

WAMBO COAL PTY LTD



SOUTH BATES (WAMBO SEAM) UNDERGROUND MINE MODIFICATION

ENVIRONMENTAL ASSESSMENT

For the Modification of DA 305-7-2003 (MOD 15)
The Addition of South Bates (Wambo Seam) Underground Mine
Longwalls 14 to 16

July 2015

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EXECUTIVE SUMMARY

ES1.1 BACKGROUND

The Wambo Coal Mine (Wambo) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales. Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at Wambo since mining operations commenced in 1969. Mining under the Development Consent (DA 305-7-2003) commenced in 2004 and currently both open cut and underground operations are conducted. The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum (Mtpa) and product coal is transported from Wambo by rail.

An aerial photograph of Wambo, illustrating the approved extent of the open cut and underground mine operations and key infrastructure is provided on Figure ES-1. A summary of the approved Wambo Coal Mine is provided in Table ES-1.

ES1.2 DESCRIPTION OF THE MODIFICATION

Following a review of mine planning and recent exploration results, WCPL has identified coal reserves in the Wambo Seam underneath the approved South Bates (Whybrow Seam) Underground Mine that can be economically mined with underground mining methods.

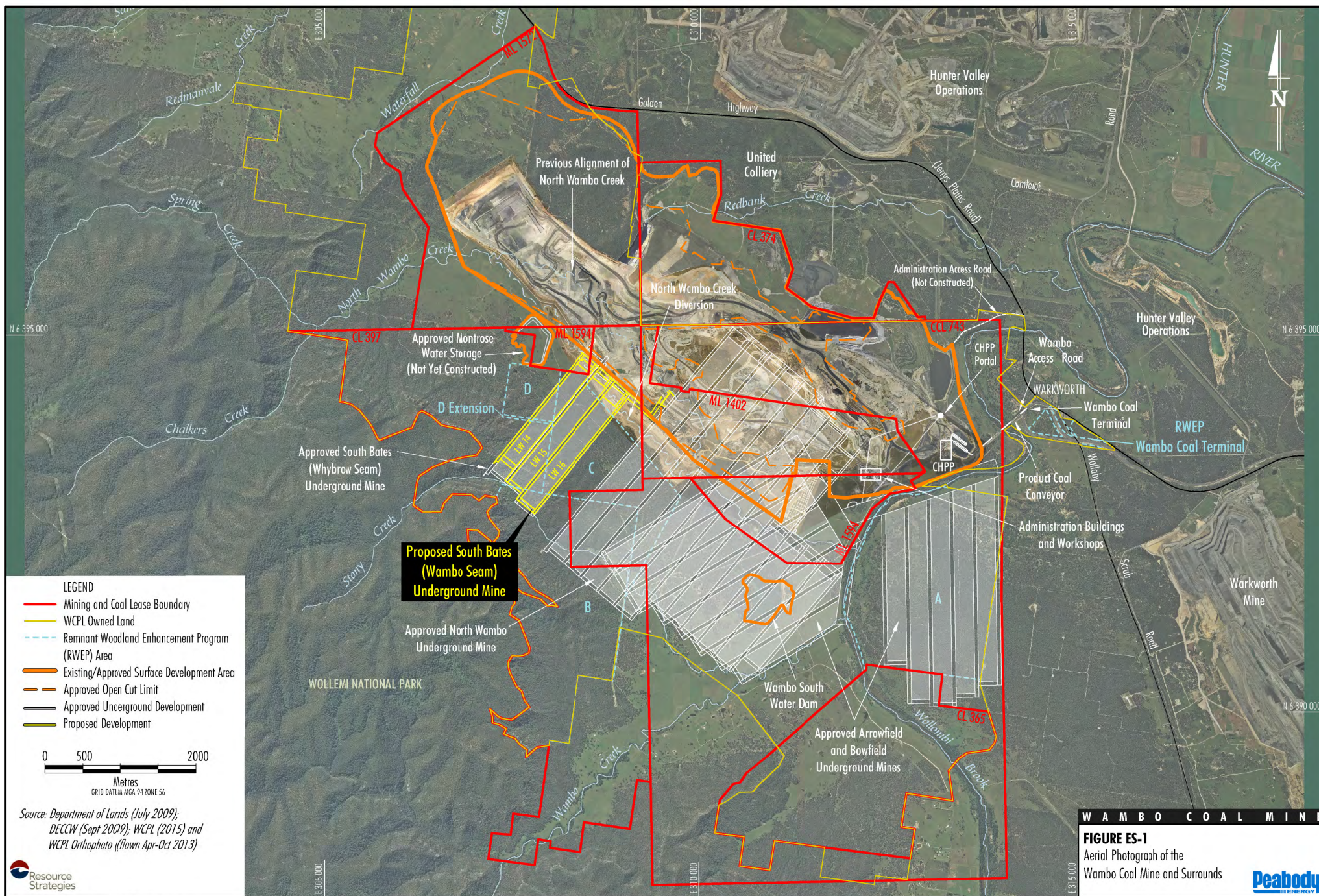
This Environmental Assessment has been prepared to support an application to modify the Wambo Development Consent (DA 305-7-2003) to access coal reserves underneath the approved South Bates (Whybrow Seam) Underground Mine, referred to as the South Bates (Wambo Seam) Underground Mine Modification (the Modification).

Table ES-1
Summary of the Approved Wambo Coal Mine

Component	Approved Wambo ¹
Life of Mine	21 years (from the date of the commencement of Development Consent [DA 305-7-2003]).
Open Cut Mining	- Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams. - An estimated total open cut ROM coal reserve of 98 million tonnes (Mt). - Open cut mining operations until 2017.
Underground Mining	- Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. <i>Underground ROM coal reserves are estimated at 109.3 Mt.</i>
Subsidence Commitments and Management	The subsidence impact performance measures listed in Conditions 22 and 22A, Schedule 4 of the Development Consent (DA 305-7-2003).
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal.
Total ROM Coal Mined	<i>207.3 Mt.</i>
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations.
Total Waste Rock	640 million bank cubic metres.
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour.
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export.
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices.
Total CHPP Rejects	<i>Approximately 28.2 Mt of coarse rejects and approximately 18.6 Mt of tailings.</i>
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River.
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation 444, Exploration Licence 7211.

¹ Development Consent DA 305-7-2003 (as modified).

Note: Italicised components would be modified by the Modification.



The Modification would include the addition of three longwall panels (proposed Longwalls 14 to 16) in the Wambo Seam below the three approved longwall panels in the Whybrow Seam (Longwalls 11 to 13) at the approved South Bates (Whybrow Seam) Underground Mine.

The Modification would utilise approved South Bates (Whybrow Seam) Underground Mine and Wambo surface infrastructure.

The Modification would produce approximately 5.6 Mt of additional ROM coal and would be mined within the approved Wambo mine life.

The Modification would result in a marginal increase in total rejects from the CHPP (an additional 1.1 Mt coarse reject and 0.8 Mt tailings). No alteration of current coarse rejects or tailings management measures would be required.

The following approved components of Wambo would be unchanged by the Modification:

- overall life of the mine;
- ROM coal production rate;
- open cut operations;
- coal handling, CHPP and product coal transport operations; and
- major surface infrastructure.

ES1.3 ENVIRONMENTAL REVIEW

The key potential impacts of the Modification are related to the extraction of the proposed Longwalls 14 to 16 and the associated subsidence impacts and consequences.

The modified mine layout has been designed to be consistent with the subsidence impact performance measures in the existing Development Consent (DA 305-7-2003) (Table ES-2).

In order to assess the potential environmental impacts of the Modification, environmental reviews were completed for issues relating to potential subsidence impacts and environmental consequence. Table ES-3 summarises the key environmental assessment conclusions regarding the Modification.

WCPL would continue to implement existing environmental management and monitoring measures to minimise the potential impacts of Wambo incorporating the Modification on existing environmental values.

Additional mitigation measures, management and monitoring proposed for the Modification are summarised in Table ES-3.

An Extraction Plan would be prepared for the South Bates (Wambo Seam) Underground Mine prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA 305-7-2003).

ES1.4 JUSTIFICATION OF THE MODIFICATION

The Modification would allow the recovery of approximately 5.6 Mt of additional ROM coal in an area that is already approved for subsidence.

The existing underground mine workforce would continue to be employed for the Modification. The Modification would generate approximately 14 months of additional employment for the South Bates Underground Mine workforce.

This coal would be mined within the approved Wambo mine life, would require minimal surface disturbance and would use the approved surface infrastructure of Wambo and the South Bates (Whybrow Seam) Underground Mine. Therefore, the Modification is a natural extension to the existing approved underground operations at Wambo.

The Modification is consistent with the subsidence impact performance measures in the existing Development Consent (DA 305-7-2003). In addition, this Environmental Assessment has demonstrated that the Modification can be conducted with minimal additional environmental impacts beyond those already approved for Wambo.

Table ES-2
Subsidence Impact Performance Measures

Feature	Subsidence Impact Performance Measure	Potential Environmental Consequences from the Modification
Wollombi Brook	Negligible impact. Controlled release of excess site water only in accordance with Environment Protection Licence requirements.	Wollombi Brook is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
Wollemi National Park	Negligible subsidence impacts. Negligible environmental consequences.	It is unlikely that the Wollemi National Park or the associated Wollemi National Park Escarpment would be adversely impacted by the Modification. This performance measure can continue to be achieved.
Warkworth Sands Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.	The Warkworth Sands Woodland community is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.	The White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodland community is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
Other threatened species, populations or communities	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.	The Modification is expected to have no significant impact on threatened species, populations or ecological communities. Ponding as a result of subsidence is expected to be restricted to the North Wambo Creek Diversion where no natural vegetation community has developed. This performance measure can continue to be achieved.
Wambo Homestead Complex	Negligible impact on heritage values, unless approval has been granted by the Heritage Branch and/or the Minister.	The Wambo Homestead Complex is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
All built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	Infrastructure and improvements can be managed in a safe and serviceable condition, through the preparation and implementation of the appropriate management strategies as part of the Extraction Plan process. This performance measure can continue to be achieved.
Public safety	No additional risk.	There would be no additional risk to public safety, through the implementation of appropriate management strategies as part of the Extraction Plan process. This performance measure can continue to be achieved.

Source: Conditions 22 and 22A, Schedule 4, Wambo Development Consent DA 305-7-2003.

Table ES-3
Key Outcomes of the Environmental Review

Environmental Aspect	Summary of Environmental Assessment Conclusions	Additional Mitigation Measures, Management and Monitoring Proposed for the Modification ¹
Infrastructure and Improvements	- WCPL owns the infrastructure and improvements potentially affected by subsidence from the proposed Longwalls 14 to 16. - Infrastructure and improvements can be managed in a safe and serviceable condition, through the preparation and implementation of the appropriate management strategies as part of the Extraction Plan process.	A Built Features Management Plan would be prepared during preparation of the Extraction Plan for the South Bates (Wambo Seam) Underground Mine.
Land Resources	- The majority of land within the Modification area is set aside as part of the Remnant Woodland Enhancement Programme. As such, there are no agricultural activities over the majority of the Modification area. - WCPL would implement mitigation measures and management to minimise potential risks to land uses	A Land Management Plan would be prepared during preparation of the Extraction Plan for the South Bates (Wambo Seam) Underground Mine.
Groundwater	- The Modification would cause no discernible additional drawdown in any alluvial aquifer and would have no discernible impact on stream baseflow or natural river leakage for Wollombi Brook, North Wambo Creek, Wambo Creek or Stony Creek, beyond the effects of the approved mining layout. - The Modification would have no significant impact on the quality of groundwater or surface water around Wambo. - The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally. - The Modification is consistent with the <i>Aquifer Interference Policy</i> and adequate licences are available to account for the potential take of water associated with the approved Wambo operations and the Modification.	- An approved Surface and Groundwater Response Plan would continue to be implemented in the event a complaint is received in relation to loss of groundwater supply. - Groundwater levels and quality would continue to be monitored in accordance with an approved Groundwater Monitoring Program.
Surface Water	- WCPL has designed the proposed Longwalls 14 to 16 to avoid extraction directly beneath the low flow channel of the North Wambo Creek Diversion. - There is predicted to be only minor increases in gradient and potential areas of ponding along the North Wambo Creek Diversion as a result of the proposed Longwalls 14 to 16 compared to the approved Longwalls 11 to 13. - Surface cracking will occur along the alignment of the North Wambo Creek Diversion as a result of the approved Longwalls 11 to 13. Further surface cracking is expected to develop where the proposed Longwalls 15 and 16 mine up to the North Wambo Creek Diversion. - No significant impact on the sediment load in the North Wambo Creek Diversion is expected as a result of the Modification. - The Modification would result in minor additional stress along Stony Creek and other minor natural drainage lines, and the Modification is unlikely to warrant additional remediation work.	- WCPL would implement an adaptive management approach to manage potential subsidence impacts on the North Wambo Creek Diversion, involving monitoring the development of subsidence and implementation of remediation measures where required. - Observed impacts from the approved Longwalls 11 to 13 would be considered in the development of monitoring, mitigation and management measures for the Extraction Plan for the proposed Longwalls 14 to 16. - Trigger Action Response Plans (TARPs) would be developed as part of the Extraction Plan process to outline appropriate triggers and remedial actions.

Table ES-3
Key Outcomes of the Environmental Review

Environmental Aspect	Summary of Environmental Assessment Conclusions	Additional Mitigation Measures, Management and Monitoring Proposed for the Modification ¹
Aboriginal Cultural Heritage	- Incremental subsidence from the Modification would not change the likelihood of impact on any Aboriginal cultural heritage sites. - The Modification would not substantially increase cumulative impacts to Aboriginal heritage in the region.	- WCPL intends to leave artefact scatters and isolated finds <i>in situ</i>, subject to monitoring. - Prior to the commencement of longwall mining associated with the Modification, all grinding groove sites would be archivally recorded. - For two grinding groove sites, WCPL would consider engineering solutions to prevent cracking or to minimise movement of the grinding groove as part of the development of the Extraction Plan, in consultation with the Aboriginal community and in consideration of the potential impacts of any mitigation works on the values of the site compared to the unmitigated potential impacts. - WCPL would apply for a variation to the existing Consent No. 2222 to cover the portion of the Modification area not contained within the existing Consent.
Flora and Fauna	- It is unlikely that vegetation or fauna habitat would be adversely affected by mine subsidence. - The Modification would have no significant impact on threatened species, populations, ecological communities or critical habitat.	WCPL considers that no specific or additional mitigation measures, management or monitoring of flora or fauna are required for the Modification.

¹ In addition to measures currently required under the Development Consent (DA 305-7-2003), mining leases, Environment Protection Licence or WCPL management plans and monitoring programmes.

1 INTRODUCTION

This document is an Environmental Assessment (EA) for a proposed modification to the Wambo Coal Mine (Wambo), an open cut and underground coal mining operation which operates in accordance with Development Consent DA 305-7-2003 (Attachment 1). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

This Modification is sought under section 75W of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.1 WAMBO COAL MINE

Wambo is situated approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (Figure 1). Wambo adjoins grazing land to the south, other coal mining operations to the east and north, grazing land to the north-west and Wollemi National Park to the west and south-west (Figures 1 and 2).

A range of open cut and underground mine operations have been conducted at Wambo since mining operations commenced in 1969. Mining under the Development Consent (DA 305-7-2003) commenced in 2004 and currently both open cut and underground operations are conducted. The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum (Mtpa) and product coal is transported from Wambo by rail.

An aerial photograph of Wambo, illustrating the approved extent of the open cut and underground mine operations and locations of key infrastructure is provided on Figure 2.

1.2 SOUTH BATES (WAMBO SEAM) UNDERGROUND MINE MODIFICATION

Following a review of mine planning and recent exploration results, WCPL has identified coal reserves in the Wambo Seam underneath the approved South Bates (Whybrow Seam) Underground Mine that can be economically mined with underground mining methods. This proposed extension to Wambo is referred to as the South Bates (Wambo Seam) Underground Mine Modification (the Modification).

The Modification would include the addition of three longwall panels (Longwalls 14 to 16) in the Wambo Seam below the three approved longwall panels in the Whybrow Seam (Longwalls 11 to 13) at the approved South Bates (Whybrow Seam) Underground Mine (Figure 2). The Modification would utilise existing surface infrastructure of the approved South Bates (Whybrow Seam) Underground Mine.

There would be no change to the approved ROM coal production rate of 14.7 Mtpa as a result of the Modification.

Table 1 provides a comparative summary of the approved and proposed modified Wambo.

1.3 CONSULTATION FOR THE MODIFICATION

Consultation has been conducted with the local community, Aboriginal stakeholders, United Collieries, key state government agencies and Singleton Shire Council (SSC) during the preparation of this EA. A summary of this consultation is provided below.

It is anticipated that consultation between the local community, United Collieries and regulatory agencies will continue during the assessment of the Modification by the NSW Government.

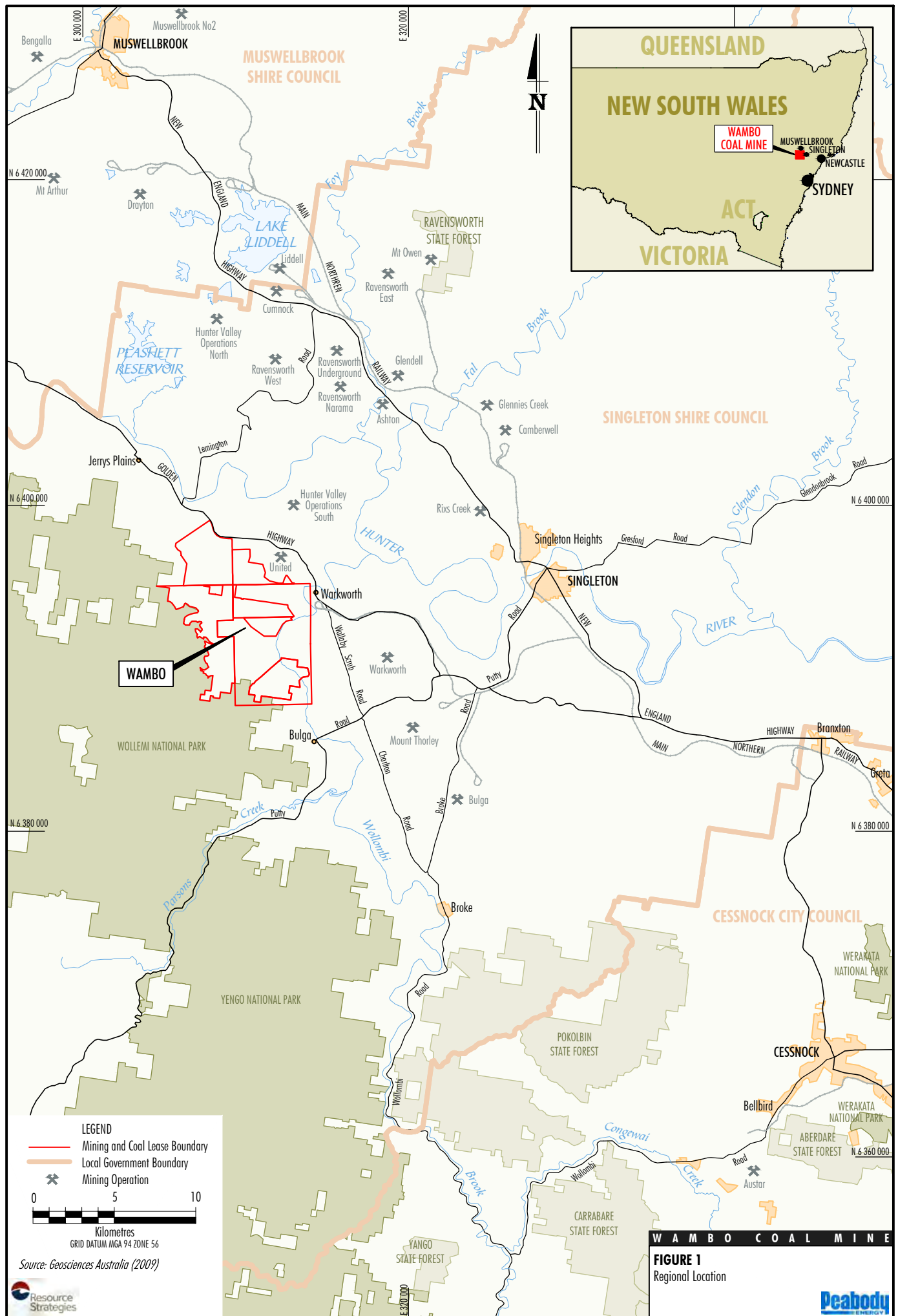
Local Community

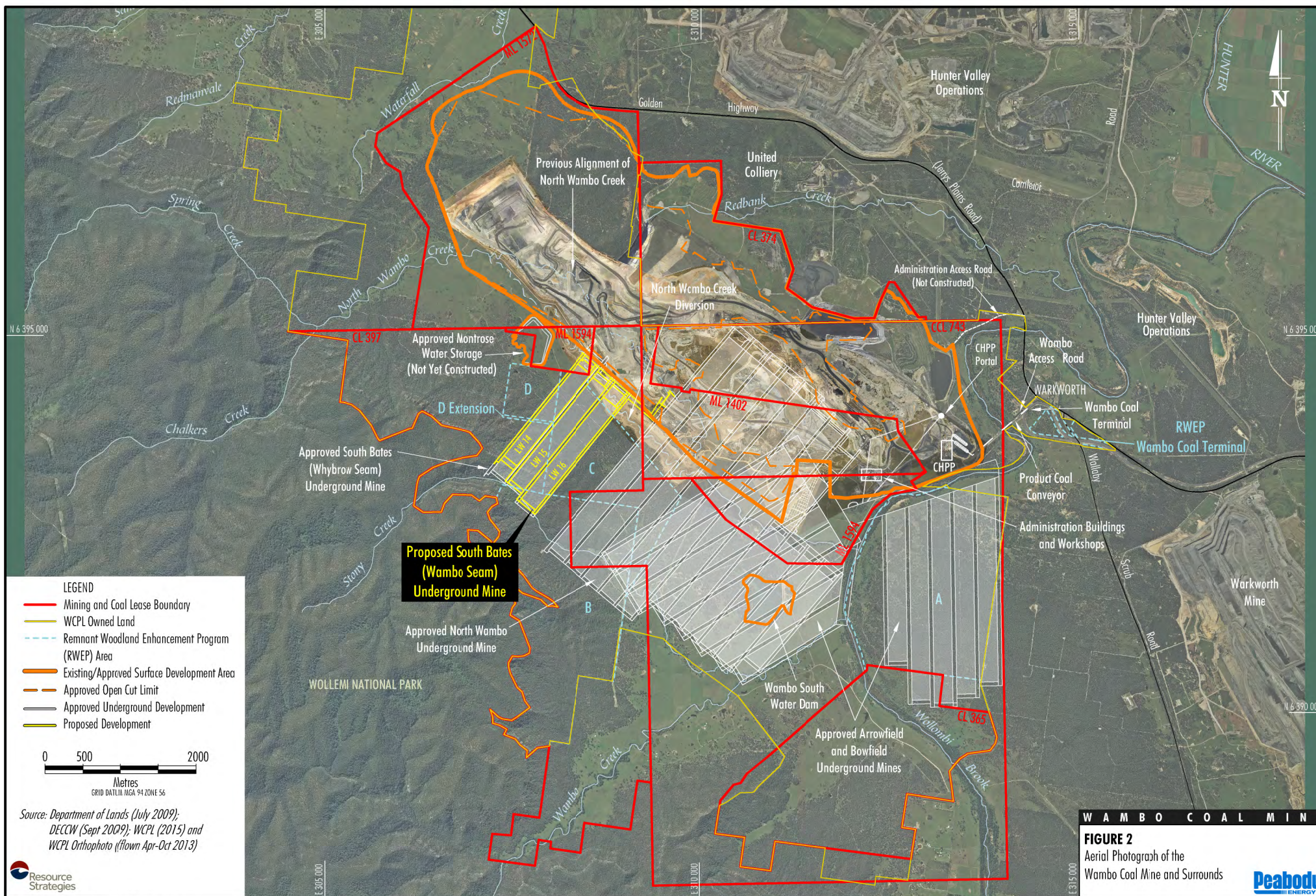
A Community Consultative Committee (CCC) for Wambo is in place and provides a mechanism for ongoing communication between WCPL and the local community. WCPL provided an overview of the proposed Modification at the CCC meeting on 7 July 2015.

Aboriginal Stakeholders

Aboriginal stakeholders were consulted throughout the preparation of the Cultural Heritage Impact Assessment (CHIA) for the Modification. Consultation is being conducted in accordance with the NSW Office of Environment and Heritage (OEH) policy *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (NSW Department of Environment, Climate Change and Water [DECCW], 2010a) and Condition 56A, Schedule 4 of the Development Consent DA 305-7-2003.

Further detail on consultation with Aboriginal stakeholders for the Modification is provided in Appendix D.





WAMBO COAL MINE

FIGURE 2
Aerial Photograph of the
Wambo Coal Mine and Surrounds



Table 1
Comparative Summary of the Approved and Modified Wambo Coal Mine

Component	Approved Wambo ¹	Modified Wambo
Life of Mine	21 years (from the date of the commencement of Development Consent [DA 305-7-2003]).	Unchanged.
Open Cut Mining	- Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams. - An estimated total open cut ROM coal reserve of 98 million tonnes (Mt). - Open cut mining operations until 2017.	Unchanged.
Underground Mining	- Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. - Underground ROM coal reserves are estimated at 109.3 Mt.	- Unchanged. - Approximately 5.6 Mt of additional ROM coal from the South Bates (Wambo Seam) Underground Mine.
Subsidence Commitments and Management	The subsidence impact performance measures listed in Conditions 22 and 22A, Schedule 4 of the Development Consent (DA 305-7-2003).	Unchanged.
ROM Coal Production Rate	Up to 14.7 Mtpa of ROM coal.	Unchanged.
Total ROM Coal Mined	207.3 Mt.	212.9 Mt.
Waste Rock Management	Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations.	Unchanged.
Total Waste Rock	640 million bank cubic metres (Mbcm).	Unchanged.
Coal Washing	Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph).	Unchanged.
Product Coal	Production of up to 11.3 Mtpa of thermal coal predominantly for export.	Unchanged.
CHPP Reject Management	Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices.	Unchanged.
Total CHPP Rejects	Approximately 28.2 Mt of coarse rejects and approximately 18.6 Mt of tailings.	Approximately 1.1 Mt of additional coarse rejects and 0.8 Mt of tailings.
Water Supply	Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River.	Unchanged.
Mining Tenements	Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.	Unchanged.

¹ Development Consent DA 305-7-2003 (as modified).

United Collieries

WCPL and United Collieries have formed a joint venture over the tenements adjoining this proposed Modification. Consultation with United Collieries regarding the Modification was conducted during June 2015. During this consultation the interactions between the Modification and existing and future infrastructure were discussed.

State Government Agencies

WCPL continues to consult with relevant State Government agencies on a regular basis in relation to the current mining operations at Wambo.

Department of Planning and Environment

WCPL attended a briefing with the NSW Department of Planning and Environment (DP&E) on 10 June 2015 to provide an overview of the proposed Modification. Key assessment requirements and the proposed timing for EA lodgement were discussed.

NSW Office of Water

WCPL provided a briefing letter to the NSW Office of Water (NOW) in July 2015 providing information on the Modification and the results of the Groundwater Assessment (Appendix B).

NSW Office of Environment and Heritage

WCPL provided a briefing letter to the OEHL in May 2015 notifying the OEHL of the registered Aboriginal parties (RAPs) for the Modification. WCPL also consulted with the OEHL during the preparation of the CHIA (Appendix D).

WCPL sent a letter to the OEHL in June 2015 to provide a briefing on the Modification and offering a meeting to provide further detail.

Singleton Shire Council

Wambo is located within the Singleton local government area (LGA).

The SSC has been updated on the Modification through its involvement in the CCC (see above). WCPL also sent a letter to the General Manager of the SSC in July 2015 to provide a briefing on the Modification and offering a meeting to provide further detail.

1.4 STRUCTURE OF THIS DOCUMENT

This EA comprises a main text component and supporting studies. An overview of the main text sections is presented below:

Section 1	Provides an overview of Wambo, the Modification and the consultation undertaken in relation to the Modification.
Section 2	Provides a description of existing and approved operations at Wambo.
Section 3	Provides a description of the Modification.
Section 4	Provides an environmental assessment of the Modification and describes the existing WCPL environmental management systems and measures available to manage and monitor any potential impacts.
Section 5	Describes the general statutory context of the Modification and identifies any Development Consent conditions or site management documents that would require revision in support of the Modification.
Section 6	References.

Attachments 1 and 2 and Appendices A to F provide supporting information as follows:

Attachment 1	Wambo Coal Mine Consolidated Development Consent.
Attachment 2	Relevant Environmental Planning Instruments and Government Policies.
Appendix A	Subsidence Assessment.
Appendix B	Groundwater Assessment.
Appendix C	Surface Water Assessment.
Appendix D	Cultural Heritage Impact Assessment.
Appendix E	Flora Assessment.
Appendix F	Fauna Assessment.

2 WAMBO COAL MINE – EXISTING OPERATIONS

2.1 APPROVALS HISTORY

The Wambo Development Project was approved under Part 4 of the NSW EP&A Act in February 2004. Twelve modifications to the Development Consent (DA 305-7-2003) have since been granted under the EP&A Act:

- 2004 under Section 96(1) – to facilitate the commencement of operations under Development Consent DA 305-7-2003 (MOD 1);
- May 2005 under Section 96(2) – to facilitate alterations to the North Wambo Underground Mine (MOD 2);
- January 2006 under Section 96(1A) – to facilitate the construction of an open cut workshop extension and surface infrastructure for the North Wambo Underground Mine (MOD 3);
- April 2006 under Section 96(1A) – to facilitate the extraction of remnant coal from the existing Wollemi Underground Mine (MOD 4);
- October 2006 under Section 96(1A) – to facilitate the construction and operation of a temporary North Wambo Creek bypass around the open cut operations (MOD 5);
- January 2007 under Section 96(2) – to facilitate the staged construction of the North Wambo Creek Diversion, a temporary North Wambo Creek pipeline and construction of gas drainage and dewatering infrastructure for the North Wambo Underground Mine (MOD 6);
- June 2009 under Section 96(1A) – to facilitate the construction and operation of the Chitter Dump Dam (MOD 7);
- August 2009 under Section 96(2) – to facilitate the construction and operation of the South Wambo Dam (MOD 8);
- February 2011 under Section 75W – to modify Development Consent DA 305-7-2003 to require WCPL to prepare an Extraction Plan for all underground operations at Wambo, rather than a Subsidence Management Plan (MOD 9);
- January 2013 under Section 75W – to modify Development Consent DA 305-7-2003 to facilitate the construction and operation of the Montrose Water Storage and associated supporting infrastructure (MOD 11);

- July 2013 under Section 75W – to modify Development Consent DA 305-7-2003 to facilitate the development of two additional longwall panels contiguous with the existing North Wambo Underground Mine and recovery of an additional 3.7 Mtpa of ROM coal (MOD 13); and
- September 2014 under Section 75W – to modify Development Consent DA 305-7-2003 to facilitate the development an additional longwall panel contiguous with the existing North Wambo Underground Mine and recovery of an additional 1.9 Mtpa of ROM coal (MOD 14).

The consolidated Development Consent (DA 305-7-2003), incorporating these modifications, is provided in Attachment 1.

In addition, a modification application and request for Environmental Assessment Requirements were lodged in September 2012 for the realignment and extension/relocation of the Arrowfield and Bowfield Seam Underground Mines (the South Wambo Underground Mine Modification [MOD 12]). The South Wambo Underground Mine Modification will be subject to separate environmental assessment and approval.

2.2 OPEN CUT MINING

Open cut mining operations at Wambo involve the extraction of coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams (Figure 3). The open cut is bounded by the United Colliery and the Golden Highway to the north, Wollombi Brook to the east (Figure 2) and by uneconomic strip ratios to the south and west.

The open cut mining fleet includes excavators, dozers, front end loaders, haul trucks, water trucks, service trucks, graders and drills.

During the 2014 reporting period, approximately 5.4 Mt of ROM coal was mined at the Wambo open cut operations (WCPL, 2015a).

2.3 UNDERGROUND MINING

The following underground mines at Wambo are approved (Figures 2 and 3):

- North Wambo Underground Mine (Wambo Seam);
- South Bates (Whybrow Seam) Underground Mine (also known as Whybrow Underground Mine) (Whybrow Seam);

SUPERGROUP	GROUP	SUBGROUP	FORMATION	SEAM	
SINGLETON SUPERGROUP	NARRABEEN GROUP	WIDDEN BROOK CONGLOMERATE			
	NEWCASTLE COAL MEASURES ¹	GLEN GALLIC SUBGROUP	Greigs Creek Coal		
			Redmanvale Creek Formation		
			Dights Creek Coal		
		DOYLES CREEK SUBGROUP	Waterfall Gully Formation		
			Pinegrove Formation		
		HORSESHOE CREEK SUBGROUP	Lucernia Coal		
			Strathmore Formation		
			Alcheringa Coal		
			Clifford Formation		
		APPLETREE FLAT SUBGROUP	Charlton Formation		
			Abbey Green Coal		
	WITTINGHAM COAL MEASURES	WATTS SANDSTONE			
		DENMAN FORMATION			
		JERRYS PLAINS SUBGROUP	Mount Leonard Formation	Whybrow Seam ²	
			Althorpe Formation		
			Malabar Formation	Redbank Creek Seam ²	
				Wambo Seam ²	
				Whynot Seam ²	
				Blakefield Seam	
			Mount Ogilvie Formation	Glen Munro Seam	
				Woodlands Hill Seam	
			Milbrodale Formation		
			Mount Thorley Formation	Arrowfield Seam ²	
				Bowfield Seam ²	
				Warkworth Seam ³	
			Fairford Formation		
			Burnamwood Formation	Mount Arthur Seam	
				Piercefild Seam	
				Vaux Seam	
				Broonie Seam	
				Bayswater Seam	
		ARCHERFIELD SANDSTONE			
		VANE SUBGROUP	Bulga Formation		
			Foybrook Formation		
			Saltwater Creek Formation		

¹ Previously known as the Wollombi Coal Measures.

² Coal reserves currently, previously and proposed to be mined at the Wambo Coal Mine.

³ Coal reserves to be mined by the Wambo Coal Mine where the upper three plies of the Warkworth Seam combine with the two plies of the Bowfield Seam.

After: DMR (1993)

W A M B O C O A L M I N E

FIGURE 3
Stratigraphy of the
Wambo Coal Mine Area

- Arrowfield Underground Mine (Arrowfield Seam); and
- Bowfield Underground Mine (Bowfield Seam).

Development of the North Wambo Underground Mine commenced in 2005 and production (using longwall mining methods) commenced in 2007 (WCPL, 2008). During the 2014 reporting period approximately 4.2 Mt of ROM coal was mined at the North Wambo Underground Mine (WCPL, 2015a).

Access to the North Wambo Underground Mine is via the open cut highwall. ROM coal is conveyed to a 70,000 tonne (t) capacity stockpile adjacent to the open cut highwall where it is loaded into haul trucks and hauled to the ROM bin or the ROM coal stockpile.

Access to the approved South Bates (Whybrow Seam) Underground Mine will be via the Bates South open cut highwall. ROM coal will be conveyed to a stockpile where it will be loaded into haul trucks and hauled to the ROM bin or the ROM coal stockpile.

Underground mining equipment includes continuous miners, longwall mining equipment, electric shuttle cars, load haul dump machines and personnel transporters.

Longwall extraction is scheduled to commence in Longwalls 11 to 13 at the approved South Bates (Whybrow Seam) Underground Mine in February 2016. Mining has not commenced at the Arrowfield Underground Mine or the Bowfield Underground Mine to date.

2.4 COAL HANDLING AND PREPARATION

ROM coal from the mining operations is hauled to the CHPP for processing. The majority of ROM coal is placed directly into the 400 t ROM bin and the remainder is placed onto the 250,000 t capacity ROM coal stockpile (WCPL, 2015a). ROM coal is reclaimed from the ROM coal stockpile by front end loader as required.

ROM coal is crushed and washed in the CHPP which operates at a rate of up to approximately 1,800 tph of ROM coal feed. A product coal stockpile with an approximate capacity of 500,000 t is used to stockpile product coal, prior to reclaim and loading to trains for transport off-site.

The CHPP operates up to 24 hours per day, 7 days per week and during the 2014 reporting period approximately 9.7 Mt of ROM coal was processed at the CHPP producing approximately 6.2 Mt of product coal (WCPL, 2015a).

2.5 PRODUCT COAL TRANSPORT

The Wambo Coal Terminal is capable of loading product coal onto trains at a rate of 4,500 tph. Product coal is reclaimed from the product coal stockpile at three reclaim points and is transferred via conveyors to the train load-out bin.

The Wambo Coal Terminal operates up to 24 hours per day, 7 days per week. An average of four trains are loaded each day, with a maximum of six trains per day being loaded during peak coal transport periods.

2.6 WASTE ROCK MANAGEMENT

The open cut operations are expected to produce approximately 640 Mbcm of waste rock during the life of Wambo (WCPL, 2014a). Only a limited amount of waste rock will be produced from the underground operations. The overburden and interburden waste rock materials comprise mudstones, siltstones, sandstone, shale and conglomerates (WCPL, 2012).

Overburden removal is carried out mostly by excavators and haul trucks with the waste rock material hauled to open cut voids or waste rock emplacements. Approximately 29.5 Mbcm of waste rock was excavated during the 2014 reporting period (WCPL, 2015a).

2.7 COAL REJECT MANAGEMENT

Approximately 28.2 Mt of coarse reject material is expected to be produced over the life of Wambo and will primarily comprise minor quantities of coal as well as sandstone, siltstones, shales, conglomerates and mudstone (WCPL, 2014a). The coarse reject material is selectively handled and co-disposed of with waste rock in open cut voids or would be used as bulk fill in the covering and rehabilitation of tailings materials (WCPL, 2003).

Tailings produced at the CHPP primarily comprise carbonaceous shale, sands and clay materials (WCPL, 2003). The tailings are pumped as slurry to open cut voids. Once the tailings have filled a void they are progressively covered with coarse rejects and/or waste rock material using a combination of encapsulation and incorporation. Approximately 18.6 Mt of tailings (dry basis) are expected to be produced over the life of Wambo (WCPL, 2014a).

2.8 INFRASTRUCTURE AND SERVICES

The main administration building, bathhouse and workshops are located at the south-east corner of the open cut operations (Figure 2). An administration block, bathhouse and workshops are also located at the CHPP.

An ablution building, water tanks, fire depot and power services located at the former Wollemi Underground Mine Portal service the South Bates (Whybrow Seam) Underground Mine.

Access to Wambo is currently via the sealed Wambo Access Road which intersects the Golden Highway near Warkworth (Figure 2).

2.9 SITE WATER MANAGEMENT

The site water management strategy for Wambo is based on the containment and re-use of mine water and on the control of sediment that may be potentially carried with runoff from disturbed areas such as the waste rock emplacements.

The Wambo water management system controls waters generated from development and operational areas while diverting upstream water around such areas. It includes both permanent structures that will continue to operate post-closure and temporary structures that will only be required until the completion of rehabilitation works. The water management system includes:

- up-catchment diversion structures;
- water storage dams;
- sediment dams;
- water transfer infrastructure (i.e. pumps and pipelines); and
- the North Wambo Creek Diversion.

The site water management system operates predominately as a closed self-contained system. The water balance of the system fluctuates with climatic conditions and as the extent of the mining operations evolves over time.

In accordance with Condition 25, Schedule 4 of the Development Consent (DA 305-7-2003), WCPL annually reviews the site water balance for Wambo and reports the results of this review in the Annual Environmental Management Report.

A section of North Wambo Creek has been diverted to avoid the Wambo open cut. The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007).

2.10 WORKFORCE

The Wambo workforce currently consists of approximately 670 employees and contractors.

2.11 REHABILITATION

Rehabilitation at Wambo occurs progressively as areas/landforms become available to minimise the area of disturbance at any one time. Approximately 374 hectares of final rehabilitation has been undertaken at Wambo (WCPL, 2015a).

A summary of the key elements of the rehabilitation programme at Wambo is provided below.

Rehabilitation Principles and Objectives

The following rehabilitation principles form the basis for rehabilitation planning and design at Wambo:

- Existing remnant vegetation to be preserved wherever possible.
- Integration of open cut mining and rehabilitation planning to minimise the area of disturbance at any one time.
- Progressive rehabilitation of disturbed areas, including partial rehabilitation of temporarily inactive waste rock emplacements.
- Creation of post-mining landforms that enhance the amenity of the local landscape and contribute to local and regional habitat corridors as presented in the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (NSW Department of Mineral Resources, 1999).
- Consideration of issues of public safety in the design of final landforms.
- Consultation with the relevant state government authorities, SSC and the CCC during the final design and planning of rehabilitated landforms.

- Implementation of trials and design studies as necessary to maximise effectiveness of the rehabilitation programme.
- Routine monitoring in order to identify rehabilitated areas requiring maintenance works.

The rehabilitation objectives at Wambo include:

- The creation of safe, stable, adequately drained post-mining landforms that are consistent with the local surrounding landscape.
- Establishment of woodland vegetation linking remnant vegetation to the north and east of Wambo with the eastern borders of Wollemi National Park.
- Preservation of existing beneficial use of water resources.
- Development of a sustainable post-mining land use plan towards the end of Wambo's life.

Final Landform Concepts

The preferred final landform concepts for Wambo will be revised and refined throughout the life of Wambo, utilising the outcomes of ongoing consultation with relevant authorities, stakeholders and the results of rehabilitation trials.

Surface infrastructure with no ongoing beneficial use will be removed from the site at the completion of mining. Some infrastructure (e.g. site access roads, water storages) may be retained for alternate post-mining uses (where agreed in consultation with the relevant landholders).

Revegetation Strategy

The Wambo revegetation programme will establish significant areas and a net increase in woodland vegetation over the long-term. The final distribution of woodland to be established on rehabilitated landforms will ultimately depend on the outcome of closure planning including the shape of final landforms and the agreed post-closure land use (WCPL, 2003).

In recognition of the importance of vegetation corridors to regional biodiversity, rehabilitation initiatives for Wambo will aim to increase the continuity of vegetation in the region through the establishment of woodland corridors. Accordingly, the rehabilitation programme has been designed to establish linkages between the rehabilitation areas, existing remnant vegetation and Wollemi National Park (WCPL, 2003).

The provisional revegetation strategy includes the revegetation of disturbance areas with areas of woodland (corridors), areas which contain a mixture of woodland and pasture, and riparian vegetation.

Remnant Woodland Enhancement Programme

Five Remnant Woodland Enhancement Programme (RWEPP) areas have been established at Wambo (Figure 2). The objective of the RWEPP areas is to help to conserve regional biodiversity, whilst enhancing the habitat available to flora and fauna (WCPL, 2014b). Conservation and enhancement of the RWEPP areas will strengthen the linkages to be developed between Wollemi National Park, existing remnant woodland and woodland rehabilitation areas (WCPL, 2014b).

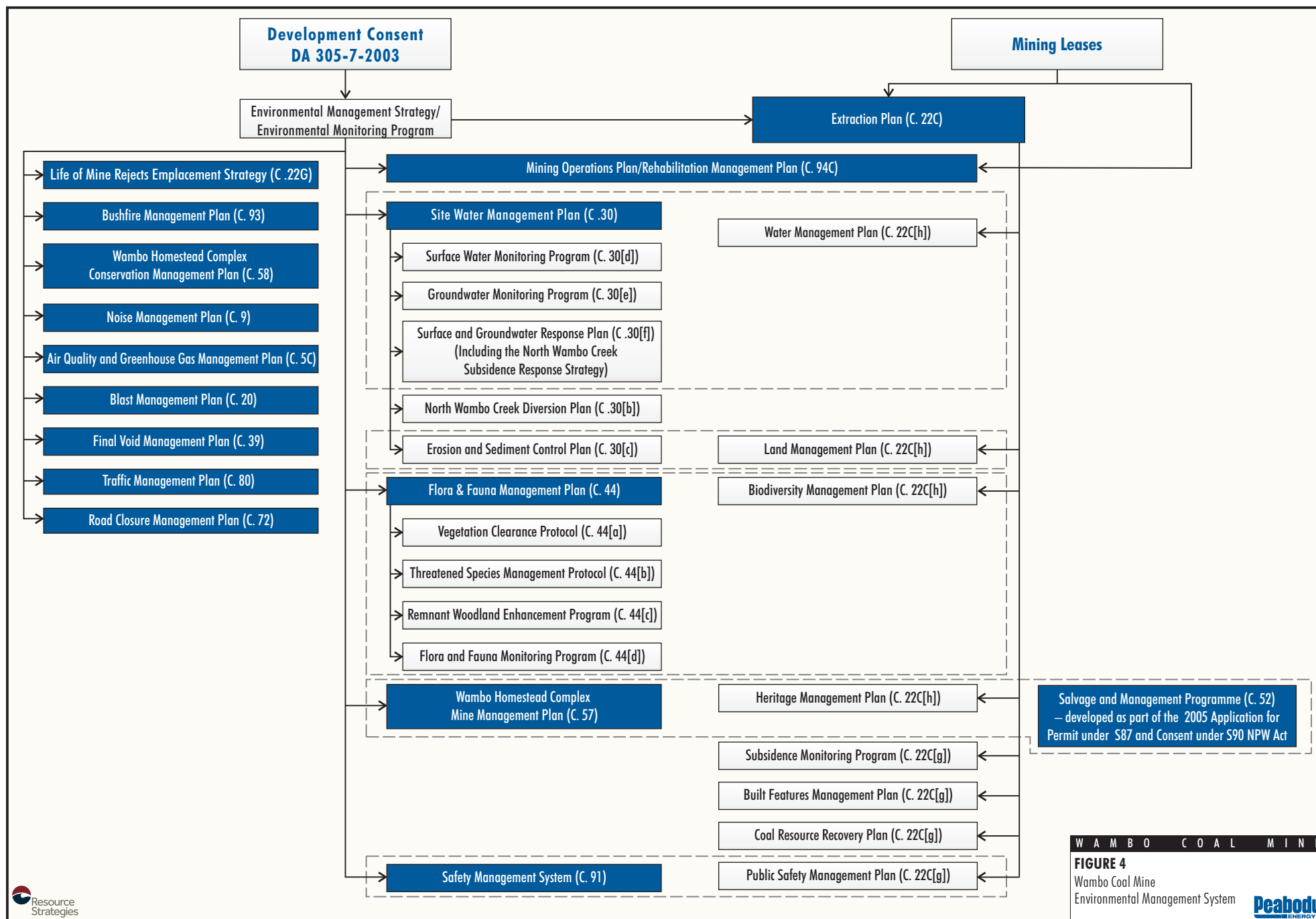
Details of the management of the RWEPP areas are provided in the Flora and Fauna Management Plan (WCPL, 2014b).

WCPL is currently in the process of finalising agreements to conserve the RWEPP areas as part of a Voluntary Conservation Agreement under Part 4, Division 12 of the NSW *National Parks and Wildlife Act, 1974* in accordance with Condition 41, Schedule 4 of Development Consent DA 305-7-2003.

2.12 ENVIRONMENTAL MONITORING AND MANAGEMENT

Environmental management at Wambo encompasses a range of management plans and monitoring programmes overseen by statutory planning provisions (Figure 4). Approved management plans/monitoring programmes include:

- Environmental Management Strategy (WCPL, 2010a).
- Environmental Monitoring Program (WCPL, 2010b).
- Flora and Fauna Management Plan (WCPL, 2014b).
- Blast Management Plan (WCPL, 2014c).
- Noise Management Plan (WCPL, 2014d).
- Air Quality and Greenhouse Gas Management Plan (WCPL, 2014e).
- Site Water Management Plan incorporating the following:
 - North Wambo Creek Diversion Plan (WCPL, 2007).
 - Groundwater Monitoring Program (WCPL, 2010c).



- Surface Water Monitoring Program (WCPL, 2010d).
- Erosion and Sediment Control Plan (WCPL, 2010e).
- Surface and Groundwater Response Plan (WCPL, 2010f).
- North Wambo Underground Mine Subsidence Management Plan for Longwalls 1 to 6 (WCPL, 2006).
- North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A (WCPL, 2015b).
- Surface and Subsurface Investigation Programme (Strata Engineering, 2005).
- Life of Mine Rejects Emplacement Strategy (WCPL, 2011).
- Bushfire Management Plan (WCPL, 2013).
- Wambo Homestead Complex Mine Management Plan (Godden Mackay Logan, 2012).

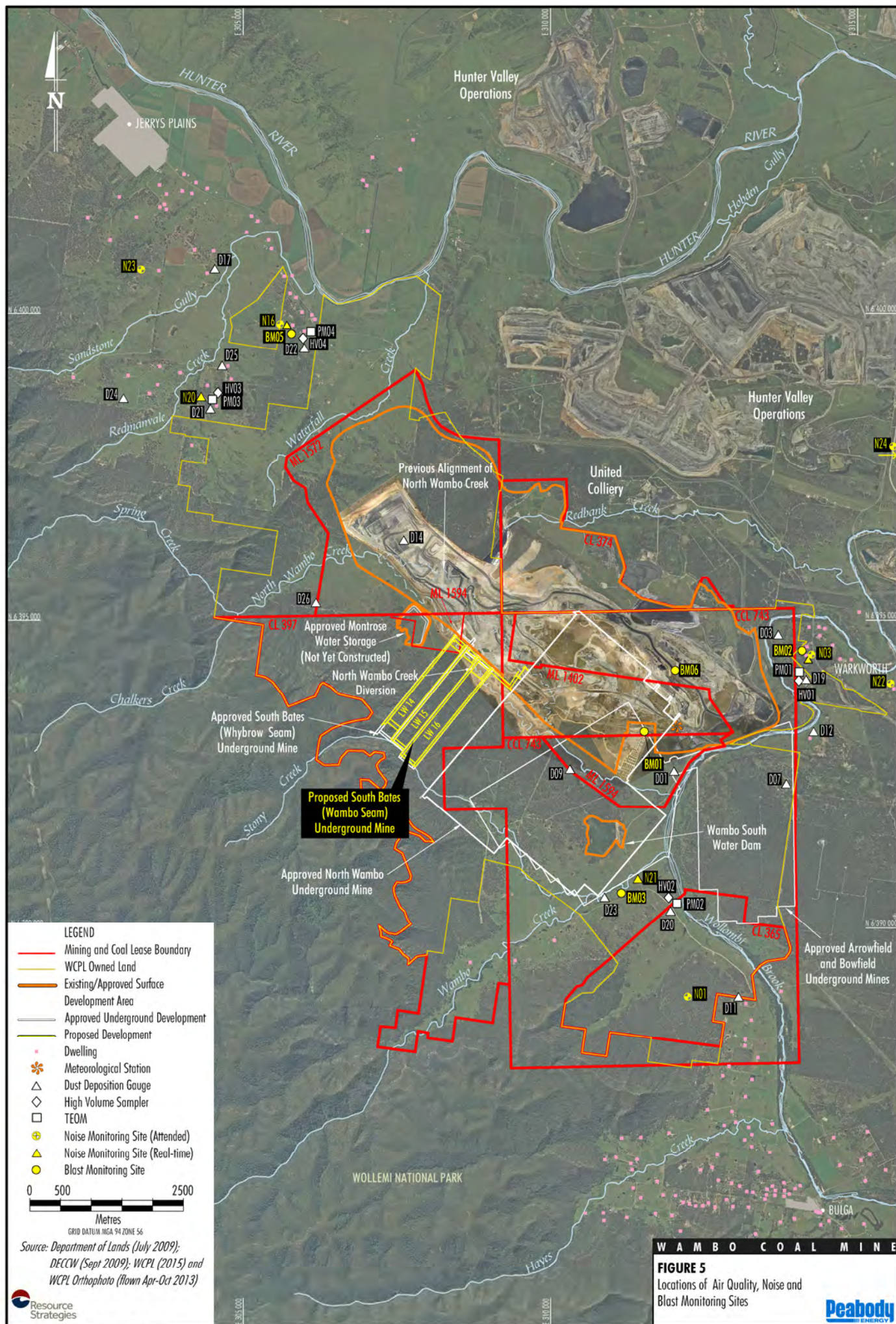
WCPL maintains an extensive monitoring programme whereby data is collected, analysed and maintained for reporting, future examination and assessment. The locations of existing environmental monitoring sites at Wambo are shown on Figures 5 and 6.

2.13 COMPLAINTS

WCPL maintains a 24 hours a day, 7 days per week complaints line which is directed to the Environment and Community Manager (phone 02 6570 2245) and an email address (wambocommunity@peabody.com).

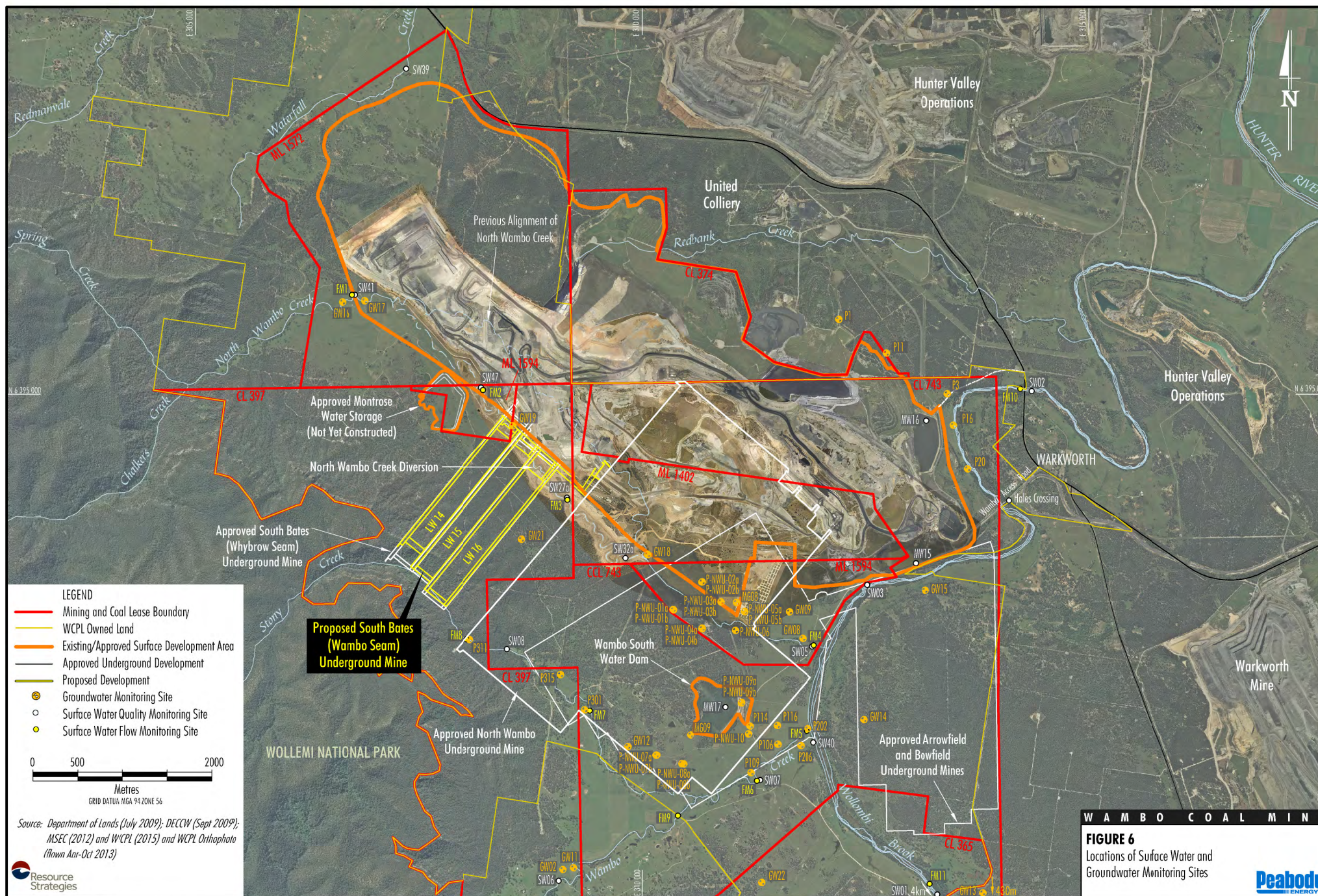
WCPL received a total of 31 complaints during the 2014 reporting period, with the majority related to blasting (42 percent [%]) and noise (32%) (WCPL, 2015a). This was consistent with the number of complaints received during the 2013 reporting period, where a total of 30 complaints were received. The complaints received were related to noise, blasting, lighting and dust, and generally not related to the underground mining operations (WCPL, 2015a).

Mine-related complaints are managed in accordance with WCPL's Community Complaints Procedure.



WAMBO COAL MINE

FIGURE 5
Locations of Air Quality, Noise and Blast Monitoring Sites



3 SOUTH BATES (WAMBO SEAM) UNDERGROUND MINE MODIFICATION

The Modification would not require any significant alteration to the approved Wambo operations and general supporting infrastructure. A description of the Modification is provided below.

3.1 SOUTH BATES (WAMBO SEAM) UNDERGROUND MINE

Layout of the Underground Mining Area

The proposed layout of the Modification is shown on Figure 7. The proposed Modification Longwalls 14 to 16 would be situated directly underneath approved longwall panels in the Whybrow Seam. The Modification longwalls would have lengths varying between approximately 1.56 and 1.84 km and widths varying between approximately 222 and 240 metres (m).

The extent of the proposed Longwalls 14 to 16 to the south-west is set back or in line with approved Longwalls 11 to 13 to avoid impact on the Wollemi National Park Escarpment. Similarly, Longwalls 14 to 16 would avoid potential interference with the Bates South pit highwall.

Mine Access and Development Works

Access to the proposed Modification longwall panels would be via a dedicated main heading from the Bates South pit. Gate roads would be driven from the main heading to the north-west to allow for the extraction of coal from the Wambo seam. Subject to all necessary approvals being in place, development would commence in December 2015.

Longwall Mining Operations

Longwall mining operations would be undertaken consistent with operations at the North Wambo Underground Mine and South Bates (Whybrow Seam) Underground Mine. Longwall mining would commence at the south-western end of the Modification longwall panels and move towards the north-east. In order to start each new longwall panel, the longwall machine would be separated into components and re-assembled in the roadway of the next panel.

Consistent with approved operations, underground mining operations would be conducted 24 hours a day, 7 days per week.

Approximately 5.6 Mt of additional ROM coal would be mined over a period of approximately 14 months. This would involve an extension of the existing mine life by approximately 1 year. Production from the South Bates (Wambo Seam) Underground Mine would be at a rate of up to 7.5 Mtpa, consistent with approved underground mining operations. Gate road development of the Modification longwall panels is proposed to commence in March 2016. Longwall extraction of the proposed Modification longwall panels is scheduled to commence in September 2017.

Underground Equipment and Mobile Fleet

The existing South Bates (Whybrow Seam) Underground Mine equipment and mobile fleet (Section 2.3) would be used for the Modification.

Ventilation System

The existing fan ventilation system in the Bates South pit would be utilised to service the Modification longwall panels. As such, no additional surface disturbance for ventilation systems would be required.

Gas Management

The ventilation system would be the primary mechanism to monitor and control the concentrations of mine gases for the Modification. In addition, gas may also be drained by drilling in-seam (i.e. horizontal) boreholes in advance of mining.

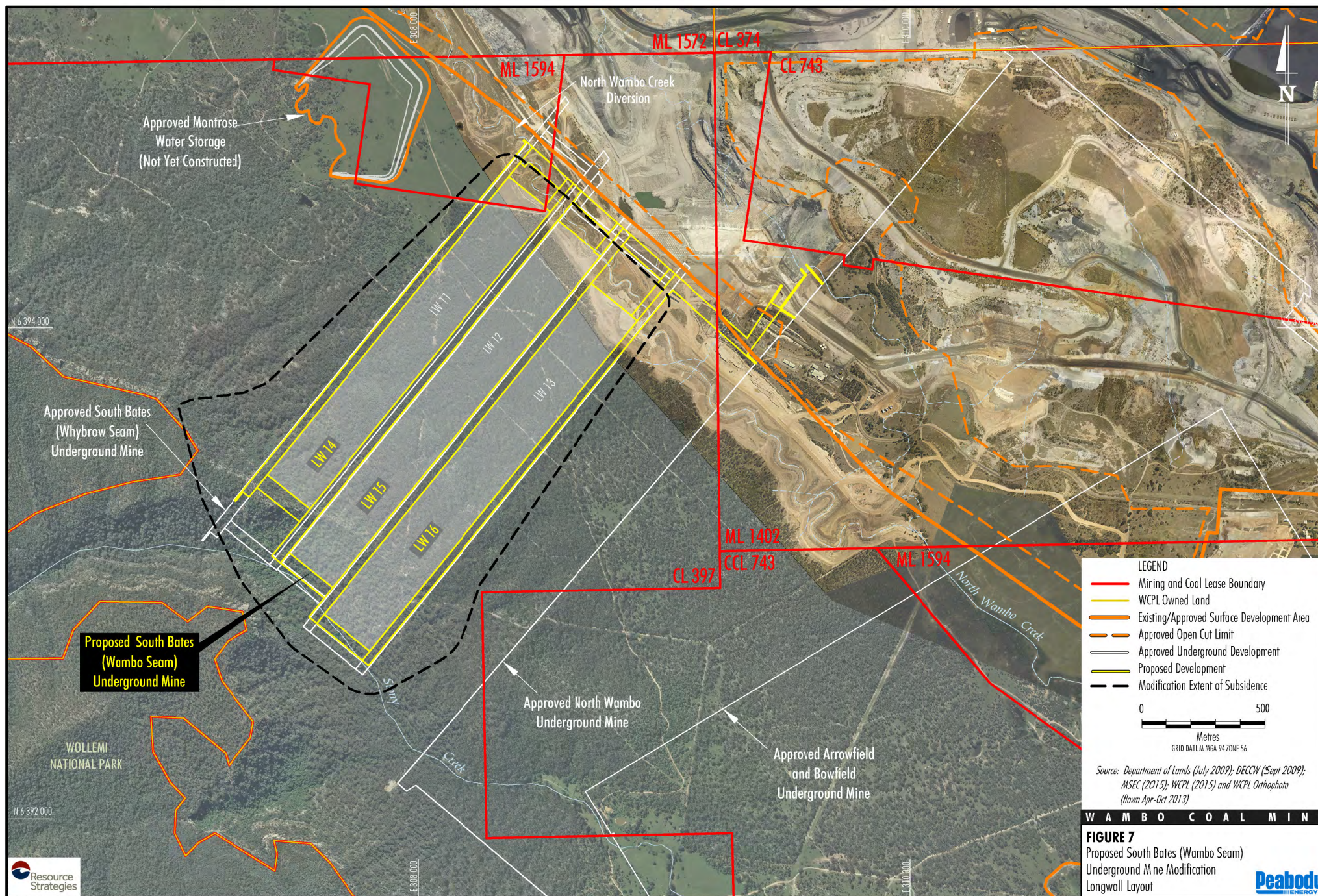
Dewatering

Groundwater that accumulates in the underground workings would be pumped to the surface via underground sumps, consistent with operations at the South Bates (Whybrow Seam) Underground Mine. As such, no additional dewatering bores would be required for the Modification.

3.2 APPROVED UNDERGROUND OPERATIONS

The Modification would include the development of three longwall panels (Longwalls 14 to 16) in the Wambo seam, directly underlying existing workings at the South Bates (Whybrow Seam) Underground Mine.

The proposed Modification does not include any alteration to the layout and/or operation of the approved South Bates (Whybrow Seam) Underground Mine, Arrowfield Underground Mine or Bowfield Underground Mine.



3.3 OPEN CUT OPERATIONS

The Modification would not alter the approved open cut mining methods, open cut maximum production rates, open cut mine fleet or waste rock management practices.

3.4 COAL HANDLING, PREPARATION AND PRODUCT COAL TRANSPORT

The Modification would not alter the approved coal handling, CHPP or product coal transport operations (Sections 2.4 and 2.5).

3.5 COAL REJECT MANAGEMENT

The Modification would result in production of approximately 1.1 Mt of coarse rejects and 0.8 Mt of tailings. No alteration of current coarse rejects or tailings management measures would be required (Section 2.7).

3.6 INFRASTRUCTURE AND SERVICES

The existing South Bates (Whybrow Seam) Underground Mine support facilities (including offices, control room, crib room, workshop, ablution building, laydown areas and a range of service facilities), access roads and utilities (Section 2.8) would be utilised for the Modification.

Minor extensions and upgrades to existing utilities (e.g. electrical supply and communications) may be conducted for the Modification as required.

3.7 WATER MANAGEMENT AND SUPPLY

The Modification would not include any material changes to the approved water management system, water supply or water demand (Section 2.9).

3.8 WORKFORCE

The existing underground mine workforce would continue to be employed for the Modification and therefore the Modification would not materially result in any additional demand for employees/contractors. The Modification would generate approximately 14 months of additional employment for the South Bates Underground Mine workforce.

3.9 REHABILITATION

The Modification would not require a material change to the rehabilitation programme presented in the EIS (WCPL, 2003) (Section 2.11).

The Modification area would be remediated if visual monitoring identifies any areas subject to excessive erosion and sedimentation as a result of subsidence. The following mitigation measures would be implemented if required:

- filling of cracks and minor erosion holes, where practicable;
- installation of sediment fences downslope of subsidence-induced erosion areas;
- stabilisation of erosion areas using rock or other appropriate materials;
- stabilisation of banks subject to soil slumping; and
- revegetation using brush matting, seeding or tubestock.

4 ENVIRONMENTAL ASSESSMENT

The Modification would include the development of three longwall panels at the South Bates (Wambo Seam) Underground Mine (proposed Longwalls 14 to 16). The “Modification area” is the extent of predicted measurable vertical subsidence from the proposed Longwalls 14 to 16 (Figure 7).

The approved Longwalls 11 to 13 at the South Bates (Whybrow Seam) Underground Mine are also shown on Figure 7.

4.1 IDENTIFICATION OF KEY ISSUES

The following approved components of Wambo would be unchanged by the Modification (Section 3):

- overall life of the mine;
- ROM coal production rate;
- open cut operations;
- coal handling, CHPP and product coal transport operations; and
- major surface infrastructure.

In addition, the Modification would not materially result in any additional demand for employees/contractors.

Therefore, there would be no material alteration to the approved impacts of Wambo on the following aspects:

- air quality;
- noise;
- open cut blasting;
- visual amenity;
- road or rail transport network; and
- population and community infrastructure demand.

The key potential impacts of the Modification are related to the extraction of the proposed Longwalls 14 to 16 at the South Bates (Wambo Seam) Underground Mine and the associated subsidence impacts and consequences.

A discussion of the predicted subsidence effects and impacts is provided in Section 4.2. An assessment of the potential consequences of the predicted subsidence impacts is provided in Sections 4.2 to 4.8 for:

- built features;
- land resources;
- groundwater;
- surface water;
- Aboriginal cultural heritage;
- flora; and
- fauna.

For completeness, Section 4.9 discusses potential impacts of the Modification on other issues, including greenhouse gas emissions, non-Aboriginal heritage and hazards and risk.

4.2 SUBSIDENCE

4.2.1 Background

Subsidence is the vertical and horizontal movement of the overburden and land surface as a result of the extraction of underlying coal. These movements are generically referred to as subsidence effects. The type and magnitude of the subsidence effects is dependent on a range of variables (e.g. mine geometry, topography and geology).

The different types of subsidence effects include systematic subsidence movements, non-systematic subsidence movements and sub-surface strata movements.

A cumulative Subsidence Assessment, including the Modification, has been prepared by Mine Subsidence Engineering Consultants (MSEC) (2015) and is presented in Appendix A.

Extraction Plan

Condition 22C, Schedule 4 of the Development Consent (DA 305-7-2003) requires WCPL to prepare an Extraction Plan for secondary workings prior to extraction.

4.2.2 Environmental Review

The subsidence assessment:

- provides subsidence predictions for the proposed Longwalls 14 to 16 in the Wambo Seam, and for approved Longwalls 11 to 13 in the Whybrow Seam;
- identifies the natural and built features located above and in the vicinity of the proposed Longwalls 14 to 16; and
- provides subsidence predictions and impact assessments, in conjunction with other specialist consultants, for these natural and built features.

A summary of the key findings of the Subsidence Assessment is provided in the following subsections.

Prediction Methodology

Predictions of the systematic subsidence parameters for the Modification were made using the Incremental Profile Method, which consists of subsidence prediction curves based on monitoring data from mines extracting coal from the Southern, Newcastle, Hunter and Western Coalfields of NSW (Appendix A).

The Incremental Profile Method has a tendency to give slightly conservative predictions of the systematic subsidence parameters where the proposed mining geometry and geology are within the range of the empirical database (i.e. the method is based on upper bound curves and is generally conservative) (Appendix A).

The predicted subsidence effects for the approved and modified mining layout (incorporating the proposed Longwalls 14 to 16) have been calculated using a calibrated Incremental Profile Method, so that the change in subsidence effects can be directly compared.

Appendix A provides a more detailed description of the subsidence prediction methodologies, including a description of previous subsidence monitoring at Wambo and other collieries in the Hunter Coalfield and how the data has been used for the Modification subsidence predictions.

Predicted Subsidence Effects

Subsidence effects are the deformation of the ground mass due to underground mining, including all mining induced ground movements.

Systematic Subsidence Effects

Systematic subsidence movements are described by the following parameters: subsidence, tilt, curvature, and associated strains (tensile and compressive strains).

Table 2 presents a comparison of the predicted subsidence effects from the approved mining layout (in the Whybrow Seam) and cumulatively with the modified mining layout (in the Wambo Seam).

The maximum predicted total vertical subsidence for the modified mining layout is greater than the predictions based on the approved layout using the calibrated Incremental Profile Method (Appendix A).

The maximum predicted total tilt, hogging curvature and sagging curvature for the modified mining layout is similar to those predicted based on the approved mining layout using the calibrated Incremental Profile Method (Appendix A). The maximum tilts and curvatures occur above the north-eastern ends of the proposed Longwalls 14 to 16, where the depths of cover are the shallowest.

Tensile and Compressive Strains

There is no linear relationship between curvature and strain for multi-seam mining conditions, as localised strains develop in multi-seam mining conditions as the result of remobilising the existing goaf and chain pillars in the overlying seam, which are not directly related to curvature (Appendix A).

The magnitudes of the strains for the proposed Longwalls 14 to 16 are expected to be similar to those observed for multi-seam conditions during the previously extracted longwalls at the adjacent North Wambo Underground Mine. Further discussion on predicted strains is provided in Appendix A.

Subsurface Subsidence Effects

The caving and subsidence development process above a longwall panel usually results in subsurface fracturing and shearing of sedimentary strata in the overburden. The extent of fracturing and shearing depends on mining geometry and overburden geometry.

This subsurface fracturing and shearing of sedimentary strata results in changes in bulk rock mass permeability and storage capacity.

The potential impacts of subsurface fracturing on groundwater and surface water systems is assessed in Appendices B and C, and summarised in Sections 4.4 and 4.5.

Table 2
Comparison of Predicted Systematic Effects for the Approved and Modified Mining Layouts

Layout	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (km ⁻¹)	Maximum Predicted Sagging Curvature (km ⁻¹)
Approved Mining Layout (Whybrow Seam Only)	1,950	90	> 3.0	> 3.0
Proposed Longwalls 14 to 16 (Wambo Seam Only)	2,500	35	1.0	1.0
Modified Mining Layout (Wambo and Whybrow Seams)	4,150	100	> 3.0	> 3.0

Source: Appendix A.

mm = millimetre.

mm/m = millimetre per metre.

km⁻¹ = per kilometre.

Non-systematic Subsidence Effects

Non-systematic subsidence movements include far-field horizontal movements, irregular subsidence movements and valley related movements (Appendix A). Appendix A provides a detailed description of potential non-systematic subsidence predictions.

The potential subsidence impacts to surface features which are sensitive to non-systematic movements have been identified and included in assessments made in the Subsidence Assessment (Appendix A).

Subsidence Impacts

Subsidence impacts are the physical changes to the ground and its surface caused by the subsidence effects described above. Potential subsidence impacts associated with the proposed Longwalls 14 to 16 include:

- surface cracking;
- changes in stream bed gradients;
- ponding and changes in stream alignment; and
- slope instability and rock fall.

MSEC (Appendix A) concluded that the levels of impact on the natural and built features could be managed by the preparation and implementation of the appropriate management strategies.

Potential Environmental Consequences on Key Natural and Built Features

The modified mining layout has been designed to be consistent with the subsidence impact performance measures in the existing Development Consent (DA 305-7-2003) (Table 3).

A summary of the potential consequences of the potential subsidence impacts above the proposed Longwalls 14 to 16 is provided below, including cross-references to sub-sections with further detail.

Streams

Wollombi Brook is located outside the extent of measurable tilts, curvatures or strains associated with the proposed Longwalls 14 to 16.

A short section of Stony Creek is located directly above the proposed Longwall 16. Potential subsidence impacts and environmental consequences for Stony Creek are described in Section 4.5 and Appendix C.

A section of North Wambo Creek has been diverted to avoid the Wambo open cut. The natural section of North Wambo Creek is located 700 m east of the proposed Longwalls 14 to 16 at its closest point. Therefore, it is unlikely that the natural section of North Wambo Creek would experience any adverse impacts resulting from the Modification (Appendix A).

The North Wambo Creek Diversion is located above and directly adjacent to the approved Longwalls 11 to 13 and the proposed Longwalls 14 to 16. Potential subsidence impacts and environmental consequences for the North Wambo Creek Diversion are described in Section 4.5 and Appendix C.

Alluvial Aquifers

The surface lithology within the Modification area generally comprises Wittingham Coal Measures, Watts Sandstone, Newcastle Coal Measures and Widden Brook Conglomerate (Appendix A). There are no natural alluvial aquifers located in the immediate vicinity of the Modification area.

Potential impacts on alluvium are described in Section 4.4 and Appendix B.

Cliffs

Cliffs, minor cliffs and rock outcrops have formed in the Modification area and surrounds from the Widden Brook Conglomerate of the Narrabeen Group (Appendix A). Cliffs and minor cliffs in the Modification area were identified by MSEC (Appendix A) as shown on Figure 8 using Light Detection and Ranging (LiDAR) survey data and detailed site investigations.

Cliffs were defined as a continuous rock face, including overhangs, having a minimum length of 20 m, a minimum height of 10 m and a minimum slope of 2 to 1. Minor cliffs were defined as continuous rock faces, including overhangs, having a minimum length of 20 m, heights between 5 m and 10 m and a minimum slope of 2 to 1; or a rock face having a maximum length of 20 m and a minimum height of 10 m.

Cliffs Associated with the Wollemi Escarpment

Cliffs associated with the Wollemi Escarpment are the higher level cliffs located along the boundary of the Wollemi National Park.

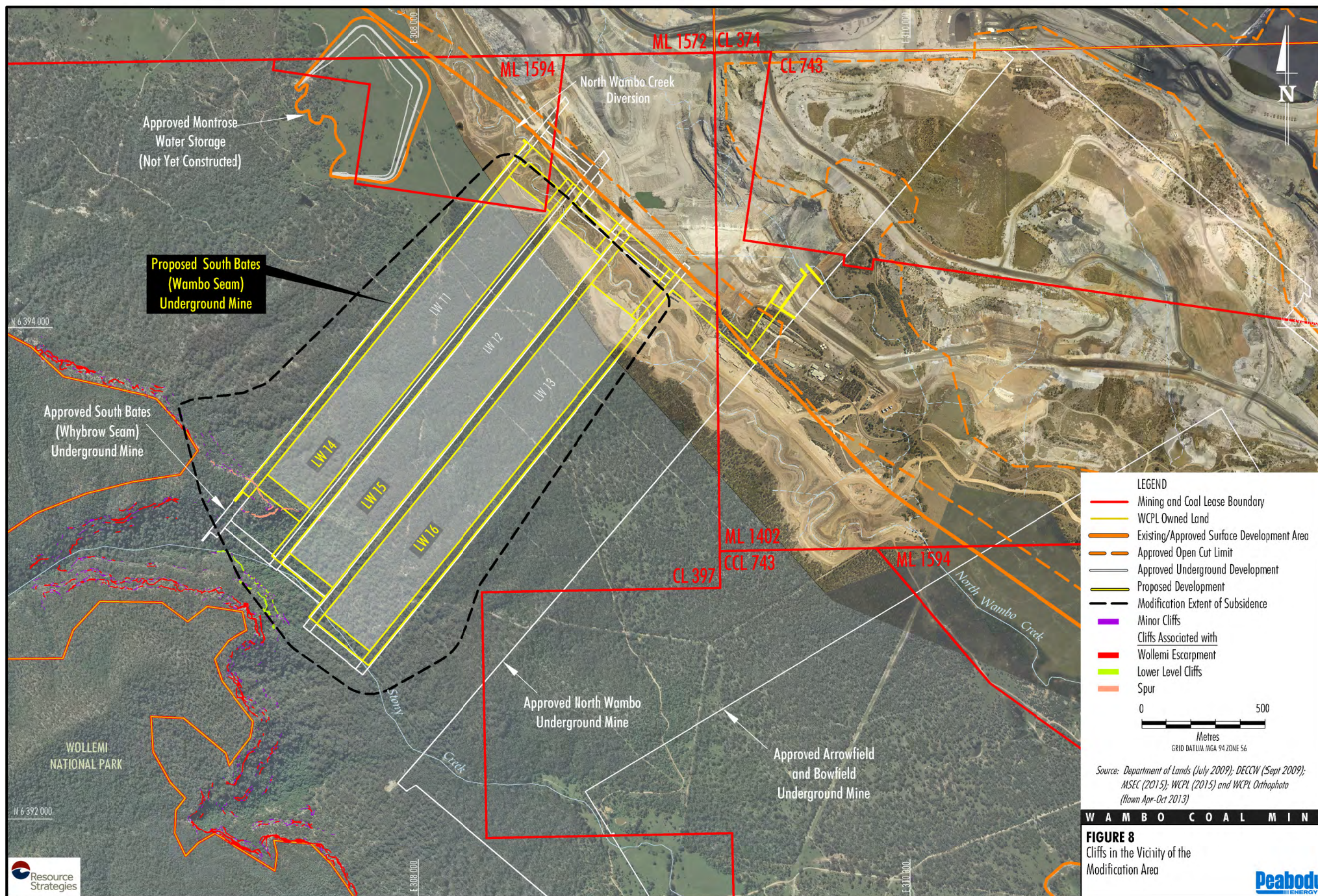
These cliffs are located outside of the 26.5° angle of draw associated with the proposed Longwalls 14 to 16. MSEC (Appendix A) concludes these cliffs are not predicted to experience any significant conventional tilts, curvatures or strains. While these cliffs associated with the Wollemi Escarpment could experience low level far-field horizontal movements, it is unlikely that the cliffs would be adversely impacted by these far-field horizontal movements (Appendix A).

Table 3
Subsidence Impact Performance Measures

Feature	Subsidence Impact Performance Measure
Wollombi Brook	Negligible impact. Controlled release of excess site water only in accordance with EPL requirements.
Wollemi National Park	Negligible subsidence impacts. Negligible environmental consequences.
Warkworth Sands Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.
White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.
Other threatened species, populations or communities	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.
Wambo Homestead Complex	Negligible impact on heritage values, unless approval has been granted by the Heritage Branch and/or the Minister.
All built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
Public safety	No additional risk.

Source: Conditions 22 and 22A, Schedule 4, Wambo Development Consent DA 305-7-2003.

EPL = Environment Protection Licence.



Low Level Cliffs

Low level cliffs are located downslope of the Wollemi Escarpment and are discontinuous, having lengths typically between 20 m and 40 m, but varying up to 125 m in length (Appendix A). These cliffs are not located directly above the proposed Longwalls 14 to 16, therefore it is not expected that any large cliff instabilities would occur as a result of the extraction of these longwalls, based on extensive experience of mining adjacent to (i.e. not directly beneath) cliffs in the NSW Coalfields (Appendix A). It is possible that minor and isolated rock falls could occur along the low level cliffs as a result of the extraction of the proposed Longwalls 14 to 16 (Appendix A).

Cliffs along the Spur

Cliffs are located along a spur located south-west of the proposed Longwall 14 and directly above the approved Longwall 11 (Figure 8).

MSEC (Appendix A) predicts that less than 5% of the lengths (or less than 3% of the face areas) of the cliffs along the spur located directly above the approved mining layout or modified mining layout would be impacted.

Rock Features

Isolated pagodas have been identified along the spur located south-west of the proposed Longwall 14 and directly above the approved Longwall 11. These isolated pagodas could experience some fracturing which, where the rock is marginally stable, could result in spalling of the exposed rock faces (Appendix A). MSEC (Appendix A) predicts that the impacts resulting from mining would represent less than 1% of total surface area of isolated pagodas located directly above the approved mining layout or modified mining layout.

Steep Slopes

Steep slopes (where the natural gradient is between 1 in 3 and 1 in 2) occur in the Modification area along the spur located south-west of the proposed Longwall 14 and downslope of the Wollemi Escarpment.

The maximum predicted total tilt for these steep slopes of 35 mm/m (i.e. 1 in 30) is small when compared to the natural surface grades, which are greater than 1 in 3 (Appendix A). Therefore, MSEC concludes (Appendix A) it is unlikely that the mining induced tilts would result in any adverse impact on the stability of these steep slopes.

Potential impacts on steep slopes would generally result from the downslope movement of the ground, resulting in tension cracks appearing at the tops of the steep slopes and compression ridges forming at the bottoms of the steep slopes. Remediation of surface cracking is described in Section 4.3.2.

Wollemi National Park

The Wollemi National Park is located to the south-west and to the west of the proposed Longwalls 14 to 16. Wollemi National Park is predicted to experience very low levels of vertical subsidence, low level far-field horizontal movements and no significant conventional tilts, curvatures or strains (Appendix A).

Therefore, MSEC (Appendix A) concludes it is unlikely Wollemi National Park would be adversely impacted by the proposed Longwalls 14 to 16.

Land Use and Land Resources

Potential consequences on land resources and land use as a result of subsidence impacts are described in Section 4.3.

Aboriginal Cultural Heritage

A number of Aboriginal cultural heritage items, including artefact scatters, isolated finds and grinding groove sites have been identified in the Modification area. Potential consequences on Aboriginal cultural heritage items as a result of subsidence impacts are described in Section 4.6 and Appendix D.

Non-Aboriginal Cultural Heritage

Potential consequences on non-Aboriginal heritage as a result of subsidence impacts are discussed in Section 4.9.2.

Threatened Ecological Communities

Potential consequences on threatened ecological communities as a result of subsidence impacts are discussed in Section 4.7 and Appendix E.

Infrastructure and Improvements

The potential impacts of subsidence effects on infrastructure and improvements are assessed in Appendix A. Infrastructure and improvements located within the Modification area and surrounds include:

- unsealed roads and tracks;
- fences on WCPL-owned land;
- a groundwater monitoring bore owned by WCPL;
- exploration boreholes; and
- underground power and telecommunications cables and a water pipeline owned and operated by WCPL for mining activities.

The Subsidence Assessment indicates that the predicted levels of impact on other infrastructure and improvements can be managed through the preparation and implementation of appropriate management strategies, as part of the Extraction Plan process, to maintain items in a safe and serviceable condition.

Public Safety

Surface cracking, erosion, cliff instability and ponding have the potential to pose a safety hazard.

Potential safety issues resulting from extraction of the proposed Longwalls 14 to 16 could include potential safety hazards for users of existing unsealed roads and tracks in active subsidence areas.

WCPL would implement a Public Safety Management Plan approved as part of the Extraction Plan so that there would be no additional risk to public safety.

Mitigation Measures, Management and Monitoring

An Extraction Plan would be prepared prior to the commencement of secondary workings in the proposed Longwalls 14 to 16 to:

- demonstrate that the subsidence impact performance measures can be achieved; and
- develop detailed mitigation measures and monitoring to manage the potential impacts and/or environmental consequences on natural and built features.

Mitigation measures and management for potential consequences on land resources, groundwater, surface water, Aboriginal cultural heritage, flora and fauna are described in Sections 4.3 to 4.8.

Infrastructure and Improvements

As described above, WCPL owns the infrastructure and improvements potentially affected by the proposed Longwalls 14 to 16.

Measures to manage the impacts of subsidence on surface infrastructure would be developed as a component of the relevant Extraction Plan for consideration and approval by the relevant authorities, and would be consistent with the requirements of the Development Consent (DA 305-7-2003).

Public Safety

The Extraction Plan for proposed Longwalls 14 to 16 would include a Public Safety Management Plan as required under Condition 22C(g), Schedule 4 of the Development Consent (DA 305-7-2003). The approved Public Safety Management Plan includes measures to maintain public safety (e.g. regular monitoring and remediation of surface cracking).

4.3 LAND RESOURCES

4.3.1 Background

Landforms and Topography

Wambo is located in the Upper Hunter Valley region where landforms are characterised by gently sloping floodplains associated with the Hunter River and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range.

Elevations in the vicinity of Wambo range from approximately 60 m Australian Height Datum (AHD) at Wollombi Brook to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west of Wambo (WCPL, 2003). Elevations directly above the proposed Longwalls 14 to 16 range from approximately 360 m AHD in the south-west to approximately 90 m AHD in the north-east.

Land Use

Land use in the vicinity of Wambo is characterised by a combination of coal mining operations, RWEF areas, agricultural land use and WCPL-owned lands that are not subject to mining operations being utilised for the agistment of stock (WCPL, 2003a).

The Modification area is wholly located on WCPL-owned land. The majority of the Modification area is within RWEF Areas B, C, D and D Extension. As such, livestock grazing is excluded from this land. The North Wambo Creek Diversion is located above the north-eastern portion of the Modification area.

Soils

Regional soil landscapes (Kovac & Lawrie, 1991) mapped across the Modification area include the Bulga, Benjang and Lees Pinch soil landscapes. Soils associated with soil landscapes in the Modification area comprise yellow soloth soils, yellow solodic soils, red solodic soils and siliceous sands (Resource Strategies, 2003a).

Agricultural Activities and Productivity

Historical agricultural activities in the region included beef cattle farming, dairying and cultivation of crops such as wine grapes (FloraSearch, 2015).

Most of the land within the Modification area comprises forest and woodland that has been set aside as part of the RWEF. This land is subject to exclusion from livestock grazing.

As a result of the RWEF, there are no agricultural activities over the majority of the Modification area.

Strategic Agricultural Lands

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) includes mapping of lands identified as Biophysical Strategic Agricultural Land (BSAL).

The closest mapped BSAL in the Mining SEPP is associated with the Hunter River and is located more than 3 km to the north-west of the Modification area (Figure 9).

The Modification area is not located within mapped Viticulture or Equine Critical Industry Clusters. The closest Viticulture Critical Industry Cluster is located more than 6 km to the south-east of the Modification area. The closest Equine Critical Industry cluster is located approximately 11 km to the north-west of the Modification area (Figure 9).

4.3.2 Environmental Review

Potential Impacts

Potential land resource impacts as a result of the Modification would be limited to impacts associated with mine subsidence.

The Modification area is wholly located on WCPL-owned land which is primarily managed for biodiversity conservation. Subsidence may impact the integrity of fences used to exclude livestock from the RWEF areas. Fences would be monitored and repaired during mining. Potential impacts on the biodiversity values of vegetation in the Modification area (including the RWEF areas) is discussed in Sections 4.7 and 4.8.

Potential impacts on soils and agricultural productivity would be associated with the following potential subsidence impacts:

- surface cracking;
- slope instability and rock fall; and
- ponding and changes in stream alignment.

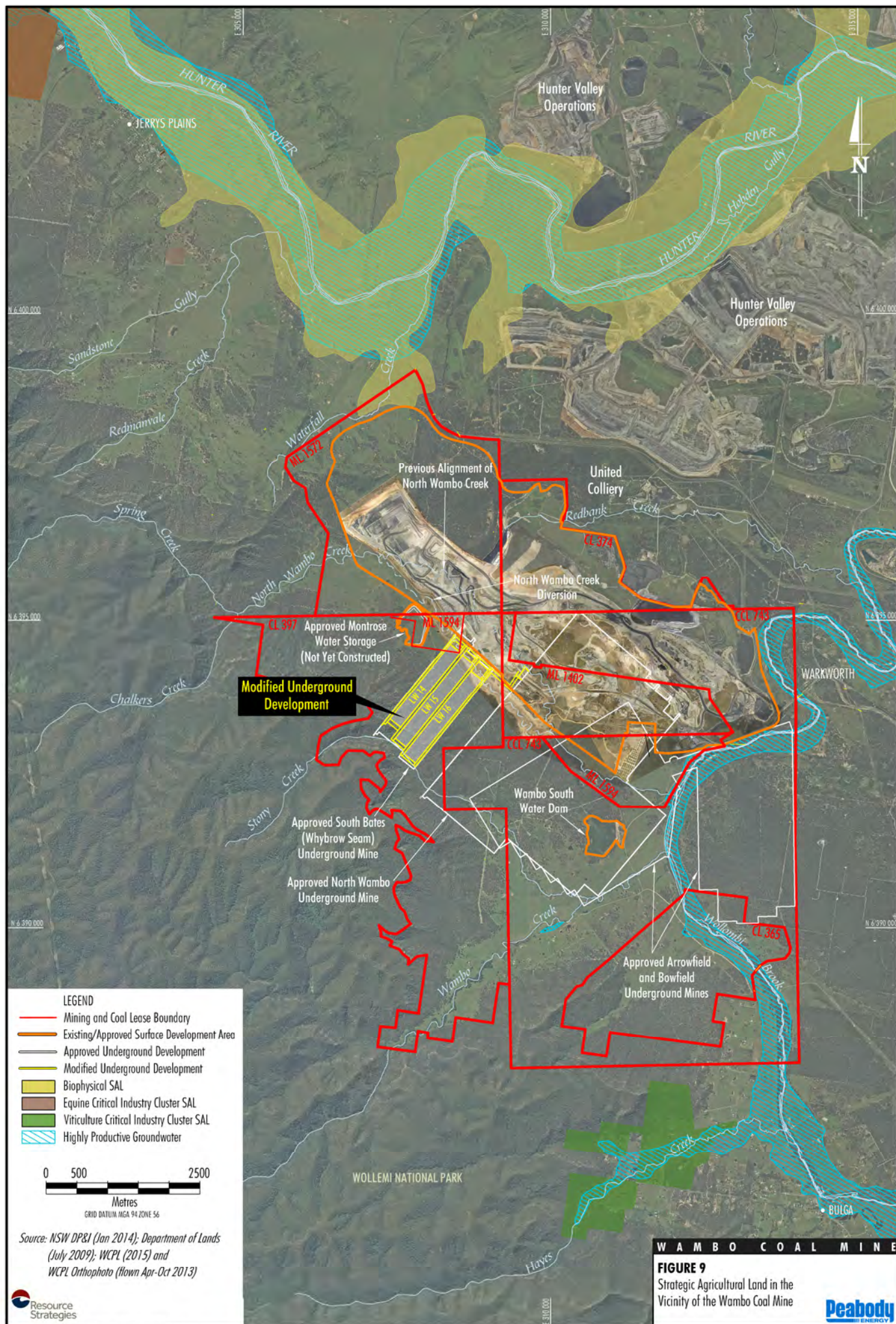
Agricultural activities are restricted within RWEF areas, therefore, there would be limited potential for impacts on land resources due to subsidence. Notwithstanding, it is noted that Frazier *et al.* (2010) found no significant effect of longwall mining subsidence on agricultural production, including cattle grazing, in the Hunter Valley region. Given the above, there is a low potential for impact to agricultural productivity in the Modification area.

WCPL would implement mitigation measures and management to minimise potential risks to land uses as described below.

It is considered that the Modification would not have any significant adverse impacts on the Viticulture and Equine Critical Industry Clusters as there are no equine or viticulture-related activities in the vicinity of the Modification area.

Mitigation Measures, Management and Monitoring

Erosion and sediment management at Wambo would continue to be conducted in accordance with an approved Erosion and Sediment Control Plan.



In the event that significant surface cracking is identified, the following remediation would be undertaken:

- infilling of surface cracks with soil or other suitable materials; or
- locally regrading, ripping and re-compacting the surface.

Erosion protection measures (e.g. vegetation planting) to stabilise any areas of surface cracking in the longer term would be implemented where required.

Whilst the majority of the Modification area would not be subject to agricultural activities, the management of potential subsidence impacts on agricultural activities would be managed in accordance with an approved Land Management Plan. The Land Management Plan would include measures such as:

- notification to agistees of areas of longwall mining and active subsidence;
- exclusion of agistment grazing from areas where surface cracking presents a reasonable risk to people and/or livestock;
- monitoring and repair of fences; and
- management measures in accordance with the Erosion and Sediment Control Plan, including remediation of surface cracks where practicable.

A Land Management Plan would be prepared for the proposed Longwalls 14 to 16 during preparation of the Extraction Plan.

The Modification area would be rehabilitated as per the existing underground mining rehabilitation areas at Wambo as discussed in Section 2.11.

4.4 GROUNDWATER

4.4.1 Background

Hydrogeological Regime

The hydrogeological regime of the Wambo area and surrounds comprises two main systems (Appendix B):

- Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek.

- Underlying Permian strata consisting of:
 - hydrogeologically “tight” and hence very low yielding to essentially dry sandstone and lesser siltstone; and
 - low to moderately permeable coal seams, which are the prime water-bearing strata within the Permian measures.

Alluvial Aquifers

Groundwater flow patterns within the shallow alluvial aquifers reflect topographic levels and the containment of alluvium within the principal drainage pathways (Appendix B).

Evidence indicates that the alluvial aquifer is responsive to rainfall recharge and it is likely that the alluvium plays an important role in supplying recharge to the underlying Permian strata as well as contributing to baseflow of surface water features (Appendix B). Deviations from this trend can be seen in a number of alluvium monitoring bores, which are attributed to impacts associated with approved open cut and underground mining operations.

There are no natural alluvial aquifers located in the immediate vicinity of the Modification area.

Permian Aquifers

Prior to the commencement of mining operations in the region, the piezometric surface within the Permian aquifers of the Wambo area most probably reflected the topography, with elevated water levels/pressures in areas distant from the major drainages and reduced levels in areas adjacent to the alluvial lands (Appendix B).

Historical and ongoing open cut and underground mining within the Wambo area and adjoining mining operations has created a regional zone of depressurisation within the Permian coal measures (Appendix B).

Groundwater Monitoring Program

A Groundwater Monitoring Program (WCPL, 2010c) for Wambo was established in 2005 and details a monitoring programme, groundwater impact assessment criteria, data review and investigation processes, and reporting requirements. WCPL is in the process of revising the approved Groundwater Monitoring Program in consultation with the NOW.

Groundwater levels and quality are generally monitored bi-monthly at each of the groundwater monitoring sites (Figure 6) and results are reported in the Annual Environmental Management Report.

Surface and Groundwater Response Plan

A Surface and Groundwater Response Plan (WCPL, 2010f) for Wambo was established in 2005 and details measures to mitigate potential surface and groundwater impacts. WCPL is in the process of revising the approved Surface and Groundwater Response Plan in consultation with the NOW.

4.4.2 Environmental Review

A cumulative Groundwater Assessment, including the Modification, has been prepared by HydroSimulations (2015) and is presented in Appendix B.

The Groundwater Assessment included predictive modelling of the cumulative groundwater impacts using a three-dimensional numerical model. Detail on the development and calibration of the numerical model is provided in Appendix B.

A summary of the key findings of the Groundwater Assessment is provided below.

Potential Impacts

The main potential impacts on the groundwater regime due to the Modification are as a result of:

- subsurface fracturing and shearing of sedimentary strata above the proposed Longwalls 14 to 16 resulting in changes in bulk rock mass permeability and storage capacity;
- dewatering of groundwater that enters the underground mining area as a result of the above; and
- dewatering of the overlying approved workings in the Whybrow Seam to mitigate inflow risk to the underground mining area.

The potential impacts of the Modification on the groundwater system as a result of these mechanisms is summarised below.

Groundwater Inflows

The peak predicted inflow rates to the South Bates (Whybrow Seam) Underground Mine based on the approved mining layout is approximately 0.34 megalitres per day (ML/day) (Appendix B).

The Modification would result in a combined inflow rate for the modified mining layout of up to 0.49 ML/day (an increase of approximately 54 megalitres per annum) (Appendix B).

The predicted inflows to the South Bates (Wambo Seam) Underground Mine are less than the modelled inflows to the North Wambo Underground Mine that have been managed to date.

Impacts to Permian Aquifers

The Permian coal measures within the South Bates Underground Mine footprint are predicted to be essentially dewatered during mining of the target Whybrow Seam and Wambo Seam (Appendix B).

The Groundwater Assessment (Appendix B) concluded that outside the mine footprint, the main impact from the approved South Bates (Whybrow Seam) Underground Mine on potentiometric pressures within Permian strata would occur to the immediate north-west of the mine. Impacts to the north, north-east, east and south would be minimal due to the influence of neighbouring and the fact that the areas to the north-east are close to subcrop location (Appendix B).

The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally (Appendix B).

HydroSimulations (Appendix B) concluded the Modification would not have significant impact on the recovery of groundwater levels compared to the approved mining layout.

Impacts to Alluvial Aquifers

HydroSimulations (Appendix B) concluded the Modification would cause no discernible additional drawdown in any alluvial aquifer compared with the approved mining layout.

Stream Baseflows

The Modification would have no discernible impact on stream baseflow or natural river leakage for Wollombi Brook, North Wambo Creek, Wambo Creek or Stony Creek, beyond the effects of the approved mining layout (Appendix B). The predominant gaining/losing natures of the streams would also not be altered by the Modification (Appendix B).

HydroSimulations (Appendix B) concludes the Modification would not have a significant impact on the quality of groundwater or surface water around Wambo. The modelling shows no potential for increased flux of more saline water, due to the Modification, from the Permian strata to the alluvium (Appendix B).

Groundwater Users

HydroSimulations (Appendix B) predict that no privately owned registered bores in alluvium or regolith would be affected by drawdown associated with the Modification.

Limited information is available on three privately owned bores in the vicinity of Wambo. Depending on the extraction depth and nature of bores, these bores may experience more than 2 m cumulative drawdown as a result of the approved Wambo operations (Appendix B). The Modification would result in no additional drawdown in these bores.

Aquifer Interference Policy

An assessment of the Modification against the minimal impact considerations in the *NSW Aquifer Interference Policy* (the AIP) (NSW Government, 2012a) was conducted as part of the Groundwater Assessment (Appendix B). The Groundwater Assessment concluded that the Modification is within the 'Level 1' minimal impact considerations outlined in the AIP for highly productive groundwater. Further discussion on the AIP is provided in Attachment 2 and Appendix B.

Mitigation Measures, Management and Monitoring

Alluvial Aquifers

Monitoring would continue to be conducted in accordance with an approved Groundwater Monitoring Program and the Surface Water Monitoring Program.

Consistent with the Surface and Groundwater Response Plan (WCPL, 2010f), in the event that monitoring identifies a groundwater level or quality trigger level exceedance specified in the Groundwater Monitoring Program (WCPL, 2010c), an investigation would be conducted.

Permian Aquifers

WCPL would continue to implement an approved Surface and Groundwater Response Plan in the event a complaint is received in relation to loss of groundwater supply.

Groundwater levels and quality would continue to be monitored at Wambo in accordance with an approved Groundwater Monitoring Program.

4.5 SURFACE WATER

4.5.1 Background

Hydrology

Wambo is situated adjacent to Wollombi Brook, south-west of its confluence with the Hunter River (Figures 1 and 2). Wollombi Brook drains an area of approximately 1,950 square kilometres and joins the Hunter River some 5 km north-east of Wambo. The Wollombi Brook sub-catchment is bound by the Myall Range to the south-east, Doyles Range to the west, the Hunter Range to the south-west and Broken Back Range to the north-east (Hunter Catchment Management Trust, 2002).

The majority of lands within Wambo mining tenements drain via Wambo (also known as 'South Wambo'), Stony, North Wambo and Redbank Creeks to Wollombi Brook, while Waterfall Creek drains directly to the Hunter River (Figure 2).

A section of North Wambo Creek has been diverted to avoid the Wambo open cut (Figure 2). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007). A portion of the North Wambo Creek Diversion (comprising Stages 1 to 3) lies above and directly adjacent to Longwalls 11 to 13 and the proposed Longwalls 14 to 16.

Site Water Management and Monitoring

A summary of the existing site water management is provided in Section 2.9. WCPL annually reviews the site water balance for Wambo and reports the results of this review in the Annual Environmental Management Report.

A Surface and Groundwater Response Plan (WCPL, 2010f) for Wambo was established in 2005 and it details measures to mitigate potential surface and groundwater impacts.

The Erosion and Sediment Control Plan (WCPL, 2010e) for Wambo was established in 2005. The Erosion and Sediment Control Plan identifies potential erosion and sediment sources and details design criteria, inspection and monitoring programmes and reporting requirements.

A Surface Water Monitoring Program (WCPL, 2010d) for Wambo was established in 2005 and details surface water quality, stream flow and creek bed stability monitoring programmes, water quality criteria, data review, and reporting requirements.

Surface water quality is generally monitored monthly at each of the surface water monitoring sites and stream flow is measured at the surface water flow monitoring sites during flow events (Figure 6).

WCPL is in the process of revising the Site Water Management Plan (including the Surface Water Monitoring Program, Erosion and Sediment Control Plan and Surface and Groundwater Response Plan) in consultation with the NOW.

4.5.2 Environmental Review

An assessment of potential subsidence impacts on natural drainage lines in the Modification area and the North Wambo Creek Diversion has been prepared by Advisian (2015) and is presented in Appendix C.

Potential Impacts

North Wambo Creek Diversion

The approved Longwalls 11 to 13 at the South Bates (Whybrow Seam) Underground Mine extend beneath the North Wambo Creek Diversion.

WCPL has designed the proposed Longwalls 14 to 16 to avoid extraction directly beneath the low flow channel of the North Wambo Creek Diversion.

The potential impacts of subsidence from the approved Longwalls 11 to 13 and the proposed Longwalls 14 to 16 on the North Wambo Creek Diversion include (Appendix C):

- possible increased erosion as a result of increased bed gradients;

- possible increased ponding as a result of differential subsidence; and
- possible cracking of the channel bed as a result of tensile strains.

Table 4 presents a summary of the approved and predicted subsidence effects on the North Wambo Creek Diversion.

The main potential for erosion would occur near the upstream edge of the longwalls that underlie the North Wambo Creek Diversion (Appendix C). There is predicted to be only minor increases in gradient as a result of the proposed Longwalls 14 to 16 (Table 4).

Erosion control works will be installed in the channel and over-bank floodplain to protect areas from scour as a result of subsidence due to the approved Longwalls 11 to 13. Given the very minor increases in gradient associated with the proposed Longwalls 14 to 16, Advisian (Appendix C) expects no additional erosion control works would be required. No significant impact on the sediment load in the North Wambo Creek Diversion is expected as a result of the Modification (Appendix C).

The approved Longwalls 11 to 13 in the Whybrow Seam are predicted to lead to ponding along the alignment of the North Wambo Creek Diversion of between 200 m and 250 m long and with a maximum width of approximately 40 m (Appendices A and C). The increase in ponding associated with the proposed Longwalls 14 to 16 is predicted to be about 0.1 m and would lead to a trivial increase in the ponded area compared to the approved Longwalls 11 to 13 (Appendix C).

Table 4
Comparison of Predicted Subsidence Effects on North Wambo Creek Diversion and Stony Creek for the Approved and Modified Mining Layouts

Layout	North Wambo Creek Diversion		Stony Creek	
	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Change in Gradient (%)	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Change in Gradient (%)
Approved Mining Layout (Whybrow Seam Only)	1,950	7.5	400	0.6
Modified Mining Layout (Wambo and Whybrow Seams)	2,750	8.0	675	0.9

Source: After Appendix C.

Ponds have been included as a design feature in the Stage 2 North Wambo Creek Diversion. Advisian (Appendix C) concludes the creation of additional ponds would further enhance the diversity of habitat along the North Wambo Creek Diversion.

Surface cracking will occur along the alignment of the North Wambo Creek Diversion as a result of the approved Longwalls 11 to 13. Further surface cracking is expected to develop where the proposed Longwalls 15 and 16 mine up to low flow channel associated with the North Wambo Creek Diversion (Appendix C).

The Extraction Plan for the approved Longwalls 11 to 13 at the South Bates (Whybrow Seam) Underground Mine will include a remediation plan with measures to promptly seal or fill any surface cracks as cracks are identified. The techniques developed for sealing any cracking that results from the approved Longwalls 11 to 13 would be used to mitigate the potential for any additional leakage due to additional cracking (or re-activation of existing cracks) as a result of the proposed Longwalls 15 and 16 (Appendix C).

Stony Creek and Other Drainage Lines

Advisian (Appendix C) concluded that subsidence associated with the Modification is not predicted to have any noticeable effect on surface levels and grades along Stony Creek. The predicted impact of ponding on minor drainage lines as a result of the proposed Longwalls 14 to 16 is very minor and is not expected to require any additional remedial work (Appendix C).

The bed of Stony Creek in the Modification area comprises large boulders together with gravel and coarse sand which are disconnected from the underlying bedrock, with only occasional exposed rock bars (Appendix C). The Modification would result in minor additional stress along Stony Creek and other minor drainage lines, and the Modification is unlikely to warrant additional remediation work (Appendix C). Any additional cracking at isolated rock bars as a result of the Modification would be managed using techniques developed and used elsewhere at Wambo.

Site Water Balance

The Modification would not include any material changes to the approved water management system, water supply or water demand (Section 3.7). The water demand for Wambo would not materially change as a result of the Modification, as maximum ROM coal production would remain unchanged.

The Groundwater Assessment predicted that the inflows to the South Bates (Wambo Seam) Underground Mine are less than the modelled inflows to the North Wambo Underground Mine that have been managed to date (Section 4.4.2). Therefore, it is expected these inflows could be managed by the approved water management system.

Mitigation Measures, Management and Monitoring

North Wambo Creek Diversion

WCPL would implement an adaptive management approach to manage potential subsidence impacts on the North Wambo Creek Diversion, involving monitoring the development of subsidence and implementation of remediation measures where required. Observed impacts from the approved Longwalls 11 to 13 would be considered in the development of monitoring, mitigation and management measures for the Extraction Plan for the proposed Longwalls 14 to 16.

An Extraction Plan would be prepared for the proposed Longwalls 14 to 16 prior to the commencement of secondary workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA 305-7-2003).

The following measures would be included in the Extraction Plan:

- longitudinal geomorphological surveys conducted along the North Wambo Creek Diversion in the Modification area, including prior to commencement of secondary extraction; immediately following subsidence; and following the completion of any restoration or remediation works;
- creek channel monitoring and implementation of remedial measures to fill or seal channel bed cracking;
- review of measures implemented for the approved Longwalls 11 to 13 to protect areas from scour, with augmentation of localised stabilisation works (e.g. rock armouring and/or large woody debris) or vegetation establishment if required; and
- licensing under the *Water Management Act, 2000* to mitigate against any residual impacts.

Stony Creek and Other Drainage Lines

Advisian (Appendix C) concluded the Modification is unlikely to warrant additional remediation work on Stony Creek and other minor drainage lines.

Trigger Action Response Plans (TARPs) would be developed as part of the Extraction Plan process to outline appropriate triggers and remedial actions in the unlikely event that remediation is required.

Site Water Balance

Water pumped out of the South Bates (Wambo Seam) Underground Mine would be monitored.

The site water balance would be reviewed in consideration of the predicted groundwater inflows and measured water make. The results of the site water balance review would be reported in the Annual Environmental Management Report in accordance with Condition 25, Schedule 4 of the Development Consent (DA 305-7-2003).

4.6 ABORIGINAL CULTURAL HERITAGE

4.6.1 Background

A number of Aboriginal cultural heritage surveys and assessments have previously been undertaken across the Modification area and surrounds.

A comprehensive survey and assessment was undertaken by White (2003) in the area to the east of the Wambo and Jerrys Plains ridgelines (including the Modification area). White (2003) identified several artefact scatters and isolated finds in the Modification area which varied in significance.

A number of open camp sites have been identified outside (downstream) of the Modification area, indicating that the Modification area was likely used for foraging and access to the lower lying areas to the east.

Aboriginal Cultural Heritage Management

Management of Aboriginal cultural heritage at Wambo is currently conducted in accordance with Consent 2222 under section 90 of the *National Parks and Wildlife Act, 1974* and the associated Aboriginal Research Design and Study Plan.

The existing Consent 2222 covers the majority of the Modification area (Figure 10). The Cultural Heritage Impact Assessment (CHIA) provided in Appendix D includes a recommendation to modify the existing Consent 2222 to include the full extent of the Modification area.

4.6.2 Environmental Review

A CHIA was prepared for the Modification by RPS Australia East (RPS) (2015) and is presented in Appendix D.

The CHIA was undertaken in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a), the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b), the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the *Burra Charter* (Australia International Council on Monuments and Sites, 2013).

Assessment Programme

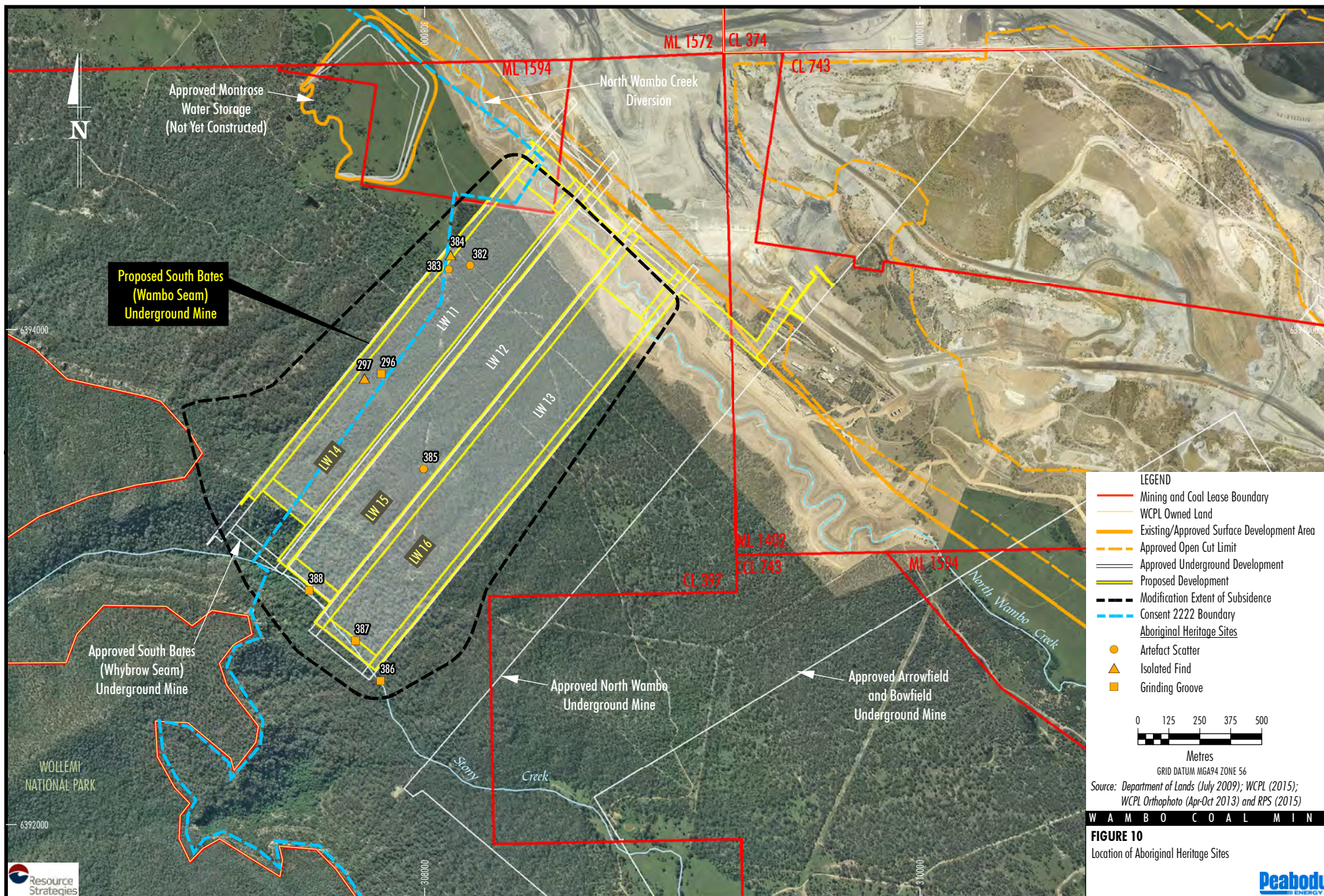
The CHIA (Appendix D) incorporates the results of:

- prior field work and previous studies undertaken by archaeologists and representatives of the Aboriginal community;
- search results from the OEH Aboriginal Heritage Information Management System (AHIMS) database;
- the results of archaeological and cultural surveys of the Modification area conducted by archaeologists and representatives of the Aboriginal community in May and June 2015 (Appendix D); and
- ongoing consultation with the Aboriginal community on the Modification, as well as previous surveys and assessments.

Survey Design

Archaeological and cultural surveys were undertaken to ground truth Aboriginal cultural heritage sites previously recorded within the Modification area, in addition to identifying new sites.

The survey focused on landforms associated with previously identified Aboriginal cultural heritage sites, exposed ground surfaces and also sampling all landform types within the Modification area.



Archaeological Findings

Observed Aboriginal cultural heritage site occurrences were low within the Modification area when compared to the Modification area surrounds and other previously surveyed areas at Wambo.

Seven previously unrecorded Aboriginal cultural heritage sites were identified within the Modification area during the survey. Of these, three were artefact scatters (i.e. Wambo Sites 382, 383 and 385), one was an isolated find (i.e. Wambo Site 348) and three were grinding groove sites (i.e. Wambo Sites 386, 387 and 388) (Figure 10).

Two previously recorded Aboriginal cultural heritage sites are also located within the Modification area, including an isolated find and a grinding groove site situated on a sandstone boulder (i.e. Wambo Sites 297 and 296, respectively). The isolated find was not able to be relocated during the Modification surveys and may have been washed away during recent rainfall events.

A detailed description of the nine Aboriginal cultural heritage sites within the Modification area is provided in Appendix D and locations are shown on Figure 10.

Archaeological and Cultural Heritage Values

As part of the CHIA, archaeological significance was assessed in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).

RPS (Appendix D) concluded that all of the Aboriginal cultural heritage sites within the Modification area were of a low archaeological significance at a regional level. At a local level, Wambo Sites 296, 386, 387 and 388 (i.e. grinding groove sites) were considered to be of moderate archaeological significance.

Separate to the archaeological significance assessment, RAPs were requested to provide comment in regard to the cultural significance of the Modification area and Aboriginal cultural heritage sites within it. Based on the comments received, the RAPs identified that all Aboriginal cultural heritage sites and objects, in particular grinding groove sites, are of cultural significance (Appendix D).

Potential Impacts

Potential impacts of the Modification on Aboriginal cultural heritage sites would be associated with (Appendix D):

- subsidence impacts from the extraction of the proposed Longwalls 14 to 16 beneath the approved Longwalls 11 to 13; and
- direct disturbance associated with subsidence remediation activities, if required.

Subsidence Impacts

Subsidence movements can potentially result in surface cracking, resulting in impacts to Aboriginal cultural heritage sites where they coincide with any cracking.

Aboriginal cultural heritage sites are located across the Modification area and would be subject to the full range of predicted subsidence effects (Section 4.2.2). Individual predictions for the nine known Aboriginal cultural heritage site are presented in Appendices A and D.

Open artefact sites are not particularly susceptible to subsidence impacts (Appendices A and D). The potential mining induced curvatures and strains as a result of the Modification could result in surface cracking in the vicinity of the Aboriginal cultural heritage sites located directly above the proposed Longwalls 14 to 16 (Appendix A). However, MSEC considers it unlikely that the artefact scatters or isolated finds themselves would be adversely impacted as a result of the Modification (Appendix D).

Subsidence impacts on rock-based sites (such as grinding grooves) have been defined in terms of cracking potential (Appendix A). The risk of cracking at these sites has been assessed as “very unlikely” (Wambo Site 386), “unlikely” (Wambo Sites 296 and 388) and “possible” (Wambo Site 387) (Appendix D).

MSEC (Appendix A) concluded that the incremental subsidence likely to result from the Modification would not change the likelihood of impact on any of the Aboriginal cultural heritage sites (i.e. the risk category of the potential for adverse impacts for all Aboriginal cultural heritage sites remains unchanged).

RPS (Appendix D) concluded that the Modification would not substantially increase cumulative impacts to Aboriginal heritage in the region, in consideration of the nature and scale of historic and ongoing land disturbance processes in the region, the nature and extent of identified and likely Aboriginal cultural heritage sites within the Modification area, and the nature and scale of potential impacts associated with the Modification.

Direct Disturbance

The Modification would not result in any material additional land disturbance. Direct disturbance to the Aboriginal cultural heritage sites within the Modification area would be limited to impacts associated with vehicular movements and minor subsidence remediation works (Appendix D).

Vehicular movements in the Modification area would be limited to those required for monitoring and general site maintenance activities and would generally be on existing tracks. If required, any subsidence remediation works would be located to minimise impacts on Aboriginal cultural heritage sites wherever possible.

Mitigation Measures, Management and Monitoring

Given the low risk of potential impacts to artefact scatters and isolated finds, WCPL intends to leave these sites *in situ*, subject to subsidence monitoring. If monitoring identifies cracking or erosion in proximity to an artefact scatter or isolated find, WCPL would salvage and transfer the artefact(s) to the temporary keeping place (subject to the relevant Aboriginal Heritage Impact Permit and in consultation with the relevant RAPs) (Appendix D).

Prior to the commencement of longwall mining associated with the Modification, all grinding groove sites would be archivally recorded (Wambo Sites 296, 386, 387 and 388).

With regard to Wambo Sites 387 and 296, engineering solutions to prevent cracking or to minimise movement of the grinding groove would be considered by WCPL (e.g. installation of stress relief slots and/or stabilisation/removal of the sandstone boulder) as part of the development of the Extraction Plan. Any such works would be designed in consultation with the Aboriginal community and would consider the potential impacts of any mitigation works on the values of the site compared to the unmitigated potential impacts.

Consistent with current site procedures, if any previously unrecorded Aboriginal cultural heritage sites are identified during the course of the Modification, surface works in that area would cease until the site has been recorded. Any new Aboriginal cultural heritage sites would be managed in accordance with management measures for similar sites previously identified, in consultation with the RAPs.

In the event skeletal remains are discovered, surface work would cease in that area and the NSW Police Coroner and OEH would be contacted to determine if the material is of Aboriginal origin. If determined to be of Aboriginal origin, an action plan for the management of the skeletal remains would be developed in consultation with OEH and the RAPs prior to any further surface works commencing in that area.

As described in Section 4.6.1, the existing Consent 2222 covers the majority of the Modification area (Figure 10). As recommended in Appendix D, WCPL would apply for a variation to the existing Consent to cover the remaining portion of the Modification area not covered by Consent 2222.

4.7 FLORA

4.7.1 Background

A flora assessment was conducted by Orchid Research (2003) for the Wambo Development Project in 2003. Areas of remnant vegetation were systematically surveyed using quadrats and spot sampling sites to compile a comprehensive species list and to detect threatened species which may have been present.

Remnant vegetation was dominated by eucalypt forests and woodlands, however thin strips of River She-oak (*Casuarina cunninghamiana*) were reported to occur along North Wambo Creek, Wambo Creek, Stony Creek and Wollombi Brook. Sand dune heathy woodlands were also reported to be present.

A number of tree species including Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*) and Bulloak (*Allocasuarina luehmannii*) were widespread and common, and associated within many other species. Other dominant tree species included Spotted Gum (*Corymbia maculata*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Rough-barked Apple (*Angophora floribunda*) and Drooping She-oak (*Allocasuarina verticillata*).

No threatened flora species or populations listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) were recorded at Wambo by Orchid Research (2003).

Orchid Research (2003) recorded two threatened ecological communities in the vicinity of Wambo, namely the Warkworth Sands Woodland Endangered Ecological Community (EEC) (listed in the TSC Act) and the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands EEC (listed in the TSC Act and EPBC Act).

Flora and Fauna Management Plan

A Flora and Fauna Management Plan (WCPL, 2014b) is implemented at Wambo and includes a vegetation clearance protocol, threatened species management protocol, RWEPP management measures, rehabilitation programme and rehabilitation and RWEPP monitoring programmes.

4.7.2 Environmental Review

A Flora Assessment was prepared for the Modification by FloraSearch (2015) and is presented in Appendix E. The impact of the Modification on threatened flora species, populations and communities was assessed in consideration of the *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation [DEC] and Department of Primary Industries [DPI], 2005).

Flora Surveys

Flora surveys were conducted in the Modification area and surrounds over 5 days in the periods of 12 to 14 May 2015 and 2 to 3 July 2015. These surveys were supported by data collected by FloraSearch in 2012 and Orchid Research (2003) over the wider Wambo area.

Vegetation was systematically surveyed using quadrats, spot sampling and random meanders. Target searches for threatened flora species were conducted in areas of suitable habitat as part of the field surveys. The locations of spot and quadrat sampling sites are shown in Appendix E.

Table 5
Vegetation Communities within the Modification Area

Community Number	Common Name	Scientific Names
1	White Cedar – Rusty Fig dry rainforest	<i>Melia azedarach</i> – <i>Ficus rubiginosa</i>
2	Spotted Gum – Grey Myrtle sheltered forest	<i>Corymbia maculata</i> – <i>Backhousia myrtifolia</i>
2a	White Mahogany – Rough-barked Apple riparian forest	<i>Eucalyptus acmenoides</i> – <i>Angophora floribunda</i>
3	Narrow-leaved Ironbark shrub – grass woodland	<i>Eucalyptus crebra</i> – <i>E. moluccana</i> – <i>Allocasuarina luehmannii</i>
3a	Narrow-leaved Ironbark – Coast Myall shrubby woodland	<i>Eucalyptus crebra</i> – <i>Acacia binervia</i> – <i>A. luehmannii</i>
4	<i>Melaleuca decora</i> low forest	<i>Melaleuca decora</i> – <i>E. crebra</i> – <i>E. punctata</i> – <i>E. moluccana</i> – <i>A. luehmannii</i>
5	Slaty Box shrubby woodland	<i>E. dawsonii</i> – <i>E. crebra</i> – <i>A. luehmannii</i>
5a	Slaty Box shrubby woodland – disturbed	<i>E. dawsonii</i> – <i>E. crebra</i> – <i>A. luehmannii</i>
5b	Slaty Box – Coast Myall shrubby woodland	<i>E. dawsonii</i> – <i>A. binervia</i>
6	Narrow-leaved Stringybark – Large-fruited Grey Gum shrubby open forest	<i>E. sparsifolia</i> – <i>E. punctata</i>
7	Coast Myall shrubland	<i>A. binervia</i>
8	Derived Grassland	<i>Austrostipa personata</i>

Source: Appendix E.

As a component of the baseline flora surveys, a number of reference sources were reviewed, including previous relevant surveys, database records (e.g. BioNet website) and other scientific studies and literature. Where appropriate, these reference sources were included in the assessment of existing vegetation.

Vegetation Communities

A total of eight broad vegetation communities (with some variants) have been mapped within the Modification area (Figure 11 and Table 5). A detailed description of these vegetation communities is provided in Appendix E.

Condition of Vegetation

The majority of land in the Modification area comprises forest and woodland that has been set aside as part of the RWEP. Livestock grazing is excluded from this land.

The general condition of vegetation in the Modification area was found to be in very good condition, with the exception of a small area of cleared derived grassland (Appendix E).

Vegetation in derived grassland on the flat valley floor in the north of the Modification area was found to be in poor condition, with the majority of original native tree and shrub cover previously cleared (Appendix E).

Threatened Flora Species

One flora species listed in the schedules of the TSC Act (the Small-flower Grevillea [*Grevillea parviflora* subsp. *parviflora*]) was identified during the survey, however it is located outside the Modification area (Appendix E).

No flora species listed in the schedules of the EPBC Act were recorded during targeted searches or other sampling conducted within the Modification area and surrounds (Appendix E).

Threatened Populations

No flora populations listed in the schedules of the TSC Act and/or the EPBC Act were recorded during targeted searches or other sampling conducted within the Modification area and surrounds (Appendix E).

Threatened Ecological Communities

Two threatened ecological communities listed in the TSC Act were recorded during the recent survey within the Modification area, namely the:

- *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* EEC (Community 3 on Figure 11); and
- *Hunter Valley Footslopes Slaty Box Woodland in the Sydney Basin Bioregion* Vulnerable Ecological Community (VEC) (Community 5 on Figure 11).

One threatened ecological community listed in the EPBC Act was recorded during the recent survey within the Modification area, namely the *Central Hunter Valley Eucalypt Forest and Woodland* Critically Endangered Ecological Community (Communities 3 and 5 on Figure 11).

A detailed description of the threatened ecological communities is provided in Appendix E.

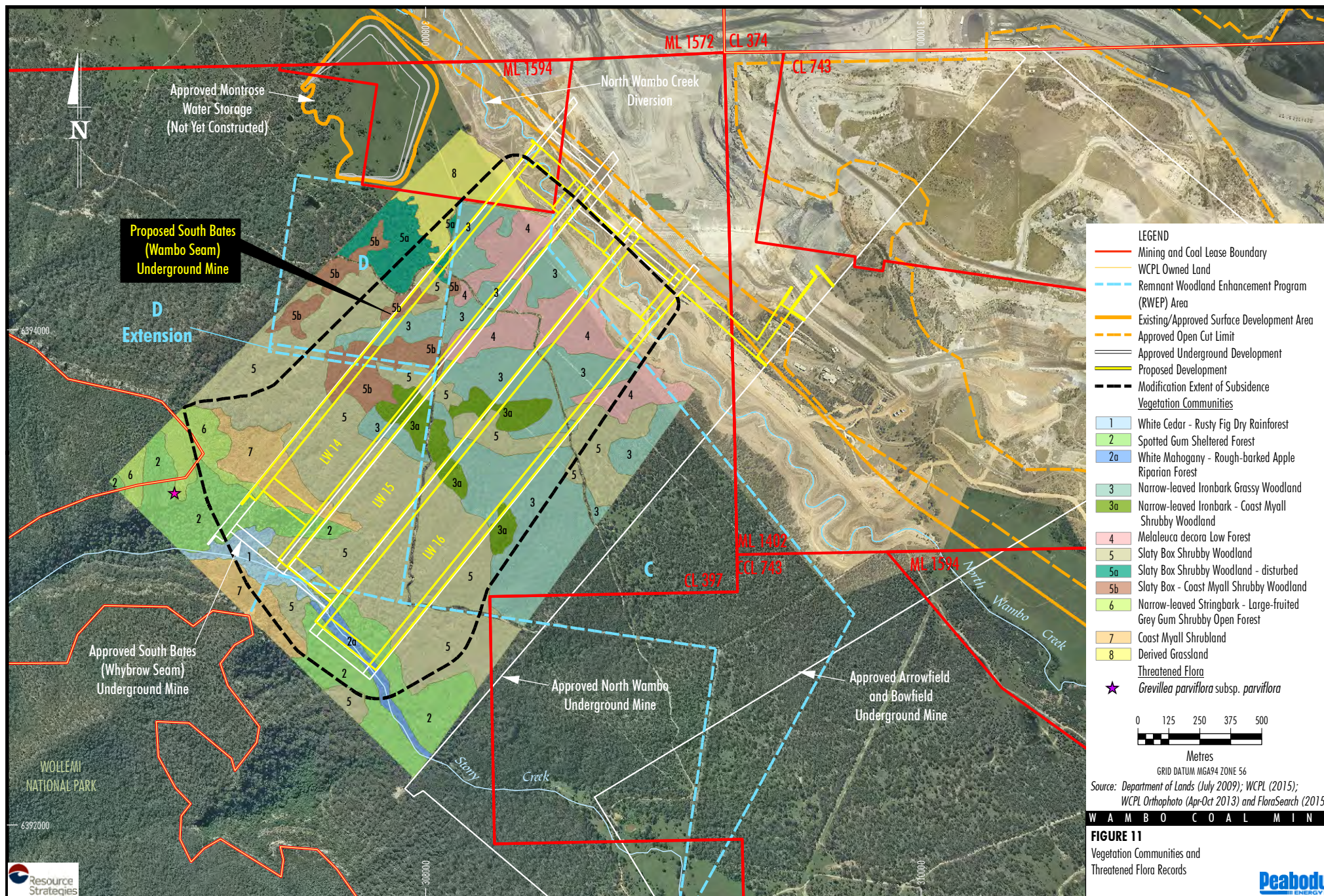
Potential Impacts

Potential flora impacts of the Modification would primarily be associated with subsidence impacts from the extraction of the proposed Longwalls 14 to 16.

FloraSearch (Appendix E) concluded that it is unlikely that vegetation within the Modification area would be adversely affected by mine subsidence. This conclusion is supported by inspection of previously undermined areas to the east of the Modification area, which showed that despite evidence of surface cracking of the soil, the condition of the vegetation on the undermined area was not noticeably different from that on adjacent similar unmined areas and showed no signs of dieback (Appendix E).

Ponding as a result of subsidence is expected to be restricted to the North Wambo Creek Diversion where no natural vegetation community has developed. As such, ponding would not be expected to adversely impact any natural vegetation (Appendix E).

FloraSearch (Appendix E) concluded that the Modification would have no significant impact on threatened flora species, populations, ecological communities or critical habitat.



Mitigation Measures, Management and Monitoring

Flora management and monitoring at Wambo would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2014b) or its revisions.

WCPL considers that no specific or additional mitigation measures, management or monitoring of flora are required for the Modification.

4.8 FAUNA

4.8.1 Background

A number of ecological studies have been undertaken previously within the Wambo area and surrounds, including routine ecological monitoring surveys commissioned by WCPL.

A relatively high diversity of animals have been recorded by previous surveys within the Wambo area attributed to the proximity of the site to Wollemi National Park and a variety of habitat types present (Niche Environment and Heritage, 2014).

A total of 25 threatened fauna species have been previously recorded in the vicinity of Wambo by previous surveys, including 17 birds and 8 mammals (WCPL, 2014b).

4.8.2 Environmental Review

A Fauna Assessment was prepared for the Modification by Eco Logical Australia (Eco Logical) (2015) and is presented in Appendix F. The impact of the Modification on threatened fauna was assessed in consideration of the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) and the *Significant Impact Guideline 1.1 – Matters of National Environmental Significance* (Commonwealth Department of the Environment [DoE], 2013).

Field Surveys

Fauna surveys were conducted in the Modification area and surrounds over 5 days in the period of 4 to 8 May 2015.

The field assessment consisted of fauna habitat mapping and targeted surveys for diurnal birds and microbats, as well as opportunistic recordings of all fauna species identified. Fauna habitat features within the Modification area were identified, with surveys targeting rocks and outcrops that may provide potential microbat cave roosting habitat.

Fauna Habitat

A large connected patch of remnant vegetation occurs within and adjacent to the Modification area, connecting it to wooded areas to the south, west and east and connecting with remnant vegetation associated with the Wollemi National Park (Appendix F).

Eco Logical (Appendix F) identified a number of fauna habitat types within the Modification area, comprising mostly of shrubby woodlands dominated by gum and ironbark species on lower footslopes and flats. Historical land practices have reduced the density of hollow-bearing trees to the extent they are uncommon in the lower relief areas. Habitat types are described in detail in Appendix F.

The portion of Stony Creek in the Modification area provides cavernous habitat and shelter for reptiles, frogs, land mammals and bats (Appendix F).

Exposed rock faces associated with the Stony Creek valley and Wollemi Escarpment contain caves, crevices and sinkholes that provide habitat for cave roosting (subterranean) microbats, as well as reptiles and other mammal species (Appendix F).

Native Fauna Species

A total of 85 fauna species were recorded during the field surveys comprising 62 birds, eight non-flying mammals, eight microbats, three reptiles and four frogs (Appendix F).

The following threatened species were recorded by the field surveys (Appendix F):

- *Glossopsitta pusilla* (Little Lorikeet);
- *Callocephalon fimbriatum* (Gang Gang Cockatoo);
- *Chthonicola sagittata* (Speckled Warbler);
- *Daphoenositta chrysoptera* (Varied Sittella);
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat); and
- *Mormopterus norfolkensis* (Eastern Free-tail Bat).

Habitat requirements for observed and potentially occurring threatened species were compared with the Modification area's characteristics to determine the likelihood of occurrence for each species.

Eco Logical (Appendix F) concluded that 40 threatened fauna species listed under the TSC Act and/or the EPBC Act occur, or have the potential to occur within the Modification area.

Potential Impacts

Eco Logical (Appendix F) concluded that the potential impacts of subsidence would be minimal and the Modification is not expected to result in the loss of vegetation cover or community structure.

Fauna habitat would not be directly impacted by the occurrence of subsidence.

Subsidence-induced rock fall and surface cracking may potentially result in direct mortality of animals (including cave roosting bats). However, the potential impacts of such events are expected to be short-term and insignificant (Appendix F).

There would be no clearance of woodland as a result of the Modification, and as such no potential for fragmentation of fauna habitat or community.

Eco Logical (Appendix F) concluded that the Modification is unlikely to result in any significant impacts to threatened fauna and cumulative impacts associated with the Modification are expected to be negligible.

Mitigation Measures, Management and Monitoring

Fauna management and monitoring at Wambo would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2014b) or its revisions.

WCPL considers that no specific or additional mitigation measures, management or monitoring of fauna are required for the Modification.

4.9 OTHER ENVIRONMENTAL ASPECTS

4.9.1 Greenhouse Gas Emissions

In accordance with the National Greenhouse Accounts Factors (NGA Factors) (DoE, 2014), direct greenhouse gas emissions are referred to as Scope 1 emissions, and indirect emissions are referred to as Scopes 2 and 3 emissions.

The major sources of greenhouse gas emissions at Wambo include;

- combustion of diesel during mining operations (Scope 1);
- use of explosives (Scope 1);
- fugitive emissions of methane (Scope 1);
- off-site generation of electricity that is consumed at Wambo (Scope 2); and
- combustion of product coal produced at Wambo by third parties (Scope 3).

Holmes Air Sciences (2003) calculated the following predicted greenhouse gas emissions from Wambo over the 21 year life:

- combustion of diesel, use of explosives, fugitive emissions and generation of electricity consumed on-site (Scopes 1 and 2) – 45.4 Mt carbon dioxide-equivalent (CO₂-e); and
- combustion of product coal by third parties (Scope 3) – 157 Mt CO₂-e.

Incremental greenhouse gas emissions associated with the Modification would be related to underground mining (i.e. additional diesel and electricity consumption and fugitive emissions) and the processing, transportation and downstream use of the additional ROM coal.

An assessment of the incremental greenhouse gas emissions (Scopes 1, 2 and 3) for the Modification was conducted using empirical emission factors provided by the NGA Factors (DoE, 2014) and site-specific data for fugitive emissions.

Incremental greenhouse gas emissions associated with the Modification would be related to increased:

- combustion of diesel for underground mining operations (approximately 3.4 kilotonnes [kt] of CO₂-e of Scope 1 and 0.3 kt CO₂-e of Scope 3 emissions);
- consumption of electricity for underground activities, in ROM coal processing and at the Wambo Coal Terminal (approximately 68 kt CO₂-e of Scope 2 and 10 kt CO₂-e of Scope 3 emissions);
- fugitive emissions from the extraction of coal and coal stockpiling (approximately 1.0 Mt CO₂-e of Scope 1 emissions); and
- combustion of product coal produced at Wambo by third parties (approximately 10.5 Mt CO₂-e of Scope 3 emissions).

WCPL is currently implementing a number of measures to minimise, to the greatest extent practicable, greenhouse gas emissions from Wambo. Relevant measures are described below:

- maximising energy efficiency as a key consideration in the development of the mine plan. For example, significant savings of greenhouse gas emissions (through increased energy efficiency) are achieved by mine planning decisions for coal and waste rock transport and therefore fuel use;
- installation of Power Factor Correction equipment in the CHPP; and
- potential investigation into the beneficial reuse of methane gas at Wambo.

4.9.2 Non-Aboriginal Cultural Heritage

A CHIA was prepared for the Modification by RPS (2015) and is presented in Appendix D. The Cultural Heritage Impact Assessment reviewed previous heritage studies and local, State and National heritage registers (Appendix D).

RPS (2015) concluded that there are no items of non-Aboriginal heritage significance in the vicinity of the Modification area.

4.9.3 Hazard and Risk

A preliminary hazard analysis (PHA) was conducted in 2003 to assess the potential hazards and risks associated with Wambo. The PHA comprised a qualitative assessment of risks to the public, property and the environment associated with the development and operations of Wambo (Resource Strategies, 2003b). The PHA was conducted in accordance with the general principles of risk evaluation and assessment provided in *Multi-Level Risk Assessment* (NSW Department of Urban Affairs and Planning, 1999).

The PHA identified no incremental risks posing significant off-site impacts (Resource Strategies, 2003b).

It is considered that the Modification would not change the existing potential risk areas identified in the PHA conducted for Wambo as the proposed activities associated with the Modification (e.g. underground mining operations) are consistent with the activities assessed in the PHA. However, environmental management plans and monitoring programmes would be reviewed, and if necessary, revised to include the Modification and manage any associated environmental risks.

5 STATUTORY CONTEXT

5.1 APPLICABILITY OF SECTION 75W OF ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

Wambo was approved under Part 4 of the EP&A Act in February 2004 (Development Consent DA 305-7-2003 – Attachment 1).

As outlined in Section 1.3, WCPL consulted with the DP&E in June 2015 with regards to seeking the necessary approvals for the Modification and based on this consultation, this EA has been prepared under section 75W of the EP&A Act.

Clause 12 of Schedule 6A of the EP&A Act provides that section 75W of Part 3A of the EP&A Act continues to apply to modifications of development consents referred to in clause 8J(8) of the *Environmental Planning and Assessment Regulation, 2000* (EP&A Regulation) following the repeal of Part 3A.

Wambo was approved under Part 4 of the EP&A Act in February 2004 by development consent under Division 4 of Part 4 of the Act (relating to State significant development). Therefore the Development Consent (DA 305-7-2003) is a development consent that falls within clause 8J(8)(c) of the EP&A Regulation. That is, section 75W of the EP&A Act continues to apply to modifications to the Wambo Development Consent (DA 305-7-2003), notwithstanding its repeal.¹

Approval for the Modification will be sought as a modification to the Development Consent (DA 305-7-2003) under section 75W of the EP&A Act. Section 75W of the EP&A Act relevantly provides:

75W Modification of Minister's approval

(1) In this section:

Minister's approval means an approval to carry out a project under this Part, and includes an approval of a concept plan.

modification of approval means changing the terms of a Minister's approval, including:

(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and

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

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

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

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

...

5.2 GENERAL STATUTORY REQUIREMENTS

Environmental Planning Instruments

The following environmental planning instruments may be potentially relevant to Wambo:

- *Singleton Local Environmental Plan 2013* (Singleton LEP);
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP);
- *State Environmental Planning Policy No 33 – Hazardous and Offensive Development* (SEPP 33);
- *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44); and
- *State Environmental Planning Policy No 55 – Remediation of Land* (SEPP 55).

These environmental planning instruments are discussed further in Attachment 2. The Modification is not inconsistent with these environmental planning instruments.

¹ Part 3A of the EP&A Act (as in force immediately before its repeal) continues to apply for Wambo. The description and quotations of relevant references to clauses of Part 3A in this document are as if Part 3A of the EP&A Act is still in force.

NSW Government Policy

In September 2012, the NSW Government released the following policy documents potentially relevant to the Modification:

- *Aquifer Interference Policy (AIP)* (NSW Government, 2012a); and
- *Strategic Regional Land Use Policy* (NSW Government, 2012b).

The relevance of these policy documents to the Modification are discussed further in Attachment 2.

Commonwealth Environment Protection and Biodiversity Conservation Act, 1999

The objective of the EPBC Act is to provide for the protection of those aspects of the environment that are of *national* environmental significance. Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a controlled action under the EPBC Act.

Proposals that are, or may be, a controlled action are required to be referred to the DoE to determine whether or not the action is a controlled action.

Wambo was referred to the Commonwealth Department of Environment and Heritage (now DoE) due to the potential for impacts to occur to the following matters of national environmental significance under the EPBC Act:

- Listed threatened species and ecological communities.
- Listed migratory species.

Wambo was determined to be a *controlled action* under the EPBC Act (EPBC 2003/1138) and was subsequently approved on 23 November 2004.

The potential impacts of the Modification on flora and fauna have been assessed in Appendices E and F and summarised in Sections 4.7 and 4.8 respectively. These assessments indicate that there would be no significant impact on threatened species, populations and communities and migratory species listed under the EPBC Act as a result of the Modification.

The potential impacts of the Modification on water resources have been assessed in Appendices B and C and summarised in Sections 4.4 and 4.5. These assessments indicate:

- The Modification would cause no discernible additional drawdown in any alluvial aquifer compared with the approved mining layout.
- The Modification would have no discernible impact on stream baseflow or natural river leakage for Wollombi Brook, North Wambo Creek, Wambo Creek or Stony Creek, beyond the effects of the approved mining layout.
- The Modification would have no significant impact on the quality of groundwater or surface water around Wambo.
- The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally.
- The Modification would result in minor additional stress along Stony Creek and other minor drainage lines, and the Modification is unlikely to warrant additional remediation work
- No significant impact on the sediment load in the North Wambo Creek Diversion is expected as a result of the Modification.

In addition, WCPL and Peabody Energy hold adequate licence entitlement under a state water resource plan to account for the potential take of water associated with the Modification.

It is therefore considered that there is no need to refer the Modification to the Commonwealth Minister for the Environment.

5.3 MANAGEMENT PLANS

An Extraction Plan would be prepared for the South Bates (Wambo Seam) Underground Mine prior to the commencement of secondary workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

WCPL is in the process of revising the Site Water Management Plan for Wambo and will include monitoring and mitigation measures for the South Bates (Wambo Seam) Underground Mine.

WCPL considers that no other management plans require revision to include the Modification.

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