could occur at those structures located directly above the longwalls, including door swings and minor roof and pavement drainage, all of which are readily repairable.

It is expected that all rural structures will remain in a safe and serviceable condition, provided they are in sound existing condition. The risk of impact is greater if they are in poor existing condition, however the risk to safety remains low. Rural structures located above the longwalls will be inspected prior to undermining to determine the need for any preventative measures.

With the continued implementation of the existing approved management strategies, it is unlikely that there would be any long term impacts on rural structures and associated rural land uses as a result of the proposed mining of LWB1-B3.

6.2.3.5 Farm Dams

There have been 20 farm dams identified within the LWB1-B3 Modification Area, of which six are located directly above the longwall panels. Subsidence can affect farm dams by changing freeboard and storage capacity or by causing cracking and leaking of water. Based on subsidence predictions and extensive experience of mining directly beneath dams both within the Austar Coal Mine and elsewhere, the potential for incidence of impacts of dams within the LWB1-B3 Modification Area is expected to be extremely low.

6.2.3.6 Local Roads

Sandy Creek Road and Barraba Lane are located within the LWB1-B3 Modification Area, with sections passing directly above the proposed longwalls (refer to **Figure 1.3**). Sandy Creek Road is a sealed local road which links Ellalong to Freemans Drive and Lake Road. Barraba Lane is an unsealed local road which provides access to a few private properties.

The predicted curvatures and strains associated with the LWB1-B3 Modification could be of sufficient magnitude to result in cracking in the box culverts or the dual circular culverts which are located directly above the proposed longwalls, however it is unlikely that this would adversely impact on the stability or the structural integrity of the culverts. This can be managed through visual inspection and if required repair/replacement of the culvert.

It is unlikely that there would be any significant impacts on the serviceability, safety or surface water drainage of the road surface as a result of the modification. The maximum predicted subsidence parameters are less than those predicted within the Stage 2 and Stage 3 areas where there have been only isolated and minor impacts to road surfaces which were remediated using normal road maintenance techniques.

6.2.3.7 Electrical and Telecommunications Infrastructure

Electrical and telecommunications infrastructure within the proposed modification area include above ground 11kV powerlines supported by timber poles located adjacent to Sandy Creek Road and Barraba Lane, low voltage powerlines supplying power to rural properties and direct buried copper cables following the general alignment of Sandy Creek Road and Barraba Lane.

Based on predicted subsidence parameters, infrastructure tolerances and extensive experience successfully mining directly beneath powerlines and telecommunications cables elsewhere within the Austar Coal Mine, it is considered unlikely that electrical or telecommunications infrastructure would experience adverse impacts as a result of the proposed modification.

6.2.4 Subsidence Management and Monitoring

Subsidence within the Austar Coal Mine is currently managed in accordance with a comprehensive range of management measures outlined in the existing approved Extraction Plan for LWA7-A10. As part of the proposed LWB1-B3 Modification, Austar will prepare an Extraction Plan for LWB1-B3 prior to the commencement of secondary extraction. As the predicted subsidence and subsidence related impacts are expected to be less than those of the approved Stage 3 mine plan, proposed management measures will be consistent with those presented in the LWA7-A10 Extraction Plan.

A key feature of the subsidence management process to be outlined in the LWB1-B3 Extraction Plan is a series of Built Features Management Plans for each private landholding and relevant public infrastructure feature potentially impacted by subsidence within the LWB1-B3 Modification Area. Built Features Management Plans outline the potential impacts of mining on the property and the management and remediation measures to be implemented should impacts occur. The key performance objective of the Austar Built Features Management Plan process is to repair, restore or replace built features to pre-mining condition. Individual Built Features Management Plans will be prepared in consultation with relevant stakeholders prior to subsidence impacts occurring.

With the continued implementation of existing management and monitoring measures, it is unlikely that there would be any significant adverse impacts as a result of the LWB1-B3 Modification.

6.3 Surface Water and Drainage

An assessment of the impacts of the LWB1-B3 Modification on the local flood and drainage regime has been undertaken by Umwelt. The assessment is provided in **Appendix 3** and a summary of findings presented below.

6.3.1 Surface Water Context

The LWB1-B3 Modification Area is located within the Quorrobolong Creek catchment. Quorrobolong Creek drains in a northerly direction along the north-eastern boundary of the LWB1-B3 Modification Area. An unnamed tributary of Quorrobolong Creek that includes a number of secondary drainage channels drains in a northerly direction through the LWB1-B3 Modification Area. The drainage channels converge into a single drainage channel upstream of Sandy Creek Road and with the unnamed tributary joining Quorrobolong Creek approximately 750 metres north of the Modification Area (refer to **Figure 1.3**).

Both Quorrobolong Creek and its unnamed tributary are ephemeral creeks with flows only occurring during prolonged or high rainfall periods.

Several farm dams are located within the LWB1-B3 Modification Area associated with the agricultural land uses within the modification area.

6.3.2 Flood Modelling Methodology

The potential impacts of the LWB1-B3 Modification on the flood behaviour of Quorrobolong Creek and its tributaries were assessed using the two dimensional (2D) hydrodynamic model previously developed for the Austar Coal Mine Stage 2 and Stage 3 areas. The previously developed 2D hydrodynamic model was modified to incorporate the predicted subsidence expected as a consequence of the mining operations proposed in the LWB1-B3 Modification.

Modelling was undertaken to assess the impact of the LWB1-B3 Modification on flooding and drainage for both:

- the existing landform (reflecting underground mining completed to date within the Stage 2 and 3 areas, being LWA3 to A8) plus proposed LWB1-B3
- the future approved landform (incorporating all approved underground mining within the Stage 2 and 3 areas, being LWA3 to A19) plus proposed LWB1-B3.

The assessment modelled the impacts of the 100% and 1% Annual Exceedance Probability (AEP) design storm events.

Modelling results were reviewed to determine the impacts of the LWB1-B3 Modification on flood depth, velocity and hazard. In particular, the following potential impacts were assessed:

- changes to flood regimes, including impacts on flood prone land, creek channels, flow paths and remnant ponding
- impacts on scouring and erosion due to changes in flow velocities
- changes to flood depths at dwellings
- flood hazard categories for dwellings and private property access routes.

6.3.3 Impact Assessment

Modelling results indicate that the potential impacts on flooding and drainage associated with LWB1-B3 are generally limited in extent to the LWB1-B3 Modification Area and that there is negligible difference in the modelled outcomes for flood behaviour either within the downstream creek systems or above the LWB1-B3 Modification Area when comparing the existing mining or the future approved mining scenarios. A description of the outcomes of the model in relation to changes in flood regimes, flow velocities, flood depths at dwelling and flood hazard category are provided in the following sections.

6.3.3.1 Changes to Flooding Regimes

The LWB1-B3 Modification will results in some minor changes to flood response within the LWB1-B3 Modification Area. These minor impacts primarily relate to changes in peak flood depths and flow velocities in the section of the unnamed tributary of Quorrobolong Creek directly over LWB2 and LWB3.

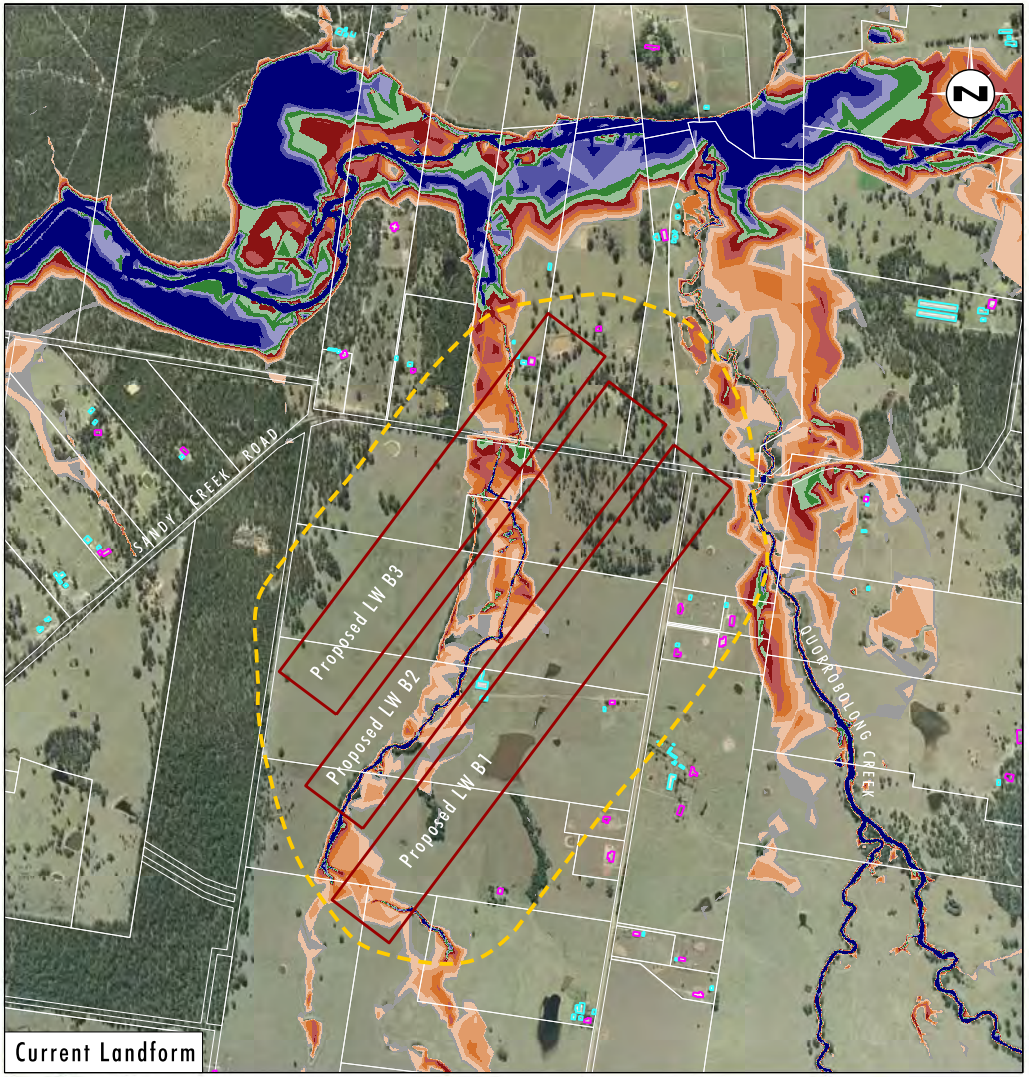
During the 1% AEP storm event, modelling indicates that out of channel flooding adjacent to the unnamed tributary of Quorrobolong Creek is typically in the order of 0.43 metres. With the proposed modification, out of channel flooding is predicted to increase by up to approximately 0.02 metres in the southern section of LWB1 adjacent to the unnamed tributary. Decreases in out of channel flooding up to 0.4 metres are predicted in the middle of LWB1 and to the west of the unnamed tributary above LWB2 and LWB3 (refer to **Figure 6.2**). However, out of channel flooding will not reach any dwelling, as discussed further in **Section 6.3.3.3**.

The impact on flood duration downstream of the LWB1-B3 Modification Area is expected to be negligible. Changes to remnant ponding are also expected to be negligible, with a minor increase in ponding occurring within one farm dam located above LWB1 and a minor increase in ponding upstream of the culvert for the unnamed tributary under Sandy Creek Road (refer to **Figure 6.3**).

Modelling indicates that the impact of these predicted minor changes in flood response and flow regimes are not expected to be significant.

6.3.3.2 Changes to Flow Velocities

Changes to the flow regimes of Quorrobolong Creek and its unnamed tributary are unlikely to be significant as predicted changes to channel grades are minor and there is minimal potential for channel realignment to occur. Flow velocities are expected to be similar to those approved under Stage 2 and Stage 3 for most of the LWB1-B3 Modification Area and are not expected to result in scouring or erosion of drainage lines within the modification area.



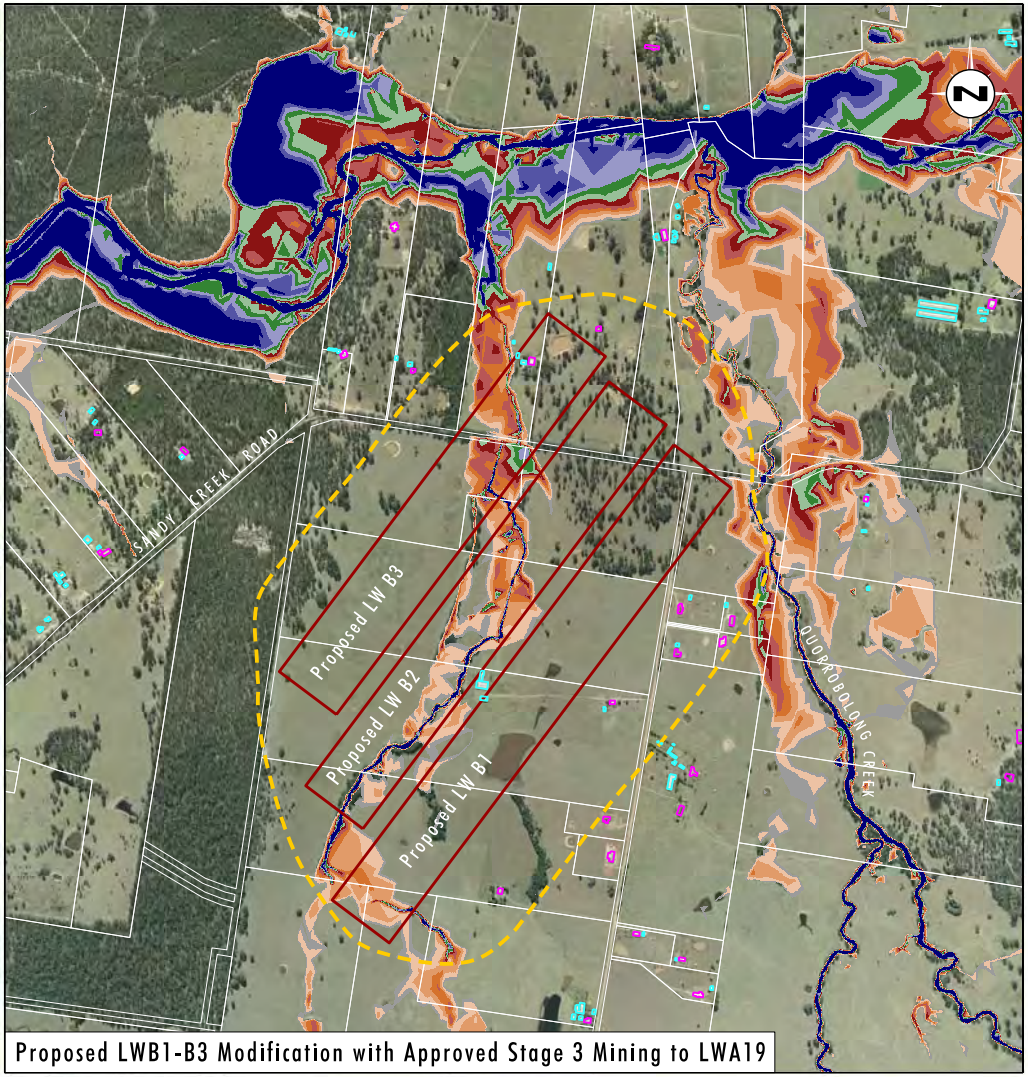


Image Source: Austar Coal Mine
Base Data Source:Austar Coal Mine, LPI - Cadastral Boundaries

0 0.5 1.0 1.25km
1:25 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Dwelling
- Other Structure
- Cadastral Boundary

Water Depth (m)

- Range [0.001 : 0.100]
- Range [0.100 : 0.300]
- Range [0.300 : 0.500]
- Range [0.500 : 0.700]
- Range [0.700 : 0.900]
- Range [0.900 : 1.100]
- Range [1.100 : 1.300]
- Range [1.300 : 1.500]
- Range [1.500 : 1.700]
- Range [1.700 : 1.900]
- Range [1.900 : 8.000]

FIGURE 6.2

Maximum Flood Depths for 1% AEP Storm Event, Comparision of Current Landform and Proposed LWB1-B3 Modification with Approved Stage 3 Mining

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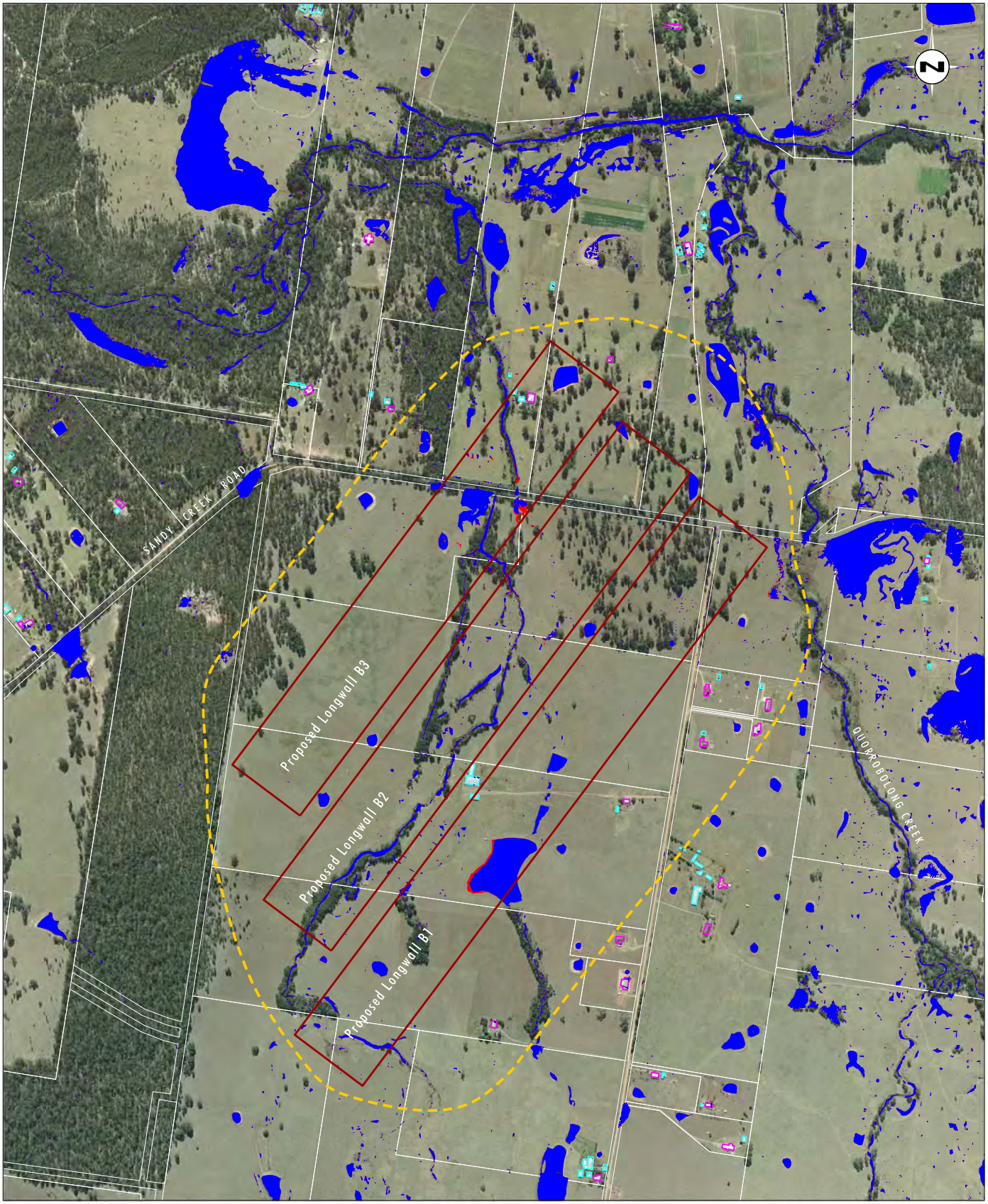


Image Source: Austar Coal Mine
Base Data Source:Austar Coal Mine, LPI - Cadastral Boundaries

0 250 500 750m
1:15 000

Legend

- Dwelling
- Other Structure
- Cadastral Boundary
- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Remnant Ponding Approved LWA3-A19
- Remnant Ponding Proposed LWB1-B3 Modification

FIGURE 6.3

Remnant Ponding with LWB1-B3 Modification and Approved Stage 3 Mining

6.3.3.3 Flood Depths at Dwellings

Modelling indicates that the maximum flood extent for the 1% AEP storm event will not reach any dwellings within the LWB1-B3 Modification Area (refer to **Figure 6.2**), and no impacts on flood level freeboard is predicted at any dwelling as a result of the LWB1-B3 Modification.

6.3.3.4 Flood Hazard Categories

The LWB1-B3 Modification will not result in any changes to existing flood hazard at any dwelling or access route potentially affected by the 1% AEP storm event (refer to **Figure 6.4**).

6.3.4 Surface Water Management and Monitoring

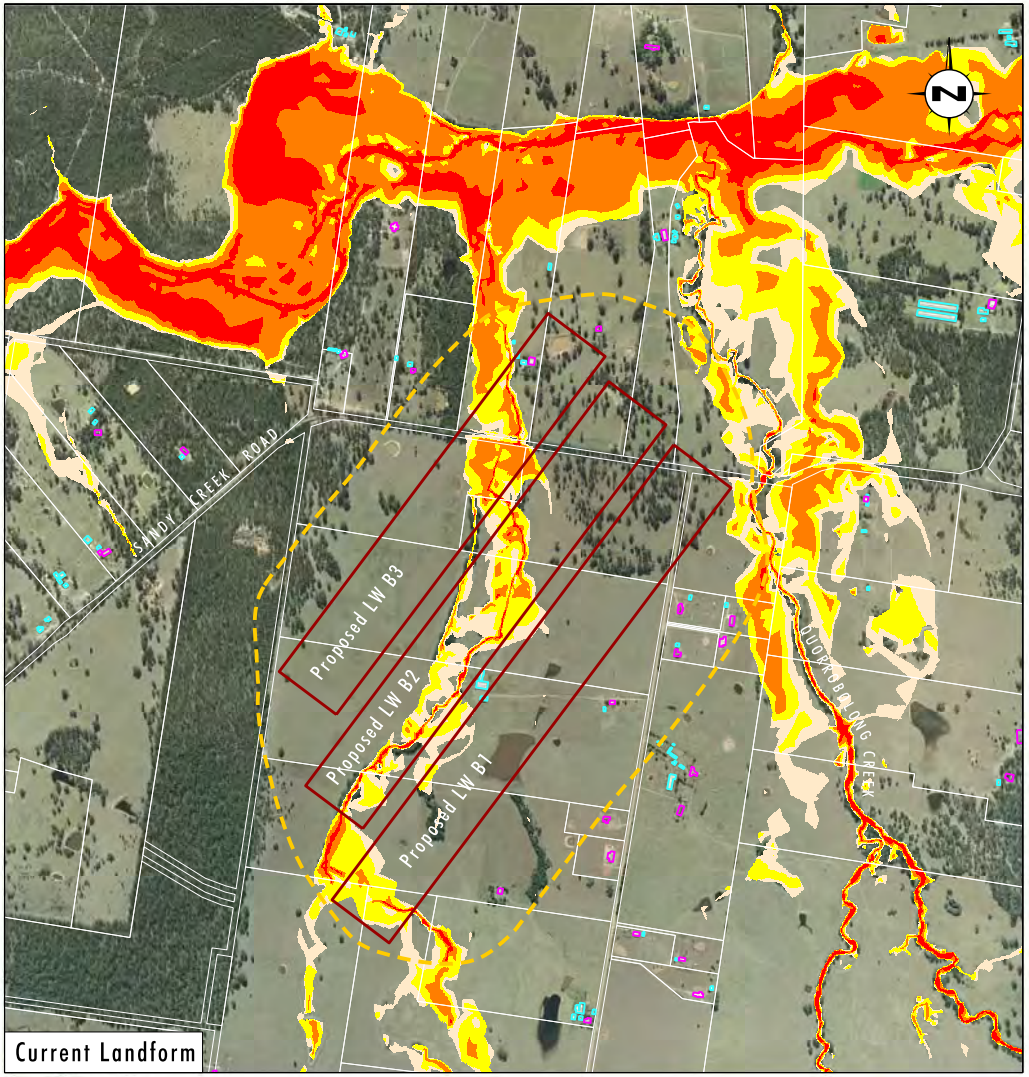
Austar currently implements a range of surface water management and monitoring measures across the Austar Coal Mine, as outlined in the Austar Site Water Management Plan (Austar 2013). Previous experience of mining within the Stage 2 and Stage 3 areas beneath private land holdings and Quorrobolong Creek has not identified any adverse impacts on watercourses associated within underground longwall mining. There has also not been any scouring or erosion issues observed within or surrounding watercourses associated with previous Stage 2 and Stage 3 mining.

Based on the predicted subsidence impacts of the LWB1-B3 Modification, the potential for adverse impacts on surface water quality or watercourses within the LWB1-B3 Modification Area is minimal. Austar will however prepare a Water Management Plan to address potential impacts to the water resources within the LWB1-B3 Modification Area as part of the Extraction Plan process. The management measures outlined in the proposed LWB1-B3 Water Management Plan will include an appropriate surface water monitoring regime for the section of Quorrobolong Creek and its unnamed tributary within the LWB1-B3 Modification Area.

6.4 Groundwater

A comprehensive groundwater assessment for the Austar Coal Mine was prepared by Ian Forster of Connell Wagner in October 2007. This assessment is supported by a verification review of groundwater impacts following the completion of LWA5 in the Stage 2 mining area undertaken by Auercon in 2013, and by groundwater monitoring undertaken within the Stage 2 and Stage 3 mining areas. While the LWB1-B3 Modification is not expected to result in any material changes in relation to groundwater impacts from those described by Connell Wagner (2007), a qualitative assessment of potential impacts of the proposed modification has been undertaken by Dundon Consulting Pty Limited. The assessment is based on a review of the previous groundwater assessment, the results of monitoring and impact verification data.

The Groundwater Assessment includes a description of the existing hydrogeological environment, the potential impacts of the LWB1-B3 Modification, the groundwater licensing requirements and recommended groundwater management and monitoring measures. The Groundwater Assessment is provided in **Appendix 4** and a summary of the findings is presented below.



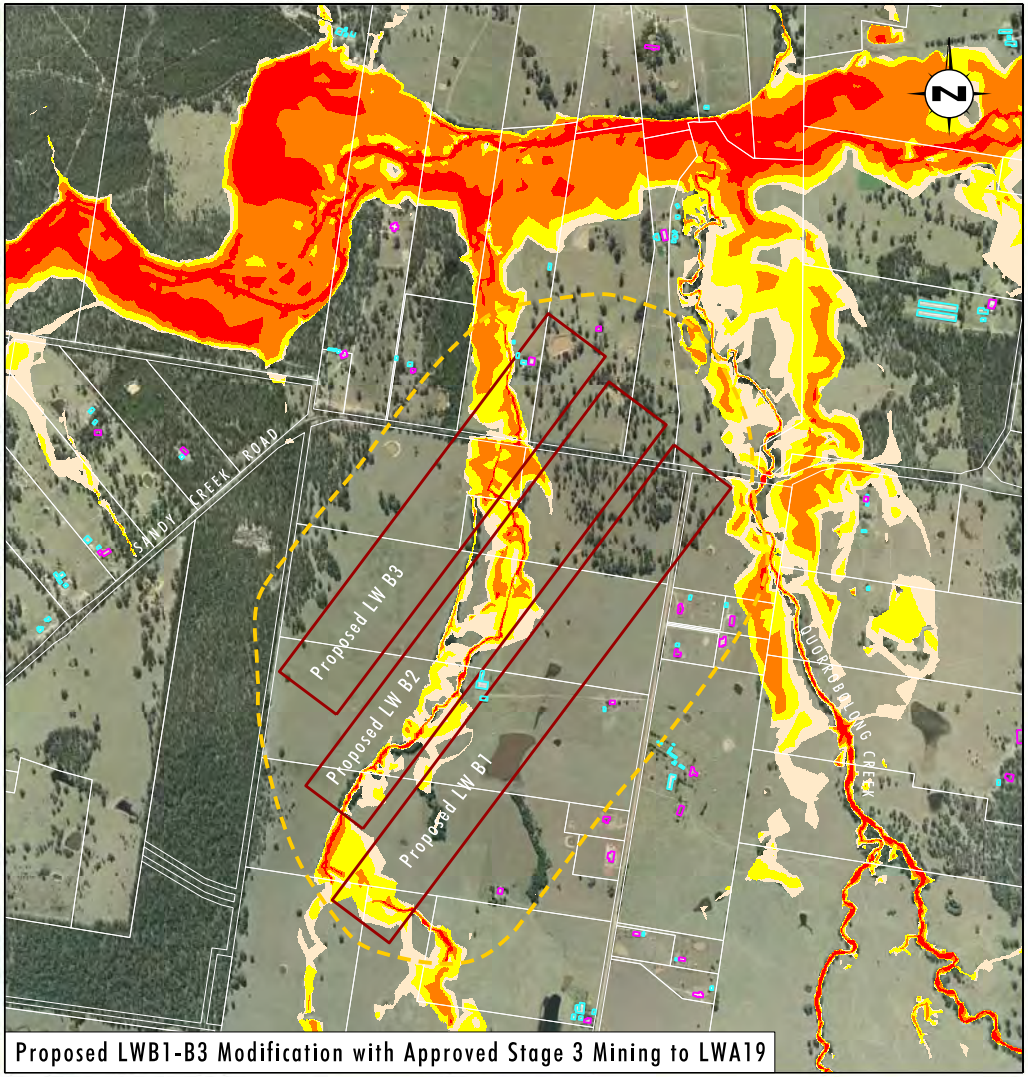


Image Source: Austar Coal Mine
Base Data Source:Austar Coal Mine, LPI - Cadastral Boundaries

0 0.5 1.0 1.25km
1:25 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Dwelling
- Other Structure
- Cadastral Boundary

Hazard Category

- Low Hazard - Walking and vehicle access
- Low Hazard - Vehicles unstable
- High Hazard - Wading unsafe
- High Hazard - Damage to light structures

FIGURE 6.4

Maximum Flood Hazard Categories for 1% AEP Storm Event, Comparison of Current Landform and Proposed LWB1-B3 Modification with Approved Stage 3 Mining

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6.4.1 Existing Groundwater Resources

The main sources of water that make up the groundwater regime within the Austar Coal Mine and surrounding area are:

- the localised alluvial aquifer system associated with the Quorrobolong Creek and its tributaries;
- non-alluvial hard rock aquifers comprising principally of the coal seams and to a lesser extent, fractured zones within the upper parts of the Branxton Formation; and
- water stored within previous underground mine voids.

Groundwater within the alluvial aquifer in the LWB1-B3 Modification Area is part of the Congewai Creek Management Zone of the Upper Wollombi Water Source and is regulated by the *Water Management Act 2000* under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*. The non-alluvial groundwater is regulated under the *Water Act 1912*.

6.4.1.1 Alluvial Aquifer System

The alluvial aquifer system comprises very poorly developed alluvial deposits within the floodplain of Quorrobolong Creek and its tributaries. The estimated areal extent of the alluvial deposits associated with Quorrobolong Creek is shown on **Figure 6.5**. Quorrobolong Creek and its tributaries comprise a series of ephemeral drainage lines which only flow after consistent or heavy rainfall. The alluvium associated with these surface drainage features in the vicinity of the LWB1-B3 Modification Area is generally shallow and low yielding (Connell Wagner, 2007).

Austar has installed four shallow monitoring bores (AQD1073, WBH1, WBH2 and WBH3) in the vicinity of Quorrobolong Creek to the northeast of the LWB1-B3 Modification Area (refer to **Figure 6.5**). Bore logs confirm that the alluvial aquifer associated with Quorrobolong Creek and its tributaries is limited in extent and depth and is associated with ephemeral streamflow. The groundwater quality is variable, and is susceptible to elevated salinities in periods of low or no rainfall recharge.

The alluvial water source has limited potential for beneficial use as a water supply for stock, domestic or other consumptive purposes and there are no known users of the alluvial water source within or surrounding the LWB1-B3 Modification Area.

6.4.1.2 Non Alluvial Hard Rock Aquifer System

'Porous rock' aquifers within the Permian hard rocks in the vicinity of the LWB1-B3 Modification Area are limited to the Branxton Formation and the Greta Coal Seam.

The Branxton Formation comprises a thick sequence of sedimentary rock overlying the Greta Coal Measures. Due to the strong and massive nature of the sandstone within the Branxton Formation and its very low interstitial permeability ($<10^{-3}$ m/d), there are few if any major water bearing zones present. Nevertheless, zones of jointing or fracturing associated with major faults may form localised aquifers. Further, shallow water bearing zones have been locally identified to occur within the first 50 metres of this formation. The formation has very low vertical permeability, and there is very little potential for leakage between any water-bearing zones or aquifers.

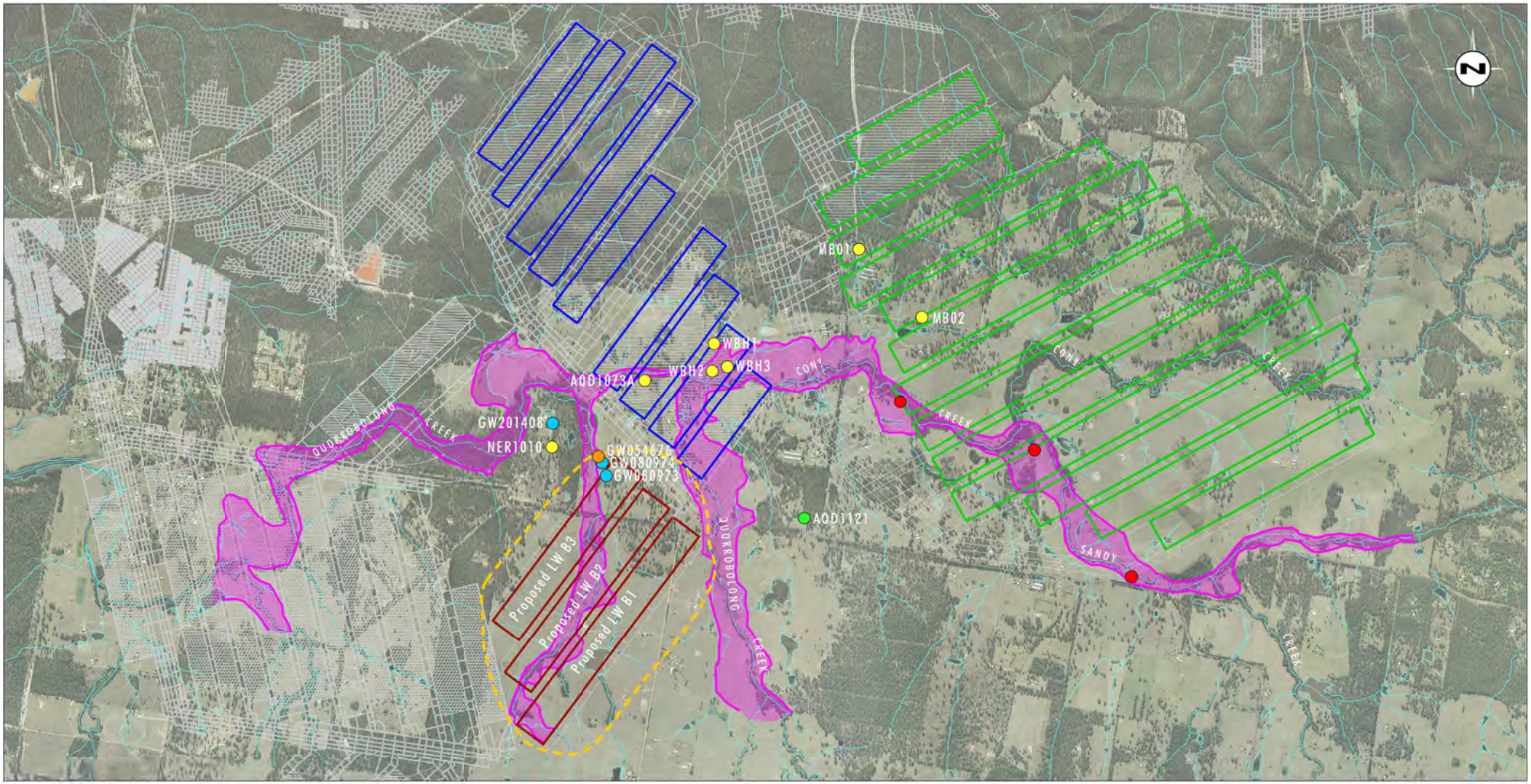

Image Source: LPI NSW (2009)
Data Source: Austar Coal Mine (2015)

0 0.5 1.0 2.0km
1:40 000

Legend

- Completed Bellbird South Stage 1, Stage 2 and Southland Longwall Panels (DA 29/95)
- Stage 3 Longwall Panels (PA08_0111 - in Progress)
- Proposed LWB1-B3 Longwall Panels
- Completed Underground Workings
- Estimated Alluvial Area
- LWB1-B3 Modification Area
- Groundwater Monitoring Bore Location
- Private Stock Bore Location
- Existing Austar Monitoring Location
- Approved Future Stage 3 Groundwater Monitoring Site
- Vibrating Wire Piezometer

FIGURE 6.5

Estimated Extent of Alluvium and Groundwater Monitoring and Bore Locations

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The importance of the shallow water bearing zones of the Branxton Formation as a water source is likely to be minimal as the water quality is poor (generally greater than 10,000 μS/cm EC) and yield low (generally less than 1 L/s). There is one private stock bore located within the LWB1-B3 Modification Area that targets the shallow water bearing zones within the Branxton Formation.

The coal seams represent the main water bearing zone within the Greta Coal Measures due to the presence of cleats and fractures in the coal which make them more permeable when compared to the interburden strata. However, the importance of the Greta Coal Seam as an aquifer is generally minimal due to the poor water quality and limited yield potential.

6.4.1.3 Water Stored in Former Mine Voids

There are a number of former mine workings (voids) within the area surrounding the Austar Coal Mine that are partially filled with water. Austar currently utilises some of these voids to store excess mine water in accordance with water management strategies described in the approved Austar Site Water Management Plan. The quality of water within these old mine workings is extremely poor and has limited beneficial use potential.

6.4.2 Groundwater Impact Assessment

The LWB1-B3 Modification will extract coal from the Greta Seam resulting in rock fracturing above the extracted seam and deformation of the overlying strata up to the surface. This can lead to increased horizontal and vertical permeability as a result of bending, fracturing, joint opening and bed separation.

At the Austar Coal Mine, the combination of large depths of cover and the bridging properties of the thick sandstones of the Branxton Formation limit the upward extent of connective cracking above the extracted longwall panels to around 85 to 150 metres, with discontinuous fracturing above LWB1-B3 predicted to extend to between 235 to 355 metres above the seam. With depths of cover above the seam of 480 to 555 metres, discontinuous fracturing is not expected to reach the surface. Consequently, near surface groundwater within the alluvium and shallow water bearing zones of the Branxton Formation is not predicted to be impacted by the LWB1-B3 Modification.

The potential impacts of the LWB1-B3 Modification on mine water inflows, groundwater levels, groundwater recharge, groundwater quality, water users and groundwater dependent ecosystems have been assessed and found to be minimal. These impacts are discussed further in the following sections. .

6.4.2.1 Mine Water Inflows

Mine inflows at the Austar Coal Mine are very complex, and comprise inflows both from the coal measures and from water stored in voids in abandoned former mine workings in the surrounding area. The most recent assessment of groundwater inflows to the mine by Aurecon (2013) notes a slowly increasing trend in inflows to the mine over time, likely due to mining progressively extending into new areas.

The LWB1-B3 modification will result in a small incremental increase in total water inflow to the mine, due to the extension of the mine into a new mining area. The inflow rate is likely to increase initially with the advance of the development headings for the LWB1-B3 panels. This increase is expected to be modest and short-lived, as the LWB1-B3 panels are along strike rather than down-dip from the closest previously mined LWA5 and LWA5a, and the Greta Seam and the immediate roof and floor sediments have already been substantially dewatered/depressurised. The magnitude of seepage inflows is predicted to be within the range of inflows that have been experienced in other locations of the Austar Coal Mine.

6.4.2.2 Impacts on Groundwater levels/Pressure

Alluvium

Previous mining of LWA4 and LWA5 within the Stage 2 mining area undermined the alluvium of Cony Creek and alluvial monitoring bores AQD1073A, WBH1, WBH2 and WBH3 with no observable drawdown of water levels in the near surface alluvial groundwater. Based on this, and the increased depth of cover above the LWB1-B3 panels, the LWB1-B3 Modification is unlikely to have an adverse effect on groundwater levels in the near surface aquifer system.

As discussed in **Section 6.2.3** predicted maximum subsidence will result in the development of shallow subsidence troughs. Where these subsidence troughs coincide with the shallow alluvium, there will likely be an initial drop in groundwater levels, as the base of the alluvium will subside by a similar magnitude to the ground surface. This predicted initial decline in water table level is likely to quickly rise to re-establish equilibrium with the adjacent sections of the alluvium outside the subsidence zone. This will result in a greater thickness of saturated alluvium and a shallower depth to the water table within the subsidence troughs, with the water table remaining at about the same absolute elevation (in mAHD) as pre-extraction conditions.

Apart from this small localised beneficial impact, no noticeable change in groundwater levels is likely to be observed in the alluvial aquifer following the completion of the LWB1-B3 Modification and no adverse effects on baseflow contributions from this aquifer are predicted.

Branxton Formation

The bulk of the sediments overlying the Greta Coal Seam form the Branxton Formation. The uppermost water-bearing zones within the Branxton Formation are generally within the first 50 metres below the base of weathering. There is one privately registered stock bore located within the LWB1-B3 Modification Area which targets these uppermost water-bearing zones (refer to **Figure 6.5**). Monitoring data indicates this bore produces modest yields of moderately saline groundwater.

The uppermost 100m of the Branxton Formation is more than 380 metres above the Greta Seam, and is therefore well above the predicted maximum height of connected fracturing from subsidence likely to occur as a result of the LWB1-B3 Modification. Hence groundwater levels in the uppermost 100 metres or so of the Branxton Formation are likely to be unaffected by the LWB1-B3 Modification.

6.4.2.3 Coal Measures and Greta Seam

The Greta Coal Measures, including the Greta Seam, will be dewatered within the immediate proximity of the longwall panels, and will also be substantially depressurised within the vicinity of the longwalls, consistent with the depressurisation experienced for the extracted longwall panels at the Austar Coal Mine, however no beneficial users will be affected.

6.4.2.4 Groundwater Quality

There is not predicted to be any adverse impact on water quality within either the alluvium or shallow water bearing zones of the Branxton Formation as a result of the proposed modification, as the zones of connected fracturing and discontinuous fracturing do not extend to the height of these aquifers.

6.4.2.5 Impacts on Water Users

There are no registered groundwater bores targeting the alluvium within or surrounding the LWB1-B3 Modification Area, reflecting the limited yield potential of this water source. In any case, the potential for the LWB1-B3 Modification to impact on the alluvium is negligible.

One private stock bore (GW054676) located within the LWB1-B3 Modification Area targets groundwater in the upper parts of the Branxton Formation. The identified water-bearing zone for this bore is in fractured shale at 10.1m – 24.4m depth, with a yield of about 1 L/s. The aquifer that contributes water to this bore is too shallow to be affected by the predicted subsidence impacts of the LWB1-B3 Modification. Although unlikely, it is possible that some damage to bore GW054676 may occur, such as blockage of the bore due to differential horizontal displacements at different horizons within the strata. In the unlikely event that damage does occur, Austar will provide an alternative water supply until such time as the bore is repaired or replaced (refer to **Section 7.6**).

6.4.2.6 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) identified in the LWB1-B3 Modification Area include riparian vegetation and a small soak area (about 0.1 ha). As discussed in Section 6.4.2, the predicted heights of either connected or discontinuous fracturing above the Greta Seam as a result of subsidence are significantly less than the depth of cover above the Greta Seam. Based on this, it is considered that any impacts on either the shallow near surface groundwater or on stream baseflows will be negligible as a result of the LWB1-B3 Modification, therefore no impact to any GDEs dependent on the near surface groundwater or on groundwater baseflow is predicted to occur. Additionally there are no known GDEs dependent on groundwater from the Branxton Formation or the Greta Coal Measures.

6.4.3 NSW Aquifer Interference Policy

The predicted groundwater impacts associated with the LWB1-B3 Modification were assessed against the NSW Aquifer Interference Policy which requires any mining activity to consider 'Minimal Impact Considerations' with respect to groundwater sources. The NSW Aquifer Interference Policy considers two categories of groundwater sources, 'highly productive' and 'less productive'. Both the alluvial and porous rock groundwater sources within the LWB1-B3 Modification Area are considered 'less productive' sources as they do not meet the relevant water quality and yield requirements for 'highly productive' groundwater sources. An assessment against the minimal impact considerations for less productive groundwater sources is provided in **Table 6.3**.

Table 6.3 Assessment against NSW Aquifer Interference Policy Minimum Impact Criteria

Relevant Minimum Impact Criteria	LWB1-B3 Modification
Less than 10% variation in the water table, 40m from any high priority groundwater dependent ecosystem or high priority culturally significant site listed in the schedule of the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*	The closest high priority groundwater dependent ecosystem or high priority culturally significant site listed in Schedule 4 of the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* is located more than 30 km away from the LWB1-B3 Modification Area. The proposed modification will not impact the water table at that distance.

Relevant Minimum Impact Criteria	LWB1-B3 Modification
A maximum 2m decline at any water supply work	One privately owned stock bore (GW054676) is located within the LWB1-B3 Modification Area, targeting a shallow water bearing zone in the Braxton Formation. Potential to impact on groundwater within the aquifer supporting this bore is considered negligible as the height of connected or discontinuous fracturing above the coal seam is not predicted to extend to this aquifer.
No mining activity to be within 200m laterally from the top of high bank or 100m vertically beneath of a highly connected surface water source that is defined as a 'reliable water supply'	There are no highly connected surface water sources as defined by the NSW Aquifer Interference Policy and Regulations within 200m laterally or 100m vertically of the LWB1-B3 Modification Area. Additionally there are no water sources that represent a 'reliable water supply' as defined by the NSW Aquifer Interference Policy and Strategic Regional Land Use Plan – Upper Hunter.
Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity	The quality of water within the alluvial aquifer is variable and there is no known current use of the near surface groundwater. The near surface aquifer is therefore considered to have limited beneficial use potential from a water supply perspective The LWB1-B3 Modification is not expected to further limit potential beneficial uses of this water supply. The groundwater within the upper parts of the Branxton Formation is also of poor quality, with limited beneficial use potential. The predicted negligible impact from the LWB1-B3 Modification will not inhibit any potential future use of that aquifer system. Groundwater in the deeper parts of the Branxton Formation and the Greta Coal Measures is saline, and therefore has very low potential for future beneficial use other than for industrial purposes such as coal mining operations.

The alluvial aquifer associated with Quorrobolong Creek and its tributaries within the LWB1-B3 Modification Area is not characterised as a 'highly productive' groundwater source or a highly connected surface water source, as defined by the NSW Aquifer Interference Policy. The lack of registered bores within the area also indicates that the alluvial aquifer in the vicinity of the LWB1-B3 Modification Area has limited use as a water supply for stock, domestic or other consumptive purpose. On this basis, it is considered that the LWB1-B3 Modification adequately satisfies the minimal impact considerations for less productive groundwater sources defined by the NSW Aquifer Interference Policy.

6.4.4 Groundwater Licensing

Groundwater impacts associated with the Austar Coal Mine involve water take from the porous rock groundwater source which is regulated by the *Water Act 1912*.

The water takes from the 'porous rock' water source for the currently approved mine plan are estimated to be up to a maximum of approximately 550 ML/y. The proposed modification is predicted to result in a minimal increase to the total water take from this source.

The current water take is authorised under access licences 20BL171481, 20BL173349 and 20BL173350, which have a combined licensed entitlement of 770 ML/y.

It is concluded therefore that current water take from the porous rock water source is well below the current licence entitlement, and an increase in the licence allocation will not be required for the proposed modification.

6.4.5 Groundwater Management and Monitoring

Groundwater will continue to be monitored within the Stage 2 and Stage 3 mining areas in accordance with the existing Site Water Management Plan (Austar, 2013a), EL6598 Groundwater Monitoring and Modelling Plan (RPS, 2014) and Environmental Monitoring Program (Austar, 2013b).

The following additional groundwater management and monitoring measures will be incorporated in the proposed LWB1-B3 Extraction Plan, consistent with the requirements of the existing approved Austar Site Water Management Plan (Austar 2013b). Austar will:

- establish one shallow groundwater monitoring bore in the alluvial area of the unnamed tributary of Quorrobolong Creek, subject to landholder access, and monitor the groundwater levels and water quality on a regular basis to give an indication of the impact of longwall mining on the groundwater in the alluvium;
- reconcile groundwater monitoring data against rainfall records to assess whether groundwater level changes are the result of longwall mining impacts
- review the results of the above monitoring at three monthly intervals and report results at the completion of each longwall panel.

6.5 Ecology

The LWB1-B3 Modification Area consists largely of cleared grazing land, with vegetation primarily limited to riparian areas along the ephemeral drainage lines and areas of regenerating woodland in the east and north (refer to **Figure 1.3**). The proposed modification does not involve any additional surface development and therefore will have no direct impact on vegetation as a result of clearing. The potential impacts of the proposed modification on flora and fauna are therefore limited to indirect impacts associated with subsidence.

In order to assess the potential ecological impacts of the LWB1-B3 Modification from subsidence, an ecological assessment has been prepared by Umwelt. The assessment included a targeted field survey over a period of 4 days in August and September 2015 to classify and map vegetation communities and fauna habitats and included targeted threatened flora and fauna species searches. The ecological assessment is included as **Appendix 5**, with a summary of the assessment provided below.

6.5.1 Existing Environment

6.5.1.1 Flora

A total of 173 flora species were recorded within the LWB1-B3 Modification Area, of which 136 species are native and 37 are introduced. A full list of flora species recorded is provided in **Appendix 5**.

Of the flora species identified within the LWB1-B3 Modification Area, three are listed as threatened species, being the netted bottlebrush (*Callistemon linearifolius*), small-flower grevillea (Grevillea parviflora subsp. parviflora) and heath wrinklewort (Rutidosis heterogama). Locations of threatened species are provided on **Figure 6.6**.

No endangered flora populations were identified occurring within the LWB1-B3 Modification Area, and based upon the habitats identified, none are expected to occur.

6.5.1.2 Vegetation Communities

Six vegetation communities were identified in the LWB1-B3 Modification Area and are shown on **Figure 6.6**. The extent of each vegetation community within the LWB1-B3 Modification Area is presented in **Table 6.4**.

Table 6.4 Vegetation Communities within the LWB1-B3 Modification Area

Vegetation Community	Status	Extent (ha)
Melaleuca shrubland with emergent Eucalypts	Potential EEC (TSC Act)	1.6
Riparian Swamp Oak Open Forest	-	16.4
Riparian Cabbage Gum Open Forest	EEC (TSC Act)	3.2
Spotted Gum Ironbark Forest	EEC (TSC Act)	56.7
Grassland	-	173
Planted Vegetation	-	1.3
Total		**252.3**

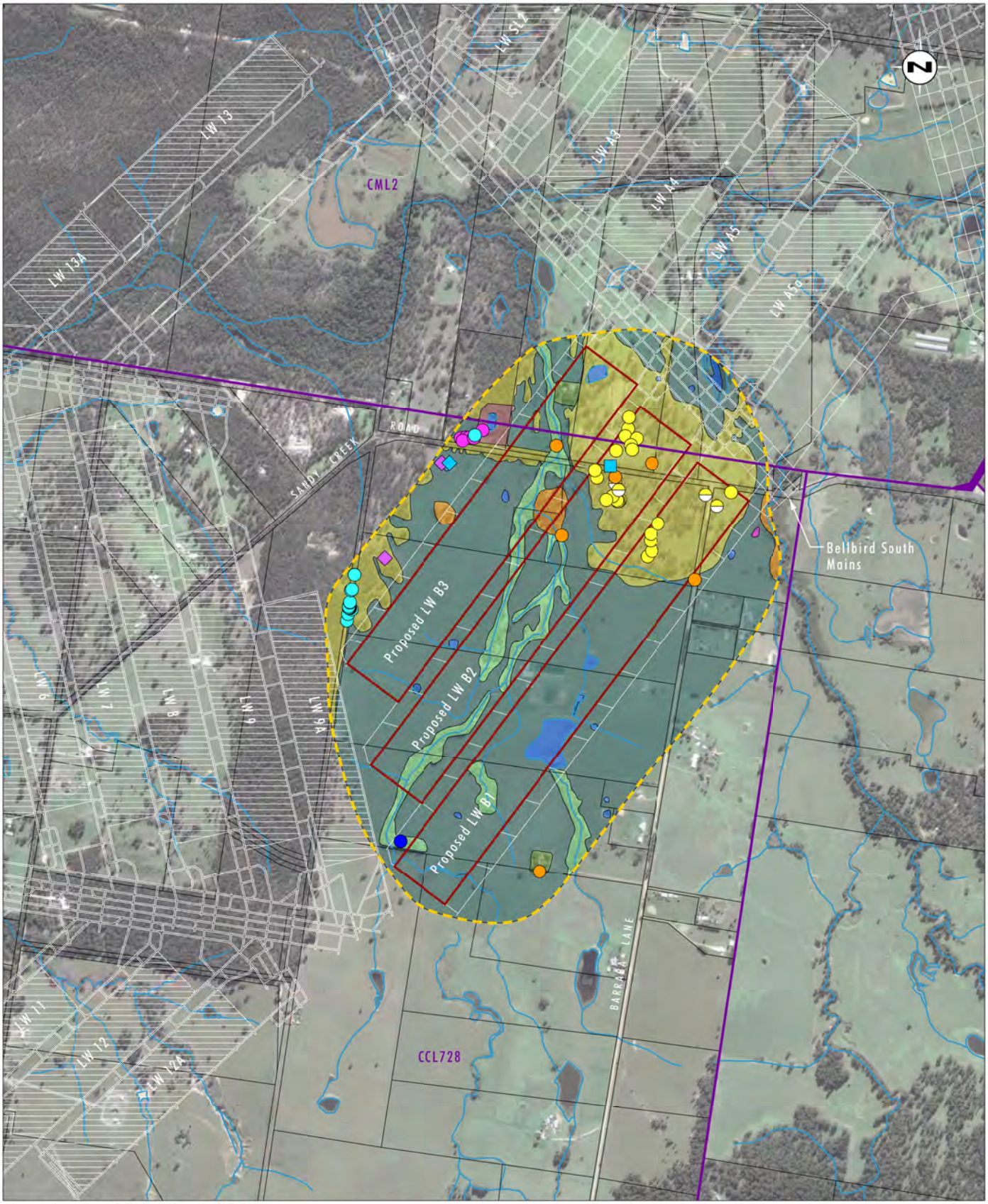

Image Source: Google Earth (2014)
Data Source: Austar Coal Mine (2015)

0 0.25 0.5 1.0km
1:20 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Completed Underground Workings
- Mining Lease Boundary
- Drainage Line
- Cadastral Boundary
- Grassland
- Spotted Gum Ironbark Forest
- Planted Vegetation
- Melaleuca Shrubland with Emergent Eucalypts
- Riparian Cabbage Gum Open Forest
- Riparian Swamp Oak Open Forest
- Water Body
- Wet Soak
- Grey-crowned babbler (eastern subspecies)
- Grey-crowned babbler nests
- Large-eared Pied Bat
- Greater Broad-nosed Bat
- Squirrel Glider
- Varied sittella
- *Callistemon linearifolius*
- *Grevillea parviflora* subsp. *parviflora*
- *Rutidosis heterogama*

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FIGURE 6.6

Vegetation Communities and Threatened Species Records

In addition, there are approximately 3.9 ha of water bodies (farm dams) and a small wet soak of approximately 0.1 ha located in the LWB1-B3 Modification Area.

Each of the vegetation communities identified in **Table 6.4** is described in detail in the Ecological Assessment (refer to **Appendix 5**).

Of the six vegetation communities identified within the LWB1-B3 Modification Area, two were considered consistent with Threatened Ecological Communities (TECs) listed under the TSC Act and one was considered potentially consistent with a TEC listed under the TSC Act. These were *River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* EEC (River-flat Eucalypt Forest EEC) and the *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion EEC* (Lower Hunter Spotted Gum – Ironbark Forest EEC) and potential *Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion EEC* (potential Quorrobolong Scribbly Gum Woodland EEC). No TECs were identified as being consistent with any listings under the EPBC Act. The details of each of these EECs as they occur within the LWB1-B3 Modification Area are provided in greater detail in **Appendix 5**.

6.5.1.3 Fauna

A total of 71 fauna species were recorded in the LWB1-B3 Modification Area, including nine frog species, six reptile species, 44 bird species and 16 mammal species. A complete list of species recorded during field surveys provided in the ecological assessment (refer to **Appendix 5**).

Of the 71 fauna species identified within the LWB1-B3 Modification Area, six were threatened, including:

- two threatened bird species, the grey-crowned babbler (*Pomatostomus temporalis temporalis*) and varied sittella (*Daphoenositta chrysoptera*), both listed as vulnerable under the TSC Act
- two threatened mammal species listed as vulnerable under the TSC Act, the squirrel glider (*Petaurus norfolcensis*) and greater broad-nosed bat (*Scoteanax rueppellii*), and two threatened mammal species listed as vulnerable under both the TSC Act and EPBC Act, the large-eared pied bat (*Chalinolobus dwyeri*) and koala (*Phascolarctos cinereus*). Although not recorded during surveys undertaken by Umwelt, a single record of the koala was identified from Wildlife Atlas records within the LWB1-B3 Modification Area.

A single bird species listed as migratory under the EPBC Act was also recorded, being the cattle egret (*Ardea ibis*).

The locations of threatened fauna species recorded in the LWB1-B3 Modification Area are shown on **Figure 6.6**. A range of potentially occurring threatened fauna species were also identified on the basis of the presence of potential habitat and local records.

6.5.1.4 Threatened Species and Threatened Ecological Communities

A summary of the threatened species and TECs identified as occurring within the LWB1-B3 Modification Area or with the potential to be impacted by the proposed modification is provided in **Table 6.5**.

Table 6.5 Threatened Species and Threatened Ecological Communities Occurring Within or Potentially Impacted by the LWB1-B3 Modification

Threatened Species or TEC	Legal Status	Status within LWB1-B3 Modification Area
heath wrinklewort (*Rutidosis heterogama*)	Vulnerable (TSC Act)	Confirmed occurrence
netted bottle brush (*Callistemon linearifolius*)	Vulnerable (TSC Act)	Confirmed occurrence
small-flower grevillea (*Grevillea parviflora subsp. parviflora*)	Vulnerable (TSC Act)	Confirmed occurrence
green-thighed frog (*Litoria brevipalmata*)	Vulnerable (TSC Act)	Potential to occur
regent honeyeater (*Anthochaera phrygia*)	Critically Endangered (EPBC Act)	Potential to occur
swift parrot (*Lathamus discolor*)	Endangered (EPBC Act)	Potential to occur
grey-crowned babbler (*Pomatostomus temporalis temporalis*)	Vulnerable (TSC Act)	Confirmed occurrence
varied sittella (*Daphoenositta chrysoptera*)	Vulnerable (TSC Act)	Confirmed occurrence
grey-headed flying fox (*Pteropus poliocephalus*)	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Potential to occur
squirrel glider (*Petaurus norfolcensis*)	Vulnerable (TSC Act)	Confirmed occurrence
koala (*Phascolarctos cinereus*)	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Wildlife Atlas database record of occurrence
southern myotis (*Myotis macropus*)	Vulnerable (TSC Act)	Potential to occur
eastern free-tailed bat (*Mormopterus norfolkensis*)	Vulnerable (TSC Act)	Potential to occur
little bentwing bat (*Miniopterus australis*)	Vulnerable (TSC Act)	Potential to occur
greater broad-nosed bat (*Scoteanax rueppelli*)	Vulnerable (TSC Act)	Confirmed occurrence

Threatened Species or TEC	Legal Status	Status within LWB1-B3 Modification Area
Large-eared pied bat (Chalinolobus dwyeri)	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Confirmed occurrence
potential Quorrobolong Scribbly Gum Woodland EEC	TEC (TSC Act)	Confirmed occurrence
River-flat Eucalypt Forest EEC	TEC (TSC Act)	Confirmed occurrence
Lower Hunter Spotted Gum – Ironbark Forest EEC	TEC (TSC Act)	Confirmed occurrence

6.5.1.5 Aquatic Ecology

Assessment of aquatic habitat characteristics and potential fish habitat was undertaken along the length of Quorrobolong Creek and its unnamed tributary within the LWB1-B3 Modification Area, and at one dam location.

The unnamed tributary was found to have several barriers to fish passage in the LWB1-B3 Modification Area, mostly in the form of sand/silt bars and was assessed as providing minimal fish habitat. The length of Quorrobolong Creek within the LWB1-B3 Modification Area was considered relatively un-impeded and was considered to provide moderate fish habitat. Both drainage lines provide habitat for small aquatic fauna species and small vertebrate fish, such as the introduced mosquito fish (*Gambusia holbrooki*).

No areas were identified in the LWB1-B3 Modification Area that were considered to have potential to provide habitat for the water rat (*Hydromys chrysogaster*) or platypus (*Ornithorhynchus anatinus*). No threatened aquatic species listed as threatened under the TSC Act, EPBC Act or *Fisheries Management Act 1994* were identified or considered likely to occur.

6.5.1.6 Groundwater Dependent Ecosystems

The near surface groundwater resources present in the LWB1-B3 Modification Area occur in the shallow alluvial aquifers associated with Quorrobolong Creek and within shallow water bearing zones of the porous rock aquifers associated with the Braxton Formation. It is highly likely that the riparian vegetation comprising Riparian Swamp Oak Open Forest and Riparian Cabbage Gum Open Forest is at least partially dependent upon alluvial groundwater during periods of reduced surface water flow.

While not listed as a groundwater dependent ecosystem or high priority groundwater dependent ecosystem by the Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems or *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*, a small wet soak area potentially fed by groundwater was identified in the north-east of the LWB1-B3 Modification Area and considered likely to comprise a groundwater dependent ecosystem. The soak is approximately 15 metres in diameter and is dominated by perennial wetland groundcover plants.

6.5.2 Ecological Impact Assessment

As the LWB1-B3 Modification does not involve any surface disturbance there will be no direct impact on vegetation as a result of clearing. The potential impacts of the proposed modification on flora and fauna are therefore limited to potential impacts associated with subsidence such as surface cracking, subsidence remediation works or changes in the hydrological regime.

The subsidence assessment findings conclude that the potential for surface cracking associated with the LWB1-B3 Modification is low due to the depth of mining within the LWB1-B3 Modification Area (greater than 480 metres), the small magnitude of predicted ground curvatures and strains and the absence of any steep slopes or cliffs within the modification area. Remediation of subsidence impacts is therefore unlikely to be required, or if required will be of a relatively minor scale.

This conclusion is supported by subsidence and ecological monitoring within the Stage 2 and 3 areas, where there has been no significant or visible surface cracking above previously extracted longwalls A3 to A8 or any evidence of impacts on ecological features.

Detailed assessment of the potential impacts of subsidence on surface water flows and groundwater also conclude that the potential for significant adverse impacts on these features is minimal (refer to **Sections 6.3** and **6.4**). The potential for the LWB1-B3 Modification to result in indirect impacts on ecological values as a result of changes in hydrology is therefore considered low.

Given the predicted subsidence impacts on the landform surface are expected to be minimal, as are the secondary impacts on flooding and drainage, the potential for the LWB1-B3 Modification to adversely impact vegetation communities and fauna habitat identified in the LWB1-B3 Modification Area is considered low.

6.5.2.1 Threatened Species and Threatened Ecological Communities

An assessment of the potential impacts of the LWB1-B3 Modification on each of the threatened species and ecological communities listed in **Table 6.4** was undertaken (refer to **Appendix 5**). This assessment concluded that due to the LWB1-B3 Modification not involving any vegetation clearing and the minimal subsidence impacts predicted at the surface, it is unlikely to have a significant impact on vegetation (including threatened species and TECs) or habitats of any threatened fauna species listed under the TSC Act or EPBC Act.

6.5.2.2 Groundwater Dependent Ecosystems

Previous monitoring of the impacts of mining on shallow aquifers within the Austar Coal Mine has identified no observable impact on alluvial or shallow rock aquifers as a result of mining (Austar 2014). The surface water and groundwater assessments completed for the proposed modification indicate that impacts on groundwater and surface water regimes are predicted to be minor. Therefore groundwater dependent ecosystems occurring in the LWB1-B3 Modification Area, including the Riparian Swamp Oak Open Forest, Riparian Cabbage Gum Open Forest and the small soak area identified, are unlikely to be adversely impacted as a result of the LWB1-B3 Modification.

6.5.3 Ecological Management and Monitoring

Austar Coal Mine will prepare a specific Biodiversity Management Plan (BMP) for approval as part of the LWB1-B3 Extraction Plan, to manage any potential impacts from secondary extraction of LWB1-B3 on biodiversity values within the LWB1-B3 Modification Area. The BMP will identify baseline information on ecological values within the LWB1-B3 Modification Area, the potential impacts to those aspects by predicted subsidence as identified in the ecological assessment report, and a description of relevant monitoring and management measures, such as:

- Monitoring of River-flat Eucalypt Forest EEC; Lower Hunter Spotted Gum – Ironbark Forest EEC vegetation; and potential Quorrobolong Scribbly Gum Woodland EEC vegetation.

- Monitoring of the heath wrinklewort (Rutidosis heterogama) population, small-flower grevillea (Grevillea parviflora subsp. parviflora) population and the netted bottlebrush (*Callistemon linearifolius*) population, where EEC monitoring indicates further surveys of threatened flora species populations is required.

- Mitigation, management and contingency measures (where relevant), and the timing of implementation of these measures.

6.6 Aboriginal Cultural Heritage

As described previously, the LWB1-B3 Modification does not involve any additional surface development and the potential impacts of the proposed modification on Aboriginal cultural heritage are limited to indirect impacts associated with subsidence.

In order to assess the potential archaeological impacts of the LWB1-B3 Modification from subsidence, an Aboriginal Cultural Heritage and Archaeological Assessment has been prepared for the LWB1-B3 Modification Area by Umwelt in consultation with the registered Aboriginal parties (RAPs) for the modification. The assessment is included as **Appendix 6** with a summary of the findings provided below.

6.6.1 Background

The Austar Coal Mine has been subject to a number of previous Aboriginal cultural heritage assessments and investigations as part of previous Stage 2 and Stage 3 approvals. Aboriginal cultural heritage issues are managed in accordance with an existing approved Aboriginal Cultural Heritage Management Plan (Austar 2015) developed as a condition of PA 08_0111 and the Bellbird South Consent. The ACHMP provides a consolidated framework for the management of Aboriginal cultural heritage and mitigation strategies for the Austar Coal Mine.

A search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on 28 April 2015 and identified 43 Aboriginal archaeological sites within an area of 10 kilometres of the LWB1-B3 Modification Area. No sites were recorded within the LWB1-B3 Modification Area. All sites identified by the AHIMS search area are detailed in previous assessments undertaken for the Austar Coal Mine (Umwelt 2013b). The locations of known archaeological sites within and surrounding the modification area are shown on **Figure 6.7**.

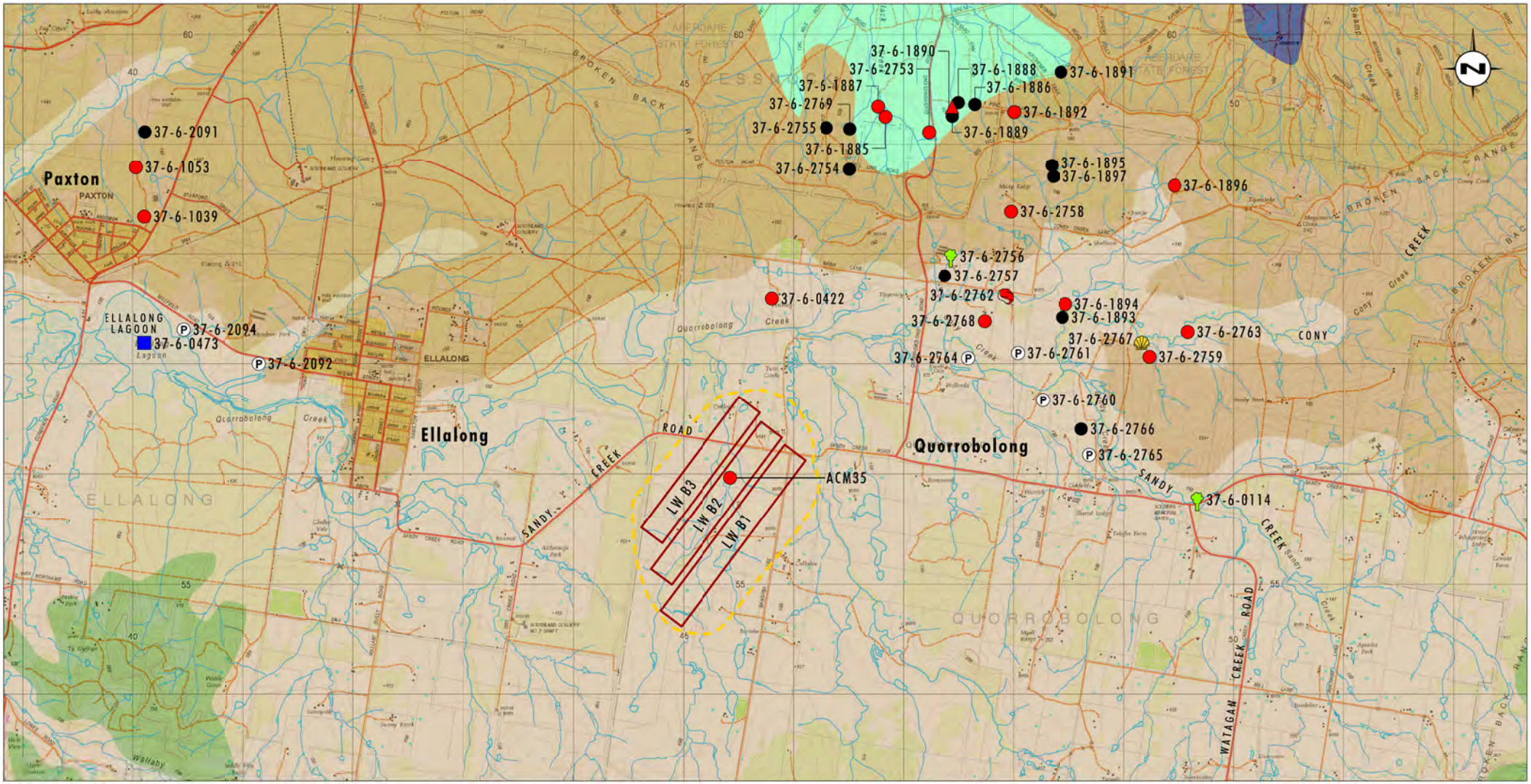

Image Source: LPI (2006)
Data Source: Austar Coal Mine (2015), AHIMS (2015), LPI (2009)

0 0.5 1.0 2.0km
1:50 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Artefact and Potential Archaeological Deposit
- Artefact and Shell
- Artefact Scatter
- Isolated Find
- Natural Mythological (Ritual)
- (P) Potential Archaeological Deposit
- Scarred Tree or Carved Tree
- Axe Grinding Groove and Artefact

Soil Landscapes:
- Awaba
- Quorrabolong
- Neath
- Aberdare
- Branxton

FIGURE 6.7

Location of ACM35 to
Soil Landscape and AHIMS Results

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20150929 16.20

6.6.2 Survey Methodology

A targeted pedestrian survey of the LWB1-B3 Modification Area was undertaken over a period of three days on 4 and 5 August 2015 and 28 September 2015, 12 RAP representatives were present at different times during the survey.

Thirty three survey transects were completed for this assessment, a description of each survey transect and location is detailed in **Appendix 6**. Ground visibility was generally poor throughout the entire LWB1-B3 Modification Area and each survey transect was generally covered with dense pastoral grasses. Minimal areas of ground exposure were noted in places such as dam walls, vehicular tracks, creek embankments and small patches of erosion where stock had disturbed the natural ground surface.

6.6.3 Survey Results

One artefact scatter (ACM35) consisting of two small stone artefacts was identified during the survey of the LWB1-B3 Modification Area (refer to **Figure 6.7**).

No areas of potential archaeological deposit were identified during the survey.

A number of areas within pastoral allotments were not surveyed due to thick grass cover and corresponding loss of ground surface visibility. These predominately higher elevation areas were visually assessed by the RAP representatives and archaeologists and all RAP representatives involved in the survey concluded that these areas presented a low probability to contain archaeological sites.

6.6.4 Significance Assessment

6.6.4.1 Archaeological Significance

Site ACM35 consists of a low density artefact scatter on a heavily disturbed embankment of the unnamed tributary of Quorrobolong Creek above LWB2. The two artefacts within this site are located in a secondary depositional context which demonstrates low integrity with limited research potential. The rarity and representative values of the site have also been assessed as low given that both site and artefact types are common throughout the region. Additionally, the modification area is situated in a working pastoral property which reduces the education potential of the site to low. From an archaeological perspective, site ACM35 has been assessed as being of low archaeological significance in accordance with the Australian cultural heritage management best-practice standards established in The Burra Charter (Australia ICOMOS 2013).

6.6.4.2 Aboriginal Cultural Significance

The majority of the RAPs involved in the fieldwork component of this assessment did not provide any additional cultural information on either the LWB1-B3 Modification Area or the newly identified artefacts at ACM35 at the time of the survey.

The draft Aboriginal Cultural Heritage and Archaeological Assessment report was provided to the RAPs for review and comment on 7 October 2015. The responses received during this consultation process are provided in **Appendix 6**. The RAPs that provided a response were generally satisfied with the assessment as provided in the report.

As discussed in **Appendix 6**, Mr. Danny Franks (Tocomwall) made some comments in relation to Archaeological (Scientific) Significance and noted the importance of the traditional owners role in determining the significance of all sites. Mr Franks provided some feedback to be considered for future developments, but did not raise any issues with the proposed management approach for this project.

6.6.5 Impact Assessment

The proposed modification does not involve any additional surface development and therefore will have no direct impact on archaeological sites as a result of land clearing. The potential impacts of the proposed modification on archaeological sites are therefore limited to indirect impacts associated with subsidence, including surface cracking, subsidence remediation works and hydrological changes.

Due to the depth of mining within the LWB1-B3 Modification Area (greater than 480 metres), and the small magnitude of predicted ground curvatures and strains, surface cracking is not expected to occur. This is supported by monitoring evidence within the Stage 2 and 3 areas, where there has been no significant or visible surface cracking above previously extracted LWA3 to A8. Predicted subsidence within the LWB1-B3 Modification Area is less than that experienced in the previously extracted Stage 2 and Stage 3 areas, therefore the potential for impacts to the land surface is also predicted to be less. Any surface cracking that does occur is expected to be minor and isolated and unlikely to directly or adversely impact site ACM35. Additionally, flood modelling indicates that the potential for secondary impacts such as increased erosion of the landscape as a result of the LWB1-B3 Modification is also expected to be minimal.

6.6.6 Archaeological Management and Monitoring

Given the low likelihood of impact to site ACM35, Austar will continue to implement the management strategies that are currently in place at the Austar Coal Mine, including those in the ACHMP (Austar 2015). Where relevant, these measures will be extended to the LWB1-B3 Modification Area and site ACM35. Specifically:

- Site ACM35 will be added to the existing archaeological site monitoring program, undertaken in accordance with the ACHMP;

- In the event that previously unidentified Aboriginal objects are located during any ground disturbing works within the LWB1-B3 Modification Area, the protocol for previously unidentified aboriginal objects/features outlined in the ACHMP will be followed; and

- In the unlikely event that subsidence remediation works are required which will impact on site ACM35, an Aboriginal Heritage Impact Permit (AHIP) will be sought to authorise these impacts prior to the commencement of any remediation works in proximity to the recorded site.

6.7 Historic Heritage

A historical heritage assessment has been prepared for the LWB1-B3 Modification Area to identify potential impacts on items of known or potential historical heritage. The assessment has been undertaken with consideration of guidelines set out in the NSW Heritage Manual 1996 (Heritage Office and Department of Urban Affairs & Planning), including *Archaeological Assessments, Assessing Heritage Significance, Statements of Heritage Impact* and the principles contained in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999* (Australia ICOMOS. 2000) and the *Historical Archaeology Code of Practice* (2006).

6.7.1 Statutory Heritage Listings

As part of the historical heritage assessment of the LWB1-B3 Modification Area, a review of relevant heritage databases was undertaken including:

- NSW State Heritage Register
- State Heritage Inventory
- Australian Heritage Database (including Commonwealth and National Heritage lists and the Register of the National Estate)
- Cessnock Local Environment Plan (LEP) 2011.

The database review identified no listed sites / items within or in the vicinity of the LWB1-B3 Modification Area. For the purposes of this assessment "within the vicinity" is considered to be two kilometres from the outer extent of the modification area.

6.7.1.1 Barraba Homestead

The LWB1-B3 Modification Area includes land that formed part of the former Barraba Estate (refer to **Section 6.7.2**). The original 1830s constructed Barraba Homestead and outbuildings have been demolished and a new house constructed in the location of the former homestead. The site of the former Barraba Homestead is located approximately 300 metres south-east of the LWB1-B3 Modification Area (refer to **Appendix 7**).

Although the former Barraba Homestead does not form part of any statutory heritage listing, it was listed in the 2008 draft version of the Cessnock LEP as Barraba Homestead (former) & outbuildings as being of local heritage significance. However, the former Barraba Homestead is not listed on the Cessnock LEP 2011.

6.7.2 Historical Context

As part of NSW heritage assessment procedures it is essential to have a full understanding of a site or item based on its historical and physical context. **Appendix 7** provides a brief historical context for the LWB1-B3 Modification Area (focusing on the Barraba Estate) and its broader locality, to provide an understanding of the potential heritage significance the LWB1-B3 Modification Area. The historical context prepared as part of the *Historical Heritage Assessment: Austar Coal Mine Project, Stage 3* (Umwelt 2008a) should also be referred to for the full historical context of the Austar Coal Mine.

6.7.3 Identification of Historical Items / Sites

The LWB1-B3 Modification Area was inspected on 4 August 2015 and 28 September 2015 in conjunction with the Aboriginal archaeological survey. No structures or items with potential heritage significance or potential historical archaeological sites were identified within the modification area.

Although outside the LWB1-B3 Modification Area (refer to **Appendix 7**), the location of the former Barraba Homestead was also visually inspected; confirming a new house has been constructed in the same location as the former 1830s homestead and outbuildings. There were no visible remains of the former homestead or outbuildings, however this does not discount the potential for archaeological remains of the former homestead site remaining within the boundaries of the current house site (outside the modification area).

6.7.4 Significance Assessment

No identified or potential historical heritage items or archaeological sites are located within the LWB1-B3 Modification Area. While the LWB1-B3 Modification Area does incorporate part of the area of the former Barraba Estate (during its ownership by George Thomas Palmer), the former location of Barraba Homestead and the associated outbuildings is outside the modification area and there are no known items associated with the Barraba Estate within the modification area; reflecting the homestead having a 'single nucleus' with no known outbuildings located away from the homestead itself.

As such, no formal significance assessment has been undertaken for the modification apart from the general consideration of the LWB1-B3 Modification Area itself discussed below.

The LWB1-B3 Modification Area is typical of a rural landscape within the Hunter Valley region. There is not expected to be any perceptible impacts to the open rural nature of the landscape as a result of the modification.

6.7.5 Impact Assessment and Management Strategies

No known or potential historical heritage items or archaeological sites have been identified within the LWB1-B3 Modification Area or will be impacted by the proposed modification.

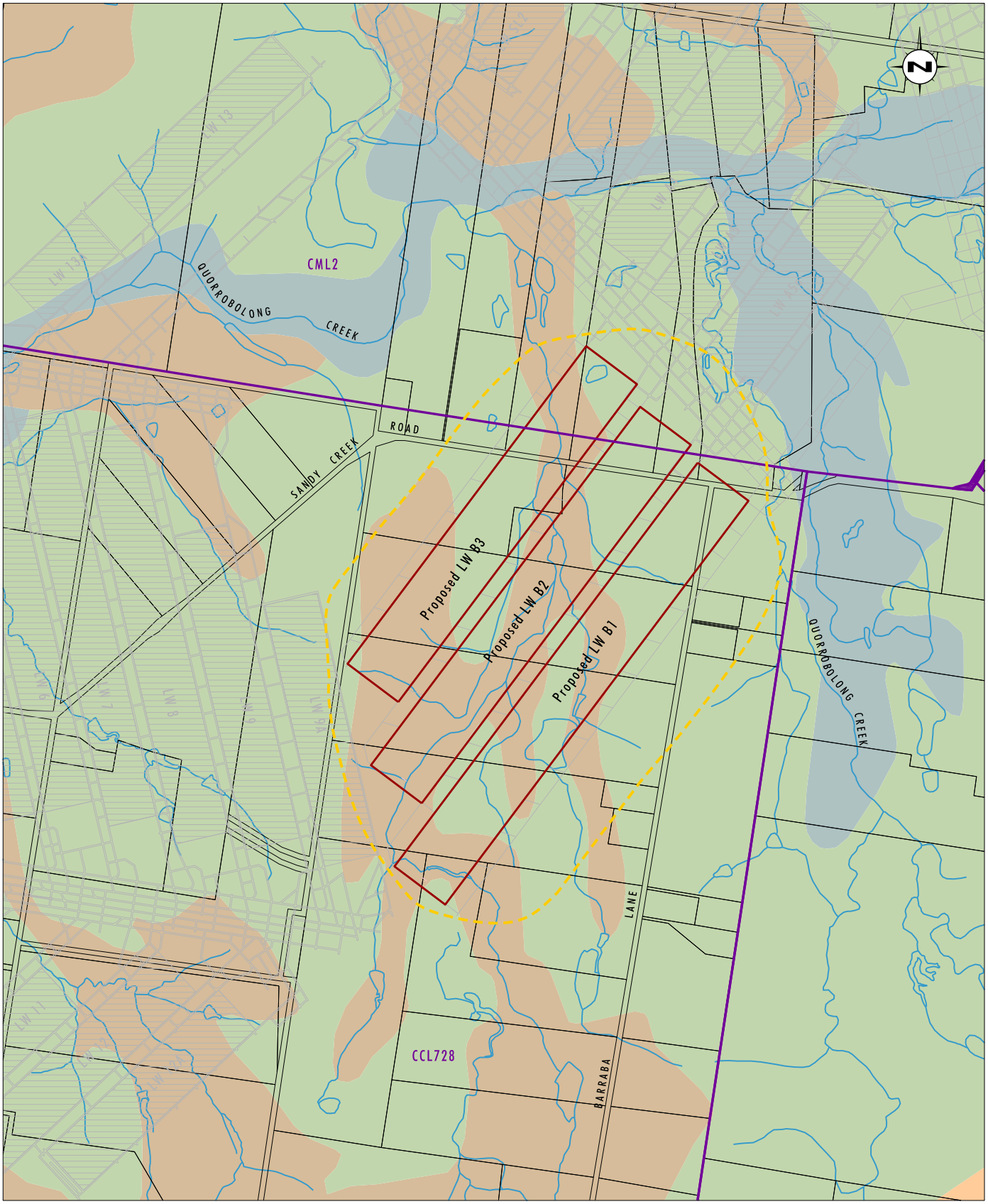
No change to the existing historical heritage management measures outlined in the Austar Historic Heritage Management Plan (Austar 2013a) is required for the modification.

6.8 Land Resources and Agriculture

6.8.1 Soil and Land Capability

As discussed in **Section 1.3**, one soil landscape type is found within the LWB1-B3 Modification Area, being the Quorrobolong soil landscape (Kovac and Lawrie 1991) (refer to **Figure 1.6**). The main soils within this landscape are prairie soils occurring in drainage depressions and on lower slopes. They are generally poorly drained, have moderate permeability and the upper horizon has moderate erodability (Kovac and Lawrie 1991). The soils are moderately fertile and the main land use is generally grazing on unimproved pasture.

The land and soil capability mapping undertaken for the Upper Hunter Strategic Regional Land Use Plan 2012 indicates the LWB1-B3 Modification Area is mapped as Class 4 and Class 5 Land and Soil Capability (refer to **Figure 6.8**). Class 4 and 5 land is considered to be land capable of a variety of land uses, such as cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry and nature conservation (OEH 2012). The definition for each class identified is provided in **Table 6.6**.



Data Source: Austar Coal Mine (2015), Department of Natural Resources (2005)

0 0.25 0.5 1.0km
1:20 000

Legend

- Proposed LWB1-B3 Longwall Panels
- LWB1-B3 Modification Area
- Completed Underground Workings
- Mining Lease Boundary
- Drainage Line

Land Capability:

- 2 - Very High Capability Land
- 4 - Moderate Capability Land
- 5 - Moderate-Low Capability Land

FIGURE 6.8

Land Capability

Table 6.6 Land and Soil Capability Classes (OEH 2012)

LSC Class	General Definition
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	Moderate capability land: Land has moderate to high limitations for high impact land uses. Will restrict land management options for regular, high impact land uses such as cropping, high intensity grazing and horticulture. These limitations can only be managed by specialized management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	Moderate-low capability land: Land has high limitations for high impact uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long term degradation.

Assessment of the potential subsidence impacts on the land surface and hydrological regime conclude that the risk of surface cracking is low as is the potential for adverse impacts on water availability or erosion. Given the minimal impacts predicted to the land surface and hydrological regime, it is unlikely that the LWB1-B3 Modification would have any impact on the current or future land and soil capability of the LWB1-B3 Modification Area.

Visual monitoring of the land surface within the LWB1-B3 Modification Area will be undertaken before, during and following mining to determine the need for any subsidence management or remediation measures, as described in **Section 6.2.4** and **Section 7.9**. The objective of any subsidence management or remediation measures would be to return the land to pre-mining condition or better.

6.8.2 Agricultural Impacts

The majority of the LWB1-B3 Modification Area is currently used for agricultural purposes, including grazing, with some rural residential use. The LWB1-B3 Modification is not expected to restrict the ongoing use of the land for agricultural or rural residential purposes as all residential and rural structures are expected to have manageable impacts and the risk of surface cracking is low. Further, the potential for adverse impacts on water availability and farm dams is minimal, with any impacts on private groundwater bores or dams being subject to rectification or establishment of alternate water supply if impacted. Land is expected to remain safe for continued grazing and agricultural use throughout mining (refer to **Section 6.2**).

Visual monitoring of the natural and built features within the LWB1-B3 Modification Area will be undertaken before, during and following mining to determine the need for any subsidence management measures, as described in **Section 6.2.4**.

Any subsidence related impacts to rural buildings, fences or farm dams will be repaired in accordance with individual Built Features Management Plans to be prepared in consultation with potentially affected landholders.

6.8.3 Compatibility with Surrounding Land Uses

The LWB1-B3 Modification Area is located within a rural environment. The dominant land use within and surrounding the modification area is grazing, with some rural residential use. The villages of Kitchener, Abernethy, Ellalong, and Paxton are located within 4 kilometres north and west of the LWB1-B3 Modification Area.

As previously discussed, the LWB1-B3 Modification does not involve any additional surface development and due to the predicted minimal impacts on the ground surface, is unlikely to have any adverse impacts on current land uses. Austar Coal Mine has coexisted with existing and previous land uses since it recommenced mining in Bellbird South in 2005 and the LWB1-B3 Modification is also considered compatible with existing surrounding land uses.

6.8.4 Management and Monitoring

The predicted impact of subsidence on land and agricultural resources is minimal, with impacts likely to be less than that previously experienced in the Stage 2 and Stage 3 LTCC extracted areas. Based on this outcome, Austar will continue to implement the management strategies currently in place within the Austar Coal Mine, consistent with those outlined in the existing approved Land Management Plan (Austar, 2013). A Land Management Plan will be prepared for the LWB1-B3 Modification Area as part of the Extraction Plan process.

6.9 Greenhouse Gas and Energy Assessment

A detailed greenhouse gas and energy assessment (GHGEA) has been prepared for the LWB1-B3 Modification by Umwelt. The findings of the GHGEA are provided below.

6.9.1 Assessment Methodology

The GHGEA framework is based on the methodologies and emission factors contained in the National Greenhouse Accounts Factors 2014. The assessment framework also incorporates the principles of The Greenhouse Gas Protocol 2004.

The Greenhouse Gas Protocol (The Protocol) provides an internationally accepted approach to greenhouse gas accounting. The Protocol provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality. The Protocol defines three 'Scopes' of emissions for GHG accounting and reporting purposes. These scopes are briefly outlined below (WRI/WBCSD 2004):

Scope 1 emissions are direct emissions which occur from sources owned or controlled by the proponent, over which they have a high level of control (such as fuel use).

Scope 2 emissions are those generated from purchased electricity consumed by the proponent, which can be easily measured and can be influenced through energy efficiency measures. Scope 2 emissions physically occur at the facility where electricity is generated (i.e. the power station).

Scope 3 emissions are indirect emissions that are a consequence of the activities of the proponent, but occur at sources owned or controlled by another reporting entity (e.g. outsourced services). Scope 3 emissions can include emissions generated upstream of the facility by providers of energy, materials and transport. Scope 3 emissions can also include emissions generated downstream of the facility by providers of product transport.

Scope 1 and 2 emissions were calculated based on the methodologies and emission factors provided by the National Greenhouse Accounts Factors 2014 (DCCEE 2014). Consistent with the National Inventory Report 2012 (DIICCSRTE 2014), ventilation fugitive emissions were forecast using an implied emissions factor, which was derived from site specific National Greenhouse and Energy Reporting data.

Scope 3 emissions associated with product transport were calculated based on emission factors contained in the National Greenhouse Gas Inventory: Analysis of Recent Trends and Greenhouse Gas Indicators (AGO 2007). Other Scope 3 emissions were calculated using methodologies and emission factors contained in the National Greenhouse Accounts Factors 2014 (DCCEE 2014).

6.9.2 Assessment Assumptions

To complete the greenhouse gas and energy calculations, the following assumptions were made:

- the LWB1-B3 Modification will recover up to an additional 4.5 million ROM tonnes of coal over five years
- diesel use intensity of the LWB1-B3 Modification will be similar to Stage 3 operations between July 2012 and June 2014. Adjustments were made to remove the diesel use impacts of the Kitchener Surface Infrastructure Site construction and from diesel Shaft 3 compressors that are no longer in use
- electricity use intensity of the LWB1-B3 Modification will be similar to Stage 3 operations between July 2012 and June 2014. Adjustments were made to remove the electricity use impacts of infrastructure no longer in use
- fugitive emissions intensity of the LWB1-B3 Modification will be similar to Stage 3 operations between July 2012 and June 2014
- product yield will average 93 per cent
- average methane percentage of ventilations exceed 0.1%, thus triggering the use of post mining fugitive emission factors
- appropriate transport assumptions based on current product transport routes.

6.9.3 Assessment Results

The greenhouse emissions associated with the LWB1-B3 Modification were calculated as follows:

- approximately 446,000 tonnes carbon dioxide equivalent (t CO_2-e) of Scope 1 emissions from combusting diesel and releasing fugitive emissions
- approximately 162,000 t CO_2-e of Scope 2 emissions from consuming electricity
- approximately 11,853,000 t CO_2-e of Scope 3 emissions generated by third parties who transport and consume coal products.

Scope 3 emissions dominate the greenhouse gas emissions attributable to the LWB1-B3 Modification. Approximately 95 per cent of the proposed modification's greenhouse gas emissions will occur either upstream or downstream of the Austar Coal Mine and outside the direct operational control of Yancoal. Approximately 5 per cent of the greenhouse gases associated with the LWB1-B3 Modification is related to on-site energy use and fugitive emissions (Scope 1 and 2 emissions).

Scope 1 emissions are expected to contribute 3.6 per cent of total emissions due to the relatively low diesel demands of an underground mine and the relatively low methane content of the coal reserves within the Austar Coal Mine. The coal reserves within the Austar Coal Mine are part of the Newcastle Coalfields, which generally exhibit lower fugitive emissions than the Southern, Hunter and Bowen Coalfields (National Inventory Report 2011). The average methane gas content of Austar Coal Mine's ventilation emissions during 2013/14 was approximately 0.11% (Yancoal 2014).

6.9.3.1 Energy Use

The LWB1-B3 Modification is forecast to require approximately 866,000 gigajoules (GJ) of energy from diesel and grid electricity.

The industry average energy use for underground coal mines in Australia ranges between 140 and 490 Megajoules (MJ)/Product tonne (Energetics 2009). The energy use intensity of the LWB1-B3 Modification is expected to average 207 MJ/Product tonne, which sits within the normal operating range for Australian underground coal mines.

6.9.4 Impact Assessment

The greenhouse gas emissions generated by the LWB1-B3 Modification have the potential to impact the environment and the greenhouse gas reduction objectives of national and international governing bodies.

The LWB1-B3 Modification is expected to directly increase greenhouse gas emissions by approximately 90,000 t CO_2-e per annum. To put the modification's emissions into perspective, over the life of the LWB1-B3 Modification, global greenhouse gas emissions are forecast to be in the order of 50,000,000,000 t CO_2-e per annum (IPCC 2014). During operation, the LWB1-B3 Modification will contribute approximately 0.00018 per cent to global emissions per annum (based on its projected Scope 1 emissions). The Scope 2 and 3 emissions associated with the LWB1-B3 Modification should not be considered in a global context, as global projections only represent Scope 1 emissions (i.e. the sum of all individual emission sources).

6.9.4.1 Impact on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) define climate change as a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and persists for an extended period, typically decades or longer (IPCC 2007).

Climate change is caused by changes in the energy balance of the climate system. The energy balance of the climate system is driven by atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation (IPCC 2007).

Climate change models forecast many different climate change impacts, which are influenced by future greenhouse gas emission scenarios. Climate change forecasts also vary significantly from region to region. Any increase in atmospheric greenhouse gas emissions attributable to the LWB1-B3 Modification can therefore generate many different climate change impacts, depending on future greenhouse gas scenarios and regional location.

The extent to which global emissions and atmospheric concentrations of greenhouse gases have a demonstrable impact on climate change will be largely driven by the global response to reducing total global emissions that includes all major emission sources and sinks.

6.9.4.2 Impact on National Policy Objectives

The Australian Government has committed to reduce Australia's greenhouse gas emissions by 5 per cent from 2000 levels by 2020 irrespective of what other countries do, and by up to 15 or 25 per cent depending on the scale of global action.

If Australia is able to meet the 5 per cent reduction target by 2020, the nation will be generating approximately 530,000,000 t CO_2-e per annum (DoE 2015). The LWB1-B3 Modification is expected to generate approximately 90,000 t CO_2-e Scope 1 emissions per annum, if emissions are not mitigated. The addition of 90,000 t CO_2-e per annum, in the national context, is unlikely to prevent the Federal Government achieving its national greenhouse gas objectives.

6.9.4.3 Impact on International Objectives

International policy makers are yet to reach a comprehensive global agreement on greenhouse gas reduction targets that includes commitments from all major emitters such as China, India and the United States of America.

The Seventeenth Conference of the Parties (COP17) climate change negotiations in Durban, however, provides some direction for international greenhouse gas objectives. Countries agreed in Durban to begin work on a new climate change agreement that will cover all countries. The intention is to develop an agreement, including emission reduction commitments, by 2015 to come into effect from 2020. Countries also agreed that there would be a second commitment period of the Kyoto Protocol that was established in January 2013 (DCCEE 2012a).

The United Nations Framework Convention on Climate Change conference held in Cancún 2010 achieved important progress towards a comprehensive post-2012 international agreement to address climate change (DIICCSRTE 2013). Under the Cancun Agreements, Australia has committed to reducing its 2020 national greenhouse gas inventory by 5 per cent (based on the 2000 inventory) (DCCEE 2012b).

Australia's international objectives align with its national objectives. The proposed modification is unlikely to prevent the Federal Government achieving its national/international 5 per cent greenhouse gas reduction target.

6.9.5 Greenhouse Gas and Energy Management and Monitoring

Austar's environmental policy states that the operation will endeavour to make business decisions that work towards achieving sustainable development, and strive to conserve resources, reduce waste and eliminate or minimise adverse environmental risk (Austar 2013a).

Austar will address the greenhouse gas and energy components of its environmental policy through the design of the LWB1-B3 Modification and the ongoing implementation of the approved Air Quality and Greenhouse Gas Management Plan.

Austar has incorporated measures into the proposed modification's design which aim to minimise potential greenhouse gas emissions and improve energy efficiency. Energy efficiency was a key driver for the design of the mine plan as energy usage is a direct driver of cost as well as greenhouse gas emissions. The proposed modification's design inherently minimises greenhouse gas emissions from the mining operations.

As part of preparation of the Air Quality and Greenhouse Gas Management Plan, various fugitive methane emission management controls for pre-drained coal mine waste gas and ventilation air methane were

considered. Technologies such as flaring, methane capture, on-site energy production and thermal flow reversal reactors were all evaluated in 2013, however, the naturally low methane concentrations available in coal mine waste gas and ventilation streams challenged the technical feasibility of all technologies (Austar 2013).

Managing energy use is the primary greenhouse gas management control option at the Austar Coal Mine (Austar 2013). Austar will continue to seek operational energy use efficiencies where commercially feasible.

6.10 Cumulative Impacts

The assessment of environmental impacts undertaken for the LWB1-B3 Modification is provided in **Sections 6.1** to **6.9** above. The LWB1-B3 Modification is located within an area surrounded by previous underground mine workings. The potential subsidence impacts of the LWB1-B3 Modification on natural and built features have been assessed and found to be less than those previously experienced in the Stage 2 and Stage 3 LTCC extracted areas. The cumulative impacts of the subsidence associated with the LWB1-B3 Modification have been assessed in the context of future approved mining within the Stage 3 area and found not to result in cumulative subsidence impacts. Houses and other built infrastructure, including rural buildings, are predicted to remain safe, serviceable and compatible with existing land uses.

The flooding assessment presented in **Section 6.3** has included consideration of Stage 2 and completed Stage 3 subsidence impacts and the cumulative impact of future approved Stage 3 subsidence in the flood modelling, ensuring consideration of the cumulative landform changes associated with mining in these areas. The cumulative impacts of the LWB1-B3 Modification with future approved mining have been found to be minimal.

The groundwater assessment summarised in **Section 6.4** considers the potential cumulative impacts of previous underground mining in the region when assessing the potential impact on groundwater and found the potential for adverse impact to also be minimal.

The ecological assessment presented in **Section 6.5** concludes that the LWB1-B3 Modification is unlikely to result in a significant impact on surface vegetation or habitats of threatened fauna species. Therefore the potential cumulative impact of the LWB1-B3 Modification on the ecological values of the area is not expected to be significant.

The assessment of impacts on Aboriginal cultural heritage presented in **Section 6.6** concludes the LWB1-B3 Modification is unlikely to impact on the one Aboriginal site identified within the modification area and is therefore unlikely to result in an increase in the cumulative impact on Aboriginal cultural heritage within the area.

The cumulative impact of the LWB1-B3 Modification with surrounding historical and approved mining activities has been considered in the context of land and agricultural capability (refer to **Section 6.8**). Given the minimal land surface and hydrological impacts predicted, it is unlikely to impact on the current or future land and soil capability of the modification area and is considered compatible with existing agricultural use of the land.

The greenhouse gas emissions generated by the proposed modification have been assessed cumulatively in the context of national and global emissions. Consideration of the impact of these emissions on climate change, national policy objectives and international objectives found the proposed modification is unlikely to prevent the Federal Government achieving its objectives.

Overall, the cumulative impact of the LWB1-B3 Modification is considered to be low.

7.0 Summary of Management and Monitoring

7.1 Subsidence

7.1.1 Austar will submit an Extraction Plan for LWB1-B3 for approval by the Secretary of the Department of Planning and Environment prior to the commencement of secondary extraction of LWB1-B3. The Extraction Plan will incorporate the following plans:

- LWB1-B3 Water Management Plan
- Land Management Plan
- Biodiversity Management Plan
- Built Features Management Plan
- Heritage Management Plan
- Subsidence Monitoring Program
- Public Safety Management Plan.

7.1.2 Where a potential subsidence impact is identified on private property, Austar will prepare a Built Features Management Plan in consultation with the property owner. This plan will clearly outline potential impacts of mining on the property and the management and remediation measures to be implemented.

7.1.3 Subsidence management measures to be implemented as part of the proposed modification will include:

- subsidence monitoring lines to be located as determined as part of the Extraction Plan process, where access is granted
- visual assessment of all natural features and items of surface infrastructure before, during and following mining to detect any subsidence impacts such as surface cracking, irregularities in the subsidence profile, erosion, damage to structures, changes in drainage patterns or loss of water from drainage structures, where access is granted
- detailed subsidence monitoring in accordance with DRE requirements
- remediation and rehabilitation of subsidence impacts will be carried out, where required, as soon as practicable following subsidence using methods specified in the Extraction Plan, where access is granted
- building structures located within the LWB1-B3 Modification Area will be inspected by a structural engineer prior to and after undermining and appropriate management measures implemented, where access is granted

- farm dams or water bores within the LWB1-B3 Modification Area will be monitored during and following undermining, where access is granted, to ensure they remain in a safe and serviceable condition, and in the case of bores – to assess bore yield. Remediation works will be undertaken as required by the Mine Subsidence Board in consultation with the landowner

- in the event of any significant loss of water from a privately-owned farm dam or bore, Austar will provide an alternate source of water, as required, until the dam or bore is repaired, where access is granted.

7.1.4 Austar will, prior to undermining of Sandy Creek Road and Barraba Lane, prepare and implement a Built Features Management Plan to manage any subsidence impacts on the roads and associated culverts and bridges in consultation with Cessnock City Council.

7.1.5 Austar will prepare management plans in consultation with relevant service providers (Ausgrid, Telstra), for the protection of infrastructure and services within the LWB1-B3 Modification Area to ensure these remain in a safe and serviceable condition throughout the mining period. These plans will be prepared as part of the Extraction Plan prior to undermining of the services.

7.2 Surface Water and Drainage

7.2.1 Austar will prepare a LWB1-B3 Water Management Plan for approval as part of the Extraction Plan process.

7.2.2 Any subsidence impacts on drainage lines will be effectively remediated, where access is granted, such that there is no significant impact on downstream water users and environmental flows. The LWB1-B3 Water Management Plan will be prepared as part of the Extraction Plan process, and in consultation with NOW, to guide the management of subsidence impacts and drainage line remediation works on surface water systems. The LWB1-B3 Water Management Plan will include:

- monitoring program

- a program to complete drainage remediation works in a timely manner, post-subsidence to limit the potential for surface water capture

- rehabilitation objectives for drainage line remediation works such that the rehabilitated drainage lines maintain a similar channel form and sinuosity to the pre-mining environment, to ensure that the overall erosive power of the creek system is consistent with that existing pre-mining.

7.2.3 Monitoring results from the LWB1-B3 Water Management Plan will be reported annually in the Annual Environmental Management Report.

7.3 Groundwater

7.3.1 A groundwater monitoring program will be implemented for the LWB1-B3 Modification as outlined in **Appendix 4**. The groundwater monitoring program will be reflected in the Austar Site Water Management Plan and will include:

- continued monitoring of water level and water quality in five shallow piezometers within the Stage 2 mining area in accordance with the existing Site Water Management Plan (Austar 2013b) and Environmental Monitoring Program (Austar 2013c)

- establishment of one additional shallow groundwater monitoring bore in the alluvial area of the unnamed tributary of Quorrobolong Creek, subject to landholder access, and monitoring of water level and electrical conductivity (EC)

- reconcile groundwater monitoring data against rainfall records to assess whether groundwater level changes are the result of longwall mining impacts

- review of the results of groundwater monitoring on a three-monthly basis and reporting of results at the completion of each longwall panel, consistent with the requirements of the existing Site Water Management Plan (Austar 2013b).

7.3.2 The results of groundwater monitoring and a comparison of measured and predicted impacts will be reported annually in the Annual Environmental Management Report.

7.3.3 Impacts on privately-owned stock bore GW054676 will be assessed by monitoring the bore yield prior to mining where access is granted and in the event that this bore yield is significantly affected by subsidence impact, an alternative water supply will be provided by Austar Coal Mine until such time as the bore is repaired -established or replaced.

7.4 Ecology

7.4.1 Austar will prepare a Biodiversity Management Plan for the LWB1-B3 Modification Area for approval as part of the Extraction Plan process.

7.4.2 Ecological monitoring will be undertaken of River-flat Eucalypt Forest EEC; Lower Hunter Spotted Gum – Ironbark Forest EEC and potential Quorrobolong Scribbly Gum Woodland EEC vegetation.

7.4.3 Ecological monitoring will be undertaken of the heath wrinklewort (Rutidosis heterogama) population, small-flower grevillea (Grevillea parviflora subsp. parviflora) population and the netted bottlebrush (*Callistemon linearifolius*) population, where EEC monitoring indicates further surveys of threatened flora species populations is required.

7.5 Heritage

7.5.1 Austar will continue to implement the management strategies that are currently in place at the Austar Coal Mine, including those in the ACHMP (Umwelt 2015). Where relevant, these measures will be extended to the LWB1-B3 Modification Area and site ACM35. Specifically:

- Site ACM35 will be added to the existing archaeological site monitoring program, undertaken in accordance with the ACHMP

- In the event that previously unidentified Aboriginal objects are located during any ground disturbing works within the LWB1-B3 Modification Area, the protocol for previously unidentified aboriginal objects/features outlined in the ACHMP will be followed

- In the unlikely event that subsidence remediation works are required which will impact on site ACM35, an Aboriginal Heritage Impact Permit (AHIP) will be sought to authorise these impacts prior to the commencement of any remediation works in proximity to the recorded site.

7.1 Land Resources and Agriculture

7.6.1 A Land Management Plan will be prepared for the LWB1-B3 Modification Area as part of the Extraction Plan process.

7.2 Greenhouse Gas and Energy

7.7.1 Austar will continue to seek operational energy use efficiencies, where commercially feasible, in accordance with the existing Austar Air Quality and Greenhouse Gas Management Plan.

7.3 Vibration

7.8.1 Vibration monitoring will be undertaken to monitor the potential vibration impacts of the LWB1–B3 Modification, subject to landholder access. Additionally, management measures to be implemented for the LWB1–B3 Modification will be consistent with those outlined in the existing Austar Noise and Vibration Management Plan.

7.4 Community

7.11.1 Austar will continue to operate the established Community Consultative Committee. Austar will provide the Community Consultative Committee with regular information regarding the environmental management performance of the LWB1-B3 Modification and any relevant matters regarding community relations.

7.9.1 Austar will notify relevant landholders prior to the commencement of any secondary extraction that could potentially impact their property, in accordance with agreed communication protocols set out in an individual Built Features Management Plan. Regular updates will also be provided as part of the Extraction Plan process.

7.9.3 Austar will maintain a 24 hour per day community information and complaint line.

7.9.4 Austar will provide regular updates of mine development and monitoring on the Austar Coal Mine website.

7.5 Environmental Management, Monitoring, Auditing and Reporting

7.10.1 Austar will incorporate the LWB1-B3 Modification into the Annual Environmental Management Report for Austar Coal Mine.

7.10.2 Austar will incorporate the LWB1-B3 Modification into the existing Independent Environmental Audit process required under the Bellbird South Consent.

8.0 Conclusion

This section provides a conclusion discussing the justification for the proposed modification, taking into consideration the environmental impacts of the proposal and the suitability of the site, to assist the consent authority to determine whether or not the proposed modification is in the public interest.

8.1 Environmental Impacts

The potential environmental impacts of the LWB1-B3 Modification have been identified through a preliminary environmental risk assessment process involving:

- assessment of the site characteristics
- review of existing expert technical assessments, management plans and historical monitoring data
- consultation with government agencies and the community
- expert technical advice.

The key issues identified were the subject of comprehensive technical assessment to identify and assess the potential impacts of the LWB1-B3 Modification on the existing environment and community. The results of these assessments are detailed in **Section 6**.

The detailed impact assessments undertaken for the LWB1-B3 Modification conclude that the proposed modification is likely to result in minimal environmental impacts. This is primarily due to the following key factors:

- the characteristics of the site
- the depth of cover to proposed mining areas (minimum of 480 metres)
- experience to date in progression of Stage 2 and Stage 3 mining
- predicted subsidence parameters and impacts likely to be less than those previously experienced in Stage 2 and Stage 3 LTCC extracted areas.

In addition, as Austar has a range of well established and effective measures to minimise and manage impacts associated with existing mining operations, it is anticipated that the proposed modification can proceed within acceptable environmental standards.

8.2 Suitability of the Site

The LWB1-B3 Modification Area is located in an area of existing mining leases with an extensive history of underground mining. Access to the LWB1-B3 Modification Area is provided by existing underground mine workings and coal extracted from LWB1-B3 can be transported and processed utilising existing infrastructure within the Austar Coal Mine.

The LWB1-B3 Modification Area is located largely beneath cleared private land used for agricultural and rural-residential purposes. The topography of the land is generally characterised by low undulating hills and creek flats, with no steep slopes or cliffs. Due to the depth of mining and minimal predicted subsidence impacts, the LWB1-B3 Modification will not limit the continued use of private land for agricultural or residential purposes. Existing management and monitoring programs will be extended to the LWB1-B3 Modification Area in order to identify and manage potential impacts on these land uses.

8.3 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is one of a number of objectives of the EP&A Act and is defined by Section 6(2) of the *Protection of the Environment Administration Act 1991*. ESD requires the integration of economic and environmental considerations in decision making processes. ESD can be achieved through the implementation of the following principles and programs:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity and ecological integrity
- improved valuation, pricing and incentive mechanisms.

These principles which are discussed further in **Sections 8.3.1** to **8.3.4**, have been incorporated into planning and assessment of the LWB1-B3 Modification through:

8.3.1 The Precautionary Principle

Environmental assessment involves the prediction of potential environmental outcomes of a development. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

A preliminary environmental risk analysis was undertaken for the LWB1-B3 Modification to identify key areas for further impact assessment. The results of the risk assessment are summarised in **Section 6.1**. The review of appropriate mitigation measures and strategies was also undertaken as a part of the detailed impact assessment process. The Precautionary Principle has therefore been applied to the assessment of the LWB1-B3 Modification by seeking to minimise the potential for serious irreversible environmental damage through:

- careful design and review of the proposed modification
- identification of the potential impacts and the likelihood and consequences of these impacts
- identification of management and mitigation measures that are designed to address the potential environmental impacts of the proposed modification
- implementation of monitoring and reporting mechanisms for the modification.

Mitigation and monitoring measures will be set out in the proposed LWB1-B3 Extraction Plan and associated management plans. Where residual risks are identified, contingency controls have been considered and will be further refined during preparation of the Extraction Plan and Built Features Management Plans for the LWB1-B3 Modification Area.

8.3.2 Intergenerational Equity

Intergenerational equity is based on the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The principles of intergenerational equity are addressed by the LWB1-B3 Modification through:

- the efficient recovery of resources by maximising resource utilisation and use of existing infrastructure, thus minimising environmental impacts
- the development and implementation of management and mitigation measures that are designed to address the potential environmental impacts of the proposed modification.

8.3.3 Conservation of Biological Diversity

A detailed assessment of the ecological and biodiversity impacts of the LWB1-B3 Modification has been undertaken and concluded that the proposed modification will result in minimal adverse impact to the land surface or ecological values of the area.

Austar will continue to implement the management measures currently in place within the Austar Coal Mine, and those proposed as part of a LWB1-B3 Biodiversity Management Plan, to minimise potential impacts on the ecological values of the modification area. Environmental monitoring will be undertaken to determine whether the environmental control measures are operating effectively and enable timely detection of issues and implementation of appropriate management measures if and where required.

8.3.4 Valuation and Pricing of Resources

The efficient and non-wasteful management of resources to maximise the welfare of society, both now and for future generations is central to ESD. The modification maximises the efficient use and management of resources through maximising resource utilisation and the recovery of coal that is not otherwise planned for extraction. In addition the modification maximises the use of existing infrastructure and facilities.

8.4 Conclusion

Austar proposes to modify the Bellbird South Consent to allow the transfer and processing of coal from three additional longwalls within the Austar Coal Mine. The key components of the LWB1-B3 Modification include an extension to the development consent area to cover the three longwall panels, an extension to the life of the consent to allow for mining of the three longwall panels and application of a contemporary Extraction Plan condition to cover the new workings. This EA has been prepared to support the LWB1-B3 Modification application under section 75W of the EP&A Act.

The LWB1-B3 Modification is proposed in order to provide business continuity for the Austar Coal Mine in the medium term. The modification will facilitate the recovery of an additional 4.5 million tonnes of ROM coal and maximises the use of existing infrastructure and facilities. The LWB1-B3 Modification is located within an area surrounded by historical mine workings with very few site constraints.

The detailed impact assessments undertaken for the LWB1-B3 Modification conclude that the proposed modification is likely to result in minimal environmental impacts. This is primarily due to the significant depth of cover above the coal seam, the site characteristics and continued implementation of existing management and mitigation measures.

The LWB1-B3 Modification is not anticipated to have a significant adverse impact on the land surface, natural or built features or on existing land uses within the modification area.

This EA demonstrates that with the continued implementation of existing management and mitigation measures, the proposed modification can proceed within acceptable environmental standards.

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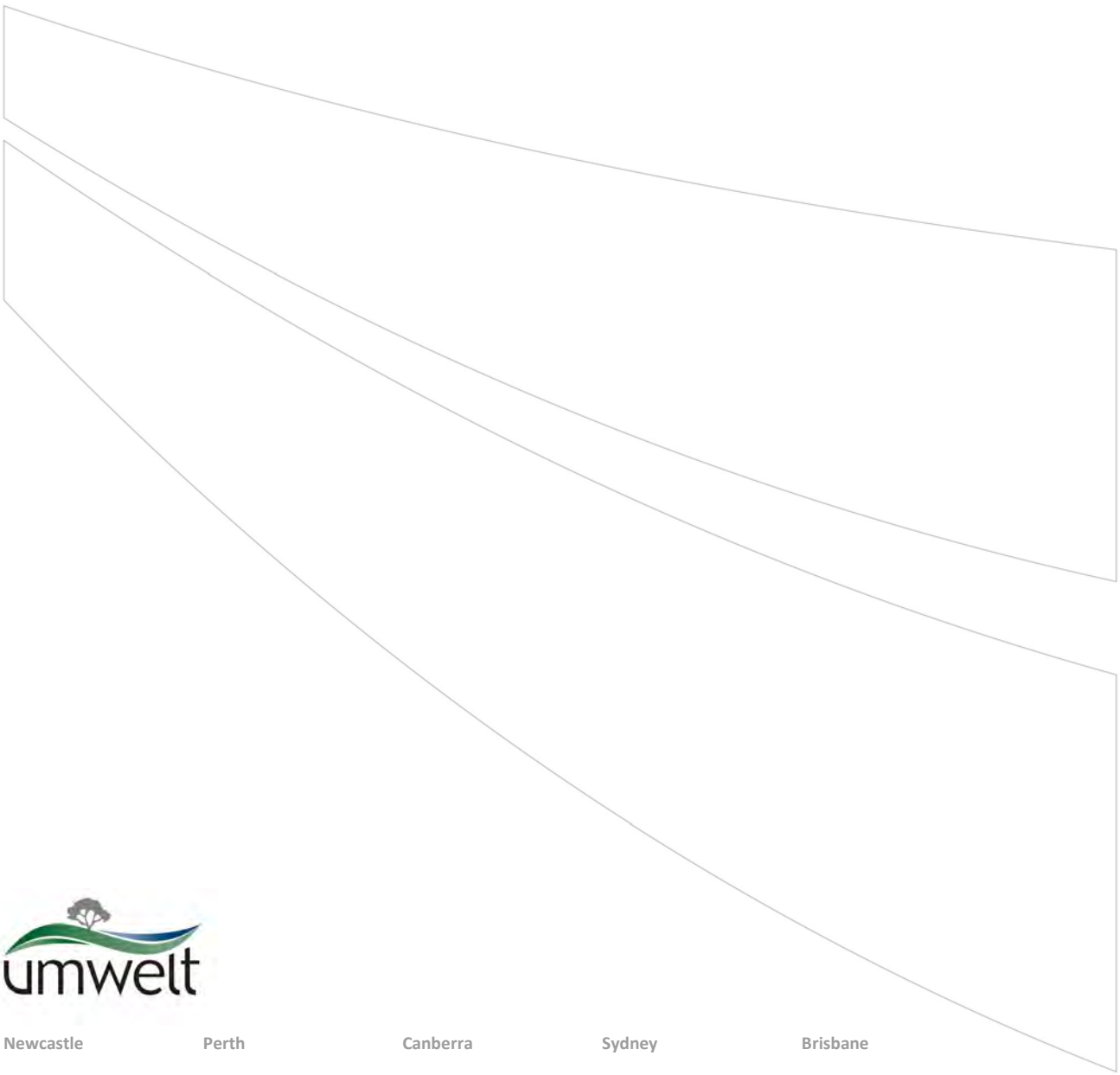
10.0 Abbreviations

AEMR	Annual Environmental Monitoring Report
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
CCC	Cessnock City Council
CCL	Consolidated Coal Lease
CHPP	Coal Handling and Preparation Plant
DA	Development Application
DRE	NSW Department of Industry, Division of Resources and Energy
DSEWPAC	Commonwealth Department
EA	Environmental Assessment
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
GHGEA	Greenhouse Gas and Energy Assessment
IPCC	Intergovernmental Panel on Climate Change
LEP	Local Environmental Plan
LGA	Local Government Area
LTCC	Longwall Top Coal Caving
LW	Longwall
MJ	Mega joule
ML	Mining Lease
MOP	Mining Operations Plan

MSB	Mine Subsidence Board
MSEC	Mine Subsidence Engineering Consultants
Mtpa	Million tonnes per annum
NT Act	Commonwealth Native Title Act 1993
OEH	NSW Office of Environment and Heritage
PA	Project Approval
PoEO Act	NSW Protection of the Environment Operations Act 1997
RMS	Roads and Maritime Services
ROM	Run of Mine
SEPP	State Environmental Planning Policy
SMP	Subsidence Management Plan
SRLUP	Strategic Regional Land Use Plan
WM Act	NSW Water Management Act 2000
WSP	Water Sharing Plan



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