



WAMBO COAL PTY LIMITED

**SOUTH WAMBO
UNDERGROUND MINE MODIFICATION
ENVIRONMENTAL ASSESSMENT**

**For the Modification of DA 305-7-2003 (MOD 12)
The Realignment and Extension/Relocation of the
Approved South Wambo Underground Mine**

April 2016

Peabody
ENERGY



WAMBO COAL PTY LIMITED

SOUTH WAMBO UNDERGROUND MINE MODIFICATION

ENVIRONMENTAL ASSESSMENT

(Modification 12 to DA 305-7-2003)

PROJECT NO. WAM-09-15

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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 is provided in Table ES-1.

ES1.2 DESCRIPTION OF THE MODIFICATION

Mining of the South Wambo (Arrowfield and Bowfield Seams) Underground Mine was assessed as part of the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003) and approved under the Development Consent (DA 305-7-2003).

Following further mine planning for the approved South Wambo Underground Mine, which considered recent exploration results, WCPL has identified a modified mine arrangement which can be mined more economically and efficiently than the approved mine arrangement.

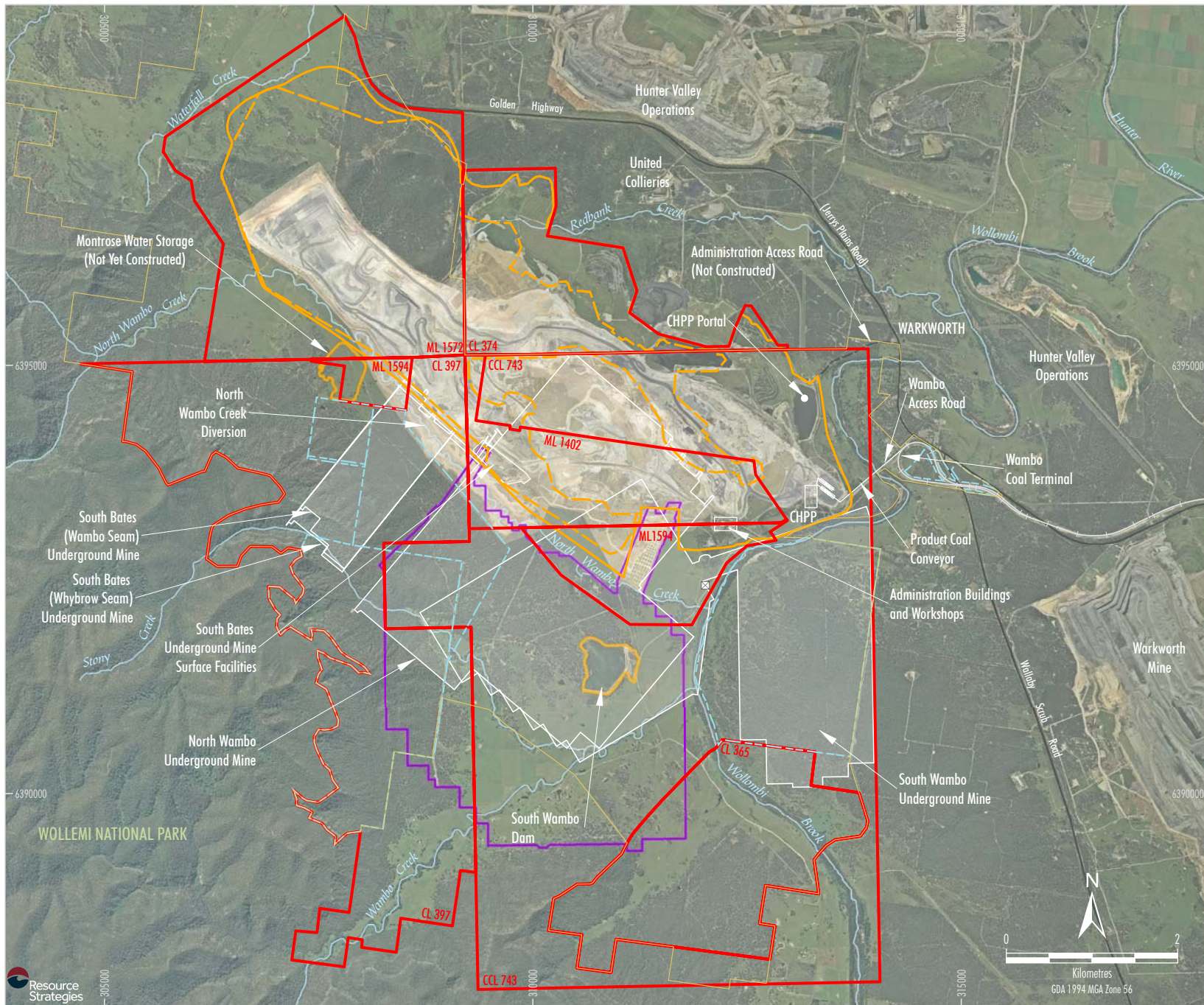
Table ES-1
Summary of the Approved Wambo Coal Mine

Component	Approved Wambo ¹
Life of Mine	<ul style="list-style-type: none"> 21 years (i.e. until 1 March 2025).
Open Cut Mining	<ul style="list-style-type: none"> 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 to March 2017.
Underground Mining	<ul style="list-style-type: none"> 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 114.9 Mt.²
Subsidence Commitments and Management	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Up to 14.7 Mtpa of ROM coal.
Total ROM Coal Mined	<ul style="list-style-type: none"> 212.9 Mt.
Waste Rock Management	<ul style="list-style-type: none"> Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations.
Total Waste Rock	<ul style="list-style-type: none"> 640 million bank cubic metres (Mbcm).
Coal Washing	<ul style="list-style-type: none"> Coal Handling and Preparation Plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph).
Product Coal	<ul style="list-style-type: none"> Production of up to 11.3 Mtpa of thermal coal predominantly for export.
CHPP Reject Management	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Approximately 29.3 Mt of coarse rejects and approximately 19.4 Mt of tailings.
Water Supply	<ul style="list-style-type: none"> 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.
Surface Facilities	<ul style="list-style-type: none"> Construction of surface facilities within the approved surface development area.
Mining Tenements	<ul style="list-style-type: none"> Coal Lease (CL) 365, CL 374, CL 397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML 1572, ML 1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

Note: Italicised components would be modified by the Modification.

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

² Excludes 23 Mt of Bowfield Seam reserves remaining after the 21 year approval period sought as part of the Development Application (DA 305-7-2003) and as described in the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003).



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - - - Approved Open Cut Limit
 - Approved Underground Development
 - Previous Underground Workings in Whybrow Seam
 - ⊠ Approved Ventilation Shaft
 - - - Remnant Woodland Enhancement Program (RWEPP) Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)


WAMBO COAL MINE
 Approved Wambo Coal Mine
 General Arrangement

Figure ES-1

This proposed rearrangement of South Wambo Underground Mine is referred to as the South Wambo Underground Mine Modification (the Modification).

The Modification would involve:

- a realignment and extension/relocation of the approved South Wambo Underground Mine longwall panels;
- mining of the Woodlands Hill Seam rather than the Bowfield Seam;
- a minor extension of the approved surface development area;
- an extension of the approved mine life by 7 years (i.e. up to and including 2032);
- an increase in the underground mine ROM coal production rate from 7.5 to 9.75 Mtpa (with no change to the approved total ROM coal production rate of 14.7 Mtpa); and
- an extension of approved open cut mining operations by 3 years (with no change to the approved total open cut ROM coal production limit, open cut extent or open cut mine fleet).

The modified mine layout of South Wambo Underground Mine is shown on Figure ES-2.

The Modification would not involve changes to any aspects of the approved North Wambo Underground Mine or South Bates Underground Mine.

Interaction with the United and Wambo Open Cut Coal Mine Project

WCPL and United Collieries have formed a joint venture over the tenements adjoining this proposed Modification in relation to the United and Wambo Open Cut Coal Mine Project (SSD 15_7142).

The United and Wambo Open Cut Coal Mine Project seeks to combine the existing open cut operations at Wambo with a proposed new open cut coal mine at the United Collieries. Wambo's CHPP and underground operations do not form part of the joint venture, and will continue to be owned and operated by WCPL.

This Modification is independent of, and not reliant on, the proposed United and Wambo Open Cut Coal Mine Project. However, it is noted that the extension to the life of the open cut operations seeks to maintain operational continuity of the open cut operations to allow for assessment and determination of the United and Wambo Open Cut Coal Mine Project.

ES1.3 ENVIRONMENTAL REVIEW

The potential environmental consequences of the Modification are primarily associated with:

- impacts due to vegetation clearance and/or disturbance for additional surface infrastructure;
- potential impacts (and benefits) due to changes in subsidence between the approved mine layout and the modified mine layout; and
- changes in the duration of some impacts due to the proposed extension in the life of Wambo.

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 key issues. 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.

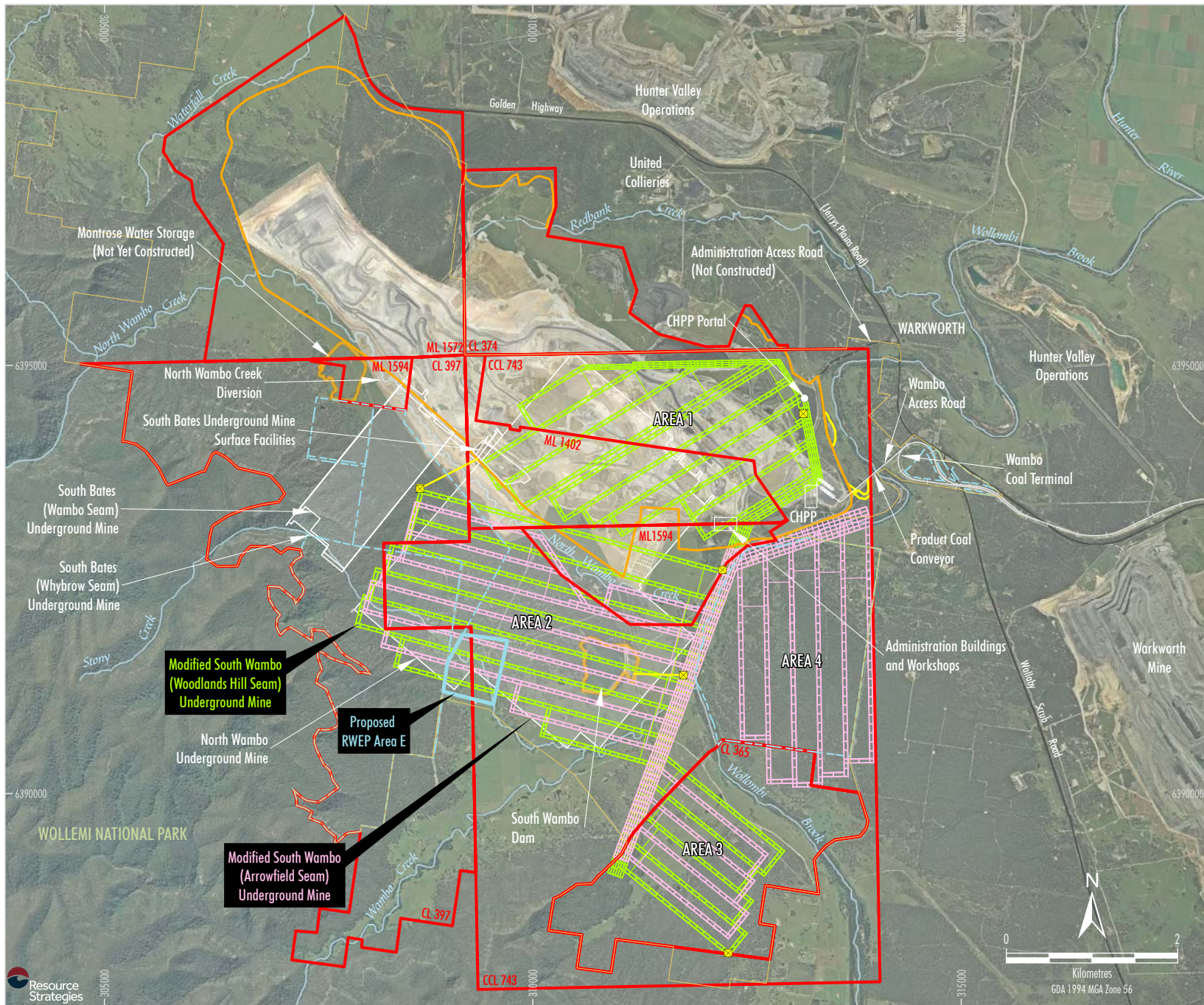
Additional mitigation measures, management and monitoring proposed for the Modification are summarised in Table ES-3.

Extraction Plans would be prepared for longwalls in the Woodlands Hill Seam and Arrowfield Seam prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

The following management plans would be reviewed, and if necessary, revised to include the Modification (subject to approval of the Modification):

- Erosion and Sediment Control Plan;
- Groundwater Monitoring Program;
- Flora and Fauna Management Plan; and
- Life of Mine Rejects Emplacement Strategy.

The Wambo Homestead Complex Mine Management Plan would also be revised and approved prior to any future secondary extraction within the Wambo Homestead Complex curtilage.



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - Modified Surface Development Area
 - Approved Underground Development
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - ⊠ Modified Ventilation Shaft
 - - - Remnant Woodland Enhancement Program (RWEP) Area
 - Proposed Offset Area
 - RWEP Area E

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

Figure ES-2

**Table ES-2
Subsidence Impact Performance Measures**

Feature¹	Subsidence Impact Performance Measure¹	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 not expected to experience any measurable tilts, curvatures or ground strains from the modified mine layout. This performance measure can continue to be achieved.
Wollemi National Park	Negligible subsidence impacts. Negligible environmental consequences.	Wollemi National Park is not expected to experience any measurable tilts, curvatures or ground strains from the modified mine layout. 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 above Area 4 of the modified mine layout (Figure ES-2). The potential subsidence impacts and environmental consequences in Area 4 would reduce as a result of 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 has not been mapped above the modified mine layout. 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. Potential impacts to vegetation associated with the potential for ponding would generally be lower for the modified mine layout than for the approved mine layout. 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 main homestead building and the majority of the building structures would not be impacted by subsidence from the modified mine layout. The predicted additional subsidence at the Mounting Yard and Horse Boxes due to the modified mine layout is small when compared with the subsidence predicted to have already occurred due to previous mining. These two structures are unlikely to experience adverse impacts on the building structure as a result of 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.

¹ 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	<ul style="list-style-type: none"> WCPL owns the infrastructure and improvements potentially affected by subsidence from the modified mine layout, with the exception of an 11 kilovolt electricity transmission line owned by Ausgrid. 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. 	<ul style="list-style-type: none"> A Built Features Management Plan would be prepared during preparation of the Extraction Plans for the South Wambo Underground Mine.
Land Resources	<ul style="list-style-type: none"> There would be no significant change to the long-term agricultural productivity of the Modification area. Mitigation measures and management would be required to minimise potential risk to agistment grazing of beef cattle within areas of active subsidence. Approximately 4.5 ha of potential agricultural land would be directly impacted by the Modification, with some of this land progressively remediated to agricultural land. The extension to the Remnant Woodland Enhancement Program (RWEPP) areas for the Modification would result in approximately 15 ha of existing grazing land sterilised in perpetuity. 	<ul style="list-style-type: none"> A Land Management Plan would be prepared during preparation of the Extraction Plans for the South Wambo Underground Mine.
Groundwater	<ul style="list-style-type: none"> The Modification would cause no discernible or negligible additional drawdown in any alluvial aquifer. The Modification would have no discernible or negligible 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 mine layout. The Modification would have no significant impact on the quality of groundwater or surface water around Wambo. 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. 	<ul style="list-style-type: none"> 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. The Groundwater Monitoring Program would be reviewed and revised to incorporate the Modification (subject to approval of the Modification).
Surface Water	<ul style="list-style-type: none"> The modified mine layout (and approved mine layout) would result in changes in surface cracking and changes in grade and associated erosion and pool development along North Wambo Creek, Stony Creek and Wambo Creek. Significant increases in erosion and sediment load are not expected, particularly with the implementation of the mitigation measures, management and monitoring. The Modification would not increase the risk of flooding or materially affect the flood hazard or flood behaviour in the vicinity of the Modification area compared to the approved mine layout. 	<ul style="list-style-type: none"> Longitudinal geomorphological surveys would be conducted along the creek reaches affected by subsidence and would be outlined in the Extraction Plan. Trigger Action Response Plans would be developed for the creeks as part of the Extraction Plan with a process to determine appropriate triggers and remedial actions for any surface cracking and changes in grade and associated erosion and pool development (based on the actions described above). The Erosion and Sediment Control Plan would be updated and revised to include the additional surface development areas (subject to approval of the Modification).

Table ES-3 (Continued)
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	<ul style="list-style-type: none"> • Nine artefact scatters of low local and regional archaeological significance would be impacted by the additional surface infrastructure for the Modification. • The risk of subsidence impacts on rock-based sites (including grinding grooves/surfaces) has been assessed as “very unlikely” or “unlikely”. • Scarred trees and possible scarred trees are considered unlikely to experience adverse impacts as a result of the Modification. • The overall cumulative impact of the Modification on sites of Aboriginal heritage is considered to be low. 	<ul style="list-style-type: none"> • WCPL intends to leave artefact scatters and isolated finds <i>in situ</i>, subject to monitoring. • An archival or baseline recording of grinding grooves/surfaces and scarred trees would be undertaken prior to undermining. • The specific locations of gas management infrastructure would be defined as a component of future detailed mine planning and engineering studies to avoid or minimise impacts on Aboriginal heritage. • WCPL would apply for an additional Aboriginal Heritage Impact Permit to cover the remaining portion of the Modification area not covered by the existing permits.
Non-Aboriginal Heritage	<ul style="list-style-type: none"> • The only item of heritage significance in the vicinity of the Modification area is the Wambo Homestead Complex. • The main homestead building and the majority of the building structures would not be impacted by subsidence from the modified mine layout. • The predicted additional subsidence at the Mounting Yard and Horse Boxes is unlikely to result in adverse impacts on the building structure as a result of the Modification. • There is likely to be negligible impact on the heritage values of the Wambo Homestead Complex as a result of the modified mine layout. 	<ul style="list-style-type: none"> • WCPL would lodge an application under section 60 of the <i>Heritage Act, 1977</i> for the longwalls of the modified mine layout within the Wambo Homestead Complex curtilage. • The application under section 60 of the <i>Heritage Act, 1977</i> would demonstrate that WCPL can comply with the subsidence impact performance measure of negligible impact on heritage value of the Wambo Homestead Complex.
Flora and Fauna	<ul style="list-style-type: none"> • The Modification would result in approximately 7.9 ha of additional surface disturbance beyond existing approved surface disturbance. • The Modification would have no significant impact on threatened species, populations, ecological communities or critical habitat. 	<ul style="list-style-type: none"> • The existing RWEF areas at the Wambo would be augmented with an additional RWEF area (RWEF Area E) as a biodiversity offset for the Modification, and documented in a revised Flora and Fauna Management Plan. • The specific locations of gas management infrastructure would be defined as a component of future detailed mine planning and engineering studies to avoid or minimise impacts on threatened flora and fauna.
Noise and Air Quality	<ul style="list-style-type: none"> • The Modification would result in a lower total sound power level when compared to existing Wambo operations. • The Modification would result in lower total suspended particulate (dust) emissions when compared to existing Wambo operations. • The Modification would not materially alter cumulative noise or air quality levels at the nearest residential receivers. 	<ul style="list-style-type: none"> • WCPL would undertake an acoustical design review prior to the construction of the two most southern ventilation shafts and would implement noise mitigation to achieve compliance with the relevant noise criteria at nearby privately-owned receivers. • WCPL considers that no other specific or additional mitigation measures, management or monitoring of noise or air quality are required for the Modification.
Road Transport	<ul style="list-style-type: none"> • The Modification would increase the duration of traffic generation at Wambo by 7 years. • The Modification and other cumulative traffic generation sources in 2032 would not alter the Level of Service experienced on the surveyed roads from those experienced in 2015. 	<ul style="list-style-type: none"> • WCPL considers that no specific or additional mitigation measures, management or monitoring of road transport impacts 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.

ES1.4 JUSTIFICATION OF THE MODIFICATION

The Modification area is within existing mining tenements held by WCPL. In addition, the majority of the area has been the subject of past mining activities.

The Modification would enable the continued use of existing Wambo infrastructure and workforce and would promote the more efficient and economic recovery of coal resources.

The Woodlands Hill Seam proposed to be mined as part of the Modification is more favourable than the approved (but no longer proposed) Bowfield Seam due its ability to be economically mined beneath the existing/approved surface development area and the shorter time period between the commencement of construction and the commencement of longwall production.

Were the Modification not to proceed, the following consequences are inferred:

- longwall mining production would be discontinued for 3 years (2019 to 2021) and the associated flow-on effects of this production would be lost;
- additional employment opportunities associated with the proposed increase in production in the underground operations would not eventuate and the associated flow-on effects of this employment would also be lost;
- existing employment would be discontinued for approximately 290 existing open cut personnel at the end of the approved open cut life (March 2017) and for approximately 230 existing underground mine personnel and other support personnel in late 2018 (for a period of approximately 2 years);
- the associated flow-on effects of the above discontinuation of existing employment would also be lost;
- there would be economic and social impacts in the region associated with the above losses of existing employment and employment opportunities;

- the potential incremental environmental and social impacts and benefits described in this EA for the Modification (compared to the approved Wambo) would not occur;
- extraction of the Woodlands Hill Seam coal resource with access to existing Wambo personnel and infrastructure would be lost (although the resource would remain available to be extracted by other means); and
- the proposed extension to the RWEPP areas would not be established.

This EA has demonstrated that the Modification can be implemented with limited additional biophysical and environmental impacts above those already approved at Wambo with the implementation of the mitigation measures summarised in Table ES-3.

As described above, the Modification would have substantial economic and social benefits associated with allowing continuity of the underground operations and the extension to the life of the open cut operations.

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, 2a and 2b).

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 maximum 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 existing/approved extent of the open cut and underground mine operations and locations of key infrastructure is provided on Figures 2a and 2b.

1.2 SOUTH WAMBO UNDERGROUND MINE MODIFICATION

Mining of the South Wambo (Arrowfield and Bowfield Seams) Underground Mine was assessed as part of the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003) and approved under the Development Consent (DA 305-7-2003).

Following further mine planning for the approved South Wambo Underground Mine, which considered recent exploration results, WCPL has identified a modified mine arrangement which can be mined more economically and efficiently than the approved mine arrangement.

This proposed rearrangement of South Wambo Underground Mine is referred to as the South Wambo Underground Mine Modification (the Modification).

The Modification would involve a realignment and extension/relocation of the approved South Wambo Underground Mine longwall panels and mining of the Woodlands Hill Seam rather than the Bowfield Seam. The modified layout of Wambo is shown on Figure 3.

The rearrangement of the South Wambo Underground Mine would require a minor extension of the approved surface development area (Figure 3) and result in an extension of the approved mine life by 7 years (i.e. to 2032).

The underground mine ROM coal production rate would increase from 7.5 to 9.75 Mtpa. The approved total ROM coal production rate (i.e. 14.7 Mtpa) would remain unchanged.

The Modification would not involve changes to any aspects of the approved North Wambo Underground Mine or South Bates Underground Mine.

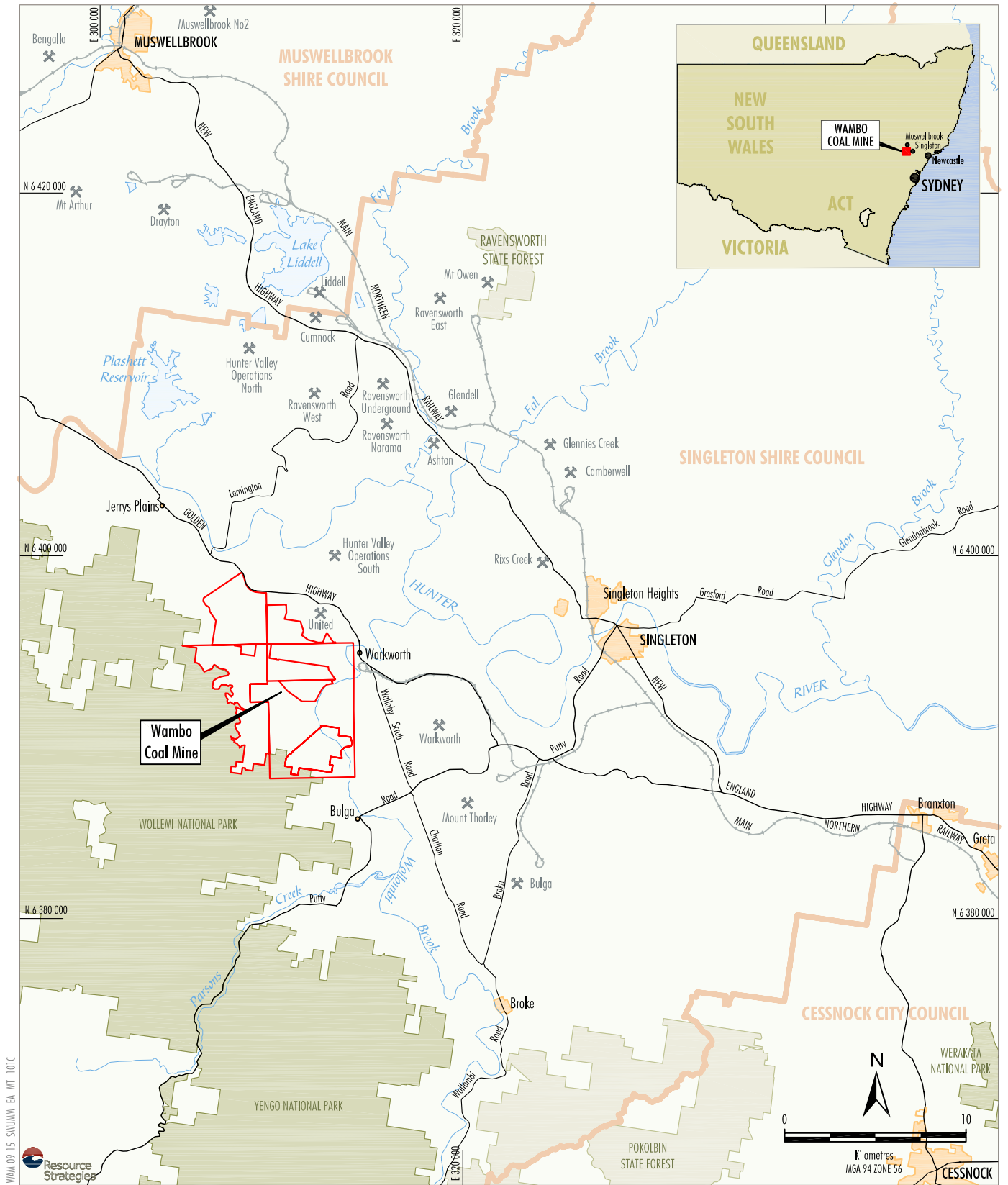
The Modification would also include an extension of approved open cut mining operations by 3 years (i.e. up to and including 2020). The Modification would not include any change to the approved total open cut ROM coal production limit.

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

1.3 CONSULTATION FOR THE MODIFICATION

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

It is anticipated that consultation with these stakeholders will continue during the assessment of the Modification by the NSW Government.



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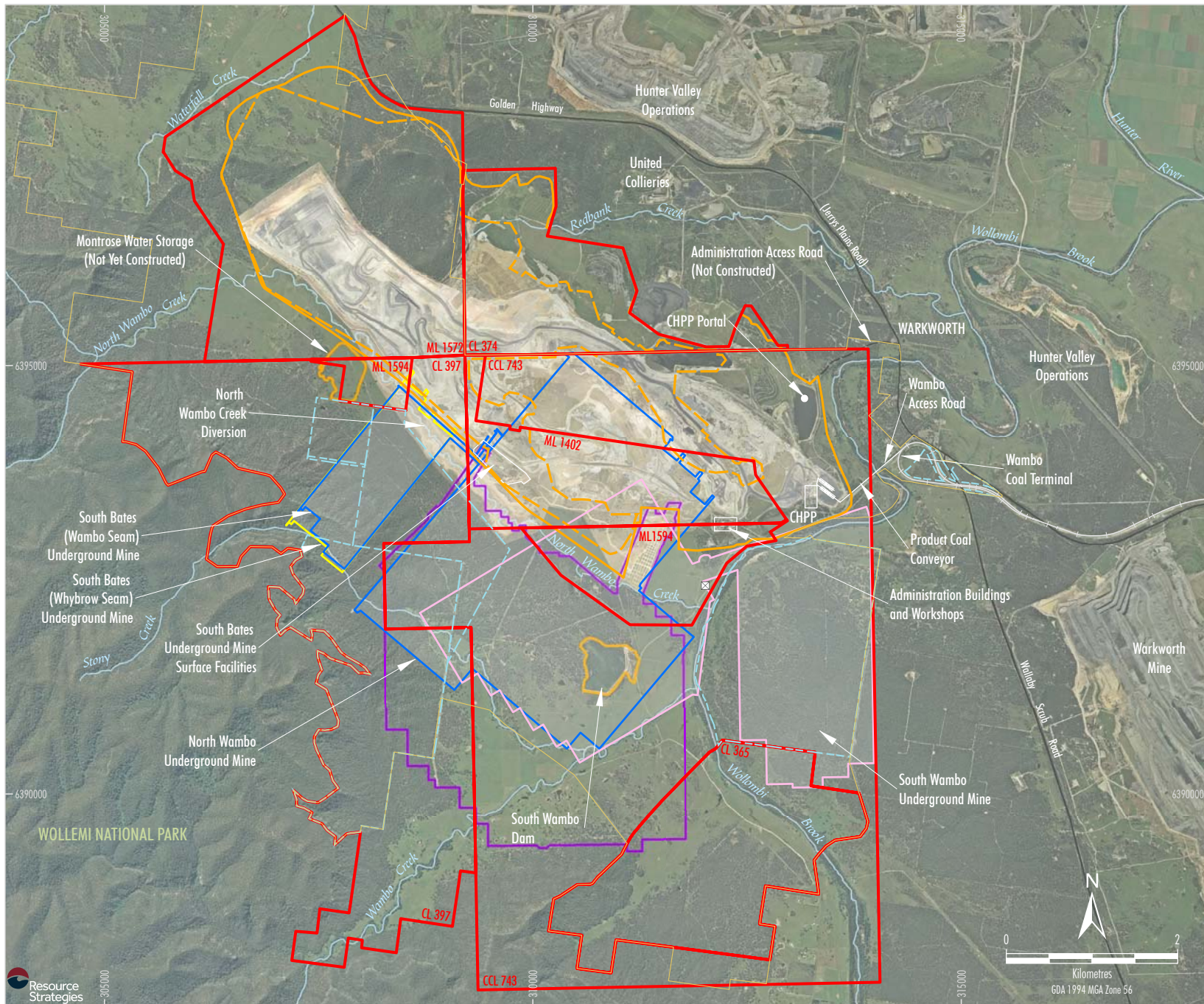
- LEGEND**
- Mining and Coal Lease Boundary
 - Local Government Boundary
 - X Mining Operation

Source: Geoscience Australia (2009)



WAMBO COAL MINE
Regional Location

Figure 1



LEGEND

- Mining and Coal Lease Boundary
- WCPL Owned Land
- Existing/Approved Surface Development Area
- Approved Open Cut Limit
- Approved Underground Development
- Whybrow Seam
- Wambo Seam
- Arrowfield and Bowfield Seams
- Previous Underground Workings in Whybrow Seam
- ⊠ Approved Ventilation Shaft
- Remnant Woodland Enhancement Program (RWEPE) Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

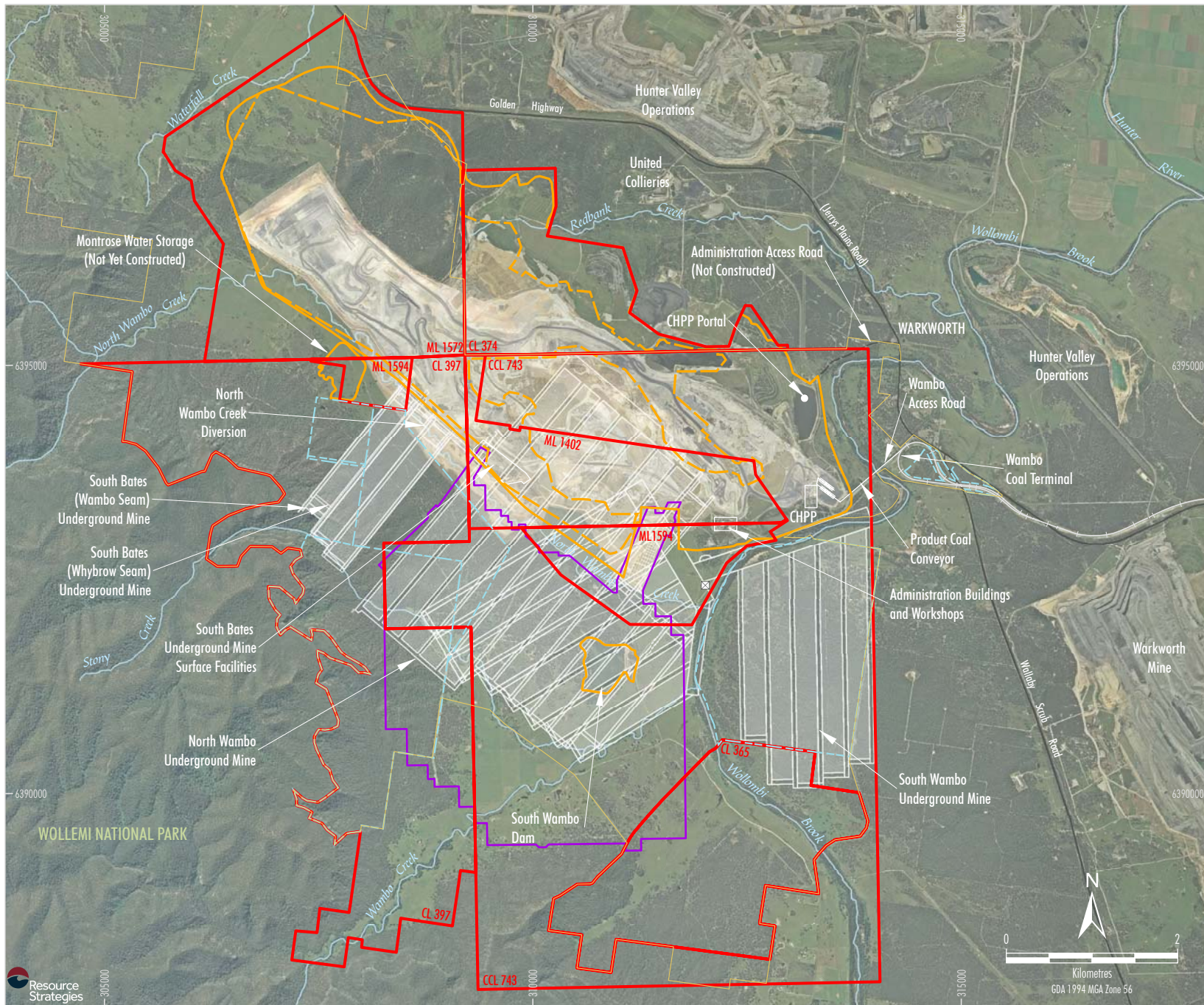
Peabody
ENERGY

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

**Approved Wambo Coal Mine
General Arrangement**



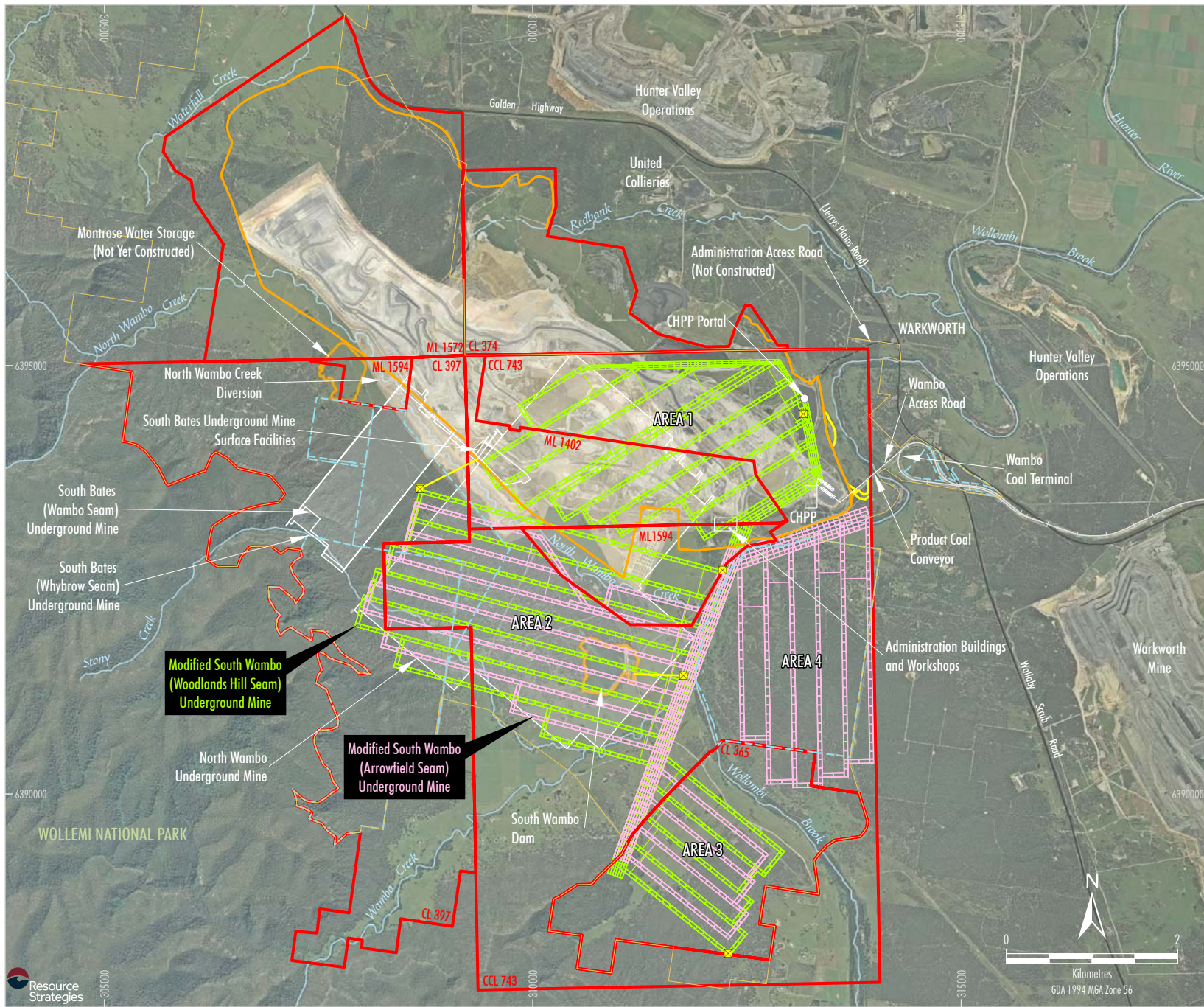
Figure 2a



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - - - Approved Open Cut Limit
 - Approved Underground Development
 - Previous Underground Workings in Whybrow Seam
 - ⊠ Approved Ventilation Shaft
 - - - Remnant Woodland Enhancement Program (RWEPP) Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

Figure 2b



LEGEND

- Mining and Coal Lease Boundary
- WCPL Owned Land
- Existing/Approved Surface Development Area
- Modified Surface Development Area
- Approved Underground Development
- Modified South Wambo (Woodlands Hill Seam) Underground Mine
- Modified South Wambo (Arrowfield Seam) Underground Mine
- Modified Ventilation Shaft
- Remnant Woodland Enhancement Program (RWEP) Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

Peabody
WAMBO COAL MINE
Modified Wambo Coal Mine
General Arrangement

Figure 3

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

Component	Approved Wambo ¹	Modified Wambo
Life of Mine	<ul style="list-style-type: none"> 21 years (i.e. until 1 March 2025). 	<ul style="list-style-type: none"> An extension of 7 years (i.e. until 1 March 2032).
Open Cut Mining	<ul style="list-style-type: none"> 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 to March 2017. 	<ul style="list-style-type: none"> An extension of open cut mining operations by approximately 3 years (i.e. up to and including 2020). Other open cut mining components unchanged.
Underground Mining	<ul style="list-style-type: none"> 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 114.9 Mt.² 	<ul style="list-style-type: none"> Changes to the alignment and extent of the approved South Wambo (Arrowfield Seam) Underground Mine longwall panels. Mining of the proposed South Wambo (Woodlands Hill Seam) Underground Mine rather than the approved South Wambo (Bowfield Seam) Underground Mine and changes to the alignment and extent. An increase in the underground mining rate up to 9.75 Mtpa of ROM coal. Approximately 28.4 Mt of additional ROM coal from the South Wambo Underground Mine.
Subsidence Commitments and Management	<ul style="list-style-type: none"> The subsidence impact performance measures listed in Conditions 22 and 22A, Schedule 4 of the Development Consent (DA 305-7-2003). 	<ul style="list-style-type: none"> Unchanged.
ROM Coal Production Rate	<ul style="list-style-type: none"> Up to 14.7 Mtpa of ROM coal. 	<ul style="list-style-type: none"> Unchanged (i.e. the combined rate of the open cut and underground mining operations would remain within this limit).
Total ROM Coal Mined	<ul style="list-style-type: none"> 212.9 Mt. 	<ul style="list-style-type: none"> 241.3 Mt.
Waste Rock Management	<ul style="list-style-type: none"> Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations. 	<ul style="list-style-type: none"> Unchanged.
Total Waste Rock	<ul style="list-style-type: none"> 640 million bank cubic metres (Mbcm). 	<ul style="list-style-type: none"> Unchanged.
Coal Washing	<ul style="list-style-type: none"> Coal Handling and Preparation Plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph). 	<ul style="list-style-type: none"> Unchanged.
Product Coal	<ul style="list-style-type: none"> Production of up to 11.3 Mtpa of thermal coal predominantly for export. 	<ul style="list-style-type: none"> Unchanged.
CHPP Reject Management	<ul style="list-style-type: none"> Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices. 	<ul style="list-style-type: none"> Unchanged.
Total CHPP Rejects	<ul style="list-style-type: none"> Approximately 29.3 Mt of coarse rejects and approximately 19.4 Mt of tailings. 	<ul style="list-style-type: none"> An additional 7.3 Mt of coarse rejects and 3 Mt of tailings.
Water Supply	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Unchanged.
Surface Facilities	<ul style="list-style-type: none"> Construction of surface facilities within the approved surface development area. 	<ul style="list-style-type: none"> Minor extension to the surface development area.
Mining Tenements	<ul style="list-style-type: none"> Coal Lease (CL) 365, CL 374, CL 397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML 1572, ML 1594, Authorisation (A) 444, Exploration Licence (EL) 7211. 	<ul style="list-style-type: none"> Unchanged.

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

² Excludes 23 Mt of Bowfield Seam reserves remaining after the 21 year approval period sought as part of the Development Application (DA 305-7-2003) and as described in the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003).

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 initial briefing regarding the Modification at the CCC meeting in August 2012. An update to the Modification was provided to the CCC meeting on 29 September 2015.

WCPL conducted community information sessions at the Jerrys Plains community hall in August 2012, February 2013, August 2013 and November 2014 to provide the community with an opportunity to obtain information about WCPL's current and future mining plans.

Modification information is publicly accessible on the Peabody Energy Website (<http://www.peabodyenergy.com/>).

Aboriginal Stakeholders

Aboriginal stakeholders were consulted throughout the preparation of the Cultural Heritage Impact Assessment (CHIA) for the Modification. Consultation was conducted in accordance with the NSW Office of Environment and Heritage (OEH) policy *Aboriginal cultural heritage consultation requirements for proponents 2010* (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 Section 4.6.

United Collieries

WCPL and United Collieries have formed a joint venture over the tenements adjoining this proposed Modification in relation to the United and Wambo Open Cut Coal Mine Project. Consultation with United Collieries regarding the Modification is ongoing. During this consultation, the interactions between the Modification and existing and future infrastructure and assessment of cumulative impacts 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 presented key components of, and justification for, the Modification to the Department of Planning and Infrastructure (now Department of Planning and Environment [DP&E]) during an initial briefing on 18 June 2012.

A modification application and request for Environmental Assessment Requirements were lodged in September 2012 for the Modification.

Environmental Assessment Requirements for the Modification were subsequently issued under section 75W(3) of the EP&A Act on 25 October 2012.

WCPL wrote to the DP&E on 17 October 2014 requesting an extension to the Environmental Assessment Requirements while WCPL assessed potential mining options.

A letter was sent to the DP&E requesting updated Environmental Assessment Requirements on 13 October 2015. Updated Secretary's Environmental Assessment Requirements (SEARs) were provided to WCPL on 23 October 2015.

WCPL attended a briefing with the DP&E on 27 October 2015 to provide an overview of the proposed change to the Modification scope. Key assessment requirements and the proposed timing for EA lodgement were discussed.

The SEARs were revised on 3 March 2016 to incorporate the environmental assessment requirements from the Commonwealth Department of the Environment.

Division of Resources and Energy (within the NSW Department of Industry)

The Division of Resources and Energy (DRE) was sent a letter providing information on the Modification and offering a meeting in December 2015. A meeting was conducted in January 2016 to discuss the Modification including justification of the Modification. A site visit was also conducted in March 2016.

Department of Primary Industries Water

WCPL requested a meeting with the Department of Primary Industries (DPI) Water in March 2016 to provide information on the Modification and the results of the Groundwater Assessment (Appendix B).

Office of Environment and Heritage

WCPL provided a letter to the OEH on 8 September 2015 notifying the OEH of the registered Aboriginal parties for the Modification. WCPL also consulted with the OEH during the preparation of the CHIA (Appendix F).

WCPL held a meeting with the OEH on 15 December 2015 to provide further detail on the Modification. A copy of the draft CHIA for the Modification was provided to the OEH in January 2016.

Other State Government Agencies

The following State Government agencies were provided with a briefing package describing the Modification between January and March 2016:

- Environment Protection Authority (EPA);
- Road and Maritime Services (RMS);
- DPI;
- Dams Safety Committee (DSC);
- Mine Subsidence Board (MSB); and
- NSW Health.

Commonwealth Department of the Environment

Components of the Modification were referred to the Federal Minister for the Environment under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) on 19 January 2016 as the Action (EPBC 2016/7636). A description of the components that form part of the Action is provided in Attachment 5.

A delegate of the Commonwealth Minister determined on 29 February 2016 that the proposed Action is a ‘controlled action’ for the purposes of the EPBC Act and the proposed action is to be assessed under the assessment bilateral agreement with the NSW Government.

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 SSC in January 2016 to provide a briefing on the Modification and offering a meeting to provide further detail.

Infrastructure Owners

WCPL provided letters to the Australian Rail Track Corporation and Ausgrid to provide a briefing on the Modification in March 2016.

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 site management documents that would require revision in support of the Modification.
Section 6	Provides a consolidated summary of environmental management and mitigation measures, and a conclusion providing justification for the Modification.
Section 7	References.

Attachments 1 to 6 and Appendices A to L provide supporting information as follows:

Attachment 1	Wambo Coal Mine Consolidated Development Consent.
Attachment 2	Secretary’s Environmental Assessment Requirements.
Attachment 3	Real Property Descriptions.
Attachment 4	Relevant Environmental Planning Instruments and Government Policies.

Attachment 5	Cross Reference to Assessment Requirements Relevant to the EPBC Act.
Attachment 6	Groundwater Peer Review Letter.
Appendix A	Subsidence Assessment.
Appendix B	Groundwater Assessment.
Appendix C	Surface Water Assessment.
Appendix D	Flora Assessment.
Appendix E	Fauna Assessment.
Appendix F	Cultural Heritage Impact Assessment.
Appendix G	Agricultural Impact Statement.
Appendix H	Noise Review.
Appendix I	Air Quality and Greenhouse Gas Review.
Appendix J	Road Transport Assessment.
Appendix K	Socio-economic Assessment.
Appendix L	Environmental Risk Assessment.

2 WAMBO COAL MINE – EXISTING OPERATIONS

2.1 APPROVALS HISTORY

The Wambo Development Project was approved under Part 4 of the EP&A Act in February 2004. Thirteen 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 Mt of ROM coal (MOD 13);
- September 2014 under section 75W – to modify Development Consent DA 305-7-2003 to facilitate the development of an additional longwall panel contiguous with the existing North Wambo Underground Mine and recovery of an additional 1.9 Mt of ROM coal (MOD 14); and
- November 2015 under section 75W – to modify Development Consent DA 305-7-2003 to facilitate the development of three additional longwall panels in the Wambo Seam at the South Bates Underground Mine below the three approved longwall panels in the Whybrow Seam (MOD 15).

A separate modification application regarding the Montrose East Underground Mine (MOD 10) was lodged in March 2011, however was later withdrawn.

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

2.2 UNDERGROUND MINING

The following underground mines at Wambo are approved (Figures 2b and 4):

- North Wambo Underground Mine (Wambo Seam);
- South Bates Underground Mine (Whybrow and Wambo Seams); and
- South Wambo Underground Mine (Arrowfield and Bowfield Seams).

The approved maximum underground mining rate is 7.5 Mtpa. Underground mining operations are conducted 24 hours per day, seven days per week.

SUPERGROUP	GROUP	SUBGROUP	FORMATION	SEAM	
SINGLETON SUPERGROUP	NARRABEEN GROUP	WIDDEN BROOK CONGLOMERATE			
		GLEN GALLIC SUBGROUP	Greigs Creek Coal		
	Redmanvale Creek Formation				
	Dights Creek Coal				
	NEWCASTLE COAL MEASURES ¹	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		
		WATTS SANDSTONE			
		WITTINGHAM COAL MEASURES	DENMAN FORMATION		
	JERRYS PLAINS SUBGROUP		Mount Leonard Formation	<i>Whybrow Seam</i> ²	
			Althorpe Formation		
			Malabar Formation	<i>Redbank Creek Seam</i> ²	
				<i>Wambo Seam</i> ²	
				<i>Whynot Seam</i> ²	
				<i>Blakefield Seam</i>	
			Mount Ogilvie Formation	<i>Glen Munro Seam</i>	
				<i>Woodlands Hill Seam</i> ⁴	
			Milbrodale Formation		
			Mount Thorley Formation	<i>Arrowfield Seam</i> ²	
				<i>Bowfield Seam</i> ²	
				<i>Warkworth Seam</i> ³	
			Fairford Formation		
			Burnamwood Formation	<i>Mount Arthur Seam</i>	
	<i>Piercefield Seam</i>				
	<i>Vaux Seam</i>				
	<i>Bronie Seam</i>				
	<i>Bayswater Seam</i>				
ARCHERFIELD SANDSTONE					
VANE SUBGROUP	Bulga Formation				
	Foybrook Formation				
	Saltwater Creek Formation				

¹ Previously known as the Wollombi Coal Measures.

² Coal reserves currently approved 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.

⁴ Coal reserves proposed to be mined at Wambo Coal Mine.

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After: DMR (1993)



WAMBO COAL MINE

Stratigraphy of the
Wambo Coal Mine Area

Figure 4

North Wambo Underground Mine

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.

Underground mining equipment includes continuous miners, longwall mining equipment, electric shuttle cars, load haul dump machines and personnel transporters (WCPL, 2015b).

Longwall extraction at the North Wambo Underground Mine finished in January 2016 (WCPL, 2015c).

South Bates Underground Mine

Development of the South Bates Underground Mine commenced in October 2014 and longwall mining commenced in the South Bates (Whybrow Seam) Underground Mine (i.e. Longwalls 11 to 13) in February 2016 (WCPL, 2015b). Subsequently, mining operations will progress to the South Bates (Wambo Seam) Underground Mine, with longwall mining scheduled to commence in September 2017.

Access to the approved South Bates Underground Mine is via the Bates South open cut pit wall. ROM coal is conveyed to a stockpile where it is loaded into haul trucks and hauled to the ROM bin or the ROM coal stockpile.

South Bates Underground Mine is scheduled for completion at the end of 2018 (WCPL, 2015b).

South Wambo Underground Mine

Mining at the approved South Wambo (Arrowfield and Bowfield Seams) Underground Mine is planned to commence after completion of mining at the South Bates Underground Mine.

Access to the South Wambo Underground Mine is approved via a box cut and portal (known as the CHPP portal) and associated mine entries.

Construction of the approved CHPP portal will require the decommissioning of the Chitter Dump Dam.

ROM coal from the South Wambo Underground Mine will be conveyed to the ROM coal stockpile or directly to the CHPP for processing.

2.3 UNDERGROUND MINE SURFACE INFRASTRUCTURE

Ventilation Systems

The installation of gas drainage wells and ventilation boreholes was approved at the North Wambo Underground Mine (WCPL, 2006).

The South Bates Underground Mine intakes air via portals located at the Bates South open cut pit wall. The South Bates (Whybrow Seam) Underground Mine longwall panels operate independently with separate ventilation systems. Fans will be located at the four portals for the longwall panel gate roads with up to two fans operating at any one time (WCPL, 2003). The South Bates (Wambo Seam) Underground Mine longwall panels will be ventilated via the access drift.

The approved air intake to the South Wambo Underground Mine is via the CHPP portal and box cut (Figure 2a). An upcast fan system and ventilation shaft is approved to be installed south-east of the extent of the open cut operations (WCPL, 2003) (Figure 2a).

Gas Management

Gas drainage wells at the North Wambo Underground Mine were approved to be installed at approximately 200 metre (m) intervals along the longwall panels, generally in the centre of the panel (WCPL, 2006).

The ventilation system is the primary mechanism to monitor and control the concentrations of mine gases at the South Bates Underground Mine. Gas may also be drained by drilling in-seam (i.e. horizontal) boreholes in advance of mining (WCPL, 2015d).

The installation of a series of gas drainage wells is approved for the South Wambo Underground Mine to allow for gas drainage. Up to four gas drainage wells are approved to be installed for each longwall panel, depending on the quantity of gas to be removed and the capacity of the ventilation systems (WCPL, 2003).

Mine Dewatering

Groundwater that drains from coal seams and surrounding rock and then accumulates in underground workings is pumped to the surface via access drifts and/or boreholes, to be managed within the Wambo water management system.

Overlying and adjacent workings are also dewatered, if required for safety reasons, by surface boreholes.

2.4 OPEN CUT MINING

Open cut mining operations at Wambo involve the extraction of coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams (Figure 4). The open cut is bounded by the United Collieries and the Golden Highway to the north, Wollombi Brook to the east (Figure 2a) 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 (WCPL, 2015b).

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

2.5 CONSTRUCTION AND DEVELOPMENT ACTIVITIES

Surface construction activities at Wambo are generally undertaken during daytime hours (i.e. 7.00 am to 6.00 pm) up to seven days per week (WCPL, 2003).

Underground development activities, including underground roadway development and shafts, are undertaken up to 24 hours per day, seven days per week.

2.6 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 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, seven days per week. 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).

2.7 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, seven 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.

2.8 WASTE ROCK MANAGEMENT

The open cut operations are expected to produce approximately 640 Mbcm of waste rock during the life of Wambo (WCPL, 2015d). 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).

2.9 COAL REJECT MANAGEMENT

Approximately 29.3 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, 2015d). The coarse reject material is selectively handled and co-disposed of with waste rock in open cut voids or is 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 19.4 Mt of tailings (dry basis) are expected to be produced over the life of Wambo (WCPL, 2015d).

2.10 INFRASTRUCTURE AND SERVICES

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

The South Bates Underground Mine surface facilities (Figure 2a) include an ablution building, water tanks, fire depot and power services.

Access to Wambo is currently via the sealed Wambo Access Road which intersects the Golden Highway near Warkworth. An Administration Access Road from the Golden Highway is approved but not yet constructed (Figure 2a).

2.11 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.

The Site Water Balance prepared under Condition 30(a), Schedule 4 of the Development Consent (DA 305-7-2003) was approved in November 2015. In accordance with Condition 25, Schedule 4 of the Development Consent (DA 305-7-2003), WCPL reviews the site water balance for Wambo annually and reports the results of this review in the Annual Environmental Management Report.

Based on the most recent review of the site water balance (incorporating the planned decommissioning of the Chitter Dump Dam), the approved Mining Operations Plan (2015b) allows for additional contingent capacity through the approved Montrose Water Storage Dam (with a nominal capacity of 1,500 million litres).

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).

2.12 WORKFORCE

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

2.13 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 and beneficial use of existing 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 Program

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

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

WCPL is currently in the process of finalising agreements to conserve the RWEP areas as part of Voluntary Conservation Agreements 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.

2.14 ENVIRONMENTAL MONITORING AND MANAGEMENT

Environmental monitoring and management at Wambo encompasses a range of management plans and monitoring programmes overseen by statutory planning provisions (Figure 5). Approved management plans/monitoring programmes include:

- Environmental Management Strategy (WCPL, 2010a).
- Environmental Monitoring Program (WCPL, 2010b).
- Flora and Fauna Management Plan (WCPL, 2014a).
- Blast Management Plan (WCPL, 2014b).
- Noise Management Plan (WCPL, 2014c).
- Air Quality and Greenhouse Gas Management Plan (WCPL, 2014d).
- Site Water Management Plan incorporating the following:
 - North Wambo Creek Diversion Plan (WCPL, 2007).
 - Groundwater Monitoring Program (WCPL, 2015e).
 - Surface Water Monitoring Program (WCPL, 2015f).
 - Erosion and Sediment Control Plan (WCPL, 2015g).
 - Surface and Groundwater Response Plan (WCPL, 2015h).
- North Wambo Underground Mine Extraction Plan Longwalls 8 to 10A (WCPL, 2015c).
- South Bates (Whybrow Seam) Underground Mine Extraction Plan Longwalls 11 to 13 (WCPL, 2015i).
- 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 6 and 7.

Approved management plans/monitoring programmes are available on WCPL's website:

<http://www.peabodyenergy.com/content/422/australia-mining/new-south-wales/wambo-mine/approvals-plans-and-reports-wambo-mine>

2.15 COMPLAINTS

WCPL maintains a 24 hours a day, seven 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 16 complaints during the 2015 reporting period, with the majority related to blasting (69 percent [%]). This was less than the number of complaints received during the 2014 reporting period, where a total of 31 complaints were received. The complaints received were related to noise, blasting, lighting and dust, and generally not related to the underground mining operations.

Mine-related complaints are managed in accordance with WCPL's Community Complaints Procedure, which includes investigating each complaint, taking action if necessary and responding to the complainant.

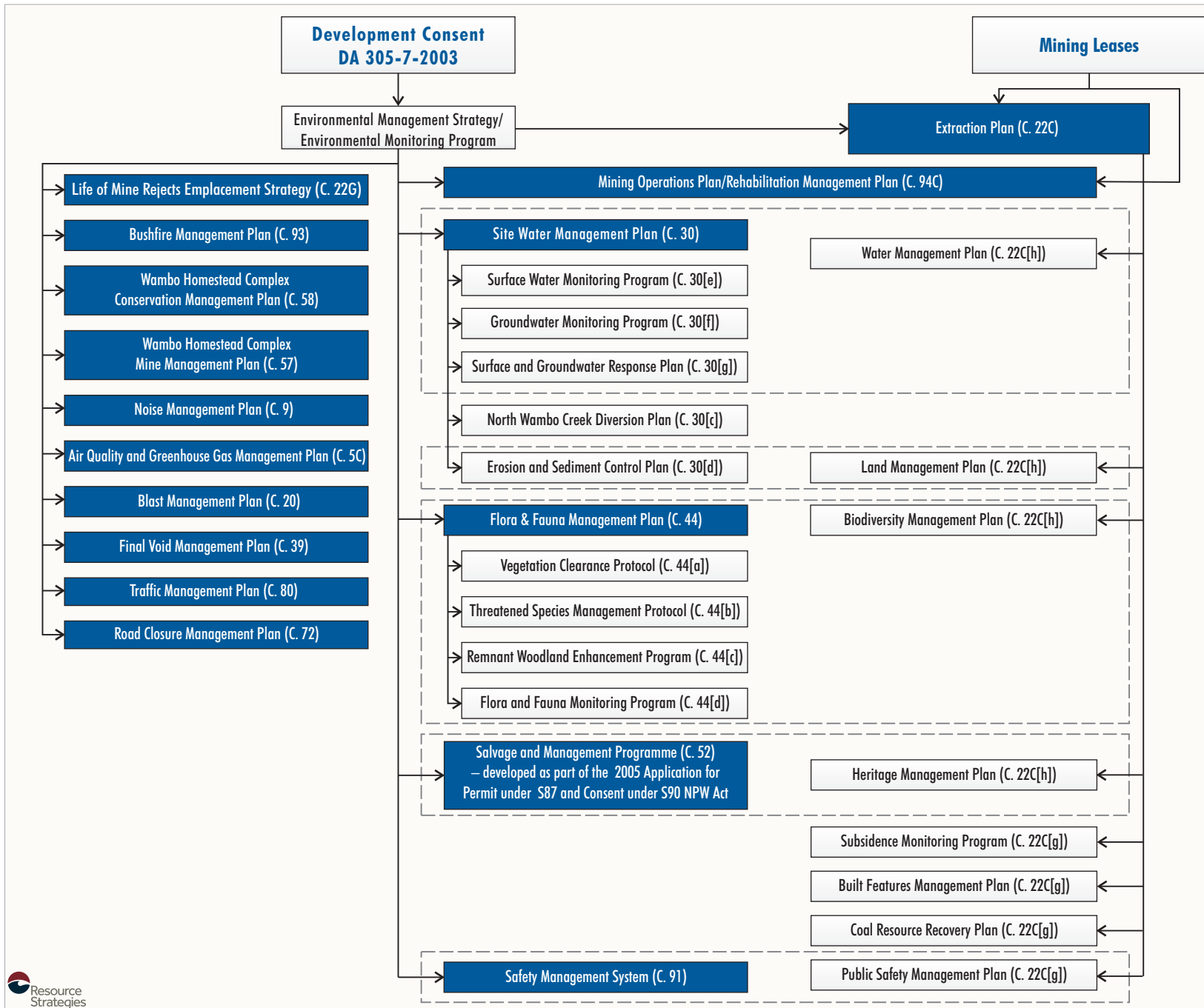
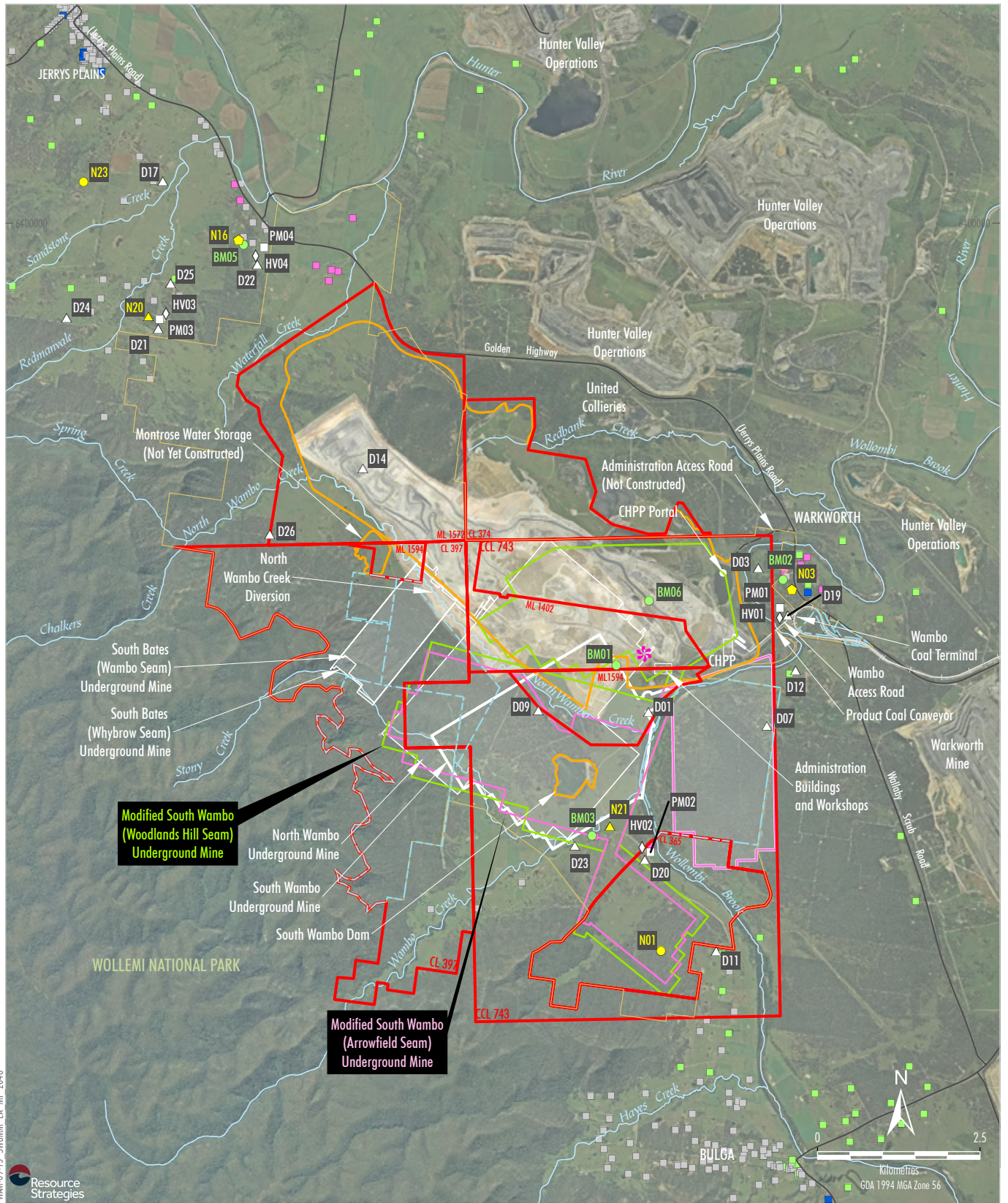


Figure 5



WMA-09-15 SHWUWMA EA INT 2046



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - Approved Underground Development
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - - - Remnant Woodland Enhancement Program (RWEP) Area

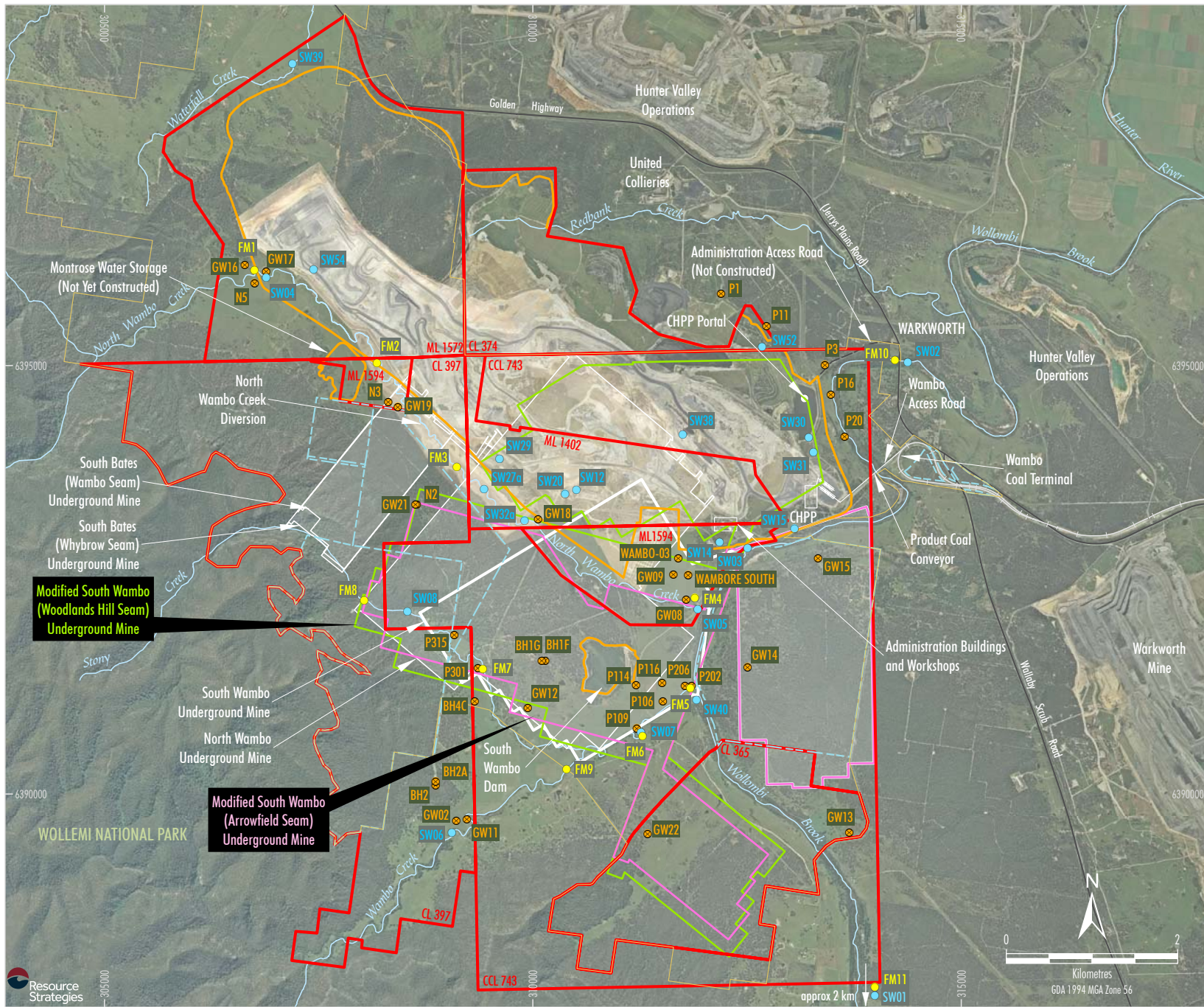
- Monitoring Sites**
- ◆ Noise Monitoring Site (Attended and Real-time)
 - ✿ Meteorological Station
 - △ Dust Deposition Gauge
 - ◇ High Volume Air Sampler
 - TEOM
 - Noise Monitoring Site (Attended)
 - ▲ Noise Monitoring Site (Real-time)
 - Blast Monitoring Site

- Residences**
- Wambo Owned
 - Other Resource Company Owned
 - Government Owned
 - Private

Peabody
W A M B O C O A L M I N E
Locations of Air Quality,
Noise and Blast Monitoring Sites

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

Figure 6



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - Approved Underground Development
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - - - Remnant Woodland Enhancement Program (RWEP) Area
 - Groundwater Monitoring Site
 - Surface Water Quality Monitoring Site
 - Surface Water Flow Monitoring Site

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)



WAMBO COAL MINE
Locations of Surface Water and Groundwater Monitoring Sites



Figure 7

3 SOUTH WAMBO UNDERGROUND MINE MODIFICATION

3.1 CONSTRUCTION AND DEVELOPMENT ACTIVITIES

The Modification would utilise existing surface infrastructure and supporting services at Wambo. Construction and development activities which are required to support the South Wambo Underground Mine (including modifications to existing infrastructure) would occur progressively in parallel with ongoing mining operations, including (Sections 3.2 and 3.7):

- approved CHPP portal box cut;
- South Wambo Underground Mine infrastructure area;
- ventilation shafts and ancillary infrastructure;
- gas management infrastructure; and
- additional access road.

Additional mobile equipment would be required for short periods during the Modification construction and development activities. The number and type of equipment would be expected to vary depending on the activity being undertaken.

Potential noise and air quality impacts associated with construction activities for the Modification are assessed in Sections 4.10 and 4.11, respectively.

CHPP Portal Box Cut

Construction of the approved CHPP portal box cut (for coal, personnel and materials access) will commence in June 2016, and will be generally undertaken during daytime hours. The CHPP portal box cut would be located within the current Chitter Dump Dam location, and the Chitter Dump Dam would be dewatered and decommissioned prior to construction of the CHPP portal box cut (Figure 8).

Construction of the associated underground adits will commence in December 2016 and will be undertaken up to 24 hours per day, seven days per week.

South Wambo Underground Mine Infrastructure Area

The Modification would require an extension to the existing/approved surface infrastructure area to allow for South Wambo Underground Mine surface infrastructure (Figure 8).

Details of the South Wambo Underground Mine infrastructure area are provided in Section 3.7.

Construction of the South Wambo Underground Mine infrastructure area would be generally undertaken during daylight hours.

Ventilation Shafts

The Modification would require the construction of five ventilation shafts (i.e. an additional four ventilation shafts compared to the approved South Wambo Underground Mine and relocation of the approved shaft) (Section 3.2). Construction of ventilation shaft sites for the Modification would involve:

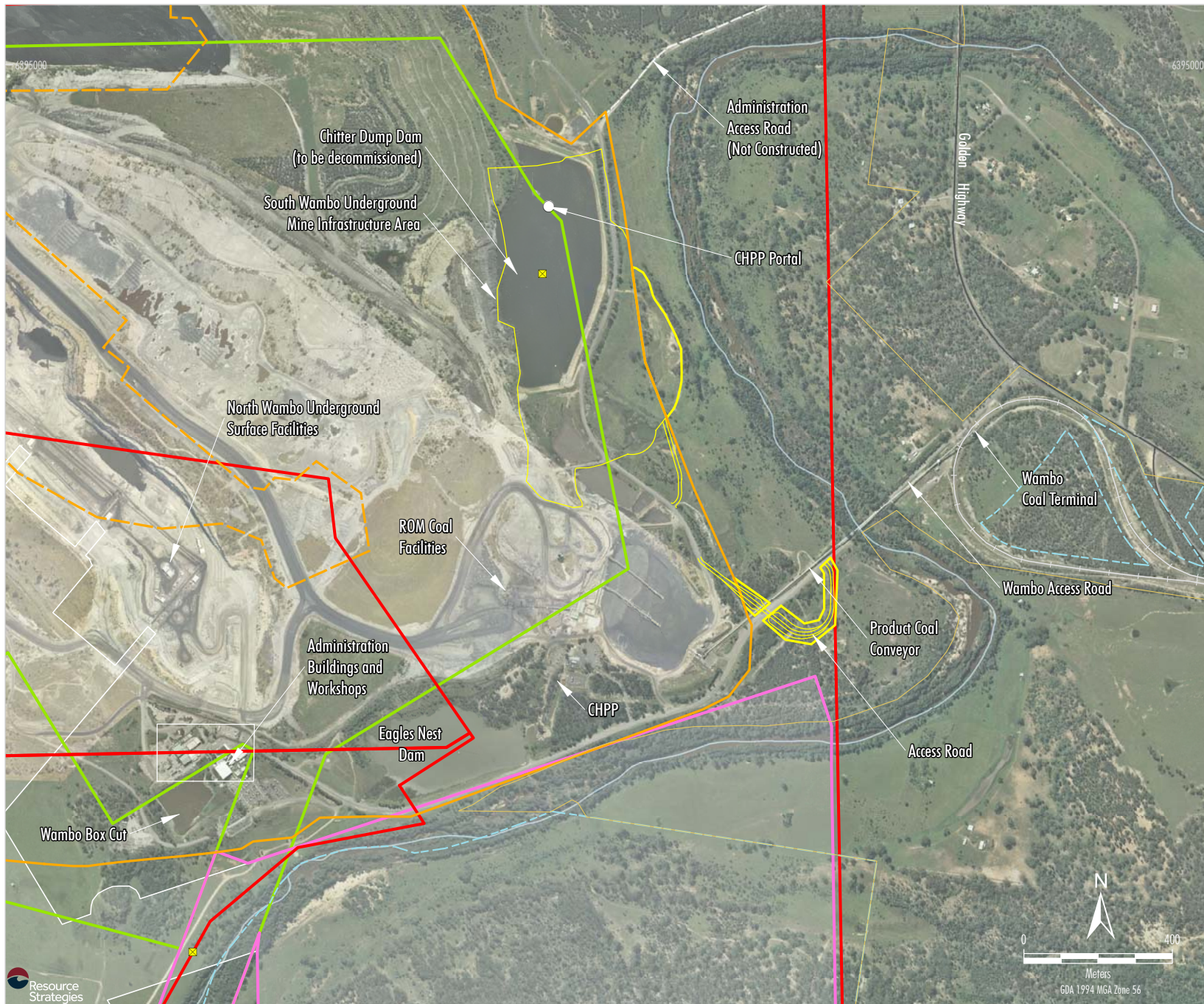
- grading and levelling of existing tracks and construction of new tracks to allow access (where necessary);
- development of a concrete or steel lined shaft (approximately 5.5 m in diameter);
- installation of a ventilation fan and associated power supply if the site would be used as an upcast shaft;
- installation of associated electrical switchroom, transformer and ancillary infrastructure for the ventilation fan;
- installation of appropriate security (i.e. fencing) to prevent unauthorised access to the ventilation shaft site; and
- installation of water management and flood control infrastructure, where required.

It is expected that the shafts would be constructed using the 'blind bore' method. Using this method, the drilling would take place in advance of development workings, with material from the excavation being removed from the top of the shaft. Excavated material would be transported by truck to the open cut voids or approved waste emplacement areas. The construction footprint would be up to approximately 75 m by 75 m.

Drilling of the shafts would occur 24 hours per day, seven days per week, while the remainder of construction activities associated with the ventilation shafts (e.g. installation of surface infrastructure) would be generally limited to daytime hours.

Gas Management Infrastructure

Gas management infrastructure for the Modification would include up to four gas drainage boreholes per longwall (consistent with the approved South Wambo Underground Mine) and up to two centralised gas plants (Section 3.2).



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - Modified Surface Development Area
 - - - Approved Open Cut Limit
 - Approved Underground Development
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - ⊠ Modified Ventilation Shaft
 - - - Remnant Woodland Enhancement Program (RWEPP) Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

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

Modified
Surface Infrastructure Layout

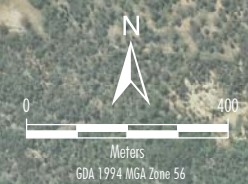


Figure 8

Gas drainage boreholes would be developed using a conventional drill rig and would be used for pre-mining gas drainage and/or goaf gas drainage.

Access to gas drainage boreholes and centralised gas plant sites for maintenance and monitoring would require the construction of temporary access tracks.

Construction of surface gas management infrastructure, including gas drainage boreholes, centralised gas plants and their associated ancillary infrastructure, would be generally undertaken during daytime hours.

Access Road

The Modification would include upgrades to the existing Wambo access road, including the construction of a grade separated crossing (Section 3.7).

The grade separated crossing would be constructed by suitably qualified contractors employed by WCPL.

Access road construction and upgrade works would be generally undertaken during daytime hours.

3.2 SOUTH WAMBO UNDERGROUND MINE

The proposed layout of the Modification is shown on Figure 9. The Modification would involve changes to the approved mine layout of the South Wambo Underground Mine and mining of the Woodlands Hill Seam rather than the Bowfield Seam.

Layout of the Underground Mining Area

The Modification longwalls would have lengths varying between approximately 0.7 and 3.7 km and widths varying between approximately 200 and 300 m. Approximately 28.4 Mt of additional ROM coal would be mined compared to the amount described in WCPL (2003).

The longwalls have been designed to achieve negligible impact on the Wollemi National Park escarpment. Similarly, the longwalls would achieve negligible impact on Wollombi Brook.

The proposed layout of the Modification falls entirely within existing WCPL mining tenements (i.e. CL 365, CL 397, CCL 743, ML 1402 and ML 1594).

Mine Access and Development Works

Access to the South Wambo Underground Mine would be via the approved CHPP portal box cut and adits (for coal, personnel and materials access) (Figure 9). Construction of the box cut will commence in June 2016 and construction of the adits would commence in December 2016.

Longwall Mining Operations

Longwall mining would commence in the South Wambo (Woodlands Hill Seam) Underground Mine in 2019. Mining would begin in Area 1 and move south through Areas 2 and 3 (Figure 9). Mining of the South Wambo (Woodlands Hill Seam) Underground Mine would continue until approximately 2029.

A second longwall machine is proposed to commence mining the South Wambo (Arrowfield Seam) Underground Mine in approximately 2023. Mining would initially be in Area 2, and would move to Area 3 before finishing with the five approved longwalls in Area 4 (Figure 9).

Mining of the South Wambo (Arrowfield Seam) Underground Mine is anticipated to conclude in 2032 if mined at the maximum proposed underground mining rate.

ROM coal would be conveyed to the stockpile area before it would be delivered by haul truck to the CHPP for processing.

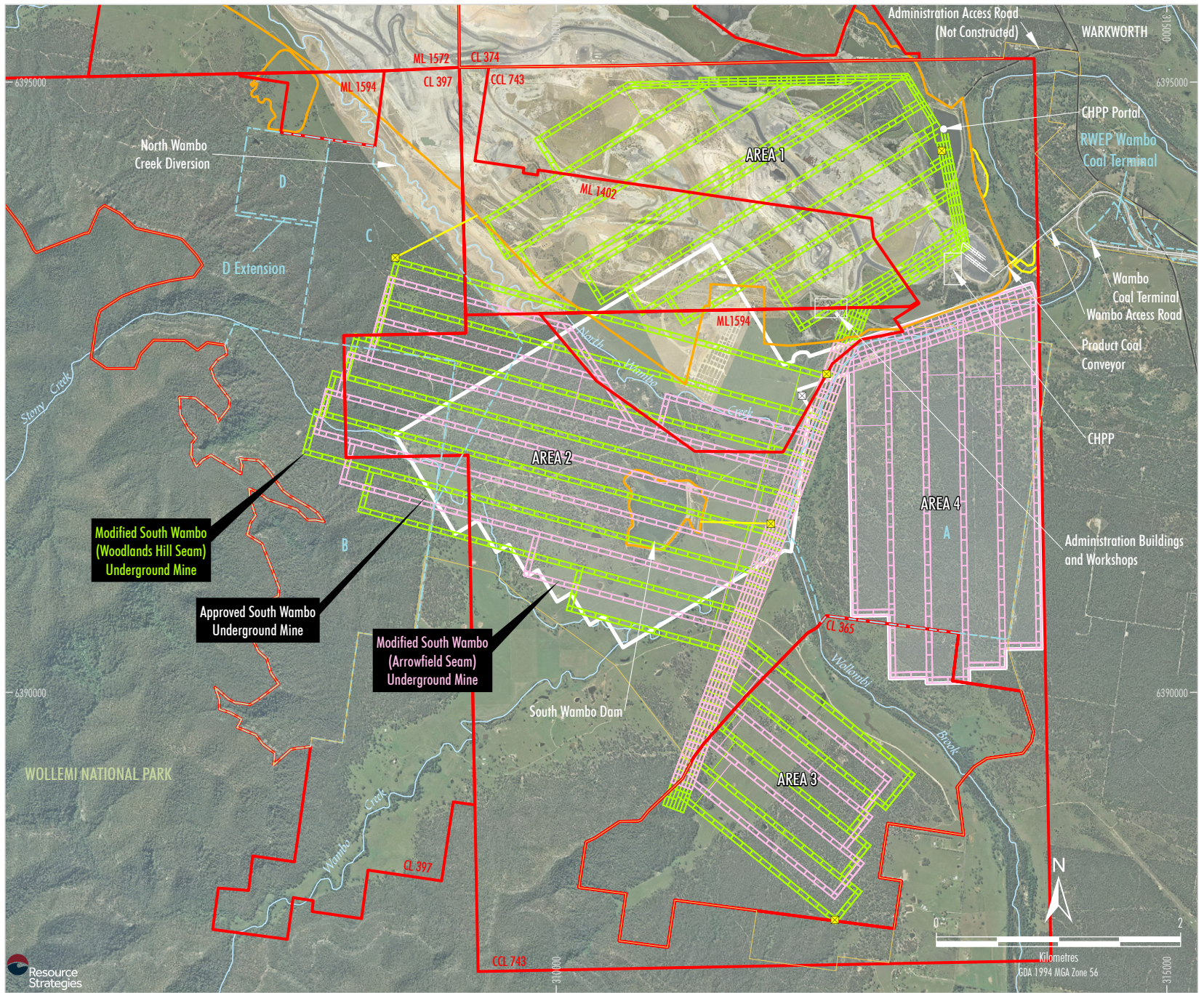
Consistent with approved operations, underground mining operations would be conducted 24 hours per day, seven days per week.

The Modification would involve an extension of the existing mine life by approximately 7 years.

Production from the South Wambo Underground Mine would be at a rate of up to 9.75 Mtpa, a proposed increase from the approved underground mining rate of 7.5 Mtpa.

Underground Equipment and Mobile Fleet

Components of the existing South Bates Underground Mine and North Wambo Underground Mine equipment and mobile fleet (Section 2.2) would be used for the Modification.



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - Modified Surface Development Area
 - Approved South Wambo Underground Mine Development
 - - - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - - - Modified South Wambo (Arrowfield Seam) Underground Mine
 - Remnant Woodland Enhancement Program (RWEPP) Area
 - Approved Ventilation Shaft
 - Modified Ventilation Shaft

Note: Refer to Figure 2a for location of North Wambo Underground Mine and South Bates Underground Mine.

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

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ENERGY

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

**Approved and Modified
South Wambo Underground Mine
General Arrangement**

Figure 9

Replacement of underground equipment would be required over the life of the South Wambo Underground Mine to maintain production capacity or increase efficiency. Two longwall machines may be used concurrently to extract coal from the Woodlands Hill Seam and Arrowfield Seam and achieve the maximum proposed underground mining rate.

Ventilation System

The Modification would require construction and operation of five ventilation shafts to support the operation of the South Wambo Underground Mine (i.e. an additional four ventilation shafts compared to the approved South Wambo Underground Mine and relocation of the approved shaft) (Figure 9).

These ventilation shafts would be staged with the progression of mining and may be used as upcast shafts (including installation of fans) or downcast shafts, depending on the location of mining. The ventilation shafts would also require access roads, security (e.g. fencing), electrical infrastructure, water management and flood control infrastructure and other associated ancillary infrastructure.

Mine Safety Gas Management

Gas Drainage

Pre-mining gas drainage, goaf gas drainage and underground in-seam gas drainage would be required for the South Wambo Underground Mine to reduce the gas content in the coal seams to levels suitable for longwall operations.

Pre-mining gas drainage would be conducted by drilling vertical (i.e. surface to in-seam) boreholes in advance of mining. These vertical wells would extract gas from the coal seam directly to the surface where it would be vented to the atmosphere or flared. Conventional underground in-seam gas drainage may also be utilised.

Goaf gas drainage would be conducted behind the progressing longwall mining operations. Goaf gas drainage would be undertaken via vertical boreholes to drain the goaf gas.

Up to four gas drainage boreholes per longwall would be required, consistent with the approved South Wambo Underground Mine. These would generally consist of two pre-drainage and two goaf gas drainage boreholes.

Although there would be no change to the number of gas drainage boreholes required per longwall panel, the Modification would result in an increase in the total number of gas drainage boreholes overall due to the increased number of longwall panels.

Gas drainage boreholes and associated infrastructure would be progressively constructed, operated and decommissioned such that a total of six would be established with approximately four operational at any one time.

Centralised Gas Plants

Up to two centralised gas plants would be required for the Modification to flare gas collected through pre-drainage and goaf gas drainage activities. Each gas plant would consist of a fully fenced area with flares, pumps, nitrogen tanks and monitoring, water collection and surface pipes. Only one gas plant would be operational at any time.

Gas would be delivered to the centralised gas plant from the gas drainage boreholes via gas pumps and a network of underground and/or surface pipes.

An example of a typical gas plant is provided in Plate 1.



Plate 1: Typical Gas Plant

Access Tracks

General access tracks would be constructed to facilitate the maintenance and monitoring of gas management infrastructure, including any required power and/or water pipes.

Gas Management Infrastructure Siting

Given the variable gas quantities and the wide range of topography, vegetation cover and access constraints across the South Wambo Underground Mine area, the specific locations of gas management infrastructure would be defined as a component of future detailed mine planning and engineering studies over the life of the South Wambo Underground Mine.

Surveys of potential gas management infrastructure locations would be conducted to identify any threatened flora/fauna (e.g. species, communities or populations) and Aboriginal cultural heritage sites. If any threatened flora/fauna or Aboriginal cultural heritage sites are identified, consideration would be given to relocating the works so as to avoid direct impacts.

It is expected that threatened flora species, threatened populations, threatened fauna species and Aboriginal cultural heritage sites would be able to be avoided. Impacts to threatened communities would be minimised by the minor nature of the disturbance (small, isolated and temporary) and by locating the surface components to reduce clearance requirements (e.g. using existing cleared areas or areas with a sparse mid/over story).

The location of gas management infrastructure would be outlined in the relevant Extraction Plan and associated Mining Operations Plan.

If portions of the underground mining area were found to be unsuitable for gas management infrastructure (e.g. due to environmental constraints), mining would proceed using underground gas management techniques.

Surface disturbance associated with gas management infrastructure would be temporary and isolated in nature. The surface disturbance would occur progressively over the life of the South Wambo Underground Mine and would be rehabilitated progressively as the gas management infrastructure is no longer required.

The potential visual amenity impacts of gas management infrastructure are assessed in Section 4.16.

Dewatering

Groundwater that accumulates in the underground workings would be pumped to the surface via underground sumps, access drifts and/or boreholes, consistent with approved operations at the North Wambo Underground Mine and South Bates Underground Mine. Overlying and adjacent workings may also be dewatered if required for safety reasons.

3.3 OTHER APPROVED UNDERGROUND OPERATIONS

The Modification does not include any alteration to the layout and/or operation of the approved North Wambo Underground Mine or South Bates Underground Mine.

3.4 OPEN CUT OPERATIONS

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

The Modification would include an extension of open cut mining operations by approximately 3 years (i.e. up to and including 2020). This extension of the open cut life is consistent with mine progression in the approved Mining Operations Plan (WCPL, 2015b). The extension in the open cut operational life is required due to lower than scheduled ROM coal production since the approval of the Wambo Development Project.

3.5 COAL HANDLING, PREPARATION AND PRODUCT COAL TRANSPORT

ROM coal from the South Wambo Underground Mine would be transported by trucks on an internal haul road from the ROM coal stockpile to the CHPP. Coal may also be transported by overland conveyor from the ROM coal stockpile to the CHPP should financial circumstances permit. This would replace truck haulage.

The Modification would not alter the CHPP or product coal transport operations as there would be no increase in the maximum ROM coal production rate at Wambo (Sections 2.6 and 2.7).

The Modification would extend these operations by 7 years to 2032.

3.6 COAL REJECT MANAGEMENT

The Modification would result in production of approximately 7.3 Mt of coarse rejects and 3 Mt of tailings.

WCPL has conducted a review of the available coal reject storage at Wambo and concluded there would be sufficient storage capacity for the additional coal rejects generated by the Modification.

Based on analysis of available coal quality data from the Woodlands Hill Seam coal, it is expected that Woodlands Hill Seam coal rejects would be geochemically similar to coal rejects currently produced from coal seams currently mined at Wambo (i.e. non-acid forming).

Given the above, no alteration of current coarse rejects or tailings management measures (Section 2.9) would be required.

3.7 INFRASTRUCTURE AND SERVICES

The Modification would include additional surface infrastructure and associated works, comprising:

- the South Wambo Underground Mine infrastructure area (Figure 8);
- an additional internal access road to facilitate access to the South Wambo Underground Mine infrastructure area (Figure 8); and
- other minor infrastructure.

South Wambo Underground Mine Infrastructure Area

The South Wambo Underground Mine infrastructure area would be an extension to the existing approved surface infrastructure area (Figure 8).

This would include the construction and operation of:

- an extended ROM coal facilities area;
- an underground equipment laydown area;
- water management infrastructure including water storage dams;
- an office complex and bathhouse;
- water and septic tanks;
- a communications room and training room;
- electrical infrastructure, workshop, stores and fuel bay; and
- car park facilities.

The Modification also includes an upgrade of the existing CHPP administration block, bathhouse and workshops located at the CHPP.

These upgrades to the surface infrastructure are required to support underground mining operations.

Access Road

An access road to the South Wambo Underground Mine infrastructure area would be constructed, including upgrades to existing access roads and the construction of a grade separated crossing of the existing Wambo access road.

Other Minor Infrastructure

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

Additional minor infrastructure required for the Modification would include:

- electrical infrastructure;
- communications infrastructure;
- service pipelines;
- water management infrastructure;
- flood control works, including levees;
- ventilation and gas management infrastructure; and
- service boreholes.

3.8 WATER MANAGEMENT AND SUPPLY

The Modification would not include any material changes to the approved water management system, water supply or water demand (Section 2.11).

3.9 WORKFORCE

The Modification would not result in any additional demand for employees and contractors.

The existing Wambo workforce currently comprises:

- approximately 230 underground mine personnel;
- approximately 290 open cut mine personnel; and
- approximately 150 CHPP, management, administration and support personnel.

As described in Section 3.4, the Modification involves continuation of the open cut workforce up to and including 2020. Following completion of the open cut operations, two longwall machines may operate concurrently in the Woodlands Hill Seam and Arrowfield Seam (Section 3.2).

The total Wambo workforce would fluctuate with the completion of open cut mining and any increase in production in the underground operations, however is not anticipated to exceed the existing Wambo workforce.

3.10 REHABILITATION

The Modification would not require a material change to the rehabilitation programme presented in the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003) (Section 2.13).

The South Wambo Underground Mine surface infrastructure with no ongoing beneficial use would be removed from site at the completion of mining. Following decommissioning, these areas would be rehabilitated consistent with the existing principles at Wambo.

The underground mining 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.

3.11 INTERACTION WITH THE UNITED AND WAMBO OPEN CUT COAL MINE PROJECT

WCPL and United Collieries have formed a joint venture over the tenements adjoining this proposed Modification in relation to the United and Wambo Open Cut Coal Mine Project (SSD 15_7142).

The United and Wambo Open Cut Coal Mine Project seeks to combine the existing open cut operations at Wambo with a proposed new open cut coal mine at the United Collieries. Wambo's CHPP and underground operations do not form part of the joint venture, and will continue to be owned and operated by WCPL.

This Modification is independent of, and not reliant on, the proposed United and Wambo Open Cut Coal Mine Project. However, it is noted that the extension to the life of the open cut operations (Section 3.4) seeks to maintain operational continuity of the open cut operations to allow for assessment and determination of the United and Wambo Open Cut Coal Mine Project.

Cumulative assessment of the Modification and the United and Wambo Open Cut Coal Mine Project will be conducted as a component of the Environmental Impact Statement for the United and Wambo Open Cut Coal Mine Project.

3.12 ACTION UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT, 1999

The components of the Modification that form part of the Action (EPBC 2016/7636) are described in Attachment 5.

4 ENVIRONMENTAL ASSESSMENT

The Modification would involve a realignment and extension/relocation of the approved South Wambo Underground Mine longwall panels and mining of the Woodlands Hill Seam rather than the Bowfield Seam. Longwall mining areas associated with the Modification are described below (Figure 9):

- **Area 1 (Woodlands Hill Seam)** – The modified mine layout includes additional longwall panels in the Woodlands Hill Seam beneath the existing/approved surface development area.
- **Area 2 (Arrowfield Seam and Woodlands Hill Seam)** – The modified mine layout includes a reorientation and minor extension of the approved Arrowfield Seam mine layout in Area 2. The Woodlands Hill Seam is proposed to replace the Bowfield Seam in this location with a reorientation and minor extension to the approved mine layout.
- **Area 3 (Arrowfield Seam and Woodlands Hill Seam)** – The modified mine layout includes an extension of mining in the Arrowfield Seam and Woodlands Hill Seam into Area 3, comprising three longwall panels in the Arrowfield Seam and four longwall panels in the Woodlands Hill Seam.
- **Area 4 (Approved Arrowfield Seam)** – The Modification does not propose any changes to the approved Arrowfield Seam mine layout to the east of Wollombi Brook. The approved Bowfield Seam mine layout is no longer proposed to be mined in Area 4 and therefore there would be a reduction in subsidence impacts in Area 4.

The “Modification area” which is assessed in this section comprises the additional surface development areas and the extent of conventional subsidence resulting from the modified mine layout.

Subsidence impacts resulting from longwall mining in the Arrowfield and Bowfield Seams in Area 4 (Figure 9) were assessed as part of the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003) and approved under the Development Consent (DA 305-7-2003).

As described further in Section 4.2.2, the predicted subsidence effects for the modified mine layout in Area 4 are predicted to reduce in all areas as only the Arrowfield Seam is proposed to be mined (i.e. mining of the Bowfield Seam is no longer proposed) (Mine Subsidence Engineering Consultants [MSEC], 2016).

The potential subsidence impacts and environmental consequences in Area 4 are therefore also expected to reduce as a result of the Modification and accordingly, environmental consequences in Area 4 are not assessed in detail by the supporting studies.

4.1 IDENTIFICATION OF KEY ISSUES

As a component of the environmental assessment of the Modification, an Environmental Risk Assessment was undertaken to identify key potential environmental issues requiring further assessment.

The key environmental issues identified in the Environmental Risk Assessment (Appendix L) are summarised in Table 2 and addressed in Sections 4.2 to 4.16 and the relevant appendices in the EA.

All of the potential issues identified were ranked within the ‘Medium – As Low as Reasonably Practicable’ or ‘Low’ range. The Environmental Risk Assessment is provided in full as Appendix L.

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 land surface 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.

Extraction Plan

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

Table 2
Summary of Key Potential Environmental Issues

Environmental Issue Subject Area	Description of Potential Issues	EA Section/Appendix
Surface Water	<ul style="list-style-type: none"> Potential for North Wambo Creek Diversion to be damaged by subsidence resulting in reduced flow affecting downstream water quality. Potential for induced leakage from North Wambo Creek Diversion due to subsidence. Potential for a change in flood regimes or extent of potential inundation due to subsidence. Potential for subsidence impacts and environmental consequences on North Wambo, Stony and Wambo Creeks. 	Section 4.5 and Appendix C
Groundwater	<ul style="list-style-type: none"> Potential for failure of the monitoring program to detect and respond to impacts on the groundwater system. 	Section 4.4 and Appendix B
Biodiversity	<ul style="list-style-type: none"> Potential for subsidence impacts and surface disturbance resulting in loss of habitat for threatened species. Potential for creation of subsidence monitoring tracks to affect the conservation values of RWEPP areas. Potential for subsidence impacts on RWEPP areas resulting in a reduction of biodiversity values. Potential for subsidence impacts on vegetation along Stony Creek and the North Wambo Creek Diversion. 	Sections 4.8 and 4.9 and Appendices D and E
Aboriginal Cultural Heritage	<ul style="list-style-type: none"> Potential for mine subsidence impacts on items of Aboriginal heritage. 	Section 4.6 and Appendix F
Agriculture	<ul style="list-style-type: none"> Potential for subsidence impacts resulting in injury to livestock. Potential for incremental ponding of agricultural land. 	Sections 4.3 and 4.5 and Appendices C and G
Land	<ul style="list-style-type: none"> Potential for unintended subsidence impacts resulting in rock instability of the Wollemi National Park escarpment and associated environmental consequences. 	Section 4.2 and Appendix A
Noise	<ul style="list-style-type: none"> Cumulative noise impacts associated with the United Collieries and Warkworth Continuation Project. 	Section 4.10 and Appendix H
Air Quality	<ul style="list-style-type: none"> Cumulative air quality impacts associated with the United Collieries and Warkworth Continuation Project. Potential for subsidence impacts on open cut mining operations resulting in increased wind erosion potential. 	Section 4.11 and Appendix I Section 4.2.3

Source: After Appendix L.

4.2.2 Prediction of Subsidence Effects

A Subsidence Assessment for the Modification has been prepared by MSEC (2016) and is presented in Appendix A. The Subsidence Assessment:

- identifies the natural and built features located above and in the vicinity of the modified mine layout;
- provides cumulative subsidence predictions for the modified mine layout in the Arrowfield and Woodlands Hill Seams and approved mining in the Wambo Seam;

- compares the subsidence predictions with the approved mine layout in the Arrowfield and Bowfield Seams; and
- assesses the likely subsidence impacts on natural and built features in consideration of cumulative subsidence effects.

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

Prediction Methodology

MSEC (2016) has assessed the predicted changes in subsidence effects associated with the modified mine layout compared to the approved mine layout.

Predictions of 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 over-predict 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 mine layouts have been calculated using a calibrated Incremental Profile Method (including consideration of multi-seam mining conditions), so that the change in subsidence effects can be directly compared.

Table 3 summarises the previous and future approved/proposed mining within the Modification area and how this mining has been considered in the subsidence effect predictions. The location of this mining is shown on Figure 10.

It is noted that mining conducted under other consents has not been included in the quoted subsidence effects predictions. However, the assessments of subsidence impacts and environmental consequences have considered the cumulative impacts of this previous mining by considering the environmental conditions following completion of this mining and the potential impacts of this mining.

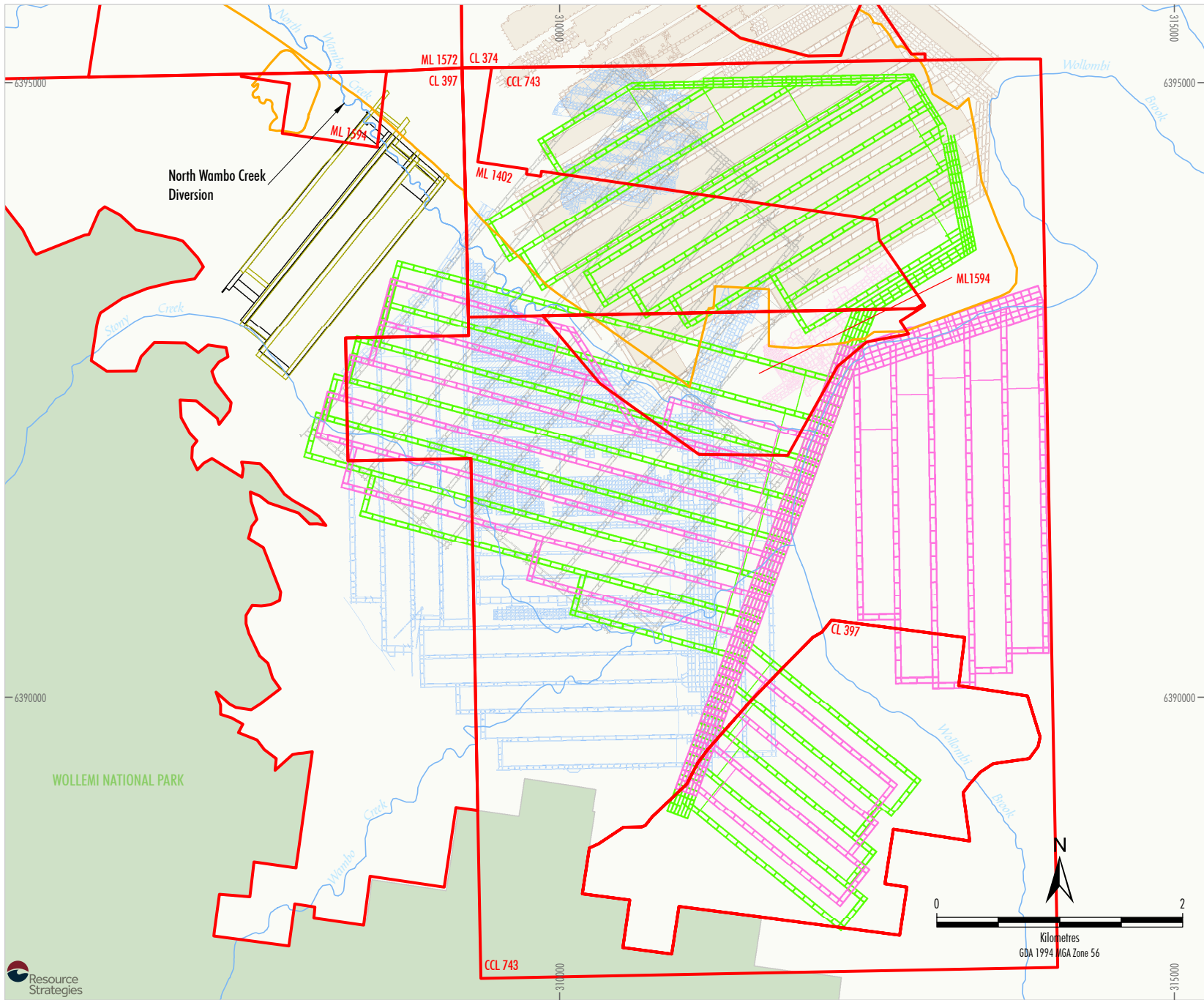
A detailed description of the numerical methodologies used to predict subsidence effects associated with the modified mine layout is provided in Appendix A.

Predicted Subsidence Effects

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


**Table 3
Previous and Approved Underground Mining in the Modification Area**

Coal Seam	Previous Mining	Future Approved and Proposed Mining	Consideration in Subsidence Effect Predictions
Whybrow Seam	Homestead/Wollemi bord and pillar and longwall mining – Completed in 2002 (under other consents).	-	Multi-seam effects of previous Whybrow Seam mining (i.e. reactivation) included in predicted subsidence effects.
Wambo Coal Seam	North Wambo Underground Mine – Completed in January 2016 (under DA 305-7-2003).	-	Subsidence from Wambo Seam mining included in subsidence effect predictions for the approved and modified mine layouts.
Woodlands Hill Seam	-	Modification mining in Woodlands Hill Seam (to replace approved mining in the Bowfield Seam).	Subsidence from Woodlands Hill Seam mining included in subsidence effect predictions for the modified mine layout only.
Arrowfield Seam	United Underground – Completed by United Collieries in 2010 (under other consents).	-	Multi-seam effects of previous Arrowfield Seam mining (i.e. overmining) included in predicted subsidence effects.
	-	Approved and Modification mining in Arrowfield Seam.	Subsidence from Arrowfield Seam mining included in subsidence effect predictions for the approved and modified mine layouts.
Bowfield Seam	-	Approved mining in Bowfield Seam (to be replaced by mining in the Woodlands Hill Seam).	Subsidence from Bowfield Seam mining included in subsidence effect predictions for the approved mine layout only.



- LEGEND**
- Mining and Coal Lease Boundary
 - Existing/Approved Surface Development Area
 - Wollemi National Park
 - ▨ Previous Mine Workings in Wambo Seam
 - ▨ Existing Homestead/Wollemi/Ridge Workings in Whybrow Seam
 - ▨ Existing United Mine Longwalls in Arrowfield Seam
 - ▨ Existing North Wambo Underground Workings in Wambo Seam
 - ▨ Approved South Bates (Wambo Seam) Underground Mine
 - ▨ Approved South Bates (Whybrow Seam) Underground Mine
 - ▨ Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - ▨ Modified South Wambo (Arrowfield Seam) Underground Mine

Source: Department of Lands (July 2009); WCPL (2015)


W A M B O C O A L M I N E
 Previous and Proposed
 Underground Mining

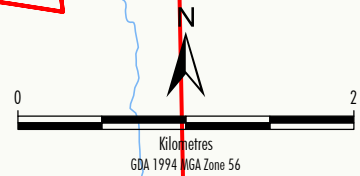


Figure 10

Systematic Subsidence Effects

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

Table 4 presents a comparison of the predicted cumulative subsidence effects from the approved mine layout and the modified mine layout under the Development Consent (DA 305-7-2003).

The maximum predicted total vertical subsidence for the modified mine layout is 6,250 mm, less than that of the approved mine layout of 9,000 mm.

The predicted total vertical subsidence for the modified mine layout has reduced because:

- the modified mine layout has a ‘staggered’ longwall arrangement (slightly offset) whereas the approved mine layout has ‘stacked’ longwalls (directly above and below each other in each seam); and
- the proposed extraction heights of the modified mine layout are slightly reduced.

The maximum predicted total tilt of the modified mine layout is 75 mm/m, less than the maxima predicted based on the approved mine layout of 90 mm/m.

The maximum predicted total hogging curvature and sagging curvature for the modified mine layout are similar to those predicted based on the approved mine layout using the calibrated Incremental Profile Method (Appendix A).

A summary of the maximum predicted total subsidence by mining area is provided in Table 5.

Tensile and Compressive Strains

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

Extensive multi-seam monitoring data were collected during extraction in the Wambo Seam at the North Wambo Underground Mine. MSEC (Appendix A) concludes that the range of strains measured during the extraction of the longwalls at the North Wambo Underground Mine should provide a reasonable, if not, slightly conservative indication of the range of potential strains for the modified mine layout. 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.

The overburden generally comprises a zone of continuous subsurface fracturing and a zone of discontinuous subsurface fracturing.

**Table 4
Comparison of Predicted Subsidence Effects for the Approved and Modified Mine 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 Mine Layout (Wambo, Arrowfield and Bowfield Seams)	9,000	90	> 3.0	> 3.0
Modified Mine Layout (Wambo, Arrowfield and Woodlands Hill Seams)	6,250	75	> 3.0	> 3.0

Source: Appendix A.
mm = millimetre.
mm/m = millimetre per metre.
km⁻¹ = per kilometre.

Table 5
Comparison of Predicted Total Subsidence for the Approved and Modified Mine Layouts by Area

Mining Area	Layout	Coal Seams Mined	Maximum Predicted Total Subsidence (mm)
Areas 1 and 2	Approved Mine Layout	Wambo, Arrowfield and Bowfield Seams	9,000
	Modified Mine Layout	Wambo, Arrowfield and Woodlands Hill Seams	6,250
Area 3	Approved Mine Layout	-	-
	Modified Mine Layout	Arrowfield and Woodlands Hill Seams	3,700
Area 4	Approved Mine Layout	Arrowfield and Bowfield Seams	6,950
	Modified Mine Layout	Arrowfield Seam	2,750

Source: After Appendix A.

Within the continuous subsurface fracturing zone, cracking is likely to result in a direct hydraulic connection to the workings, if a subsurface (or shallow surface) aquifer is intersected. However, MSEC (Appendix A) does not expect that there would be a hydraulic connection between the surface and the proposed seams, as no direct connection was observed after the extraction of the longwalls in the Wambo Seam at the North Wambo Underground Mine.

Discontinuous subsurface fracturing does not usually provide a direct flow path or connection to the mine workings, but may interact with surface cracks, joints or faults. For the Modification, MSEC (Appendix A) predict that the discontinuous fractured zone would extend upwards to the existing workings in the Wambo and Whybrow Seams, reactivate the existing goaf, with the fracturing extending to the surface where the depths of cover are the shallowest.

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).

4.2.3 Subsidence Impacts

Subsidence impacts are the physical changes to the ground and its surface caused by the subsidence effects described above in Section 4.2.2. Potential subsidence impacts associated with the Modification include:

- surface cracking;
- changes in stream bed gradients;
- ponding and changes in stream alignment;
- slope instability and erosion; and
- depressurisation of groundwater aquifers.

The type and magnitude of predicted subsidence effects for the modified mine layout are generally similar to or less than those of the approved mine layout. This is due to the 'staggered' longwall arrangement of the Modification compared to the approved 'stacked' arrangement and slightly reduced extraction heights. The total surface area affected by subsidence increases as a result of the Modification.

It is therefore expected that the potential subsidence impacts above the modified mine layout would be generally similar in nature to those associated with the approved mine layout, but over a larger area.

The Subsidence Assessment (Appendix A) includes detailed subsidence predictions and assessment for key natural and built features across the Modification area. Potential environmental consequences of subsidence on key natural and built features are summarised in Section 4.2.4.

4.2.4 Potential Environmental Consequences on Key Natural and Built Features

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 6).

A summary of the potential environmental consequences of the potential subsidence impacts above the modified mine layout in Areas 1, 2 and 3 is provided below, including cross-references to sub-sections with further detail.

Streams

Wollombi Brook

The Subsidence Assessment prepared by G.E. Holt & Associates (2003) concluded that approved longwall mining would have no subsidence impact on Wollombi Brook as:

- mining of longwall panels would be constrained by the subsidence exclusion zone limited to an angle of 26.5° from the vertical to a 40 m lateral buffer from the Wollombi Brook high bank; and
- the main development drivages beneath the Wollombi Brook for the future approved mining of the Arrowfield and Bowfield Seams would be designed to be permanently stable.

**Table 6
Subsidence Impact Performance Measures**

Feature	Subsidence Impact Performance Measure
Wollombi Brook	Negligible impact. Controlled release of excess site water only in accordance with Environmental Protection Licence (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

Wollombi Brook is located 180 m east of Area 2 at its closest point (Figure 3). At this distance, Wollombi Brook is predicted to experience less than 20 mm of vertical subsidence (Appendix A). While it is possible that Wollombi Brook could experience very low levels of subsidence, it would not be expected to experience any measurable tilts, curvatures or ground strains.

The extent of the modified mine layout is outside of the 'subsidence exclusion zone' related to Wollombi Brook (as defined above). It is therefore expected that any subsidence impact on Wollombi Brook as a result of the Modification would be negligible (Appendix A).

North Wambo, Wambo and Stony Creeks

North Wambo Creek, Wambo Creek and Stony Creek would be affected by subsidence from the approved mine layout and modified mine layout.

Predicted subsidence effects on North Wambo Creek would reduce as a result of the Modification, and would increase on Wambo Creek and Stony Creek.

Subsidence impacts on creeks include changes in grade and surface cracking.

An assessment of the potential change in environmental consequences on North Wambo Creek, Wambo Creek and Stony Creek as a result of the Modification is provided in Section 4.5 and Appendix C.

North Wambo Creek Diversion

The downstream portion of the North Wambo Creek Diversion (approximately 600 m in length) is located above the modified mine layout. Potential subsidence impacts and environmental consequences on the North Wambo Creek Diversion are described in Section 4.5 and Appendix C.

Alluvial Aquifers

Alluvium associated with Wollombi Brook and Wambo, North Wambo and Stony Creeks is located above and adjacent to the modified mine layout. The potential impacts of the Modification on alluvium are discussed in Section 4.4 and Appendix B.

Cliffs

Cliffs in the vicinity of the modified mine layout were identified by MSEC (Appendix A) using 1 m surface level contours generated from a Light Detection and Ranging (LiDAR) survey and from detailed site investigations, and are shown on Figure 11.

The only cliffs identified are associated with the Wollemi National Park escarpment. The maximum predicted vertical subsidence for the cliffs is less than 20 mm. The cliffs are not predicted to experience any significant conventional tilts, curvatures or strains. MSEC (Appendix A) concluded it is unlikely the cliffs would be adversely impacted.

Steep Slopes

Steep slopes (where the natural gradient is between 1 in 3 and 2 in 1) occur in the Modification area beneath the Wollemi National Park escarpment (Appendix A).

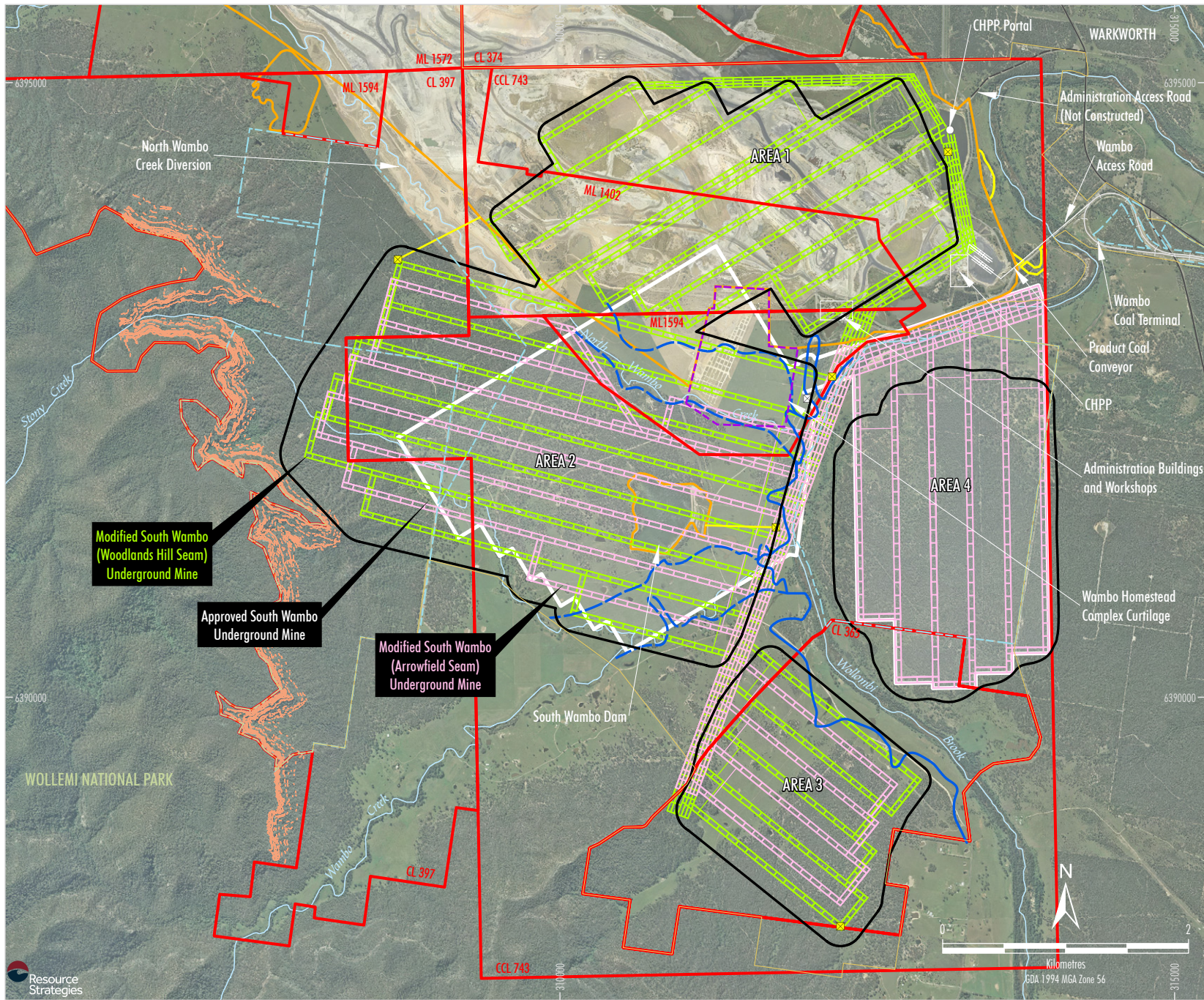
The maximum predicted total tilt for these steep slopes of 40 mm/m (i.e. 1 in 25) is small when compared to the natural surface grades, which are greater than 1 in 3 (Appendix A). Therefore, MSEC (Appendix A) concludes it is unlikely that mining induced tilts would result in any adverse impact on the stability of these steep slopes.

The steep slopes are more likely to be impacted by curvature and ground strain than tilt. The potential subsidence impacts (i.e. tension cracks at the tops and compression ridges at the bottoms) would be a result of horizontal movements in the down slope direction, which if left untreated may lead to increased soil erosion (Appendix A).

Wollemi National Park

The Wollemi National Park is located 310 m from Area 2 at its closest point (Figure 3). The modified mine layout was designed to maintain WCPL's commitment to maintain an offset equivalent to a 26.5° angle of draw from the base of the Wollemi National Park escarpment, which effectively mitigates subsidence risk to the escarpment. Land within the National Park is predicted to experience less than 20 mm vertical subsidence and no measureable tilts, curvatures or strains.

It is therefore considered unlikely the Wollemi National Park would be adversely impacted by subsidence movements (Appendix A).



- LEGEND**
- Mining and Coal Lease Boundary
 - WCPL Owned Land
 - Existing/Approved Surface Development Area
 - Modified Surface Development Area
 - Approved South Wambo Underground Mine Development (Not Constructed)
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - ⊠ Approved Ventilation Shaft
 - ⊠ Modified Ventilation Shaft
 - Predicted Extent of Modification Conventional Subsidence
 - - - Remnant Woodland Enhancement Program (RWEPP) Area
 - Wambo Homestead Complex Curtilage
 - Wollombi Brook Mapped Alluvium Extent
 - - - Mapped Alluvium Extent
 - Cliffs Associated with Wollemi National Park Escarpment
- Note: Refer to Figure 2a for location of North Wambo Underground Mine and South Bates Underground Mine.*
- Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013); MSEC (2016); Groundwater Imaging (2012)*

Peabody ENERGY

WAMBO COAL MINE

**Cliffs and Mapped Alluvium
in the Vicinity of the Modification Area**

Figure 11

Land Use and Land Resources

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

Aboriginal Cultural Heritage

A number of Aboriginal cultural heritage sites, including artefact scatters and isolated finds, scarred trees, grinding grooves/surfaces and earth mounds, have been identified in the vicinity of the Modification area. Potential consequences on Aboriginal cultural heritage sites as a result of subsidence impacts are described in Section 4.6 and Appendix F.

Non-Aboriginal Cultural Heritage

The Wambo Homestead Complex curtilage is located within the Modification area. This is discussed further in Section 4.7 and Appendix F.

Threatened Ecological Communities

Potential consequences on threatened ecological communities as a result of subsidence impacts are discussed in Section 4.8 and Appendix D.

Infrastructure and Improvements

The potential impacts of subsidence effects on infrastructure and improvements are assessed in Appendix A. Infrastructure and improvements located within the extent of subsidence from Areas 1, 2 and 3 of the modified mine layout include:

- South Wambo Dam and North-East Tailings Dam, prescribed dams owned and operated by WCPL;
- unsealed roads and tracks, including a right of way in favour of several private properties (the route of which may be varied on reasonable notice);
- site administration buildings;
- WCPL-owned house and associated rural building structures;
- underground power and telecommunications cables;
- water pipelines for WCPL mining activities;
- Wambo open cut mining and emplacement areas;

- electricity transmission lines, including an 11 kilovolt (kV) powerline owned by Ausgrid and 11 kV and 66 kV powerlines owned by WCPL;
- registered groundwater bores;
- WCPL-owned exploration boreholes;
- fences and farm dams used for grazing on WCPL-owned land; and
- survey control marks.

WCPL would continue to implement management strategies for the South Wambo Dam (developed for the approved Longwalls 9 to 10A at the North Wambo Underground Mine). These management strategies would be reviewed, and where necessary, revised to include the effects of the proposed Modification longwalls.

Due to the greater depth of cover compared to the North Wambo Underground Mine, South Wambo Dam may not need to be fully drained for mining of the Woodlands Hill and Arrowfield Seams.

Similar management strategies would be developed and implemented for the North-East Tailings Dam, in consultation with Dams Safety NSW, during the Extraction Plan process.

WCPL has previously managed subsidence effects on the Wambo open cut mining and emplacement areas during mining of the North Wambo Underground Mine. WCPL would implement similar management and mitigation strategies for the Modification. The scheduling of waste emplacement and rehabilitation would take account of planned subsidence.

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

Public Safety

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

Potential safety issues resulting from the extraction of the Modification longwall panels could include:

- potential safety hazards for users of existing unsealed roads and tracks in active subsidence areas; and
- potential safety hazards to agistees accessing active subsidence areas to manage stock.

WCPL would develop management strategies to mitigate any such risks so that there would be no additional risk to public safety as part of the Extraction Plan process.

4.2.5 Mitigation Measures, Management and Monitoring

An Extraction Plan would be prepared prior to the commencement of second workings at the South Wambo Underground Mine 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 and non-Aboriginal cultural heritage, flora and fauna are described in Sections 4.3 to 4.9.

Infrastructure and Improvements

As described above, WCPL owns the majority of the infrastructure and improvements potentially affected by the Modification.

Measures to manage the impacts of subsidence on surface infrastructure would be developed in consultation with other infrastructure owners (i.e. Ausgrid) 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 that would be developed for the Modification would include a Public Safety Management Plan as required under Condition 22C(g), Schedule 4 of the Development Consent (DA 305-7-2003).

The existing approved Public Safety Management Plans for the North Wambo Underground Mine and the South Bates (Whybrow Seam) Underground Mine include measures to maintain public safety (e.g. signage and regular monitoring and remediation of surface cracking).

4.3 LAND RESOURCES AND AGRICULTURAL PRODUCTION

An Agricultural Impact Statement for the Modification was undertaken (WCPL, 2016a) and is presented in Appendix G. An Agricultural Resource Assessment prepared by Soil Management Designs (2016) is included as Attachment 2 to Appendix G. The Agricultural Resource Assessment was informed by a soil survey that included 29 soil inspection pits in the Modification area.

A description of the existing environment relating to land resources and agricultural production is provided in Section 4.3.1. Section 4.3.2 describes the potential impacts of the Modification on land resources and agricultural production, and Section 4.3.3 describes applicable management, mitigation and monitoring measures.

4.3.1 Existing Environment

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.

Natural 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 (Appendix G). Elevations in the Modification area range from approximately 60 m AHD near Wollombi Brook to approximately 210 m AHD near the base of the Wollemi National Park escarpment.

The proposed Area 1 is beneath the existing/approved surface development area, which includes landforms modified by the open cut operations.

Land Use

Land use in the vicinity of Wambo is characterised by a combination of coal mining operations, RWEP areas, agricultural land use and WCPL-owned lands that are not subject to mining operations (Appendix G).

The majority of the Modification area is located on WCPL-owned land. Land uses include coal mining operations, RWEPA Areas A, B and C, remnant vegetation and agriculture (beef cattle). The North Wambo Creek Diversion is also located across a portion of the Modification area.

Soils

Regional soil landscapes (Kovac and Lawrie, 1991) mapped across the Modification area include Wollombi, Bulga, Benjang, Branxton, Lees Pinch and Jerrys Plains soil landscapes (Appendix G).

Soil landscape units associated with the soil inspection pits from the soil survey undertaken by Soil Management Designs (2016) include Wollombi, Bulga, Benjang, Branxton and Lees Pinch soil landscape units. Soil types associated with these soil landscapes in the Modification area comprise rudosols, dermosols, sodosols, kandosols, vertosols, tenosols and anthroposols.

Soil Condition

A broad range of soil physical and chemical constraints for agricultural land use were identified across the Modification area, including (Appendix G):

- poor waterholding capacity in shallow/stony soils;
- waterlogging in subsoil;
- dispersive subsoil;
- compaction in subsoil;
- salt concentrations in some areas;
- acidic topsoil and subsoil;
- nutrient deficiency; and
- poor organic content in deeper layers of soil.

Alluvial soils had much better physical conditions for plant growth than the non-alluvial areas, but Soil Management Designs (2016) identified deficiencies of sulphur and possibly potassium in these areas.

Land and Soil Capability

The Land and Soil Capability system (OEH, 2012) is used to give an indication of the land management practices that can be applied to a parcel of agricultural land.

Agricultural land is classified by evaluating biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards (OEH, 2012).

Based on the results of the soil survey, Soil Management Designs (2016) allocated each soil inspection pit a Land and Soil Capability rating. Soil Management Designs (2016) found that:

- approximately 45% of the soil inspection pits had a Land and Soil Capability Class of 4 or 5, which is moderate or moderate-low capability land with limitations for high impact land uses such as cropping, high intensity grazing and horticulture;
- approximately 27.5% of the soil inspection pits had a Land and Soil Capability Class of 6 or 7, which is low or very low capability land with either a limited set of land uses, or generally incapable of agricultural land use; and
- the remaining 27.5% of the soil inspection pits had a Land and Soil Capability Class of 2 or 3, which is land capable of a wide variety of land uses.

Agricultural Activities and Productivity

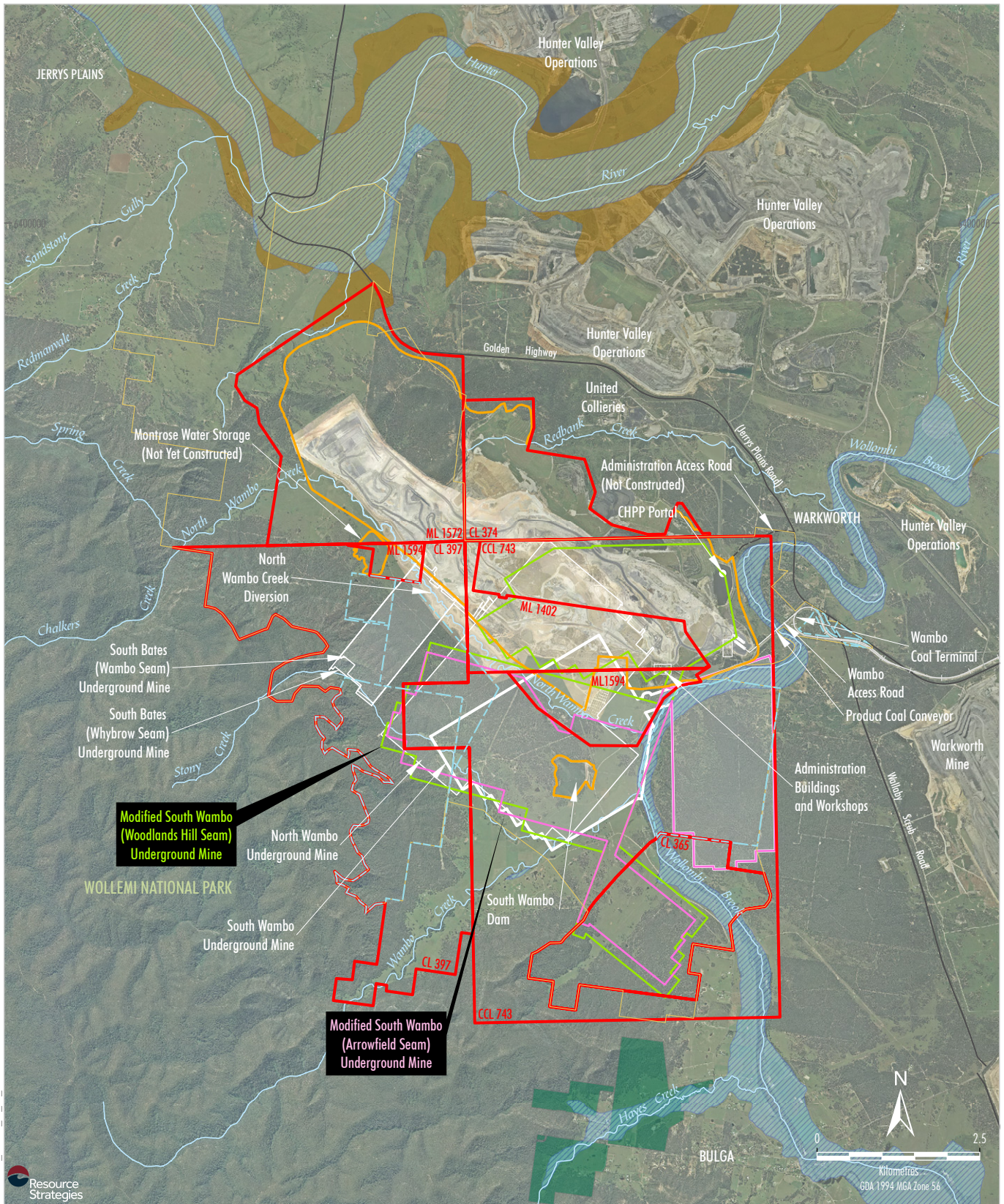
The main agricultural activities in the Upper Hunter region include dairy and beef cattle and pasture production, horse breeding, viticulture and wine making (NSW Government, 2012b).

All cleared areas were under pasture, with greater productivity on the deep well-drained alluvial soil (Soil Management Designs, 2016). However, land within the Modification area includes the Wambo open cut operations and forest and woodland not suitable for agriculture.

Strategic Agricultural Land

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 4 km to the north-east of the Modification area (Figure 12).



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LEGEND

- Mining and Coal Lease Boundary
- WCPL Owned Land
- Existing/Approved Surface Development Area
- Approved Underground Development
- Modified South Wambo (Woodlands Hill Seam) Underground Mine
- Modified South Wambo (Arrowfield Seam) Underground Mine
- - - Remnant Woodland Enhancement Program (RWEPP) Area
- Biophysical SAL
- Viticulture Critical Industry Cluster SAL
- Highly Productive Groundwater



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

Strategic Agricultural Land in the Vicinity of Wambo

Source: NSW DP&I (January 2014); Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

Figure 12

The Modification area is not located within mapped Viticulture Critical Industry Clusters (Figure 12). The closest Viticulture Critical Industry Cluster is located approximately 0.6 km to the south of the Modification area (Figure 12).

Based on the results of the site soil survey, Soil Management Designs (2016) has identified that one of the 29 soil inspection pits may be an area of higher value or strategic agricultural land. This soil pit is located above the approved South Wambo Underground Mine footprint (Figure 2a) and is therefore already approved to be affected by subsidence.

4.3.2 Potential Impacts

Potential impacts of the Modification on soils would primarily relate to:

- loss of agricultural land due to the surface development areas and the extension to the RWEPA areas; and
- subsidence-related impacts.

It is considered that the Modification would not have any significant adverse impacts on the Viticulture Critical Industry Cluster as it is well outside the predicted extent of conventional subsidence.

The subsidence effects on the identified area of possible higher value or strategic agricultural land would be generally reduced as a result of the Modification due to the proposed 'staggered' longwall layout compared to the approved 'stacked' layout (MSEC, 2016).

Agricultural Activities and Productivity

Approximately 4.5 hectares (ha) of the surface development area extension consists of derived grassland which may be suitable for agricultural uses (e.g. grazing). The remainder of the surface development area extension comprises forest and woodland that would not be suitable for agricultural uses (Appendix G).

Therefore, approximately 4.5 ha of potential agricultural land would be directly impacted by the Modification, with some of this land progressively remediated to agricultural land.

The extension to the RWEPA areas for the Modification (Section 4.8.4) would be permanently conserved and as a result, approximately 15 ha of existing grazing land in these areas would be sterilised in perpetuity. This grazing land in the extension to the RWEPA areas for the Modification includes Land and Soil Capability Classes 4 and 5.

WCPL-owned lands that adjoin the Modification area would continue to be used for agricultural uses (e.g. via agistment of stock, leasing or agreements with previous landholders).

Subsidence-related Impacts

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

- impacts on the integrity of agricultural infrastructure (e.g. fences and dams);
- surface cracking;
- slope instability;
- ponding and changes in stream alignment; and
- ponding in poorly drained areas.

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.

Subsidence impacts on soils and agricultural activities would be monitored during mining and progressively remediated.

Given the above, there is a low potential for material impact to agricultural productivity in the Modification area.

Potential impacts on the biodiversity values of vegetation in the Modification area (including RWEPA areas) are discussed in Sections 4.8 and 4.9.

4.3.3 Mitigation Measures, Management and Monitoring

Agricultural land resource management would include the following key components:

- minimisation of disturbance to agricultural lands, where practicable;
- continued use of adjoining WCPL-owned land for agricultural uses, where practicable;
- management of soil resources so they can be used for rehabilitation; and
- inclusion of agricultural lands in the Wambo rehabilitation strategy.

The management of potential subsidence impacts on agricultural activities would be managed in accordance with an approved Land Management Plan as part of the Extraction Plan process. 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;
- remediation of surface cracks¹ where practicable using conventional earthmoving equipment;
- stabilisation of any areas of surface fissuring using erosion protection measures;
- drainage works and rehabilitation of subsidence troughs (i.e. areas of induced ponding) as necessary (discussed further in Section 4.5.3);
- monitoring and repair of fences prior to allowing access for agistment grazing;
- remediation of farm dams where it presents a risk to people, livestock and/or the environment; and
- management measures in accordance with the Erosion and Sediment Control Plan.

The Modification area would be rehabilitated as per the rehabilitation of existing underground mining rehabilitation areas at Wambo discussed in Section 2.13 and the Mining Operations Plan (WCPL, 2015b).

4.4 GROUNDWATER

A Groundwater Assessment for the Modification was undertaken by HydroSimulations (2016) and is presented in Appendix B.

The Groundwater Assessment was peer reviewed by Kalf and Associates (Dr Fans Kalf) who concluded that the hydrogeological description, conceptualisation, model design, simulations and reporting had been conducted in a professional manner.

¹ Minor cracks that develop are not expected to require remediation as geomorphologic processes will result in the natural filling of these cracks over time.

A description of the existing groundwater resources in the Modification area and surrounds, including the existing monitoring regime and existing groundwater use, is provided in Section 4.4.1. Section 4.4.2 describes the potential impacts of the Modification on groundwater resources, while Section 4.4.3 outlines mitigation measures, management and monitoring.

4.4.1 Existing Environment

Hydrogeological Regime

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

- Quaternary alluvial groundwater within channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek.
- Underlying Permian strata of low hydraulic conductivity and hence very low yielding to almost dry sandstone and siltstone. The coal seams which are the prime water-bearing strata within the Permian coal measures have low to moderate hydraulic conductivity, as do the Triassic strata south-west of Wambo and beneath some parts of the alluvium.

Alluvial Aquifers

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

Evidence indicates that the alluvial groundwater is responsive to rainfall recharge and in places is likely to be 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.

Figure 11 shows alluvium in the vicinity of the Modification area based on mapping conducted by Groundwater Imaging Pty Ltd (2012).

Permian Aquifers

Prior to the commencement of mining operations in the region, the potentiometric surface within the Permian aquifers of the Wambo area most probably reflected the topography, with higher groundwater levels in areas distant from the major drainages and lower levels in areas adjacent to the alluvial flats (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, 2015e) for Wambo was established in 2005 and details the existing groundwater conditions and baseline data relevant to Wambo, a monitoring programme, groundwater impact assessment criteria, data review and investigation processes, and reporting requirements.

Groundwater levels and quality are generally monitored bi-monthly at each of the groundwater monitoring sites (Figure 7) and results are reported in the Annual Environmental Management Report.

Surface and Groundwater Response Plan

A Surface and Groundwater Response Plan (WCPL, 2015h) has been established for Wambo and details measures to mitigate potential surface and groundwater impacts, including processes to deal with a groundwater-related complaint, the groundwater impact investigation protocol and a response plan in the event that an investigation conclusively attributes an adverse impact to an existing groundwater supply user to Wambo operations.

Groundwater Use

There are 78 registered bores within 5 km of Wambo, including:

- the majority (48), which are monitoring/test bores within the WCPL tenement boundaries;
- ten, which are identified mine use/dewatering bores;
- 16, which are registered for irrigation, domestic and/or stock use; and
- four, which are of unknown use.

Groundwater Dependent Ecosystems

The closest 'high priority' groundwater dependent ecosystem (GDE) identified by the NSW Government is Parnell Spring. Parnell Spring likely flows from the Triassic age Narrabeen Group and is located approximately 9 km south-southwest of Wambo. Wambo has resulted in negligible drawdown in Triassic age material.

Potential GDEs in the Wambo area and surrounds have been identified through a review of relevant water sharing plans, the regional mapping of GDEs in the Bureau of Meteorology *Atlas of Groundwater Dependent Ecosystems* (2015), the vegetation mapping conducted by FloraSearch (2016) and consideration of the simulated depth to groundwater in the Wambo area.

GDEs in the vicinity of the Wambo area are likely to be associated with the riparian zone associated with Wambo Creek and the riparian, floodplain and alluvial zones on Wollombi Brook. These zones generally correlate with River Oak Riparian Woodland (Community 1) and Forest Red Gum Floodplain Forest (Community 2) mapped by FloraSearch (2016).

4.4.2 Potential Impacts

Numerical modelling has been undertaken to inform the Groundwater Assessment (Appendix B) for the Modification and to quantify the likelihood and magnitude of potential impacts.

The numerical groundwater model covers an area of approximately 300 square kilometres (km²) (19 km east-west and 16 km north-south) and incorporates the cumulative impacts of neighbouring mining areas (Appendix B).

Further detail on the development and calibration of the numerical groundwater model is provided in Appendix B.

The potential impacts of the Modification on groundwater have been assessed by comparing model outputs for the approved mine layout and the modified mine layout. Neighbouring mines and other influences (e.g. rainfall recharge) are the same in both models.

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 resulting in changes in bulk rock mass permeability and storage capacity; and
- dewatering of groundwater that enters underground mining areas as a result of the above.

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

Groundwater Inflows

The peak predicted combined inflow rate to the Arrowfield and Woodland Hill Seam workings for the modified mine layout is approximately 3.5 megalitres per day (ML/day) (Appendix B). This is approximately 0.3 ML/day higher than the peak predicted for the approved mine layout, however the peak would occur around 4 to 5 years later than the approved mine layout (Appendix B).

Impacts to Permian Aquifers

Depressurisation of the Permian strata within the mine footprint would occur as part of the approved South Wambo Underground Mine. The Permian coal measures within the mine footprint would essentially be dewatered as a result of mining at the North Wambo Underground, United Underground and South Bates Underground Mines.

As the Modification involves mining the Woodlands Hill Seam rather than the Bowfield Seam, it is predicted that there would be more drawdown in the Woodlands Hill Seam and less than previously predicted in the Bowfield Seam (Appendix B).

Outside the mine footprint, the main impact from the approved South Wambo Underground Mine on hydraulic pressures within Permian strata would occur to the immediate south and west. Depressurisation to the north and east would be minimal due to the influence of neighbouring open cut and underground mines (Appendix B).

Impacts to Alluvial Aquifers

HydroSimulations (Appendix B) concluded the Modification would cause negligible additional drawdown in a small portion of the alluvium adjacent to North Wambo Creek and Wambo Creek compared with the approved mine layout.

There would be no discernible additional drawdown along the highly productive Wollombi Brook alluvium.

HydroSimulations (Appendix B) concluded that fracturing to the surface is not anticipated above Area 3 of the modified mine layout. Extraction of shallower seams has already occurred in Area 2, and there are no natural alluvial aquifers above Areas 1 and 4.

The modified mine layout would have negligible impact on the hydraulic characteristics of the alluvial aquifer associated with Wollombi Brook, and there would be no change in the integrity of the hydrogeological connections between Wollombi Brook and the Permian aquifers.

Stream Baseflows

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

Impacts on Water Quality

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 over the recovery period.

Groundwater Users

HydroSimulations (Appendix B) predicts there would be no additional privately-owned registered groundwater users affected as a result of the Modification.

One privately-owned bore in an alluvial aquifer has a predicted drawdown of 2.2 m for the modified mine layout, compared to a predicted drawdown of 2.1 m for the approved mine layout. HydroSimulations (2016) and previous groundwater assessments for Wambo predict that some privately-owned bores may experience more than 2 m cumulative drawdown as a result of the already approved operations at Wambo. These drawdowns are due to the cumulative effects of all mining in the Wambo district.

Given the Modification would result in no discernible or negligible impact on alluvial aquifers and stream baseflow, no additional impacts on GDEs are anticipated from the Modification.

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' or 'Level 2' minimal impact considerations outlined in the AIP for highly productive and less productive groundwater. Further discussion on the AIP and licensing requirements is provided in Attachment 4 and Appendix B.

4.4.3 Mitigation Measures, Management and Monitoring

No additional groundwater impact mitigation measures are considered necessary for the Modification. Groundwater levels and quality would continue to be monitored at Wambo in accordance with the Groundwater Monitoring Program (WCPL, 2015e).

The Groundwater Monitoring Program would be reviewed and revised to incorporate the Modification (subject to approval of the Modification).

Consistent with the currently approved Surface and Groundwater Response Plan (WCPL, 2015h), in the event that a groundwater quality or trigger level specified in the Groundwater Monitoring Program is exceeded, an investigation would be conducted in accordance with the Surface and Groundwater Response Plan.

4.5 SURFACE WATER

A Surface Water Assessment for the Modification was undertaken by Advisian (2016) and is presented in Appendix C.

A description of the existing surface water resources in the Wambo area and surrounds is provided in Section 4.5.1. Section 4.5.2 describes the potential impacts of the Modification, while Section 4.5.3 outlines mitigation measures, management and monitoring.

4.5.1 Existing Environment

Hydrology

Wambo is situated adjacent to Wollombi Brook, south-west of its confluence with the Hunter River. Wollombi Brook drains an area of approximately 1,950 km² 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 WCPL mining tenements drain via Wambo, Stony, North Wambo and Redbank Creeks to Wollombi Brook, while Waterfall Creek drains directly to the Hunter River (Figure 2a).

A section of North Wambo Creek has been diverted to avoid the Wambo open cut (Figure 2a). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007). Approximately 600 m of the North Wambo Creek Diversion would be undermined by the modified mine layout.

There are also a number of ephemeral unnamed drainage lines within the Modification area (Appendix C). These unnamed drainage lines have a shallow incision in the surface soils, do not demonstrate any significant channel formation and drain from broad open pasture areas.

Site Water Management and Monitoring

A summary of the existing site water management is provided in Section 2.11. WCPL annually reviews the site water balance for Wambo and reports the results of this review in the Annual Environmental Management Report.

The Erosion and Sediment Control Plan (WCPL, 2015g) identifies potential erosion and sediment sources and details design criteria, inspection and monitoring programmes and reporting requirements.

A Surface Water Monitoring Program (WCPL, 2015f) 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 7).

A Surface and Groundwater Response Plan (WCPL, 2015h) has been established for Wambo and details measures to mitigate potential surface and groundwater impacts.

4.5.2 Potential Impacts

The following sub-sections describe the potential operational and post-mining impacts of the Modification on surface water flow regimes and surface water quality.

As discussed in Section 4.2, it is expected that any subsidence impacts on Wollombi Brook as a result of the Modification would be negligible.

Erosion and Scour

North Wambo, Wambo and Stony Creeks

North Wambo, Wambo and Stony Creeks are all expected to experience increases in grade along short sections as a result of the modified mine layout. North Wambo Creek and Wambo Creek may experience some scour without the implementation of mitigation works (Appendix C). The change in grade in Stony Creek is unlikely to lead to significant scour (Appendix C).

North Wambo Creek Diversion

There are two locations along the North Wambo Creek Diversion where the gradient is predicted to increase from 0.6% and 0.9% to approximately 2.8% and 6% as a result of subsidence from the modified mine layout, respectively (Appendix C).

The first location has already been the subject of extensive reconstruction and stabilisation works, including rock stabilisation, and the second location has existing extensive rock protection in the bed of the creek. Therefore, these locations are not expected to require any additional stabilisation works (Appendix C).

Unnamed Drainage Lines

Ephemeral unnamed drainage lines are expected to experience minor changes in grade which are not expected to result in significant scour.

Modification Surface Development Area

The minor extension to the approved surface development area may lead to the disturbance of *in situ* soil resources and increased erosion and sediment movement due to the exposure of soils during construction of infrastructure.

With the implementation of the Erosion and Sediment Control Plan (WCPL, 2015g), it is considered that the potential for any significant additional erosion impacts from the additional surface development areas is low.

Ponding

Ponding is predicted to occur where mining induced changes in stream gradient oppose, and are greater in magnitude than, natural stream gradients. The predicted ponding impacts on named watercourses as a result of the modified mine layout and the approved mine layout are summarised in Table 7.

Advisian (Appendix C) concluded the formation of ponds may be beneficial due to creation of new and diverse habitat, and noting these watercourses are ephemeral streams, retained pools may enhance the diversity of aquatic ecology at Wambo.

**Table 7
Predicted Maximum Depths and Lengths of Ponding within Named Watercourses for the Approved and Modified Mine Layouts**

Watercourse	Predicted Extent Due to Approved Mine Layout	Predicted Extent Due to Modified Mine Layout
North Wambo Creek Diversion	-	1.3 m deep x 200 m long
North Wambo Creek	0.8 m deep x 200 m long	0.6 m deep x 100 m long
	6.0 m deep x 275 m long	2.2 m deep x 275 m long
	5.7 m deep x 325 m long	1.5 m deep x 375 m long
	4.5 m deep x 450 m long	0.6 m deep x 150 m long
	3.9 m deep x 275 m long	1.6 m deep x 350 m long
	3.5 m deep x 425 m long	0.9 m deep x 450 m long
Wambo Creek	0.6 m deep x 225 m long	1.7 m deep x 400 m long
	0.2 m deep x 200 m long	1.0 m deep x 250 m long
	0.3 m deep x 125 m long	-
	0.7 m deep x 270 m long	-
Stony Creek	0.5 m deep x 150 m long	0.4 m deep x 100 m long
	1.6 m deep x 250 m long	1.0 m deep x 200 m long
	0.2 m deep x 75 m long	0.9 m deep x 150 m long
	1.3 m deep x 500 m long	1.4 m deep x 250 m long
	-	0.8 m deep x 300 m long

Source: After Appendix C.

Cracking of Creek Beds

It is expected that fracturing of the topmost bedrock could develop along sections of North Wambo, Wambo and Stony Creeks located directly above the modified mine layout. Existing fractures along the section of North Wambo Creek located above previously extracted longwalls at Wambo could also be reactivated (Appendix C). The depth of cover and shallow incision in the surface soils of ephemeral unnamed drainage lines make it unlikely that any significant cracking would be observed in these drainage lines at the surface (Appendix C).

Flooding

Advisian (Appendix C) concluded the Modification would not increase the risk of flooding or materially affect the flood hazard or flood behaviour in the vicinity of the Modification area compared to the approved mine layout.

Water Quality

Impacts on water quality are associated with the potential for sediment to be mobilised due to erosion/scour.

Significant increases in erosion and sediment load are not expected, particularly with the implementation of the mitigation measures, management and monitoring outlined in Section 4.5.3 (Appendix C).

Licensed Water Users

The groundwater modelling by HydroSimulations (Appendix B) concluded that the Modification would have no discernible influence on stream baseflow or stream leakage in Wollombi Brook beyond the effects of approved mining.

Wollombi Brook is a losing stream on average within the area modelled by HydroSimulations. The cumulative effect of mining in the area is a predicted increase in stream leakage from Wollombi Brook in the order of 125 megalitres per year (ML/year) (Appendix C). In the context of the mean annual flow in Wollombi Brook of approximately 139,000 ML/year, this cumulative impact (that would occur regardless of the Modification) represents an impact of less than 0.1% on the flow in Wollombi Brook.

The Modification is not expected to change water quality downstream of Wambo.

Therefore, no significant impact on licensed surface water users is expected as a result of the Modification.

Site Water Balance

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

As described in Section 4.2.2, the Modification would increase the peak inflow to the underground workings by approximately 9% (0.3 ML/day) compared to the approved mine layout. As indicated in Attachment 4, there are adequate licences available to account for the potential take of water associated with the South Wambo Underground Mine incorporating the Modification.

The site water management strategy for Wambo is based on the containment and re-use of mine water within the water storage dams at Wambo. There is additional contingent capacity for water storage at Wambo (i.e. the approved Montrose Water Storage Dam with a nominal capacity of 1,500 million litres). The annual review of the site water balance under Condition 25, Schedule 4 of the Development Consent (DA 305-7-2003) would continue to review and confirm that these inflows can be managed by the approved water management system, or initiate corrective action if required.

4.5.3 Mitigation Measures, Management and Monitoring

WCPL would continue to implement the Surface Water Monitoring Program (WCPL, 2015f), Erosion and Sediment Control Plan (WCPL, 2015g) and Surface and Groundwater Response Plan (2015h) at Wambo incorporating the Modification.

Geomorphologic Survey

Longitudinal geomorphological surveys would be conducted along the creek reaches affected by subsidence. Surveys would be conducted prior to commencement of secondary extraction, immediately following subsidence, and following the completion of any restoration or remediation works.

Erosion and Sediment Control

Potential areas of erosion would be monitored and the post-mining profile would be regularly observed, particularly after flow events. Where erosion/scour is detected, WCPL would implement suitable stabilisation measures (e.g. vegetation planting, battering back shallow banks). WCPL has experience implementing these types of works elsewhere at Wambo, along Wambo and Stony Creeks.

The Erosion and Sediment Control Plan (WCPL, 2015g) would be updated and revised to include the additional surface development areas.

Control strategies outlined in the Erosion and Sediment Control Plan (WCPL, 2015g) that would continue to be implemented for the Modification include:

- separation of disturbed and undisturbed catchment runoff, where practicable;
- construction of sediment control structures (e.g. dams) to contain runoff from disturbed areas;
- utilisation of existing topography and adoption of construction practices that minimise soil erosion and sediment discharge from the area;
- installation of diversion drains, hay bales, rock structures, sediment fences and sediment dams to control erosion;
- maintenance of erosion and sediment control measures to ensure they remain in proper working order; and
- progressive rehabilitation and stabilisation of disturbed areas.

Ponding

Where ponding is deemed desirable for the provision of aquatic and riparian habitat, it is preferable to minimise any works to re-grade the creek to facilitate drainage of the pond. Any such works have the potential to lead to other problems, such as erosion of the creek bed.

If pools are observed that are significantly larger than predicted, remedial actions would include:

- Assessment of the ecological significance of the pool and its impact on the aquatic and riparian habitat by an appropriately qualified ecologist.
- Consultation with relevant regulatory agencies to determine whether action is warranted to reduce or eliminate the pool.
- Drainage works and rehabilitation of subsidence troughs as necessary, similar to those outlined in the Land Management Plan for North Wambo Underground Mine Longwalls 8 to 10A.
- Channel excavation and stabilisation works to re-grade a downstream section of channel in order to eliminate or reduce the length of the pool.

Stream Bed Cracking

Visual monitoring of all watercourses in the Modification area would be undertaken on a regular basis during undermining to identify any stream bed cracking.

North Wambo Creek Diversion

Any significant surface cracking would be visible and would be sealed by:

- washing a slurry containing well graded sandy-silt into the cracks to fill cracks in the underlying rock; and
- infilling larger surface cracks with typical alluvial material.

It is unlikely that significant bedrock cracking would occur as a result of the Modification. However, if it was to happen, it could warrant grouting of the underlying bedrock. This would be implemented in consultation with relevant regulatory agencies in the unlikely event significant bedrock cracking occurred. Similar grouting has been undertaken by WCPL previously.

Natural Watercourses

It is expected that any fracturing that develops in the underlying bedrock of the natural watercourses would gradually be filled with surface soils during subsequent flow events. This is the preferred management method for stream bed cracking due to the likely level of disturbance associated with other management measures (e.g. backfilling with imported materials delivered by trucks).

If necessary, possible minor surface cracks would be in-filled with soil or other suitable materials (e.g. mulch) and the surface re-graded and re-compacted.

Site Water Balance

Water pumped out of underground mine workings 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).

Extraction Plan

An Extraction Plan would be developed for the South Wambo Underground Mine. The Extraction Plan would include a Trigger Action Response Plan with a process to determine triggers and remedial actions for any surface cracking and changes in grade and associated erosion and pool development (based on the actions described above).

4.6 ABORIGINAL CULTURAL HERITAGE

A CHIA (Cultural Heritage Impact Assessment) was prepared for the Modification by RPS Australia East Pty Ltd (RPS) (2016) and is presented in Appendix F.

The assessment of Aboriginal cultural heritage in the CHIA was undertaken in accordance with the following guidelines and regulations relevant to Aboriginal cultural heritage:

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a).
- *Ask First: A guide to respecting indigenous heritage places and values* (Australian Heritage Commission, 2002).
- Clause 80C of the *National Parks and Wildlife Regulation, 2009*.
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).
- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Environment and Conservation [DEC], 2005).
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011).
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council, 2010).
- The Australian International Council on Monuments and Sites (ICOMOS) *Burra Charter* (Australia ICOMOS, 2013).

A description of Aboriginal heritage (cultural and archaeological) in the vicinity of the Modification is provided in Section 4.6.1. Section 4.6.2 describes the potential impacts of the Modification on Aboriginal heritage, while Section 4.6.3 outlines mitigation measures, management and monitoring.

4.6.1 Existing Environment

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 much of the Modification area). White (2003) identified several artefact scatters and isolated finds in the Modification area which varied in significance.

Occupation areas or open camp sites were generally located on the gently sloping areas in close proximity to water, in particular, along major creek lines and at the confluence of major tributaries of North Wambo Creek, Wambo Creek, Waterfall Creek and Stony Creek (White, 2003).

Aboriginal Cultural Heritage Management

Management of Aboriginal cultural heritage at Wambo is currently conducted in accordance with Aboriginal Heritage Impact Permit (AHIP) #2222 and AHIP #C0001474 issued under section 90 of the *National Parks and Wildlife Act, 1974* and the associated Aboriginal Research Design and Study Plan. This includes the methodology for the salvage of sites within the AHIP areas.

These existing consents cover the majority of the Modification area. The CHIA provided in Appendix F includes a recommendation to apply for a new AHIP to cover the full extent of the Modification area.

Assessment Programme

The CHIA (Appendix F) used 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 and other registers;
- the results of archaeological and cultural surveys of the Modification area conducted by archaeologists and representatives of the Aboriginal community in October 2015; and
- ongoing consultation with the Aboriginal community on the Modification, as well as previous surveys and assessments.

The CHIA included consultation with 66 registered Aboriginal parties (Appendix F) in accordance with the OEH policy *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a) and Condition 56A, Schedule 4 of the Development Consent (DA 305-7-2003). Participation of registered Aboriginal parties in the field surveys was in accordance with the established Wambo Coal Mine fieldwork roster system.

Survey Design

The archaeological and cultural surveys were undertaken to ground-truth previously recorded sites, in addition to identifying new sites.

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

As described in Section 4.2.2, subsidence effects are expected to reduce in Area 4 as a result of the Modification, due to the removal of mining in the Bowfield Seam. On the basis that the approved impacts on Aboriginal cultural heritage sites in this area would reduce as a result of the Modification, the CHIA (Appendix F) did not consider the archaeological sites previously identified by other surveys in Area 4.

Archaeological Findings

The field surveys identified 52 previously unrecorded Aboriginal cultural heritage sites in the Modification area, all of which were surface artefact sites (i.e. artefact scatters, potential archaeological deposits [PADs] or isolated finds).

There are also 35 previously recorded sites within the Modification area, including surface artefact sites, scarred tree/possible scarred tree sites, grinding grooves/surfaces and earth mounds (Appendix F).

A detailed description of all 87 Aboriginal cultural heritage sites identified in the Modification area is provided in Appendix F.

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 F) concluded that all of the Aboriginal cultural heritage sites within the Modification area were of a low archaeological significance at a regional level, with the exception of Wambo Site 329 (grinding groove site), which was of a moderate archaeological significance at a regional level. At a local level, fifteen sites were considered to be of moderate archaeological significance (Appendix F).

The registered Aboriginal parties were requested to provide comment in regard to the cultural significance of the Modification area and Aboriginal cultural heritage sites within it at all stages of the consultation process (including during field surveys, information sessions and review of relevant documentation). Based on the comments received (Appendix F):

- all Aboriginal sites are culturally significant (especially grinding grooves/surfaces and scarred trees);
- the banks of the creeks and natural connecting ridgelines have specific cultural significance as these areas would have been suitable for camping and procurement of food and water; and
- artefact sites within the Modification area were of cultural significance and related to other sites in the Wambo area, particularly to the other sites in the Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek areas.

4.6.2 Potential Impacts

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

- direct disturbance associated with development of mining infrastructure, vehicle movements and subsidence remediation activities, if required; and
- subsidence impacts from the extraction of the proposed longwalls.

Direct Disturbance

The Modification would involve direct disturbance associated with additional surface infrastructure areas, maintenance and access tracks, gas management infrastructure, subsidence monitoring and remediation works (where required) and surface rehabilitation works (where required).

There are nine Aboriginal cultural heritage sites located within the additional surface infrastructure areas, all of which are artefact scatters of low local and regional archaeological significance. These artefact scatters represent approximately 12% of the total number of artefact scatters identified within the Modification area. The surface infrastructure areas avoid all known grinding grooves/surfaces, earth mounds and scarred trees/possible scarred trees.

The location and design of gas management infrastructure would be flexible and would be located in an attempt to avoid Aboriginal cultural heritage sites and areas of cultural sensitivity as far as practicable (Section 3.2). All grinding grooves, earth mounds and scarred trees would be avoided for the Modification.

Vehicular movements for monitoring and general site maintenance activities 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.

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).

Open artefact sites are not particularly susceptible to subsidence impacts (Appendices A and F). 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. However, MSEC considers it unlikely that the artefact scatters or isolated finds themselves would be adversely impacted as a result of the Modification (Appendices A and F).

Subsidence impacts on rock-based sites (including grinding grooves/surfaces) have been defined in terms of cracking potential (Appendix A). The risk of cracking at these sites has been assessed as “very unlikely” (Wambo Sites 329, 330, 331, 332 and 377) and “unlikely” (Wambo Site 117) (Appendix F).

Relative to the approved mine layout, the risk of cracking at the rock based sites would be reduced as a result of the Modification, with the exception of Wambo Site 117, where its risk of cracking would increase from “rare” to “unlikely” (Appendix F).

Notwithstanding, it is noted that this site has been previously undermined by the North Wambo Underground Mine.

Subsidence impacts on scarred trees or possible scarred trees include potential cracking of the soils which may alter the ground surface and disturb the root system, adversely affecting the health of the tree. Both Wambo Site 32 and 360 are considered unlikely to experience adverse impacts as a result of the Modification, as the chance of surface cracking coincident with the trees is considered low (Appendix F).

The two earth mounds in the vicinity of the Modification area (Wambo Sites 334 and 335) are not predicted to experience any significant tilts, curvatures or strains, and are therefore unlikely to experience adverse impacts associated with the Modification (Appendices A and F).

In addition to the above, it is noted that the previously identified Bora Ground is located to the east of Wollombi Brook and would not be impacted by the Modification.

RPS (Appendix F) assessed the overall cumulative impact of the Modification on sites of Aboriginal heritage as low.

4.6.3 Mitigation Measures, Management and Monitoring

The nine artefact scatters that would be directly impacted as a result of additional surface development areas would be salvaged consistent with current procedures implemented at Wambo.

Given the low risk of potential subsidence impacts to the remaining artefact scatters, PADs 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 AHIP and in consultation with the relevant registered Aboriginal parties) (Appendix F).

While the locations of maintenance and access tracks and gas management infrastructure are flexible, some Aboriginal cultural heritage sites may not be able to be avoided completely. Appropriate management measures including salvage would be implemented where this occurs, as required.

Where not previously undertaken, all grinding groove/surface sites would be archivally recorded prior to undermining associated with the Modification.

As part of the development of the Extraction Plan, subsidence predictions for the grinding groove/surface sites, scarred tree/possible scarred tree sites and earth mounds would be re-assessed. If the predicted risk of potential adverse impacts to any of the grinding groove/surface sites increases, then additional assessment by a qualified engineer and/or subsidence specialist would be considered as necessary.

A baseline recording of both the scarred tree and possible scarred tree sites would be undertaken by an archaeologist and/or qualified surveyor prior to undermining, including the tilt of the trees. This would be compared to the tilt and condition of the trees post-mining. If any adverse changes were identified, appropriate stabilisation works and salvage would be considered.

As the earth mound sites are not predicted to experience adverse impacts as a result of the Modification, no specific management and mitigation measures are considered to be required. If the re-assessment of subsidence predictions as part of the Extraction Plan process were to identify the risk of potential impacts, then assessment of the sites would be undertaken to ensure they were not adversely impacted.

In the event that further investigations by qualified archaeologists and/or relevant specialists determine that any of the previously recorded sites are not of Aboriginal origin (e.g. stone artefacts, earth mounds, scarred trees, grinding grooves), the above described management measures would no longer be required. WCPL would apply to have any such sites removed from the AHIMS register as required.

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 registered Aboriginal parties.

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 registered Aboriginal parties prior to any further surface works commencing in that area.

As described in Section 4.6.1, the existing AHIP #2222 and AHIP #C0001474 cover the majority of the Modification area. As recommended in Appendix F, WCPL would apply for an additional AHIP to cover the remaining portion of the Modification area not covered by the existing AHIPs.

4.7 NON-ABORIGINAL HERITAGE

The CHIA prepared for the Modification by RPS (2016) identified whether non-Aboriginal heritage sites, objects or places would be impacted by the Modification, and provides mitigation and management recommendations (Appendix F).

The assessment of non-Aboriginal heritage in the CHIA (Appendix F) was undertaken in accordance with the following guidelines and regulations relevant to historic heritage:

- *NSW Heritage Manual* (Heritage Office and Department of Urban Affairs and Planning, 1996a).
- *Statements of Heritage Impact* (Heritage Office and Department of Urban Affairs and Planning, 1996b).
- *Burra Charter* (Australia ICOMOS, 2013).

4.7.1 Background

EJE Town Planning assessed the potential non-Aboriginal impacts of Wambo in 2003 (EJE Town Planning, 2003). The assessment included surveys of lands in the vicinity of Wambo and an assessment of the heritage significance of sites identified during these surveys.

The assessment identified the Wambo Homestead Complex as the only item of non-Aboriginal heritage significance in the Wambo area (EJE Town Planning, 2003).

The heritage value of the Wambo Homestead Complex was assessed in 1994 and the Wambo Homestead Complex was subsequently listed on the State Heritage Register of NSW accompanied by the following Statement of Significance:

Wambo Homestead is highly significant in the context of Australian pastoral activities and horse breeding in New South Wales. The use of Wambo relates directly to the economic climate and resource based needs of the Colony and State. It is an important group of homestead buildings which remain substantially intact and display the progressive architectural development of a typical Australian homestead.

The heritage status of the Wambo Homestead Complex has diminished since it was listed on the State Heritage Register of NSW due to changes in the physical surrounds and setting of the Wambo Homestead Complex (WCPL, 2003).

Underground mining has previously occurred within the Wambo Homestead Complex curtilage by United Collieries at the United Underground Mine and WCPL at the North Wambo Underground Mine.

WCPL implemented the Wambo Homestead Complex Mine Management Plan (Godden Mackay Logan, 2012) which demonstrated that the underground mining at the completed North Wambo Underground Mine would not have adverse heritage impacts on the Wambo Homestead Complex due to subsidence (with the implementation of appropriate mine designs in place).

4.7.2 Potential Impacts

Research of the various heritage databases and site surveys identified no other items of heritage significance in the vicinity of the Modification area in addition to the Wambo Homestead Complex (Appendix F).

The Wambo Homestead Complex curtilage is shown on Figure 11 and is the boundary of the listing of the Wambo Homestead Complex under the State Heritage Register of NSW.

The Wambo Homestead Complex consists of a main homestead building and eight other building structures.

The Wambo Homestead Complex would not be impacted by any direct disturbance associated with the Modification.

The main homestead building and the majority of the building structures would not be impacted by subsidence from the modified mine layout (i.e. vertical subsidence of less than 20 mm and strains less than 0.5 mm/m tensile and compressive) (Appendix A).

Mounting Yard and Horse Boxes

The Mounting Yard and Horse Boxes are predicted to experience only low levels of additional vertical subsidence (30 mm and 60 mm, respectively) and low levels of strain (2 mm/m tensile and compressive) as a result of the modified mine layout (Appendix A).

These Mounting Yard and Horse Boxes are directly above a previous longwall extracted by United Collieries and adjacent to Longwall 7 extracted at the North Wambo Underground Mine.

The Mounting Yard is estimated to have previously experienced between 300 and 490 mm of vertical subsidence, and the Horse Boxes between 215 and 519 mm of vertical subsidence (Ditton Geotechnical Services, 2012). These structures were estimated to have experienced moderate tilt impacts (> 7 mm/m) from previous mining, with these subsidence impacts indiscernible from impacts associated with near-surface movements associated with clay reactivity to moisture changes (Ditton Geotechnical Services, 2012).

The predicted additional subsidence at the Mounting Yard and Horse Boxes due to the modified mine layout are small when compared with the subsidence predicted to have already occurred due to previous mining.

MSEC (Appendix A) concluded these two timber framed structures are unlikely to experience adverse impacts on the building structure as a result of the Modification. It is therefore concluded that there is likely to be negligible impact on the heritage values of the Wambo Homestead Complex as a result of the modified mine layout.

4.7.3 Mitigation Measures, Management and Monitoring

In accordance with Condition 57, Schedule 4 of the Development Consent (DA 305-7-2003), WCPL would lodge an application under section 60 of the *Heritage Act, 1977* for the longwalls of the modified mine layout within the Wambo Homestead Complex curtilage.

The application under section 60 of the *Heritage Act, 1977* would:

- demonstrate that WCPL can comply with the subsidence impact performance measure of negligible impact on heritage value of the Wambo Homestead Complex; and
- be supported by an updated Wambo Homestead Complex Mine Management Plan that outlines the monitoring and mitigation measures required to avoid adverse heritage impacts on the Wambo Homestead Complex due to subsidence.

Consistent with current site procedures, if any new significant non-Aboriginal heritage material is uncovered during the course of the Modification, surface work would cease in that area until an appropriate management strategy has been developed.

4.8 FLORA

A Flora Assessment for the Modification was undertaken by FloraSearch (2016) and is presented in Appendix D.

The impact of the Modification on threatened flora species, populations and communities was assessed in consideration of the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) and the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Department of the Environment, 2013).

A description of the existing environment relating to flora is provided in Section 4.8.1. Section 4.8.2 describes the potential impacts of the Modification on flora, Section 4.8.3 describes applicable management, mitigation and monitoring measures, and Section 4.8.4 describes the Modification biodiversity offset strategy.

4.8.1 Existing Environment

Regional Setting

The Modification area is located in the north of the Sydney Basin Bioregion as originally defined by Thackway and Cresswell (1995), and in the south west corner of the North Coast Botanical Division (Anderson, 1968; Harden, 1990-2002). It is close to the southern boundary of the Brigalow Belt South Bioregion (Thackway and Cresswell, 1995) and just outside the eastern boundary of the Central Western Slopes Botanical Division (Anderson, 1968; Harden, 1990-2002).

Flora Surveys

The Modification area has been surveyed extensively as part of previous flora surveys conducted for Wambo (Orchid Research [2003] and FloraSearch surveys in 2010, 2011, 2012, 2014, 2015 [Appendix D]).

Additional flora surveys for the Modification were carried out by FloraSearch (Appendix D) during September 2015 and included targeted threatened species surveys, quadrat sampling, rapid assessment spot sampling and random meanders.

The Flora Assessment (Appendix D) was informed by the additional flora surveys for the Modification, previous flora surveys conducted at Wambo, literature and database reviews and ground-truthed vegetation mapping.

A detailed description of the flora survey methods, including previous surveys, is provided in Appendix D.

Vegetation Communities

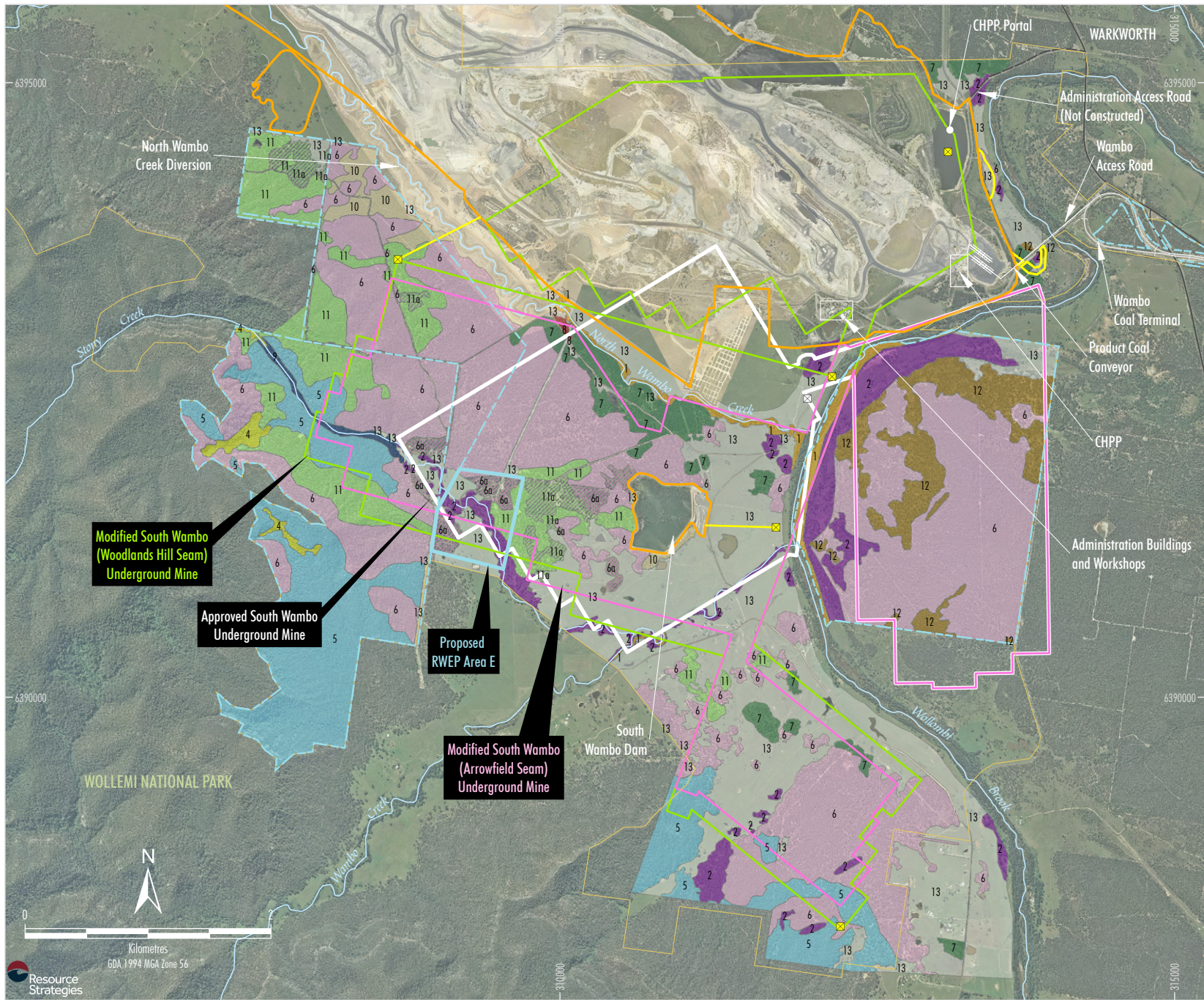
The following 13 native vegetation communities have been identified in the Modification area (Figure 13):

- 1 – River Oak riparian woodland.
- 2 – Forest Red Gum lowland forest.
- 3 – River Red Gum woodland.
- 4 – Rusty Fig – Native Quince – Native Olive dry rainforest.
- 5 – Spotted Gum – Narrow-leaved Ironbark – Grey Box – woodland.
- 6 – Narrow-leaved Ironbark – Grey Box woodland.
- 7 – Bull Oak grassy woodland.
- 8 – Weeping Myall Woodland.
- 9 – Sandstone riparian shrub forest.
- 10 – *Melaleuca decora* low forest.
- 11 – Grey Box – Slaty Box woodland.
- 12 – Rough-barked Apple – Coast Banksia woodland.
- 13 – Derived Grassland.

A detailed description of these communities is provided in Appendix D.

Condition of Vegetation

Vegetation in the Modification area varies considerably in condition, from extensive cleared grasslands through fragmented woodlands to extensive continuous woodland areas still supporting most of the original flora diversity.



- LEGEND**
- Existing/Approved Surface Development Area
 - Modified Surface Development Area
 - Approved South Wambo Underground Mine Development
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - ⊠ Approved Ventilation Shaft
 - ⊞ Modified Ventilation Shaft
 - WCPL Owned Land
 - - - Remnant Woodland Enhancement Program (RWEP) Area
- Proposed Offset Area**
- RWEP Area E
- Vegetation Communities**
- Community 1 - River Oak Riparian Woodland
 - Community 2 - Forest Red Gum Floodplain Forest
 - Community 3 - River Red Gum Woodland
 - Community 4 - Rusty Fig - Native Quince - Native Olive Dry Rainforest
 - Community 5 - Spotted Gum - Narrow-leaved Ironbark - Grey Box Woodland
 - Community 6 - Narrow-leaved Ironbark - Grey Box Woodland
 - Community 6a - Narrow-leaved Ironbark - Grey Box Woodland (Disturbed)
 - Community 7 - Bull Oak Grassy Woodland
 - Community 8 - Weeping Myall Woodland
 - Community 9 - Sandstone riparian scrub
 - Community 10 - *Melaleuca decora* Low Forest
 - Community 11 - Grey Box - Slaty Box Woodland
 - Community 11a - Grey Box - Slaty Box Woodland (Disturbed)
 - Community 12 - Rough-barked Apple - Coast Banksia Woodland
 - Community 13 - Derived Grassland

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013); FloraSearch (2016)

Figure 13

Some of the Modification area comprises forest and woodland that has been set aside as part of the RWEF. Livestock grazing is excluded from this land.

Threatened Ecological Communities

Six Endangered Ecological Communities (EECs) listed in the schedules of the NSW *Threatened Species Conservation Act, 1995* (TSC Act) occur within the Modification area:

- *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* (Community 6 on Figure 13).
- *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions* (Community 5 on Figure 13).
- *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* (Community 3 on Figure 13).
- *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions* (Community 2 on Figure 13).
- *Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion* (Community 8 on Figure 13).
- *Warkworth Sands Woodland in the Sydney Basin Bioregion* (Community 12 on Figure 13).

Two Critically Endangered Ecological Communities (CEECs) listed in the schedules of the EPBC Act occur within the Modification area:

- *Central Hunter Valley Eucalypt Forest and Woodland* (Communities 5, 6 and 11 on Figure 13).
- *Hunter Valley Weeping Myall (Acacia pendula) Woodland* (Community 8 on Figure 13).

Threatened Flora Species and Populations

No threatened flora species listed under the TSC Act or EPBC Act were recorded during recent surveys of the Modification area (Appendix D).

FloraSearch (Appendix D) concluded that a previous record of Slaty Red Gum (*Eucalyptus glaucina*) in the Modification area was likely a misidentification of juvenile Slaty Box (*Eucalyptus dawsonii*) trees, and therefore it is likely this is not a threatened species record (Appendix D).

The surveys identified members of three threatened populations at Wambo (Figure 14):

- *Acacia pendula* population in the Hunter Catchment;
- *Eucalyptus camaldulensis* population in the Hunter Catchment; and
- *Cymbidium canaliculatum* population in the Hunter Catchment.

4.8.2 Potential Impacts

Potential direct impacts of the Modification on flora include (Appendix D):

- impacts due to vegetation clearance and/or disturbance for surface infrastructure; and
- potential impacts due to subsidence.

Potential indirect impacts from the Modification on vegetation (e.g. dust, bushfire risk) are not expected to increase as a result of the Modification.

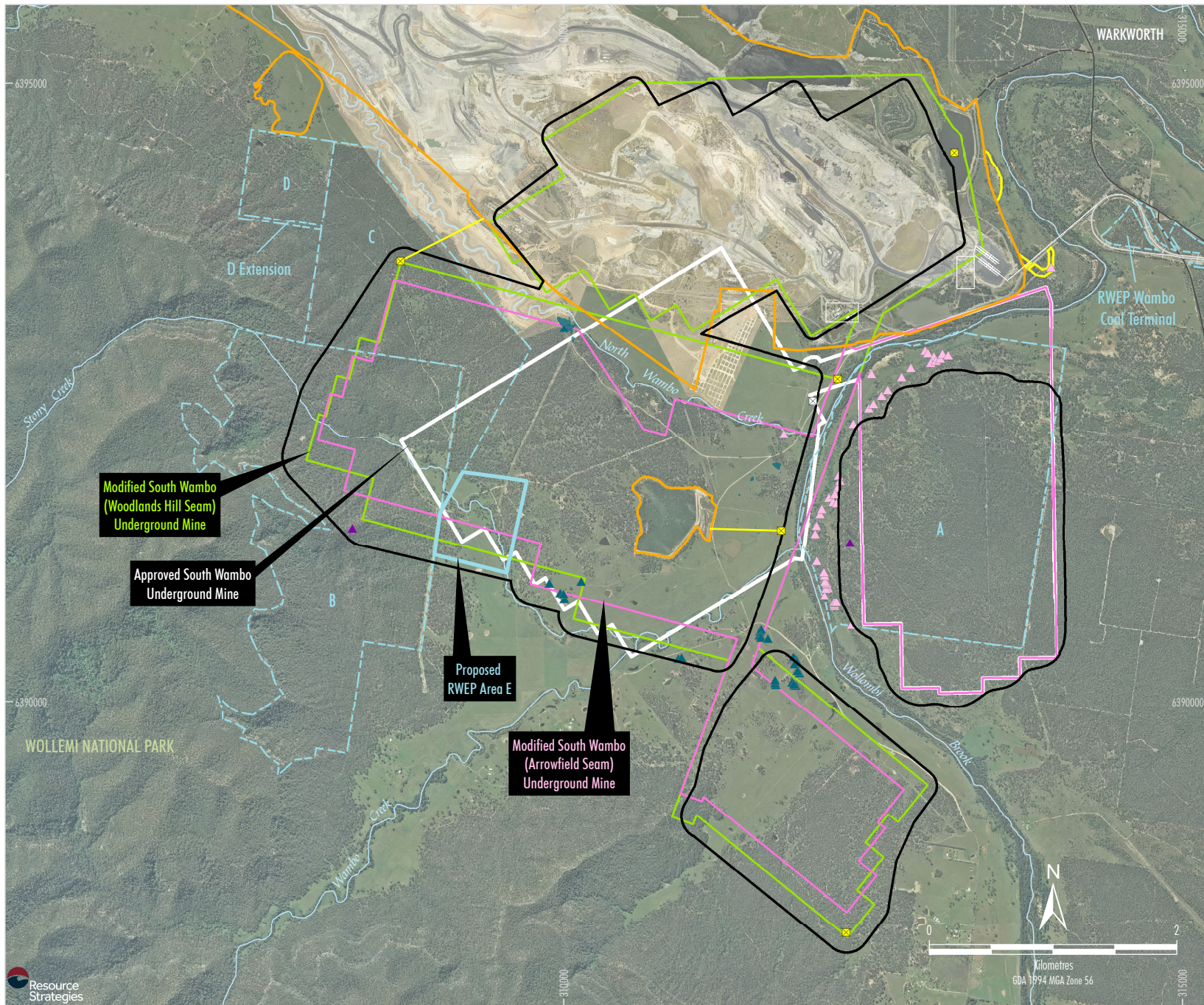
Surface Disturbance

The existing surface infrastructure and supporting services at Wambo would be supplemented for the Modification, including development of the South Wambo Underground Mine infrastructure area, access road, additional ventilation infrastructure and additional gas management infrastructure and other ancillary activities (including monitoring, subsidence remediation works and general site maintenance activities, among others).

Surface disturbance associated with the South Wambo Underground Mine (incorporating the Modification) is estimated at approximately 21 ha, of which approximately 7.9 ha is additional surface disturbance beyond existing approved surface disturbance.

The approximately 7.9 ha of additional surface disturbance being assessed as part of the Modification comprises approximately 3.4 ha of woodland vegetation and approximately 4.5 ha of native grassland (Appendix D).

Approximately 1.5 ha of the 3.4 ha of woodland vegetation to be cleared for the Modification is listed as threatened ecological communities under the TSC Act and/or EPBC Act.



- LEGEND**
- Modified Surface Development Area
 - Existing/Approved Surface Development Area
 - Approved South Wambo Underground Mine Development
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - ⊠ Approved Ventilation Shaft
 - ⊠ Modified Ventilation Shaft
 - Predicted Extent of Modification Conventional Subsidence
 - Remnant Woodland Enhancement Program (RWEF) Area

- Proposed Offset Area**
- RWEF Area E
- Threatened Populations**
- ▲ *Acacia pendula* population in the Hunter Catchment
 - ▲ *Acacia pendula* population in the Hunter Catchment
 - ▲ *Cymbidium canaliculatum* population in the Hunter Catchment
 - ▲ *Eucalyptus camaldulensis* population in the Hunter Catchment

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013); FloraSearch (2016)

Figure 14

FloraSearch concluded it is unlikely that any threatened flora species, the *Acacia pendula* population or the *Cymbidium canaliculatum* population would be disturbed as a result of the Modification.

Some disturbance of *Eucalyptus camaldulensis* (mostly younger trees and saplings) would be required as part of the construction of the proposed access road, which FloraSearch (Appendix D) considers is not significant in a regional sense for this population.

Subsidence Impacts

The surface area that is located above the proposed longwalls that has not been previously affected by mining (underground or open cut) or has not been previously approved to be mined is approximately 185 ha (MSEC, 2016).

FloraSearch (Appendix D) noted there may be some potential impacts to woodland vegetation associated with the potential for surface ponding along creeks. These impacts would generally be lower for the modified mine layout than for the approved mine layout (Appendix D).

FloraSearch (Appendix D) concluded that it is considered unlikely that vegetation would be adversely affected by soil cracking caused by subsidence. This conclusion is supported by inspection of previously undermined areas above the North Wambo Underground Mine, 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 D).

Threatened Flora Species, Populations and Communities

FloraSearch (Appendix D) concluded that the Modification is unlikely to have a significant impact on threatened flora species, populations, ecological communities or critical habitat.

Cumulative Impacts

The minimal vegetation disturbance associated with the proposed underground mining methods at the South Wambo Underground Mine means that the Modification is expected to make only a very small contribution to cumulative vegetation losses resulting from open cut coal mining in the south-western parts of the Hunter Valley (Appendix D).

4.8.3 Mitigation Measures, Management and Monitoring

The disturbance required for proposed surface development areas has been refined to avoid and minimise potential impacts on biodiversity values within technical constraints.

Gas Management Infrastructure Siting

As discussed in Section 3.2, the specific locations of Modification gas management infrastructure and associated surface disturbance is somewhat variable, and would be defined as a component of future detailed mine planning and engineering studies over the life of the Modification.

Surveys of potential gas management infrastructure locations would be conducted to identify any threatened flora/fauna (e.g. species, communities or populations). If any threatened flora/fauna sites are identified, consideration would be given to relocating the works so as to avoid direct impacts.

It is expected that threatened flora/fauna species and populations would be able to be avoided. Impacts to threatened communities would be minimised by the minor nature of the disturbance (small, isolated and temporary) and by locating the surface components to reduce clearance requirements (e.g. using existing cleared areas or areas with a sparse mid/over story).

Surface disturbance associated with gas management infrastructure would be temporary and isolated in nature. The surface disturbance would occur progressively over the life of the South Wambo Underground Mine and would be rehabilitated progressively as the gas management infrastructure is no longer required.

Flora and Fauna Management Plan

Flora management and monitoring at Wambo would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2014a) or its revisions. Management measures outlined in the Flora and Fauna Management Plan (WCPL, 2014a) relevant to flora include:

- Vegetation Clearance Protocol, including delineation of areas to be cleared, pre-clearance surveys, vegetation clearance procedures, seed collection and salvage/reuse of materials.
- RWEP, including offset conservation, limitation of activities within RWEP areas (e.g. no agistment of stock), fencing, weed and pest control programs, Bushfire Management Plan and landform stabilisation.

- Rehabilitation program, including progressive rehabilitation of disturbed areas to minimise total disturbance at any one time.
- Monitoring program, including visual monitoring, assessment of the quality of rehabilitation using Ecosystem Function Analysis and permanent flora survey quadrats that have been established in RWEF areas.

4.8.4 Biodiversity Offset Strategy

The Modification biodiversity offset strategy has been developed to address the potential residual impacts on biodiversity values associated with the Modification, such that biodiversity values of the region are maintained and improved in the medium to long-term (as required by the SEARs for the Modification).

The existing RWEF areas at Wambo (Section 2.13) would be augmented with an additional RWEF area (RWEF Area E) as a biodiversity offset for the Modification (Figure 14).

RWEF Area E was selected in consideration of a range of factors, including:

- relationship to existing RWEF areas;
- proximity to the Modification area;
- regional conservation priorities and vegetation most in need of conservation;
- available land tenure on which to locate an offset area;
- vegetation and habitat composition to meet the 'like for like or better' criterion;
- the size of the proposed offset area relative to the additional surface disturbance required by the Modification;
- the ecosystem resilience and condition of the proposed offset area; and
- the presence of similar threatened species and ecological community records and/or potential habitat to those within the Modification area.

The Modification biodiversity offset strategy has been developed to be consistent with:

- the principles developed by OEH for use by projects other than those that are State significant (OEH, 2014); and
- the *EPBC Act Environmental Offsets Policy* (Department of Sustainability, Environment, Water, Population and Communities [SEWPAC], 2012).

A comprehensive assessment of how the proposed biodiversity offset strategy addresses both NSW and Commonwealth offset principles is provided in Appendix D.

Key ecological benefits of RWEF Area E would include:

- RWEF Area E is approximately 42 ha (excluding existing disturbed land and approved clearance) compared to the approximate 7.9 ha proposed to be disturbed as part of the Modification.
- Forest Red Gum Floodplain Forest is listed as endangered in NSW and is very poorly represented in the central Hunter Valley. With approximately 9.1 ha protected within RWEF Area E compared to the approximate additional 0.4 ha to be disturbed as part of the Modification, the offset area represents a significant environmental gain for this community.
- RWEF Area E would protect 18 ha of the EPBC Act listed Central Hunter Valley Eucalypt Forest and Woodland CEEC, against the approximate 0.9 ha proposed to be disturbed.
- RWEF Area E contains approximately 13 ha of a threatened ecological community that would not be disturbed by the Modification, i.e. Narrow-leaved Ironbark - Grey Box Woodland which is part of the NSW listed Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC and the Federally listed Central Hunter Valley Eucalypt Forest and Woodland CEEC.
- The threatened Little Lorikeet (*Glossopsitta pusilla*) was recorded in RWEF Area E.
- RWEF Area E includes a significant length of Stony Creek and its riparian zone. This important landscape element provides a key habitat resource for wildlife and its restoration would be important for landscape functioning.
- RWEF Area E includes representations of all the fauna habitat types that would be impacted by the Modification.
- Expansion of the existing RWEF would increase its size and long-term sustainability, and is preferable to establishing an entirely new, small offset area elsewhere.
- The vegetation communities in the proposed offset area are similar to or better in condition than those proposed to be disturbed.

The proposed biodiversity offset strategy is considered to be a suitable offset against the residual flora and fauna impacts associated with the Modification.

Management of the Offset Areas

The existing RWEPA areas are located on land held by WCPL and are in the process of being protected in perpetuity by a Voluntary Conservation Agreement. To allow for consistent management, it is proposed to apply the same method of conservation security to the proposed RWEPA Area E for the Modification.

The management of RWEPA Area E would be described within an updated Flora and Fauna Management Plan. Management measures would include:

- management of livestock grazing;
- control of weeds;
- management of exotic animal pests;
- bushfire management;
- revegetation;
- control of vehicular access; and
- minimisation of disturbance.

4.9 FAUNA

A Fauna Assessment for the Modification was undertaken by Eco Logical Australia Pty Ltd (Eco Logical) (2016) and is presented in Appendix E.

The impact of the Modification on threatened fauna species was assessed in consideration of the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) and the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Department of the Environment, 2013). Consideration was also given to the *State Environmental Planning Policy No. 44 – Koala Habitat Protection*.

A description of the existing environment relating to fauna is provided in Section 4.9.1. Section 4.9.2 describes the potential impacts of the Modification on fauna and Section 4.9.3 describes applicable management, mitigation and monitoring measures.

4.9.1 Existing Environment

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 has 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).

Fauna Surveys

Additional fauna surveys for the Modification were carried out by Eco Logical (Appendix E) between 28 September and 23 October 2015, specifically targeting areas that had been excluded from the significant body of detailed ecological assessments and monitoring that had previously been completed within Wambo area to date.

Survey methods included fauna habitat mapping, diurnal bird surveys, microbat surveys, remote camera surveys, amphibian and reptile surveys, nocturnal mammal surveys, terrestrial and arboreal mammal trapping, riparian habitat assessment and opportunistic fauna sightings.

A detailed description of the fauna survey methods and previous surveys is provided in Appendix E.

Fauna Habitat

The Modification area largely comprises shrubby woodlands dominated by gum and ironbark species on lower footslopes with floodplains consisting of primarily mixed native/exotic derived grasslands.

Eco Logical (Appendix E) observed that historical logging has reduced the density of hollow-bearing trees within the shrubby woodlands to the extent they are uncommon in the lower relief areas. Remaining hollow-bearing trees and decorticated bark forms habitat for arboreal mammals, hollow-roosting bats and reptile species (Appendix E).

A large proportion of the Modification area contains mixed native/exotic derived grassland, which have been historically cleared for predominantly agricultural purposes. These areas generally have low habitat values for threatened fauna, despite providing broader foraging areas for threatened birds of prey and some microbat species (Appendix E).

Agricultural dams and ephemeral drainage lines present within and adjacent to the Modification area also provide habitat resources.

Threatened Fauna

Thirteen threatened fauna species listed under the TSC Act and/or EPBC Act were recorded during the Modification fauna surveys, as follows:

- *Chthonicola sagittata* (Speckled Warbler);
- *Circus assimilis* (Spotted Harrier);
- *Climacteris picumnus victoriae* (Brown Treecreeper – eastern subspecies);
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler – eastern subspecies);
- *Daphoenositta chrysoptera* (Varied Sittella);
- *Glossopsitta pusilla* (Little Lorikeet);
- *Grantiella picta* (Painted Honeyeater);
- *Melanodryas cucullata cucullata* (Hooded Robin – south-eastern form);
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Mormopterus norfolkensis* (Eastern Freetail-bat);
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat);
- *Scoteanax rueppellii* (Greater Broad-nosed Bat); and
- *Vespadelus troughtoni* (Eastern Cave Bat).

All of the above species are listed under the TSC Act as 'Vulnerable'. The Painted Honeyeater and Large-eared Pied Bat are also listed as 'Vulnerable' under the EPBC Act (Appendix E).

Based on a conservative assessment, Eco Logical (Appendix E) concluded the Modification area is considered to contain potential habitat for 40 threatened fauna species listed under the TSC Act and/or the EPBC Act.

Further information on recorded and potentially occurring threatened fauna species is provided in Appendix E.

4.9.2 Potential Impacts

The Modification would require removal of vegetation and potential fauna habitat within the proposed surface disturbance areas (approximately 7.9 ha of additional disturbance) and would cause potential subsidence effects over an area of approximately 185 ha not previously affected by or approved for underground or open cut mining.

Potential indirect impacts from the Modification on fauna (e.g. noise, night-lighting and pests) are either not expected to materially increase as a result of the Modification or are considered minimal and readily managed.

Direct Disturbance

Vegetation clearing associated with the Modification and associated potential loss of fauna habitat would be small, isolated and temporary in nature (Appendix E). Eco Logical (Appendix E) considers these impacts should be managed through the existing processes in WCPL's Flora and Fauna Management Plan.

Suitable habitat resources would remain present outside the Modification area, with abundant similar habitat available in wooded areas to the south, east and west as well as in the connected corridor with Wollemi National Park to the south of the Modification area (Appendix E).

Subsidence Impacts

Subsidence of vegetation within the Modification area is not expected to result in the loss of vegetation cover or community structure (Appendix E). Therefore, no impacts are expected to occur to diurnal birds, forest owls or tree-roosting microbats as a result of the Modification (Appendix E).

Eco Logical (Appendix E) concluded any impacts on fauna associated with subsidence impacts on streams and steep slopes would be minor and not significant.

Threatened Fauna Species

Eco Logical (Appendix E) concluded that the Modification is unlikely to result in any significant impacts to threatened fauna species.

Cumulative Impacts

Eco Logical (Appendix E) considers the disturbance associated with the Modification is minor in comparison to the remaining vegetation above the underground disturbance areas and remnant vegetation associated with the Wollemi National Park and within the RWEPA areas.

4.9.3 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, 2014a) or its revisions.

Management measures outlined in the Flora and Fauna Management Plan (WCPL, 2014a) relevant to fauna include:

- Vegetation Clearance Protocol, including delineation of areas to be cleared, pre-clearance surveys and management of impacts to fauna.
- Collection and stockpiling of suitable habitat features important to threatened fauna species.
- Incorporation of ongoing management for weeds and pest animals to manage potential impacts upon fauna and their habitat.
- Monitoring within revegetated areas (including areas subject to subsidence from underground mining) such as visual monitoring of vegetation to assess the success of revegetation efforts and the condition of the vegetation, to determine the need for any maintenance and/or contingency measures (e.g. the requirement for weed and pest animal control).
- If remediation works are required, use of appropriate native flora species characteristic of the original communities, including use of local provenance seed stock where possible.

In addition to the above, WCPL are proposing an extension to the RWEP areas to offset residual impacts associated with the Modification (Section 4.8.4).

4.10 NOISE

The potential noise impacts of Wambo were assessed by Richard Heggie Associates in 2003 (Richard Heggie Associates, 2003). The assessment considered the potential noise and blasting impacts likely to be generated by Wambo and surrounding mining operations at potentially affected receptors against applicable assessment criteria.

Additionally, a Noise Review for the Modification was undertaken by SLR Consulting Australia Pty Ltd (SLR) (2016) and is presented in Appendix H. The Noise Review was prepared in consideration of:

- *NSW Industrial Noise Policy (INP)* (EPA, 2000);
- *Interim Construction Noise Guideline* (Department of Environment and Climate Change [DECC], 2009);
- *NSW Road Noise Policy (RNP)* (Department of Environment, Climate Change and Water [DECCW], 2011); and
- *Rail Infrastructure Noise Guideline (RING)* (EPA, 2013).

Section 4.10.1 provides a description of the existing environment relating to noise and Wambo's noise management and monitoring regime. Section 4.10.2 provides an assessment of potential noise impacts of the Modification. Section 4.10.3 outlines noise mitigation measures, management and monitoring.

4.10.1 Existing Environment

Noise Management and Monitoring Regime

Noise management at Wambo is currently undertaken in accordance with the Noise Management Plan which outlines:

- noise mitigation measures and controls;
- the noise monitoring and reporting regimes; and
- procedures for the management of exceedances and complaints.

The Noise Management Plan describes general noise management and mitigation measures including:

- the training of contractors and staff on environmental noise control and awareness;
- operation of machinery and potential noise emitting plant by experienced and appropriately trained personnel;
- consideration of sound power levels in equipment selection;

- regular maintenance of plant and equipment and pre-start up inspections;
- management of complaints received;
- monitoring for adverse meteorological conditions and adjusting mining operations where necessary;
- predictive meteorological forecasting to guide day-to-day planning of mining operations; and
- attended monitoring to verify ongoing compliance with noise criteria.

The Noise Management Plan describes the current noise monitoring network, which consists of: two off-site operator-attended monitoring sites; two off-site continuous real-time monitoring sites; two off-site operator-attended/real-time monitoring sites; and one on-site Automatic Weather Station (AWS). Current attended and real-time noise monitoring locations in the vicinity of Wambo are shown on Figure 6.

Current real-time noise monitoring is focused to the north-west, east and south of Wambo in the vicinity of the nearest privately-owned receivers (Figure 6).

As described in the Noise Management Plan, the noise monitoring system provides real-time access to noise data and provides the capacity to set a real-time target noise level (e.g. 2 decibels [dB] below the compliance level).

Upon noise emissions reaching the identified target level, an automated SMS message is sent to the relevant WCPL personnel, who then implement the response protocol described in the Noise Management Plan.

The response protocol includes the identification of the noise source. Upon determination that the noise source is Wambo related, and was not triggered by meteorological conditions (e.g. rainfall events and/or wind gusts greater than 3 metres per second), active measures can be put in place to modify operations or stand down equipment to ensure compliance with noise criteria continues to be maintained.

Compliance and Complaints

To date, the obligation to meet the noise criteria specified in Development Consent DA 305-7-2003 for privately-owned receivers has been achieved by WCPL through a combination of the following:

- Property acquisition, which has reduced the number of privately-owned receivers that could potentially be affected by noise impacts from Wambo.
- For the remaining privately-owned receivers, the implementation of the Wambo noise management strategy as per the Noise Management Plan, which includes the use of real-time noise monitoring to manage noise levels.

Attended noise monitoring is undertaken at Wambo at the locations shown on Figure 6.

WCPL reported compliance with relevant noise limits at the nearest privately-owned receivers during the most recent Independent Audit period between 2011 and 2014 (Hansen Bailey, 2015), and Quarters 1 and 2 of 2015 (Appendix H).

WCPL manages complaints in accordance with the Noise Management Plan. In 2014, nine complaints were received in relation to on-site noise, while only two complaints were received in 2015 in relation to on-site noise.

All complaints received by WCPL relating to noise were responded to in accordance with the Community Complaints Response procedure outlined in the Noise Management Plan. In some cases, mining operations were modified in response to a complaint lodged with WCPL during adverse weather conditions (Appendix H).

Noise Measurement and Description

The assessed noise levels presented in Appendix H and summarised in this section are expressed in A-weighted decibels (dBA). The logarithmic dBA scale simulates the response of the human ear, which is more sensitive to mid to high frequency sounds and relatively less sensitive to lower frequency sounds.

4.10.2 Potential Impacts

The Noise Review (Appendix H) included assessment of the following potential impacts:

- on-site operational noise;
- construction noise; and
- road and rail traffic noise.

These aspects are described further below and in Appendix H.

Operational Noise

Potential operational noise impacts of the Modification would be associated with:

- changes to the South Wambo Underground Mine ROM coal handling activities; and
- operation of five ventilation shafts.

ROM coal handling activities associated with the Modification are discussed in Section 3.5. The Modification would not include any significant change to approved ROM coal handling activities and associated noise impacts.

The Noise Review included a review of the sound power level of the existing Wambo operations and three indicative years incorporating the Modification (i.e. 2019, 2023 and 2028) as well as modelling of the proposed ventilation infrastructure.

As presented in Table 8, the Modification would reduce the sound power level when compared to existing Wambo operations.

**Table 8
Comparison of Site Sound Power Levels**

Indicative Year	Total Site Sound power Level (dBA re 1pW)
2016	140
2019	139
2023	133
2028	133

The Modification would have minimal potential to alter the existing intrusive or amenity noise levels at the nearest privately-owned receivers in the vicinity of Wambo.

SLR (Appendix H) also concluded that the Modification would not alter existing cumulative noise levels at the nearest residential receivers based on the review of estimated site sound power levels, modelling of the ventilation infrastructure and a review of noise results from contemporary assessments of surrounding mining operations (including the Warkworth Mine).

Construction Noise

All construction activities would be generally undertaken during daylight hours with the exception of the drilling of the ventilation shafts, which would occur up to 24 hours per day, seven days per week.

As the majority of the construction activities associated with the Modification would be conducted during the daytime, potential noise impacts associated with these activities would be minor compared to surrounding operations at Wambo.

Road and Rail Traffic Noise

Other than an extension of duration, any potential road or rail traffic noise impacts would remain generally unaltered as a result of the Modification (Appendix H).

4.10.3 Mitigation Measures, Management and Monitoring

Noise mitigation and management measures for the existing Wambo operations are described in the Noise Management Plan (Section 4.10.1) and would continue to be implemented for the Modification.

Consistent with the commitments in the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003), WCPL would implement noise mitigation on ventilation infrastructure to achieve compliance with the relevant noise criteria at nearby privately-owned receivers. This may involve installation of silencers on the fans and/or optimised outlet/louver orientation away from receivers.

WCPL would undertake an acoustical design review prior to the construction of the two most southern ventilation shafts.

4.11 AIR QUALITY

The potential air quality impacts of Wambo were assessed by Holmes Air Sciences [HAS] in 2003 (HAS, 2003). The assessment considered the potential air quality emissions likely to be generated by Wambo and surrounding mining operations at potentially affected receptors against applicable assessment criteria.

Additionally, an Air Quality and Greenhouse Gas Review for the Modification was undertaken by Todoroski Air Sciences (Todoroski) (2016) and is presented in Appendix I.

A description of the existing environment relating to air quality and Wambo's air quality management and monitoring regime is provided in Section 4.11.1. Section 4.11.2 describes the potential air quality impacts of the Modification, including cumulative impacts, and Section 4.11.3 outlines Modification air quality mitigation measures, management and monitoring.

4.11.1 Existing Environment

Air Quality Monitoring Program

An Air Quality Monitoring Program (WCPL, 2014d) for Wambo has been established. It details relevant air quality criteria, monitoring program, air quality management protocols (including air quality monitoring protocol and the complaint response protocol), mitigation and management measures, and reporting requirements.

Air quality management measures currently implemented at Wambo include (WCPL, 2014d):

- minimising disturbance areas;
- progressively rehabilitating disturbed land to reduce total disturbed area;
- revegetating topsoil stockpiles as new stockpiles are created;
- regular watering of haul roads (including four water truck fill points);
- implementing dust suppression measures (e.g. dust skirts, sprinklers) at drills, ROM coal and product coal stockpiles and the CHPP receival bin;
- implementing speed limits on roads to minimise dust generation, including reducing the speed limit in accordance with prevailing conditions;
- designing blast holes with stemming to provide optimum confinement of the blast charge;
- constraining blast operations to reduce potential impact on surrounding receivers (e.g. rescheduling blasts when wind is blowing towards immediate receivers); and
- modifying mining operations during unfavourable weather conditions to reduce dust generation.

Air quality monitoring conducted at Wambo includes dust deposition and dust concentrations (as total suspended particulate [TSP] and particulate matter 10 micrometers or less in diameter [PM₁₀]). The locations of the air quality monitoring sites are shown on Figure 6.

The annual average dust deposition results at all sites located outside WCPL-owned land were within the criterion in the Development Consent (DA 305-7-2003) (i.e. 4 grams per square metre per month [g/m²/month]) between 2011 and 2014.

TSP concentrations are measured by high volume air samplers (HVASs) at four locations (Figure 6). Annual average TSP concentrations recorded at each site from January 2011 to November 2015 demonstrate compliance with the annual average TSP criterion in the Development Consent (DA 305-7-2003) (i.e. 90 micrograms per cubic metre [µg/m³]) (Appendix I).

PM₁₀ concentrations are measured by tapered element oscillating microbalances (TEOMs) at four locations (Figure 6). Annual average PM₁₀ concentrations recorded at each site from January 2011 to November 2015 demonstrate compliance with the annual average PM₁₀ criterion in the Development Consent (DA 305-7-2003) (i.e. 30 µg/m³) (Appendix I).

Maximum 24-hour average PM₁₀ concentrations above the criteria of 50 µg/m³ have been recorded on occasions since 2011. The majority of these occurrences have been attributed to regional dust events or sources outside the influence of Wambo (Appendix I).

4.11.2 Potential Impacts

Components of the Modification that would potentially impact dust emissions from Wambo include (Appendix I):

- construction activities;
- operational activities; and
- transport of product coal.

Construction Activities

The total amount of dust generated from Modification construction activities (Section 3.1) is unlikely to be significant relative to the total amount of dust currently generated from the mining activities and other background sources. As such, any potential dust impacts related to construction activities would be unlikely to be discernible beyond the existing levels of dust in the area surrounding Wambo (Appendix I).

Given that construction activities would occur for a limited period, no significant or prolonged effect at any off-site receiver is predicted to arise as a result of construction activities (Appendix I).

Operational Activities

Open cut mining is the main contributor to dust emissions at Wambo. Achieving the proposed increase in the underground ROM coal production rate would occur as the open cut ROM coal production rate declines along with associated dust emissions (Appendix I).

Todoroski (Appendix I) undertook a review of the overall TSP emissions from Wambo, incorporating the Modification and the planned open cut ROM coal extraction rates. Todoroski (Appendix I) determined that the overall emissions from Wambo, incorporating the Modification, would be lower than the overall TSP emissions assessed by HAS (2003) for the approved operations.

As the Modification would result in lower overall TSP emissions, no significant cumulative air quality impacts are expected as a result of the Modification.

Transport of Product Coal

Coal produced by the Modification would be transported off-site via rail (Section 2.7).

Studies have been undertaken to determine the effect of coal trains on dust emissions. The findings of these studies indicate that the potential for any adverse air quality impacts associated with coal dust generated during rail transport would be low and would not make any appreciable difference to air quality (Appendix I).

As the Modification is not seeking any increase in product coal transported from Wambo or any change to rail movements, there would be no change to the potential air quality impacts due to this activity.

4.11.3 Mitigation Measures, Management and Monitoring

The dust control measures and management practices currently implemented at Wambo (Section 4.11.1) would continue for the Modification, where relevant.

In addition, WCPL would continue to implement air quality monitoring and response protocols in accordance with the Air Quality Monitoring Program (WCPL, 2014d).

4.12 GREENHOUSE GAS EMISSIONS

4.12.1 Quantitative Assessment of Potential Greenhouse Gas Emissions

A quantitative review of Modification greenhouse gas emissions was undertaken by Todoroski (2016) and is provided in Appendix I. A summary of the review is provided below.

National Greenhouse Accounts Factors

In accordance with the *National Greenhouse Accounts (NGA) Factors* (Department of the Environment, 2015a), direct 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 generated by the Modification would include:

- combustion of diesel during mining operations (Scope 1);
- fugitive emissions of gas within the coal seams (Scope 1);
- off-site generation of electricity consumed at Wambo (Scope 2); and
- combustion of product coal produced at Wambo by third parties (Scope 3).

Greenhouse Gas Emissions Estimation Methodology

Todoroski (Appendix I) estimated the greenhouse gas emissions of the Modification based on the maximum ROM coal production rate combined with estimates presented in the most recent National Greenhouse and Energy Reporting document for Wambo (Peabody, 2015). Additionally, fugitive emissions were estimated based on gas quantity and quality testing conducted for the modified South Wambo Underground Mine (GeoGas, 2016).

Todoroski (Appendix I) considers this approach provides a reasonable ‘worst case’ approximation of potential greenhouse gas emissions and is considered conservative. It is also considered to be a better method of estimating greenhouse gas emissions at Wambo compared to adopting the generic emissions factors in the National Greenhouse Accounts Factors (Department of the Environment, 2015a).

Modification Greenhouse Gas Emissions

Todoroski predicted the annual average greenhouse gas emissions for Wambo incorporating the Modification would be approximately 1.84 million tonnes of carbon dioxide equivalent (Mt CO₂-e) per annum. This is lower than the value predicted by HAS (HAS, 2003) for the approved operations of approximately 2.16 Mt CO₂-e per annum.

The estimated annual greenhouse gas emissions for Australia for the period February 2014 to March 2015 was 545.1 Mt CO₂-e (Department of the Environment, 2015b). Therefore, the average annual contribution of greenhouse gas emissions for Wambo incorporating the Modification, in comparison to the Australian greenhouse gas emissions, is conservatively estimated to be approximately 0.34%.

4.12.2 Greenhouse Gas Management Measures and Monitoring

WCPL implements a number of management measures to minimise, to the greatest extent practicable, greenhouse gas emissions from Wambo, including:

- 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 which minimise haul distances for coal and waste rock transport and therefore fuel use.
- Monitoring the consumption of fuel and regular maintenance of equipment and plant.
- Sealing completed longwall panels to reduce fugitive methane emissions.
- Real-time gas monitoring at ventilation shafts.

The greenhouse gas management measures and monitoring described above would continue for the Modification, where relevant.

4.13 ROAD TRANSPORT

A Road Transport Assessment for the Modification was undertaken by GTA Consultants (2016) and is presented in Appendix J.

The assessment was prepared in consideration of the *Guide to Traffic Generating Developments* (NSW Roads and Traffic Authority [RTA], 2002).

Section 4.13.1 provides a description of the existing road network and traffic volumes. Section 4.13.2 provides an assessment of the potential impacts of the Modification on the road network in the vicinity of Wambo, including cumulative impacts. Section 4.13.3 describes requirements for management measures for road transport.

4.13.1 Existing Environment

Road Hierarchy and Conditions

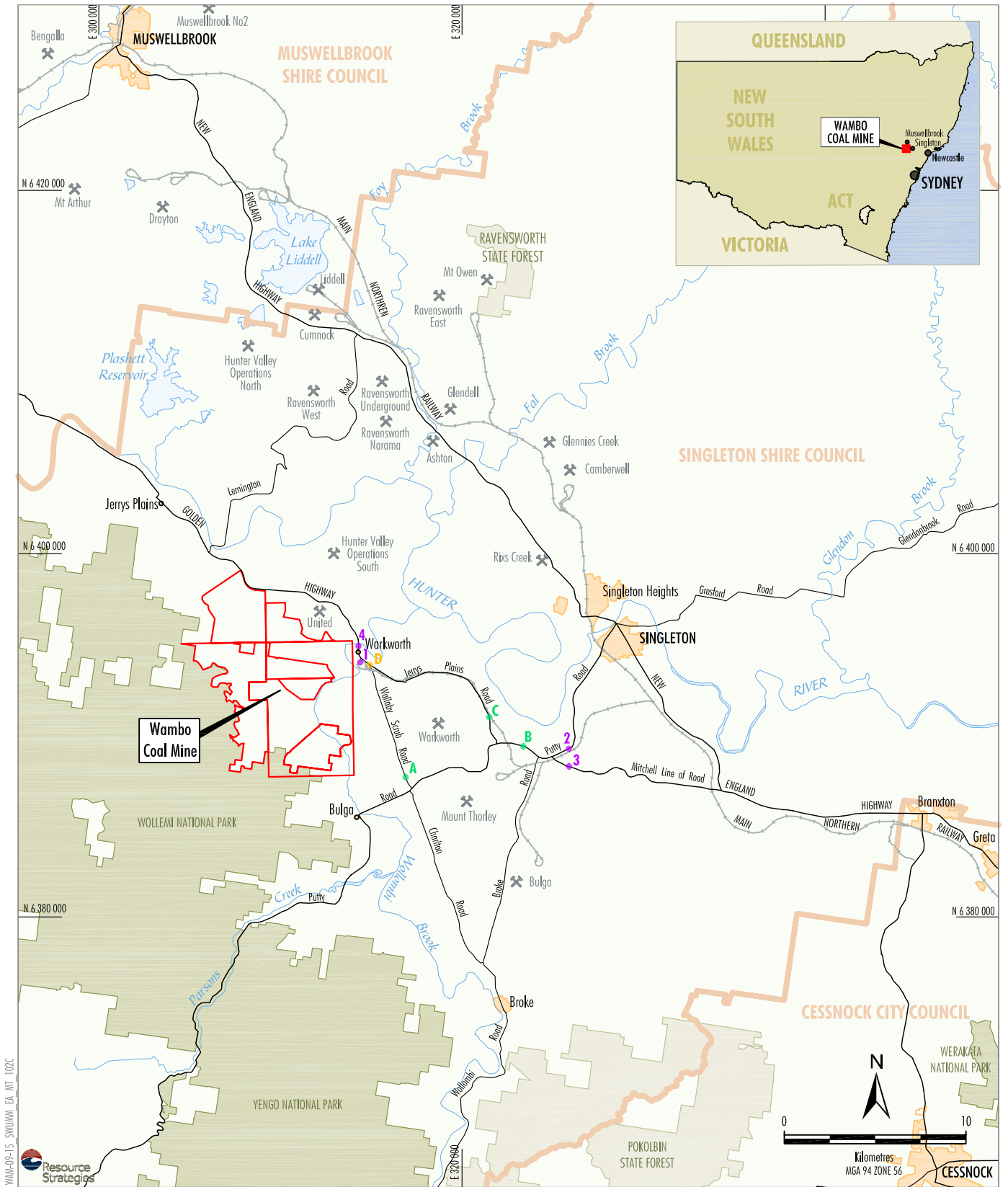
The following key roads (the names of which are based on the NSW government’s SIX Maps website) are of relevance to Wambo (Figure 15):

- Jerrys Plains Road – provides an east-west link between Denman Road near Denman and Putty Road at Mt Thorley.
- Putty Road – a rural road which provides a link from Singleton to Wilberforce in the outskirts of Sydney.
- Mitchell Line of Road – extends between Putty Road south of Singleton and the New England Highway east of the Main Northern Railway.
- New England Highway – provides an inter-regional link from Hexham in the south to near Toowoomba in the north.
- Wallaby Scrub Road – a rural road which provides a link between Jerrys Plains Road and Putty Road east of Wambo.

Sections of Jerrys Plains Road, Putty Road and Mitchell Line of Road form part of the Golden Highway.

The primary route from Singleton to the site would be via Putty Road and Jerrys Plains Road (Figure 15).

Access to Wambo from Jerrys Plains Road is via an internal mine access road (known as Wambo Access Road) connecting existing mine facilities to Jerrys Plains Road (the Golden Highway).



Source: Geoscience Australia (2009); EMM (2014); GTA Consultants (2016)


WAMBO COAL MINE
 Traffic Survey Locations

Figure 15

RMS is planning to upgrade the New England Highway between Belford and Mitchell Line of Road to include two travel lanes in each direction and a flyover for vehicles turning right from Mitchell Line of Road. Concept design and environmental assessment work are underway and are expected to be displayed for community comment in late 2016.

Wallaby Scrub Road is approved for closure from 2017 as part of the approved Warkworth Continuation Project.

Existing Traffic Volumes

A program of tube count surveys were conducted for the Road Transport Assessment (Appendix J) between 6 and 12 October 2015 and between 21 and 27 November 2015. Results from the tube count surveys are provided in Table 9.

During the period of traffic surveys, atypical activities were occurring, including the construction of South Bates Underground Mine surface infrastructure and campaign rehabilitation activities. These activities were short term only, and are not considered part of the typical day-to-day operational activity at Wambo.

In addition to the recent surveys, EMGA Mitchell McLennan (EMM) (2014) undertook traffic surveys between 4 and 10 March 2014 on roads in the vicinity of Wambo. The results of these surveys are provided in Table 10.

Roadway Capacity

The Austroads (2013) *Guide to Traffic Management Part 3: Traffic Studies and Analysis* defines a Level of Service as a qualitative measure describing operational conditions within a traffic stream (in terms of speed, travel time, freedom to manoeuvre, safety and convenience) and their perception by motorists and/or passengers. Level of Service A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. Level of Service B to D describes progressively worse traffic conditions. Level of Service E occurs when traffic conditions are at or close to capacity.

Due to the number of lanes or the posted speed limit, the Wambo Access Road and Putty Road (between Mitchell Line of Road and Jerrys Plains Road) cannot be allocated a Level of Service under the Austroads (2013) *Guide to Traffic Management Part 3: Traffic Studies and Analysis*. The remaining survey locations have current Levels of Service ranging between A and D (Appendix J).

Table 9
Surveyed Traffic – October and November 2015

Site ¹	Survey Location	AM Peak Hour (vehicles per hour)	PM Peak Hour (vehicles per hour)	Daily (vehicles per day)	Proportion of Heavy Vehicles Over Average Weekday (%)
1	Wambo Access Road South of Jerrys Plains Road	167	126	1,185	14.2
2	Putty Road North of Mitchell Line of Road	504	489	4,771	12.8
3	Mitchell Line of Road East of Putty Road	822	536	6,686	16.5
4	Jerrys Plains Road West of Wambo Coal Mine Access Road	239	254	3,114	19.6

Source: After Appendix J.

¹ Refer to Figure 15 for locations.

Table 10
Surveyed Traffic – March 2014

Site ¹	Survey Location	AM Peak Hour (vehicles per hour)	PM Peak Hour (vehicles per hour)	Daily (vehicles per day)
A	Wallaby Scrub Road North of Putty Road	83	95	921
B	Putty Road East of Jerrys Plains Road	1,132	838	9,849
C	Jerrys Plains Road North of Putty Road	237	267	3,314

Source: Appendix J.

¹ Refer to Figure 15 for locations.

Road Safety

A review of RMS accident data in the vicinity of the Modification was undertaken by GTA Consultants (Appendix J). This review indicated that accident rates on Jerrys Plains Road, Putty Road and Wallaby Scrub Road are below accident rates described as being typical for rural roads (RTA, 2004).

Accident rates on Mitchell Line of Road were found to be higher than typical rates, with most of these accidents being at the intersection with the New England Highway. As noted above, RMS is planning an upgrade to this section of the New England Highway.

4.13.2 Potential Impacts

Potential traffic impacts of the Modification on traffic generation, roadway capacity and safety are assessed in Appendix J and summarised below.

Modification Traffic Generation

The Modification would not result in any additional demand for employees and contractors (Section 3.9). As a result, the typical weekday traffic generated by Wambo and its distribution on the surrounding road network is expected to remain the same as in 2015 for the duration of the Modification.

The Modification would, however, increase the duration of traffic generation at Wambo by 7 years.

Table 11 summarises the existing and predicted Modification daily vehicle movements (traffic in both directions).

**Table 11
Existing Wambo and Predicted Modification
Two-way Weekday Traffic**

Traffic Generated by Wambo	Daily (vehicles per day)	
	Light	Heavy
Existing and Predicted	1,017	30

Source: After Appendix J.

Cumulative Traffic Increases

In order to conservatively consider the potential impacts of the Modification in the context of potential background traffic growth and traffic growth associated with other approved and proposed projects, GTA Consultants (Appendix J) considered an annual baseline growth rate and the expected traffic generation from key projects.

A 1.8% per annum baseline traffic growth rate was applied to the existing traffic volumes, which is considered conservatively high on these roads, as a significant proportion of the existing traffic during peak hours is directly associated with mining activity, and is unlikely to increase in the absence of changes to activities at those mines (Appendix J).

Table 12 presents the predicted traffic flows on key roads with and without the Modification in 2032 (i.e. the proposed final year of the Modification). The closure of Wallaby Scrub Road was approved as part of the Warkworth Continuation Project and vehicles currently using that route would be required to detour to alternative routes, as shown in Table 12.

The Modification and other cumulative traffic generation sources in 2032 would not alter the Level of Service experienced on the surveyed roads from those experienced in 2015 (Appendix J).

Road Safety Review

As described in Section 4.13.1, the accident rate on Mitchell Line of Road is higher than typical rates. The Modification would result in an additional 723 vehicles per weekday through the intersection between 2025 and 2032 compared with current approved operations. The planned upgrade of the New England Highway by RMS is expected to significantly reduce the number of crashes on Mitchell Line of Road.

4.13.3 Mitigation Measures, Management and Monitoring

No specific management or mitigation measures are considered to be warranted by GTA Consultants (Appendix J) for the Modification, noting that upgrade of the New England Highway is expected to occur.

Notwithstanding, staff and drivers would continue to be made aware of safe driving behaviour through site-specific inductions and staff education programs.

Table 12
Predicted Cumulative Two-way Weekday Traffic

Site ¹	Location	Daily (vehicles/day)		
		2015	2032 (No Modification)	2032 (With Modification)
1	Wambo Access Road South of Jerrys Plains Road	1,185	0	1,047
2	Putty Road North of Mitchell Line of Road	4,771	5,867	6,132
3	Mitchell Line of Road East of Putty Road	6,686	7,626	8,349
4	Jerrys Plains Road West of Wambo Coal Mine Access Road	3,114	3,988	4,048
A	Wallaby Scrub Road North of Putty Road	921	0	0
B	Putty Road East of Jerrys Plains Road	10,046	12,454	13,442
D	Jerrys Plains Road East of Wambo Access Road	5,304	5,457	6,445

Source: After Appendix J.

¹ Refer to Figure 15 for locations.

4.14 SOCIO-ECONOMIC

A Socio-Economic Assessment for the Modification was undertaken by AnalytEcon (2016) and is presented in Appendix K.

The cost benefit analysis has been conducted on a NSW basis consistent with the *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government, 2015) (Appendix K).

The region adopted for the local effects analysis was the Singleton, Muswellbrook, Dungog, Cessnock and Maitland LGAs as approximately 76% of the existing workforce resides in this region (Appendix K).

The cost benefit analysis and local effects analysis focused on the effects of the modified South Wambo Underground Mine activities. The analyses did not consider the effects of the proposed extension of life of the open cut operations as no other aspects of the operations are proposed to change and the life extension is consistent with the currently approved Mining Operations Plan. The proposed extension of life of the open cut operations would have a relatively small beneficial contribution compared to the changes to the underground operations.

4.14.1 Existing Environment

The population of the regional economy (i.e. Singleton, Muswellbrook, Dungog, Cessnock and Maitland LGAs) is approximately 177,000 (Appendix K).

Key industries in the region include mining, mining support services, power generation, agriculture, tourism and defence (Appendix K).

Consistent with the general downturn in the mining industry in Australia, the unemployment rate in the region has increased recently and exceeds the NSW unemployment rate (Appendix K).

4.14.2 Potential Impacts

Cost Benefit Analysis

The cost benefit analysis identified the estimated incremental net benefits of the proposed modifications to the South Wambo Underground Mine to NSW at \$101 million (M) (present value) (Appendix K).

Any environmental, social or cultural impacts of the proposed modifications to the South Wambo Underground Mine to NSW, after mitigation, would need to be valued at more than \$101M for the Modification to be undesirable from an economic efficiency perspective.

In addition, the cost benefit analysis presented in Appendix K also considered potential residual incremental impacts of the Modification, including subsidence, water resources, biodiversity, noise, air quality, road transport, Aboriginal heritage, and greenhouse gas emissions. The assessment concluded that the main potential incremental impacts of the Modification were either internalised into the production costs (e.g. through mitigation measures) or negligible.

Local Effect Analysis

As the Modification would avoid a 3 year break in longwall mining operations at Wambo, it would allow for the continued employment of approximately 230 existing underground mine personnel and other support personnel at the South Wambo Underground Mine.

Without approval of the Modification, it is anticipated that the loss of production continuity and loss of employment opportunities would compound the current levels of high unemployment in the region.

In addition, the Modification would allow for the continued employment of approximately 290 existing open cut mine personnel for an additional three years.

The first-round net benefits of the proposed modifications to the South Wambo Underground Mine for the regional economy consists of the additional disposable income that accrues to the South Wambo Underground Mine workforce estimated at approximately \$6.1M (present value).

In addition to the first-round effect described above, the proposed modifications to the South Wambo Underground Mine are expected to give rise to the following incremental flow-on impacts on the local economy (Appendix K):

- \$3.2M in additional disposable income (present value);
- twelve additional full-time equivalent employment opportunities (over the life of the South Wambo Underground Mine); and
- direct benefits to businesses and their employees in the region associated with the estimated \$430M (present value) of additional operating expenditures.

The Modification is not expected to have an adverse effect on other local industries as it would provide for the continuation of an existing mining operation utilising an existing workforce (Appendix K).

It is noted that these potential regional economic effects also need to be balanced against other potential environmental benefits and costs, which are described in this EA.

Community Infrastructure

The Modification is not expected to have an adverse effect on health and education services, housing, and other services in the region as it would provide for the continuation of an existing mining operation utilising an existing workforce (Appendix K).

4.14.3 Mitigation Measures

WCPL would make continued contributions to the local community through ongoing support for community initiatives.

No other specific socio-economic mitigation measures are proposed.

4.15 HAZARD AND RISK

A review of potential incidents and hazards identified for the Modification is described in Section 4.15.1. Proposed preventative and control measures to address potential hazards are discussed in Section 4.15.2.

4.15.1 Hazard Identification and Risk Assessment

A preliminary hazard analysis (PHA) was conducted in 2003 to assess the potential hazards and risk associated with Wambo. The PHA comprises a qualitative assessment of risk to the public, property and the environment associated with the development and operations of Wambo (Resource Strategies, 2003). 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, 2003).

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.

4.15.2 Hazard Prevention and Mitigation Measures

A summary of the potential risks identified by the PHA (Resource Strategies, 2003), preventative measures proposed by the PHA and the equivalent contemporary management plan which outlines the relevant mitigation measures are summarised in Table 13. It is expected that these management plans would continue to be implemented for the Modification.

Table 13
Risk Identification Table

Project Component	Incidence Type	Scenario	Existing or Proposed Preventative Measures	Risk	Contemporary Management Plan
Transport to Site (Explosives, Fuel, Chemicals and General Goods)	Spill	Poor maintenance, poor design, collision or human error leading to off-site impacts	<ul style="list-style-type: none"> Contractors licensed and operate in accordance with Australian Standards and NSW Legislation. WCPL Contractor Management Plan. Radio/mobile telephone communications and on-board fire fighting equipment. 	Low	Safety Management System Bushfire Management Plan Pollution Incident Response Management Plan Shotfire & Explosives Management Plan Contractor Management Plan
	Fire				
	Explosion				
	Theft	Malicious act resulting in off-site impacts			
On-site Storage (Fuels, Chemicals, Explosives and Water)	Leak/Spill	Failed tank or pipe leading to off-site impacts including chemical or fuel contamination	<ul style="list-style-type: none"> Design of structures/tanks/pipes to relevant standards. Bunding of storage facilities. Regular inspections and maintenance where required. 	Low	Safety Management System Pollution Incident Response Management Plan Shotfire & Explosives Management Plan Erosion and Sediment Control Plan
	Spill	Failed dam leading to off-site contamination	<ul style="list-style-type: none"> Design of dam structures to relevant standards. Regular inspections and maintenance where required. 		
	Spill	Exceeded dam capacity leading to an overflow event	<ul style="list-style-type: none"> Inspections and intervention where required. Design of dam structures to relevant standards and required containment capacities. 		
General Operations (Construction, ground preparation, mine waste rock emplacements, waste excavation, rehabilitation, CHPP, coal transport and tailings)	Spill	Containment structure not adequately built or maintained leading to off-site discharge of silt or saline water	<ul style="list-style-type: none"> Design of dam structures to relevant standards and required containment capacities. Supervision during construction. Inspection of containment structures and pipes. Maintenance or intervention where required. 	Low	Safety Management System Pollution Incident Response Management Plan Erosion and Sediment Control Plan
	Spill	Containment structure not adequately built or maintained leading to off-site discharge of diesel or chemicals	<ul style="list-style-type: none"> Design to appropriate standard. Supervision during construction. Regular maintenance. Inspection of containment structures and pipes. 		

Table 13 (Continued)
Risk Identification Table

Project Component	Incidence Type	Scenario	Existing or Proposed Preventative Measures	Risk	Contemporary Management Plan
General Operations (Construction, ground preparation, mine waste rock emplacements, waste excavation, rehabilitation, CHPP, coal transport and tailings) (continued)	Fire	Mobile plant, powerlines, fixed plant, human action or spontaneous combustion leading to off-site fire related impacts	<ul style="list-style-type: none"> Expansion of existing operating procedures to manage Project related activities. Regular maintenance of mobile plant and fire fighting equipment. Development and maintenance of appropriate fire breaks. Review and implementation of the existing Bushfire Management Plan in consultation with the Rural Fire Service. Review and implementation of the existing Emergency Response Plan. Regular inspections of mobile and fixed plant, coal stockpiles, fire fighting equipment and fire breaks. Review and implementation of the existing Spontaneous Combustion Management Plan. Training and competency assessment of plant operators. 	Low	Safety Management System Bushfire Management Plan Emergency Response Plan Spontaneous Combustion Management Plan
	Unplanned movement to off-site	Waste rock, mobile plant or equipment parts moved off-site in an uncontrolled manner	<ul style="list-style-type: none"> Planning of activities to ensure adequate control and buffer distances. Supervision by appropriately qualified persons. Development of appropriate operating procedures. Training and competency assessment of plant operators. 	Low	Safety Management System Mining Operations Plan
General Operations (Drill and Blast)	Unplanned movement to off-site	Blasting leading to flyrock damaging property/persons off-site	<ul style="list-style-type: none"> Planning and design of blast events to ensure adequate control and buffer distances. Operational procedures - blasting undertaken by trained personnel in compliance with Australian Standards. Where blasting occurs in close proximity to the Golden Highway temporary road closures would occur in accordance with RMS requirements and a Traffic Management Plan. Following blasting, the road would be checked for debris prior to re-opening. 	Low	Safety Management System Blast Management Plan

**Table 13 (Continued)
Risk Identification Table**

Project Component	Incidence Type	Scenario	Existing or Proposed Preventative Measures	Risk	Contemporary Management Plan
Open Cut (Mine Waste Rock Emplacements)	Unplanned movement to off-site	Slump or collapse of mine waste rock emplacement batter leading to off-site impacts	<ul style="list-style-type: none"> Mine waste rock emplacement batters designed to appropriate standards. Establishment of appropriate buffer distances. Regular inspections and surveys of mine waste rock emplacement batters during their development. 	Low	Safety Management System Mining Operations Plan
Underground (Secondary Extraction)	Unexpected rapid subsidence	Unexpected rapid subsidence leading to off-site impact	<ul style="list-style-type: none"> Compliance with the requirements of the <i>Work Health and Safety (Mines and Petroleum Sites) Act, 2013</i>. Mine planning and design to control subsidence extent and magnitude. 	Low	Safety Management System Relevant Extraction Plan, including the Subsidence Monitoring Plan
CHPP (Tailings)	Leaks/Spills	Pipeline failure leads to off-site release of tailings	<ul style="list-style-type: none"> The pipeline systems designed to appropriate standards. Regular inspections and maintenance as required. Bunding of portions of the pipeline that are outside of the catchment of containment structures of open cuts. Bunds to be designed to divert tailings to a containment structure. 	Low	Safety Management System Pollution Incident Response Management Plan
Transport On-site (Explosives, Fuel, Chemicals and General Goods)	Spill	Poor maintenance, poor design, collision or human error leading to off-site impacts	<ul style="list-style-type: none"> Contractors licensed and operate in accordance with Australian Standards and NSW Legislation. WCPL Contractor Management Plan. Site policies, management plans and procedures. Containment structures. Operator training. 	Low	Safety Management System Pollution Incident Response Management Plan Shotfire & Explosives Management Plan Contractor Management Plan
	Fire				
	Explosion				
Transport Off-site (Rail Loop Construction and Rail Loop Operations)	Leaks/Spills	Sediment control structure failure leads to discharge to watercourse	<ul style="list-style-type: none"> Sediment control structures to be designed to relevant standards. Development of construction management plans (including an integrated Erosion and Sediment Control Plan) in consultation with the relevant authorities. 	Low	Safety Management System Pollution Incident Response Management Plan Erosion and Sediment Control Plan

**Table 13 (Continued)
Risk Identification Table**

Project Component	Incidence Type	Scenario	Existing or Proposed Preventative Measures	Risk	Contemporary Management Plan
Transport Off-site (Rail Loop Construction and Rail Loop Operations) (continued)	Vehicle Accident	Vehicle accident on a public road due to construction activities associated with the rail loop	<ul style="list-style-type: none"> • Development of a Traffic Management Plan in consultation with the relevant authorities. • Management of traffic during construction of Golden Highway underpass in accordance with RMS guidelines (including the diversion of traffic and speed limits). 	Low	Safety Management System Traffic Management Plan
	Leaks/Spills	Overloading, derailment or collision leading to coal or fuel spillage offsite	<ul style="list-style-type: none"> • Development of operating procedures and training to minimise the potential for overloading. • Regular inspections of train loading activities and rail infrastructure and intervention/maintenance where required. • WCPL Contractor Management Plan. • Appropriately qualified engineers to design the rail infrastructure and signalling systems. 	Low	Safety Management System Pollution Incident Response Management Plan Contractor Management Plan

Source: After Resource Strategies (2003).

4.16 VISUAL AMENITY

4.16.1 Existing Environment

There are a number of approved open cut and underground coal mining operations in the vicinity of Wambo (Section 4.3.1), including Hunter Valley Operations, United Collieries and the Mt Thorley Warkworth operations.

Views of Wambo open cut operations or major infrastructure are not available from any private dwellings due to intervening topography and existing vegetation.

Wambo can be seen from some short sections of the Golden Highway (Jerrys Plains Road). However, there is significant existing vegetation along the Golden Highway which obscures views of the mine along the majority of the road.

4.16.2 Potential Impacts

The Modification would result in only minor changes to the visual landscape. In the context of the existing visual landscape (i.e. a number of open cut and underground coal mining operations), the incremental impact associated with the Modification would be low.

Notwithstanding, the potential impacts of the Modification have been considered and are discussed below.

Modification Surface Development Area

The Modification would require an extension to the approved surface development area. This would include an additional access road and expansion of the South Wambo Underground Mine infrastructure area, both located to the north-east of the existing/approved surface development area (Section 3.7).

Views of existing infrastructure adjacent to the South Wambo Underground Mine infrastructure area (e.g. the CHPP) from the Golden Highway are generally obscured by vegetation. Therefore, the South Wambo Underground Mine infrastructure area and additional access road are predicted to have a negligible impact on the existing visual amenity.

Surface development would also be required for access tracks and gas drainage infrastructure. This disturbance would be minor and temporary, and it is not expected that these components of the Modification would be visible from any private residence or public road due to intervening topography and existing vegetation.

Ventilation Systems

The Modification would require construction and operation of five ventilation shafts to support the operation of the South Wambo Underground Mine (i.e. an additional four ventilation shafts compared to the approved South Wambo Underground Mine and relocation of the approved shaft) (Section 3.2).

Of these, only the southernmost ventilation shaft may be visible from a public road (i.e. Wambo Road).

Given the extensive existing vegetation in the area, and the distance of the ventilation shaft from any nearby private receivers and Wambo Road, the impact of the ventilation shaft on visual amenity is predicted to be minor.

Night-lighting at the ventilation infrastructure is not expected to materially increase night-lighting impacts beyond those of the approved operations.

Open Cut Operations

The Modification would include an extension of open cut mining operations by approximately 3 years, but would not alter the approved open cut mining methods, open cut extent, open cut maximum ROM coal production rates, open cut mine fleet or waste rock management practices.

The extension of the life of the open cut mining operations would prolong the approved visual impacts of the open cut mining operations.

Subsidence Effects

As described in Section 4.2, the type and magnitude of predicted subsidence impacts for the modified mine layout are generally similar to or less than those of the approved mine layout, although the Modification would result in an increase in the total surface area affected by subsidence. Subsidence impacts from the modified mine layout would be restricted to WCPL-owned land.

Given the undulating terrain in the vicinity of Wambo, the impact of subsidence on the landscape and visual amenity would be negligible.

4.16.3 Mitigation Measures, Management and Monitoring

Given the Modification is predicted to have negligible visual amenity impact, no specific management or mitigation measures are considered to be warranted for the Modification.

Progressive rehabilitation of open cut disturbance would occur in accordance with the Mining Operations Plan.

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).

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.²

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.*

...

The Secretary issued revised SEARs for the Modification on 3 March 2016.

This EA has been prepared in accordance with the SEARs issued pursuant to section 75W(3) of the EP&A Act (Attachment 2).

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 (Infrastructure) 2007* (Infrastructure SEPP);
- *State Environmental Planning Policy No 33 – Hazardous and Offensive Development* (SEPP 33);
- *State Environmental Planning Policy No 44 – Koala Habitat Protection*; and
- *State Environmental Planning Policy No 55 – Remediation of Land* (SEPP 55).

These environmental planning instruments are discussed further in Attachment 4. The Modification is not inconsistent with these environmental planning instruments.

² 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, 2012c).

The relevance of these policy documents to the Modification are discussed further in Attachment 4.

The Framework for Biodiversity Assessment, the NSW Biodiversity Offset Policy for Major Projects and the Voluntary Land Acquisition and Mitigation Policy apply to State Significant Development and do not apply to this Modification under section 75W of the EP&A Act.

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.

Components of the Modification were referred to the Federal Minister for the Environment under the EPBC Act on 19 January 2016 as the Action (EPBC 2016/7636) (Attachment 5).

A delegate of the Commonwealth Minister determined on 29 February 2016 that the proposed Action is a 'controlled action' for the purposes of the EPBC Act due to potential impacts on the following controlling provisions under Part 3 of Chapter 2 of the EPBC Act:

- listed threatened species and communities (sections 18 and 18A); and
- a water resource, in relation to coal seam gas development and large coal mining developments (sections 24D and 24E).

The delegate of the Commonwealth Minister also determined on 29 February 2016 that the proposed action is to be assessed under the assessment bilateral agreement with the NSW Government.

The Modification will be assessed in accordance with the Bilateral Agreement and will require approval under both the EP&A Act and the EPBC Act.

Consideration of the assessment requirements relevant to the EPBC Act is provided in Attachment 5.

Other Statutory Requirements

In addition to the EP&A Act, the following NSW Acts may be potentially relevant to Wambo:

- *Aboriginal Land Rights Act, 1983;*
- *Contaminated Land Management Act, 1997;*
- *Crown Lands Act, 1989;*
- *Dams Safety Act, 1978;*
- *Dams Safety Act, 2015;*
- *Dangerous Goods (Road and Rail Transport) Act, 2008;*
- *Explosives Act, 2003;*
- *Fisheries Management Act, 1994;*
- *Heritage Act, 1977;*
- *Mining Act, 1992;*
- *National Parks and Wildlife Act, 1974;*
- *Native Vegetation Act, 2003;*
- *Noxious Weeds Act, 1993;*
- *Protection of the Environment Operations Act, 1997;*
- *Roads Act, 1993;*
- TSC Act;
- *Water Act, 1912;*
- *Water Management Act, 2000;* and
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

The following approvals would be obtained before the Modification commences:

- modification of the Development Consent (DA 305-7-2003) issued under the EP&A Act, and any relevant secondary approvals under the Development Consent conditions (e.g. management plans);

- approval of the proposed Action (EPBC 2016/7636) under sections 130(1) and 133 of the EPBC Act, and any relevant secondary approvals under the approval conditions (e.g. management plans) (for those portions of the Modification included in the proposed Action);
- an Aboriginal Heritage Impact Permit under section 90 of the NPW Act (for disturbance outside the area covered by Consent 2222); and
- relevant water access licences, and water supply works and use approvals under the NSW *Water Management Act, 2000* where applicable.

Other approvals required to support the Modification include, but are not limited to:

- variation of the premises of EPL 529 under the *Protection of the Environment Operations Act, 1997* (PoEO Act);
- revisions to the Mining Operations Plan prepared under the conditions of the mining leases;
- approval of Extraction Plans prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003);
- approvals under section 60 of the *Heritage Act, 1977* for activities within the Wambo Homestead Complex curtilage; and
- approvals from the Dams Safety Committee under the *Dams Safety Act, 1978* or *Dams Safety Act, 2015* once commenced, and/or under the mining lease conditions.

5.3 CONDITIONS AND PLANS THAT REQUIRE REVISION

5.3.1 Development Consent Conditions

Table 14 summarises the modifications to the Development Consent proposed as part of this Modification. These proposed modifications include:

- revision of Development Consent conditions to incorporate the Modification; and
- removal or revision of Development Consent conditions no longer relevant to Wambo.

5.3.2 Development Consent Land

As noted in Table 14, the Modification necessitates an extension to the land covered by the Development Consent (DA 305-7-2003). Figure 16 shows the extent of the Development Application Area for DA 305-7-2003 and the proposed extension to incorporate the Modification.

Attachment 3 includes a revised Schedule of Land for Wambo incorporating the additional parcels of land for the Modification.

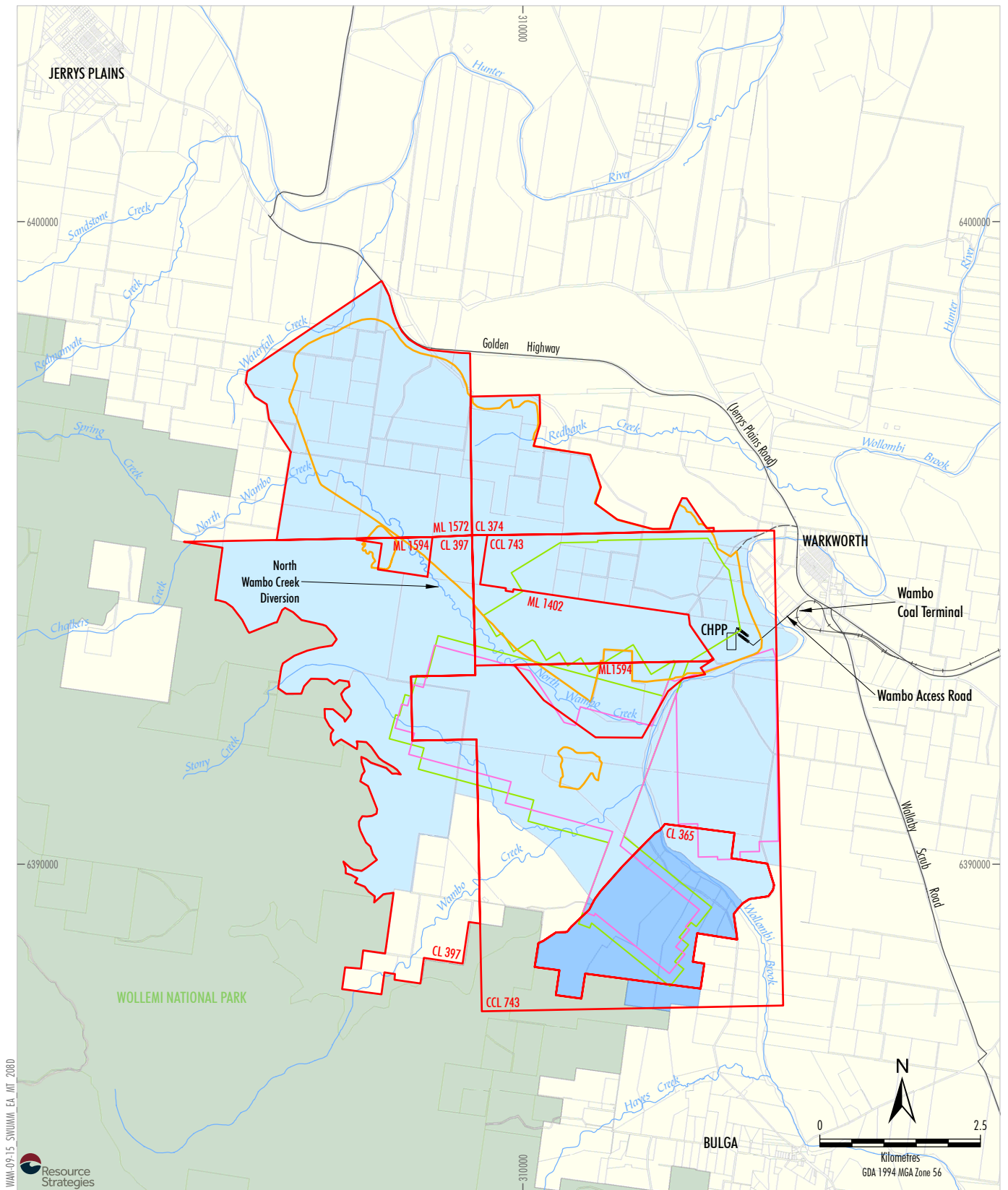
5.3.3 Management Plans

The following management plans would be reviewed, and if necessary, revised to include the Modification (subject to approval of the Modification):

- Erosion and Sediment Control Plan;
- Groundwater Monitoring Program;
- Flora and Fauna Management Plan; and
- Life of Mine Rejects Emplacement Strategy.

Extraction Plans would be prepared for longwalls in the Woodlands Hill Seam and Arrowfield Seam prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

The Wambo Homestead Complex Mine Management Plan would be revised and approved prior to any future secondary extraction within the Wambo Homestead Complex curtilage.



- LEGEND**
- Mining and Coal Lease Boundary
 - Existing/Approved Surface Development Area
 - Modified South Wambo (Woodlands Hill Seam) Underground Mine
 - Modified South Wambo (Arrowfield Seam) Underground Mine
 - DA 305-7-2003 Development Application Area
 - Proposed Extension to the Development Application Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL (2003)


WAMBO COAL MINE
 Development Application Area

Figure 16

**Table 14
Proposed Modifications to the Development Consent**

Proposed Modification	Justification								
<p>Revise dot point 7 in the 'Proposed Development' in Schedule 1 as follows:</p> <ul style="list-style-type: none"> • construction of a portal and drift access to facilitate longwall mining of the Arrowfield and <u>Woodlands Hill Bowfield Seams</u>; 	<p>The Modification proposes to carry out mining in the Woodlands Hill Seam rather than the Bowfield Seam.</p>								
<p>Revise Condition 2, Schedule 3 as follows:</p> <p>2. The Applicant shall carry out the development generally in accordance with the:</p> <p>...</p> <p>(p) the modification application DA 305-7-2003 MOD 15 and accompanying documents entitled South Bates (Wambo Seam) Underground Mine Modification Environmental Assessment – The addition of South Bates (Wambo Seam) Underground Mine Longwalls 14 to 16, dated August 2015, and associated Response to Submissions dated September 2015 and letter from Peabody Energy to the Department of Planning and Environment entitled <u>'Modification 15 to DA 305-7-2003 – Supplementary Request To Include Revised Portal Location'</u> dated 2 November 2015; and</p> <p>(q) <u>the modification application DA305-7-2003-MOD16 and accompanying document entitled 'South Wambo Underground Mine Modification Environmental Assessment'</u>.</p>	<p>Inclusion of reference to this Modification application and an administrative change to include a relevant incorporated document that formed part of MOD 15.</p>								
<p>Revise Condition 6, Schedule 3 as follows:</p> <p>6. The Applicant may carry out mining operations at the Wambo Mining Complex until 1 March 2025 <u>2032</u>.</p>	<p>The Modification involves an extension to the life of mine of 7 years (Table 1).</p>								
<p>Remove Conditions 11 and 12, Schedule 3:</p> <p>Section 94 Contribution</p> <p>11. Before carrying out any development, or as agreed otherwise by Council, the Applicant shall pay Council \$60,000 in accordance with Council's Section 94 Contribution Plan.</p> <p>Community Enhancement Contribution</p> <p>12. Before carrying out any development, or as agreed otherwise by Council, the Applicant shall pay Council \$15,000 for the enhancement of community infrastructure or services in the Warkworth/Jerrys Plains area.</p>	<p>The most recent Independent Environmental Audit Report (Hansen Bailey, 2015) confirmed compliance with these conditions in October 2005 and recommended their removal from the consent.</p>								
<p>Revise Table 1 in Schedule 4 as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="text-align: center;">2 - Lambkin</td> <td style="text-align: center;">23A & B - Kannar</td> </tr> <tr> <td style="text-align: center;">13C - Skinner</td> <td style="text-align: center;">31A, B, C & D - Fisher</td> </tr> <tr> <td style="text-align: center;">19A & B - Kelly</td> <td style="text-align: center;">51 - Hawkes</td> </tr> <tr> <td style="text-align: center;">22 - Henderson</td> <td style="text-align: center;">56 - Haynes</td> </tr> </tbody> </table>	2 - Lambkin	23A & B - Kannar	13C - Skinner	31A, B, C & D - Fisher	19A & B - Kelly	51 - Hawkes	22 - Henderson	56 - Haynes	<p>The following properties have been purchased by WCPL and should be removed from the condition:</p> <ul style="list-style-type: none"> • Fisher property, purchased September 2004; • Haynes property, purchased September 2006; • Hawkes property purchased September 2006; and • Kannar property purchased March 2007.
2 - Lambkin	23A & B - Kannar								
13C - Skinner	31A, B, C & D - Fisher								
19A & B - Kelly	51 - Hawkes								
22 - Henderson	56 - Haynes								
<p>Revise Table 10 in Schedule 4 as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Day/Evening/Night L_{Aeq} (15 minute)</th> <th style="text-align: center;">Property</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">43</td> <td>94 – Curlewis 23C – Kannar 254A – Algje</td> </tr> <tr> <td style="text-align: center;">40</td> <td>All other residential or sensitive receptor, excluding the receptors listed in condition 1 above</td> </tr> </tbody> </table>	Day/Evening/Night L _{Aeq} (15 minute)	Property	43	94 – Curlewis 23C – Kannar 254A – Algje	40	All other residential or sensitive receptor, excluding the receptors listed in condition 1 above	<p>The Kannar property was purchased by WCPL in March 2007 and should be removed from the condition.</p>		
Day/Evening/Night L _{Aeq} (15 minute)	Property								
43	94 – Curlewis 23C – Kannar 254A – Algje								
40	All other residential or sensitive receptor, excluding the receptors listed in condition 1 above								

Table 14 (Continued)
Proposed Modifications to the Development Consent

Proposed Modification	Justification
<p>Remove Condition 28A, Schedule 4:</p> <p>Chitter Dump Dam</p> <p>28A. The Applicant shall design and construct the Chitter Dump Dam in consultation with United Collieries Pty Ltd, and to the satisfaction of the DSC and DRE. The design of the dam must be accompanied by a detailed assessment of the potential operational and environmental risks associated with the dam, particularly in relation to potential subsidence related impacts.</p>	<p>The Chitter Dump Dam will be dewatered and decommissioned as part of construction of the approved CHPP portal box cut (Section 3.1). Therefore, this condition is no longer relevant.</p>
<p>Revise Condition 28C, Schedule 4 as follows:</p> <p>28C. The South Wambo Dam shall be fully, or substantially, drained prior to the commencement of mining in the underlying longwalls to the satisfaction of DSC to minimise the risk of operational or environmental impacts from subsidence.</p>	<p>The South Wambo Dam may not be required to be fully drained for mining of the Woodlands Hill Seam and Arrowfield Seam due to the greater depth of cover (Section 4.2).</p> <p>Management measures for South Wambo Dam would require the agreement of the DSC during the Extraction Plan process.</p>
<p>Remove Condition 72, Schedule 4:</p> <p>Read Closure</p> <p>Note: The Applicant requires Council approval under the Roads Act 1993 prior to closing Pinegrove Road.</p> <p>72. Prior to closing Pinegrove Road, the Applicant shall prepare and implement a Road Closure Management Plan in consultation with the affected landowners, and to the satisfaction of Council. This plan must describe the alternate access arrangements for any affected landowners.</p>	<p>Pinegrove Road was closed with Council approval under the <i>Roads Act, 1993</i> and acquired by WCPL in 2012. Therefore, this condition is no longer relevant.</p> <p>Note that all affected landowners were purchased by WCPL prior to the formal closure of Pinegrove Road.</p>
<p>Revise Conditions 74 to 78, Schedule 4 as follows:</p> <p>Coal Haulage</p> <p>74. The Applicant shall not transport more than 3 million tonnes of product coal a year from the site until a rail coal loader is commissioned in the vicinity of the site.</p> <p>75. The Applicant shall cease all coal haulage on public roads as soon as a rail coal loader is commissioned in the vicinity of the site. The Applicant shall ensure that all product coal is transport from the site by rail except in an emergency, and as agreed by the Secretary in consultation with Council.</p> <p>76. If no rail loader is commissioned in the vicinity of the site within 2 years of the commencement of this consent, the Applicant shall submit a report to the Secretary outlining the alternatives to road haulage, and describing the proposed arrangements for transporting coal from the site.</p> <p>77. The Applicant shall ensure that all loaded coal haulage vehicles entering or leaving the site are covered.</p> <p>78. The Applicant shall pay Council 0.5 cents for each tonne of product coal hauled along Council roads to the Mount Therley Coal Loader, in accordance with Council's Section 94 Contribution Plan.</p>	<p>The rail coal loader was commissioned in May 2006, and WCPL does not currently transport product coal on public roads. Therefore, these conditions are no longer relevant.</p>
<p>Replace Appendix 1 with the Schedule of Land provided in Attachment 3 of this EA.</p>	<p>As described in Section 5.3.2, the Modification includes an extension to the land the subject of the Development Consent.</p>
<p>Replace Appendix 5 with a figure showing the Modified Wambo layout.</p>	<p>The Modification proposes to modify the approved underground mine layout.</p>

6 CONCLUSION AND MODIFICATION JUSTIFICATION

6.1 SUMMARY OF ENVIRONMENTAL MANAGEMENT AND MONITORING MEASURES

This section provides a consolidated summary of all proposed environmental commitments for the Modification, as well as management and monitoring measures.

6.1.1 Modification Specific Commitments

Extension to the RWEPA Areas

The existing RWEPA areas at Wambo (Section 2.13) would be augmented with an additional RWEPA area (RWEPA Area E) as a biodiversity offset for the Modification (Figure 14).

The existing RWEPA areas are located on land held by WCPL and are in the process of being protected in perpetuity by a Voluntary Conservation Agreement. It is proposed to apply the same method of conservation security to the proposed RWEPA Area E for the Modification.

The management of RWEPA Area E would be described within an updated Flora and Fauna Management Plan. Management measures would include:

- management of livestock grazing;
- control of weeds;
- management of exotic animal pests;
- bushfire management;
- revegetation;
- control of vehicular access; and
- minimisation of disturbance.

Gas Management Infrastructure Siting

The specific locations of gas management infrastructure would be defined as a component of future detailed mine planning and engineering studies over the life of the South Wambo Underground Mine.

Surveys of potential gas management infrastructure locations would be conducted to identify any threatened flora/fauna (e.g. species, communities or populations) and Aboriginal cultural heritage sites. If any threatened flora/fauna or Aboriginal cultural heritage sites are identified, consideration would be given to relocating the works so as to avoid direct impacts.

It is expected that threatened flora species, threatened populations, threatened fauna species and Aboriginal cultural heritage sites would be able to be avoided. Impacts to threatened communities would be minimised by the minor nature of the disturbance (small, isolated and temporary) and by locating the surface components to reduce clearance requirements (e.g. using existing cleared areas or areas with a sparse mid/over story).

The location of gas management infrastructure would be outlined in the relevant Extraction Plan and associated Mining Operations Plan.

Acoustical Design Review of Ventilation Infrastructure

WCPL would undertake an acoustical design review prior to the construction of the two most southern ventilation shafts.

WCPL would implement noise mitigation on ventilation infrastructure to achieve compliance with the relevant noise criteria at nearby privately-owned receivers. This may involve installation of silencers on the fans and/or optimised outlet/louver orientation away from receivers.

6.1.2 Environmental Management and Monitoring

Section 4 outlines proposed environmental mitigation, management and monitoring measures.

WCPL would continue to implement the environmental monitoring and management system described in Section 2.14, with updates to the management plans identified in Section 5.3.3.

In addition, environmental management, monitoring and reporting will be conducted in accordance with the conditions of the Development Consent (DA 305-7-2003), which may be updated as a result of approval of the Modification.

6.2 MODIFICATION JUSTIFICATION

The Modification area is within existing mining tenements held by WCPL. In addition, the majority of the area has been the subject of past mining activities. WCPL considers the proposed Wambo site is suitable for the Modification.

The Modification would enable the continued use of existing Wambo infrastructure and workforce and would promote the more efficient and economic recovery of coal resources.

This EA has demonstrated that the Modification can be implemented with limited additional biophysical and environmental impacts above those already approved at Wambo, with the implementation of the mitigation measures described in Section 6.1. The Modification would have substantial economic and social benefits associated with allowing continuity of the underground operations (Section 4.14) and the extension to the life of the open cut operations.

6.2.1 Consideration of Alternatives

Alternatives to the proposed location, mining methods and scale of the Modification have been considered by WCPL in the development of the South Wambo Underground Mine design. An overview of alternatives to the Modification considered by WCPL is provided below.

Modification Location

Mine Layout

The modified mine layout was identified by:

- the presence of coal seams able to be economically mined in the vicinity of Wambo;
- mining tenements held by WCPL;
- the ability to achieve WCPL's existing subsidence impact performance measures for significant natural and built features; and
- the presence of other geological and natural constraints.

Surface Development Areas

The locations of the proposed surface development areas were determined by the infrastructure required to safely and efficiently service the South Wambo Underground Mine, the space available for this infrastructure and a number of other design parameters, including geotechnical and environmental factors.

The disturbance required for proposed surface development areas has been refined to avoid and minimise potential impacts on biodiversity values.

Gas Drainage

Surface disturbance for pre-mining gas drainage, and goaf gas drainage would be required for the South Wambo Underground Mine to reduce the gas content in the coal seams to levels suitable and safe for longwall operations.

WCPL would implement the gas management infrastructure siting process outlined in Section 3.2, which would involve consideration be given to relocating the works so as to avoid direct impacts.

Mining Operations

Mining Method

The depth, seam thickness and depth of the coal seams associated with the South Wambo Underground Mine are more amenable to underground mining methods than open cut mining methods. The approved longwall mining method was retained over other mining methods due to its superior productivity and suitability to extract the resource.

Target Coal Seams

The Woodlands Hill Seam proposed to be mined as part of the Modification is more favourable than the approved (but no longer proposed) Bowfield Seam due its ability to be economically mined beneath the existing/approved surface development area and the shorter time period between the commencement of construction and the commencement of longwall production.

The proposed mining of the Woodlands Hill and Arrowfield Seams does not preclude future access to the Bowfield Seam subject to obtaining all necessary approvals.

Extent and Scale

Resource definition and mine planning indicate that the modified mine layout is of a sufficient extent and scale. As described in Section 5.1, the Modification is within the scope of a modification to the Development Consent (DA 305-7-2003) under section 75W of the EP&A Act.

No Modification

Consideration of the potential consequences of the Modification not proceeding is provided in Section 6.2.5.

6.2.2 Ecologically Sustainable Development Considerations

Background

As described in Section 5, components of the Modification will require approval under both the EP&A Act and the EPBC Act.

In deciding whether or not to approve the proposed Action, the Commonwealth Minister must take into account the principles of ecologically sustainable development (ESD) pursuant to section 136(2) of the EPBC Act. The relevant definition of the principles of ESD is provided in section 3A of the EPBC Act.

The objects of the EP&A Act also require encouragement of ESD. Section 6(2) of the *NSW Protection of the Environment Administration Act, 1991* provides a definition of ESD.

The principles of ESD as outlined in section 3A of the EPBC Act and clause 7(4) of Schedule 2 of the EP&A Regulation are presented and compared in Table 15.

The design, planning and assessment of the Modification have been carried out applying the principles of ESD, through:

- incorporation of risk assessment and analysis at various stages in the Modification pre-feasibility assessment and design, environmental assessment and decision-making;
- adoption of high standards for environmental and occupational health and safety performance;
- consultation with regulatory and community stakeholders;
- assessment of potential greenhouse gas emissions associated with the Modification;
- optimisation of the economic benefits to the community arising from the development of the Modification; and
- taking account of biophysical considerations in the design, including the principles of ESD as defined in section 3A of the EPBC Act and clause 7(4) of Schedule 2 of the EP&A Regulation.

In addition, it can be demonstrated that the Modification can be undertaken in accordance with ESD principles through the application of measures to avoid, mitigate and offset the potential environmental impacts of the Modification, and adaptive management would be implemented.

The following sub-sections describe the consideration and application of the principles of ESD to the Modification.

Precautionary Principle

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

An Environmental Risk Assessment (Appendix L) and review of the previous PHA (Section 4.15) were conducted to identify any incremental risks associated with the Modification and to develop appropriate mitigation measures and strategies.

The Environmental Risk Assessment (Appendix L) considers potential environmental impacts associated with the Modification, including long-term effects. In addition, long-term risks are considered by the specialist studies conducted in support of this EA (Section 1.4). Findings of these specialist assessments are presented in Section 4 and relevant appendices.

Measures designed to avoid, mitigate and offset potential environmental impacts arising from the Modification are also described in Sections 4 and 6.1.

The specialist assessments, Environmental Risk Assessment and review of the Preliminary Hazard Analysis have evaluated the potential for harm to the environment associated with the Modification.

Assessment of potential short, medium and long-term impacts of the Modification have been carried out during the preparation of this EA on aspects of (but not limited to) subsidence, groundwater and surface water, terrestrial and aquatic ecology, Aboriginal and historic heritage, noise, air quality (including greenhouse gas emissions), agricultural land uses, road transport, social and community infrastructure and economics.

Table 15
Principles of Ecologically Sustainable Development – EPBC Act and EP&A Regulation

Section 3A of the EPBC Act	Clause 7(4) of Schedule 2 of the EP&A Regulation
(a) <i>decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;</i>	-
(b) <i>if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;</i>	<p>(a) <i>the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:</i></p> <ul style="list-style-type: none"> (i) <i>careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and</i> (ii) <i>an assessment of the risk-weighted consequences of various options,</i>
(c) <i>the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;</i>	(b) <i>inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,</i>
(d) <i>the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;</i>	(c) <i>conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,</i>
(e) <i>improved valuation, pricing and incentive mechanisms should be promoted.</i>	<p>(d) <i>improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:</i></p> <ul style="list-style-type: none"> (i) <i>polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,</i> (ii) <i>the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,</i> (iii) <i>environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.</i>

Minimal uncertainty regarding the information used in these specialist assessments is expected given:

- the period of operational experience and number of site-based surveys and assessments conducted at Wambo to date;
- the comprehensive nature of the assessments; and
- the consultation process conducted with key stakeholders (Section 1.3).

A range of measures have been adopted as components of the current Wambo operations and the Modification to minimise the potential for serious and/or irreversible damage to the environment, including physical controls (e.g. physical offsets of longwalls from the Wollemi National Park escarpment) and operational controls (e.g. the standing down of some mobile equipment during adverse weather conditions), the development of environmental management and monitoring programmes, and biodiversity offsets (Section 4). Where residual risks are identified, contingency controls have also been considered (Section 4).

Wambo would continue to achieve the subsidence impact performance measures in the Development Consent through an adaptive management approach as part of the Extraction Plan process.

The implementation of an adaptive management approach is consistent with the precautionary principle as described by Chief Justice Preston in *Newcastle & Hunter Valley Speleological Society Inc v Upper Hunter Shire Council and Stoneco Pty Limited* [2010] NSW Land and Environment Court 48 at [184]:

...In adaptive management the goal to be achieved is set, so there is no uncertainty as to the outcome and conditions requiring adaptive management do not lack certainty, but rather they establish a regime which would permit changes, within defined parameters, to the way the outcome is achieved.

Social Equity

Social equity is defined by inter-generational and intra-generational equity. Inter-generational equity is the concept that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations, while intra-generational equity is applied within the same generation.

The principles of social equity are addressed through:

- assessment of the social and economic impacts of the Modification, including the distribution of impacts between stakeholders and consideration of the potential economic costs of climate change (Appendix K);
- management measures to be implemented in relation to the potential impacts of the Modification on water resources, heritage, land resources, agriculture, noise and blasting, air quality, ecology, transport, hazards and risks, greenhouse gas emissions, visual character, economics and social impacts (Section 4);
- implementation of environmental management and monitoring programmes (Section 4) to minimise potential environmental impacts (which include environmental management and monitoring programmes covering the life of Wambo);
- implementation of an extension of the RWEP areas during the life of Wambo to compensate for potential localised impacts that have been identified for the Modification (Sections 4.8 and 6.1); and
- WCPL would make continued contributions to the local community through ongoing support for community initiatives.

The Modification would benefit current and future generations through the maintenance of employment at Wambo. It would also provide significant stimulus to local and regional economies and provide NSW export earnings and royalties, thus contributing to future generations through social welfare, amenity and infrastructure.

The current Wambo operations and the Modification would incorporate a range of physical controls (e.g. physical offsets of longwalls from the Wollemi National Park escarpment) and operational controls (e.g. the standing down of some mobile equipment during adverse weather conditions), and environmental management and mitigation measures (e.g. biodiversity offsets) to minimise potential impacts on the environment and the costs of these measures would be met by WCPL.

Where relevant, these costs have been included in the economic assessment, therefore, the potential benefits to current and future generations have been calculated in the context of the mitigated Modification.

Conservation of Biological Diversity and Ecological Integrity

Biological diversity or 'biodiversity' is considered to be the number, relative abundance, and genetic diversity of organisms from all habitats (including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part) and includes diversity within species and between species as well as diversity of ecosystems (Lindenmayer and Burgman, 2005).

The assessments in Sections 4.8 and 4.9 (and Appendices D and E) describe the potential impacts of the Modification on local and regional ecology.

In accordance with ESD principles, the Modification addresses the conservation of biodiversity and ecological integrity by proposing an environmental management framework designed to conserve ecological values, where practicable, after consideration of potential Modification impacts.

A range of impact avoidance, mitigation and offset measures would be implemented for the Modification to maintain or improve the biodiversity values of the surrounding region in the medium to long-term, as described in Sections 4.8, 4.9 and 6.1.

Valuation

One of the common broad underlying goals or concepts of sustainability is economic efficiency, including improved valuation of the environment. Resources should be carefully managed to maximise the welfare of society, both now and for future generations.

In the past, some natural resources have been misconstrued as being free or underpriced, leading to their wasteful use and consequent degradation. Consideration of economic efficiency, with improved valuation of the environment, aims to overcome the underpricing of natural resources and has the effect of integrating economic and environmental considerations in decision making, as required by ESD.

While historically, environmental costs have been considered to be external to project development costs, improved valuation and pricing methods attempt to internalise environmental costs and include them within project costing.

The Economic Assessment (Appendix K) undertakes an analysis of the Modification and incorporates environmental values via direct valuation where available (e.g. Project impacts on existing land uses). Furthermore, wherever possible, direct environmental effects of the Modification are internalised through the adoption and funding of mitigation measures by WCPL to mitigate and offset potential environmental impacts (e.g. biodiversity offsets and operational noise management costs). The above is presented in a cost benefit analysis, which evaluates the relative costs and benefits of the Modification to society from an economic perspective.

The cost benefit analysis in Appendix K indicates a direct net benefit to NSW of approximately \$101M which would be foregone if the Modification is not implemented.

6.2.3 Consideration of the Modification against the Objects of the Environmental Planning and Assessment Act, 1979

Section 5 of the EP&A Act describes the objects of the EP&A Act as follows:

- (a) *to encourage:*
- (i) *the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
 - (ii) *the promotion and co-ordination of the orderly and economic use and development of land,*
 - (iii) *the protection, provision and co-ordination of communication and utility services,*
 - (iv) *the provision of land for public purposes,*
 - (v) *the provision and co-ordination of community services and facilities, and*
 - (vi) *the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and*
 - (vii) *ecologically sustainable development, and*
 - (viii) *the provision and maintenance of affordable housing, and*

- (b) *to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and*
- (c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

The Modification is considered to be generally consistent with the objects of the EP&A Act, because it is a Modification which:

- incorporates:
 - measures for the management and conservation of natural and artificial resources including water, agricultural land and natural areas (Section 4);
 - development of the State's mineral resources (i.e. coal resources) more economically and efficiently than the approved mine arrangement (Section 1.2);
 - continued implementation of measures to minimise potential amenity impacts associated with noise, blasting, air quality and visual impacts on surrounding land uses (Section 4);
 - significant continued employment and other socio-economic benefits to the community (Sections 4.14 and 6.2.5); and
 - an extension of the life of Wambo for a further 7 years and the economic use and development of land;
- would support the ongoing provision of community services and facilities through significant contributions to State royalties, State taxes and Commonwealth tax revenue;
- incorporates a range of measures for the protection of the environment, including the protection of native plants and animals, threatened species, and their habitats (Sections 4.8 and 4.9);
- incorporates relevant ESD considerations (Section 6.2.2);
- is a Modification that would be determined by a delegate of the Minister for Planning, however, consultation with other levels of government and a range of stakeholders has been undertaken (Section 1.3); and
- includes public involvement and participation through the ongoing operational consultation and consultation regarding the Modification (Section 1.3), the public exhibition of the EA document and DP&E assessment of the Modification in accordance with the requirements of the EP&A Act.

6.2.4 Consideration of the Modification against the Objects of the Environment Protection and Biodiversity Conservation Act, 1999

Section 3 of the EPBC Act describes the objects of the EPBC Act as follows:

- (1) *The objects of this Act are:*
 - (a) *to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and*
 - (b) *to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and*
 - (c) *to promote the conservation of biodiversity; and*
 - (ca) *to provide for the protection and conservation of heritage; and*
 - (d) *to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples; and*
 - (e) *to assist in the co-operative implementation of Australia's international environmental responsibilities; and*
 - (f) *to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and*
 - (g) *to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.*

The Modification is considered to be generally consistent with the objects of the EPBC Act, because it is a Modification which:

- incorporates a range of measures for the protection of the environment, including listed threatened species and ecological communities, water resources and heritage (Section 4);
- incorporates relevant ESD considerations (Section 6.2.2);
- includes a proposal for offset of unavoidable impacts on biodiversity and other compensatory measures (Sections 4.8 and 6.1);

- includes the involvement and participation of the community, landholders and indigenous people through the ongoing operational consultation and consultation regarding the Modification (Section 1.3), the public exhibition of the EA document and DP&E assessment of the Modification in accordance with the requirements of the EP&A Act;
- would not result in a significant impact on migratory species protected under international agreements; and
- includes the involvement of registered Aboriginal parties throughout the life of the South Wambo Underground Mine through the Heritage Management Plan.
- existing employment would be discontinued for approximately 290 existing open cut personnel at the end of the approved open cut life (March 2017) and for approximately 230 existing underground mine personnel and other support personnel in late 2018 (for a period of approximately 2 years);
- the associated flow-on effects of the above discontinuation of existing employment would also be lost;
- there would be economic and social impacts on the Wambo region (including the Singleton, Dungog, Cessnock, Maitland and Muswellbrook LGAs) associated with the above losses of existing employment and employment opportunities;

6.2.5 Consideration of the Consequences of not Carrying out the Modification

As described in Section 4.14, the Cost Benefit Analysis did not consider the effects of the proposed extension to the life of the open cut operations by 3 years. Based on the results of AnalytEcon (Appendix K), the following consequences are inferred if the modifications proposed to the South Wambo Underground Mine development do not proceed:

- direct net benefits to NSW of around \$101M would be foregone;
- company income tax revenue in the order of \$50M (NSW share) in present value terms would not be generated; and
- royalties to the State of NSW in the order of \$43M in present value terms would not be generated.

Were the Modification not to proceed, the following additional consequences are inferred:

- longwall mining production would be discontinued for 3 years (2019 to 2021) and the associated flow-on effects of this production would be lost;
- additional employment opportunities associated with the proposed increase in production in the underground operations would not eventuate and the associated flow-on effects of this employment would also be lost;

- the potential incremental environmental and social impacts and benefits described in this EA for the Modification (compared to the approved Wambo) would not occur;
- the efficiencies associated with extraction of the Woodlands Hill Seam coal resource with current access to existing Wambo personnel and infrastructure would be lost (although the resource would remain available to be extracted by other means); and
- the proposed extension to the RWEPA areas would not be established.

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