WAMBO DEVELOPMENT PROJECT

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WAMBO COAL PTY LIMITED

MAIN REPORT

VOLUME 1

ResourceStrategies

WAMBO COAL PTY LIMITED

WAMBO DEVELOPMENT PROJECT

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1

MAIN REPORT

July 2003

ResourceStrategies

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19 June 2003

Mr Chris Wilson
Director
Major Development Assessment
PlanningNSW
Level 4
Henry Deane Building
20 Lee Street
SYDNEY NSW 2000

Dear Mr Wilson

The enclosed Environmental Impact Statement for the Wambo Development Project has been prepared on our behalf by Resource Strategies Pty Ltd.

Wambo Coal Pty Limited believes the EIS to represent an accurate statement of the Company's project development intentions, the environmental investigation and assessment undertaken in support of the development application and the Company's proposed environmental impact mitigation and management measures.

Yours faithfully
Wambo Coal Pty Limited

ALLAN DAVIES
Executive Director

Submission of
environmental impact statement (EIS)
prepared under the *Environmental Planning and Assessment Act 1979*
Section 78A (8)

EIS prepared by	
name	Joshua Hunt
qualifications	B.Eng. (Civil)
address	Resource Strategies Pty Ltd Post Office Box 1842, MILTON QLD 4064
in respect of	Wambo Development Project
development application	
applicant name	Wambo Coal Pty Limited
applicant address	Level 9 1 York St SYDNEY NSW 2000
land to be developed: address, lot no. DP/MPS, vol/fol etc	As described in the EIS and maps attached, and in the accompanying Development Application.
proposed development	Development of open cut and underground mining operations at the Wambo Coal Mine. The Project includes development of open cut and underground mining operations and mine waste rock emplacements, upgrade of the Wambo Coal Mine Coal Handling and Preparation Plant, relocation of the administration area and site offices and construction of a water control structure across North Wambo Creek, access roads, internal haul roads, rail spur, rail loop, coal reclaim area, product coal conveyor, train load-out bin and the realignment of Wallaby Scrub Road. *or* map(s) attached
environmental impact statement	an environmental impact statement (EIS) is attached
certificate	I certify that I have prepared the contents of this Statement and to the best of my knowledge • it is in accordance with clauses 72 and 73 of the *Environmental Planning and Assessment Regulation 2000*; • it contains all available information that is relevant to the environmental assessment of the development to which the statement relates; and • the information contained in the statement is neither false nor misleading.
signature	
name	JOSHUA HUNT
date	19 JUNE 2003

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ES1 INTRODUCTION

This Environmental Impact Statement (EIS) assesses the Wambo Development Project (the Project) and potential cumulative impacts arising from its development in combination with existing and proposed operations in the immediate vicinity. Located within the Singleton local government area (LGA), in the Hunter Valley of New South Wales (NSW) (Figure ES-1), the Project includes the continued development of open cut and underground mining operations at the Wambo Coal Mine (Figure ES-2) and the development and operation of rail and train loading infrastructure.

ES1.1 WAMBO COAL MINE

Wambo Coal Mine is owned by Wambo Coal Pty Limited (WCPL), which is a wholly owned subsidiary of HunterCoal Pty Ltd.

The Wambo Coal Mine comprises open cut mining operations, the Homestead Underground Mine (decommissioned) and the Wollemi Underground Mine (currently on care and maintenance), a Coal Handling and Preparation Plant (CHPP), and associated raw and product coal handling facilities.

Up to 3 million tonnes per annum (Mtpa) of product coal is transferred from the CHPP to the Mount Thorley Coal Loader (MTCL) by a combination of B-Double and single trailer trucks. Product coal is then railed from the MTCL to the Port of Newcastle for export.

Wambo Coal Mine currently produces thermal coal, which is widely accepted in north Asian markets, including Japan and Taiwan.

ES1.2 PROJECT OVERVIEW

The Project is being developed by WCPL and comprises an Open Cut and Underground Mining Component and a Rail and Train Loading Infrastructure Component. A summary of key Project information is presented in Table ES-1.

The Open Cut and Underground Mining Component would include:

- continued development of open cut mining operations within existing WCPL mining and coal leases and into new mining lease application areas;
- selective auger mining of the Whybrow, Redbank Creek, Wambo and Whynot Seams up to 200 m beyond the open cut limits within WCPL owned land;
- continued placement of waste rock and coarse rejects within mine waste rock emplacements;
- continued placement of tailings within open cut voids and capping with waste rock and coarse rejects;
- an extension to the existing Wollemi Underground Mine Box Cut (within the limits of the Project open cut mining area) to provide direct access for three underground longwall panels in the Whybrow Seam;
- extension of drifts from the Wollemi Underground Mine to facilitate longwall mining of the Wambo Seam;
- construction of a portal and drift access adjacent to the CHPP to facilitate longwall mining of the Arrowfield and Bowfield Seams;
- upgrade of the existing CHPP to facilitate increased coal production;
- development of a water control structure across North Wambo Creek at the north-western limit of the open cut operation and a channel to allow the passage of flows to the lower reaches of North Wambo Creek around the open cut development;
- de-gazettal and physical closure of Pinegrove Road;
- development of new access roads and internal haul roads;
- relocation of the existing explosives magazine and construction of additional hydrocarbon storage facilities; and
- relocation of the administration area and site offices.

Scheduled to commence in 2004, the Open Cut and Underground Mining Component of the Project has a peak production rate of 14.7 Mtpa of run-of-mine (ROM) coal. The Underground Mining Component has an expected operational life in excess of the 21 year Development Application (DA) period.

WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-1
Project Location

WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-2
Aerial View of Wambo Coal Mine and Surrounds

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Table ES-1
Project Snapshot

Project Component	Summary
General	
Project	• Development of open cut and underground mining operations and construction and operation of rail and train loading infrastructure at the Wambo Coal Mine.
Proponent	• Wambo Coal Pty Limited (ACN 000 668 057), which is a wholly owned subsidiary of HunterCoal Pty Ltd.
Tenement Status	• In addition to mining and coal leases covering an area of approximately 5,740 hectares (ha), WCPL will lodge a mining lease application (MLA) to cover approximately 1,275 ha of land encompassing distinct areas adjoining coal lease (CL) 397 and CL 374 to the north-west (MLA1), and adjoining mining lease (ML) 1402 within CL 743 (MLA2). WCPL will also lodge a MLA over portions of the rail spur, the rail loop and associated infrastructure east of CL 743.
Employment	• Construction workforce of approximately 100 employees and an operational workforce of up to 370 employees when fully developed.
Open Cut and Underground Mining	
Mining	• Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams with an average stripping ratio of 6.5(bank cubic metres (bcm) waste rock):1(t ROM coal) and an estimated total open cut reserve of 98 million tonnes (Mt). • Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. Underground reserves are estimated at 104 Mt.
Processing	• A second module would be commissioned to operate in conjunction with the existing 900 tonne per hour (tph) single-module CHPP to facilitate processing in the order of 1,800 tph.
Product Coal	• Production of up to 11.3 Mtpa of thermal coal predominantly for export.
CHPP Rejects	• Coarse rejects (approximately 27 Mt during the Development Application (DA) period) and tailings (approximately 18 Mt during the DA period) would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo Coal Mine management practices.
Mine Waste Rock Management	• Mine waste rock would be deposited in open cut voids and in mine waste rock emplacements adjacent to the open cut operations.
Component Life	• Coal reserves indicate a mine life in excess of the 21 year DA period.
Hours of Operation	• Operations would be conducted 24 hours per day, 7 days per week.
Water Control System	• A water control system would be constructed to allow the passage of flows from North Wambo Creek around the open cut.
Roadworks	• De-gazettal and physical closure of Pinegrove Road.
Rail and Train Loading Infrastructure	
Product Coal Transport	• Product coal would be loaded onto nominal 8,600 t capacity trains and transported to the Port of Newcastle via the Project rail and train loading infrastructure.
Component Life	• Dependent on the future development of coal reserves the rail and train loading infrastructure would operate for a period in excess of the 21 year DA period.
Hours of Operation	• Trains would operate 24 hours per day, seven days per week.
Roadworks	• Construction of a rail spur underpass beneath the Golden Highway and realignment of the Wallaby Scrub Road-Golden Highway intersection.

The Rail and Train Loading Infrastructure Component would include (Figure ES-3):

- construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin;
- construction of a rail spur underpass beneath the Golden Highway;
- realignment of the intersection between Wallaby Scrub Road and the Golden Highway; and
- transportation of product coal to the market via 8,600 t net capacity trains 24 hours per day, seven days per week.

Construction of the Rail and Train Loading Infrastructure Component of the Project is scheduled to commence in Year 1, leading to the commencement of rail transportation of product coal in Year 2. The Rail and Train Loading Infrastructure Component is expected to operate for a period in excess of the 21 year DA period.

ES1.3 DEVELOPMENT APPROVAL PROCESS

Approval for the Project is sought in the form of two DAs (Figure ES-4) which encompass the Open Cut and Underground Mining Component (DA1) and the Rail and Train Loading Infrastructure Component (DA2) respectively. The Project DAs will be assessed in accordance with the framework established by the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation, 2000*.

A declaration made by the Minister for Urban Affairs and Planning on 29 June 2001, under Section 76A (7) of the EP&A Act identifies classes of development that are considered to be State significant development. Project development covered by DA1 is State significant development under this declaration.

The Minister for Planning is the consent authority for State significant development.

The Minister for Planning is also the consent authority for development listed in Schedule 1 of the *State Environmental Planning Policy No. 34 – Major Employment Generating Industrial Development* (SEPP 34). SEPP 34 is considered to apply to DA2.

The Minister for Planning is therefore the consent authority for both DA1 and DA2.

Table ES-2 contains a summary of the Director-General's requirements for the Project EIS, noting where the requirements are addressed in the EIS.

ES1.4 COMMUNITY CONSULTATION

An open community consultation meeting conducted at the Jerrys Plains Hall on 17 December 2002 was attended by members of the local community, Planning NSW and WCPL representatives. During the meeting community members were invited to make formal submissions to PlanningNSW highlighting aspects of the Project that were of specific interest. Submissions received by PlanningNSW were then included in the formal Director-General's requirements for the preparation of the EIS. Issues raised in these community submissions are summarised in Table ES-3, along with an indication of where each issue is addressed in the EIS.

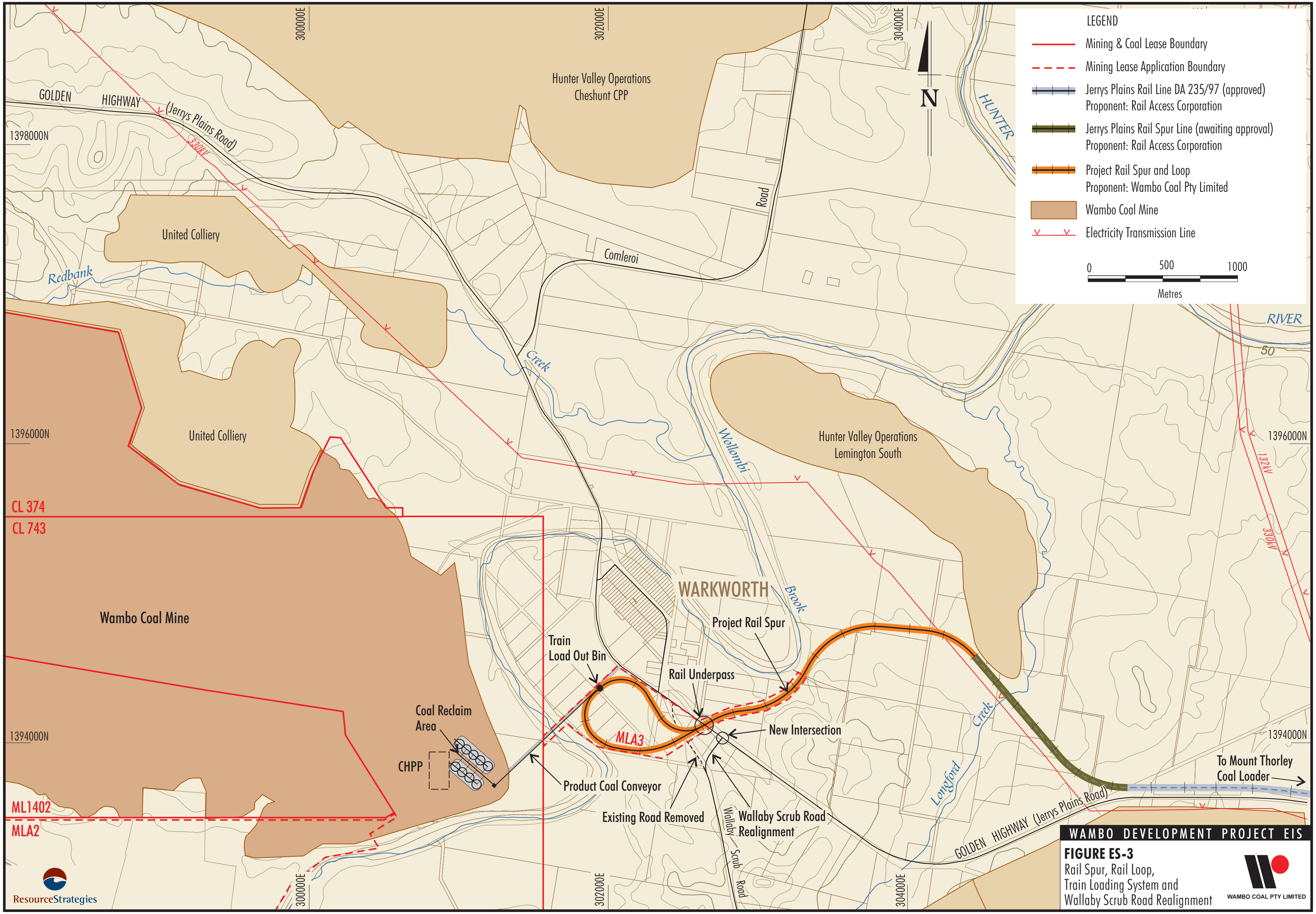
A Project Community Consultative Committee (CCC) was also formed at the 17 December 2002 meeting, allowing WCPL to inform the community of its plans and community representatives to raise any concerns. The Project CCC operates independently from the Wambo Coal Mine CCC and comprises representatives of the Singleton Shire Council (SSC), the community, Department of Mineral Resources (DMR) and WCPL.

ES2 PROJECT DESCRIPTION

Project mining operations would extract coal from the Whybrow, Redbank Creek, Wambo, Whynot, Arrowfield and Bowfield Seams. The recoverable coal reserve for the Project is approximately 202 million tonnes (Mt) of which approximately 98 Mt would be mined by open cut methods and some 104 Mt by underground mining methods.

The Project has been designed to maximise the utilisation of Wambo Coal Mine infrastructure. New or upgraded infrastructure required to support the Project would be developed progressively in parallel with ongoing mining operations.

It is anticipated that the construction of the Project rail and train loading infrastructure and upgrade of the CHPP would require an additional workforce of up to 100 people, while in the order of 370 people would be employed when the Project is at full development.



WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-3
Rail Spur, Rail Loop, Train Loading System and Wallaby Scrub Road Realignment

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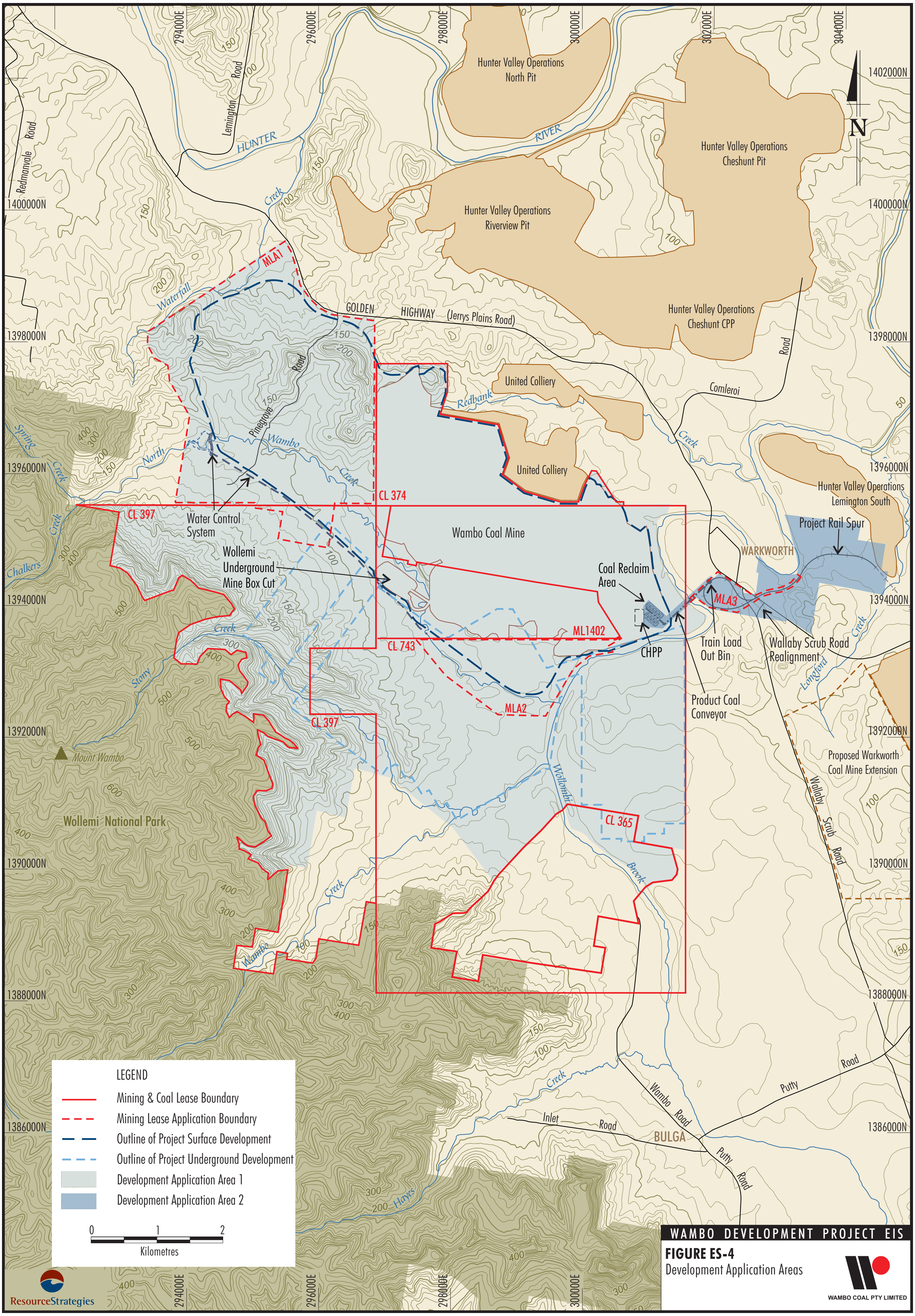

WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-4
Development Application Areas

WAMBO COAL PTY LIMITED

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Table ES-2
Director-General's Requirements for the Project EIS – Reference Summary

Specific Issues to be Addressed	Main Text Reference	Appendix Reference
Under clause 73(1) of the *Environmental Planning and Assessment Regulation, 2000*, the Director-General requires the following specific issues to be addressed in the EIS:		
Description of the Proposal Describe and justify the proposal, clearly identifying the resource, the proposed site, the proposed works (including any rehabilitation works), the proposed intensity of operations, and the likely inter-relationship between these proposed operations and the existing or approved mining operations at the Wambo Coal Mine.	Sections 1 and 2	N/A
Permissibility Demonstrate that the proposal is permissible with consent.	Section 1	N/A
Statutory Instruments/Policies Assess the proposal against the relevant provisions in: • *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*; • *State Environmental Planning Policy No. 44 – Koala Habitat Protection;* • *Hunter Regional Environmental Plan 1989;* • *Hunter Regional Environmental Plan 1989 (Heritage);* • *Singleton Local Environmental Plan 1996;* and • any relevant Development Control Plans.	Section 1	N/A
Key Issues Assess the following potential impacts of the proposal during construction and operation, and describe what measures would be implemented to manage, mitigate, or offset these potential impacts:		
(a) subsidence;	Section 4.2	Appendix O
(b) surface water;	Section 4.6	Appendix E
(c) groundwater;	Section 4.7	Appendix F
(d) noise and vibration;	Section 4.4	Appendix A
(e) air quality/odour;	Section 4.5	Appendix B
(f) heritage, both European and Aboriginal;	Sections 4.13 and 4.14	Appendices C and D
(g) fauna and flora, particularly on critical habitats, threatened species, populations, or ecological communities;	Sections 4.8, 4.9 and 4.10	Appendices HA to HE
(h) soil;	Section 4.1	Appendix L
(i) traffic and transport;	Section 4.15	Appendix M
(j) hazards;	Section 4.16	Appendix K
(k) visual;	Section 4.3	Appendix N
(l) waste management;	Section 2.9	Appendix G
(m) utilities and services; and	Sections 2.11 and 4.11	Appendix J
(n) economic and social.	Sections 4.11 and 4.12	Appendices I and J
Cumulative Impacts Potential cumulative impacts of the Project should be assessed for the following environmental aspects:		
• air quality;	Section 4.5	Appendix B
• noise;	Section 4.4	Appendix A
• surface water;	Section 4.6	Appendix E
• groundwater;	Section 4.7	Appendix F
• flora and fauna;	Sections 4.8 and 4.9	N/A
• archaeology; and	Sections 4.13 and 4.14	N/A
• taking into account the proposed expansion of several mines in the surrounding area, particularly the United, Warkworth, Mount Thorley, Hunter Valley Operations, and Bulga mines.	Section 4	Appendices A, B, E, F, J, M and N

Table ES-2 (Continued)
Director-General's Requirements for the Project EIS – Reference Summary

Specific Issues to be Addressed	Main Text Reference	Appendix Reference
Environmental Monitoring and Management Plans Describe in detail how the environmental performance of the proposal would be monitored and managed over time, including the provision of specific details about the proposed monitoring programme (including location, frequency, and methods) and any mitigation measures to be implemented.	Section 6 and Section 4	N/A
Best Management Practice Current best management practice should be identified and reviewed for the following environmental issues, using any relevant Australian and International literature:		
• air quality (including particulate mater from construction and mining activities, air emissions from off-road vehicles, and odour from ventilation shafts);	Sections 4.5, 2.6.4 and 2.6.5	Appendix B
• noise;	Section 4.4	Appendix A
• fauna and flora; and	Sections 4.8 and 4.9	Appendices HA, HB, HC and HE
• subsidence and the associated surface and groundwater impacts.	Sections 4.2, 4.6 and 4.7	Appendices E, F and O
Consultation The EIS should include: • consideration of the requirements of key agencies, community members and groups as presented in Attachment 2; • consideration and review of key issues that emerge from consultation with surrounding landowners and occupiers that are likely to be affected by the proposal; and • a record of consultation undertaken with the relevant local, state and commonwealth government authorities, service providers and community groups in the area and issues raised during the preparation of the EIS.	Section 1.5	N/A

Source: After PlanningNSW (2002)

ES2.1 INITIAL PROJECT DEVELOPMENT ACTIVITIES

The Wambo Coal Mine CHPP comprises an operational module (Module 2) with a design washing capacity of 900 tonnes per hour (tph) and a module (Module 1) which was decommissioned in 2001. The Project would include doubling the CHPP capacity through construction of a second 900 tph module within the footprint of Module 1. Construction of the new module would take approximately six months and is planned for completion in Year 2.

The Project would also include the construction and operation of rail and train loading infrastructure including a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin (Figure ES-3). Construction of Project rail and train loading infrastructure is scheduled such that the rail transportation of product coal would commence in Year 2 of the Project.

The Project rail spur would join a small section of the Jerrys Plains Rail Spur Line (Figure ES-3), which was proposed in a DA lodged by Rail Access Corporation (now Rail Infrastructure Corporation (RIC)) in 1999. This proposal is currently awaiting approval from the Minister of Planning.

The Jerrys Plains Rail Spur Line would in turn join the Jerrys Plains Rail Line (Figure ES-3), which was granted development consent in July 1998 by SSC under DA 235/97. RIC is the proponent of the Jerrys Plains Rail Line. When constructed the Jerrys Plains Rail Line will connect to the State rail network at the MTCL.

The development of rail and train loading infrastructure would also involve the construction of a rail underpass beneath the Golden Highway and realignment of the intersection between Wallaby Scrub Road and the Golden Highway (Figure ES-3).

Table ES-3
Director-General's Requirements for the Project EIS – Community Submissions Summary

Submission Received	Issues Raised	EIS Reference	
		Main Text Reference	**Appendix Reference**
Holt, Alwyn, Helen and Rebecca	• Haulage of product coal on public roads and the realignment of the Wallaby Scrub Road and Golden Highway intersection.	Sections 2.4.2, 2.4.4 and 4.15	Appendix M
	• Dust-related impacts.	Section 4.5	Appendix B
	• Visual impacts – *"What strategies, policies and procedures will be put in place to counteract the discomfort and interference to our quality of life."*	Section 4.3.4	Appendix N
	• Noise – "*How is this going to be monitored and where?"*	Section 6.3.3	Appendix A
	• Heritage – *"Will steps be taken to preserve the heritage of the Wambo Homestead and any associated buildings, gardens, monuments etc? If so, what will they be?"*	Section 4.14	Appendix C
	• *"Are strategies in place to protect the Warkworth Sands? Would there be ramifications for mining under the Brook that may adversely affect the pristine environmental value of the Sands?"*	Sections 4.8 and 4.2.3	Appendices HA, HE and O
	• Social and cultural impacts in the area, in particular Jerrys Plains – *"the village itself offers numerous services to the community and passing traffic – are these services going to be interfered with in any way because of mining infringing on the community?"*	Sections 4.11 and 4.12	Appendices I and J
	• *"Will we have access to information about Wambo Mine and its operations after it has received approval for its DA?"*	Section 6	N/A
MacBain, Robert and Lynette	• Cumulative impacts of the Project, including the rail spur and surrounding mines.	Section 4	N/A
	• Amenity of the area.	Sections 4.1 and 4.3	Appendix N
	• Adoption of "Best Practice" measures.	Sections 4 and 6	N/A
	• Community and social impacts, including impact on employment and farmland reduction and degradation.	Sections 4.11, 4.12 and 4.1	Appendices I, J and L
	• Heritage – long term impacts on the Wambo Homestead, historic cemeteries in the Jerrys Plains area, other historic properties within the area and the impact of the proposed rail loop on St. Phillip's Anglican Church and cemetery.	Section 4.14	Appendix C
	• Noise impacts, including vibration, and taking into account prevailing weather conditions and temperature inversions.	Section 4.4	Appendix A
	• Air quality impacts, including health concerns, and taking into account prevailing weather conditions and temperature inversions.	Section 4.5	Appendix B
	• Rehabilitation.	Section 5	N/A
	• Subsidence.	Section 4.2	Appendix O
	• Tailings disposal methods.	Section 2.9.3	Appendix G
	• Road transport impacts.	Section 4.15	Appendix M
	• Surface and groundwater impacts.	Sections 4.6 and 4.7	Appendices E and F

Table ES-3 (Continued)
Director-General's Requirements for the Project EIS – Community Submissions Summary

Submission Received	Issues Raised	EIS Reference	
		Main Text Reference	**Appendix Reference**
Nichols, Paul	• Visual impacts, including height of batters, rail transport and lighting impacts.	Section 4.3	Appendix N
	• Air quality impacts.	Section 4.5	Appendix B
	• Noise impacts.	Section 4.4	Appendix A
	• Road and rail transport impacts, including intersections.	Section 4.15	Appendix M
	• Social, economic and agricultural impacts.	Sections 4.11, 4.12 and 4.1	Appendices I and J
	• Future expansion plans (i.e. in excess of 21 year DA period) and mine exit strategy.	Sections 1.2.1 and 4.12.2	Appendix I
	• Heritage impacts on Wambo Homestead and St. Philips Anglican Church, Warkworth.	Sections 3.11, 4.4.4 and 4.14	Appendix C
	• Cumulative impacts on Jerrys Plains and nearby residents.	Section 4	N/A
Singleton Historical Society	• Heritage – "*our particular concern is for the Church building and the homestead*"	Sections 3.11, 4.4.4 and 4.14	Appendix C
Skinner, Dallas	• Surface and groundwater impacts.	Sections 4.6 and 4.7	Appendices E and F
	• Dust-related impacts.	Section 4.5	Appendix B
Dallimore, Howard and Christine Haynes, Ken and Lorraine Henderson, Janene Long, Errol Merrick, Bruce Schipper, John and Annie Stuart, Dudley Wardens, Vestry and Friends of St. Philips Anglican Church, Warkworth	Concerns for the Church Building and Headstones:		
	• Historical significance of the Church building and surrounding cemeteries.	Section 3.11.2	Appendix C
	• Visual impact of the Project rail spur on the existing rural setting.	Section 4.3	Appendix N
	• Vibration – concern that the stress generated by the constant vibration of rail carriages will cause the structure of the Church and headstones to crumble.	Section 4.4.3 and 4.4.4	Appendix A
	• Dust-related impacts on the buildings and headstones.	Section 4.5	Appendix B
	Concerns for Quality of Worship		
	• Concern of the impact of noise on the quality of worship, particularly during formal services on Friday evening and Sunday morning.	Section 4.4	Appendix A
	Health Concerns		
	• Noise and dust-related impacts on the health of residents in the Warkworth area.	Sections 4.4 and 4.5	Appendices A and B
	Wambo Homestead and Outbuildings		
	• "*The Homestead being close to Warkworth has strong historical connections to St. Philip's Church. Previous residents of the Homestead and workers attended St. Philip's Church and some are buried in the surrounding cemeteries.*"	Sections 3.11 and 4.14.1	Appendix C

Source: After PlanningNSW (2002)

ES2.2 MINING METHOD

The Project coal reserve would be mined using both open cut and underground mining methods.

Coal reserves from the Whybrow, Redbank Creek, Wambo and Whynot Seams would be mined by open cut methods, which would be conducted up to 24 hours a day, seven days a week for approximately 13 years.

Mining would progress in a generally north-west direction commencing at Wambo Coal Mine open cut operations within coal lease (CL) 374. The maximum depth of the open cut would be approximately 115 m in the north-western corner, while the minimum elevation of the open cut floor in the south would be approximately -30 m Australian Height Datum (AHD). Two final voids would remain on the western edge of the open cut operations.

Open cut mining would typically involve excavators loading 150 tonne (t) haul trucks for haulage to the CHPP.

As the open cut operation reaches the mining limits there may be opportunities to recover additional coal through augering of the Whybrow, sections of the Redbank Creek, Wambo and Whynot Seams.

In addition to these open cut mining operations coal reserves in the Whybrow, Wambo, Arrowfield and Bowfield Seams would be mined using underground longwall mining methods. Underground mining operations would typically be conducted 24 hours a day, seven days per week.

Underground mining operations would commence in Year 2 with the development of the Whybrow Seam Underground Mine. The Whybrow Seam Underground Mine would be accessed by an extension of the existing Wollemi Underground Mine Box Cut and would utilise existing infrastructure at the Wollemi Underground Mine Portal including the stack-out conveyor, ROM coal stockpile and surface facilities.

Underground mining of the Wambo Seam is planned to commence in Year 5 following completion of the Whybrow Seam Underground Mine and is scheduled to operate until Year 12. Access to the Wambo Seam would be provided via the extension of drifts from the Wollemi Underground Mine.

The Arrowfield Seam Underground Mine is planned to commence in Year 5 on the eastern side of Wollombi Brook and would be completed in approximately Year 19 on the western side of Wollombi Brook.

The Bowfield Seam Underground Mine is planned to commence in Year 14 and, subject to further approvals, would operate beyond the 21 year approval period.

The Arrowfield Seam Underground Mine is immediately above the Bowfield Seam Underground Mine on both sides of Wollombi Brook. A portal would be developed adjacent to the existing CHPP to provide access to the Arrowfield and Bowfield Seam Underground Mines.

The timing of Project activities described above may vary to take account of localised geological features, coal market volume and quality requirements and mining economics.

The majority of ROM coal would be dumped by haul trucks directly into the CHPP coal receival bin, while the remainder would be reclaimed from the ROM coal stockpile by front end loader.

Product coal from the CHPP would be stored in a product coal stockpile prior to being loaded onto typical Hunter Valley nominal 8,600 t trains for transport to the Port of Newcastle. The rail transport of product coal would remove in the order of 160,000 existing truck movements per annum from the Golden Highway. Where possible, train movements would be minimised on Friday evenings and Sunday mornings to reduce potential noise emissions at St. Philips Anglican Church in Warkworth.

ES2.3 MINE WASTE MANAGEMENT

Approximately 640 million bank cubic metres (Mbcm) of waste rock material would be generated by Project open cut mining operations.

Waste rock generated from open cut operations would be placed within designated mine waste rock emplacements to a maximum elevation of approximately 160 m AHD and predominantly within open cut voids behind the advancing open cut.

Following the removal of topsoil, softer overburden materials would be excavated and hauled into adjacent open cut voids or mine waste rock emplacements. A combination of blast/dozer push and truck/excavator operations would then be employed to remove stronger/less weathered overburden materials to expose underlying coal seams.

These overburden materials would also be placed in adjacent open cut voids or hauled to external mine waste rock emplacements.

Mine waste rock emplacements would generally be constructed in 10 to 15 m vertical lifts then shaped to their final landform profile once dumping is completed. Mine waste rock emplacements would be developed with maximum final batter slopes of 10 degrees. Where long slopes exist, contour drains and/or deep staggered rips would be established.

Approximately 27 Mt of coarse reject material and 18 Mt of tailings would be produced over the life of the Project. Coarse rejects would be selectively handled and disposed of in open cut voids or used as bulk fill in the covering and rehabilitation of tailings materials. Tailings materials would be pumped to open cut voids and progressively covered with coarse rejects and/or waste rock material.

ES2.4 WATER MANAGEMENT

The Project water management strategy is based on the containment and reuse of mine water and on the control of sediment-containing runoff from disturbed areas such as active mine waste rock emplacements.

Water management and water supply requirements at the Wambo Coal Mine have been balanced by importing water from Wollombi Brook and the Hunter River during times of shortage, and by transferring water to neighbouring mines during times of excess. Water has also been released to the Hunter River in accordance with the conditions of Wambo Coal Mine Environment Protection Licence and using salinity credits held under the Hunter River Salinity Trading Scheme (HRSTS).

Project water supply requirements include CHPP operation, wash down of mobile plant, dust suppression on haul roads and hardstand areas and dust emission control sprays in the ROM and product coal stockpile areas. Water would also be used in underground mines to control dust emissions in active mine areas, for irrigation of vegetation establishment areas, fire fighting and other minor non-potable uses.

The water management system would operate predominantly as a closed self-contained system, which would fluctuate with climatic conditions and as the extent of the mining operation evolves over time. Depending on the climatic conditions experienced during the Project life there may be periods when controlled releases would be made under the HRSTS.

There may also be periods when water would be sourced externally, either opportunistically from adjacent mining operations, or from the Hunter River or Wollombi Brook using water extraction licences held by WCPL.

The majority of the Project water supply requirement would be met by return water from the tailings storage areas and dewatering of open cut and underground mining areas.

The Project water management system would include permanent structures that would operate post-closure (e.g. the North Wambo Creek water control system) and temporary structures that would only be required until the completion of rehabilitation works (e.g. sediment dams).

The North Wambo Creek water control system (Figure ES-4) would divert flows around the western limit of the open cut operations and mine waste rock emplacements and would comprise a water control structure across the alignment of North Wambo Creek and a channel. Based on the planned production rate, the water control system would be constructed by Year 7.

ES3 POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

ES3.1 LAND RESOURCES

Landforms of the Upper Hunter region are characterised by gently sloping flood plains associated with the Hunter River and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range. Regionally significant features in the vicinity of the Project include the escarpments and peaks of the Wollemi National Park and the riparian vegetation and cleared flood plains of Wollombi Brook and the Hunter River. Wollemi National Park is situated to the south and west of the Project (Figure ES-4) and is part of the Greater Blue Mountains World Heritage Area.

Local elevations range from approximately 60 m AHD at Wollombi Brook to the east of the Project, to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west. Components of the Wambo Coal Mine that contribute to local topography include the Homestead and Wollemi Underground Mines, open cut mining operations and mine waste rock emplacements.

Modifications to existing topography that would result from the Project relate primarily to open cut mining operations and mine waste rock emplacements, while underground mining would result in subsidence of the land surface.

Project infrastructure and landforms have been designed and located to integrate with existing topography and landscape features through measures such as the progressive backfilling of the open cut and the progressive rehabilitation of mine waste rock emplacements.

Erosion and sediment control strategies for the Project would be based on accepted practices established for the Wambo Coal Mine. Soil stockpiles would be managed to ensure long-term viability through implementation of appropriate management practices designed to reduce erosion hazard, improve drainage, promote revegetation and maintain soil structure, organic matter and microbial activity.

ES3.1.1 Subsidence

Subsidence is the lowering of the land surface resulting from the extraction of underlying coal seams. Subsidence of the land surface resulting from Project underground mining would occur as a series of small movements as longwall extraction proceeds along each panel and would be expressed at the surface as an elongated depression which broadens as the number of panels mined in each seam increases.

The Project underground mines would be constrained and designed such that subsidence does not impact on Wollemi National Park or Wollombi Brook.

Subsidence may result in surface cracking, increased erosion potential and the potential for ponding in areas where isolated depressions form. These impacts have been observed to occur in the existing underground mining areas at the Wambo Coal Mine. Where subsidence occurs within, or adjacent to, an existing flood plain it may result in an increase in the depth and duration of inundation during flood events.

During the development of the Project underground mines, areas subject to subsidence would be monitored to validate subsidence predictions and to identify areas where the above potential impacts may occur.

Potential subsidence impacts on the land surface would be assessed, and where necessary, remediated through the implementation of mitigation measures, including filling of minor cracks, contour ripping and revegetation of exposed surfaces, regrading of landforms and remediation of creek beds.

Improvements such as fencing, dams, farm tracks and powerlines within the area of land to be subsided would be visually monitored and remedial action would be undertaken if required.

ES3.1.2 Visual

The local visual landscape is dominated by the rugged escarpments and forested landforms of the Wollemi National Park. The peaks and ridges of the Wollemi National Park are visible from the majority of locations in the vicinity of the Project, except where obscured at close range by local topography or vegetation. Other features of the local visual landscape include remnant vegetation and isolated landforms, local watercourses, coal mining operations, power supply infrastructure, agricultural land and residential areas such as Jerrys Plains.

Views of the Project from local roads, such as the Golden Highway and Wallaby Scrub Road would include the realignment of Wallaby Scrub Road, the rail spur, rail underpass, train load-out bin, rail operations, open cut mining operations and mine waste rock emplacements. Views of the Project would be screened to varying degrees by roadside vegetation and intervening topography.

Views of the Project from local townships/localities would largely be limited by intervening topography and vegetation. Limited and distant views may be available from elevated positions within Bulga and Jerrys Plains. Dwellings within Warkworth may have views of Project infrastructure including the train load-out bin, rail operations and rail spur as it crosses the Hunter River flood plain to the south-east.

Views from rural dwellings/properties in the vicinity of the Project would include mine waste rock emplacements, open cut mining operations, the water control system and other items of Project infrastructure.

Project night-lighting would be similar to that used at the Wambo Coal Mine, producing a glow above operational areas contrasts with the night sky. This glow would be visible at nearby dwellings and along transport routes, while direct views of mobile machinery lights and operational lighting may be available from some elevated positions.

Measures that would be employed to mitigate potential visual impacts include the design and construction of Project infrastructure in a manner that minimises visual contrasts and the progressive rehabilitation of mine waste rock emplacements (particularly outer batters).

Night-lighting would be restricted to the minimum required for operational and safety requirements and would be directed away from incoming views. All lighting above natural topographic screens would be directed downwards.

ES3.2 ACOUSTICS, BLAST AND VIBRATION

The NSW Environment Protection Authority (EPA) Industrial Noise Policy (INP) provides both the framework and process for Project noise impact assessment.

Noise assessment criteria presented in Table ES-4 were derived for the Project based on background noise levels, which were characterised in accordance with INP objectives.

In cases where the Project specific assessment criteria (Table ES-4) are not achieved, it does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable. In subjective terms, exceedances of the INP Project-specific assessment criteria can be generally described as follows:

- negligible noise level increase (less than 1 dBA) (not noticeable by all people);
- marginal noise level increase (between 1 dBA and 2 dBA) (not noticeable by most people);
- moderate noise level increase (between 3 dBA and 5 dBA) (not noticeable by some people but may be noticeable by others); and
- appreciable noise level increase (greater than 5 dBA) (noticeable by most people).

Table ES-4
Project Specific Noise Assessment Criteria (dBA re 20 μPa)

Locality	Land Owner	Project Specific Assessment Criteria					
		Intrusive $L_{Aeq(15minute)}$[1]			Amenity $L_{Aeq(period)}$[1]		
		Day	Evening	Night	Day	Evening	Night
Wambo Road (INP Rural)	2 Lambkin	35	35	35	50	45	40
	25 Fenwick	35	35	35	50	45	40
	Other Residential	35	35	35	50	45	40
Warkworth Village (INP Suburban)	19(A, B) Kelly	40	38	38	55	45	40
	51 Hawkes	38	36	36	55	45	40
	56 Haynes	39	37	36	55	45	40
	Other Residential	39	37	36	55	45	40
INP Place of Worship	St. Philips Anglican Church (Internal)	Intrusive criteria apply only to residential receivers		Not in use	40	40	Not in use
INP Passive/Active Recreation Area	St. Philips Anglican Church Grounds (External)				50-55	50-55	
Gouldsville (INP Suburban)	23(C) Kannar	38	38	38	55	45	38
	Other Residential	35	35	35	55	45	40
Maison Dieu (INP Suburban)	Residential	38	38	38	55	45	40
Redmanvale/ Pinegrove Roads (INP Rural)	15(B) McGowen/Caslick	35	36	35	50	45	40
	24 Long	36	35	35	50	45	40
	Other Residential	35	35	35	50	45	40
Golden Highway (INP Suburban)	31(D) Fisher	39	40	35	55	45	40
	Other Residential	39	40	35	55	45	40

Source: Appendix A
1 Daytime 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 7.00 am.

Predictive noise emission modelling was undertaken for four snapshots (Year 1.5 - including construction activities and Years 2, 7 and 9 of operations) based on planned Project production. The first snapshot (construction Year 1.5) was assessed cumulatively as works would occur concurrently with existing Wambo Coal Mine operations.

Noise mitigation measures included in the predictive modelling are described below.

Construction Noise Mitigation Measures

- Surface construction works would generally be undertaken during daytime hours, up to seven days per week.
- Underground construction works (i.e. excavation blasting to develop drift access for the Wambo, Arrowfield and Bowfield Seam Underground Mines) would be undertaken in a manner to ensure off-site blast emissions are negligible.

Operation Noise Mitigation Measures

- Based on current mine planning and predictive noise modelling select Project mobile equipment would be modified from Year 5 to meet current “achievable” maximum noise suppression standards.
- From Year 5, evening and night-time controls would be implemented for operations in the open cut to the north and would include overburden haulage and dumping operations on internal dump areas and/or behind a minimum 10 m high bund wall or equivalent shielding mine landform. Alternatively, mine waste rock emplacement areas to the south of the open cut would be utilised for waste rock dumping. In addition, overburden removal in areas on the top and outer sides of topographic ridges where bunding is not feasible would be restricted to daytime only.

The implementation of these controls would be mine progression dependent, i.e. these controls would be implemented as mining progresses into the areas described above in order to achieve the necessary potential impact mitigation in relation to noise emissions.

In order to minimise any residual noise impact at the St. Philips Anglican Church from the rail transport of coal, WCPL would liaise with the rail service provider to minimise the potential impact of noise emissions on St. Philips Anglican Church (where practicable) particularly on Friday evenings (i.e. approximately 6.00 pm to 9.00 pm) and Sunday mornings (i.e. approximately 9.00 am to 12.00 pm).

Modelling of daytime, evening and night-time noise emissions from the Project indicates that there would be exceedances of the Project specific noise assessment criteria at a number of nearby dwellings and at privately owned vacant lands.

Table ES-5 summarises the privately owned dwellings where the $L_{Aeq(15minute)}$ intrusive emissions are predicted to exceed the criteria during operation. Figures ES-5, ES-6 and ES-7 present predicted indicative noise emission contours for the Year 2, Year 7 and Year 9 snapshots respectively.

Privately owned vacant land was also assessed against the Project specific noise assessment criteria. Privately owned vacant lands where the criteria were predicted to be exceeded by up to 5 dBA over more than 25% of the land area include 136 Ernst, 254 Algie, 42 Redman, 45 Mansfield, 54 Nichols, 95 Gee, 14 Keys, 46 Ball and 28 Garland (Figures ES-5, ES-6 and ES-7). Privately owned vacant land where the criteria were predicted to be exceeded by greater than 5 dBA over more than 25% of the land area include 9 Upward, 23 Kannar and 55 Burley (Figures ES-5, ES-6 and ES-7).

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable and maximum cumulative amenity levels for all industrial noise in an area.

For all assessment localities listed in Table ES-5 the non-adverse cumulative noise emissions from the Project and adjoining mining operations were below the relevant acceptable amenity criteria for industrial noise during the daytime, evening and night-time.

Similarly, worst case adverse cumulative noise emissions from the Project and adjoining mines were below the relevant maximum amenity criteria for industrial noise for all assessment localities.

As detailed in Table ES-5, private dwellings where noise emissions are predicted to be above Project specific noise assessment criteria can be divided into a noise management zone (1 to 5 dBA above Project specific criteria) and a noise affectation zone (greater than 5 dBA above Project-specific criteria).

Table ES-5
Private Dwellings within Noise Management and Affectation Zones

Locality	Period	Noise Management Zone		Noise Affectation Zone
		1 dBA to 2 dBA above Project Specific Criteria	3 dBA to 5 dBA above Project Specific Criteria	>5 dBA above Project Specific Criteria
Wambo Road	Adverse W Wind and Inversion Winter Evening/Night	35 Brosi 178 Smith 246 Bailey	1 Brosi 3 Birrell 4(B) Circosta 5 Strachan 6 Merrick 7 Maizey 25 Fenwick 63 Abrocuff 91 Bailey	2 Lambkin
Warkworth	Non-Adverse Annual Daytime	Nil	22 Henderson	19(A, B) Kelly 23(A, B) Kannar 51 Hawkes 56 Haynes
	Adverse SE Wind Summer, Autumn, Spring Evening/Night	Nil	22 Henderson	19(A, B) Kelly 23(A, B) Kannar 51 Hawkes 56 Haynes
	Adverse W Wind and Inversion Winter Evening/Night	Nil	Nil	19(A, B) Kelly 22 Henderson 23(A, B) Kannar 51 Hawkes 56 Haynes
Gouldsville	Adverse W Wind and Inversion Winter Evening/Night	23(C) Kannar	Nil	Nil
Maison Dieu	Adverse W Wind and Inversion Winter Evening/Night	254(A) Algie	94 Curlewis	Nil
Redmanvale/ Pinegrove Roads	Non-Adverse Annual Daytime	Nil	Nil	24 Long
	Adverse SE Wind Summer, Autumn, Spring Evening/Night	137 Woodruff 163 Rodger/Williams 188 Fuller	15(B)McGowen/Caslick 30 Williams 33 Thelander/O'Niell 37 Lawry 48 Ponder 49 Oliver 75 Barnes	13(C) Skinner 24 Long
	Adverse W Wind and Inversion Winter Evening/Night	13(C) Skinner	Nil	24 Long
Golden Highway	Adverse SE Wind Summer, Autumn, Spring Evening/Night	13(B) Skinner 27 Birralee 43 Carmody 262(A, B, C) Moses	16 Cooper 17 Carter 18 Denney 28(A, B) Garland 39 Northcote 40 Muller 50(A, B) Nowland	31(A, B, C, D) Fisher

Source: Appendix A

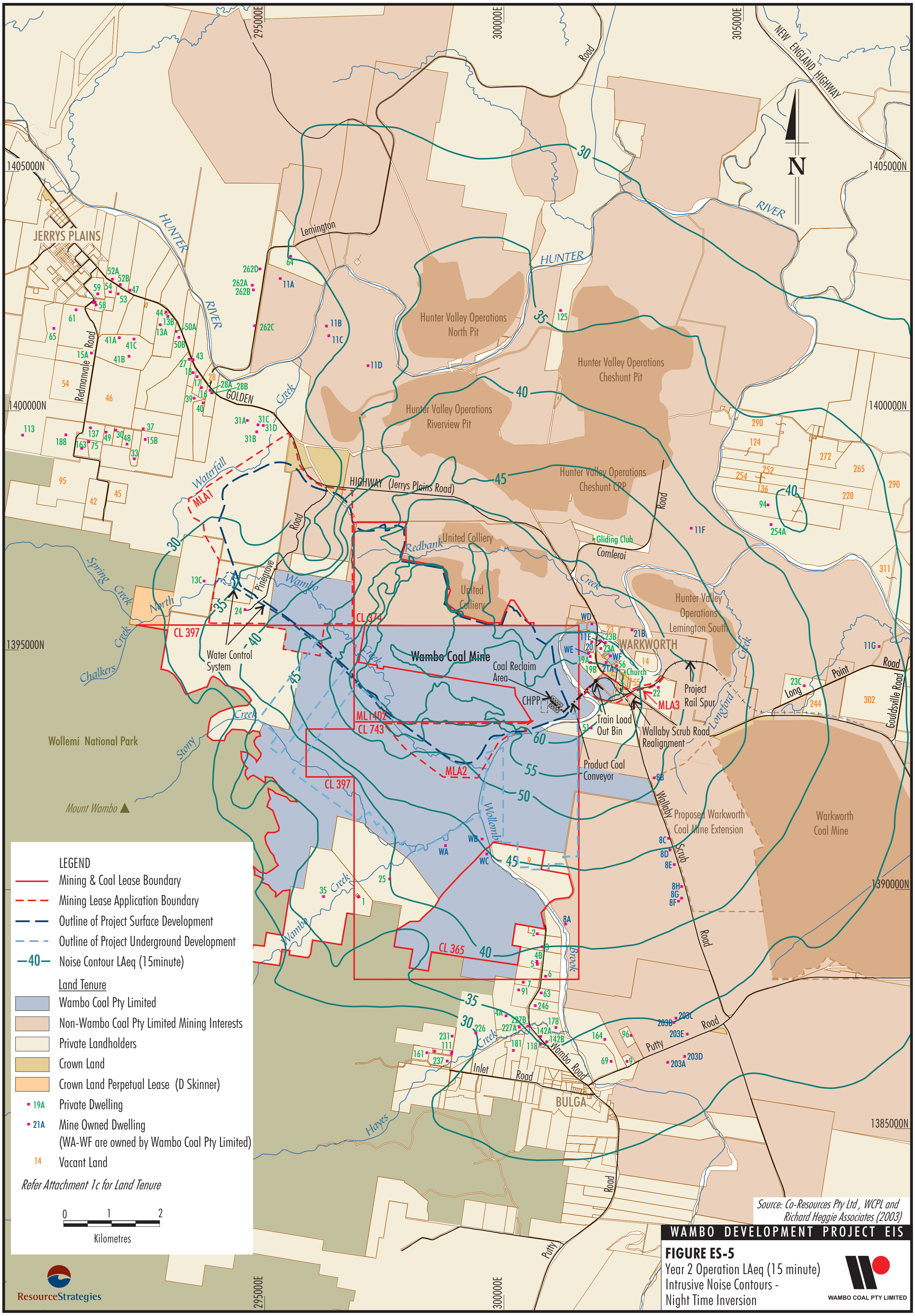

FIGURE ES-5
Year 2 Operation LAeq (15 minute) Intrusive Noise Contours - Night Time Inversion

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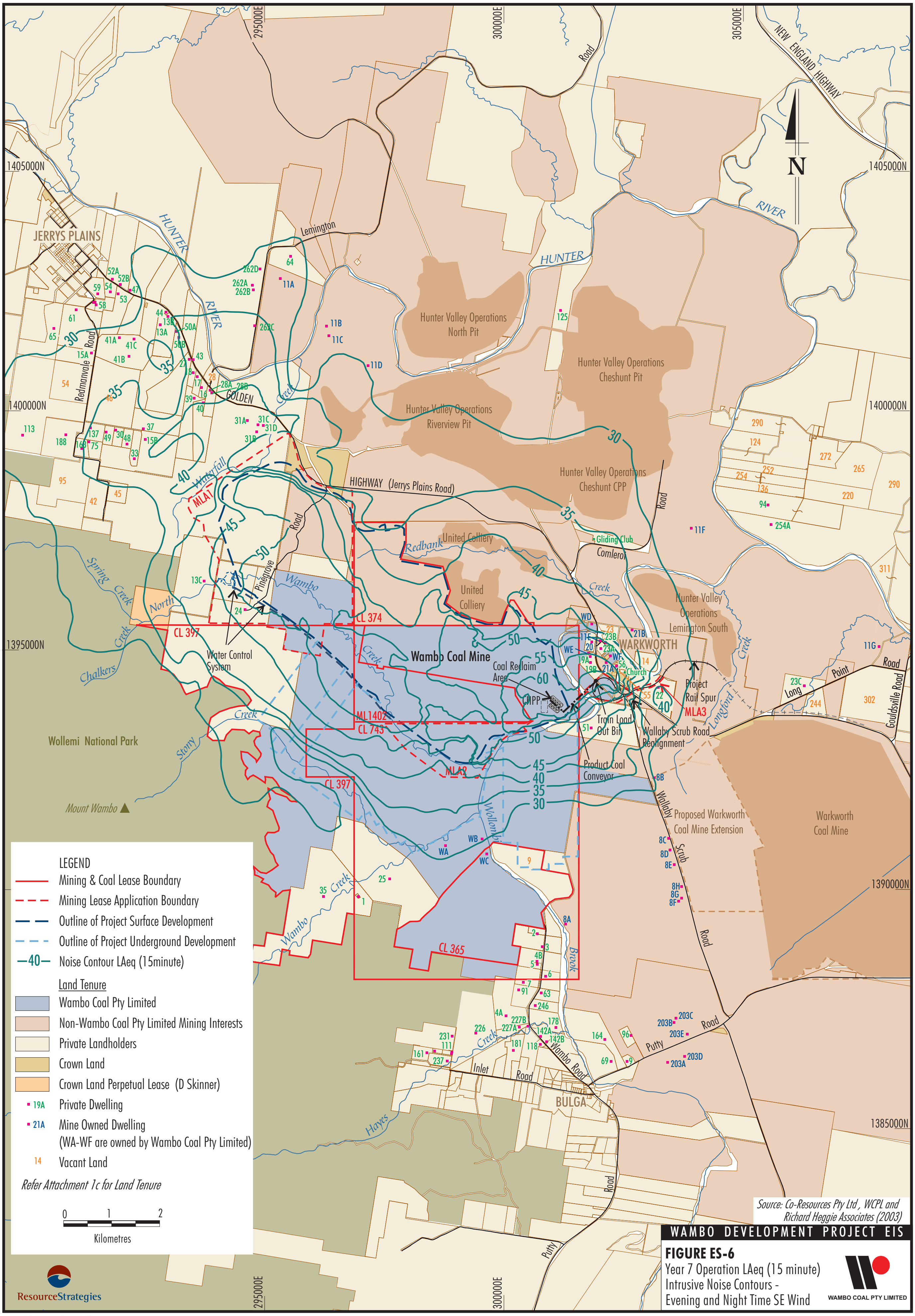

FIGURE ES-6
Year 7 Operation LAeq (15 minute) Intrusive Noise Contours - Evening and Night Time SE Wind

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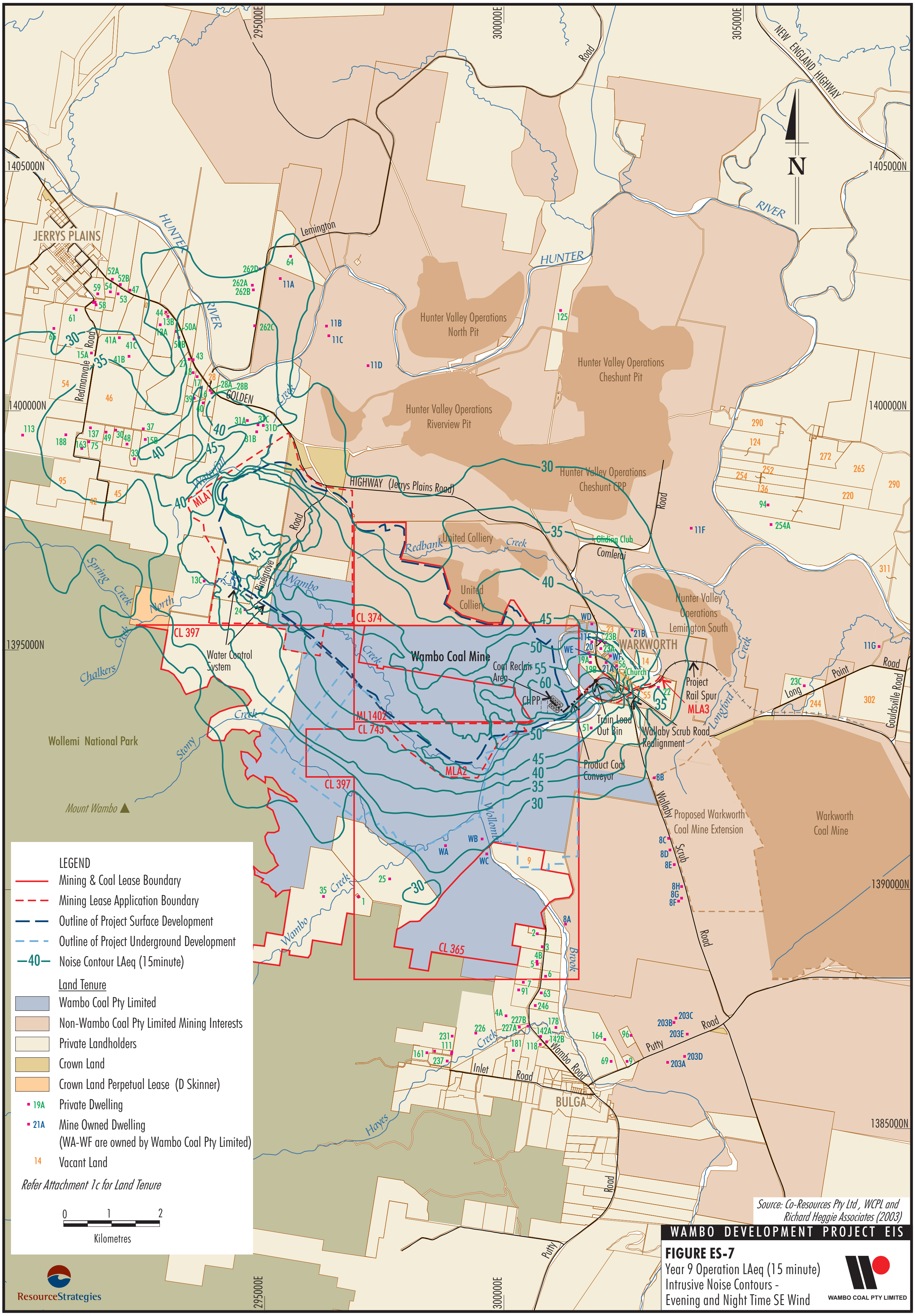

FIGURE ES-7
Year 9 Operation LAeq (15 minute) Intrusive Noise Contours - Evening and Night Time SE Wind

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Proposed noise management procedures for these zones are detailed below.

Noise Management Zone

Noise impacts could range from negligible to moderate within the noise management zone. In addition to the noise mitigation measures included in the predictive modelling, noise management procedures would include:

- noise monitoring on site and within the community;
- prompt response to any community issues of concern;
- refinement of on-site noise mitigation measures and mine operating procedures where practical;
- discussions with relevant landowners to assess concerns;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with landowners.

Noise Affectation Zone

Exposure to noise levels greater than 5 dBA above the Project-specific noise criteria may be considered unacceptable by some landowners. Management procedures for noise affectation zones would include:

- discussions with relevant landowners to assess concerns and develop practical mitigation;
- implementation of acoustical mitigation at receivers (e.g. bunding, double glazing of windows); and
- negotiated agreements with landowners if required.

ES3.2.1 Road Transportation Noise Assessment

Existing road traffic noise levels at the nearest dwellings to the Golden Highway exceed the *Environmental Criteria for Road Traffic Noise* (ECRTN) policy criteria in the absence of a majority of Wambo Coal Mine vehicles. Therefore, in accordance with ECRTN policy, any increase in traffic noise due to the Project should be limited to a marginal 2 dBA at the nearest dwelling to the Golden Highway.

This requirement is achieved when the Project-related percentage increase in existing light and heavy vehicle movements is no greater than 60%.

The projected increase in vehicle movements attributable to the Project is less than 60% for both daytime and night-time periods.

ES3.2.2 Rail Transportation Vibration

Product coal would be transported off-site using nominal 8,600 t capacity trains requiring an average of approximately four train trips (i.e. four arrivals and four departures) per day. Rail transport vibration was assessed against German Standard DIN 4150-3 1999 *Structural Vibration Part 3: Effects of Vibration on Structures*.

An assessment of potential train generated vibration for the two potentially affected structures proximal to the Project rail spur (i.e. St. Philips Anglican Church and the Henderson dwelling) predicted peak vibration levels that are well below the relevant potential damage criteria.

ES3.2.3 Blast Impact Assessment

The EPA advocates the use of the ANZECC guidelines for assessing potential residential disturbance (human comfort) arising from blast emissions. The ANZECC guidelines for the control of blasting impact at a dwelling are as follows:

- The recommended maximum level for airblast is 115 dBL.
- The level of 115 dBL may be exceeded on up to 5% of the total number of blasts over a period of 12 months, however, the level should not exceed 120 dBL at any time.
- The recommended maximum level for ground vibration is 5 mm/s peak vector sum (PVS) vibration velocity. It is recommended however that 2 mm/s PVS vibration velocity be considered as the long-term regulatory goal for the control of ground vibration.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months, however levels should not exceed 10 mm/s at any time (at a sensitive receiver).

Australian Standard (AS) 2187: *Explosives – Storage, Transport and Use* nominates blast vibration building damage assessment criteria which range from 5 mm/s to 25 mm/s PVS according to building type and use. The airblast criteria for building damage is 133 dBL (peak).

The blast emission assessment found that the building damage criteria of 10 mm/s and 133 dB Linear (dBL) would be met at all dwellings. Similarly, all emission levels would be well below the damage criteria (5 mm/s and 133 dBL) for heritage structures, including St. Philips Anglican Church and the cemeteries in the vicinity of the Project.

Predictive modelling indicates that the ANZECC human comfort vibration criteria would generally be met at all non-WCPL controlled dwellings although compliance at the nearby Fisher, Garland and Muller dwellings would require the application of special blasting techniques. Changes in blast design to conform with the criteria are unlikely to be practicable at the nearby Long and Skinner dwellings.

ES3.3 AIR QUALITY

Air Quality Criteria

The EPA amenity criteria for dust deposition seek to limit the maximum increase in the mean annual rate of dust deposition from a new development to 2 g/m^2/month and total dust deposition to 4 g/m^2/month.

Human health effects of dust are related to exposure to suspended particulates rather than deposited dust. The effects of dust particles when inhaled are related to the types of particles inhaled, particle sizes and the ability of the respiratory tract to capture and eliminate the particles. Such particles (total suspended particulates) are typically less than 50 micrometers (µm) in size and can be as small as 0.1 µm. Fine particles less than 10 µm are referred to as PM_{10}.

Air quality criteria used in the assessment comprised the following:

- The United States (US) EPA 24 hour 150 µg/m^3 PM_{10} standard has been utilised as a target that should be met at all dwellings in the vicinity of the Project (concentrations due to the Project and other mining operations).
- The National Health and Medical Research Council's (NHMRC) annual goal for Total Suspended Particulate (TSP) of 90 µg/m^3 has been interpreted as a goal that should be met at all locations in the vicinity of the Project where there are dwellings (concentrations due to the Project and other mining operations).
- The National Environment Protection Measure (NEPM) 24 hour long-term reporting standard for PM_{10} of 50 µg/m^3 and the NSW EPA 24 hour PM_{10} reporting goal of 50 µg/m^3 (for concentrations due to the Project alone).
- The NSW EPA annual goal for 30 µg/m^3 has been interpreted as a goal for PM_{10} that should be met within the region (concentrations due to the Project and other mining operations).

Assessment

The air quality impact assessment considered the air emissions likely to be generated by the Project and the likely impact of these emissions in combination with existing and proposed future emissions of relevant surrounding mining operations (i.e. Warkworth Coal Mine, Hunter Valley Operations and United Colliery). Project impacts were modelled for operational Years 2, 7 and 9.

Wind blown dust from exposed areas and dust generated from mining activities would be the primary sources of dust produced by the Project. Cumulative dust deposition impacts were assessed by estimating Project dust emissions (Years 2, 7 and 9) and adding relevant contributions from surrounding mining operations.

Project-only increases in annual average dust deposition at all privately owned dwellings are predicted to remain below the applicable 2 g/m^2/month EPA amenity criteria.

Potential impacts associated with concentrations of suspended particulate matter were calculated as 24 hour average and annual average PM_{10} concentrations and annual average TSP concentrations for comparison against the applicable criteria. The cumulative impacts of the Project and relevant surrounding mining operations were calculated. The non-cumulative impacts of the Project were also calculated.

Results of the Project-only modelling indicate that predicted concentrations of annual average TSP, 24 hour average PM_{10} and annual average PM_{10} remain below the applicable health based air quality standards/goals for particulate matter at all privately owned dwellings in the vicinity of the Project.

From cumulative modelling a total of 26 dwellings, the Gliding Club, the Church and three parcels of vacant land are predicted to experience either suspended particulates or deposition levels above the EPA assessment criteria at some time over the Project life as a result of dust emissions from relevant surrounding mining operations.

Seven of the dwellings (8B to 8H) are predicted to be predominantly affected by the Warkworth Coal Mine and three dwellings (11D, 11E and 11F) are predicted to be predominantly affected by Hunter Valley Operations to the north (Figure ES-7).

A range of controls based on procedures developed at the Wambo Coal Mine and techniques recommended by the NSW EPA would be employed to reduce dust emissions from the Project. Controls for mine generated dust may include watering of active roads, revegetation of topsoil stockpiles, installation and use of dust suppression equipment such as automatic sprays and confinement of blast charge.

ES3.4 HYDROLOGY

ES3.4.1 Surface Water

A surface water management study was undertaken as part of the development of surface water management systems for the Project and to assess potential impacts on surface water resources. The study included a description of existing surface water resources, quantification of Project water management requirements, water balance modelling, water management planning and post-mining water management concepts.

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 ES-4).

The Project would include the construction of a water control structure across North Wambo Creek and a channel to facilitate the passage of creek flows around the southern limit of the open cut mine and its associated mine waste rock emplacement areas.

North Wambo Creek has been highly disturbed by historic and present grazing activities. Stock access has led to areas of bank destabilisation and erosion, trampling of riparian and aquatic vegetation and the introduction of cattle wastes into flowing and standing water bodies. The impacts of cattle are noticeably absent near the confluence of North Wambo Creek with Wollombi Brook due to fencing, steep slopes and lack of pasture.

Waste rock samples were taken from exploration drillholes within the Project open cut area and were assessed for acid mine drainage (AMD) potential and element leaching. Results of the testwork undertaken classified the waste rock samples as non-acid forming (NAF) and unlikely to generate environmentally harmful leachate when exposed to surface oxidation processes. These results are consistent with the observed behaviour of waste rock at the Wambo Coal Mine.

Reject samples (coarse reject and tailings) taken from the Wambo Coal Mine CHPP were classified as indeterminate (IND) and potentially acid forming (PAF), respectively. However, AMD has not been identified at the Wambo Coal Mine and is not expected to occur during the life of the Project provided that appropriate CHPP reject management practices are implemented.

A long-term water balance of the final voids indicates that the salinity of void waters would slowly increase with time. Direct rainfall and infiltration through the mine waste rock emplacements would dominate inflows to the voids.

The water management system would integrate with the Wambo Coal Mine water management system and would be developed in accordance with accepted water management principles including minimising contamination of site water, maximising re-use of mine water and managing water so that any releases from site are controlled in accordance with the HRSTS and the requirements of the Project Environment Protection Licence. Project water management strategies include minimising disturbance areas, isolation, containment and recycling, progressive stabilisation and revegetation of disturbed areas and erosion and sediment control.

ES3.4.2 Groundwater

The hydrogeological regime of the Project area comprises a Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek and underlying Permian strata of very low yielding to essentially dry sandstone and lesser siltstone and low to moderately permeable coal seams which are the prime water bearing strata within the Permian sequence.

Groundwater levels and/or surface flow in the alluvial aquifer system would generally remain unchanged due to underground mining.

Although connectivity between the underground workings and Stony and Wambo Creeks is considered to be unlikely, careful monitoring of alluvial groundwater levels via a network of piezometers and stream flows along Wambo and Stony Creeks would be conducted.

Should connectivity of the creek(s) to the working be detected, a mitigation option would be to grout and seal any cracks in the creek bed.

Open cut mining would remove the majority of the alluvium in North Wambo Creek. The removal of the alluvium in North Wambo Creek by open cut mining would result in little further drainage (i.e. additional to that drained by the existing box cut) of the alluvials.

Further removal of the North Wambo Creek alluvium is planned for Year 9 of the Project when mining near the confluence of North Wambo Creek and Wollombi Brook would commence. As the open cut would be excavated well below the level of Wollombi Brook and to within 300 m of Wollombi Brook, it is expected that some inflow or reversal of hydraulic gradient within the alluvium in the lower reaches of North Wambo Creek would result. The magnitude of this flow however is dependent upon a number of factors including actual distance from the open cut excavation to Wollombi Brook (i.e. potential for the Wollombi Brook alluvium to recharge the North Wambo Creek alluvium), elevation of the base of the alluvium at the open cut relative to the water level in Wollombi Brook and the hydraulic conductivity of the alluvium and upper interburden unit in the area between Wollombi Brook and the pit excavation.

Measures that would be adopted to manage inflows from alluvial aquifers would include the installation of sumps on open cut benches to collect inflows before they reach the floor of the open cut. These waters could then be returned to the local creek systems and/or managed in accordance with the relevant licence/permits.

The Project would not impact groundwater users along the Hunter River. It is expected that with the implementation of appropriate mitigation measures there would be no impacts on groundwater bores or wells along Wollombi Brook.

No water quality impact is expected on the local alluvial groundwater system.

Substantial dewatering of the coal seams in the Wambo Coal Mine area has already taken place. The Project would result in further dewatering of the Permian aquifers and lowering of groundwater levels, particularly in the Permian strata around the Project underground workings.

Loss of aquifer pressures in the Permian strata is not predicted to impact any existing licensed water supply bores within the coal measures.

An assessment of groundwater recovery following cessation of mining indicates that it would take up to approximately 200 years for water levels in the Permian strata from the Wambo Seam and above to fully recover. With respect to the deeper Arrowfield and Bowfield Seams, it has been assessed that it would take approximately 265 years for the water levels to recover to -110 m AHD following the completion of underground mining.

ES3.5 FLORA AND FAUNA

ES3.5.1 Flora

The condition of native vegetation in the vicinity of the Project varies, with the most disturbed areas generally occurring along watercourses and on flat and undulating areas which have been cleared for grazing. Areas of remnant vegetation have been semi-cleared, subjected to historic or current stock grazing and contain open areas with regeneration of various ages. The least disturbed areas occur on the steep rocky slopes and foothills which adjoin Wollemi National Park.

A total of 357 plant species, comprising 252 native and 105 introduced species, and 16 vegetation communities were identified during the flora survey of the Project area. Figure ES-8 shows the surveyed distribution of vegetation communities.

VEGETATION COMMUNITIES

Riverine Communities (Alluvial Soils)

1. *Casuarina cunninghamiana/Angophora floribunda*
2. *Eucalyptus camaldulensis*
3. *E. melliodora/E. blakelyi/A. floribunda*

Colluvial Soil Communities

4. *E. tereticornis/Melaleuca decora*

Aeolian Soil Communities (Warkworth Sands Woodland)

5. *Banksia integrifolia/A. floribunda/E. blakelyi*

0 1 2 Kilometres

Soils Derived from Sandstone, Shale, Conglomerate

6. *E. crebra/E. moluccana/Allocasuarina luehmannii/M. decora*
7. *A. floribunda/E. crebra/E. moluccana/A. luehmannii*
8. *E. moluccana/E. crebra/Allocasuarina verticillata*
9. *Corymbia maculata/E. crebra/E. moluccana/A. luehmannii/M. decora*
10. *E. dawsonii/E. crebra/A. luehmannii/M. decora*
11. *E. punctata/E. crebra/A. luehmannii/M. decora*
12. *E. blakelyi/A. floribunda/E. crebra*
13. *E. acmenoides/A. floribunda*
14. *Geijera salicifolia/Notelaea microcarpa*
15. *Acacia aneura*
16. Vine Thicket (Dry Rainforest)

LEGEND

Mining & Coal Lease Boundary

Mining Lease Application Boundary

Source: Orchid Research (2003)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-8
Vegetation Communities of Remnants in the Vicinity of the Project

WAMBO COAL PTY LIMITED

ResourceStrategies

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No plant species listed as threatened under the *Threatened Species Conservation Act, 1995* (TSC Act) or Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) were recorded in the vicinity of the Project. However, the Warkworth Sands Woodland (listed under the TSC Act) and White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands (listed under both the TSC Act and EPBC Act) endangered ecological communities were identified by the Project flora survey.

Surveys of the Warkworth Sands Woodland indicate that the community has a patchy, yet extensive distribution on lands to the east of Wollombi Brook around Warkworth, and between Wollombi Brook and Wallaby Scrub Road (Figure ES-8). The Warkworth Sands Woodland identified between Wollombi Brook and Wallaby Scrub Road (Figure ES-8) is in good condition.

Potential impacts of underground mining activities on the Warkworth Sands Woodland primarily relate to the potential for minor surface cracking as a result of subsidence. It is not expected that subsidence would significantly impact the Warkworth Sands Woodland community in this area.

The Project would entail the removal of less than 1 ha of the Warkworth Sands Woodland to accommodate the rail loop. The area of Warkworth Sands Woodland that would be disturbed by the rail loop is heavily invaded by weeds, fragmented and in poor condition.

The White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands (Box-Gum Woodland) is represented by scattered occurrences of Yellow Box in small isolated groups and individuals along both sides of Wollombi Brook and by one patch of an association of Blakely's Red Gum/Rough-barked Apple/Narrow-leaved Ironbark in the south. Patches of Box-Gum Woodland within the study area have been mapped and are presented on Figure ES-8 as vegetation communities 3 and 12.

Potential impacts of underground mining activities on the Box-Gum Woodland primarily relate to the potential for ponding and surface cracking. Disturbance to the land surface and to the Box-Gum Woodland as a result of surface cracking and ponding is however predicted to be minimal.

In accordance with the provisions of Section 5A of the EP&A Act, Eight Part Tests of Significance have been prepared for 17 threatened flora species and three endangered ecological communities considered possible occurrences in the vicinity of the Project. Based on the information presented in the Eight Part Tests it was determined that the Project is unlikely to place any threatened flora species, populations, ecological communities, or their habitats at risk of extinction.

The Project would result in the removal of approximately 473 ha of remnant vegetation, the majority of which would be removed from within the open cut operations area (some 460 ha). Construction of Project infrastructure would remove approximately 13 ha of remnant vegetation.

Eight of the 16 vegetation communities identified would be disturbed by the Project. The majority of disturbance would occur to vegetation community 6 (*E. crebra/E. moluccana/A. luehmannii/M. decora),* vegetation community 7 (*A. floribunda/E. crebra/E. moluccana/A. luehmannii*) and vegetation community 1 (*C. cunninghamiana/A. floribunda).*

One species listed as rare, *Acacia bulgaensis*, and one listed as poorly known, *Grevillea montana*, in *Rare or Threatened Australian Plants* (ROTAP) (Briggs & Leigh, 1996) were identified by Project flora surveys. The Project is unlikely to affect the long-term viability of either *A. bulgaensis* or *G. montana* in the vicinity of the Project.

A total of 65 species listed in the *Preliminary List of Regionally Significant Plants of the Hunter Catchment* (Bell, *et al.*, in prep) were recorded within the study area. While some specimens of regionally significant species could potentially be affected by open cut operations and construction of Project infrastructure, the Project is considered unlikely to affect the long-term viability of these species in the vicinity of the Project.

Regionally significant populations of the River Red Gum (*Eucalyptus camaldulensis*) occur in small scattered patches along Wollombi Brook and an area of vine thicket occurs to the north-west of MLA1 (Figure ES-8). Neither the River Red Gum nor the vine thicket would be disturbed by the Project, being situated outside proposed disturbance areas.

Paperbark woodlands dominated by *Melaleuca decora* are also considered to be regionally significant. A number of vegetation communities identified in the vicinity of the Project include *M. decora* as a dominant species (Figure ES-8). Remnants that are representative of these communities occur outside of the Project disturbance areas.

As a result of Project subsidence, increased areas of ponding are expected to occur along and adjacent to the lower reaches of North Wambo Creek and Wambo Creek. Some of these areas are likely to become wetlands over time. As a result, a change in flora species composition and structure would be expected to occur as the creation of wetland habitat provides greater opportunities for wetland species.

Eight Part Tests of Significance undertaken for various regional coal mines and a recently approved sand mining operation to the east of the Project have concluded that the developments are unlikely to place any threatened flora species, populations, ecological communities, or their habitats at risk of extinction.

Flora Management

Mitigation measures relevant to vegetation clearance activities would include retention of existing native vegetation and avoidance of clearance, development of a vegetation clearance protocol, re-use of cleared vegetative material, management of topsoil resources and progressive clearance of vegetation in conjunction with open cut mining operations.

The Project revegetation programme would include progressive revegetation of disturbed areas, with the aim of re-establishing floristic diversity within woodland areas, and the enhancement of some 1,080 ha of remnant woodland. The banks of the North Wambo Creek water control channel would be planted with *C. cunninghamiana* and *A. floribunda* resulting in a net increase in the quantity of riparian vegetation along North Wambo Creek. Areas in the vicinity of the rail loop would be revegetated with native species characteristic of the Warkworth Sands Woodland (such as *A. floribunda* and *B. integrifolia*).

Areas of remnant woodland selected for enhancement would include areas of Warkworth Sands Woodland and Box Gum Woodland located on WCPL land between Wollombi Brook and Wallaby Scrub Road.

Management measures relevant to flora within these enhancement areas would include the fencing of remnants to exclude stock to allow the natural regeneration of native species, the implementation of weed control measures and selective planting of native vegetation to enlarge the remnants and to link existing remnant vegetation, where appropriate.

ES3.5.2 Fauna

Terrestrial fauna surveys undertaken for the Project identified a total of 165 fauna species, comprising 10 amphibians, 15 reptiles, 117 birds and 23 mammals. This included 11 introduced species, comprising the House Sparrow, Common Starling, Common Mynah, House Mouse, Black Rat, Cat, Dog, Red Fox, Brown Hare, European Rabbit and Cow.

A total of 13 threatened fauna species, listed under the Schedules of the TSC Act were recorded in the vicinity of the Project including the Square-tailed Kite, Glossy Black-cockatoo, Turquoise Parrot, Brown Treecreeper (eastern subspecies), Speckled Warbler, Hooded Robin, Grey-crowned Babbler (eastern subspecies), Diamond Firetail, Squirrel Glider, Yellow-bellied Sheathtail Bat, Little Bentwing Bat, Large Bentwing Bat and Large-eared Pied Bat. The Large Bentwing Bat and Large-eared Pied Bat are also listed as conservation dependent and vulnerable, respectively, under the EPBC Act.

A total of 37 migratory species listed under the EPBC Act have been recorded in the vicinity of the Project.

The White-bellied Sea-eagle was recorded during Project surveys and is covered by the marine provisions of the EPBC Act. The Swift Parrot and White-throated Needletail have also been recorded in the local area and while considered to be predominantly non-marine, these species are known to overfly or occasionally visit the Commonwealth marine area.

Project vegetation clearance has the potential to affect fauna species through the reduction in opportunities for foraging, breeding, nesting, predator avoidance and movement between areas thus promoting genetic diversity and facilitating dispersal/migration.

Other potential Project impacts on terrestrial fauna include disruptions to routine activities as a result of increased noise levels, increased populations or concentrations of introduced species, increased incidence of fauna mortality via vehicular strike and modification of behavioural patterns as a result of Project lighting.

Based on the information presented in the Eight Part Tests of Significance completed for 41 threatened fauna species, it was determined that the Project is unlikely to significant affect any threatened fauna species to the extent of undermining the viability of a local population of that species.

Eight Part Tests of Significance undertaken for threatened migratory species including the Square-tailed Kite and Regent Honeyeater concluded that the species are unlikely to be significantly affected by the Project to the extent of undermining the viability of a local population of that species.

The Eight Part Tests of Significance undertaken for the Project also assessed the cumulative impacts of the Project on threatened fauna, taking into consideration the extent and type of habitat disturbance associated with regional developments. The Eight Part Tests concluded that the Project is unlikely to place any threatened fauna species, populations, ecological communities, or their habitats at risk of extinction.

An assessment of potential and core Koala habitat conducted for the Project concludes that lands within the vicinity of the Project do not contain potential or core Koala habitat. The provisions of *State Environmental Planning Policy No. 44 (Koala Habitat Protection)* are therefore not considered applicable to the Project.

Initiatives developed to mitigate the potential impacts (including cumulative impacts) of the Project on fauna include the establishment of a long-term net increase in woodland vegetation in the vicinity of the Project and the enhancement of remnant woodland vegetation, which would include the conservation of areas of known habitat for a number of threatened fauna species including the Squirrel Glider, Grey-crowned Babbler, Glossy Black-cockatoo, Speckled Warbler, Diamond Firetail, Yellow-bellied Sheathtail Bat, Large Bentwing Bat and Large-eared Pied Bat.

Mitigation measures relevant to vegetation clearance activities would include the development of a vegetation clearance protocol, retention of mature trees and stags with hollows wherever feasible, consideration of seasonal factors to minimise disturbance to potential breeding and hibernation activities, development of fauna management strategies to minimise the impact of clearing activities on resident fauna in the short-term and minimise the impact of loss of habitat in the long-term, salvage and re-use of habitat features (e.g. large hollows) where practicable and consideration of the use of artificial nesting/roosting boxes for fauna.

Other management measures to be undertaken would include the mandating of a clean, rubbish-free environment to discourage scavenging and reduce the potential for colonisation by non-endemic fauna (e.g. introduced rodents, birds), implementation of a feral animal control programme and the imposition of speed limits on roads and tracks within the Project area.

ES3.5.3 Aquatic Ecosystems

At the time of Project aquatic surveys, North Wambo Creek was characterised by a flowing pool-riffle or pool-run sequence near the confluence with Wollombi Brook, a series of isolated pools in the middle reaches and a dry channel in the upper reaches. Wambo Creek was predominantly dry at the time of the survey with some isolated small pools, and Stony Creek was completely dry. The aquatic assessment indicated that the water quality of these streams is "*possibly mildly polluted*" to "*probably moderately polluted*".

North Wambo and Wambo Creeks are considered to represent minimal fish habitat. Two native and one introduced fish species were recorded from North Wambo Creek, and three native and one introduced species recorded from Wambo Creek. The results indicate a relatively species-poor fish fauna assemblage. The most widespread and numerically dominant species was the Mosquito Fish (*Gambusia holbrooki*). The majority of native fish species were only recorded at sites where the introduced Mosquito Fish was absent. North Wambo and Wambo Creeks possess characteristics that are considered unlikely to support a species-rich fish assemblage.

Potential impacts of the Project on the aquatic ecosystems of North Wambo, Wambo and Stony Creeks are primarily associated with the development of open cut mining operations, the North Wambo Creek water control system and effects of subsidence as a result of underground mining activities.

Alterations to aquatic habitat as a result of the Project are unlikely to significantly alter the macroinvertebrate or fish community composition, or the conservation values of these streams given the high degree of historical disturbance.

ES3.6 COMMUNITY INFRASTRUCTURE

A community infrastructure assessment conducted for the Project addressed potential impacts on housing, education facilities and community services as well as potential direct and indirect impacts on employment and population.

The transient increase in population that would accompany initial development activities is expected to have a minimal impact on local community services, health, education and short-term accommodation facilities in the town due to the extensive range of services available.

Following the completion of initial development activities, Project employment would peak during the period of maximum coal production with the creation of up to 233 full-time jobs in addition to the existing 137 full-time employees at the Wambo Coal Mine.

Direct and indirect full-time jobs generated by the Project are expected to be filled predominantly by people who currently reside within the Hunter region. The Project-induced population increase within the local SLAs of Singleton, Maitland, Cessnock and Muswellbrook is expected to be in the order of 87 people. This minimal increase in population is expected to have a negligible impact on the local housing market, education facilities, and community organisations and support services. The minor population increase would also not have a significant impact on the delivery of hospital services in the local area.

ES3.7 ECONOMICS

Economic analysis is primarily concerned with weighing up the potential economic costs and benefits of a project to the community (i.e. consideration of economic efficiency).

The primary technique used to evaluate proposals with respect to economic efficiency is a benefit cost analysis. As part of the economic assessment a benefit cost analysis was performed for the Project. Information on the regional economic impact or economic activity generated by development proposals is also of interest to decision-makers. A regional economic impact analysis that considers the likely contribution of the Project to annual direct and indirect output, value-added, income and employment was also undertaken.

A benefit cost analysis of the Project identified a range of potential economic costs and benefits, including possible external environmental impacts. The main potential economic costs of the Project relate to the opportunity cost of land and capital equipment, the capital cost of mine and infrastructure establishment and annual operating costs, while the main economic benefits relate to the sale of product coal and the residual value of capital equipment and land at the completion of the evaluation period.

The main decision criterion for assessing the economic desirability of a proposal is usually the Net Present Value (NPV), where a positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to a project, because the community would obtain net benefits. The analysis indicated that the Project would result in incremental production benefits of approximately $547M accruing to Australia. This figure represents the opportunity cost to Australian society of not proceeding with the proposal. Interpreted another way, any residual environmental impacts from the proposal, after mitigation, would need to be valued at greater than $547M to make the proposal questionable from an Australian economic efficiency perspective.

This is equivalent to each household in the Hunter region being willing to pay $2,426 to avoid any of the residual environmental and social impacts of the Project, after mitigation by WCPL.

Regional economic impact assessment is primarily concerned with the effect of an impacting agent on an economy in terms of specific indicators, such as employment, income, gross regional product and gross regional output.

It is estimated that the Wambo Coal Mine currently contributes in the order of $298M in annual direct and indirect regional output or business turnover, $116M in annual direct and indirect regional value added, $51M in annual direct and indirect household income and 869 regional jobs. In the absence of the Project, the economic impacts of the Wambo Coal Mine would cease in some six years time.

The incremental, or additional, regional economic impacts of the Project are estimated to be in the order of $334M in annual regional output or business turnover, $103M in annual value added, $38M in annual household income, and 529 regional jobs.

The construction and operation of the Project would stimulate demand in the local and regional economy leading to increased business turnover in a range of sectors and increased employment opportunities. Cessation of the Project would, however, lead to a reduction in economic activity.

The socio-economic significance of cessation of the Project would depend on the relative significance of the Project to the regional economy and other regional economic factors at the time, where impacts associated with Project cessation are likely to be greater in a declining economy than in a growing diversified economy. WCPL would work with the SSC and the community to investigate how to minimise the potential adverse socio-economic effects of a significant reduction in local employment levels and closure of the mine at the end of its life.

ES3.8 ARCHAEOLOGY

ES3.8.1 Aboriginal Heritage

The Aboriginal heritage assessment utilised the results of a search of the NPWS Aboriginal Sites Register and Project surveys conducted by an archaeological team and representatives of the Lower Wonnarua Tribal Council, Upper Hunter Wonnarua Council and Ungooroo Aboriginal Corporation. These results were supplemented by a geomorphological study.

A total of 292 sites were identified and consist of a carved tree/ceremonial site, grinding groove sites, possible grinding groove sites, probable scarred tree, contact sites with flaked glass objects, possible contact sites with scatters of historic material together with stone objects, and isolated objects and object scatters (open sites).

The locations of sites identified during the Project surveys are illustrated on Figure ES-9.

The carved tree/ceremonial area identified as Site 2 on Figure ES-9 is considered to be of high archaeological significance because of the site type (ceremonial ground), its connectedness to the other sites in the area and because of the known chronology of the site.

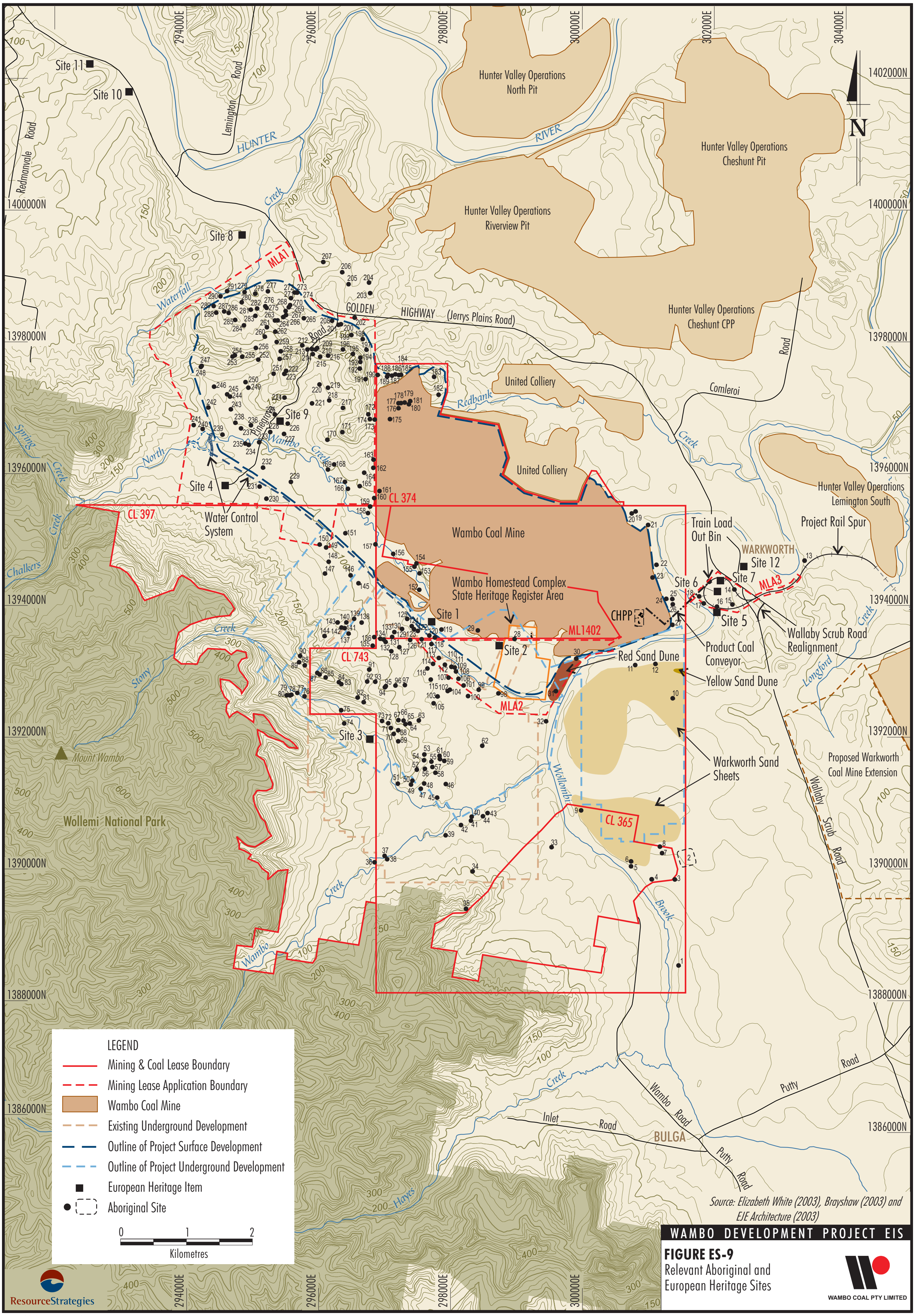
The carved tree/ceremonial area (Site 2) is located to the east of Wollombi Brook, outside of the outline of Project surface and underground development (Figure ES-9). As part of the Aboriginal heritage assessment research was undertaken by Helen Brayshaw to both locate and learn more about the site. Brayshaw (2003) concludes that it is “beyond doubt” that the site is located in the vicinity as indicated on Figure ES-9. No physical evidence of the carved tree/ceremonial site was however found during these field surveys (Brayshaw, 2003).

Stratified or dateable materials have the potential to contribute to the history of an area by assigning objects with a relative chronology. The geomorphologic assessment conducted as part of the Aboriginal heritage assessment identified features with the potential to provide a chronology of occupation, including a red sand dune near the western side of Wollombi Brook, sand sheets on the eastern side of Wollombi Brook that extend eastward into the Warkworth Coal Mine area and a yellow sand dune that is located on the eastern side of Wollombi Brook (Figure ES-9).

Potential impacts include those associated with the Project surface development area, subsidence from underground mining operation areas, the rail spur, realignment of Wallaby Scrub road and construction of the water control system.

As the Project surface development would damage or destroy Aboriginal objects, consent to destroy all sites located within this area would be sought under section 90 of the *National Parks and Wildlife Act, 1979* (NPW Act).

Potential subsidence impacts on Aboriginal objects include cracking, ponding, erosion along flow paths and sedimentation. These impacts have the potential to damage or destroy Aboriginal objects, however some sites may remain unaffected. Consent to destroy all sites located within areas where the impacts of the underground mining operations could potentially damage Aboriginal objects would be sought under section 90 of the NPW Act.



WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-9
Relevant Aboriginal and European Heritage Sites

As part of the Project detailed design phase the final alignment of the rail spur, Wallaby Scrub Road intersection and water control structure would be determined. Prior to construction, pre-clearance surveys would be conducted to identify Aboriginal objects located within the footprint of these works. Consent to destroy would be sought under section 90 of the NPW Act for Aboriginal objects unable to be avoided by these Project components.

Mitigation measures were developed in consultation with the Upper Hunter Wonnarua Council (also representing the Wonnarua Nation Aboriginal Corporation), the Lower Wonnarua Tribal Council, the Wanaruah Local Aboriginal Land Council, the Ungooroo Aboriginal Corporation, and the Combined Council of Hunter Valley Elders both during and after the Aboriginal cultural heritage survey.

In recognition of issues raised during the consultation process with Aboriginal groups and based on the results of the archaeological studies modifications were made to the Project layout including limitation of the southern extent of the underground mining operations east of Wollombi Brook in the vicinity of Site 2 and associated Sites 1 and 3-9, relocation of surface development west of Wollombi Brook to avoid the disturbance of two large open sites (Sites 30 and 31), modification of the surface development and underground mining operations areas to avoid disturbance to the red and yellow sand dunes, fencing of Site 32 (a scar tree) to ensure no impact from surface development, withdrawal of the surface development back from Waterfall Creek to avoid Sites 290 and 291 and alignment of infrastructure to avoid Aboriginal objects wherever possible (after formal surveying).

Mitigation measures for Aboriginal objects would include collection and relocation of objects to a "Keeping Place" for analysis, documentation and storage. Aboriginal objects would be replaced in the landscape once final rehabilitation works are completed.

ES3.8.2 Non-Aboriginal Heritage

Wambo Homestead Complex

The Wambo Homestead Complex (WHC) (Figure ES-9) is located on the western side of Wollombi Brook to the south of the Wambo Coal Mine. Components of the WHC include the Kitchen Wing, the New House, Servants' Wing, Stud Master's Cottage, Carriage House with Stables and Granary, Slab Butcher's Hut, Slab Horse Boxes and Mounting Yard Horse Boxes.

The WHC was 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."*

Since this Statement of Cultural Significance was written in 1994, the land surrounding the WHC curtilage has been subject to further mining development.

While there have been additional losses and changes to the physical integrity and setting of the WHC, many of the individual buildings still retain some historic, social, aesthetic and technical importance. The ability to interpret the early history of these buildings has and continues to be compromised by mining development and natural deterioration due to ageing and environmental factors. The heritage significance of the WHC has diminished over the last decade due to changes in the physical surrounds and setting of the WHC.

The WHC and surrounding grounds are located within the Project open cut mining area (Figure ES-9). From Year 2 of the Project there is potential for blast and vibration impacts on the WHC from open cut mining operations. Protective measures would be undertaken to mitigate these potential impacts. Surface development within the WHC curtilage is planned to commence during Year 9 resulting in the destruction of the buildings and modification of the surrounding landscape. Underground mining operations under the WHC are scheduled to occur after surface disturbance of the WHC.

An alternative to the Project has been considered whereby mining operations would be restricted to areas beyond the WHC curtilage. However, this proposal would not eliminate the ongoing trend of diminishing heritage value and would result in substantial economic losses from the sterilisation of coal reserves under the WHC curtilage.

It is therefore proposed to relocate the WHC to other locations both within the Singleton LGA and the wider Hunter region. The form of relocation would be dependent on both the nature and characteristics of the element to be relocated and the relocation destination.

For a number of the individual elements/buildings in the WHC substantial relocation and re-erection is desirable and would be of benefit by simply retaining the physical and technical significance of the structure at another location where it can be available for public access and interpretation. In this regard it is proposed to substantially relocate items such as the Stud Master's Cottage, Slab Horse Boxes, Butcher's Hut, Carriage House and Mounting Yards.

For the remaining components of the WHC the relocation proposal would involve relocation of substantial elemental fabric. All significant fabric which retains its integrity would be salvaged and used elsewhere for interpretation purposes. Components of the WHC which would be treated in this manner include the Servants' Wing, Kitchen Wing and New House.

Other Items of Non-Aboriginal Heritage

The heritage assessment included surveys of lands in the vicinity of the Project with a specific focus on surface development areas. Of the 12 items identified during the assessment (Figure ES-9), eight sites were considered of heritage significance in accordance with the *NSW Heritage Manual*.

Two abandoned grain silo and shed complexes (Site 1 and Site 2) and an abandoned Massey Ferguson tractor (Site 9) would be disturbed by Project open cut mining operations, while impacts from subsidence are likely to exacerbate the dilapidated condition of an abandoned homestead building (Site 3) recorded within the underground mining operations area (Figure ES-9).

Prior to disturbance, Sites 1, 2 and 3 would be recorded to an archival standard (written description and photographic record) and the records provided to Tourism Singleton and the State Library of NSW. Where moveable heritage items are likely to be disturbed (Site 9), they would be placed in a permanent repository, in consultation with the relevant stakeholders.

An abandoned homestead building (Site 5) and a timber piggery and butchers hut (Site 6) were identified in the vicinity of the rail spur (Figure ES-9). Sites 5 and 6 would be identified and avoided during both the construction and operation of the Project rail spur. If this is not practicable, Sites 5 and 6 would be managed as per Sites 1, 2 and 3 above.

ES3.9 ROAD TRANSPORT

The Wambo Coal Mine generates an average of approximately 648 vehicle (light and heavy) movements per day on the Golden Highway, the majority of which travel to and from the east (i.e. Singleton, Cessnock and Maitland).

Initial development activities would be completed within approximately two years and would involve the construction of Project rail and train loading infrastructure and the continuation of current open cut mining operations. Predicted traffic generation for this period would be in the order of 919 vehicle movements, comprising an increase in both light and heavy vehicle movements.

During the peak production period increased levels of employment would result in an increase in light vehicle traffic movements. The increased volumes of light vehicle traffic generated by the Project during this period would however be offset by the removal of in the order of 160,000 annual coal haulage movements following the commissioning of Project rail and train loading infrastructure. Traffic generation for this period is expected to be in the order of 626 vehicle movements, which corresponds to a net decrease in total vehicle movements.

Traffic generated by the Project is predicted to originate predominantly from the regional centres of Singleton, Cessnock and Maitland, and to a lesser extent from Newcastle. The local road network is expected to experience minor changes in traffic flows as a result of the Project with no change to its overall serviceability.

Potential impacts arising from works affecting the public road network would be managed in accordance with a Traffic Management Plan that would be prepared in consultation with the relevant authorities. The Traffic Management Plan would address blasting-related road closures on the Golden Highway and would be developed in accordance with the RTA *Traffic Control at Worksites Manual*.

ES3.10 HAZARD AND RISK

A preliminary hazard analysis (PHA) was conducted to gain an understanding of the potential hazards and risks associated with the Project. The PHA was conducted in accordance with the general principles of risk evaluation and assessment provided in the PlanningNSW guidelines for *Multi-Level Risk Assessment*.

Potentially hazardous materials required for the Project are generally limited to conventional explosives and diesel. The annual explosive consumption for the Project would be approximately double the existing usage at the Wambo Coal Mine. Consequently the delivery of materials used to produce explosives would increase.

Additional diesel transport requirements and increased diesel storage and usage would also be required. The incremental risks posed by the usage of these materials for the Project would include increases in their transport, handling and consumption.

The potential risks identified in the PHA related to Project elements/activities including development of the Project open cut and mine waste rock emplacements, Project underground mining operations, CHPP, transport of general or potentially hazardous goods to site, on-site and from site and increase in diesel and explosive consumption and additional storage facilities.

Given the in-place or proposed mitigation measures and considering that the incremental Project risks associated with some increase in consumable usage and storage are more than off-set by the cessation of road transport of product coal, no incremental risks posing significant off-site impacts were identified.

ES4 REHABILITATION

The rehabilitation programme, final landform design and revegetation strategy are conceptual to allow a degree of flexibility for consideration of future research and design studies. Final rehabilitation requirements would ultimately be formulated in consultation with key government authorities and other relevant stakeholders and reported in the Mining Operation Plan (MOP) for approval prior to implementation.

The principles and objectives relating to rehabilitation planning and design for the Project include retention of remnant vegetation wherever possible, progressive rehabilitation of disturbed areas, creation of safe, stable and adequately drained post-mining landforms that are consistent with the local landscape and contribute to local and regional habitat corridors, preservation of existing beneficial use of water resources, implementation of trials and design studies as necessary to maximise effectiveness of the rehabilitation programme and routine monitoring in order to identify rehabilitated areas requiring maintenance works.

Key activities of the rehabilitation programme include planning, progressive rehabilitation, erosion and sediment control, soil removal, handling and placement, amelioration of soil/mine waste rock materials, revegetation, replacement of Aboriginal objects, studies and trials and maintenance and monitoring.

ES4.1 FINAL LANDFORM DESIGN CONCEPTS

The conceptual final landform would consist of a single, broad ridgeline with a south-east to north-west alignment reaching approximately 160 m AHD and flanked on the western side by two final voids (Figure ES-10). Drainage of the final landform would be designed to integrate with the surrounding catchment and would include permanent diversions and contour drains.

The final landform concept proposes a balanced rehabilitation outcome, recognising the alternative land uses that exist in the region and with the aim of establishing the potential for both sustainable agriculture and endemic woodland habitat. Wherever possible, it is proposed to link existing woodland with woodland rehabilitation areas to provide corridors for the movement of fauna and to establish a net increase in woodland areas in the Hunter catchment.

Rehabilitation of mine waste rock emplacements would be progressive and would be undertaken as soon as practicable. Mine waste rock emplacements would cover an area of approximately 1,300 ha and would generally be constructed with an overall outer batter slope of 10 degrees (1V:5.7H). Where long slopes are present, contour drains or deep staggered rips would be established.

Exhausted tailings ponds would be decommissioned either through incorporation/encapsulation within coarse rejects and/or waste rock or through a capping process in order to create a landform that is stable and can be rehabilitated as a mine waste rock emplacement.

Infrastructure with no on-going beneficial use would be removed from the site at the completion of the Project. Foundation soils would be chemically tested, contour ripped and chemically ameliorated as required. Stockpiled soils would then be applied as necessary and stabilised.

1386000N 1386000N

294000E 296000E 298000E 300000E

LEGEND

- Mining & Coal Lease Boundary
- Mining Lease Application Boundary
- Outline of Project Surface Development
- Permanent Pond
- A Project Remnant Woodland Enhancement Programme Area
- Potential Fauna Corridor

0 1 2
Kilometres

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE ES-10
Final Landform Concepts
and Revegetation Strategy

WAMBO COAL PTY LIMITED

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Roads that have no specific post-mining use would be ripped, topsoiled and revegetated. Some access roads may be retained post-mining to enable access and for use in bushfire and other land management activities.

Ventilation infrastructure, including fans and vents would be removed and ventilation shafts backfilled and sealed in accordance with DMR requirements. The various drift accesses and portals would be sealed to prevent the discharge of waters from the workings as they become flooded.

Water management and sediment control structures would either be retained as wetland habitat/water features or decommissioned and rehabilitated.

Mine planning in the final years of open cut operations prior to mine closure would focus on battering down internal slopes and backfilling of the open cut with waste rock to minimise the size of the final voids. The surface catchment of the final voids would be minimised by the use of contour drains.

Perimeter bunding would be constructed around the final voids in order to restrict access to steeper slopes.

ES4.2 REVEGETATION STRATEGY

The revegetation programme would establish significant areas and a net increase in woodland vegetation over the long-term. In recognition of the importance of vegetation corridors to regional biodiversity, rehabilitation initiatives for the Project would aim to increase the continuity of vegetation in the region through the establishment of woodland corridors that link rehabilitation areas, existing remnant vegetation and Wollemi National Park (Figure ES-10).

Revegetation of woodland areas would include the use of endemic plant species which are characteristic of the vegetation communities to be disturbed, establishment of upper, mid and lower storey native vegetation and use of regionally significant flora species and the ROTAP species, *Grevillea montana*, where practicable and appropriate.

Areas proposed to contain a mixture of woodland and pasture would be rehabilitated in a manner that results in contiguous strips of woodland which are connected to the woodland corridors, as opposed to scattered patches of woodland within the pasture areas, while areas proposed for pasture would be revegetated using native grasses, where practicable.

The revegetation strategy for the Project includes the planting of the banks of the North Wambo Creek water control channel with River Oak and Rough-barked Apple. A selection of native grasses would also be utilised in the revegetation of the North Wambo Creek riparian zone.

ES4.3 REMNANT WOODLAND ENHANCEMENT PROGRAMME

During the initial stages of Project development, remnant woodland vegetation located within WCPL owned land and outside the Project open cut operations area would be managed to maintain and enhance inherent conservation values. Three areas of remnant woodland have been identified for potential enhancement (Figure ES-10).

The remnant woodland enhancement programme includes the conservation and enhancement of areas of remnant woodland adjacent to Wollemi National Park. Management measures may include the fencing of remnants to exclude stock and allow natural regeneration of native species, weed control, feral animal control, habitat enhancement initiatives (such as the provision of nest boxes and resources for threatened fauna species) and selective planting of native vegetation to enlarge the remnants and to link existing remnant vegetation, where appropriate.

ES4.4 REHABILITATION MONITORING, MAINTENANCE AND REPORTING

The quality of rehabilitation would be monitored using the Commonwealth Scientific and Industrial Research Organisation (CSIRO) developed Ecosystem Function Analysis (EFA) or a similar systems-based approach.

Visual monitoring of rehabilitated areas would be conducted on a regular basis to ensure that revegetation is establishing and to determine the need for any maintenance and/or contingency measures. Routine monitoring of rehabilitation areas would include erosion and sediment control, runoff water quality, vegetation establishment, weeds and/or feral animals.

ES4.5 MINE CLOSURE AND LEASE RELINQUISHMENT

Rehabilitation performance would be considered to be satisfactory when the assessment process indicates a trajectory towards self-sustaining ecosystems across the rehabilitation areas. Once this rehabilitation status has been achieved, monitoring and maintenance programmes would be ceased in consultation with the relevant regulatory authorities and key stakeholders and a mining lease relinquishment process would be commenced.

ES5 ENVIRONMENTAL MANAGEMENT AND MONITORING

Project environmental management and monitoring programmes have been formulated from experience gained at the Wambo Coal Mine and are based on the results of the environmental baseline studies and impact assessments undertaken for the Project. The management and monitoring programmes are considered provisional pending further input from the relevant authorities during the assessment phase of the EIS.

A MOP and Annual Environmental Management Plan (AEMR) are currently produced for the Wambo Coal Mine.

The current Wambo Coal Mine MOP covers the 2002-2006 period and provides a description of the history of the mine, mining operations, mining approvals and licences, geology, surface infrastructure, land preparation, disturbance and rehabilitation, water management, flora and fauna management and archaeology. The current MOP would be revised and expanded to include Project-related operations.

Each AEMR provides a summary of mining operations, community consultation activities, recorded complaints and a review of environmental performance for the reporting period. Environmental monitoring data assessed includes meteorological, surface and groundwater quality, subsidence, air quality, noise, vibration and blast. Other areas assessed include rehabilitation performance, land use management, water supply, water use and discharge, erosion and sediment management, CHPP rejects management, general waste management and recycling, cultural and natural heritage conservation and hazardous and explosive materials management.

Recommended future environmental management and monitoring initiatives are also documented. The scope of the AEMR would be expanded to include Project-related activities.

Prior to the completion of Project mining operations, a Mine Closure Plan (MCP) would be developed that would document the mine closure process, final rehabilitation works and monitoring requirements appropriate to the proposed lease relinquishment criteria. The MCP would include a Final Void Management Plan which would address issues such as the predicted hydrological behaviour of the final voids, groundwater and surface water management, long-term geotechnical stability of the voids, public safety, including the construction of bunds, access requirements and water quality monitoring requirements.

The existing Wambo Coal Mine Environmental Management Plans (Open Cut Mine, Wollemi Underground Mine and Coal Handling and Preparation Plant) and corresponding emergency response documents, would be revised to include Project-related activities. The existing Wambo Coal Mine Land and Bushfire Management Plans would also be revised to incorporate Project-related activities.

A Weed and Animal Pest Control Plan (WAPCP) would be developed for the Project, incorporating the existing Wambo Coal Mine Weed Management Plan. The WAPCP would include management strategies to control the potential adverse impacts of weeds and feral animals.

Additional management plans that would be prepared for the Project include an Erosion and Sediment Control Plan (ESCP), Subsidence Management Plan (SMP), Site Water Management Plan (SWMP), Flora and Fauna Management Plan (FFMP), Non-Aboriginal Cultural Heritage Management Plan (NACHMP), Aboriginal Cultural Heritage Management Plan (ACHMP) and Traffic Management Plan (TMP).

An ESCP would be developed for the Project detailing methods for the control of erosion and sediment from disturbed areas. The control measures presented in the ESCP would generally aim to minimise soil erosion and sediment generation in areas disturbed during the development of the Project and minimise the potential for Project activities to adversely affect the water quality of the Wollombi Brook or the Hunter River.

A SMP would be prepared in accordance with section 138 of the *Coal Mines Regulation Act*, *1982* in consultation with the Mine Subsidence Board and, where necessary, with any affected landholders. The SMP would document monitoring and management measures for potential subsidence impacts within underground mining areas.

A SWMP would be developed that would describe the Project site water management system, including water supply balance, details of surface water management structures and procedures that would be implemented to minimise potential surface water impacts and preferentially use runoff from operational areas. The SWMP would also establish downstream surface water quality criteria and include surface water and groundwater monitoring programmes.

A FFMP would be prepared that would contain a number of management strategies to minimise the potential impacts of the Project on protected and threatened flora and fauna and their habitats. The FFMP would include a Vegetation Clearance Protocol, Threatened Species Management Protocol, Remnant Woodland Enhancement Programme and a variety of other flora and fauna management initiatives.

A NACHMP would be developed for the Project for the management of the WHC and other items of non-Aboriginal heritage. The NACHMP would describe procedures for the management and maintenance of the WHC prior to and during relocation. Procedures for the monitoring of potential subsidence impacts, blasting and vibration and the recording and archiving of other items of non-Aboriginal heritage would also be included.

An ACHMP would be prepared and would describe management procedures for Aboriginal objects identified within the Project area. The management of Aboriginal cultural heritage in the Project area would be directed towards protecting/salvaging Aboriginal objects as well as enhancing local knowledge of Aboriginal cultural heritage in the area.

A TMP would be prepared in consultation with the Roads and Traffic Authority and SSC and would address temporary road closures on the Golden Highway due to blasting and relocation of the Wallaby Scrub Road and Golden Highway intersection.

Environmental monitoring requirements for the Project would necessitate expansion of the Wambo Coal Mine environmental monitoring programme. The results of the Project environmental monitoring programme would be reported in the AEMR. The monitoring locations, parameters and frequencies would be reviewed annually through the AEMR process. A range of parameters would be monitored within the following categories:

- meteorology;
- air quality;
- noise;
- blasting;
- erosion and sediment control structures;
- subsidence;
- surface water quality, levels and flows;
- groundwater;
- flora and fauna;
- weed and animal pests;
- non-Aboriginal heritage; and
- Aboriginal heritage.

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1 INTRODUCTION

This Environmental Impact Statement (EIS) assesses the proposed Wambo Development Project (the Project) and potential cumulative impacts arising from its development in combination with existing and proposed operations in the immediate vicinity. Located within the Singleton local government area (LGA), in the Hunter Valley of New South Wales (NSW) (Figures 1-1 and 1-2), the Project includes the continued development of open cut and underground mining operations at the Wambo Coal Mine and the development and operation of rail and train loading infrastructure.

1.1 WAMBO COAL MINE

Situated approximately 15 kilometres (km) west of Singleton near the village of Warkworth, the Wambo Coal Mine is surrounded by grazing land and Wollombi Brook to the south, coal mining operations to the east and north, grazing land to the north-west and Wollemi National Park to the west (Figure 1-3).

Wambo Coal Mine was granted development consent by Patrick Plains Shire Council in 1969. Subsequent development consents issued in 1972, 1974 and 1977 covered a range of early open cut and underground operations, while activities such as the construction of office buildings, bathhouses, the Homestead Underground Mine coal conveyor, Hales Crossing on Wollombi Brook, extensions to mining operations and modifications to road haulage rates were consented by Singleton Shire Council (SSC) between 1980 and 1991.

In July 1991, Development Application (DA) 108/91 was lodged with the SSC seeking approval for the expansion of open cut and underground mining activities and the consolidation of earlier development consents. Development consent was granted in February 1992, approving the production of up to 3 million tonnes per annum (Mtpa) of saleable product coal over a 21 year period. Subsequent modifications to DA 108/91 (SSC, 1992) have related to the Wollemi Underground Mine Box Cut entry, coal transportation, noise, tailings, auditing, Maison Dieu Bridge, and the internal coal conveyor, stockpile area and haul road for Brambles coal haulage.

Other development consents granted by SSC since 1991 include:

- DA 161/93 Gravel supply borehole (lapsed in December 1998).
- DA 228/95 Underground longwall mining panel (Longwall 9).
- DA 239/97 Additional underground longwall mining panel (Longwall 9A).
- DA 58/98 De-watering borehole No. 1 and ancillary development.
- DA 298/00 Truck wash (not acted upon).
- DA 443/00 De-watering borehole No.2.
- DA 353/01 Open cut fuel farm.

Wambo Coal Mine is owned by Wambo Coal Pty Limited (WCPL) and is defined by Coal Leases (CL) 365, 374, 397 and 743, and Mining Lease (ML) 1402.

The Wambo Coal Mine comprises open cut mining operations, the Homestead Underground Mine (decommissioned) and the Wollemi Underground Mine (currently on care and maintenance), a Coal Handling and Preparation Plant (CHPP), and associated raw and product coal handling facilities.

Subsequent to the grant of development consent DA 108/91 (SSC, 1992), open cut mining operations were conducted from 1993 until their cessation in March 1999. Following a temporary hiatus, open cut operations recommenced in August 2001 at a rate of 1 Mtpa of run-of-mine (ROM) coal.

Underground mining operations at the Homestead Underground Mine commenced in 1979 until their cessation in 1999, while production at the Wollemi Underground Mine commenced in 1997. The Wollemi Underground Mine produced in the order of 3 million tonnes (Mt) of ROM coal during the 2001/2002 financial year and entered a care and maintenance phase in October 2002.

Following the suspension of underground operations in October 2002, open cut operations were expanded to maintain an overall production rate at 4 Mtpa of ROM coal. Wambo Coal Mine ROM coal is washed at the CHPP. Mine waste rock material generated by the CHPP consists of coarse rejects and fine rejects (tailings) that are placed within open cut voids and mine waste rock emplacements.

Product coal is transferred from the CHPP to the Mount Thorley Coal Loader (MTCL) by a combination of 37 tonne (t) capacity B-Double trucks and single trailer 28 t capacity trucks (Appendix M). Product coal is then railed from the MTCL to the Port of Newcastle for export.

WAM-02-01-Sect 1_001F

FIGURE 1-2
Project Location

WAM-02-01- Sect 1_002N

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 1-3
Aerial View of Wambo Coal Mine and Surrounds

WAMBO COAL PTY LIMITED

WAM-02-01-Sect 1_005J

Wambo Coal Mine currently produces thermal coal, which is widely accepted in north Asian markets, including Japan and Taiwan.

At the end of April 2003, the total site workforce of 137 included a mixture of WCPL employees and open cut mining contractor personnel. Open cut mining operations are currently conducted on a roster of two 10.5 hour shifts per day from Monday to Friday with single shifts conducted on Saturday and Sunday.

1.2 PROJECT OVERVIEW

The acquisition of WCPL by HunterCoal Pty Ltd in January 2001 triggered a revision of the Wambo Coal Mine strategic plan. The Project is the result of this strategic review and represents the desire to further develop open cut and underground mining operations and to rationalise existing development consents. The Project comprises an Open Cut and Underground Mining Component and a Rail and Train Loading Infrastructure Component.

An overview of each component is provided below.

1.2.1 Open Cut and Underground Mining Component

The Open Cut and Underground Mining Component would include:

- continued development of open cut mining operations (including limited auger mining beyond open cut mining limits) within existing WCPL mining and coal leases and into new mining lease application areas;
- continued placement of waste rock and coarse rejects within mine waste rock emplacements;
- continued placement of tailings within open cut voids and capping with waste rock and coarse rejects;
- an extension to the existing Wollemi Underground Mine Box Cut (within the limits of the Project open cut mining area) to provide direct access for three underground longwall panels in the Whybrow Seam (Figure 1-4);
- extension of drifts from the Wollemi Underground Mine to facilitate longwall mining of the Wambo Seam;
- construction of a portal and drift access adjacent to the CHPP to facilitate longwall mining of the Arrowfield and Bowfield Seams;
- upgrade of the existing CHPP to facilitate increased coal production;
- development of a water control structure across North Wambo Creek at the north-western limit of the open cut operation and a channel to allow the passage of flows to the lower reaches of North Wambo Creek around the open cut development (Figure 1-4);
- de-gazettal and physical closure of Pinegrove Road;
- development of new access roads and internal haul roads;
- relocation of the existing explosives magazine and construction of additional hydrocarbon storage facilities; and
- relocation of the administration area and site offices.

Scheduled to commence in 2004, the Open Cut and Underground Mining Component of the Project has an expected peak production rate of 14.7 Mtpa of ROM coal. The Underground Mining Component has an expected operational life in excess of the 21 year DA period.

1.2.2 Rail and Train Loading Infrastructure Component

The Rail and Train Loading Infrastructure Component would facilitate the rail transportation of product coal to market and would include:

- construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin (Figure 1-5) to enable the transport of product coal by rail to market;
- construction of a rail spur underpass beneath the Golden Highway (Figure 1-5);
- realignment of the intersection between Wallaby Scrub Road and the Golden Highway (Figure 1-5); and
- transportation of product coal to the market via nominal 8,600 t capacity trains 24 hours per day, seven days per week.

Construction of the Rail and Train Loading Infrastructure Component of the Project is scheduled to commence in Year 1, leading to the commencement of rail transportation of product coal in Year 2. The Rail and Train Loading Infrastructure Component is expected to continue to operate beyond the 21 year DA period.

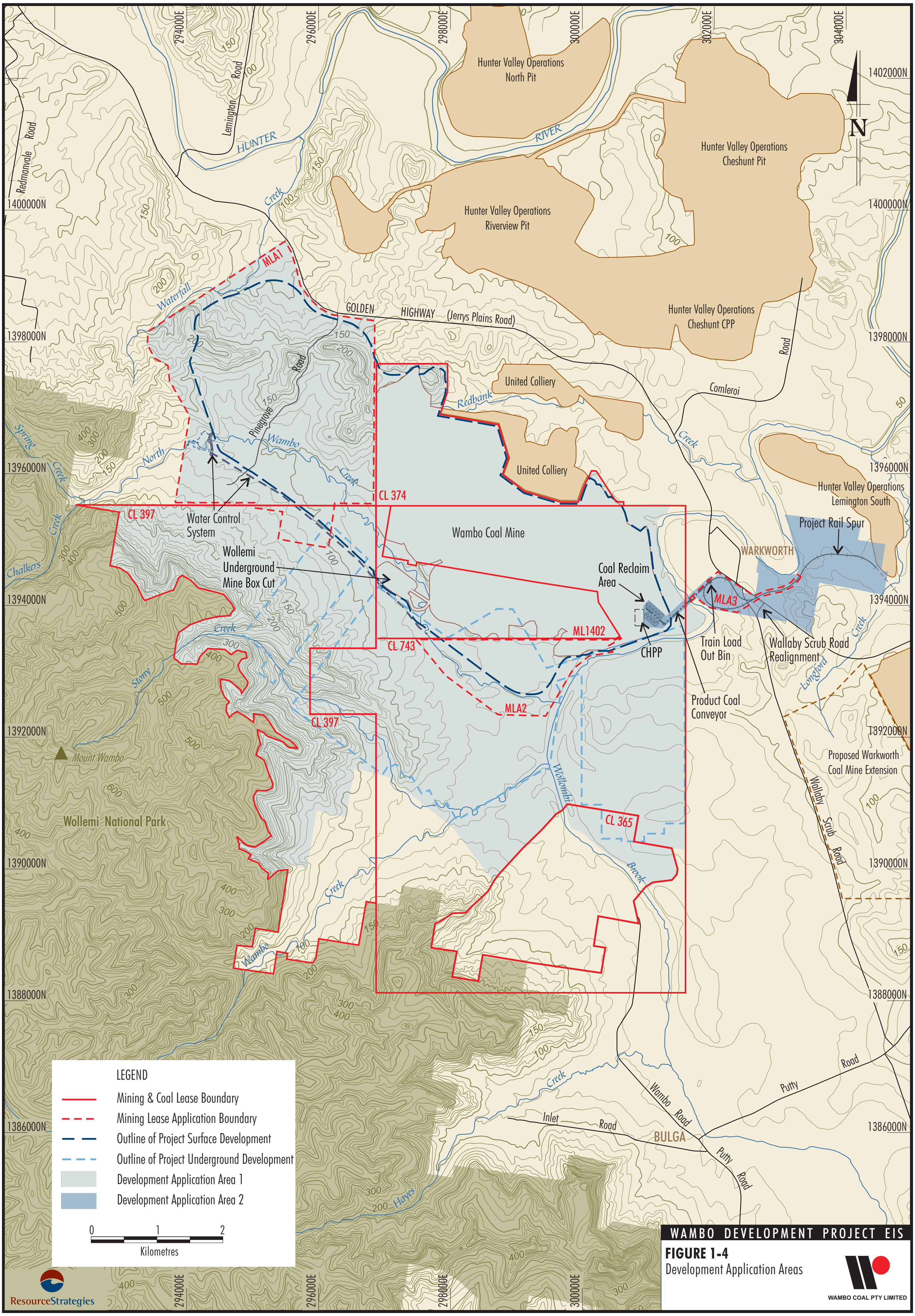

FIGURE 1-4
Development Application Areas

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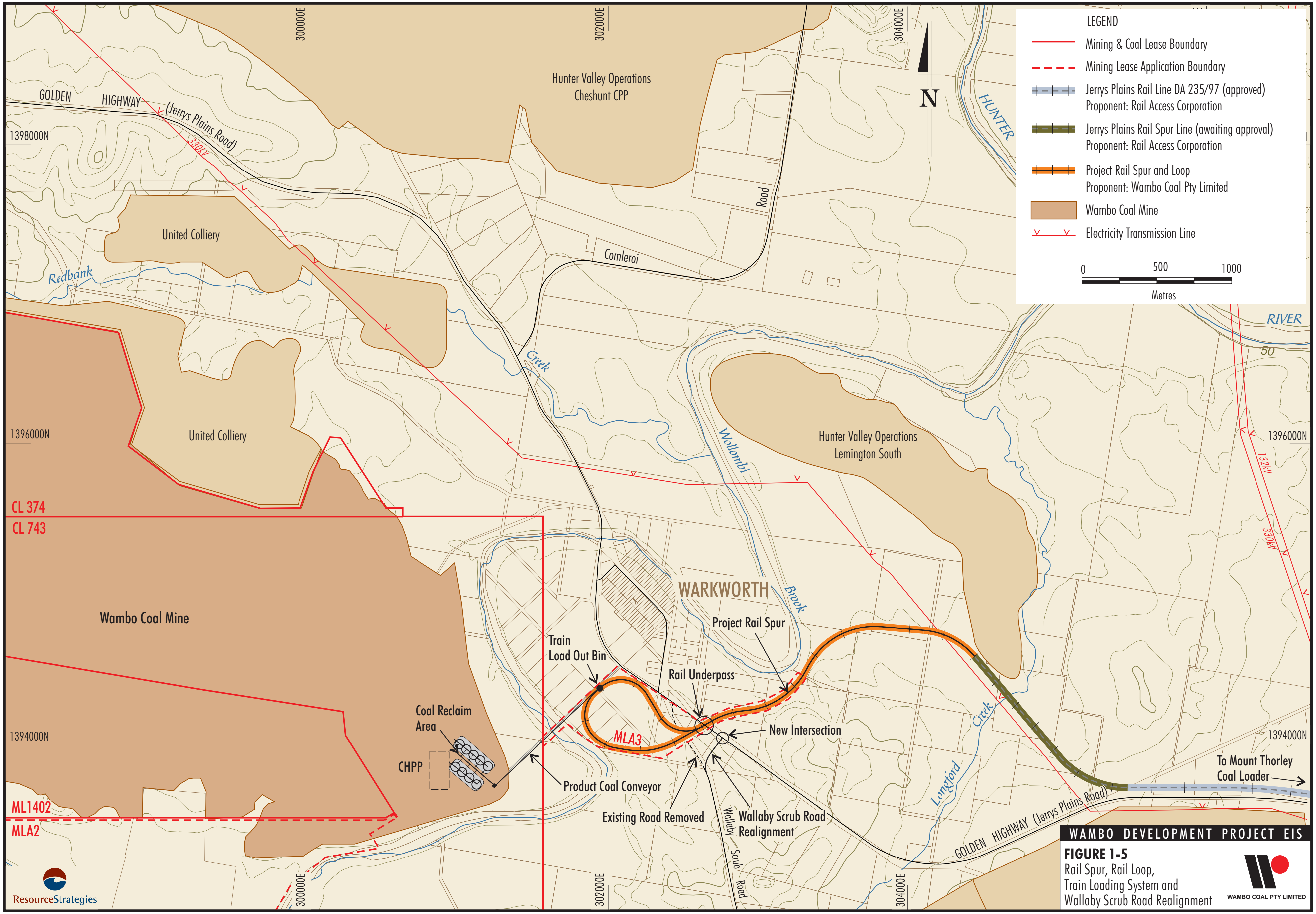


WAMBO DEVELOPMENT PROJECT EIS

FIGURE 1-5
Rail Spur, Rail Loop,
Train Loading System and
Wallaby Scrub Road Realignment

WAMBO COAL PTY LIMITED

WAM-02-01-Sect 1_009N

The Project rail spur would join sections of rail infrastructure proposed as part of the Jerrys Plains Rail Spur Line and Jerrys Plains Rail Line developments (Figure 1-5). These developments are summarised below.

Jerrys Plains Rail Spur Line

The Project rail spur would join a small section of the Jerrys Plains Rail Spur Line (approximately 1.3 km in length) to the west of Longford Creek (Figure 1-5). Rail Access Corporation (now Rail Infrastructure Corporation (RIC)) lodged a DA, accompanied by a Statement of Environmental Effects, for the Jerrys Plains Rail Spur Line in 1999. This proposal is currently awaiting approval from the Minister for Planning.

Jerrys Plains Rail Line

The Jerrys Plains Rail Spur Line would in turn join the Jerrys Plains Rail Line (Figure 1-5), which was granted development consent in July 1998 by SSC under DA 235/97. RIC is the proponent of the Jerrys Plains Rail Line.

When constructed the Jerrys Plains Rail Line will connect to the State rail network at the MTCL.

1.2.3 Mining Tenements

As part of the Open Cut and Underground Mining Component of the Project a Mining Lease Application (MLA) will be lodged over a total of 1,275 hectares (ha) of land that is adjacent to, and within, existing mining and coal leases that cover an area of approximately 5,740 ha (Table 1-1). Two distinct areas encompassing 1,060 ha and 215 ha respectively, make up the application area and are illustrated on Figure 1-3 (MLA1 and MLA2).

MLA1 encompasses an area that adjoins CL 374 and CL 397, and includes a portion of land within CL 397 that currently excludes mining of the surface and land below to 15 metres (m).

MLA2 adjoins ML 1402 and encompasses a portion of CL 743 that currently excludes mining of the surface and land below to 15 m. Land tenure within and surrounding WCPL mining tenements (current as at 24 April 2003) is presented on Figure 1-6 and in Attachments 1a to 1c.

As part of the Rail and Train Loading Infrastructure Component of the Project a second MLA, hereafter referred to as MLA3, will be lodged to cover rail infrastructure east of CL 743 as illustrated on Figure 1-5.

1.2.4 Project Snapshot

A summary of key Project information is presented in Table 1-2 and a detailed Project description is provided in Section 2.

1.2.5 Proponent

The Project is being developed by WCPL, which is a wholly owned subsidiary of HunterCoal Pty Ltd. The registered and principal office of HunterCoal Pty Ltd is:

HunterCoal Pty Ltd
Level 9
1 York St
SYDNEY NSW 2000

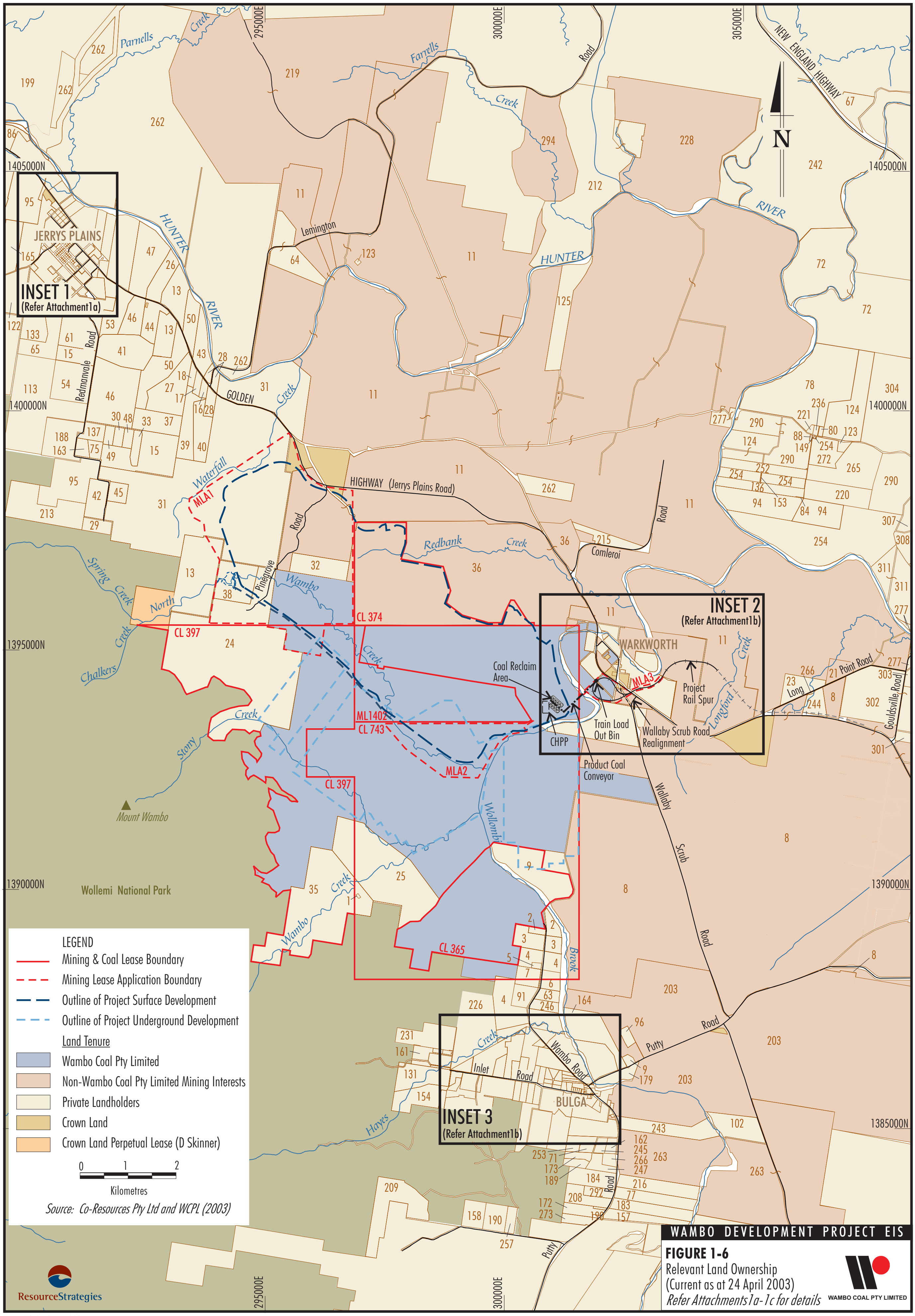
WCPL is based at the Wambo Coal Mine:

Wambo Coal Mine
Wambo Coal Pty Limited
Private Mail Bag 1
SINGLETON NSW 2330
Telephone: (02) 6570 2200

Table 1-1
WCPL Mining Tenements

Title Numbers	Grant Date	Expiry Date	Approximate Area (ha)
CL 365	1990	2011	530
CL 374	1991	2005	380
CL 397[1]	1992	2013	1,480
CL 743[1,2]	1990	2009	3,000
ML 1402[3]	1996	2009	350

Source: After WCPL (2002)
1 United Collieries Pty Ltd has a strata title lease to the Arrowfield Seam in the northern 1.5 km of CL 743 and CL 397.
2 CL 743 is a consolidated coal lease over a total of 10 earlier coal leases.
3 ML 1402 covers surface rights to enable development of the Wollemi Underground Mine.



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 1-6
Relevant Land Ownership
(Current as at 24 April 2003)
Refer Attachments1a-1c for details

WAM-02-01-Sect1_003AE

Table 1-2
Project Snapshot

Project Component	Summary
General	
Project	• Development of open cut and underground mining operations and construction and operation of rail and train loading infrastructure at the Wambo Coal Mine.
Proponent	• Wambo Coal Pty Limited (ACN 000 668 057), which is a wholly owned subsidiary of HunterCoal Pty Ltd.
Tenement Status	• In addition to mining and coal leases covering an area of approximately 5,740 ha, WCPL will lodge a MLA to cover approximately 1,275 ha of land encompassing distinct areas adjoining CL 397 and CL 374 to the north-west (MLA1), and adjoining ML 1402 within CL 743 (MLA2). WCPL will also lodge a MLA over portions of the rail spur, the rail loop and associated infrastructure east of CL 743.
Employment	• Construction workforce of approximately 100 employees and an operational workforce of up to 370 employees when fully developed.
Open Cut and Underground Mining	
Mining	• Open cut mining at a rate of up to 8 Mtpa of ROM coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams with an average stripping ratio of 6.5 (bank cubic metres (bcm) waste rock):1(t ROM coal) and an estimated total open cut reserve of 98 Mt. • Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. Underground reserves are estimated at 104 Mt.
Processing	• A second module would be commissioned to operate in conjunction with the existing 900 tonne per hour (tph) single-module CHPP to facilitate processing in the order of 1,800 tph.
Product Coal	• Production of up to 11.3 Mtpa of thermal coal predominantly for export.
CHPP Rejects	• Coarse rejects (approximately 27 Mt during the DA period) and tailings (approximately 18 Mt during the DA period) would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo Coal Mine management practices.
Mine Waste Rock Management	• Mine waste rock would be deposited in open cut voids and in mine waste rock emplacements adjacent to the open cut operations.
Component Life	• Coal reserves indicate a mine life in excess of the 21 year DA period.
Hours of Operation	• Operations would be conducted 24 hours per day, 7 days per week.
Water Control System	• A water control system would be constructed to allow the passage of flows from North Wambo Creek around the open cut.
Roadworks	• De-gazettal and physical closure of Pinegrove Road.
Rail and Train Loading Infrastructure	
Product Coal Transport	• Product coal would be loaded onto nominal 8,600 t capacity trains and transported to the Port of Newcastle via the Project rail and train loading infrastructure.
Component Life	• Dependent on the future development of coal reserves the rail and train loading infrastructure would operate for a period in excess of the 21 year DA period.
Hours of Operation	• Trains would operate 24 hours per day, seven days per week.
Roadworks	• Construction of a rail spur underpass beneath the Golden Highway and realignment of the Wallaby Scrub Road-Golden Highway intersection.

1.3 DEVELOPMENT APPROVAL PROCESS

Approval for the Project is sought in the form of two DAs (Figure 1-4):

DA1 Encompassing the Open Cut and Underground Mining Component of the Project as described in Section 1.2.1.

DA2 Encompassing the Rail and Train Loading Infrastructure Component of the Project as described in Section 1.2.2.

The Project DAs will be assessed in accordance with the framework established by the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (the Regulations).

1.3.1 Requirement for Development Consent

The Project DAs are situated wholly within the Singleton LGA and on land zoned Rural 1(a) within the *Singleton Local Environmental Plan 1996* (Singleton LEP) under the EP&A Act. Development of the Project is permissible within this zone with development consent from the consenting authority.

1.3.2 State Significant Development

A declaration made by the Minister for Urban Affairs and Planning on 29 June 2001, under section 76A (7) of the EP&A Act, identifies classes of development that are considered to be State significant development. Schedule 1 of the declaration includes coal mines that require a new mining lease under section 63 of the *Mining Act, 1992*. Project development covered by DA1 is therefore State significant development as a new mining lease is required under section 63 of the *Mining Act, 1992*.

In accordance with section 76A (9) of the EP&A Act the Minister for Planning is the consent authority for State significant development.

The Minister for Planning is also the consent authority for development included in Schedule 1 of the *State Environmental Planning Policy No. 34 – Major Employment Generating Industrial Development* (SEPP 34). SEPP 34 is considered to apply to DA2, as the development covered by DA2 would have a capital investment value of greater than $20 M and would be for the purposes of storage, handling and transportation of product coal.

The Minister for Planning is therefore the consent authority for DA1 and DA2.

1.3.3 Designated Development

Section 77A of the EP&A Act defines designated development as *"development that is declared to be designated development by an environmental planning instrument or the regulations"*.

Schedule 3 of the Regulations establishes development that is defined as designated development, including the categories of "coal mines" and "coal works" presented below.

Clause 11 – Coal Mines

Coal mines that mine, process or handle coal, being:

a) underground mines, or

b) open cut mines:

- *i) that produce or process more than 500 tonnes of coal or carbonaceous material per day, or*
- *ii) that disturb or will disturb a total surface area of more than 4 hectares of land (associated with a mining lease or mineral claim or subject to a notice under section 8 of the Mining Act 1992) by clearing or excavating, by constructing dams, ponds, drains, roads, railways or conveyors or by storing or depositing overburden, coal or carbonaceous material or tailings, or*

c) mines that are located:

- *i) in or within 40 metres of a natural waterbody, wetland, a drinking water catchment or an environmentally sensitive area, or*
- *ii) within 200 metres of a coastline, or*
- *iii) on land that slopes at more than 18 degrees to the horizontal, or*
- *iv) if involving blasting, within 1,000 metres of a residential zone or within 500 metres of a dwelling not associated with the mine.*

Under Part 1 of Schedule 3 of the Regulations, the Open Cut and Underground Mining Component of the Project covered by DA1 is considered designated development under the category of "coal mines" as it includes underground mining and open cut mining that would produce more than 500 t of coal per day.

> *Clause 12 – Coal works*
>
> *Coal works that store and handle coal or carbonaceous material (including any coal loader, conveyor, washery or reject dump) at an existing coal mine or on a separate coal industry site, and:*
>
> *a) that handle more than 500 tonnes per day of coal or carbonaceous material, or*
>
> *b) that store more than 5,000 tonnes of coal, except where the storage is within a closed container or a closed building, or*
>
> *c) that store or deposit more than 5,000 tonnes of carbonaceous reject material, or*
>
> *d) that are located in or within 40 metres of a natural waterbody, wetland, a drinking water catchment or an environmentally sensitive area.*

Under Part 1 of Schedule 3 of the Regulations the Rail and Train Loading Infrastructure Component of the Project covered by DA2 is considered designated development under the category of "coal works" as it would handle in excess of 500 t of coal per day.

Section 78A(8) requires that an EIS be prepared for designated development in the form prescribed by the Regulations. Division 4 of the Regulations sets out the form of an EIS and clause 72 states that the contents of an EIS must include the matters referred to in guidelines established by the Director-General.

This EIS has therefore been prepared to accompany the Project DAs.

1.3.4 Integrated Development

Integrated development is development that requires development consent and one or more specified approvals under the following Acts:

- *Fisheries Management Act, 1994*.
- *Heritage Act, 1977.*
- *Mine Subsidence Compensation Act, 1961.*
- *National Parks and Wildlife Act, 1974.*
- *Protection of the Environment Operations Act, 1997.*
- *Rivers and Foreshores Improvement Act, 1948.*
- *Roads Act, 1993.*
- *Rural Fires Act, 1997.*
- *Water Act, 1912.*

Where an approval of this type is required the DA must be submitted to the relevant authority and the consent authority cannot determine the DA until that authority has provided General Terms of Approval.

Statutory approvals that may be required under these Acts for the Open Cut and Underground Mining (DA1) and Rail and Train Loading Infrastructure (DA2) Components of the Project are considered in Tables 1-3 and 1-4.

The Open Cut and Underground Mining Component (DA1) of the Project is therefore integrated development in accordance with section 91 of the EP&A Act.

The Rail and Train Loading Infrastructure Component (DA2) of the Project is therefore integrated development in accordance with section 91 of the EP&A Act.

1.3.5 Environmental Planning Instruments

Relevant environmental planning instruments are outlined below.

Singleton Local Environmental Plan 1996

The Project lies wholly within the Singleton LGA and is situated on land zoned Rural 1(a) within the *Singleton Local Environmental Plan 1996* (Singleton LEP) under the EP&A Act. In accordance with the Singleton LEP, land use within this zone must comply with the following objectives:

> *(a) to protect and conserve agricultural land and to encourage continuing viable and sustainable agricultural land use;*
>
> *(b) to promote the protection and preservation of natural ecological systems and processes;*
>
> *(c) to allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining;*
>
> *(d) to maintain the scenic amenity and landscape quality of the area;*

Table 1-3
Likely Integrated Development Approvals – Open Cut and Underground Mining Component

Act	Provision	Requirement
Fisheries Management Act, 1994	s.219	A permit is required to construct or alter a dam, floodgate, causeway or weir across or within a bay, inlet, river or creek, or across or around a flat, such that the passage of fish could be blocked.
Heritage Act, 1977	s.58 (Heritage Council)	In relation to an item listed on the State Heritage Register, approval is required in respect of the doing or carrying out of an act, matter or thing referred to in s.57(1) of the Act.
Mine Subsidence Compensation Act, 1961	s.15	Approval is required to alter or erect improvements within a mine subsidence district.
National Parks and Wildlife Act, 1974	s.90	In the case that Aboriginal objects will be destroyed, defaced or damaged as a result of Project activities a consent under section 90 of this Act will be required.
Protection of the Environment Operations Act, 1997	ss.43(a), 43(b), 47, 48 and 55	An Environment Protection Licence (EPL) is required for the undertaking of scheduled development works and/or scheduled activities under this Act.
Rivers and Foreshores Improvement Act, 1948	Part 3A	A permit is required under section 22B of the Act to excavate or remove material from *protected land* or do anything that obstructs or detrimentally affects the flow of *protected waters*.
Roads Act, 1993	s.138 (SSC – gazetted roads including Pinegrove Road)	Under section 138 of the Act, consent is required to: (a) erect a structure or carry out a work in, on or over a public road, or (b) dig up or disturb the surface of a public road, or (c) remove or interfere with a structure, work or tree on a public road, or (d) pump water into a public road from any land adjoining the road, or (e) connect a road (whether public or private) to a classified road.
Water Act, 1912	ss.10 and 116	A licence is required under section 10 of this Act to divert or dam any stream of water, whether permanent or intermittent, which flows in a natural or artificial channel. A licence is required under section 116 of this Act to sink a bore and to take or use water obtained from any such bore.
Water Management Act, 2000	Selected sections commenced	Licences required under the provisions of the *Water Act, 1912* will be required under the provisions of the *Water Management Act, 2000* once the relevant sections are commenced.

Table 1-4
Likely Integrated Development Approvals – Rail and Train Loading Infrastructure Component

Act	Provision	Requirement
Heritage Act, 1977	s.58 (Heritage Council)	In relation to an item listed on the State Heritage Register, approval is required in respect of the doing or carrying out of an act, matter or thing referred to in s.57(1) of the Act.
Mine Subsidence Compensation Act, 1961	s.15	Approval is required to alter or erect improvements within a mine subsidence district.
National Parks and Wildlife Act, 1974	s.90	In the case that Aboriginal objects will be destroyed, defaced or damaged as a result of Project activities a consent under section 90 of this Act will be required.
Protection of the Environment Operations Act, 1997	ss.43(a), 43(b), 47, 48 and 55	An Environment Protection Licence (EPL) is required for the undertaking of scheduled development works and/or scheduled activities under this Act.
Rivers and Foreshores Improvement Act, 1948	Part 3A	A permit is required under section 22B of the Act to excavate or remove material from *protected land* or do anything that obstructs or detrimentally affects the flow of *protected waters*.
Roads Act, 1993	s.138 (RTA – Golden Highway) (SSC – gazetted roads including Wallaby Scrub Road)	Under section 138 of the Act, consent is required to: (a) erect a structure or carry out a work in, on or over a public road, or (b) dig up or disturb the surface of a public road, or (c) remove or interfere with a structure, work or tree on a public road, or (d) pump water into a public road from any land adjoining the road, or (e) connect a road (whether public or private) to a classified road.

(e) to provide for the proper and co-ordinated use of rivers and water catchment areas; and

(f) to promote provision of roads that are compatible with the nature and intensity of development and the character of the area.

Clause 5 of the Singleton LEP excludes the Singleton LGA from the *Hunter Regional Environmental Plan (Heritage) 1989* (Hunter REP (Heritage)). All items of local, regional and State significance contained within the Hunter REP (Heritage) are listed in Schedule 3 of the Singleton LEP.

Part 9 of the Singleton LEP addresses the conservation of heritage items of local, regional and State significance, which are listed in Schedule 3 of the Singleton LEP. The potential impact of the Project on items of heritage significance, including items listed in Schedule 3 of the Singleton LEP, is assessed in Appendix C.

Hunter Regional Environmental Plan 1989

The proposal lies within the jurisdiction of the *Hunter Regional Environmental Plan 1989* (Hunter REP), which was enacted in 1989 with the following goals:

(a) to promote the balanced development of the region, the improvement of its urban and rural environments and the orderly and economic development and optimum use of its land and other resources, consistent with conservation of natural and man-made features and so as to meet the needs and aspirations of the community;

(b) to coordinate activities related to development in the region so there is optimum social and economic benefit to the community; and

(c) to continue a regional planning process that will serve as a framework for identifying priorities for further investigations to be carried out by the Department and other agencies.

In regard to mineral resources and extractive materials the Hunter REP aims to:

(a) manage the coal and other mineral resources and extractive materials of the region in a coordinated manner so as to ensure that adverse impacts on the environment and the population likely to be affected are minimised;

(b) ensure that development proposals for land containing coal and other mineral resources and extractive materials are assessed in relation to the potential problems of rendering those resources unavailable; and

(c) ensure that the transportation of coal and other mineral resources and extractive materials has minimal adverse impact on the community.

The Hunter REP contains a number of matters of direct relevance to the Project. These matters have been addressed where relevant throughout the sections and appendices of this EIS.

Hunter Regional Environmental Plan (Heritage) 1989

Clause 5 of the Singleton LEP excludes the Singleton LGA from the *Hunter REP (Heritage) 1989*. All items of local, regional and State significance contained within the *Hunter REP (Heritage) 1989* are listed in Schedule 3 of the Singleton LEP.

State Environmental Planning Policy No. 11 (Traffic Generating Developments)

SEPP 11 requires the consent authority to refer a copy of the Project DAs to the RTA.

State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)

SEPP 33 requires the consent authority, in considering a development application for a potentially hazardous or a potentially offensive industry, to take into account:

- current guidelines or circulars published by PlanningNSW;
- consultations with public authorities;
- any preliminary hazard analysis;
- any feasible alternatives to the carrying out of the development and the reasons for choosing the development;

- the subject of the application; and
- any likely future use of the land surrounding the development.

For potentially hazardous development, SEPP 33 requires a preliminary hazard analysis to be prepared (Appendix K).

State Environmental Planning Policy No. 44 (Koala Habitat Protection)

SEPP 44 requires the consent authority for any development application in certain LGAs (including Singleton) to consider whether land subject to a development application is "*potential Koala habitat*" or "*core Koala habitat*".

An assessment of potential and core Koala habitat is presented in Appendix HB and Section 4.9.1. This assessment concludes that lands within the vicinity of the Project do not contain potential or core Koala habitat.

The provisions of SEPP 44 are therefore not considered applicable to the Project.

1.3.6 Other Statutory Approvals

The following Acts may be applicable to the Project:

- *Coal Mines Regulation Act, 1982;*
- *Dams Safety Act, 1978;*
- *Dangerous Goods Act, 1975;*
- *Environmental Planning and Assessment Act, 1979;*
- *Fisheries Management Act, 1994;*
- *Heritage Act, 1977;*
- *Local Government Act, 1993;*
- *Mine Subsidence Compensation Act, 1961;*
- *Mines Inspection Act, 1901;*
- *Mining Act, 1992;*
- *National Parks and Wildlife Act, 1974;*
- *Native Title (Commonwealth) Act, 1993;*
- *Native Title (New South Wales) Act, 1994;*
- *Native Vegetation Conservation Act, 1997;*
- *Noxious Weeds Act, 1993;*
- *Protection of the Environment Operations Act, 1997;*
- *Rail Safety Act, 1993;*
- *Rivers and Foreshores Improvement Act, 1948;*
- *Road and Rail Transport (Dangerous Goods) Act, 1997;*
- *Roads Act, 1993;*
- *Rural Fires Act, 1997;*
- *Soil Conservation Act 1938;*
- *Threatened Species Conservation Act, 1995;*
- *Water Act ,1912;*
- *Water Management Act, 2000; and*
- *Wilderness Act, 1987.*

The Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) may also be applicable to the Project.

1.3.7 Environment Protection and Biodiversity Conservation Act, 1999

The EPBC Act commenced operation on 16 July 2000 and repealed a number of existing Commonwealth environmental laws, with the protection of the environment, particularly those aspects of the environment that are of *"national environmental significance"* as its primary objective.

The EPBC Act defines proposals that are likely to have a significant impact on a matter of environmental significance as a *"controlled action"*. Proposals that may include a controlled action are required to be referred to the Commonwealth Minister for the Environment and Heritage for a determination as to whether or not the action is a controlled action.

The Project will be referred to the Commonwealth Minister for the Environment and Heritage for an assessment of whether or not it includes a controlled action under the EPBC Act.

1.4 DOCUMENT STRUCTURE

This EIS has been prepared to accompany the Project DAs (i.e. DA1 and DA2 as described in Section 1.3) in accordance with the provisions of Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act), and considering the PlanningNSW EIS guideline *Coal Mines and Associated Infrastructure* (DUAP, 2000). The EIS comprises a main text component and a supporting study component, which includes Appendices A through O.

An overview of the main text, incorporating Sections 1 to 8, is presented below.

Section 1	Provides background information on the Project including location, history of mining, current operations, an overview of the Project, consultation undertaken, development alternatives considered, legislative requirements and the application of the principles of ecologically sustainable development.
Section 2	Describes the Project.
Section 3	Provides a description of the existing environment in the vicinity of the Project.
Section 4	Describes the potential impacts of the Project and associated mitigation measures.
Section 5	Outlines operational and post-mining rehabilitation concepts.
Section 6	Summarises environmental management and monitoring proposals.
Section 7	Lists documents referenced within Sections 1 to 6.
Section 8	Defines abbreviations, acronyms and terms used in Sections 1 to 6.

Appendices A to O contain supporting documentation, including a number of independent specialist reports:

Appendix A	Noise and Blasting Assessment
Appendix B	Air Quality Assessment
Appendix C	Non-Aboriginal Heritage Impact Statement
Appendix D	Aboriginal Heritage Assessment
Appendix E	Surface Water Assessment
Appendix F	Groundwater Assessment
Appendix G	Waste Rock and CHPP Rejects/ Tailings Management
Appendix HA	Flora Assessment
Appendix HB	Terrestrial Fauna Assessment
Appendix HC	Bat Fauna Assessment
Appendix HD	Aquatic Assessment
Appendix HE	Eight Part Tests of Significance
Appendix I	Economic Assessment
Appendix J	Community Infrastructure Assessment
Appendix K	Preliminary Hazard Analysis
Appendix L	Soils, Rural Land Capability and Agricultural Suitability Assessment
Appendix M	Road Transport Assessment
Appendix N	Visual Assessment
Appendix O	Subsidence Assessment

1.5 CONSULTATION

WCPL is committed to an open and constructive consultation programme, which aims to:

- inform government and public stakeholders of the nature and status of the Project;
- present information to stakeholders to facilitate a clear understanding of the proposal;
- identify local concerns or interests in the Project; and
- establish dialogue between WCPL and government and community stakeholders that would be ongoing should the Project be approved.

Consultation undertaken to date is summarised in the following sections.

1.5.1 Public Consultation

The Minister for Mineral Resources appointed Margaret McDonald-Hill to chair a Project Community Consultative Committee (CCC). The Project CCC was formed at an open community consultation meeting that was conducted on 17 December 2002 at the Jerrys Plains Hall and chaired by Margaret McDonald-Hill. This meeting was attended by members of the local community, David Kitto of PlanningNSW and WCPL representatives. During the meeting community members were invited to make formal submissions to PlanningNSW highlighting aspects of the Project that were of specific interest. Submissions received by PlanningNSW were then included in the formal Director-General's requirements for the preparation of the EIS (Table 1-5 and Attachment 2).

Table 1-5
Director-General's Requirements for the Project EIS – Community Submissions Summary

Submission Received	Issues Raised	EIS Reference	
		Main Text Reference	**Appendix Reference**
Holt, Alwyn, Helen and Rebecca	• Haulage of product coal on public roads and the realignment of the Wallaby Scrub Road and Golden Highway intersection.	Sections 2.4.2, 2.4.4 and 4.15	Appendix M
	• Dust-related impacts.	Section 4.5	Appendix B
	• Visual impacts – *"What strategies, policies and procedures will be put in place to counteract the discomfort and interference to our quality of life."*	Section 4.3.4	Appendix N
	• Noise – "*How is this going to be monitored and where?"*	Section 6.3.3	Appendix A
	• Heritage – *"Will steps be taken to preserve the heritage of the Wambo Homestead and any associated buildings, gardens, monuments etc? If so, what will they be?"*	Section 4.14	Appendix C
	• *"Are strategies in place to protect the Warkworth Sands? Would there be ramifications for mining under the Brook that may adversely affect the pristine environmental value of the Sands?"*	Sections 4.8 and 4.2.3	Appendices HA, HE and O
	• Social and cultural impacts in the area, in particular Jerrys Plains – *"the village itself offers numerous services to the community and passing traffic – are these services going to be interfered with in any way because of mining infringing on the community?"*	Sections 4.11 and 4.12	Appendices I and J
	• *"Will we have access to information about Wambo Mine and its operations after it has received approval for its DA?"*	Section 6	N/A
MacBain, Robert and Lynette	• Cumulative impacts of the Project, including the rail spur and surrounding mines.	Section 4	N/A
	• Amenity of the area.	Sections 4.1 and 4.3	Appendix N
	• Adoption of "Best Practice" measures.	Sections 4 and 6	N/A
	• Community and social impacts, including impact on employment and farmland reduction and degradation.	Sections 4.11, 4.12 and 4.1	Appendices I, J and L
	• Heritage – long term impacts on the Wambo Homestead, historic cemeteries in the Jerrys Plains area, other historic properties within the area and the impact of the proposed rail loop on St. Phillip's Anglican Church and cemetery.	Section 4.14	Appendix C
	• Noise impacts, including vibration, and taking into account prevailing weather conditions and temperature inversions.	Section 4.4	Appendix A
	• Air quality impacts, including health concerns, and taking into account prevailing weather conditions and temperature inversions.	Section 4.5	Appendix B
	• Rehabilitation.	Section 5	N/A
	• Subsidence.	Section 4.2	Appendix O
	• Tailings disposal methods.	Section 2.9.3	Appendix G
	• Road transport impacts.	Section 4.15	Appendix M
	• Surface and groundwater impacts.	Sections 4.6 and 4.7	Appendices E and F

Table 1-5 (Continued)
Director-General's Requirements for the Project EIS – Community Submissions Summary

Submission Received	Issues Raised	EIS Reference	
		Main Text Reference	**Appendix Reference**
Nichols, Paul	• Visual impacts, including height of batters, rail transport and lighting impacts.	Section 4.3	Appendix N
	• Air quality impacts.	Section 4.5	Appendix B
	• Noise impacts.	Section 4.4	Appendix A
	• Road and rail transport impacts, including intersections.	Section 4.15	Appendix M
	• Social, economic and agricultural impacts.	Sections 4.11, 4.12 and 4.1	Appendices I and J
	• Future expansion plans (i.e. in excess of 21 year DA period) and mine exit strategy.	Sections 1.2.1 and 4.12.2	Appendix I
	• Heritage impacts on Wambo Homestead and St. Philips Anglican Church, Warkworth.	Sections 3.11, 4.4.4 and 4.14	Appendix C
	• Cumulative impacts on Jerrys Plains and nearby residents.	Section 4	N/A
Singleton Historical Society	• Heritage – "*our particular concern is for the Church building and the homestead*"	Sections 3.11, 4.4.4 and 4.14	Appendix C
Skinner, Dallas	• Surface and groundwater impacts.	Sections 4.6 and 4.7	Appendices E and F
	• Dust-related impacts.	Section 4.5	Appendix B
Dallimore, Howard and Christine Haynes, Ken and Lorraine Henderson, Janene Long, Errol Merrick, Bruce Schipper, John and Annie Stuart, Dudley Wardens, Vestry and Friends of St. Philips Anglican Church, Warkworth	Concerns for the Church Building and Headstones:		
	• Historical significance of the Church building and surrounding cemeteries.	Section 3.11.2	Appendix C
	• Visual impact of the Project rail spur on the existing rural setting.	Section 4.3	Appendix N
	• Vibration – concern that the stress generated by the constant vibration of rail carriages will cause the structure of the Church and headstones to crumble.	Sections 4.4.3 and 4.4.4	Appendix A
	• Dust-related impacts on the buildings and headstones.	Section 4.5	Appendix B
	Concerns for Quality of Worship		
	• Concern of the impact of noise on the quality of worship, particularly during formal services on Friday evening and Sunday morning.	Section 4.4	Appendix A
	Health Concerns		
	• Noise and dust-related impacts on the health of residents in the Warkworth area.	Sections 4.4 and 4.5	Appendices A and B
	Wambo Homestead and Outbuildings		
	• "*The Homestead being close to Warkworth has strong historical connections to St. Philip's Church. Previous residents of the Homestead and workers attended St. Philip's Church and some are buried in the surrounding cemeteries.*"	Sections 3.11 and 4.14.1	Appendix C

Source: After PlanningNSW (2002)

Issues raised in these community submissions include heritage, visual, vibration and noise, dust, transport, flora and fauna, social, economics, water and rehabilitation. These issues are summarised in Table 1-5, along with an indication of where each is addressed in the EIS.

The Project CCC provides a channel for communication between the local community and WCPL, allowing WCPL to inform the community of its plans and community representatives to raise any concerns.

The Project CCC operates independently from the Wambo Coal Mine CCC and comprises Margaret McDonald-Hill and representatives of the SSC, the community, DMR and WCPL.

Subsequent consultation undertaken included meetings of the Project CCC that were held in February 2003, March 2003 and June 2003. An update on status and timing of Project environmental studies was provided at the inaugural meeting of the Project CCC in February 2003, while preliminary assessment findings in relation to issues of community interest were presented in March 2003 and discussed further in June 2003.

In addition to the above, WCPL appointed a Community Liaison Officer (Peter Doyle) to act as a primary point of contact for community members wishing to have direct discussions with the company. The Community Liaison Officer is able to respond to information requests and provide information on the status of the approval process and associated studies.

Consultation has also been undertaken in the form of:

- regular contact with surrounding landholders (from September 2002) during the conduct of baseline studies (i.e. noise, visual, archaeological and surface water);
- direct response by the Community Liaison Officer to information requests from the community;
- distribution of Project information summary booklets to attendees of the initial consultation meeting conducted on 17 December 2003;
- formal presentation to representatives of the St. Philips Anglican Church congregation in regard to preliminary findings of the noise, blast and air quality assessments (14 April 2003); and
- inspection of the Wambo Homestead Complex (WHC) by representatives of the Project CCC on 2 June 2003.

1.5.2 Government Agencies

Consultation with NSW government agencies commenced in late-2002. A Planning Focus Meeting held on 4 December 2002 was attended by representatives of the following agencies:

- Department of Land and Water Conservation (DLWC)[1];
- Department of Mineral Resources (DMR);
- Department of Urban and Transport Planning (PlanningNSW)[1];
- Environment Protection Authority (EPA);
- Hunter Catchment Management Trust (HCMT);
- Mine Subsidence Board (MSB);
- National Parks and Wildlife Service (NPWS);
- NSW Agriculture (NSW Ag);
- NSW Heritage Office;
- Roads and Traffic Authority of NSW (RTA); and
- Singleton Shire Council (SSC).

The objective of the Planning Focus Meeting was to familiarise government stakeholders with the development proposal and to identify key issues that should be addressed in the EIS.

This EIS has been prepared in accordance with the requirements of the Director-General of PlanningNSW. These requirements are presented in Attachment 2 and summarised in Table 1-6 along with an indication of where each requirement is addressed in the EIS.

In addition to the requirements listed in Table 1-6, Attachment 2 contains the EIS assessment requirements of the DLWC, DMR, EPA, HCMT, NSW Heritage Office, MSB, NPWS, NSW Ag, NSW Fisheries, RTA and SSC.

[1] The DLWC and PlanningNSW are now known as the Department of Infrastructure, Planning and Natural Resources (DIPNR). However, herein they are referred to as the DLWC and PlanningNSW.

Table 1-6
Director-General's Requirements for the Project EIS – Reference Summary

Specific Issues to be Addressed	Main Text Reference	Appendix Reference
Under clause 73(1) of the *Environmental Planning and Assessment Regulation, 2000*, the Director-General requires the following specific issues to be addressed in the EIS:		
Description of the Proposal		
Describe and justify the proposal, clearly identifying the resource, the proposed site, the proposed works (including any rehabilitation works), the proposed intensity of operations, and the likely inter-relationship between these proposed operations and the existing or approved mining operations at the Wambo Coal Mine.	Sections 1 and 2	N/A
Permissibility		
Demonstrate that the proposal is permissible with consent.	Section 1	N/A
Statutory Instruments/Policies		
Assess the proposal against the relevant provisions in:	Section 1	N/A
• *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*;		
• *State Environmental Planning Policy No. 44 – Koala Habitat Protection;*		
• *Hunter Regional Environmental Plan 1989;*		
• *Hunter Regional Environmental Plan 1989 (Heritage);*		
• *Singleton Local Environmental Plan 1996;* and		
• any relevant Development Control Plans.		
Key Issues		
Assess the following potential impacts of the proposal during construction and operation, and describe what measures would be implemented to manage, mitigate, or offset these potential impacts:		
(a) subsidence;	Section 4.2	Appendix O
(b) surface water;	Section 4.6	Appendix E
(c) groundwater;	Section 4.7	Appendix F
(d) noise and vibration;	Section 4.4	Appendix A
(e) air quality/odour;	Section 4.5	Appendix B
(f) heritage, both European and Aboriginal;	Sections 4.13 and 4.14	Appendices C and D
(g) fauna and flora, particularly on critical habitats, threatened species, populations, or ecological communities;	Sections 4.8, 4.9 and 4.10	Appendices HA to HE
(h) soil;	Section 4.1	Appendix L
(i) traffic and transport;	Section 4.15	Appendix M
(j) hazards;	Section 4.16	Appendix K
(k) visual;	Section 4.3	Appendix N
(l) waste management;	Section 2.9	Appendix G
(m) utilities and services; and	Sections 2.11 and 4.11	Appendix J
(n) economic and social.	Sections 4.11 and 4.12	Appendices I and J
Cumulative Impacts		
Potential cumulative impacts of the Project should be assessed for the following environmental aspects:		
• air quality;	Section 4.5	Appendix B
• noise;	Section 4.4	Appendix A
• surface water;	Section 4.6	Appendix E
• groundwater;	Section 4.7	Appendix F
• flora and fauna;	Sections 4.8 and 4.9	N/A
• archaeology; and	Sections 4.13 and 4.14	N/A
• taking into account the proposed expansion of several mines in the surrounding area, particularly the United, Warkworth, Mount Thorley, Hunter Valley Operations, and Bulga mines.	Section 4	Appendices A, B, E, F, J, M and N

Table 1-6 (Continued)
Director-General's Requirements for the Project EIS – Reference Summary

Specific Issues to be Addressed	Main Text Reference	Appendix Reference
Environmental Monitoring and Management Plans Describe in detail how the environmental performance of the proposal would be monitored and managed over time, including the provision of specific details about the proposed monitoring programme (including location, frequency, and methods) and any mitigation measures to be implemented.	Section 6 and Section 4	N/A
Best Management Practice Current best management practice should be identified and reviewed for the following environmental issues, using any relevant Australian and International literature:		
• air quality (including particulate mater from construction and mining activities, air emissions from off-road vehicles, and odour from ventilation shafts);	Sections 4.5, 2.6.4 and 2.6.5	Appendix B
• noise;	Section 4.4	Appendix A
• fauna and flora; and	Sections 4.8 and 4.9	Appendices HA, HB, HC and HE
• subsidence and the associated surface and groundwater impacts.	Sections 4.2, 4.6 and 4.7	Appendices E, F and O
Consultation The EIS should include: • consideration of the requirements of key agencies, community members and groups as presented in Attachment 2; • consideration and review of key issues that emerge from consultation with surrounding landowners and occupiers that are likely to be affected by the proposal; and • a record of consultation undertaken with the relevant local, state and commonwealth government authorities, service providers and community groups in the area and issues raised during the preparation of the EIS.	Section 1.5	N/A

Source: After PlanningNSW (2002)

Regular issue-focussed meetings were conducted with PlanningNSW and other regulatory agencies. These have included formal and informal progress meetings with input from regulatory agencies on the assessment process.

1.5.3 Aboriginal Groups

Consultation with the Aboriginal community included the following recognised groups:

- Ungooroo Aboriginal Corporation;
- Wonnarua Nation Aboriginal Corporation;
- Upper Hunter Wonnarua Council;
- Wanaruah Local Aboriginal Land Council (LALC);
- Lower Wonnarua Tribal Council; and
- Combined Council of Hunter Valley Traditional Owners.

Representatives of the Upper Hunter Wonnarua Council are also members of the Wonnarua Nation Aboriginal Corporation.

The Project Planning Focus Meeting held on 4 December 2002 was attended by representatives of the Ungooroo Aboriginal Corporation.

Representatives of the Ungooroo Aboriginal Corporation, Upper Hunter Wonnarua Council, Wanaruah LALC and Lower Wonnarua Tribal Council accompanied the specialist archaeologists during field surveys conducted as part of the Aboriginal heritage assessment presented in Appendix D.

A consultation meeting held on 24 February was attended by the specialist archaeologist, representatives of WCPL and representatives of the Ungooroo Aboriginal Corporation, Wanaruah LALC, Lower Wonnarua Tribal Council and the Combined Council of Hunter Valley Traditional Owners.

Representatives of all of the aforementioned groups took part in a field survey to locate a ceremonial site conducted on 7 March 2003.

A further consultation meeting conducted on 17 March 2003 was attended by the specialist archaeologist, representatives of WCPL and representatives of the Ungooroo Aboriginal Corporation, Upper Hunter Wonnarua Council, Wanaruah LALC, Lower Wonnarua Tribal Council and the Combined Council of Hunter Valley Traditional Owners.

Consultation was undertaken in order to review the findings of the field surveys, determine cultural values and provide comment on the proposed management strategies for identified Aboriginal objects.

1.6 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The concept of sustainable development came to prominence at the World Commission on Environment and Development 1987, in the report entitled *Our Common Future*, which defined sustainable development as:

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

In recognition of the importance of sustainable development the Commonwealth Government (1992) developed a National Strategy for Ecologically Sustainable Development (NSESD) that defines ecologically sustainable development (ESD) as:

> *"using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased."*

The NSESD was developed with the following core objectives:

- enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- provide for equity within and between generations; and
- protect biological diversity and maintain essential processes and life support systems.

In accordance with these core objectives the NSESD challenges the mining industry in Australia (Commonwealth of Australia, 1992):

> *"to further develop the mining industry in a way which manages the renewable and non-renewable resources on which it depends in an efficient manner which is also consistent with the principles of ESD."*

Australia's commitment to the principles of ESD is further enshrined in the EPBC Act, which defines ecologically sustainable use of natural resources as:

> *"use of natural resources within their capacity to sustain natural processes while maintaining the life-support systems of nature and ensuring that the benefit of the use to the present generation does not diminish the potential to meet the needs and aspirations of future generations."*

This definition is supported at the State (NSW) level by the EP&A Regulations, which requires an EIS to justify a proposed development:

> *"having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:*
>
> *(a) 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) *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*

(ii) *an assessment of the risk-weighted consequences of various options,*

(b) *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,*

(c) *conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*

(d) *improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:*

(i) *polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*

(ii) *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,*

(iii) *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.*

1.6.1 Ecologically Sustainable Development for the Project

In recognition of the importance of ESD, the Project design, planning and assessment has been conducted in accordance with the principles of ESD, through:

- incorporation of risk assessment within the decision-making process;
- adoption of high standards for environmental and occupational health and safety performance;
- consultation with regulatory and community stakeholders; and
- optimisation of the economic benefits to the community arising from the development of the Project.

Assessment of potential long-term impacts of the Project was performed during the preparation of specialist reports on aspects of air quality, noise, water management, cultural heritage, ecology (flora and fauna), landscape assessment and rehabilitation.

The Project design takes into account biophysical, economic and social considerations, including the principles of ecologically sustainable development identified in the EP&A Regulations. The following section addresses the application of the principles of ESD to the Project.

Precautionary Principle

Consideration of the precautionary principle in the design, planning and assessment of the Project is evident in the identification of risks and the range of mitigation measures presented throughout this EIS. A preliminary hazard analysis (PHA) (Appendix K) was conducted to identify risks and develop appropriate mitigation measures and strategies. The PHA focuses on short-term catastrophic events, while longer-term non-catastrophic risks are considered by the specialist studies conducted in support of this EIS. These are presented in Section 4 and relevant appendices. Measures designed to mitigate potential environmental impacts arising from the conduct of the Project are also presented in Section 4.

A number of measures have been adopted to minimise the potential for serious and/or irreversible damage to the environment, including:

- design and planning such that the Wollombi Brook and Wollombi Brook flood plain would not be affected by Project activities;
- design and planning such that the escarpment boundary of the Wollemi National Park would not be affected by Project activities;
- creation of designated enhancement areas to protect local vegetation communities, including the Warkworth Sands Woodland and White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological communities listed in the schedules of the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and/or Commonwealth EPBC Act (Section 4.8.2); and
- modification of the extent of Project open cut and underground mining and the Project rail spur to avoid, where practicable, the disturbance of certain Aboriginal archaeological sites.

Social Equity

Social equity is defined by inter 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:

- development of a conceptual rehabilitation strategy (Section 5) with aims that include the creation of stable post-mining landforms that enhance the amenity of the local landscape and contribute to local and regional habitat corridors;
- management of local surface and groundwater resources such that flow and water quality in Wollombi Brook and the Hunter River is not measurably reduced and in a manner that minimises impacts to downstream users (Sections 4.6 and 4.7 and Appendices E and F);
- direct employment of up to 370 people and net production benefits to Australia in the order of $547M (Appendix I); and
- modification of the extent of Project open cut and underground mining and the Project rail spur to avoid, where practicable, the disturbance of certain Aboriginal archaeological sites.

Biological and Ecological Integrity

Biodiversity is defined in the EPBC Act as the variability among living organisms from all sources (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.

The Project addresses the principles of ecological integrity and biodiversity by proposing an environmental management framework designed to conserve, wherever possible, ecological values and long-term species diversity and abundance. This is to be supported through measures including:

- design of infrastructure to minimise impacts on the existing environment;
- incorporation of progressive rehabilitation (Section 5), taking into account regional planning documents such as the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (DMR, 1999);
- creation of designated enhancement areas to protect local vegetation communities, including the Warkworth Sands Woodland and White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological communities listed in the schedules of the NSW TSC Act and/or Commonwealth EPBC Act (Section 4.8.2);
- compliance with statutory conditions and guidelines (Section 1.3); and
- commitment to an ongoing programme of environmental monitoring and reporting (Section 6).

Valuation

Historically, environmental costs have been considered external to project development costs. Improved valuation and pricing methods attempt to internalise environmental costs and include them within project costing.

The economic assessment presented in Appendix I identifies environmental impacts and discusses them from an economic perspective. Environmental costs associated with Project greenhouse gas emissions were valued and incorporated within the final calculation of the net production benefit to Australia, which was estimated at $547M (Appendix I).

Other environmental costs that are not readily quantifiable are considered predominantly through the pricing of measures that would be adopted to mitigate environmental impacts (Section 4) and inclusion of these within Project costing.

1.7 PROJECT ALTERNATIVES

1.7.1 Mining Method

Coal deposits are typically mined in one of two ways:

- underground methods (whereby the deposit is accessed via a small surface opening leading to subsurface excavations which expose the deposit); or
- open cut methods (whereby mining occurs from the surface downwards to progressively expose all of the economic deposit).

Wambo Coal Mine operations to date have included a combination of both underground and open cut mining methods. The Project would utilise open cut mining methods to recover coal resources from shallower, more readily accessible seams, while underground mining methods would be used to recover deeper coal reserves where open cut mining is precluded by economic constraints.

The open cut mining method requires the utilisation of excavators, trucks and dozers to enable the optimum level of resource recovery. This equipment is suitably flexible to facilitate the economic recovery of multiple coal seams.

Environmental benefits of this mining method include operational flexibility for management of dust, noise and other environmental impacts and planning flexibility to enable the continuation of open cut mining operations at shielded locations during adverse weather conditions. A degree of flexibility in the minimisation of visual impacts is also available.

Some 459 ha of remnant vegetation would be removed by Project open cut mining operations (Section 4.8.1). Open cut mining in this area was selected due to the absence of coal reserves that could be mined economically by underground mining methods (WCPL, 2003).

Underground mining methods considered include longwall mining and room-and-pillar techniques. Longwall mining is typically applied to thin, bedded deposits, with uniform thickness and large horizontal expansion, while room-and-pillar methods are suited to the mining of flat, bedded deposits of limited thickness, including coal seams.

Following consideration of the geology and geometry of the coal resource, and economic and environmental constraints, longwall mining was selected as the preferred method for underground mining.

Sections 2.5 and 2.6 describe Project open cut and underground mining operations.

1.7.2 Wambo Homestead Complex

The WHC is described in Section 3.11.1 and is situated within the outline of Project open cut mining operations. Alternatives considered in relation to the mining of coal reserves beneath the WHC curtilage are presented in Section 4.14.1 and included restrictions on the extent of mining operations and the relocation of elements of the WHC.

The restricted mining alternative considered the establishment of a buffer zone around the WHC curtilage within which no mining would occur. Under this alternative the WHC would remain. Modifications to the surrounding landscape and land use would, however, significantly affect both the short and long-term heritage significance of the WHC.

A relocation proposal for the WHC has been considered and formulated. Substantial relocation of the following items to sites within the Singleton LGA and the wider Hunter region would be undertaken under this alternative:

- Stud Master's Cottage;
- Slab Horse Boxes;
- Butcher's Hut;
- Carriage House; and
- Mounting Yards.

The relocation proposal for the remaining components of the WHC would comprise salvage of and relocation of substantial elemental fabric for use elsewhere for interpretation purposes or re-use on other Heritage listed properties.

The restricted mining alternative was not considered feasible as it would result in substantial economic losses from the sterilisation of coal reserves under the WHC curtilage, while heritage values would continue to be eroded.

The relocation alternative was therefore selected and is discussed further in Section 4.14.1.

1.7.3 Production Rate

The scale of a mining project is determined by the optimum production rate that ensures profitability and ongoing viability. WCPL undertook an analysis of coal resources, mining methods, markets and hours of operation to determine the optimum production level for the Project. Alternative ROM coal production rates were considered for open cut mining and underground mining operations.

Open cut mining ROM coal production rates between 4 Mtpa and 15 Mtpa were considered in conjunction with ROM coal production from underground mining operations ranging from 2 Mtpa to 10 Mtpa.

Open cut mining ROM coal production rates in the order of 15 Mtpa were not considered feasible due to the cost and extent of environmental constraints associated with this level of production, while lower production rates in the order of 4 Mtpa did not meet WCPL criteria for economic viability. Following a consideration of relevant economic, social, geological and environmental constraints the peak optimum open cut mining production rate was determined to be 8 Mtpa of ROM coal.

Underground mining ROM coal production rates in the order of 10 Mtpa were not considered feasible due to a combination of mining method, economic and environmental constraints. Optimum underground ROM coal production rates peak at 7.5 Mtpa.

Consideration of the cost of Project development, associated infrastructure and ongoing expenses, such as coal transportation costs, resulted in the selection of a variable overall ROM coal production rate that ranges between 4.0 Mtpa and 14.7 Mtpa and a 24 hour per day, 7 days per week operation.

The provisional mine schedule is presented in Section 2.5.1.

1.7.4 Transport

Product coal is currently transferred by truck from the Wambo Coal Mine, via the Golden Highway, to the MTCL for rail to the Port of Newcastle. Alternatives considered for the transportation of product coal included:

- continuation of road haulage of product coal to the MTCL at a rate of 3 Mtpa;
- expansion of road haulage to enable the transfer of product coal beyond the current rate of 3 Mtpa;
- construction of rail and train loading infrastructure to enable the transportation of product coal by rail from the Wambo Coal Mine to market (removing road haulage of product coal entirely).

Condition 10(a) of DA 108/91 (SSC, 1992) provides an indication of the desire at the local government level for the cessation of road haulage of product coal. Transportation of product coal by rail to market has the potential to remove in the order of 160,000 annual Wambo Coal Mine truck movements from the Golden Highway. The Project rail spur would also be available for the transport of coal from surrounding mines (e.g. Hunter Valley Operations and United Colliery) which (either currently or in the recent past) transport coal by road to the MTCL. This could result in the removal of in the order of a further 240,000 truck movements per annum from public roads.

Conversely, road haulage of product coal at up to 11.3 Mtpa would require a substantial increase in the number of truck movements on the Golden Highway.

The selection of the rail option acknowledges the desire of the local community to reduce product coal haulage on the public road network, is consistent with the objectives of environmental planning instruments such as the Hunter REP and follows consideration of a range of economic, social and environmental factors.

The location of the rail spur and rail loop was selected following an analysis of economic, social and environmental factors, including potential impacts on the road network (e.g. the Golden Highway and Wallaby Scrub Road) and heritage items.

1.7.5 Waste Rock, Coarse Reject and Tailings Management

Mined material that does not contain economic coal is termed waste rock, while mine waste rock materials generated by the washing of ROM coal in the CHPP consist of coarse and fine reject (tailings) streams.

Tailings, coarse rejects and waste rock are usually disposed of in open cut voids and/or mine waste rock emplacements and progressively rehabilitated (stabilised and revegetated). Options considered for disposal of Project mine waste rock materials included:

- disposal of all mine waste rock material in permanent out-of-pit mine waste rock emplacements;
- storage of mine waste rock material in temporary out-of-pit mine waste rock emplacements followed by rehandling of all mine waste rock to backfill the open cut; or
- use of a combination of open cut backfilling and permanent out-of-pit mine waste rock emplacements.

The final option was selected for the Project as it allows progressive rehabilitation of mine landforms to minimise visual impacts during the mine life, avoids additional dust and noise emissions associated with rehandling Project mine waste rock materials and allows for the disposal of Project tailings using proven methods (Section 2.9 and Appendix G).

1.8 CONSEQUENCES OF NOT PROCEEDING WITH THE PROJECT

In accordance with the requirements of the Director-General of PlanningNSW, an assessment of the consequences of not proceeding with the Project has been conducted. Were the Project not to proceed the following consequences are inferred:

- net production benefits to Australia of $547M would not occur (Section 4.12.1 and Appendix I);
- a peak of up to 370 direct employment opportunities, and associated flow-on effects, would not be created (Section 2.13 and Appendix I);
- the proposed rail and train loading infrastructure would not be constructed and in the order of 160,000 Wambo Coal Mine annual product coal haulage truck movements would continue via the Golden Highway (Section 4.15.1 and Appendix M);
- alterations to current land use practices would not occur; and
- Project tax revenue would not be generated (Appendix I).

1.9 GREENHOUSE EMISSIONS

The Kyoto Protocol was developed in 1997 with provisions that, once enacted, will limit emissions of the following six greenhouse gases or groups of gases:

- carbon dioxide (CO_2);
- methane (CH_4);
- nitrous oxide (N_2O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs); and
- sulphur hexafluoride (SF_6).

The Protocol contains provisions designed to limit the emissions of greenhouse gases in Australia to no more than 108% of 1990 levels.

The air quality assessment presented in Appendix B assesses the greenhouse gas emissions likely to result from Project activities and reports the results in terms of carbon dioxide equivalents (CO_2-e).

Estimated Project CO_2-e emissions from the consumption of fuels, explosives and electricity would be less than 0.3 Mtpa, while up to an estimated 2.6 Mtpa would be released through the mine ventilation and gas drainage system (Appendix B). It is estimated that approximately 45 Mt CO_2-e emissions would be released over the 21 year life of the Project at an average rate of approximately 2.2 Mtpa CO_2-e. This represents around 0.41% of the annual national greenhouse gas emission rate[2].

2 Based on 2000 estimate of 535.3 Mt (CO_2-e) (AGO, 2002)

More significant greenhouse gas emissions would result from the burning of coal produced by the Project. Conservatively assuming conversion of all product coal to CO_2, the emissions would average approximately 11.2 Mtpa or 0.2% of the annual global production of carbon from the combustion of fossil fuels and cement production[3] (Appendix B).

1.10 PROJECT CONSULTANTS

This EIS was prepared by Resource Strategies Pty Ltd with specialist input provided by the following organisations and individuals:

- WCPL (*project design, background data and resource economics*);
- Australasian Groundwater and Environmental Consultants (*groundwater assessment*);
- EJE Town Planning *(non-Aboriginal heritage survey and assessment)*;
- Elizabeth White (Archaeologist) (*Aboriginal heritage survey and assessment*);
- Gilbert and Associates (*surface water assessment*);
- Gillespie Economics (*economic assessment*);
- Greg Richards and Associates (*bat fauna survey and assessment*);
- Holmes Air Sciences (*air quality assessment*);
- GE Holt & Associates *(subsidence assessment)*;
- Mount King Ecological Surveys (*terrestrial fauna survey and assessment*);
- Orchid Research (*flora survey and assessment*); and
- Richard Heggie Associates (*noise and blasting assessment*.

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3 Based on 1996 estimate of 5.5 Gt (CO_2) (IPCC, 1996)

WAMBO DEVELOPMENT PROJECT

MAIN REPORT

Section Two
Project Description

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2 PROJECT DESCRIPTION

2.1 COAL RESOURCE

The Project is located in the Hunter Coalfield, a subdivision of the Sydney Basin (Figure 1-1). The Hunter Coalfield covers an area of approximately 2,100 square kilometres (km^2) and contains coal measures of bituminous rank and Permian in age and comprises a large variety of coal types predominantly high quality thermal coals and semi-soft coking coals.

Current mining operations at the Wambo Coal Mine utilise open cut mining methods to extract coal from the Wittingham Coal Measures. Prior to October 2002 WCPL also operated a number of underground mines. Within the Project area the upper portion of the Wittingham Coal Measures (Jerrys Plains Subgroup) contain some 15 formally named coal seams, many of which have mining potential. The Wollombi Coal Measures, overlying the Wittingham Coal Measures, outcrop in the south-west of the Project area and do not contain economic coal reserves. The Project general arrangement is shown on Figure 2-1, while Figures 2-2 and 2-3 identify the main stratigraphic units to be mined by the Project. A more detailed description of the site geology is provided in Section 3.1.3.

The Project would include the extraction of coal from several seams within the Jerrys Plains Subgroup. The Whybrow, Redbank Creek, Wambo and Whynot Seams would be mined using open cut methods, while the Whybrow, Wambo, Arrowfield and Bowfield Seams would be mined using underground mining methods (Figures 2-1 and 2-3).

These seams dip gently to the south-west at approximately 2 to 3 degrees with minor local variations due to varying thicknesses of interseam sediments and fault zones. Faulting usually trends north or north-east to south-west with normal throws of up to 10 m with some low angle thrusts (i.e. reverse faults) of variable throw (MineConsult, 2001).

The recoverable coal reserve for the Project comprises approximately 202 Mt of which approximately 98 Mt would be mined by open cut methods and some 104 Mt by underground mining methods. Open cut mining operations would require the excavation of some 640 million bank cubic metres (Mbcm) of waste rock.

A summary of the structure and characteristics of the various coal seams to be mined as part of the Project is provided in the following subsections.

2.1.1 Whybrow Seam

The Whybrow Seam is part of the Mount Leonard Formation (the uppermost unit of the Jerrys Plains Subgroup) and consists of plies A, B and C (Table 2-1 and Figure 2-2). The Whybrow Seam produces a low ash thermal coal.

Coal from the Whybrow Seam would be extracted by both open cut and underground mining operations over the life of the Project. Approximately 6.5 Mt of ROM coal would be extracted from the Whybrow Seam using underground mining methods while approximately 20 Mt of ROM coal would be mined using open cut mining methods.

2.1.2 Redbank Creek Seam

The Redbank Creek Seam comprises A, B, C and D plies, and is the uppermost of the four coal seams within the Malabar Formation (Table 2-1 and Figure 2-2). The A, B and C plies produce a high ash thermal coal. The D ply produces a low ash thermal coal.

Approximately 28 Mt of ROM coal would be extracted from the Redbank Creek Seam using open cut mining methods.

2.1.3 Wambo Seam

The Wambo Seam (Table 2-1) is part of the Malabar Formation of the Jerrys Plains Subgroup (Figure 2-2) and produces a low ash thermal coal. Approximately 19 Mt of ROM coal would be extracted from the Wambo Seam using underground mining methods, while approximately 25 Mt of ROM coal would be extracted from the Wambo Seam using open cut mining methods. This seam produces a low ash thermal coal.

Above the Wambo Seam lie the Wambo Rider A and Wambo Rider C Seams being 0.7 m and 0.4 m thick respectively. These seams would be mined by open cut mining methods where it is economic to do so.

2.1.4 Whynot Seam

The Whynot Seam overlies the basal Blakefield Seam of the Malabar Formation (Figure 2-2) and produces a low ash thermal coal.

Approximately 25 Mt of ROM coal would be extracted from the Whynot Seam by open cut mining methods.

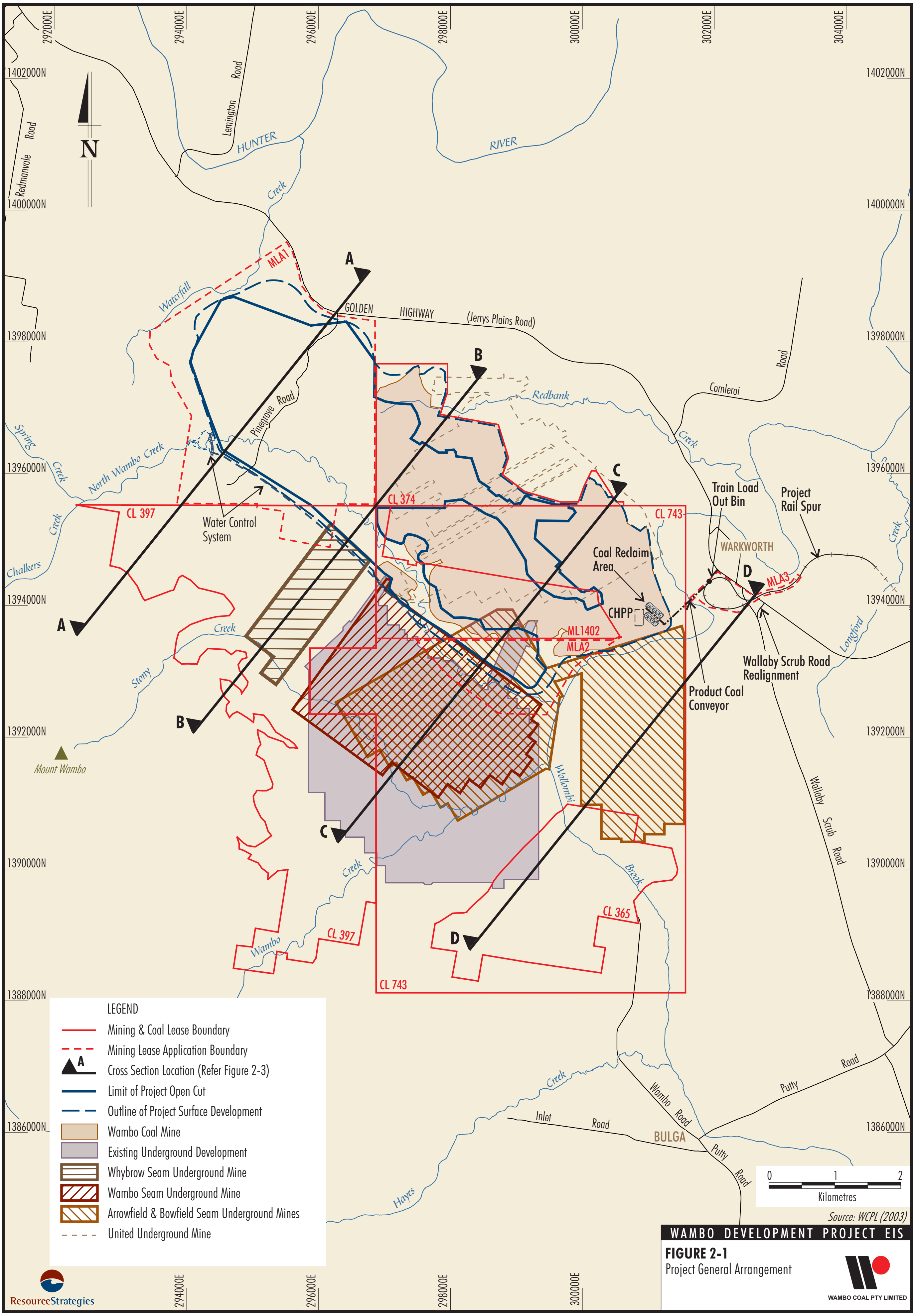

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FIGURE 2-1
Project General Arrangement

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

[1] Coal reserves currently/previously mined at the Wambo Coal Mine
[2] Coal reserves to be mined by the Project
[3] Coal reserves to be mined by the Project where the upper three plies of the Warkworth Seam combine with the two plies of the Bowfield Seam.

Source: Hunter Coalfield Regional Geology (1993)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-2
Stratigraphy of the Project Area

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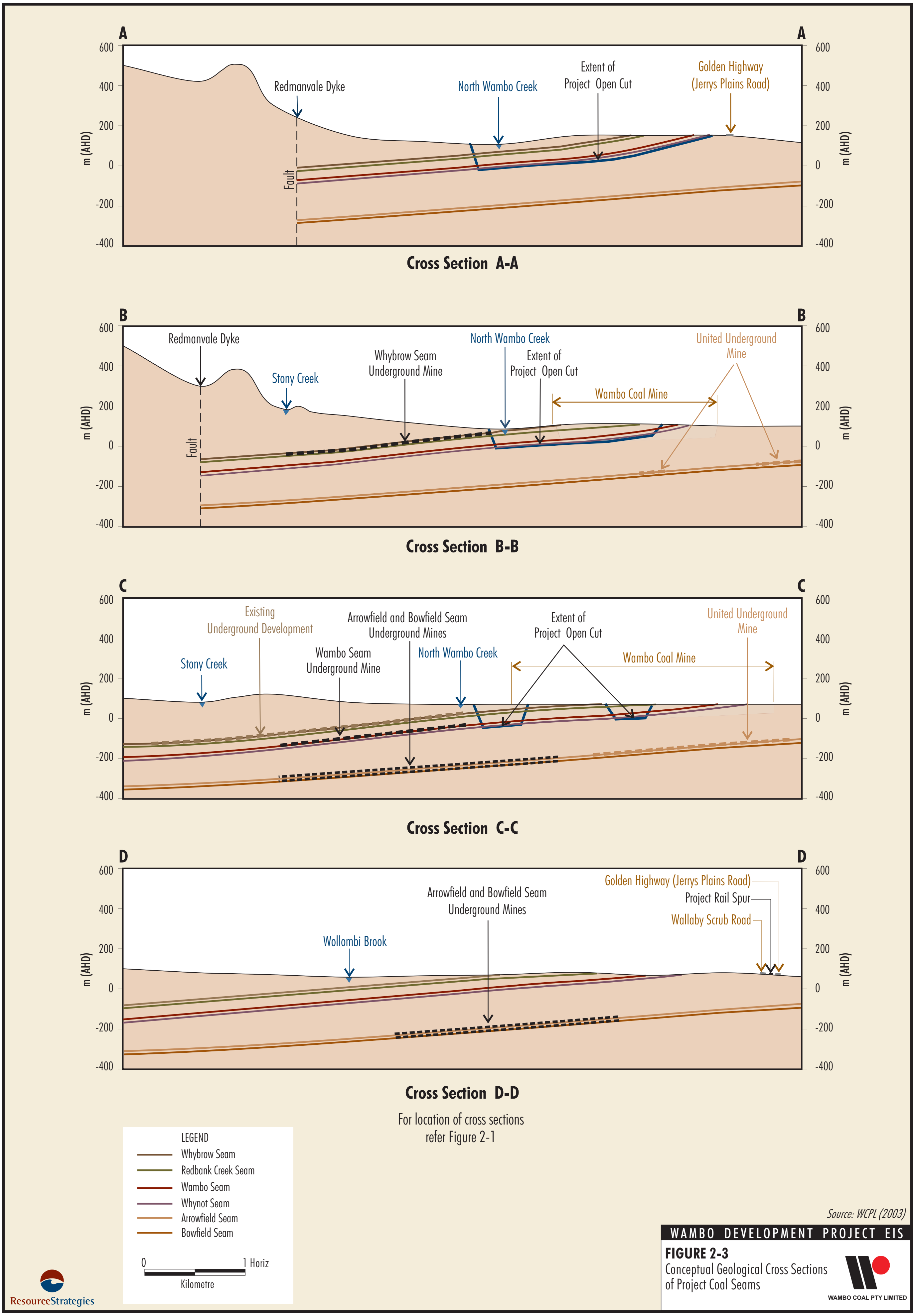


WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-3
Conceptual Geological Cross Sections
of Project Coal Seams

Table 2-1
Characteristics of the Project Coal Seams

Seam	Extraction Method	Ply	Average Thickness (m)	Raw Ash (%)
Whybrow	Underground/Open Cut	A	1.30	8.8-14.3
		B	0.25	80
		C	1.00	11.1-17.5
Redbank Creek	Open Cut	A	0.50	42.8
		B	0.55	33.8
		C	0.65	28.8
		D	1.30	17.5
Wambo	Underground/Open Cut	A	2.00	17
Whynot	Open Cut	A	0.90	23.8
		B	1.40	14.3
Arrowfield	Underground	A	1.00	6.2-20.7
		B	1.00	6.4-25.7
		C	1.00	5.3-23.0
		D	0.25	6.7-37.5
		E	0.25	6.7-22.1
Bowfield (Incorporates Warkworth Seam plies A,B,C)	Underground	BFA	2.02	12.4-31.8
		BFB	0.20	71.1-88.0
		WKA	1.29	8.4-29.6
		WKB	0.15	25.3-81.7
		WKC	0.44	7.0-52.1

Source: WCPL (2003)

2.1.5 Arrowfield Seam

The Arrowfield Seam is the uppermost seam of the Mount Thorley Formation of the Jerrys Plains Subgroup and is overlain by the Milbrodale Formation, a white tuffaceous claystone to cherty siltstone (Figure 2-2). The Arrowfield Seam comprises five coal plies (Table 2-1) and would produce a low ash thermal coal.

Approximately 49 Mt of ROM coal would be extracted from the Arrowfield Seam using underground mining methods.

2.1.6 Bowfield Seam

The Bowfield Seam underlies the Arrowfield Seam and is part of the Mount Thorley Formation (Figure 2-2). In the Project area the Bowfield Seam forms a working section where the upper three plies of the underlying Warkworth Seam have combined with the two plies of the Bowfield Seam.

The Bowfield Seam working section therefore consists of five plies (Table 2-1) and would produce a low ash thermal coal.

Approximately 29 Mt of ROM coal would be extracted from the Bowfield Seam using underground mining methods. A further 23 Mt of Bowfield Seam reserves would remain after the 21 year Project approval period.

2.2 EXISTING MINING OPERATIONS

The Wambo Coal Mine is currently an open cut operation.

Open cut mining operations are supported by infrastructure including administration, bathhouse, workshop, safety and training buildings, haul roads, access roads, refuelling facilities, hardstand areas, as well as the CHPP and associated coal handling infrastructure.

2.2.1 Existing Open Cut Mining Operations

Open cut mining at Wambo Coal Mine commenced in 1969 to support the development of underground operations.

Following a suspension of operations between March 1999 and August 2001, open cut mining recommenced at a rate of 1 Mtpa of ROM coal. With the closure of the Wollemi Underground Mine operations in October 2002, open cut operations were expanded to maintain an overall production rate of 3 Mtpa of product coal.

Waste rock material is placed in open cut voids or in mine waste rock emplacements beyond the economic open cut mining limits. A number of other open cut areas mined over the life of the Wambo Coal Mine have extracted coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams. The majority of these areas have since been partially or fully rehabilitated.

Historically the average ROM strip ratio for open cut operations has been 7:1 (i.e. 7 bcm of waste rock to 1 t of coal).

Coal is transported by off-road rear dump trucks to the CHPP ROM hopper for beneficiation.

2.2.2 Previous Underground Mining Operations

Underground mining commenced at the Wambo Coal Mine in 1969. The most recent underground mining operations were the Homestead Underground Mine and the Wollemi Underground Mine. Both the Wollemi and Homestead Underground Mines extracted coal from the Whybrow Seam.

The Homestead Underground Mine commenced in 1979 and operated until 1999. The mine entries were sealed in March 2003. Infrastructure at the Homestead Underground Mine comprises an administration building, bathhouse and mechanical and electrical workshops. This infrastructure is not currently utilised.

The Wollemi Underground Mine commenced production in 1997 and was placed under care and maintenance in October 2002 with the available reserves exhausted. The Wollemi Underground Mine produced 3.2 Mt of ROM coal during the 2001/2002 financial year.

Infrastructure at the Wollemi Underground Mine includes sealed access roads, administration buildings, workshops and a bathhouse. An earthen bund surrounds the box cut to provide flood protection from North Wambo Creek and has been vegetated with native tree and shrub species.

Coal extracted from the Wollemi Underground Mine was transferred by conveyor across North Wambo Creek to the Wollemi ROM coal stockpile. Stockpiled ROM coal was then hauled by truck to the CHPP for beneficiation.

Other decommissioned underground mining operations at the Wambo Coal Mine include the Wambo Underground Mine (Wambo Seam) and Ridge Underground Mine (Whybrow Seam).

The United Colliery currently operates a longwall underground mine in the Arrowfield Seam beneath portions of the Wambo Coal Mine open cut operations.

2.2.3 Existing Coal Handling and Preparation Plant

Infrastructure at the CHPP includes ROM and product coal stockpiles, two CHPP modules (one operational and one decommissioned), workshops, administration building and a bathhouse.

ROM coal from existing open cut operations is reclaimed, crushed, screened and washed at the CHPP. The CHPP has a nominal capacity of 900 tph. Waste material generated by the CHPP comprises coarse rejects and tailings slurry. Coarse rejects are placed within open cut voids and mine waste rock emplacements. Tailings are pumped into open cut voids which are rehabilitated when full using a process of encapsulation/ incorporation with mine waste rock and coarse reject material.

2.2.4 Existing Administration, Safety and Training Facilities

The existing main administration building is centrally located for the current operations and is sited adjacent to the store and contractor’s facilities. A converted dwelling (“Coralie”) is utilised as a safety and training centre and is located off the Wambo Access Road east of Wollombi Brook.

2.3 PROJECT GENERAL ARRANGEMENT

The general arrangement of the Project has been designed to maximise the utilisation of Wambo Coal Mine infrastructure components. Figure 2-4 shows the provisional development schedule for the Project. Project general arrangements for Years 2, 4, 7, 9, 13 and 20 are shown on Figures 2-5 to 2-10. These general arrangements are based on planned maximum production and mine progression. The main activities associated with development of the Project would include:

- upgrade of the existing CHPP to facilitate increased coal production;
- construction and operation of a rail spur, rail loop, coal reclaim area, product coal conveyor and train load-out bin to enable the transport of product coal by rail to market;
- construction of a rail spur underpass beneath the Golden Highway;
- realignment of the intersection between Wallaby Scrub Road and the Golden Highway;
- continued development of open cut mining operations within existing WCPL mining and coal leases and into MLA1 to the north-west and MLA2 within CL 743;
- selective auger mining of the Whybrow, Redbank Creek, Wambo and Whynot Seams up to 200 m beyond the open cut limits within WCPL owned land;
- continued placement of waste rock and coarse rejects within mine waste rock emplacements;
- continued placement of tailings within open cut voids and capping with waste rock and coarse rejects;
- an extension to the existing Wollemi Underground Mine Box Cut (within the limits of the Project open cut mining area) to provide direct access for three underground longwall panels in the Whybrow Seam;
- extension of drifts from the Wollemi Underground Mine to facilitate longwall mining of the Wambo Seam;
- construction of a portal and drift access adjacent to the CHPP to facilitate longwall mining of the Arrowfield and Bowfield Seams;
- development of a water control structure across North Wambo Creek at the north-western limit of the open cut operation and a channel to allow the passage of flows to the lower reaches of North Wambo Creek around the open cut development;
- de-gazettal and physical closure of Pinegrove Road;
- development of new access roads and internal haul roads;
- relocation of the existing explosives magazine and construction of additional hydrocarbon storage facilities; and
- relocation of the administration area and site offices.

The mining sequence shown on Figures 2-5 to 2-10 may vary to take account of localised geological features, coal market volume and quality requirements and mining economics. The mining sequence over any given period would be documented in the relevant Mining Operations Plan (MOP) as required by the DMR.

The current administration office, bathhouse and workshop have been evacuated until the United Colliery longwall passes underneath them and subsidence is finished. It is planned that once necessary refurbishment of these facilities has been completed they would be reoccupied. Mine waste rock placement in this area would avoid the locale until these facilities are relocated.

Figures 2-5 to 2-10 also show the approximate location of dwellings in the vicinity of the Project. For the purposes of this EIS, a dwelling is taken to be a place in which people reside, whether on a permanent or intermittent basis.

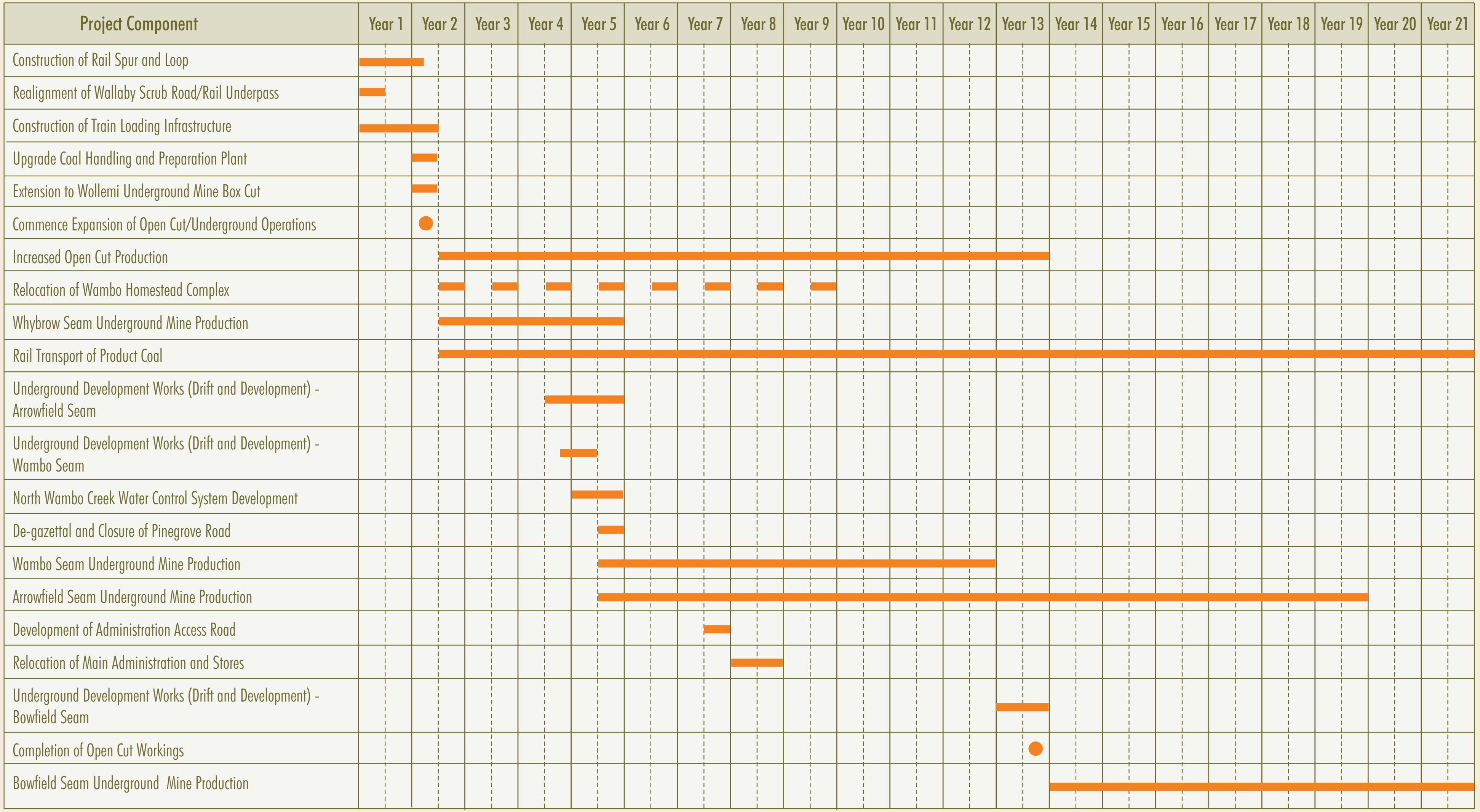
2.4 INITIAL PROJECT DEVELOPMENT ACTIVITIES

Infrastructure that is required to support the Project would be progressively developed in parallel with ongoing mining operations.

The key Project components that would be constructed during the initial stages of Project development include (Figure 1-5):

- upgrade of the existing CHPP, product coal stockpile area and reclaim system;

Provisional Development Schedule



Source: WCPL (2003)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-4
Provisional Development Schedule

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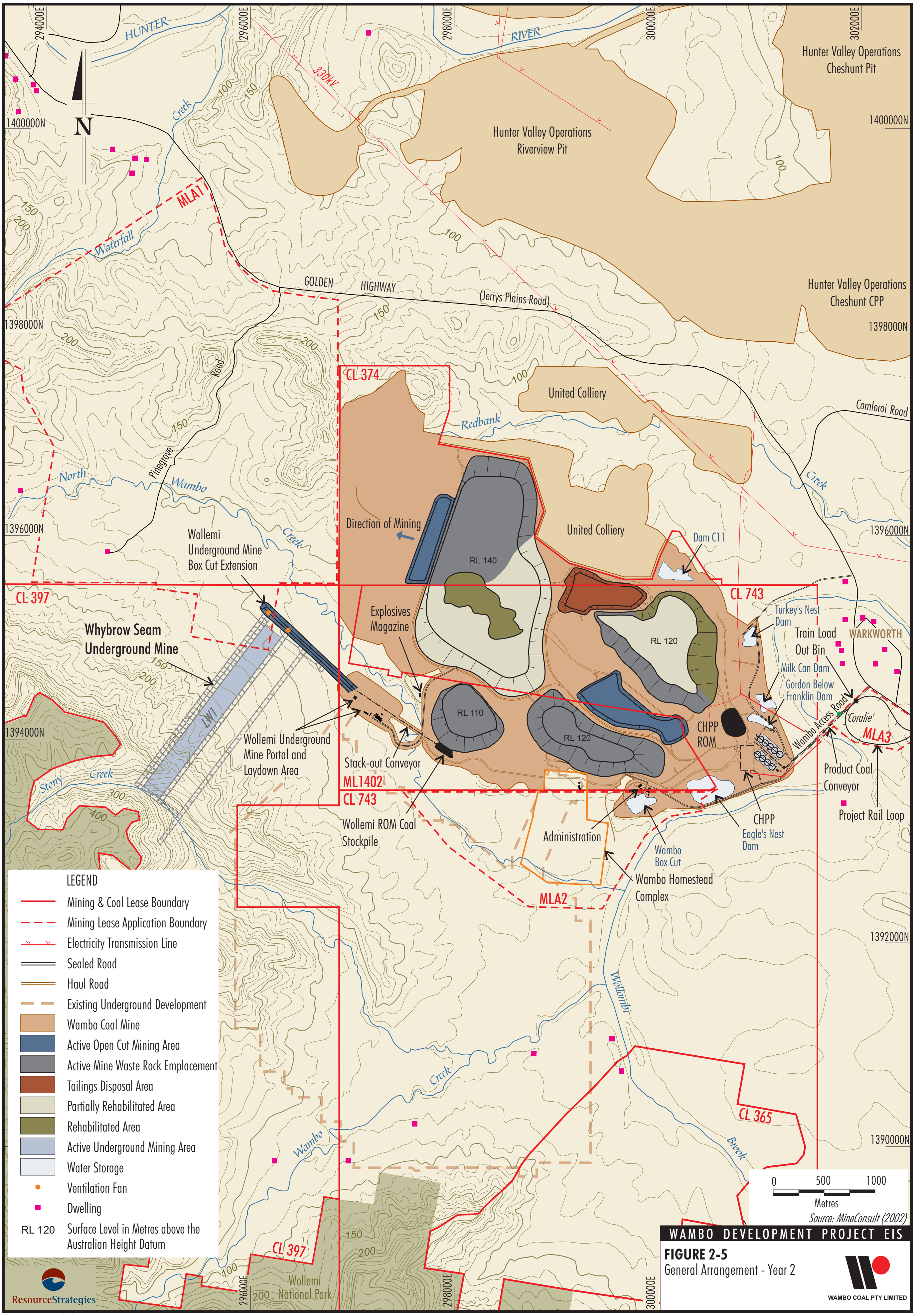

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-5
General Arrangement - Year 2

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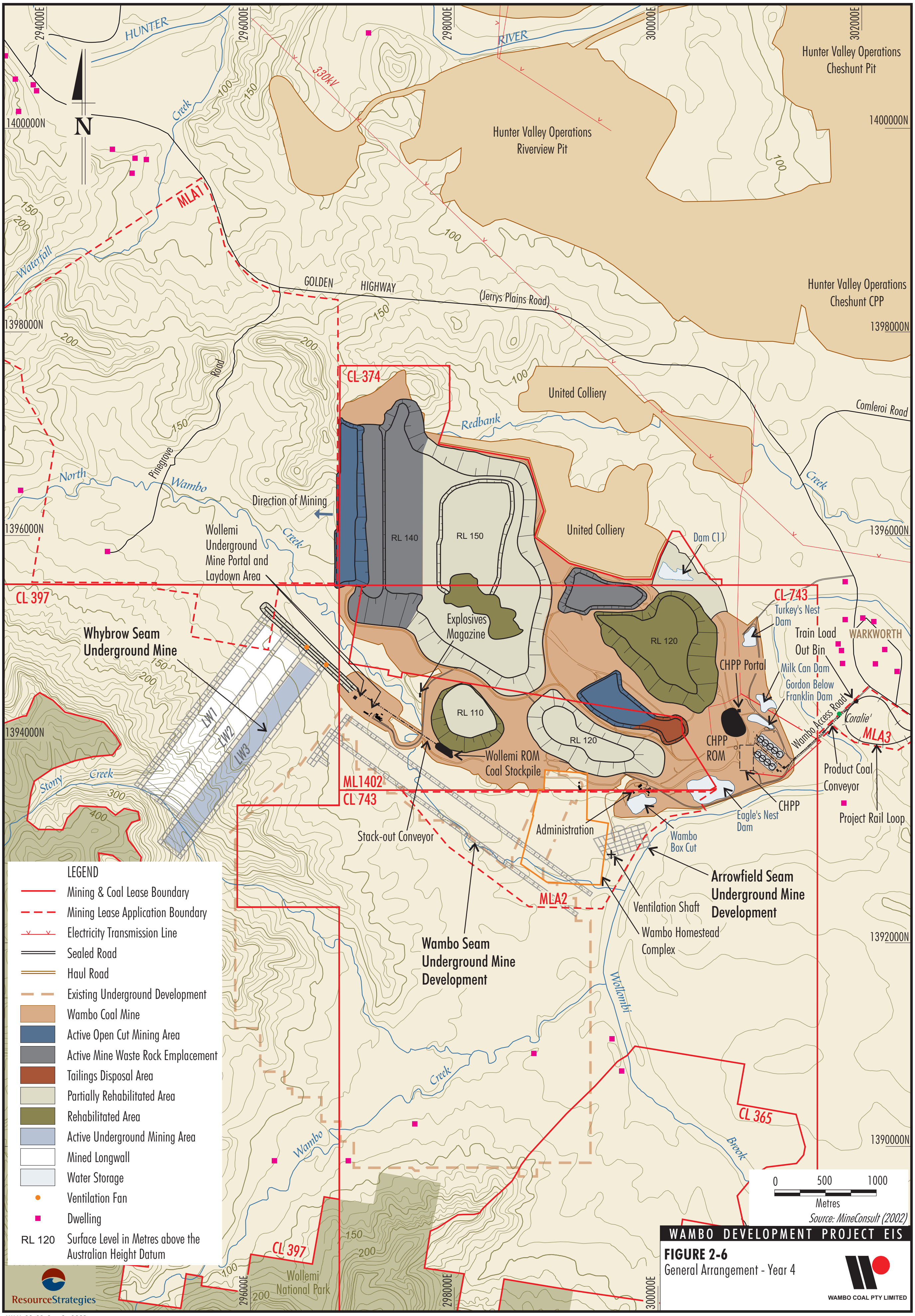

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FIGURE 2-6
General Arrangement - Year 4

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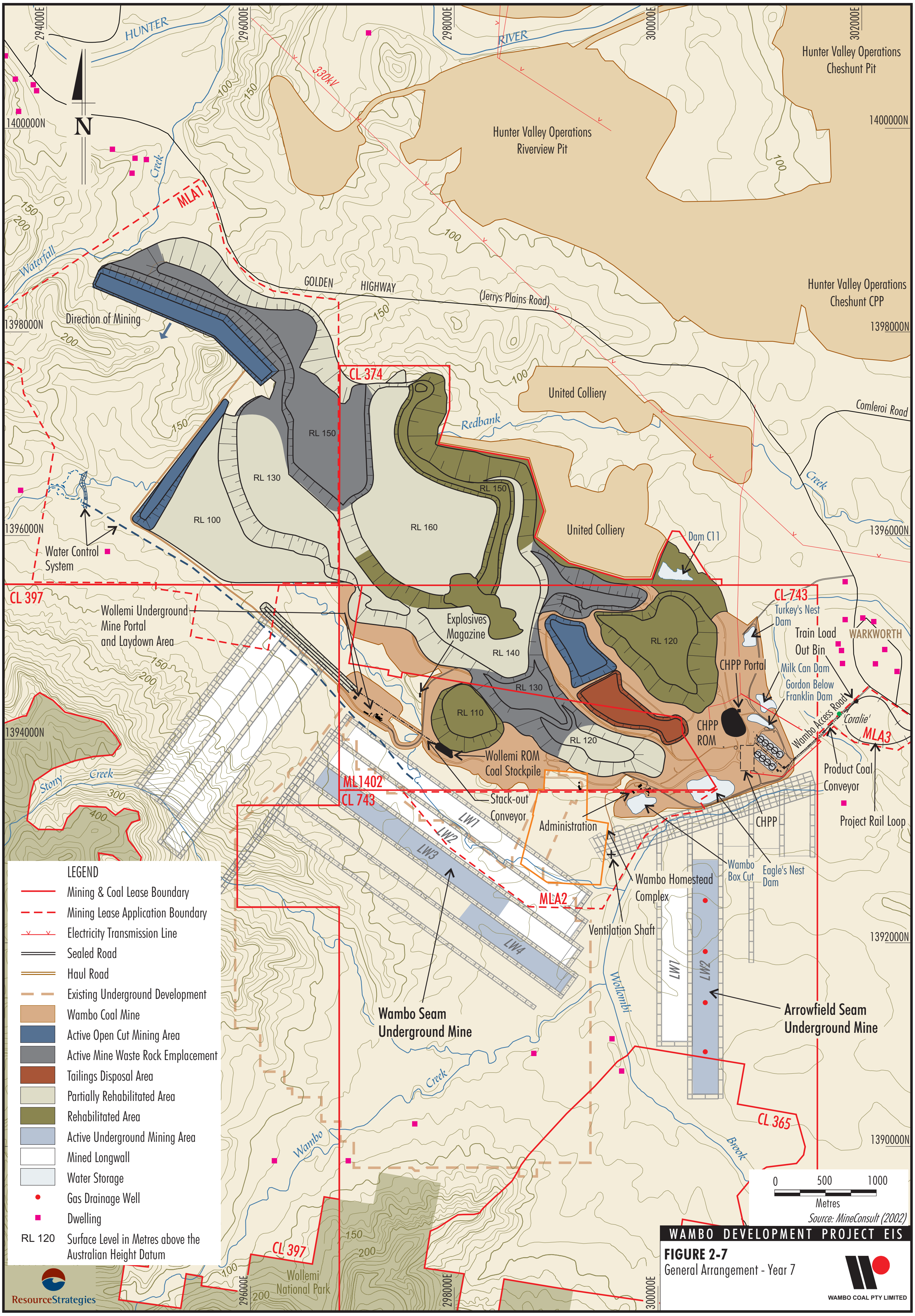

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-7
General Arrangement - Year 7

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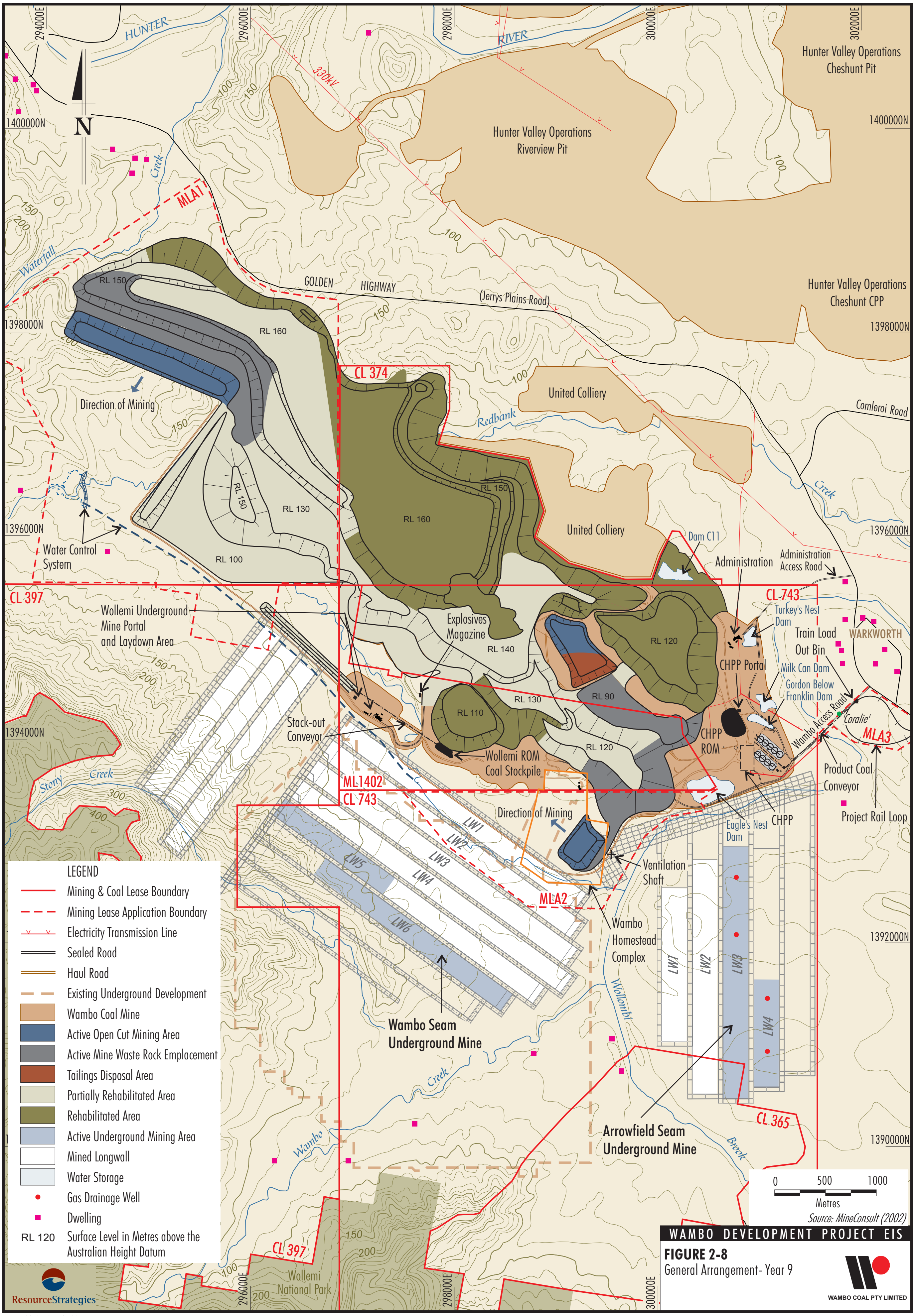

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-8
General Arrangement- Year 9

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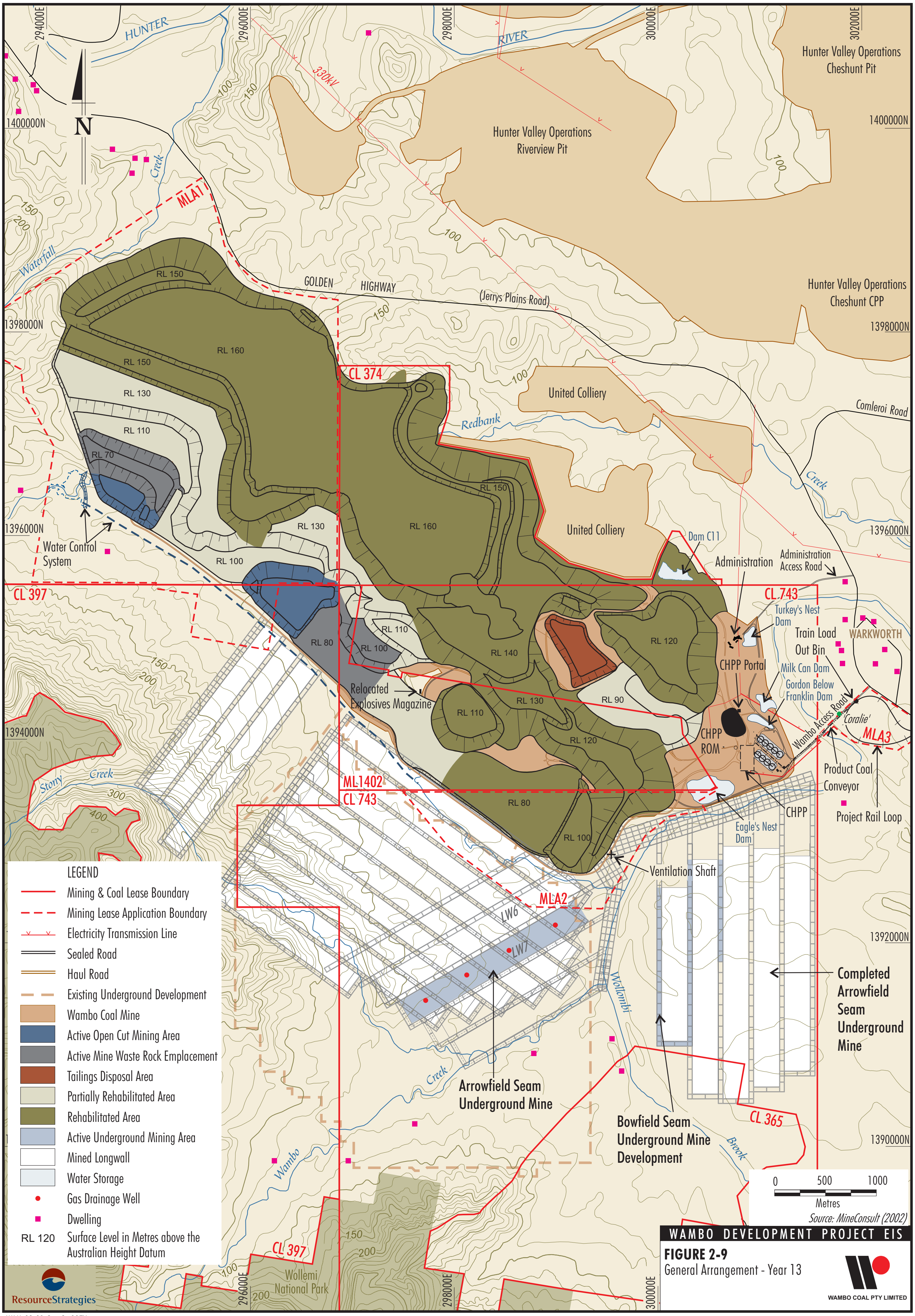

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-9

General Arrangement - Year 13

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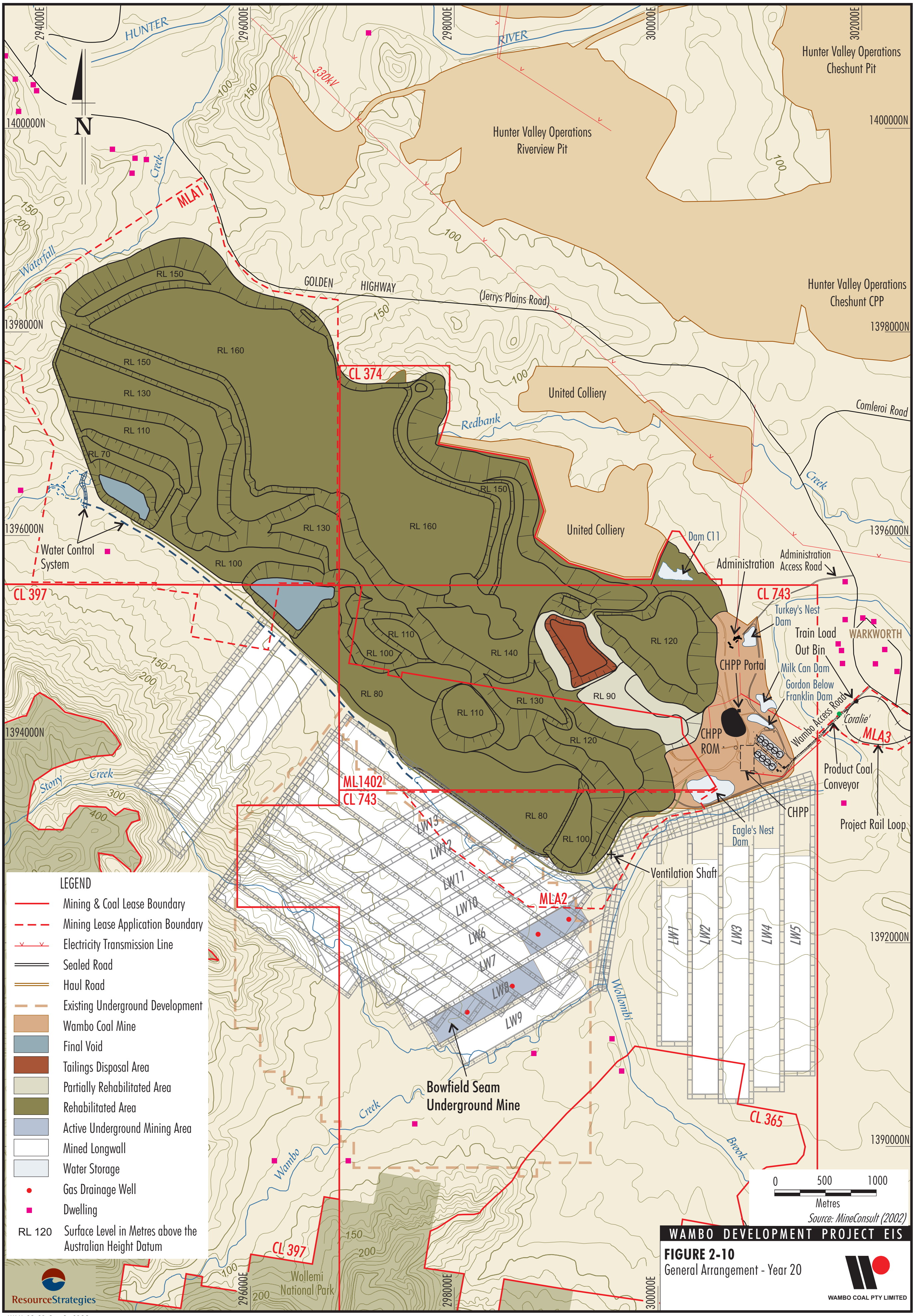

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- a 4 km long rail spur and rail loop;
- train loading infrastructure; and
- realignment of the intersection between the Wallaby Scrub Road and the Golden Highway.

These activities are described in more detail below.

Construction activities would be undertaken generally during daytime hours up to seven days per week.

2.4.1 Coal Handling and Preparation Plant

The Wambo Coal Mine CHPP comprises an operational module (Module 2) with a design washing capacity of 900 tph and a module (Module 1) which was decommissioned in 2001. The Project would include doubling of the CHPP capacity by the construction of a second 900 tph module within the footprint of Module 1. This would increase the total capacity of the CHPP to 1,800 tph. Construction of the new module would take approximately six months and is planned for completion in Year 2. The module would include a coal reclaim, crushing, screening, coarse coal and fine coal washing circuits. The operation of the Project CHPP is described in Section 2.7.

2.4.2 Rail Spur Line and Rail Loop

The Project would include the construction of a rail loop on the eastern side of Wollombi Brook and a rail spur. As described in Section 1.2.2 the Project rail spur would join the Jerrys Plains Rail Spur Line that is the subject of a separate DA lodged in 1999. The Jerrys Plains Rail Spur Line would connect onto the Jerrys Plains Rail Line which was granted development consent in July 1998. The Jerrys Plains Rail Line would join the State rail network near the MTCL.

The Project rail spur would facilitate the rail transport of product coal to the Port of Newcastle and would remove in the order of 160,000 existing Wambo Coal Mine truck movements per annum from the Golden Highway. The Project rail spur would also be available for the transport of coal from surrounding mines (e.g. Hunter Valley Operations and United Colliery) which (either currently or in the recent past) transport coal by road to the MTCL.

The location of the Project rail spur and loop is shown on Figure 1-5.

The rail spur would pass under the Golden Highway via a grade separated crossing (i.e. the rail spur would be placed in a cutting below the level of the existing road surface).

The rail underpass would comprise a 7 m deep cutting with a single span, pre-cast concrete deck for the new Golden Highway road surface. Design and construction of the underpass would be undertaken in accordance with relevant RTA and SSC guidelines. Wallaby Scrub Road would be realigned to meet the Golden Highway approximately 400 m south-east of the existing intersection (Figure 1-5).

2.4.3 Train Loading System

Overland product coal conveyors would deliver coal from the CHPP product coal reclaim area to a 400 t train load-out bin to be constructed above the rail loop (Figure 2-1).

Nine underground reclaim points, each with a transfer conveyor to feed coal onto the main reclaim conveyor, would be required to service the product coal stockpile area. Each reclaim point would have a feed capacity of up to 4,500 tph. The reclaim system would be able to blend coal from the different reclaim points to achieve the required coal quality. The train loading system would have the capacity to accommodate potential future use by other coal mines.

The main reclaim conveyor would transfer the reclaimed coal to a transfer station and then onto the product coal conveyor to the train load-out bin (Figure 1-5).

The product coal conveyor and support structure would run adjacent to the Wambo Access Road and cross Wollombi Brook over the existing bridge (Figure 2-5).

The train loading system would be designed to load trains at a rate of 4,500 tph. Each train would therefore take approximately two hours to load.

2.4.4 Realignment of Wallaby Scrub Road and Golden Highway Intersection

The construction of the Project rail spur and rail loop would require the realignment of a section of Wallaby Scrub Road and its intersection with the Golden Highway (Figure 2-1). The realigned section would be approximately 450 m in length. The new intersection would comprise a rural T-junction with auxiliary right and left turn lanes in accordance with the RTA's *Road Design Guide*. The redundant section of Wallaby Scrub Road would be rehabilitated in consultation with the SSC.

Realignment of the Wallaby Scrub Road and Golden Highway intersection would occur during construction of the rail spur and rail loop which is planned for Year 1.

2.5 OPEN CUT OPERATIONS

2.5.1 Mine Schedule

A provisional mine schedule for the Project is presented in Table 2-2, based on the planned maximum production. Open cut mining operations would be conducted up to 24 hours a day, seven days a week for approximately 13 years. General arrangements which match the provisional schedule in Table 2-2 for Years 2, 4, 7, 9, 13 and 20 of the Project life are provided on Figures 2-5 to 2-10. As discussed in Section 2.3 above, the actual mining sequence may vary and hence the actual Project general arrangements in these years may differ from those shown on these figures.

The Project open cut would mine the Whybrow, Redbank Creek, Wambo and Whynot Seams. The perimeter of the open cut is bounded by the United Colliery and the Golden Highway to the north, Wollombi Brook to the east and by uneconomic strip ratios to the south and west. An overall average strip ratio of 6.5 (bcm waste rock):1 (t ROM coal) is estimated for Project open cut operations.

Open cut batters would generally have slopes of 63 degrees (2V:1H). The maximum depth of the open cut would be approximately 115 m in the north-western corner. The minimum elevation of the floor of the open cut would occur in the south at approximately -30 m AHD in Year 9 of the Project life.

Waste rock generated from open cut operations would be placed within designated mine waste rock emplacements predominantly within open cut voids. Mine waste rock management techniques that have been developed for the Wambo Coal Mine, as reported in the current MOP (WCPL, 2002), would be adopted for the Project and are described further in Section 2.9.

The general sequence of open cut mining operations for the Project would be as follows:

1. Vegetation clearing and soil stripping. Stripped soil would be used directly in progressive rehabilitation or placed in temporary stockpiles.
2. Excavation of weathered overburden and haulage to mine waste rock emplacements.
3. Blasting of the harder and more competent fresher overburden and interburden materials, excavation and haulage to mine waste rock emplacements.
4. Selective mining of coal and haulage to the ROM stockpile.
5. Progressive rehabilitation of mine waste emplacements.

The above open cut mining process is described further below.

2.5.2 Mine Fleet

A provisional mine equipment fleet for Project open cut operations is provided in Table 2-3. The equipment fleets required for the CHPP and for underground mining operations are also presented.

2.5.3 Soil Stripping

A soil survey of Project surface development areas (including open cut areas, mine waste rock emplacements and infrastructure areas) has determined that the depth of soil available for rehabilitation works ranges from 0 cm to 30 cm (Appendix L). Stripping depths in the open cut areas would predominantly be in the order of 10 cm to 20 cm. On areas such as the North Wambo Creek flood plain, soil stripping would be undertaken to greater depths.

Where soils cannot be used directly for progressive rehabilitation they would be stockpiled and seeded with grasses and legume species to maintain soil viability. Soil management and stockpiling procedures for the Project are detailed in Section 5.2.4. A description of the soil resources within the Project area and relevant management measures is presented in Appendix L.

2.5.4 Overburden Removal and Handling

Excavators and dozers would remove overburden and interburden materials. Mine waste rock emplacements would be shaped by dozer prior to commencement of rehabilitation activities (i.e. re-contouring, topsoiling and revegetation).

Table 2-2
Provisional Mine Schedule

Year	Open Cut Waste Rock (Mbcm)	Open Cut ROM Coal (Mtpa)	Underground ROM Coal (Mtpa)	CHPP Rejects		Total ROM Coal (Mtpa)	Total Product Coal (Mtpa)
				Coarse (Mtpa)	Tailings (Mtpa)		
1	26.7*	4.3*	-	0.8*	0.5*	**4.3***	**3.0***
2	44.2	6.8	0.4	1.3	0.8	**7.2**	**5.1**
3	46.8	7.2	2.3	1.6	1.1	**9.5**	**6.8**
4	52.0	8.0	2.5	1.7	1.2	**10.5**	**7.6**
5	52.0	8.0	2.5	1.7	1.2	**10.5**	**7.6**
6	52.0	8.0	3.0	1.7	1.1	**11.0**	**8.2**
7	52.0	8.0	5.1	1.9	1.3	**13.1**	**9.9**
8	52.0	8.0	6.7	2.0	1.4	**14.7**	**11.3**
9	52.0	8.0	6.7	2.0	1.4	**14.7**	**11.3**
10	52.0	8.0	6.7	2.0	1.4	**14.7**	**11.3**
11	52.0	8.0	6.5	2.0	1.3	**14.5**	**11.2**
12	52.0	8.0	5.4	1.9	1.3	**13.4**	**10.2**
13	52.0	8.0	4.0	1.8	1.2	**12.0**	**9.0**
14	-	-	7.5	0.6	0.4	**7.5**	**6.5**
15	-	-	7.5	0.6	0.4	**7.5**	**6.5**
16	-	-	7.5	0.6	0.4	**7.5**	**6.5**
17	-	-	7.5	0.6	0.4	**7.5**	**6.5**
18	-	-	7.0	0.6	0.4	**7.0**	**6.0**
19	-	-	7.0	0.6	0.4	**7.0**	**6.0**
20	-	-	4.0	0.4	0.2	**4.0**	**3.4**
21	-	-	4.0	0.4	0.2	**4.0**	**3.4**
Total	**637.7**	**98.3**	**103.8**	**26.8**	**18.0**	**202.1**	**157.3**

Source: WCPL (2003)
* Continuation of Wambo Coal Mine open cut operations during initial Project development phase

Table 2-3
Provisional Mine Equipment Fleet

Mobile Plant	Primary Purpose	Mine Fleet		
		Existing	Additional	Total
Open Cut Operations				
Excavator (500 t)	Overburden Excavation/Loading	2	2	4
Excavator (250 t)	Overburden Excavation/Loading, Coal Mining/ Loading	1	1	2
Excavator (180 t)	Coal Mining/Loading	1	-	1
Haul Truck (240 t)	Overburden Haulage	8	8	16
Haul Truck (150 t)	Overburden/Coal Haulage	7	5	12
D10 Dozer (or equivalent)	Overburden Ripping/Pushing, Drill Preparation, Coal Mining	2	2	4
D11 Dozer (or equivalent)	Soil Stripping, Overburden Ripping/Pushing/ Shaping	2	3	5
Grader	Overburden Contouring, Road Grading	2	1	3
Water Truck	Dust Suppression	2	2	4
Drill	Overburden Drilling	2	1	3
Coal Handling and Preparation Plant				
992 Front End Loader (or equivalent)	Product Coal Handling	3	2	5
D11 Dozer (or equivalent)	Product Coal Pushing	2	1	3
Underground Operations				
B-Doubles (2 x 70 t Trailers)	Coal Haulage	-	4	4
992 Front End Loader (or equivalent)	Coal Handling	-	1	1

Source: WCPL (2003)

Overburden and interburden materials that are not able to be efficiently ripped and excavated by mobile plant would require drilling and blasting. Overburden material would typically be drilled in 10 m to 20 m benches using patterns ranging from 5 m x 5 m to 7.5 m x 10 m. A mixture of ammonium nitrate and fuel oil (ANFO) (dry holes) and emulsion blends (wet holes) would be used at an average powder factor of approximately 0.5 kg/bcm.

Blast sizes would typically range from 150,000 bcm up to 500,000 bcm. An average of around five blasts would be conducted per week. The actual number of blasts in any week would be dependent on mine production. Typically 250,000 bcm of overburden material would be broken per blast. Blasting would only occur during daylight hours. Prior to each blast an assessment of wind direction and speed would be made. During unfavourable conditions blasts would be modified or delayed, where practicable, to minimise potential effects of dust emissions on sensitive receptors.

During the initial two years of the Project open cut operation, waste rock would be placed in four mine waste rock emplacements (Figure 2-5). Waste rock material from the extension of the Wollemi Underground Mine Box Cut would be placed in the mine waste rock emplacement to its immediate south-east (Figure 2-5). Waste rock from the open cut adjacent to the CHPP would be placed into the mine waste rock emplacements to its immediate north and south. Waste rock from the northern open cut would be placed in the mine waste rock emplacement to its immediate south-east as it progresses to the north-west (Figure 2-5).

Waste rock material would continue to be placed behind the advancing northern open cut, to a maximum elevation of approximately 160 m AHD, through to its completion in Year 13 (Figure 2-9).

From approximately Year 9, waste rock would be placed in the mine waste rock emplacement behind the southern open cut as it advances to the north-west (Figures 2-8 and 2-9). Waste rock from the initial box cut for the southern open cut would be placed in the mine waste rock emplacement to its immediate north-east (Figure 2-8).

The final batter slopes of mine waste rock emplacements would be approximately 10 degrees (1V:5.7H). Section 2.9 and Appendix G describe the mine waste rock management procedures for the Project. Section 5 describes the rehabilitation concepts for the mine waste rock emplacements.

2.5.5 Coal Mining and Handling

Open cut coal mining would typically involve excavators loading 150 t haul trucks for haulage to the ROM coal receival hopper at the CHPP. Where direct feed is not possible due to operational constraints coal would be dumped on the adjacent stockpile for later rehandling to the hopper at the CHPP. The ROM stockpile would have a capacity of up to 80,000 t. A fleet of up to 10 haul trucks would service the coal haulage requirements of Project open cut operations.

Approximately 13% of the open cut ROM coal would be dumped on the CHPP ROM pad for rehandling by a front-end loader or dozer. The remainder would be dumped directly into the dump hopper and conveyed into the CHPP.

As the open cut operation reaches the mining limits there may be opportunities to recover additional coal through augering of the Whybrow, sections of the Redbank Creek, Wambo and Whynot Seams. This auger operation would enable WCPL to recover coal which otherwise would be lost. The area which would be auger mined is wholly within land owned by WCPL and on completion the auger holes would be sealed with an inert material. Auger mining beyond the open cut limits may penetrate some 100 to 200 m into each coal seam and would involve only partial extraction of the coal resource. Sufficient coal would remain *in-situ* between the auger holes so that no significant subsidence would occur above those areas to be auger mined.

2.5.6 Open Cut Dewatering

Excavation of the Project open cut would form a sink towards which groundwater would flow, particularly groundwater contained within the coal seams. Groundwater flows into the open cut are expected to be small compared to rainfall and runoff and would not normally hinder the mining operation.

The hydrogeological assessment undertaken for the Project (Appendix F) estimates that groundwater inflows to the open cut should range generally from 0.3 L/s to 9.2 L/s. Short-term peaks in groundwater inflows are conservatively estimated to reach 12.7 L/s and 18.0 L/s in Years 6 and 11, respectively.

These peaks would coincide with periods when Project open cut mining intersects North Wambo Creek alluvium. The majority of these inflows from the alluvium would be intercepted prior to reaching the floor of the open cut and returned to the North Wambo Creek or would be pumped directly to the Project water supply system (subject to the relevant DLWC licence/permit requirements).

This would be achieved by the installation of sumps and a pump/pipe system located on a bench of the open cut (similar to the current practice at the Wollemi Underground Mine Box Cut). As discussed in Section 2.10, the North Wambo Creek water control structure would be keyed into the rock strata underlying the alluvium to act as a barrier to subsurface flows.

Experience at the Wambo Coal Mine to date has shown that conventional open cut sump and dewatering systems are sufficient to handle the quantities of water accumulated in the workings. Water that accumulates in the open cut would be used for dust suppression over Project haul roads and active mine waste rock emplacement surfaces and used for water supply for the CHPP. The Project water management system is described in Section 2.10.

The open cut dewatering system would be designed and managed to minimise the potential for disruptions to mining operations due to excessive quantities of stored water.

2.5.7 Relocation of Wambo Homestead Complex

During Year 9 of the Project, open cut mining operations are scheduled to pass through the location of the WHC. Prior to this time, relocation of individual buildings and substantial elemental fabric comprising the WHC would be undertaken to an off-site setting. These works would be conducted in accordance with the requirements of the NSW Heritage Council and in consultation with the SSC and the local community. The relocation proposal is discussed further in Section 4.14.1 and Appendix C.

2.5.8 Final Voids

Two final voids would remain on the western edge of the open cut operations (Figure 2-10).

The surface catchment of the final voids would be minimised by the use of contour drains around their perimeter. The surface water assessment presented in Appendix E indicates that they would form permanent sinks in the local groundwater table, with a general groundwater gradient within the mine waste rock emplacements towards the voids.

2.6 UNDERGROUND OPERATIONS

The provisional mine schedule for underground mining operations presented in Table 2-2 is based on the planned maximum production.

Based on current mine planning, underground mining operations would be developed progressively with planned commencement in Year 2 at the Whybrow Seam Underground Mine, before the commencement of the development of the Wambo and Arrowfield Seam Underground Mines by Year 5 and Bowfield Seam Underground Mine in Year 13 (Figures 2-5 to 2-10). The actual mining sequence in relation to the underground mining schedule may vary and hence the actual Project general arrangements in these years may differ from those shown on Figures 2-5 to 2-10.

Underground mining operations would typically be conducted 24 hours a day, seven days per week.

2.6.1 Whybrow Seam Underground Mine

The existing Wollemi Underground Mine Box Cut would be extended by approximately 1.2 km to the north-west in order to provide highwall access to the Whybrow Seam Underground Mine (Figure 2-5). The box cut extension would extend to the base of the Whybrow Seam (approximately 40 to 65 m below surface). Longwall gateroads would be driven from the highwall of the box cut to provide direct access to the Whybrow Seam.

Approximately 3.5 Mbcm of waste rock material would be removed and placed in mine waste rock emplacements during the extension of the box cut (Figure 2-5).

The box cut extension is planned for development in the first half of Year 2. The box cut would be developed using general mine fleet during normal open cut operating hours.

The Whybrow Seam Underground Mine is constrained by the Project open cut to the east, fault structures to the south and the Wollemi National Park to the south-west (Figures 2-5 and 2-6).

Longwall mining would be used to extract coal from the Whybrow Seam from three panels (LW1, LW2 and LW3). The longwall panels would each extend approximately 2 km to the south-west (Figures 2-5 and 2-6).

Existing longwall mining infrastructure at the Wollemi Underground Mine Portal would be used for the Whybrow Seam Underground Mine including the stack-out conveyor and 40,000 t capacity Wollemi ROM coal stockpile. Conveyor driveheads would be located at the surface within the box cut.

Existing Wollemi Underground Mine surface facilities would also be utilised, including the bathhouse, administration buildings, car park, equipment service facility, fuel storage and washdown area.

Coal conveyed to the surface would be reclaimed from the Wollemi ROM coal stockpile using a front end loader onto off-highway 140 t B-Double trucks for haulage to the CHPP ROM stockpile.

Up to 2.5 Mtpa of ROM coal would be extracted from the Whybrow Seam Underground Mine with a yield of approximately 75%. Some 4.9 Mt of saleable coal would be produced over its four year operational life.

2.6.2 Wambo Seam Underground Mine

Mining of the Wambo Seam Underground Mine is planned to commence in Year 5 following completion of the Whybrow Seam Underground Mine and is scheduled to operate until Year 12.

The Wambo Seam Underground Mine would utilise the existing Wollemi Underground Mine Box Cut access and surface infrastructure, including the 1.2 km long stack-out conveyor over North Wambo Creek and the Wollemi ROM coal stockpile. Access to the Wambo Seam Underground Mine would be via the extension of drifts from the Wollemi Underground Mine to the Wambo Seam.

These drift accesses would service the Wambo Seam Underground Mine via:

- a 400 m long drift at a slope of 1(V) in 4(H) with a conveyor to transfer coal to the surface; and
- an 800 m long “men and materials” drift at a slope of 1(V) in 8(H).

The Wambo Seam Underground Mine (Figures 2-6 to 2-8) would be limited by the Project open cut to the north-east, fault structures to the north-west, Wollombi Brook to the east and splitting of the seam to the south. A north/south orientated dyke with a 1 m throw, and north-east/south-west fault with a 3 m throw have also been identified within the Wambo Seam Underground Mine workings.

Longwall mining would be used to extract the coal from the Wambo Seam along nine panels. The longwall panels would be between 1.5 km and 3.2 km in length (Figures 2-6 to 2-8).

Coal conveyed to the surface would be reclaimed from the Wollemi ROM stockpile using a front end loader onto off-highway 140 t B-Double trucks for haulage to the CHPP ROM stockpile (Figure 2-8).

2.6.3 Arrowfield and Bowfield Seam Underground Mines

Mining within the Arrowfield Seam Underground Mine is planned to commence on the eastern side of Wollombi Brook in Year 5 (Figure 2-7) and would be completed on the western side of Wollombi Brook in approximately Year 19. The Bowfield Seam Underground Mine is planned to commence in Year 14 and, subject to further approvals, would operate beyond the 21 year approval period.

The CHPP portal would be developed adjacent to the existing CHPP for the Arrowfield and Bowfield Seam Underground Mines (Figure 2-6). Two drift accesses with slopes of 1(V) in 4(H) (conveyor drift) and 1(V) in 8(H) ("men and materials" drift) would be installed to the Arrowfield Seam. These drift accesses would be developed to a depth of approximately 300 m and would facilitate the conveying of coal to the surface and access for mine personnel and materials.

The Arrowfield Seam drift access would also be extended to provide access to the deeper Bowfield Seam. Both the conveyor drift and "men and materials" drift would be extended to the Bowfield Seam (approximately 350 m below the surface) at slopes of 1(V) in 4(H) and 1(V) in 8(H) respectively.

Mining of the Arrowfield and Bowfield Seams would be constrained by Wollombi Brook, the gas content of the seams and strata control issues at depths of cover exceeding 400 m.

The Arrowfield Seam Underground Mine (Figures 2-7 to 2-10) is immediately above the Bowfield Seam Underground Mine on both sides of Wollombi Brook. Both mines would comprise the mining of five longwall panels east of Wollombi Brook and eight panels west of Wollombi Brook.

ROM coal from both the Arrowfield and Bowfield Seam Underground Mines would be conveyed directly to the CHPP for processing or to the ROM stockpile.

2.6.4 Ventilation Systems

Whybrow Seam Underground Mine

Air intake to the Whybrow Seam Underground Mine would be via the portals located in the base of the box cut extensions (Figures 2-5 and 2-6).

All panels would operate independently with separate ventilation systems. Four fans would be located at the four outlets of the longwall panel accesses with two fans operating at any one time. Each fan would vent at a rate of approximately 60 cubic metres per second (m^3/s). The ventilation system would be powered by mains electricity.

Wambo Seam Underground Mine

Air intake to the Wambo Seam Underground Mine would be via the drift accesses from the Wollemi Underground Mine Portal. The existing fan system which ventilated the Wollemi Underground Mine in the Whybrow Seam would be used to exhaust air from the Wambo Seam Underground Mine.

The fan would operate at a rate of approximately 200 m^3/s.

Arrowfield and Bowfield Seam Underground Mines

Air intake to the workings of the Arrowfield and Bowfield Seam Underground Mines would be via the CHPP portal (Figure 2-6). An upcast fan system and ventilation shaft would be installed south of the extent of Project open cut operations to exhaust air from the underground mines (Figures 2-6 to 2-10). Air would be vented at approximately 350 m^3/s.

2.6.5 Coal Seam Gas Management

A gas management system would be developed for each of the Project underground mining operations in order to monitor and control the concentrations of mine gases.

A series of gas drainage wells would be installed for the Arrowfield and Bowfield Seams to allow gas to be drained to the surface (Figures 2-7 to 2-10). Gas would drain from the wells either due to density differentials or via an exhaust fan. As underground mine development progresses gas drainage wells would be relocated as required.

Up to four gas drainage wells may be installed for each longwall panel depending on the quantity of the gas to be removed and the capacity of the ventilation systems. Observations of gas content from existing underground operations suggest that approximately 2 m^3/s of gas containing a maximum of 80% methane may be produced from each of the Arrowfield and Bowfield Seam Underground Mines. This content would generally increase with depth.

The atmosphere in all underground mines would be monitored continuously at conveyor driveheads and return airway stations in accordance with existing operational procedures at the Wambo Coal Mine.

2.6.6 Underground Mine Dewatering

Groundwater that drains from coal seams and surrounding rock and then accumulates in underground workings would be pumped to the surface via access drifts and/or a borehole. This water would then be managed within the Project water management system (Section 2.10). Typically this water would be pumped directly to the Eagle's Nest Dam (Figures 2-5 to 2-10) and used as a source of water supply to the Project CHPP.

2.7 COAL RECLAIM AND PREPARATION

The two CHPP modules would operate up to 24 hours per day, seven days per week with a combined design capacity of approximately 1,800 tph of ROM feed. A description of the operation of each of the CHPP modules is provided below and shown on Figure 2-11.

2.7.1 Coal Reclaim, Crushing and Screening

At each CHPP module a majority of the ROM coal would be dumped by haul trucks directly into the 250 t CHPP coal receival bin. The remainder would be reclaimed from the ROM coal stockpile by front end loader. A dozer would be used in conjunction with the front end loader for management of the ROM coal stockpile.

The CHPP coal receival bin would dump to the raw coal breaker which operates at a nominal 900 tph with a top particle size output of 300 mm. Raw coal from the breaker would be conveyed to a 900 tph secondary crusher with a top particle size output of 150 mm.

Tertiary sizing of the crushed coal would be conducted via two 450 tph crushers with a top particle size output of 50 mm, prior to retention in raw coal sumps.

Raw coal would then be fed to two desliming screens with 1.0 mm apertures. Screen overflow (>1.0 mm) would be fed to the coarse coal circuit, while screen underflow (<1.0 mm) would be fed to the fine coal circuit.

2.7.2 Coarse Coal Circuit

Coal screened to the coarse coal circuit would be pump fed to two 900 mm diameter dense medium cyclones for separation. Coarse rejects from the underflow of the cyclones would be screen rinsed and drained through 0.5 mm apertures and conveyed to the reject bin prior to being hauled to areas within open cut voids and mine waste rock emplacements.

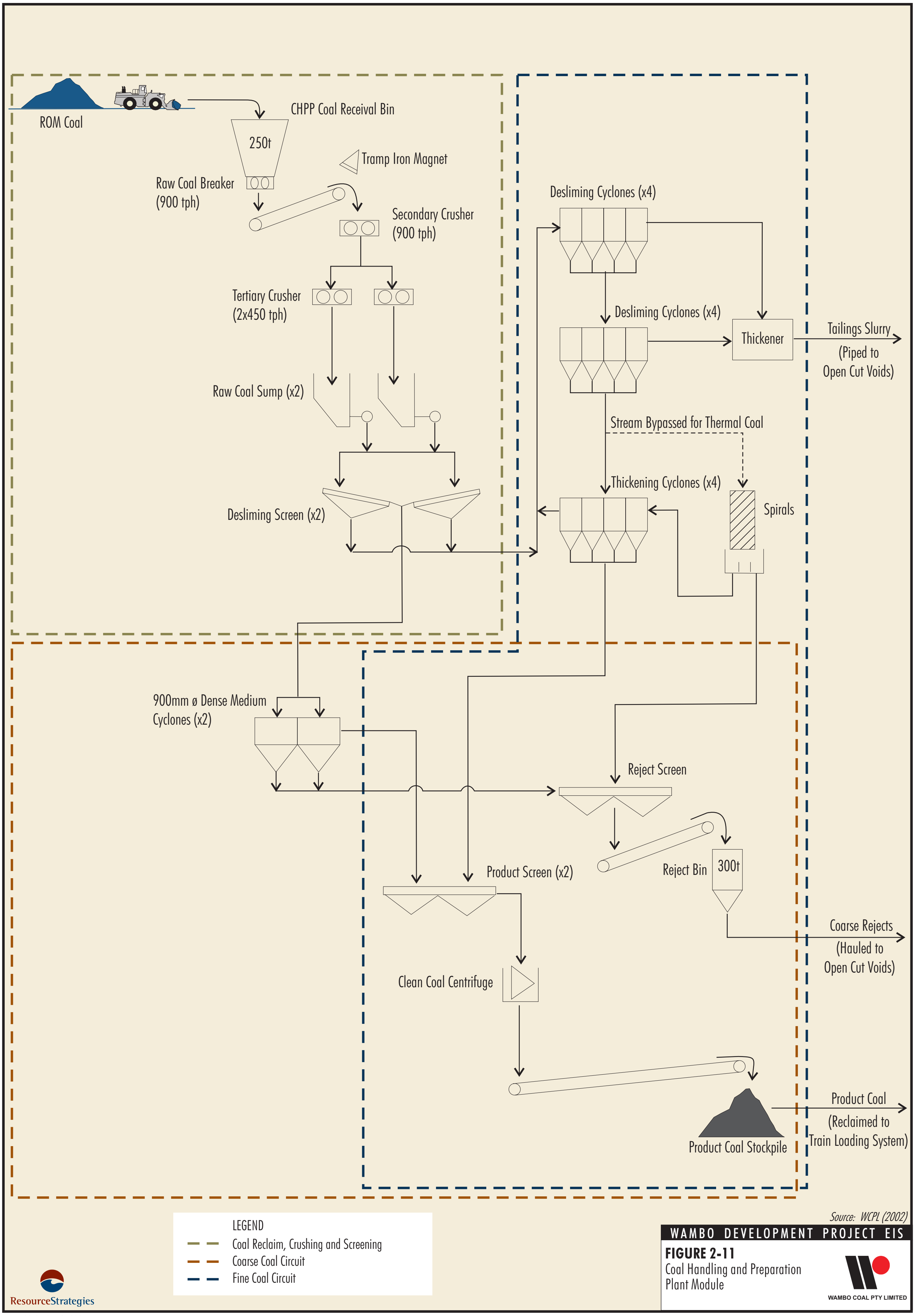
Product coal from the cyclones would be screened through two product drain and rinse screens (0.5 mm apertures) prior to being fed to the clean coal centrifuge and then to the product conveyor.

Product coal would be conveyed to the product bin with a hold-up capacity of 300 t, before conveying via a tripper stacker to the product coal stockpile (600,000 t capacity) for reclaim to the train loading system.

2.7.3 Fine Coal Circuit

Coal sieved to the fine coal circuit (<1.0 mm) would be pump fed to two banks of 4 x 600 mm diameter desliming cyclones. Deslimed cyclone underflow would be fed to spiral concentrators and the product coal fed to a bank of 4 x 600 mm diameter thickening cyclones.

Rejects from the spiral concentrators would be screen rinsed and drained through 0.5 mm apertures and conveyed to the 300 t reject bin prior to being transferred to areas within open cut voids and mine waste rock emplacements.



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-11
Coal Handling and Preparation Plant Module

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Overflow from the thickening cyclones would be recycled to the desliming cyclones. Overflow from the desliming cyclones would be thickened and piped to dedicated areas within open cut voids.

Deslimed underflow from the thickening cyclones would be screened through two product drain and rinse screens (0.5 mm apertures) prior to being fed to the clean coal centrifuge with gravity feeding to the product conveyor.

Product coal would be conveyed via a tripper stacker to the product coal stockpile for reclaim to the train loading system.

2.8 COAL TRANSPORT

Product coal from the Wambo Coal Mine is currently transferred from the CHPP to the MTCL by a combination of 37 t capacity B-Double trucks and single trailer 28 t capacity trucks at a rate of up to 3 Mtpa (Appendix M). This practice would continue until Project rail and train loading infrastructure is commissioned.

Thereafter, product coal would be loaded onto typical Hunter Valley nominal 8,600 t trains 24 hours a day, seven days per week, using the Project train loading system for transport to market. An average of four trains would be loaded each day. The maximum number of trains loaded per day would be six, based on a two hour loading period and two hour clearance and arrival of a new train on the rail spur. This would correspond to a maximum of 12 train movements in any one day (i.e. six arrivals and six departures). The potential environmental impacts associated with the transport of coal by rail are addressed in Section 4. Where possible, train movements would be minimised on Friday evenings and Sunday mornings to ameliorate the potential impact of rail traffic noise emissions at St. Philips Anglican Church.

2.9 MINE WASTE ROCK AND CHPP REJECTS/TAILINGS MANAGEMENT

The development of the Project open cut and underground mines would result in the generation of waste rock (overburden and interburden materials), CHPP coarse rejects and CHPP tailings. Management practices for these materials are described below. The geochemical characteristics and mine waste rock management procedures are further described in Appendix G.

Mine waste rock management procedures that have been developed at the existing Wambo Coal Mine would be adopted for the Project.

2.9.1 Overburden and Interburden

Approximately 640 Mbcm of waste rock material would be generated during the life of the Project open cut operations. Overburden and interburden would be removed to uncover the Whybrow, Redbank Creek, Wambo and Whynot Seams using conventional open cut coal mining methods as described in Section 2.5.

Overburden and interburden waste rock materials would comprise mudstones, siltstones, sandstone, shale and conglomerates and are expected to be geochemically similar to those materials currently produced at the Wambo Coal Mine (Appendix G).

Following the removal of topsoil, a pre-stripping fleet would be used to excavate and haul softer overburden materials into adjacent open cut voids or mine waste rock emplacements.

A combination of blast/dozer push and truck/excavator operations would then be employed to remove stronger/less weathered overburden materials to expose underlying coal seams. These materials would also be disposed of in adjacent open cut voids or hauled to external mine waste rock emplacements.

Mine waste rock emplacements would generally be constructed in 10 to 15 m vertical lifts then shaped to their final landform profile once dumping is completed. The outer batters would be at maximum slopes of 10 degrees. Where long slopes exist, contour drains and/or deep staggered rips would be established. Once the final profile has been achieved the surface would be progressively rehabilitated.

Rehabilitation strategies and final landform details for the mine waste rock emplacements are presented in Section 5.

2.9.2 Coarse Rejects

Approximately 27 Mt of coarse reject material would be produced over the life of the Project and would primarily comprise minor quantities of coal as well as sandstone, siltstones, shales, conglomerates and mudstone (as predominantly gravel and cobble sized fragments). The coarse reject material produced from the CHPP during the Project is expected to be geochemically similar to that currently produced at the Wambo Coal Mine (Appendix G) and would continue to be selectively handled and disposed of in open cut voids or used as bulk fill in the covering and rehabilitation of tailings materials.

2.9.3 Tailings

Approximately 18 Mt of tailings (dry basis) would be produced over the life of the Project. The tailings management procedures developed for the Wambo Coal Mine to address the particular physical characteristics of tailings generated to date would generally be adopted for the Project.

Tailings would be pumped as slurry to open cut voids from where supernatant waters would be recovered to the mine water management system for dust suppression or reuse in the CHPP.

Once the tailings have filled a void they would be progressively covered with coarse rejects and/or waste rock material using a combination of encapsulation and incorporation, as illustrated on Figures 2-12 and 2-13, and as described in the existing Wambo Coal Mine MOP (WCPL, 2002). This tailings management system has been developed by WCPL to achieve stable landforms capable of supporting vegetation.

Encapsulation/incorporation of the tailings involves the placement of weathered waste rock and coarse rejects in successive layers (being approximately 1.5 times the combined thicknesses of the previously placed layers) over the tailings surface. Following encapsulation, the tailings material is buried under waste rock and coarse rejects to a minimum depth of cover of 5 m prior to final profiling and rehabilitation.

Final landforms are constructed with an allowance for the long-term settlement of the tailings which is estimated to be 10% to 15% of the total thickness of tailings (WCPL, 2002).

The majority of the tailings to be produced by the Project is however expected to behave in a more similar manner to tailings produced at other Hunter Valley coal mining operations. At these operations the application of the above encapsulation/ incorporation approach to stabilise the landform is not utilised. It is therefore likely that as the Project evolves, capping of tailings areas may be undertaken in a manner similar to standard practice elsewhere in the Hunter Valley (Appendix G).

2.10 WATER MANAGEMENT

The Project water management system controls waters generated from development and operational areas while diverting upstream water around such areas.

The water management system would include both permanent structures that would continue to operate post closure (e.g. the North Wambo Creek water control structure and channel) and temporary structures that would only be required until the completion of rehabilitation works (i.e. sediment dams).

The water management system would be progressively developed as water management requirements change over time. A detailed description and assessment of the Project water management system is provided in Appendix E.

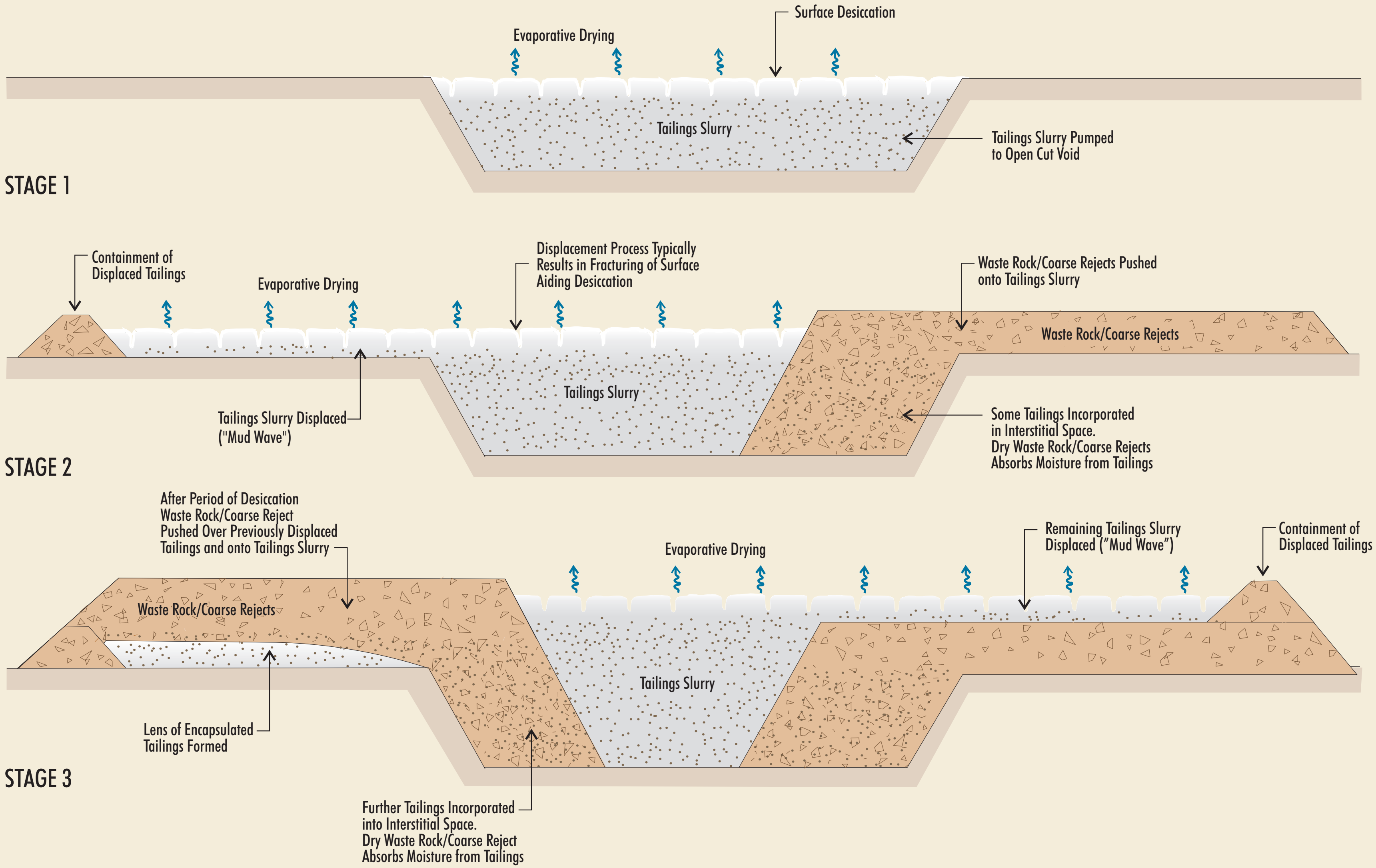
The water management strategy for the Project is based on the containment and reuse of mine water and on the control of sediment that may be potentially carried with runoff from disturbed areas such as the mine waste rock emplacements prior to rehabilitation.

The key components of the strategy are:

- Separation of undisturbed area runoff from disturbed area runoff.
- Collection and reuse of surface runoff from disturbed areas (including mining pre-strip areas, mine waste rock emplacements and haul roads).
- Capture and onsite containment of mine water, comprising groundwater and/or surface water inflows to the open cut.
- Reuse of contained mine water for dust suppression over active surfaces (haul roads, mine waste rock emplacement surfaces, etc.).
- Consumption of contained waters in the Project water supply system.
- Controlled release of excess site water in accordance with the requirements of the Hunter River Salinity Trading Scheme (HRSTS).

2.10.1 Existing Water Management System

A network of storages has been established at the Wambo Coal Mine to separate undisturbed area runoff from disturbed catchment areas. Runoff from areas disturbed by mining is diverted into open cut storages and used as a priority source of water for the CHPP and for dust suppression. Runoff from haul roads is diverted to containment storages. Runoff from the CHPP and associated industrial areas collects in sediment ponds and is returned to the CHPP as part of its water supply system.



Source: Pells Sullivan Meynink (2002)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-12
Tailings Management Process (Stages 1 to 3)

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Resource Strategies

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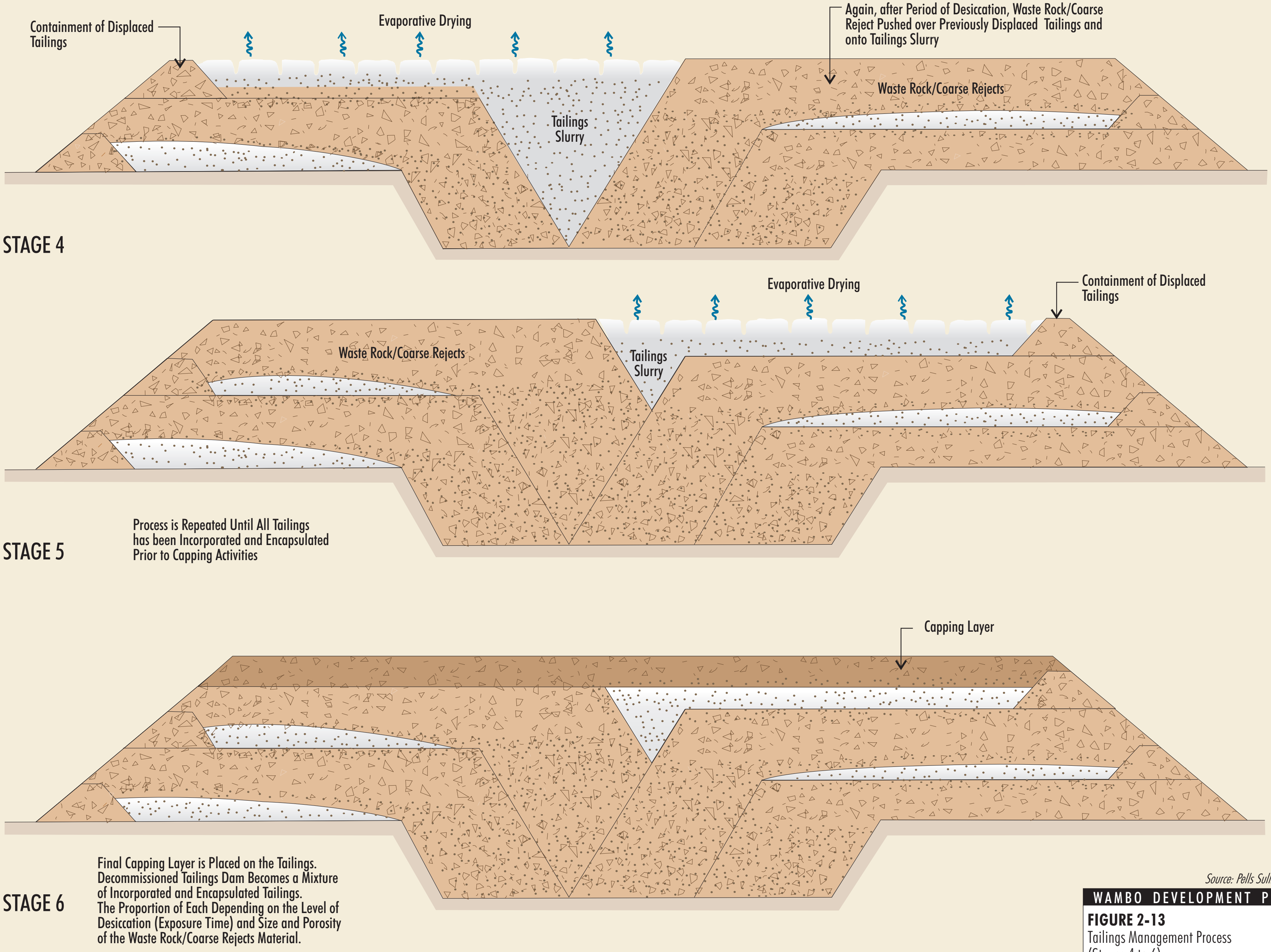


Source: Pells Sullivan Meynink (2002)

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-13
Tailings Management Process
(Stages 4 to 6)

WAMBO COAL PTY LIMITED

WAM-02-01-Sect 2_022D

Domestic wastewater is collected and treated in a septic system. Wastewater from the bathhouse and office is treated and used to irrigate vegetated and garden areas around the mine and administration area.

Historically the water management and water supply requirements have been balanced by importing water from Wollombi Brook and the Hunter River during times of shortage and by transferring water to neighbouring mines during times of excess. Some water has also been released to the Hunter River in accordance with the conditions of the Wambo Coal Mine Environment Protection Licence (EPL) and using salinity credits held by WCPL under the HRSTS.

2.10.2 Project Water Management System

The water management system is shown in schematic form on Figure 2-14.

System Inflows

Project water sources include groundwater inflows to the underground and open cut mines, which need to be removed to facilitate ongoing safe and efficient mining. Groundwater reporting to inactive (abandoned) underground workings that overlie active mine areas would also need to be de-watered for safety reasons. As assessed in Appendix F, groundwater inflows to both open cut and underground mining areas are predicted to vary over the Project life.

Water removed from active mine workings would be contained in one or more secure water supply storages for use in the CHPP and for dust suppression. Surface workings would become sinks for incident rainfall, infiltration through mine waste rock emplacements and runoff from rainfall. Sumps would be excavated in the floor of an active open cut as part of routine mining operations to facilitate efficient dewatering operations and to minimise interruption to mining.

Surface runoff from mine waste rock emplacements and supernatant waters from tailings disposal areas would be intercepted and diverted to containment storages for management in the site water management system as shown on Figure 2-14.

Water Consumption

Water would be needed to operate the CHPP, for wash down of mobile plant, for dust suppression on haul roads and hardstand areas and for dust emission control sprays in the ROM and product coal stockpile areas. Water would also be used in underground mines to control dust emissions in active mine areas. Some water would also be used for irrigating vegetation establishment areas, fire fighting and other minor non-potable uses. The demand for dust suppression would vary with climatic conditions and with the length of haul roads and area of hardstand that would need to be watered. The CHPP water demand would vary in accordance with coal production.

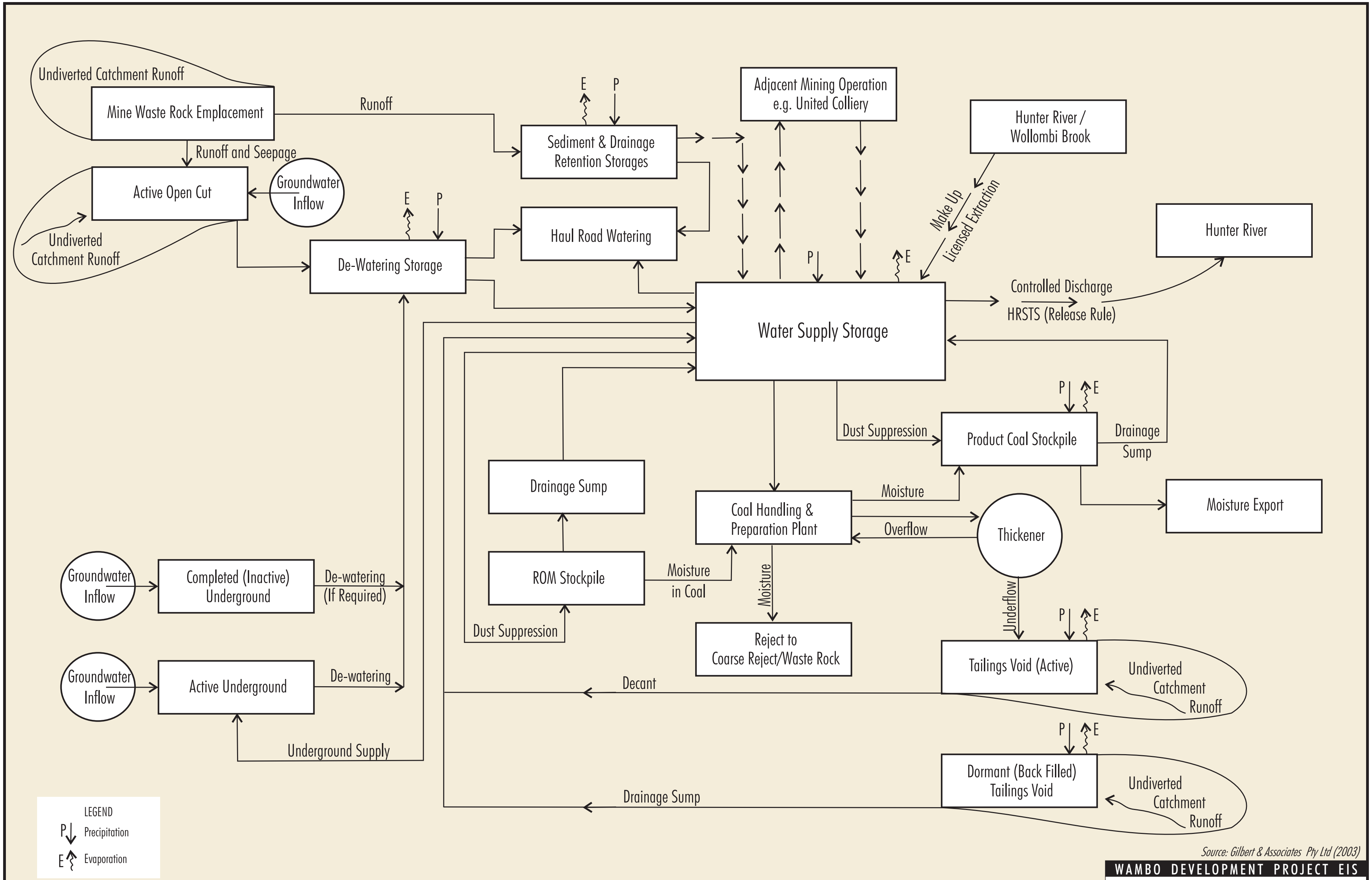
Operational Management

The water management system would operate predominantly as a closed self-contained system. The water balance of the system would fluctuate with climatic conditions and as the extent of the mining operation evolves over time.

Depending on the climatic conditions that are experienced during the Project life there may be periods when controlled releases would be made under the HRSTS. There may also be periods when the availability of water on site is insufficient for site uses and under these circumstances water would be sourced externally. In the event that there was a need to import water it would be sourced either opportunistically from adjacent mining operations, such as the United Colliery, Hunter Valley Operations and/or Warkworth Coal Mine, or from the Hunter River or Wollombi Brook using water extraction licences held by WCPL.

North Wambo Creek Water Control System

The Project would include the construction of a water control system across North Wambo Creek to divert flows around the western limit of the open cut operations and mine waste rock emplacements. The water control system would comprise a water control structure across the North Wambo Creek alignment and a channel (Figure 2-7). Based on the planned production rate, the water control system would be constructed by Year 7. The detailed design of the water control system would be developed in the Site Water Management Plan (Section 6.2.6) in consultation with the relevant authorities, based on the following principles.



Source: Gilbert & Associates Pty Ltd (2003)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 2-14
Water Management System

WAMBO COAL PTY LIMITED

ResourceStrategies

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The channel would be designed to convey flood flows up to the 1 in 10 year peak discharge within a primary channel formed in cut. Larger flows would be allowed to flow over the adjacent land surface (secondary overflow zone). A permanent bund would be constructed to act as a flood levee between the channel and the open cut/mine waste rock emplacements to reduce the risk of floodwater entering the mine area. The actual design flow capacity of the primary channel and the bund would be determined as part of detailed design studies using a risk analysis approach. The banks of the primary channel would be extensively planted with endemic riparian vegetation. The secondary overflow zone would be planted with riparian vegetation to resist erosion during high flow events. The diversion channel would be constructed at least 12 months prior to being commissioned to allow the critical vegetation elements time to establish.

Where the channel is constructed over a subsidence area, the channel would be formed so as to provide a relatively even bed slope, with any irregularities in the surface grade as a result of previous subsidence being incorporated into the channel design.

The following principles and approach to detailed design would be adopted:

- Consideration would be given to the development of pools and riffle zones within the channel alignment to provide for aquatic habitat.
- The channel form would incorporate a series of narrower, steeper riffle reaches in stretches corresponding to pillar areas where subsidence is less than in other areas. The channel would widen along the sections of greatest subsidence where bed slopes would be lower.
- The channel geometry would be selected such that channel velocities and boundary shear stresses developed under design flood flow conditions would not exceed critical values for long-term stability. These limiting velocities and boundary shear values would be determined through an assessment of the post subsided creek geometry and associated geomorphological stability.
- Consideration of lining of the invert of the channel where the potential for the leakage of channel flows to the remnant Whybrow Seam underground workings is identified.

Small retention storages would be located on localised drainage paths which would flow into the channel from the west. These storages would be located upslope of the channel to buffer potential peak flows in the channel. The water control system would be located predominantly within cleared land/grassland.

2.10.3 Site Water Supply

Where practicable, Project water supply would be prioritised as follows:

1. Recovery of supernatant waters and seepage from tailings storage areas.
2. Capture of incident rainfall and runoff across operational areas (i.e. open cut, infrastructure hardstands, CHPP and associated stockpiles).
3. Dewatering of underground mining operations.
4. Runoff captured from mine waste rock emplacement and pre-strip areas.
5. Trading of excess mine waters from surrounding mining operations (e.g. United Colliery, Hunter Valley Operations and/or Warkworth Coal Mine).
6. Licensed extractions from the Hunter River.
7. Licensed extractions from Wollombi Brook.
8. Licensed capture of potential groundwater inflows from North Wambo Creek/Wollombi Brook alluvium as discussed in Section 2.5.6 and Appendix E.

A predictive assessment of the performance of the Project water supply system is presented in Appendix E. The key findings of the assessment are summarised in Table 2-4.

Table 2-4 indicates a high level of water supply reliability for the CHPP, underground workings and open cut operations. The majority of water supply requirements would be met by return water from the tailings storage areas and dewatering of the open cut and underground mining areas.

2.11 INFRASTRUCTURE AND SERVICES

2.11.1 Administration Offices, Bathhouses and Workshops

The existing administration areas would continue to be utilised during the development of the Project.

Table 2-4
Project Water Supply System Performance

Project Water Supply System Component	Simulated Reliability
CHPP supply reliability	99.9%
Underground mine supply reliability	99.9%
Dust suppression reliability	99.9%
	Supply Contributions
Return water from the tailings storage	43.5%
Underground mine dewatering	13.8%
Open cut dewatering	28.5%
Sediment control dams	11.5%
Licensed extraction	2.6%
	Licensed Extractions/Transfers from Surrounding Mining Operations
Average annual extraction from Hunter River, Wollombi Brook and/or surrounding mining operations[1]	106 ML
Maximum annual extraction from the Hunter River, Wollombi Brook and/or surrounding mining operations[1]	1,000 ML

Source: Appendix E

Note 1: The actual proportional contribution of each of these sources would depend on Hunter River extraction allocations (as determined by the DLWC), the availability of flows in Wollombi Brook and the availability of mine waters from surrounding mining operations.

The main administration building and associated car park would be used for at least the first seven years of the Project before being relocated to the north-east corner of CL 743 (Figure 2-8). The "Coralie" building located off the Wambo Access Road would continue to be used as a safety and training centre.

The existing CHPP administration block, bathhouse and workshops would continue to be used by CHPP personnel. Some of the existing surface infrastructure at the Homestead Underground Mine (i.e. mechanical/electrical workshops) may be relocated to an area adjacent to the CHPP area to service the Arrowfield and Bowfield Seam Underground Mines.

The existing facilities at the Wollemi Underground Mine Portal and laydown area (i.e. administration building, bathhouse, equipment service facility, car park, washdown facility and fuel storage facility) would be utilised during the operation of the Whybrow and Wambo Seam Underground Mines. These facilities would be removed and the area rehabilitated at the end of their useful life.

2.11.2 Access Roads

Access to the Wambo Coal Mine would continue to be via the existing tar-sealed Wambo Access Road which intersects the Golden Highway. Warning and restricted access signs are posted at intervals along the Wambo Access Road.

When the administration buildings are relocated to the north-east corner of CL 743 an existing access road immediately north of Wollombi Brook and west of the Golden Highway would be used as the Administration Access Road (Figure 2-8). The Wambo Access Road would continue to provide direct access to the Wambo Coal Mine for contractors and suppliers during the life of the Project.

The extension of the open cut to the north-west would necessitate the de-gazettal and closure of the existing unsealed Pinegrove Road, in accordance with the SSC requirements. Upon the closure of Pinegrove Road an alternative access road would be provided from the Pinegrove Road/Golden Highway intersection to the Skinner property (property number 13 on Figure 1-6) around the perimeter of the open cut workings. The access road would be progressively moved to the north as the open cut develops.

The Project would require the progressive construction of internal haul roads between the open cut, mine waste rock emplacement areas and CHPP ROM coal stockpile. Existing internal haul roads would be utilised where possible. Haul roads would be gravel surfaced and/or regularly watered to minimise dust generation.

A haul road would be progressively constructed around the southern perimeter of the open cut operations for haulage of ROM coal from open cut areas. The Whybrow and Wambo Seam Underground Mines would utilise the existing haul road to the CHPP.

2.11.3 Electricity Supply

Project electrical power requirements would be provided via the existing 66 kilovolt (kV) transmission line from the State electricity grid. The Wambo Coal Mine electricity distribution system would be capable of meeting the Project power supply requirements.

The existing 66 kV transmission line would feed to the main site substation for distribution to three 5 megawatt (MW) transformer substations and a single 10 MW transformer substation. Two of the 5 MW substations would supply 11 kV to the CHPP while the 10 MW and the third 5 MW transformer substations would supply 11 kV to the underground operations.

Underground power would be reticulated via 11 kV armoured cables to the longwall face and associated equipment. Underground transformers (700 kilowatts (kW) to 1,500 kW capacity) would be used for transformation of the 11 kV to the required voltage. Power to the longwall face and associated equipment would be supplied at 1.1 kV or 3.3 kV.

The estimated average power demand for the operation of the CHPP is 3 MW.

2.11.4 Potable Water

The CHPP water supply is currently provided by two 25,000 L concrete tanks which are located in the vicinity of the CHPP office building. Deliveries of town water are transferred to the first tank. This tank provides water via a centrifugal pump to the office building and also the CHPP washery crib room and control room. The same pump and supply line diverts water into the second tank, which is used for the bathhouse. The supply lines from the potable water tanks contain filters which are changed monthly as part of the CHPP fire inspection regime.

A similar water supply system currently services the administration and contractor facilities. The existing potable water supply system would continue to service the Project and would be relocated as required.

2.11.5 Sewage Treatment and Waste Disposal

Sewage would be treated and disposed of in the same manner as the Wambo Coal Mine operations (i.e. septic tanks). Treated wastewater would be either irrigated on rehabilitation areas or evaporated in site evaporation ponds.

Effluent from the existing Wollemi Underground Mine office and bathhouse would be treated in an aerated wastewater treatment plant located near the south-west corner of the bathhouse building. Blackwater and greywater would flow by gravity into underground tanks.

This wastewater would then be pumped into a pair of aeration tanks where air from a blower is diffused through media material in the tanks. Aeration would occur daily at timed intervals.

Effluent would flow from the aeration tanks into a clarifier or settling chamber, where settled solids would be removed by air skimmers and returned to the aeration tanks. Effluent would then be treated by chlorine tablets before being pumped to a retention dam. Effluent would be pumped from the retention dam for irrigation of the bund wall around the Wollemi Underground Mine Portal and landscaping around the Wollemi Underground Mine office and bathhouse buildings.

Effluent from the CHPP office and bathhouse buildings would flow to a septic tank. From there it would proceed to a transpiration area to the west of the CHPP main office. Effluent from the CHPP washery control room would be treated by a separate biocycle unit.

Effluent from the administration areas is treated via a septic tank system. Domestic waste from administration offices and workforce areas would be collected regularly and managed by various waste disposal contractors. The existing recycling initiatives would be maintained including the recycling of ferrous and non-ferrous metals, and the recycling of paper.

A register of waste collected by contractors for disposal would be maintained on site for at least three years after collection. Where licensed contractors handle waste, those contractors would be required to comply with their own licence agreements with the EPA. Waste material would be disposed of at an EPA approved waste facility that is licensed under the *Protection of Environment Operations Act, 1997*.

2.11.6 Communications

Three communications systems would be required for the Project:

- fixed telephones providing both outside call and office intercom capability;
- mobile phone; and
- dedicated frequency Two-way Mobile Radio system to maintain contact with personnel during operations.

2.12 MANAGEMENT OF DANGEROUS GOODS

2.12.1 Transportation, Handling and Storage

Consistent with Wambo Coal Mine operations, hazardous reagents and explosives required for the Project would be transported in accordance with the appropriate State regulations (i.e. under the *Road and Rail Transport (Dangerous Goods) Act, 1997)* for the transportation of dangerous goods. These regulations apply versions of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Code) (DTRS, 2000).

Cessation of longwall operations at both the Homestead and Wollemi Underground Mines, and relocation of the existing open cut facilities at the Wambo Coal Mine, has led to the review and rationalisation of the existing dangerous goods and explosives storage facilities. The existing explosives magazine may require relocation due to development of Project open cut mining operations.

Hydrocarbon Storages

Hydrocarbons used on-site for the Project would include fuels (diesel and petrol), oils, greases, degreaser and kerosene.

Procedures have been developed at the Wambo Coal Mine for the handling, storage, containment and disposal of workshop hydrocarbons (i.e. oils, greases, degreaser and kerosene).

Waste hydrocarbons are collected, stored and removed by licensed waste transporters on a periodic basis. Workshop hydrocarbon spills and leaks are contained by a purpose built oil/water interceptor/separator system which is inspected and maintained on a regular basis.

Diesel and petrol usage would be approximately 30 ML and 16,000 L respectively per annum, and would require the design, construction and operation of additional hydrocarbon storage facilities in accordance with Australian Standard (AS) 1940-1993 *The Storage and Handling of Flammable and Combustible Liquids*. All new hydrocarbon storage tanks would be located in facilities designed to comply with Australian standards. The existing 20,000 L aboveground diesel storage facility located adjacent to the maintenance shed at the Wollemi Underground Mine Portal would also be maintained.

Explosives Storage

Explosives required for the Project would include initiating products and detonators, ANFO and emulsion explosives. Currently explosives for the open cut are stored in off-site magazines. Requirements for underground operations would be stored separately at the existing explosives magazine (Figure 2-5). The explosives would be used in accordance with the existing safety and operational procedures at the Wambo Coal Mine and AS 2187.2-1993 *Explosives – Storage, Transport and Use – Use of Explosives.* AS 2187.2-1993 details the requirements for the safe storage, handling and land transport of explosives as well as safe storage distances from other activities and bunding requirements.

As the southern limit of the open cut operations progress to the north-west, the existing explosives magazine would be relocated to the north (Figure 2-9).

Material Safety Data Sheets and Chemical Storages

No chemical or hazardous material would be permitted on-site unless a copy of the appropriate Material Safety Data Sheet (MSDS) is available on-site or, in the case of a new product, it is accompanied by a MSDS.

All chemicals brought on-site for use at the operation would be recorded in the existing inventory register which identifies the type of product, dangerous goods class, liquid class, hazchem class and quantity held on-site.

The register identifies the compatibility of materials and the emergency response procedures in the event of a spill. The register of MSDSs would be kept by the Chemical Control Officer and the Store.

Storage would be provided within the workshop and store areas and would be separated according to chemical type and storage requirements.

2.13 WORKFORCE

Employment at the Wambo Coal Mine has declined during recent years as a result of the restructuring of open cut mining operations and the cessation of underground operations. In May 2003 the total workforce directly employed by WCPL was 25 and the total site workforce, including the open cut mining contractor's personnel, was 137.

It is anticipated that during the staged development of the Project, the construction of the rail and train loading infrastructure and upgrade of the CHPP would require an additional workforce of up to 100 people.

At full development (concurrent open cut and underground operations), the Project would employ in the order of 370 people. This would include a mixture of direct WCPL employees and contractors.

A summary of the initial development and operational phase workforce is provided in Table 2-5.

Table 2-5
Development and Operational Workforce

Activity	Initial Development and Open Cut Operations (Years 1 and 2)	Open Cut and Underground Operations (Years 3 to 13)	Underground Operations (Years 14 to 21)
Rail Spur and Train Loading System Construction, CHPP Upgrade	100	-	-
Open Cut Mining Operators, Maintenance Supervisors and Management	110	200	-
Underground Mining Operators, Maintenance Supervisors and Management	-	120	120
CHPP Personnel and Maintenance Staff	27	30	20
WCPL Staff	8	20	20
Total	**245**	**370**	**160**

Source: WCPL (2003)

WAMBO DEVELOPMENT PROJECT

MAIN REPORT

Section Three
Existing Environment

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3 EXISTING ENVIRONMENT

The following subsections provide a description of the background environment relevant to the Project. Where applicable this includes discussion of the environmental impacts associated with the existing Wambo Coal Mine.

3.1 LAND RESOURCES

3.1.1 Landforms and Land Use

Landforms of the Upper Hunter region are characterised by gently sloping flood plains associated with the Hunter River and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range. Components of the Wambo Coal Mine that contribute to local topography include the Homestead and Wollemi Underground Mines, open cut mining operations and mine waste rock emplacements.

Local elevations range from approximately 60 m AHD (Australian Height Datum) at Wollombi Brook to the east of the Project, to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the west (Figure 3-1). Within WCPL mining tenements elevations range from approximately 60 m to 200 m AHD, while narrow ridges to the south-east of Waterfall Creek and along the lower slopes of the Wollemi National Park landforms rise to above 200 m AHD (Figure 3-1).

Greater Blue Mountains World Heritage Area

Wollemi National Park is situated to the south and west of the Project and along with the Blue Mountains, Yengo, Nattai, Kanangra-Boyd, Gardens of Stone and Thirlmere Lakes National Parks and the Jenolan Caves Karst Conservation Reserve, is included in the Greater Blue Mountains World Heritage Area (Environment Australia, 2002).

The Greater Blue Mountains World Heritage Area is particularly noted for its wide and balanced representation of eucalypt habitats as well as three small populations of the recently discovered Wollemi Pine, one of the world's rarest species (*ibid.*). The World Heritage Area also contains more than 400 fauna species including threatened or rare species of conservation significance such as the Spotted-tailed Quoll, Koala, Yellow-bellied Glider, Long-nosed Potoroo, Green and Golden Bell Frog and the Blue Mountains Water Skink (*ibid.*).

Land Use

Land use in the vicinity of the Project is characterised by a combination of coal mining operations, agricultural land uses and rural residential development (evident in the local villages of Bulga, Jerrys Plains and, to a lesser extent, Warkworth).

WCPL controlled lands that are not subject to Wambo Coal Mine operations are utilised for the agistment of stock (primarily cattle).

3.1.2 Meteorology

Regional climatic data were collected from Bureau of Meteorology (BOM) weather stations at the Jerrys Plains Post Office, the Scone Soil Conservation Service (SCS) and Singleton Army Base (Table 3-1).

Table 3-1
Bureau of Meteorology Station Locations and Recording Period

Bureau of Meteorology Station	Station Number	Location	Elevation (m)	Period of Record
Jerrys Plains Post Office	061086	10 km north-west of the Wambo Coal Mine Latitude: -32.4983°S Longitude: 150.9083°E	90.0	1884-2001
Singleton Army Base	061275	15 km east of the Wambo Coal Mine Latitude: -32.6133°S Longitude: 151.1717°E	73.1	1969-1990
Scone SCS	061089	53 km north of the Wambo Coal Mine Latitude: -32.0632°S Longitude: 150.9272°E	216.0	1950-2002

Source: Bureau of Meteorology (2002)

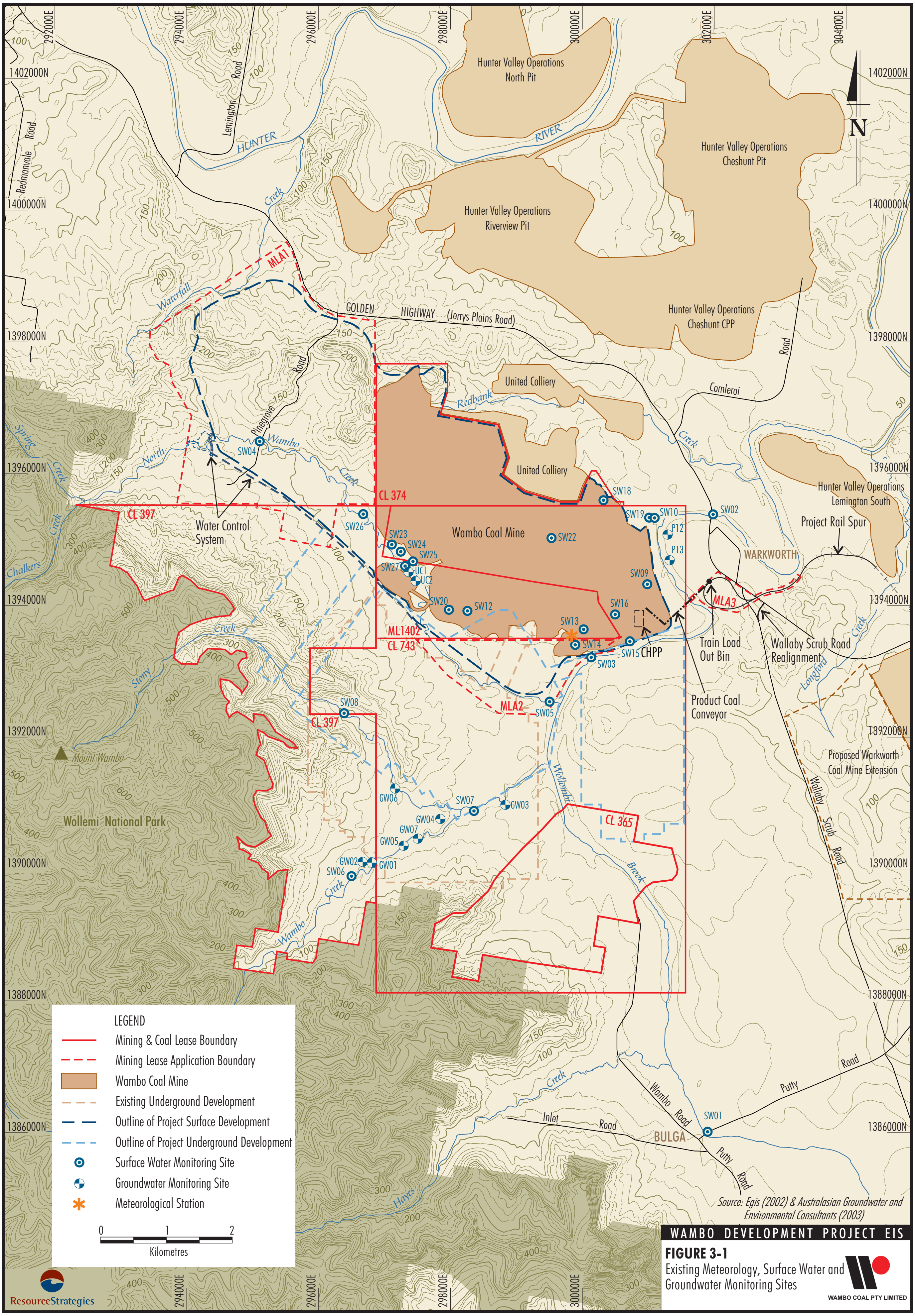


FIGURE 3-1
Existing Meteorology, Surface Water and Groundwater Monitoring Sites

WAM-02-01-Sect 3_005N

A meteorological station which continuously records wind speed and direction, temperature, relative humidity, net solar radiation, rainfall, evaporation and atmospheric pressure was installed at the Wambo Coal Mine in March 1998 (Figure 3-1).

Meteorological data collected from various regional stations and the Wambo Coal Mine is summarised in Table 3-2 and discussed below.

Temperature

The data presented in Table 3-2 indicate that regional temperatures are warmest from November through March and coolest from May through September. Average daily maximum temperatures peak in January (from the record at 31.7°C and 33.0°C for Jerrys Plains and the Wambo Coal Mine respectively), while average daily minimum temperatures are lowest in July (from the record at 3.7°C at Jerrys Plains and 5.0°C at the Wambo Coal Mine).

Relative Humidity

Relative humidity records from all sites indicate a seasonal difference with higher humidity in winter and lower humidity in summer. Average morning (9 am) relative humidity recorded at the Jerrys Plains Post Office and Singleton Army Base meteorology station was lowest in November (59%) and October (61%) respectively. Average morning (9 am) relative humidity recorded at the Wambo Coal Mine meteorology station was lowest in January and October (54%). The highest recorded average morning (9 am) relative humidity at all sites was in June (79%, 81% and 80%, respectively). Average afternoon (3 pm) monthly relative humidity ranged from 41% to 54% for Jerry Plains, from 40% to 56% for Singleton Army Base and from 36% to 54% for the Wambo Coal Mine.

Wind Speed and Direction

Wind roses for the Wambo Coal Mine meteorological station (Figure 3-2) indicate that relatively strong winds from the west-northwest are dominant during winter and spring, while winds from the south-east are more common during summer and autumn. Moderate south-easterly winds are common during the evening and night-time throughout spring, summer and autumn (Appendix A).

Evaporation

The average annual evaporation recorded at Scone is 1590.6 mm, with monthly evaporation highest in December (225.4 mm) and January (218.7 mm) and lowest in June (48.2 mm) and July (56.5 mm).

Table 3-2 shows that evaporation rates differ markedly between summer and winter.

3.1.3 Geology

Regional Geology

The Project is situated within the Hunter Coalfield (Figure 1-1) subdivision of the Sydney Basin, which forms the southern part of the Sydney-Gunnedah-Bowen Basin. The coal bearing rocks of the Sydney Basin are Permian in age (i.e. approximately 225 to 270 million years old) and are typically associated with low-lying gentle topography. The overlying rocks of Triassic age (i.e. approximately 180 to 225 million years old) cover large parts of the Sydney Basin and tend to form prominent escarpments where they outcrop.

The Sydney Basin contains localised terrestrial sediments at its base overlain by alternating layers of marine and terrestrial strata. The marine strata were deposited during marine transgressions/ incursions during the Permian era (i.e. times when the ocean inundated the valley area and extensive layers of marine sediments were deposited). The terrestrial strata represent alluvial or deltaic processes of sediment deposition that occurred during periods when the base level changed (i.e. through tectonic depression, isostatic subsidence or a glacio-eustatic rise of sea level). The extensive vegetation growth and build up of organic material required for coal formation occurred in back barrier coal swamp environments during these time periods.

Local Geology

As described in Section 2, the Project would involve both open cut and underground mining of several coal seams from the Wittingham Coal Measures, which combine with the Wollombi Coal Measures to form the Singleton Supergroup (Figure 2-2). A summary of the geology and coal measure stratigraphy underlying the Project area is provided on Figures 3-3 and 2-2, respectively.

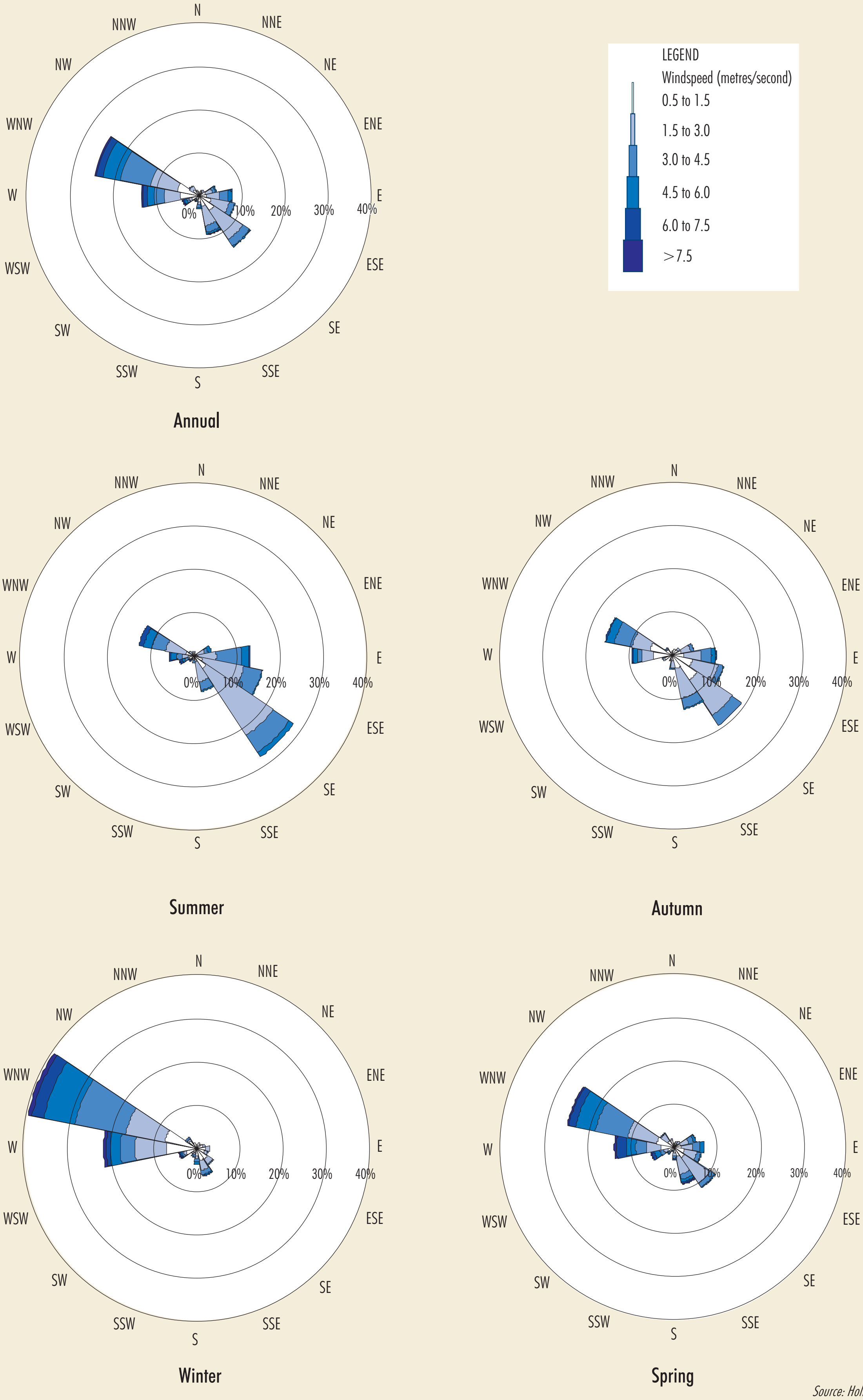
The Wittingham Coal Measures are divided into the Jerrys Plains Subgroup, Vane Subgroup, Denman Formation and Archerfield Sandstone. The Jerrys Plains Subgroup contains eight formations with 15 named coal seams. Figure 2-2 illustrates which of these seams are currently or have been previously mined at the Wambo Coal Mine and which seams would be mined by the Project (i.e. the Whybrow, Redbank Creek, Wambo, Whynot, Arrowfield and Bowfield Seams).

Table 3-2
Meteorological Data Summary

Month	Relative Humidity Monthly Average (% mean)						Average Daily Air Temperature (°C)						Average Rainfall (mm)			Average Evaporation (mm)
	Jerrys Plains		Singleton Army Base[3]		Wambo Coal Mine[4]		Jerrys Plains[5]		Singleton Army Base[3]		Wambo Coal Mine[4]		Jerrys Plains[6]	Singleton Army Base[7]	Wambo Coal Mine[4]	Scone[8]
	9am[1]	3pm[2]	9am	3pm	9am	3pm	Max.	Min.	Max.	Min.	Max.	Min.				
January	67	47	72	49	54	38	31.7	17.1	30.6	17.7	33.0	16.5	78.9	94.3	55.0	218.7
February	72	50	77	52	72	54	30.9	17.0	29.5	17.9	28.6	17.1	70.0	88.9	108.7	173.6
March	71	50	74	51	73	50	29.0	15.0	28.2	16.1	26.9	15.0	58.6	72.7	119.7	156.5
April	71	47	75	49	77	50	25.3	10.8	24.9	12.6	25.0	12.6	45.3	58.4	51.2	106.3
May	77	52	80	56	79	54	21.2	7.3	21.0	9.5	19.6	9.1	41.6	59.7	41.3	67.4
June	79	54	81	56	80	52	17.9	5.2	17.8	6.8	18.0	6.5	46.2	37.9	11.5	48.2
July	78	50	77	52	76	47	17.3	3.7	17.0	5.2	17.0	5.0	44.7	29.4	29.6	56.5
August	72	45	71	42	67	42	19.4	4.4	19.2	6.3	18.5	5.5	36.5	37.1	16.3	85.6
September	65	43	64	42	62	37	22.8	6.9	22.2	8.8	23.6	7.2	41.8	45.3	22.5	115.7
October	60	44	61	42	54	36	26.2	10.2	25.5	11.8	25.0	9.4	51.9	69.1	55.4	154.8
November	59	41	66	43	65	52	29.3	13.1	27.5	14.2	26.4	12.6	57.9	67.9	48.5	181.9
December	60	42	63	40	59	42	31.4	15.7	30.4	16.7	28.6	12.9	66.8	63.0	42.7	225.4
Annual Average	**69**	**47**	**72**	**48**	**66**	**45**	**25.2**	**10.5**	**24.3**	**11.6**	**24.2**	**10.8**	-	-	-	-
												Annual Total	**640.2**	**723.7**	**602.2**	**1590.6**

Source: Bureau of Meteorology (2002); WCPL (2002)

1 For the period 1940 – 2002
2 For the period 1957 – 2002
3 For the period 1970 – 1990
4 For the period 1998 – 2002
5 For the period 1907 – 2002
6 For the period 1884 – 2002
7 For the period 1969 – 1990
8 For the period 1965 – 2002



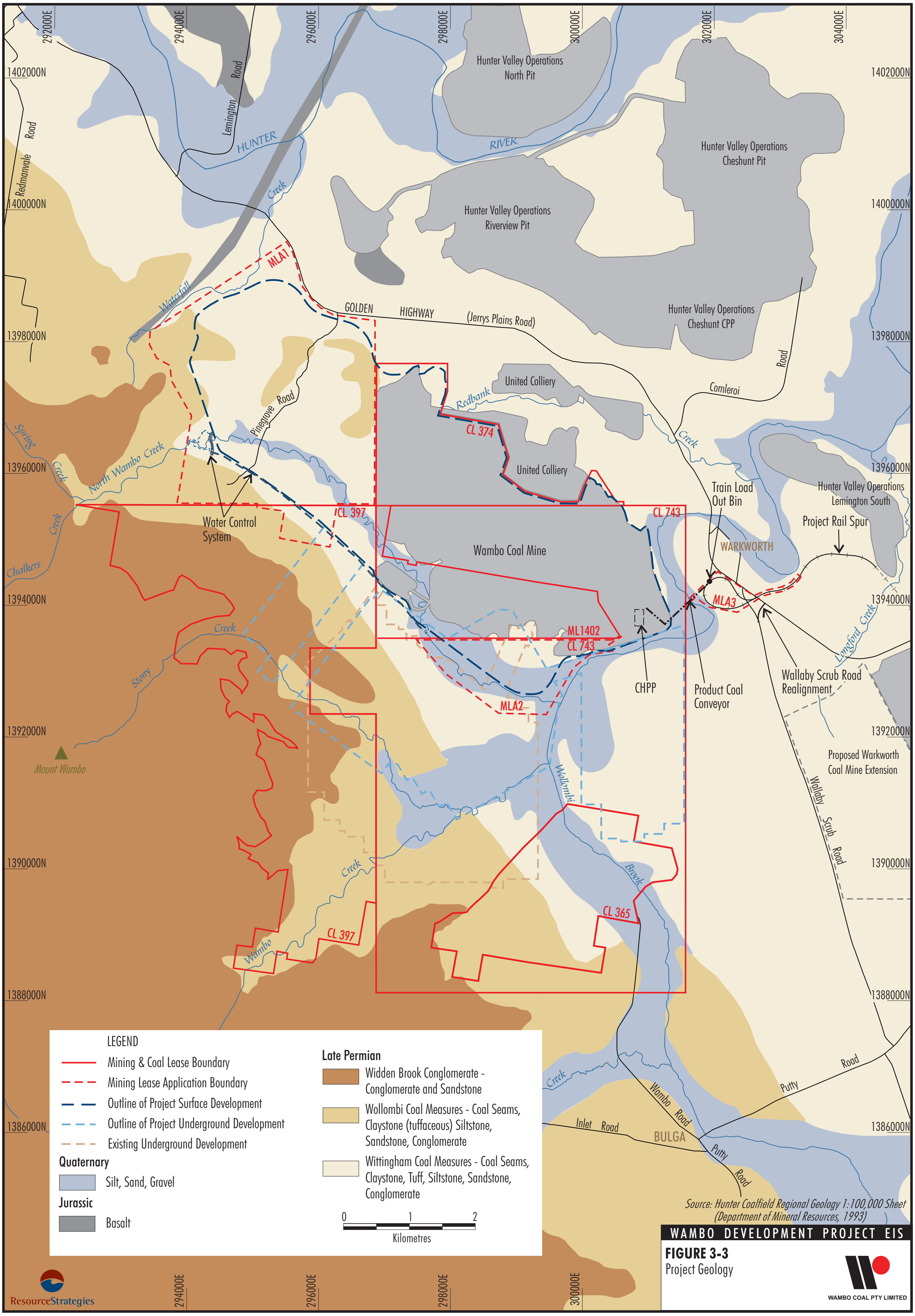
Source: Holmes Air Sciences (2003)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 3-2
Wambo Coal Mine
Annual and Seasonal Wind Roses
(30 June 2001 to 31 May 2002)

WAMBO COAL PTY LIMITED

ResourceStrategies



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 3-3
Project Geology

The overlying Wollombi Coal Measures, which outcrop to the south-west of the Wambo Coal Mine, would not be mined as part of the Project.

Quaternary alluvium occurs along Wollombi Brook and the lower reaches of its tributaries, North Wambo Creek, Redbank Creek, Stony Creek and Wambo Creek (Figure 3-3). These alluvial deposits consist of relatively shallow bands of silt, sand and gravel (DMR, 1993).

The vertical and lateral association of sedimentary rocks in the Jerrys Plains Subgroup indicates that the sequence developed primarily as several prograding, river dominated delta lobe-like landforms which began and ended with marine incursions (*ibid.*). The major episodes of delta building originated from source materials eroded from the New England area to the north of the Sydney Basin.

The Jerrys Plains Subgroup is up to 800 m thick and generally consists of relatively coarse clastic sediments (*ibid.*). The sedimentary rock layers above and between coal seams are typically lithic sandstone, siltstone and conglomerate, while minor carbonaceous claystone and tuff occurs throughout the sequence.

3.1.4 Soils, Rural Land Capability and Agricultural Suitability

A soils, rural land capability and agricultural suitability assessment was conducted for the Project and is presented in Appendix L. The assessment utilises information from previous soil surveys, DLWC and NSW Agriculture mapping, aerial photography and field surveys.

Soil landscapes, soil type, rural land capability and agricultural suitability mapping for the Project is provided in Appendix L.

Soils

Soil landscapes were classified and mapped in accordance with descriptions in the Soil Landscapes of the Singleton 1:250,000 Sheet (Kovac and Lawrie, 1991), data from previous investigations (Envirosciences Pty Ltd, 1991; HLA Envirosciences Pty Ltd, 1998; and WMC, 2000) and Project field surveys.

Soil landscapes (Kovac and Lawrie, 1991) in the vicinity of the Project including the landform, lithology, dominant soils and limitations of each soil landscape and major soil types (as described by Stace *et al.*, 1968) are described in Appendix L.

Major soil types identified include alluvial soils along major drainage lines, siliceous sands to the east of Wollombi Brook, yellow podzolics and yellow solodic intergrades adjacent to the alluvials on lower slopes and undulating plains, red podzolics on the upper and mid-slopes of elevated landforms within MLA1, soloths on moderately elevated slopes and lithosols along the eastern boundary of the Wollemi National Park and on elevated landforms within MLA1 (Figure 3-1).

Rural Land Capability

A rural land capability assessment was conducted in accordance with the standard NSW eight class system (Cunningham *et al.*, undated) which assesses biophysical soil properties and categorises land according to limitations such as erosion hazard, climate and slope. Three broad types of land use are recognised across the eight classes:

- land suitable for cultivation (Classes I to III);
- land suitable for grazing (Classes IV to VI); and
- land not suitable for rural production (Classes VII, VIII).

Seven of the eight classes were identified in the vicinity of the Project (Appendix L) utilising the DLWC 1:100,000 Land Capability Mapping (Soil Conservation Service of NSW, 1985) and the results of previous investigations (WMC, 2000). The seven rural land capability classes identified are described below in accordance with Cunningham *et al.* (undated).

Class I capability is defined (*ibid.*) as:

> *"Land capable of being regularly cultivated with no special soil conservation works or practices necessary."*

Class II capability is defined (*ibid.*) as:

> *"Land capable of being regularly cultivated with soil conservation practices such as strip cropping, conservation tillage and adequate crop rotations."*

The Project rail spur would traverse areas mapped as Class I and II capability east of Wollombi Brook. Field surveys conducted in this area identified soils of limited fertility with very little organic matter in grazed areas. This land is considered capable of regular cultivation, however limited soil fertility suggests that soil conservation works and practices would need to be employed (Appendix L).

Class II capability land has also been identified immediately north of North Wambo Creek, near its confluence with Wollombi Brook. This land is considered suitable for cultivation with simple soil conservation measures (WMC, 2000).

Class IV capability is defined (*ibid.*) as:

> *"Land not capable of being regularly cultivated but suitable for grazing with occasional cultivation with soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture."*

The majority of land south of the Wambo Coal Mine and the undulating plain associated with North Wambo Creek is considered to be Class IV capability. The Project rail spur route also intersects land considered to be Class IV capability. Slopes in these areas range from 0 to 5% with the soil types being generally yellow podzolic and yellow solodic intergrades and alluvials. These soils are of limited fertility, with very little organic matter in grazed areas. These areas are also limited by shallow soil depth and moderate erosion hazard.

Class V capability is defined (*ibid.*) as:

> *"Land not capable of being regularly cultivated but suitable for grazing with occasional cultivation and structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with the practices as in Class IV."*

Class V land is apparent in areas of mid-slopes (typically ranging from 5 to 15%) that extend north of North Wambo Creek to the Hunter River.

Class VI capability is defined (*ibid.*) as:

> *"Land not capable of being regularly cultivated but suitable for grazing with soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. This class may require some structural works."*

Class VI land is characterised by steeper grazing lands and areas of severe gully and sheet erosion and permanent seepages within Class IV land. Steeper slopes in the vicinity of the Project are generally classified as Class VI land.

Soil types within Class VI land predominantly include red podzolics and occasional soloths, which have a generally low fertility and are limited by dispersive subsoils and poor drainage.

Class VII capability is defined (*ibid.*) as:

> *"Land best protected by green timber."*

Class VII land is predominantly associated with lithosols occurring on steep slopes along the eastern boundary of the Wollemi National Park and on the elevated landforms in the MLA1 area.

Class VIII capability is defined (*ibid.*) as:

> *"Cliffs, lakes or swamps and other lands incapable of sustaining agricultural or pastoral production."*

Class VIII capability land is restricted to the steep slopes that border the Wollemi National Park and a section of Wollombi Brook near Bulga. Stony and gravely soils (lithosols) predominantly occur along these steeper slopes.

Agricultural Suitability

An agricultural suitability assessment was conducted in accordance with the five class system (Riddler, 1996), which classifies land according to its potential agricultural productivity. A summary of the agricultural suitability assessment presented in Appendix L is provided below.

Based on the NSW Agriculture (1983) Agricultural Land Classification for the portion of the Singleton LGA between Bulga and Jerrys Plains, Class 2, 3, 4 and 5 agricultural lands were identified within WCPL mining tenements (Appendix L). These classes are discussed below (Cunningham *et al.*, undated).

Class 2 agricultural suitability is defined (*ibid.*) as:

> *"Arable land suitable for regular cultivation of crops but not suited to continuous cultivation. It has moderate to high suitability for agriculture, but edaphic (soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures."*

Class 2 lands are generally confined to the flood plains of Wollombi Brook, North Wambo Creek and Wambo Creek. These lands are considered suitable for occasional cultivation for the establishment of pastures, provided appropriate soil conservation practices are employed.

Class 3 agricultural suitability is defined (*ibid.*) as:

> *"Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall production level is moderate because of edaphic or environmental constraints. Erosion hazard, soil structural breakdown and other factors including climate may limit the capacity for cultivation, and soil conservation or drainage works may be required."*

Class 3 lands are predominantly located along the undulating plains west of Wollombi Brook and adjacent to its tributaries (Stony Creek, North Wambo Creek and Wambo Creek). Class 3 lands also occur along the lower reaches of Waterfall Creek and the Project rail spur route. In these areas erosion hazard, soil structure and climatic factors limit the capacity for cultivation.

Class 4 agricultural suitability is defined (*ibid.*) as:

> *"Land suitable for grazing but not for cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of major environmental constraints."*

Class 4 lands are generally characterised by moderate to steep slopes and lower fertility land. Class 4 lands have been identified along the lower slopes of landforms on the eastern boundary of the Wollemi National Park and on the slopes of elevated landforms within MLA1 (Appendix L). Class 4 lands also occur to the east of Wollombi Brook.

Class 5 agricultural suitability is defined (*ibid.*) as:

> *"Land unsuitable for agriculture or at best suited to only light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude land improvement."*

Class 5 lands are generally characterised by steeper slopes and lower fertility land. Class 5 lands are associated with the landforms on the eastern boundary of the Wollemi National Park and on the elevated landforms within MLA1.

3.1.5 Visual Character

An assessment of the existing visual character of regional and local landscapes is provided in Appendix N and is summarised below.

Regional Setting

Since the commencement of European settlement the Upper Hunter region has been altered by clearing for agriculture resulting in the creation of a visual character that contrasts extensive agriculture on the valley floor with the rugged, forested terrain of the Barrington Tops and Wollemi National Parks that bound the valley (DMR, 1999). This visual character has been further modified over the past thirty years by coal mining and the development of power generation infrastructure, including the Bayswater and Liddell power stations (*ibid.*).

The *Upper Hunter Cumulative Impact Study and Action Strategy* (DUAP, 1997) considered the scenic quality of the Upper Hunter region in the following manner:

> *"From a broad perspective the current scenic quality of the Upper Hunter is good, its developed areas along the course of the Hunter River and New England Highway benefiting from views of the high ground framing the sides of the valley to the north, west and south."*

Regionally significant visual features in the vicinity of the Project include the escarpments and peaks of the Wollemi National Park and the riparian vegetation and cleared flood plains of Wollombi Brook and the Hunter River.

Project Setting

The local visual landscape is dominated by the rugged escarpments of the Wollemi National Park and the forested landforms that rise behind the escarpments to above 600 m AHD, peaking at Mount Wambo (approximately 650 m AHD). At lower elevations to the south of Jerrys Plains and north of Bulga, rocky, forested spurs protrude from the Wollemi National Park (Figure 1-3).

The peaks and ridges of the Wollemi National Park are visible from the majority of locations in the vicinity of the Project, except where obscured at close range by local topography or vegetation. Other features of the local visual landscape include:

- remnant vegetation and isolated landforms;
- riparian vegetation and flood plain features of the Hunter River and Wollombi Brook;
- local watercourses, including Waterfall, North Wambo, Stony and Wambo Creeks;
- coal mining operations including the existing Wambo Coal Mine, various Hunter Valley Operations' open cut mines (Coal & Allied), Warkworth Coal Mine and United Colliery;
- power supply infrastructure associated with the Redbank power station;
- agricultural land, including cropping, dairy and beef production and small-scale viticulture and olive groves; and
- residential areas including Jerrys Plains, Bulga and Warkworth.

A description of the local visual landscape is presented below, focussing on views available from potentially sensitive visual locations such as roads, townships and rural dwellings.

Local Roads

Views from the Golden Highway are generally limited by thick roadside vegetation. Intermittent views of adjacent grazing land and the riparian vegetation covering the banks of Wollombi Brook are available on the Golden Highway east of Warkworth.

Roadside vegetation dominates the landscape on both sides of the Golden Highway as it passes through Warkworth.

Views of the Wambo Coal Mine and United Colliery to the south are generally limited to elevated points where roadside vegetation is reduced, while views to the north are generally screened by roadside vegetation.

Toward the crest of a low ridgeline along the Golden Highway to the east of Pinegrove Road (approximately 130 m AHD to 150 m AHD), reduced roadside vegetation permits a panoramic view of the various open cut workings of the Hunter Valley Operations to the north.

Distant views over the Warkworth Coal Mine, to the east of the Wambo Coal Mine are available from the Golden Highway at the northern entrance to the United Colliery.

West of Warkworth, the Golden Highway traverses the northern slopes of a partially vegetated, east-west trending ridge (Figure 1-3) that rises to elevations that are generally above 150 m AHD. The vegetated higher points on this ridgeline rise to the south of the Golden Highway to approximately 220 m AHD and form an irregular feature that is readily identifiable from a number of vantage points to the north and west, and from the Golden Highway. This ridgeline dominates views to the south, while roadside vegetation screens views to the north.

West of the Golden Highway's intersection with Pinegrove Road, the visual landscape includes irrigated cropping activities, grazing lands, the riparian vegetation and flood plains of the Hunter River and an isolated landform west of Lemington Road that rises to approximately 200 m AHD.

The majority of Wallaby Scrub Road has significant screening vegetation that dominates views to the east and west. Reduced vegetation toward the northern end of Wallaby Scrub Road enables views of the Wambo Coal Mine above grazing land in the foreground.

Views of the Warkworth Coal Mine are currently screened by a series of ridges and spurs together with roadside vegetation on the eastern side of Wallaby Scrub Road (Appendix N).

Local Townships/Rural Areas

Views within Bulga and in its immediate vicinity are dominated by the landforms of the Wollemi National Park to the south through to north-west. The generally low elevations of dwellings in Bulga and on nearby Wambo Road mean that vegetated spurs protruding from the Wollemi National Park dominate the visual landscape. Views of the Warkworth Coal Mine to the north-east are generally shielded by topography, while to the east and south-east the Mount Thorley Operations and Bulga Coal Mine dominate the landscape.

The visual landscape for dwellings in Warkworth includes significant stands of remnant vegetation, cleared grazing land and riparian vegetation covering the banks of Wollombi Brook. Views of the Wambo Coal Mine are generally limited due to the presence of intervening vegetation. Reduced vegetative cover to the east enables views of grazing land and vegetation on the banks of Wollombi Brook.

The township of Jerrys Plains overlooks the Golden Highway and the Hunter River and its flood plains to the east, with distant views of the Hunter Valley Operations available from some locations. Views over the agricultural lands and remnant vegetation to the south-east are interrupted by a ridgeline that protrudes in a north-easterly direction from the Wollemi National Park. A portion of this ridgeline runs north-south on the western side of Waterfall Creek and dominates views from Jerrys Plains and properties on Redmanvale Road.

Local Rural Dwellings

Elevated dwellings on Lemington Road to the north of the Hunter River have clear views across the Hunter River flood plain into the intermediate ridgelines north of the Wambo Coal Mine. These views are obscured at lower elevations by a vegetation screen that is located on the eastern side of Lemington Road.

Rural dwellings situated on the Golden Highway south of Jerrys Plains are largely located on the northern slopes of landforms (above 150 m AHD) that have primarily been cleared for grazing.

Views from these dwellings generally include aspects of the Hunter River and its flood plain and a range of agricultural and rural residential land uses to the east and north. Intervening topography and remnant vegetation that is present on some steeper slopes generally screens southern and western aspects.

A small number of rural dwellings are located on Wambo Creek and North Wambo Creek to the south and west of the Wambo Coal Mine. These dwellings are located on northerly and north-eastern facing slopes and have views of existing Wambo Coal Mine infrastructure, including mine waste rock emplacements and the CHPP. Views from these dwellings also include the landforms of the Wollemi National Park to the south and west.

Distant views from dwellings along Wallaby Scrub Road are generally impeded by vegetation and topography.

Night-Lighting

The night-time visual landscape in the Upper Hunter region has been altered by the large number of coal mining operations. Night-lighting from mining operations produces a glow at night that is particularly visible during overcast conditions.

The glow produced by night-lighting at the Wambo Coal Mine is visible at nearby dwellings and along transport routes, while direct views of mobile machinery lights and operational lighting are available from some elevated positions. The visibility of night-lighting reduces with distance and is less noticeable to the north-west of the Wambo Coal Mine near Jerrys Plains and along Redmanvale Road, and to the south at Bulga.

3.1.6 Bushfire Regime

The Project is located in the Central Valley Fire District area within the Singleton District (Egis, 2002a). The fire season for this area is predominantly from September to December although it may extend until May depending on weather conditions and fuel loads. The Project also falls under the Muswellbrook, Scone and Singleton Bush Fire Management Committee's Bush Fire Risk Management Plan (Bush Fire Management Committee, 2000) developed by the NPWS and relevant fire authorities.

The vegetation of the Wollemi National Park and remnant vegetation to the east of Wollombi Brook presents an increased bushfire risk to mining operations and pastoral activities due to the higher level of vegetative cover and fuel load present in these areas.

The Wambo Coal Mine Bushfire Management Plan (Egis, 2002) identifies bushfire hazards and assesses fire risks to various land uses and ecological values. The Bushfire Management Plan provides fire prevention, protection and suppression strategies including standard procedures for bushfire incidents.

3.2 ACOUSTICS

An assessment of the existing noise environment has been undertaken by Richard Heggie Associates and is provided in Appendix A.

Recorded and assessed noise levels presented in Appendix A and summarised below are expressed in A-weighted decibels (dBA). The dBA system simulates the response of the human ear, which is more sensitive to high frequency sounds and de-emphasises lower frequency sounds. Table 3-3 provides information on common noise sources in dBA for comparative reference.

Hearing "nuisance" for most people begins at noise levels of about 70 dBA, while sustained noise levels of 85 dBA (i.e. eight hours) can cause hearing damage.

Measured and predicted noise levels are expressed as the equivalent continuous sound pressure level (L_{Aeq}), which is a constant sound level that is equal in energy to the fluctuating levels recorded during the sampling period.

3.2.1 Project Background Noise Monitoring

Background noise surveys were conducted during the period December 2000 to April 2001 to characterise and quantify the acoustic environment in the area surrounding the Wambo Coal Mine (Egis, 2001a). This included the positioning of unattended noise loggers at representative locations in Warkworth and to the south and south-west of the mine in March 2001 and April 2001.

Ambient noise surveys to further characterise and quantify the existing acoustic environment in the vicinity of the Project were conducted in December 2002. Eight unattended noise loggers were positioned at representative locations (N09-N16) (Figure 3-4) for a period of 12 days commencing 12 December 2002. These surveys were conducted while normal day and night shift operations were in progress at Wambo Coal Mine (Appendix A).

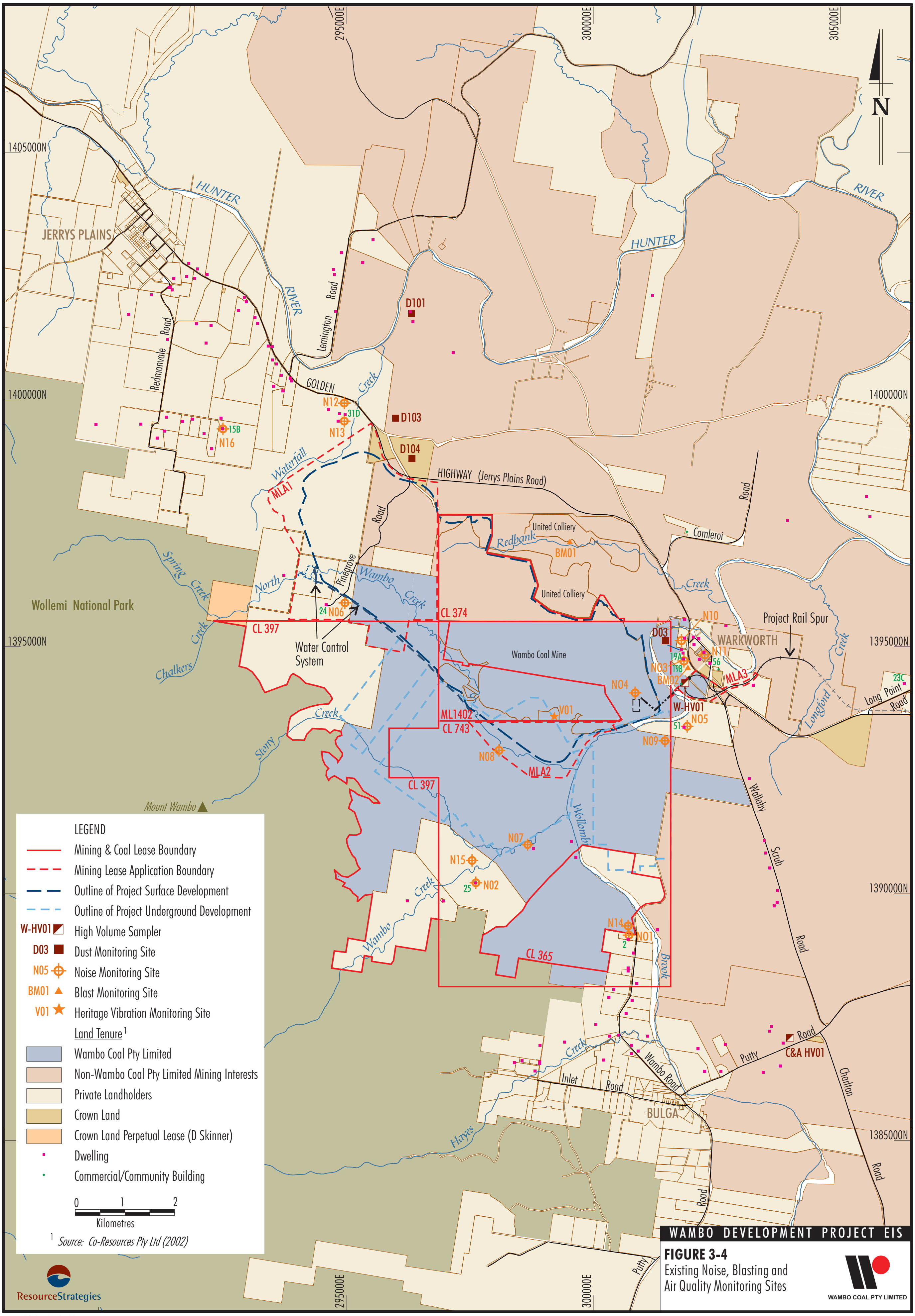
Operator-attended daytime, evening and night-time surveys were also conducted (15-16 and 22-23 December 2002) at all eight noise logging locations to supplement the unattended logger measurements and to assist in identifying the character and duration of ambient noise sources.

Noise emissions from the Wambo Coal Mine were only detected at the nearest potentially affected receivers in Warkworth and to a lesser extent at the Fenwick property (Appendix A) which is identified as dwelling number 25 on Figure 3-4. No significant industrial noise (excluding road traffic noise) from other coal mines was detected during the surveys (Appendix A).

Table 3-3
Relative Scale of Various Noise Sources

Noise Level (dBA)	Relative Loudness	Common Indoor Noise Levels	Common Outdoor Noise Levels
110 – 130	Extremely noisy	Rock band	Jet flyover at 1,000 m
100	Very noisy	Inside subway train	Petrol engine lawn mower at 1 m
90	Very noisy	Food blender at 1 m	Diesel truck at 15 m
80	Loud	Garbage disposal at 1 m, Shouting at 1 m	Urban daytime noise
70	Loud	Vacuum cleaner at 3 m, Normal speech 1 m	Commercial area heavy traffic at 100 m
60	Moderate to quiet	Large business office	-
50	Moderate to quiet	Dishwasher next room, Wind in trees	Quiet urban daytime
40	Quiet to very quiet	Small theatre, large conference room (background), Library	Quiet urban night-time
30	Quiet to very quiet	Bedroom at night, Concert hall (background)	Quiet rural night-time
20	Almost silent	Broadcast and recording studio	-
0-10	Silent	Threshold of hearing	-

Source: Modified from US Dept. Interior, Robinson Project EA (1994) and Richard Heggie Associates (1995)



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 3-4
Existing Noise, Blasting and Air Quality Monitoring Sites

WAMBO COAL PTY LIMITED

WAM-02-01-Sect3_004L

Rating Background Level

Noise data from the 2001 and 2002 surveys was then processed in accordance with the requirements of the NSW Industrial Noise Policy (INP) (EPA, 2000) to determine background noise levels (i.e. without the influence of the Wambo Coal Mine) for the Project acoustic assessment (Table 3-4).

The rating background level (RBL) is a calculated median background level representing each assessment period (day/evening/night) over the whole monitoring period. The RBL measurement methodology and analytical procedures are described in further detail in Appendix A.

Wambo Coal Mine Compliance Monitoring

Regular attended and unattended noise monitoring has also been undertaken at the Wambo Coal Mine at up to eight locations (N01 – N08) shown on Figure 3-4. During the past two years, the following noise-related actions have been undertaken:

- Monitoring during mine shutdowns in late 2000 and 2001 to assess background (i.e. non Wambo Coal Mine) noise levels.
- Establishment of Wambo Coal Mine noise goals in accordance with DA 108/91 (SSC, 1992) and changes in NSW government policy.
- Regular assessment of noise compliance against these goals.
- Conduct of complaint response noise monitoring.

Noise compliance results presented in the Annual Environmental Management Report (AEMR) indicate that no significant mine related exceedances of the Wambo Coal Mine noise limits have been recorded over the last two AEMR reporting periods (July 2000 to June 2002) (Egis, 2001b; 2002b). One noise-related complaint was recorded during the last AEMR reporting period (Egis, 2002b).

3.2.2 Road Transport Noise

Traffic noise measurements were undertaken at noise monitoring site N12 (Figure 3-4) at an offset distance of 20 m from the Golden Highway. Data recorded was then processed in accordance with the requirements of the EPA's *Environmental Criteria for Road Traffic Noise* (ECRTN), which indicated that traffic noise levels (in the absence of significant Wambo Coal Mine traffic) exceeded guideline criteria at some dwellings along the Golden Highway. In accordance with the ECRTN any increase in traffic noise due to the Project should therefore be limited to a marginal 2 dBA at the nearest properties to the Golden Highway.

Table 3-4
Noise Environment for Project Assessment Purposes

General Locality	Land Owner	Rating Background Level (dBA)		
		7.00 am to 6.00 pm	6.00 pm to 10.00 pm	10.00 pm to 7.00 am
Wambo Road (INP Rural)	2 Lambkin	30	30	30
	25 Fenwick	30	30	30
	Other Residential	30	30	30
Warkworth (INP Suburban)	19A, 19B Kelly	35	33	33
	51 Hawkes	33	31	31
	56 Hayes	34	32	31
	Residential	34	32	31
Gouldsville (INP Suburban)	23(C) Kannar	33	33	33
	Other Residential	30	30	30
Maison Dieu (INP Suburban)	Residential	33	33	33
Redmanvale/ Pinegrove Roads (INP Rural)	15B McGowen/Caslick	30	31	30
	24 Long	31	30	30
	Other Residential	30	30	30
Golden Highway (INP Suburban)	31D Fisher	34	35	30
	Other Residential	34	35	30

Source: Appendix A

3.2.3 Cumulative Impacts of Other Mines on Local Noise Levels

While Project background noise monitoring did not identify any other industrial noise during the period of attended noise monitoring, a number of existing mining developments in the area have the potential to affect the local noise environment under adverse weather conditions, including proposed expansions of the Warkworth Coal Mine and the United Colliery.

The INP requires that cumulative industrial noise (i.e. non-road traffic noise) should not exceed specified $L_{Aeq(period)}$ amenity levels that are appropriate for a particular locality and land use. The INP acceptable and maximum noise amenity criteria for the main areas surrounding the Project are summarised in Table 3-5.

The cumulative mine noise assessment presented in Appendix A assesses potential cumulative emissions against these criteria.

3.2.4 Blasting Noise and Vibration Levels

Overpressure (or airblast) is reported in linear decibels (dBL) and is the measurable effect of a blast on air pressure, including generated energy that is below the limit of human hearing. Ground vibration is the measurable movement of the ground surface caused by a blast and is measured in millimetres per second (mm/s) as Peak Vector Sum (PVS) vibration velocity.

Discernible blast emission effects can be divided into three main categories:

1. Occupants of a building are inconvenienced or disturbed.
2. Contents of a building are affected.
3. Integrity of a building structure may be compromised.

An individual's response to blasting vibration and overpressure is highly dependent on previous experience and expectations.

The EPA advocates the use of the Australian and New Zealand Environment and Conservation Councils (ANZECC) guidelines for assessing potential residential disturbance (human comfort) arising from blast emissions. The ANZECC guidelines for the control of blasting impact at dwellings are as follows:

- The recommended maximum level for airblast is 115 dBL.
- The level of 115 dBL may be exceeded on up to 5% of the total number of blasts over a period of 12 months, however, the level should not exceed 120 dBL at any time.
- The recommended maximum level for ground vibration is 5 mm/s PVS vibration velocity. It is recommended however that 2 mm/s PVS vibration velocity be considered as the long-term regulatory goal for the control of ground vibration.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months, however levels should not exceed 10 mm/s at any time (at a sensitive receiver).

In addition, the ANZECC guidelines specify blasting should generally only be permitted during the hours between 9.00 am and 5.00 pm Monday to Saturday. Blasting should not take place on Sundays and public holidays and should generally take place no more than once per day. Blasting may however be conducted outside of these hours in accordance with the applicable blast emission assessment criteria provided in the EPA's *Environmental Noise Control Manual* (1994).

Table 3-5
Project Specific Cumulative Noise Assessment Criteria

Land Use	General Locality	Acceptable $L_{Aeq(period)}$ Amenity Levels (dBA)			Maximum $L_{Aeq(period)}$ Amenity Levels (dBA)		
		Day	Evening	Night	Day	Evening	Night
Rural Residential	Wambo Road	50	45	40	55	50	45
	Redmanvale/ Pinegrove Roads	50	45	40	55	50	45
Suburban* Residential	Warkworth	55	45	40	60	50	45
	Gouldsville	55	45	40	60	50	45
	Maison Dieu	55	45	40	60	50	45
	Golden Highway	55	45	40	60	50	45

Source: Appendix A
Note : Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours
* Defined in the INP as an area affected by road traffic noise

AS 2187.2-1993 *Explosives – Storage, Transport and Use – Use of Explosives* nominates blast vibration building damage assessment criteria which range from 5 mm/s to 25 mm/s PVS according to building type and use. The airblast criteria for building damage is 133 dBL (peak).

Wambo Coal Mine Open Cut Blast Monitoring

Monitoring of airblast overpressure and ground vibration from blasting activities in the Wambo Coal Mine open cut workings is currently conducted at blast monitoring site BM01 at the United Colliery and BM02 on the Golden Highway near Warkworth (Figure 3-4).

During the July 2001 to June 2002 AEMR reporting period some 44 open cut blasts were undertaken. Overpressure results recorded at BM01 during the reporting period were below 120 dBL, although four results in excess of the 115 dBL overpressure criteria were recorded. Buildings at the United Colliery are not subject to the same blasting limits due to their industrial status.

Overpressure monitoring at BM02 recorded one blast over the 120 dBL maximum limit on 4 January 2002 (Egis, 2002b). Two blasts were recorded in excess of the 115 dBL limit. The results indicate general compliance with Wambo Coal Mine EPL conditions (Egis, 2002b).

Ground vibration levels for the period were below the limit of detection for the majority of blasts at BM02. The maximum vibration recorded at BM02 was 1.04 mm/s, while the maximum vibration recorded at BM01 was 4.76 mm/s.

One complaint regarding blasting was recorded in the July 2001 to June 2002 AEMR reporting period from the Warkworth Service Station at BM02 (Egis, 2002b). This property was subsequently purchased by WCPL.

Wambo Homestead Complex Vibration Monitoring

As a condition of consent, vibration monitoring has been undertaken on a quarterly basis at the WHC to assess the vibration impacts of haul trucks travelling past the WHC to the CHPP. With the exception of one record of 3.34 mm/s which was attributed to the activities of a nocturnal animal (Egis, 2002b), vibration monitoring results have been within the 2 mm/s assessment limit during the previous two AEMR reporting periods. A majority of results recorded at the WHC were well below 1 mm/s.

3.3 AIR QUALITY

An assessment of air quality in the vicinity of the Project has been undertaken by Holmes Air Sciences and is presented in Appendix B.
As a component of this assessment, recent background air quality data was collated and reviewed. Due to the history of mining in the Wambo Coal Mine area (i.e. since 1971), pre-mining air quality data has not been reviewed. The following section provides an overview of background dust deposition and total suspended particulates (TSP), including concentrations of particulate matter less than ten microns in size (PM_{10}).

3.3.1 Dust Deposition

Wambo Coal Mine – Historic Operations

Limited dust monitoring data is available from the early period of mining at the Wambo Coal Mine. Dust monitoring undertaken by the State Pollution Control Commission (SPCC) at two sites at the Wambo Coal Mine in the period 1976-1980 recorded dust deposition rates ranging from 0.3 to 9.6 grams per square metre per month (g/m^2/month) (Dames and Moore, 1981). Dust deposition data collected from eight dust gauges established in the vicinity of United Colliery and Wambo Coal Mine between December 1980 and May 1981 recorded results from 0.12 to 3.68 g/m^2/month with averages over the six month period generally below 1 g/m^2/month (Dames and Moore, 1981).

A dust monitoring programme was established at Wambo Coal Mine in 1985 and covered up to nine sites. Results of this programme for the period 1985 to 1990, indicated annual average dust deposition levels ranging from less than 1 g/m^2/month to approximately 18 g/m^2/month at a site located near a haul road (Envirosciences, 1991).

Wambo Coal Mine – Current Operations

The current dust monitoring network includes 13 gauges located in the vicinity of the Wambo Coal Mine. Many of the 13 dust gauges were established to assess and manage on-site dust and are therefore not suitable for determining existing deposition levels at off-site receptors. In addition, some of the gauges have been regularly contaminated by bird droppings or other non-mining sources (e.g. road traffic on local unsealed roads). Monitoring data collected since 2001 are reviewed in Appendix B.

Data from dust monitoring sites D03 (WCPL), D101, D103 and D104 (Coal and Allied) (Figure 3-4) were examined to ascertain background levels for assessment purposes. Average dust deposition results for these four sites are presented in Table 3-6 for the period January 2001 to November 2002. Wambo Coal Mine operations during this period included underground mining at the Wollemi Underground Mine and open cut mining operations which recommenced in August 2001.

The EPA has established amenity criteria for dust deposition that seek to limit the maximum increase in dust deposition from a new development to 2 g/m^2/month and total dust deposition from all sources to 4 g/m^2/month.

When the contaminated samples are discounted from the data set, the annual mean dust deposition rates at sites D03, D101, D103 and D104 are approximately 2 g/m^2/month or less, which is below the EPA goal of 4 g/m^2/month.

The 2001-2002 AEMR (Egis, 2002b) reported a total of two dust-related complaints which corresponded to blasting dust and drilling activities.

3.3.2 Suspended Particulates

The EPA has established an amenity based criterion of 90 micrograms per cubic metre (µg/m^3) for maximum annual average TSP concentrations. The EPA has also established 24-hour average and annual average PM_{10} goals of 50 µg/m^3 and 30 µg/m^3 respectively that should be generally met within the region. Further, the National Environment Protection Measure (NEPM) 24-hour standard of 50 µg/m^3 has been interpreted as a PM_{10} goal that should generally be met for the region.

Wambo Coal Mine – Current Operations

Total Suspended Particulates

Monitoring of ambient TSP levels using a high volume sampler has been undertaken every sixth day since December 1998 and is ongoing at site W-HV01 (Figure 3-4). As this monitor is located close to the existing Wambo Access Road, the results are not considered indicative of general background air quality (Appendix B).

Table 3-6
Average Dust Deposition Rates (g/m^2/month)

Month	Dust Monitoring Site							
	D03[1]		D101[2]		D103[2]		D104[2]	
	2001	2002	2001	2002	2001	2002	2001	2002
January	2.9	11.2[#]	0.5	0.9	0.5	0.9	0.2	0.4
February	5.7	1.9	0.3	1.6	0.3	1.6	0.5	1.8
March	17.7[#]	2.4	0.9	0.8	0.9	0.8	0.9	1.4
April	1.8	7.1[#]	0.5	0.6	0.5	0.6	0.9	1.2
May	1.4	1.1	0.2	0.9	0.2	0.9	0.5	1.4
June	14.3[#]	1.3	1.3	1.1	1.3	1.1	0.4	0.7
July	2.1	3.5	0.7	0.6	0.7	0.6	0.5	0.8
August	1.2	2.5	1.1	1.1	1.1	1.1	0.5	1.2
September	1.2	-	0.6	1.0	0.6	1.0	0.6	1.6
October	1.2	-	0.9	1.6	0.9	1.6	1.1	2.3
November	1.8	-	1.0	2.4	1.0	2.4	0.8	2.6
December	1.9	-	1.1	-	1.1	-	1.6	-
Annual	**4.4 (2.0*)**	**3.9 (2.1*)**	**0.8**	**1.1**	**0.8**	**1.1**	**0.7**	**1.4**

Source: Appendix B
1 WCPL dust gauge
2 Coal and Allied dust gauge
Contaminated samples
* Excluding contaminated samples

Recorded TSP concentrations (24-hour average) at W-HV01 for the period 2000-2002 ranged from 2.5 µg/m^3 to 247 µg/m^3. The highest two measurements were recorded in late November/early December and are considered to have been affected by the bushfire present in the Hunter Valley in November and December 2002 (Appendix B). Excluding data affected by the 2002 bushfires the annual average TSP concentration for the 2000-2002 period was 58.4 µg/m^3.

Data recorded at C&A W-HV01 east of Bulga (Figure 3-4) indicate that annual average TSP concentrations are likely to be approximately 32.0 µg/m^3. TSP concentrations in the vicinity of C&A W-HV01 are considered to be representative of conditions to the north-west of the Project, where land use is similar.

Particulate Matter Less than Ten Microns in Size

Long-term inferred and measured average PM_{10} concentrations at monitoring site W-HV01 were between 18.1 µg/m^{3}and 29.9 µg/m^3 for the period December 1999 to January 2003, while higher values were recorded during the bushfires (Appendix B). Long-term annual average PM_{10} concentrations from monitoring site C&A W-HV01 near Bulga were found to be 13.3 µg/m^3 (Appendix B).

Data presented in Appendix B conservatively estimates PM_{10} concentrations to be in the order of 22 µg/m^3 in the Warkworth area under normal conditions (i.e. without bushfires). In areas further from current mining (e.g. to the north-west of the Project and towards Bulga) annual average concentrations are considered likely to be in the order of 13 µg/m^3 (Appendix B).

3.4 WATER RESOURCES

3.4.1 Surface Water

A surface water assessment and management study undertaken by Gilbert and Associates is presented in Appendix E and includes characterisation of existing surface water resources, assessment of the potential impacts of the Project on those resources and an examination of existing on-site water management practices.

Regional Hydrology

The Project is located within the catchment of the Hunter River, which drains some 22,000 km^2 of central-eastern NSW to the Pacific Ocean at Newcastle.

The Hunter River is one of six river basins that have been regulated by the NSW government through the construction of large water storages. The Hunter River has three primary water storages (Glenbawn, Glennies Creek, Lostock) which are operated by the DLWC (Appendix E), however the Goulburn River and other major tributaries of the Hunter River remain unregulated (DUAP, 1997). The Hunter River has a mean annual flow at Singleton in the order of 651,000 ML/annum (Appendix E).

Local Hydrology

At a local level the Project is situated adjacent to Wollombi Brook, south-west of its confluence with the Hunter River. Wollombi Brook drains an area of approximately 1,950 km^2 (Appendix E) and joins the Hunter River some 5 km north-east of the Project. 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 (HCMT, 2003).

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 3-1).

North Wambo Creek

North Wambo Creek drains the western and south-western sections of the Project surface development area and flows south-east into Wollombi Brook, approximately 600 m south of Wambo Coal Mine.

During sampling conducted as part of the Aquatic Assessment (Appendix HD), North Wambo Creek was characterised by a flowing pool-riffle or pool-run sequence near its confluence with Wollombi Brook, while a series of isolated pools were evident in the middle reaches and a dry channel in the upper reaches. A heavy silt layer was often observed in pool habitats within the stream (Appendix HD).

North Wambo Creek has been highly disturbed by historic and present grazing activities (Appendix HD). Stock access has led to areas of bank destabilisation and erosion, trampling of riparian and aquatic vegetation and the introduction of cattle wastes into flowing and standing water bodies. The impacts of cattle are noticeably absent near the confluence of North Wambo Creek with Wollombi Brook due to fencing, steep slopes and lack of pasture (Appendix HD).

Stony Creek

Stony Creek drains from Mount Wambo in a north-east direction and meanders across the western boundary of CL 397 (Figure 3-1). The creek then passes in a south-easterly direction, through the existing underground development area of Wambo Coal Mine to join Wambo Creek.

Land use adjacent to Stony Creek consists of pasture for cattle grazing, which has resulted in the stream channel and banks being often covered in grasses and weeds. Riparian vegetation is generally sparse and discontinuous along Stony Creek, becoming more continuous upstream. Earthworks have also been conducted to re-contour the stream channel and banks to remediate subsidence effects from previous underground mining operations at the Wambo Coal Mine (Appendix HD).

Wambo Creek

Wambo Creek begins in the Wollemi National Park (Figure 3-1), drains the southern portion of CL 397 and flows into Wollombi Brook approximately 1.5 km downstream of its junction with Stony Creek.

Agricultural lands adjacent to Wambo Creek are used for cattle grazing. The riparian vegetation along the downstream and middle reaches of Wambo Creek has been extensively or completely removed, although some revegetation of native tree species along the middle reaches of Wambo Creek has been undertaken (Appendix HD).

Re-contouring of areas affected by previous underground mining operations at the Wambo Coal Mine is also apparent. The upstream reaches of Wambo Creek support a more continuous, albeit thin, strip of riparian vegetation along the stream (Appendix HD).

Surface Water Quality

Surface water quality monitoring has been undertaken in the vicinity of the Wambo Coal Mine since 1994. The water quality monitoring programme measures total suspended solids (TSS), total dissolved solids (TDS), pH and electrical conductivity (EC).

ANZECC (2000) surface water quality criteria for the protection of aquatic ecosystems and livestock watering are summarised in Table 3-7. These recommended values provide a quantitative comparison for measured pH and EC levels.

Local Creeks

Water quality is currently measured on a monthly basis at sites along Wollombi Brook and Wambo, North Wambo and Stony Creeks. The locations of relevant water quality monitoring sites are shown on Figure 3-1. Monitoring results are provided in Table 3-8.

Wollombi Brook

Sampling results at sites SW01, SW02 and SW03 on Wollombi Brook (located both upstream and downstream of the Wambo Coal Mine) indicate a mean EC ranging from 865 to 1,437 microsiemens per centimetre (µS/cm). Maximum EC results at all sites were in excess of the ANZECC guideline range for the protection of aquatic ecosystems (125 to 2,200 µS/cm), while Site SW01 also exceeded the guideline range for livestock watering (>6,000 µS/cm). Measured pH levels are generally within the ANZECC guidelines.

Table 3-7
Surface Water Quality Criteria

Indicator	Criteria	
	Protection of Aquatic Ecosystems[1]	Livestock Watering
pH	6.5 – 8.5	6.0 – 9.0[2]
Electrical Conductivity (µS/cm)	125 – 2,200	< 6,000[3]

Source: ANZECC (2000)
[1] Values for NSW lowland rivers in south-east Australia
[2] Values for stock watering surface water systems
[3] Values for beef cattle with no adverse effects expected

Table 3-8
Surface Water Quality Ranges – Local Watercourses

Site (Figure 3-1)	Sampling Period	pH			Electrical Conductivity (µS/cm)			Total Dissolved Solids (mg/L)			Total Suspended Solids (mg/L)		
		min	max	mean	min	max	mean	min	max	mean	min	max	mean
SW01	Mar 1994–Sept 2002	6.3	8.7	7.5	120	9,400	865	121	4,890	492	1	23	5
SW02	Feb 1994–Sept 2002	6.3	9.2	7.5	150	3,900	1,437	154	2,184	796	1	41	4
SW03	Feb 1994–Sept 2002	6.3	8.7	7.7	100	5,130	1,240	149	2,810	695	1	46	6
SW04	July 1996–Sept 2002	7.1	8.0	7.6	291	410	351	184	236	210	NR	NR	NR
SW05	Jan 1994–Sept 2002	6.6	8.9	7.7	240	4,650	1,839	114	4,460	1,135	1	71	6
SW26	June–Sept 2002	6.4	7.2	6.9	639	687	663	360	366	362	1	8	4
SW27	June–Sept 2002	7.0	8.4	7.9	970	1,056	1,027	524	582	548	1	2	2
SW06	July 1996–Jan 2002	6.5	8.6	7.4	140	658	370	102	466	239	1	29	7
SW07	July 1996–Jan 2002	6.8	8.8	7.6	122	736	437	120	612	274	1	47	8
SW08	July 1996–Jan 2002	6.8	8.6	7.4	120	778	312	110	461	182	1	7	2

Source: Unpublished database (GHD, 2002)

North Wambo Creek

Sampling results at sites SW04, SW05, SW26 and SW27 indicate average pH and EC ranges of 6.9 to 7.9 and 351 to 1,839 µS/cm, respectively for North Wambo Creek. The measured range of these parameters indicates all sites were generally within the ANZECC guidelines for the protection of aquatic ecosystems with the exception of site SW05 on one occasion. All samples from North Wambo Creek were within ANZECC guidelines for livestock watering (ANZECC, 2000).

Wambo Creek

Water quality results from sites SW06 and SW07 on Wambo Creek indicate average pH and EC ranges of 7.4 to 7.6 and 370 to 437 µS/cm, respectively. EC ranges were within ANZECC guidelines for protection of aquatic ecosystems and livestock watering. The measured pH range (6.5 to 8.8) indicates that the recommended ANZECC guideline pH range for the protection of aquatic ecosystems was exceeded on occasion. All samples from Wambo Creek were within ANZECC guidelines for livestock watering (ANZECC, 2000).

Stony Creek

Measurements taken from site SW08 on Stony Creek were within the recommended ANZECC guideline range for the protection of aquatic ecosystems with the exception of two samples exceeding pH and EC guideline values. Results across all parameters measured for Stony Creek were within ANZECC guidelines for livestock watering.

Wambo Coal Mine Storages

Since 2000 the water quality of operational storages at the Wambo Coal Mine has been measured at up to 17 sampling sites (SW09-SW25) (Figure 3-1). Sites SW11, SW17 and SW21 have since been removed from the monitoring programme (GHD, 2002). Water in these storages is generally alkaline and moderately to highly saline. Average pH measurements generally range from 7.5 to 9.1, consistent with latest results. Average salinity measurements vary considerably from 461 to 11,135 µS/cm.

3.4.2 Groundwater

A groundwater assessment for the Project was conducted by Australasian Groundwater and Environmental Consultants and is presented in Appendix F. The assessment included a review of previous hydrogeological investigations and results of existing groundwater flow and groundwater quality testwork.

Previous Studies

A number of hydrogeological studies and drilling and sampling programmes have been undertaken at the Wambo Coal Mine since the commencement of mining activities in 1971. Previous assessments have examined:

- groundwater inflows into open cut and underground workings;
- creek leakage due to subsidence impacts;
- water management systems and plans; and
- potential groundwater hazards to mining activities.

The existing and historical groundwater monitoring programmes provide a range of data on groundwater levels and quality within WCPL mining tenements.

Local Hydrogeology

A description of the alluvial and Permian aquifer systems identified in the vicinity of the Project is presented below.

Alluvial Aquifers

Alluvial aquifers in the vicinity of the Project comprise eroded channel fill deposits, which are up to 15 m thick along Wollombi Brook and less than 10 m thick along North Wambo and Wambo Creeks (Appendix F). While the majority of the alluvium contains a proportion of clay, discrete layers or lenses of clean sand and gravel are present in some locations. Groundwater is present in the alluvium at depths in the order of 5 to 6 m below ground level, while fluctuations of 1 to 2 m have been recorded between dry and wet periods (Appendix F).

Examination of previously reported yields indicates highly variable and anisotropic permeability distribution in the alluvium (Appendix F). The data from the various tests suggests an hydraulic conductivity range from about 1 m/day to 50 m/day, which is linked to the distribution of clay content. A storage coefficient of 0.05 is considered average for the range of alluvial material encountered and an average hydraulic conductivity of between 5 m/day to 10 m/day is expected (Appendix F).

Recharge of the alluvial aquifers occurs by direct infiltration of rainfall, runoff from bedrock subcrop areas and via infiltration of surface flow through the stream bed. Groundwater persists in the alluvium when there is no surface flow in the creeks, maintaining a base flow. The groundwater gradient in alluvium is considered likely to be similar to the gradient of the stream bed (Appendix F).

Permian Aquifers

Permian aquifers comprising low-yielding sandstone and siltstone and low to moderately yielding permeable coal seams occur throughout the local area as a regular layered sedimentary sequence dipping at about 3 degrees to the south-west.

The strata can be categorised into the following hydrogeological units (Appendix F):

- very low yielding to essentially dry sandstone and lesser siltstone; and
- low to moderately permeable coal seams, which are the prime water bearing strata within the Permian sequence.

Various tests undertaken during past studies indicate a relatively high hydraulic conductivity for the coal seams in the subcrop area of about 0.5 m/day reducing to 10^{-2} m/day with depth. Sandstone and siltstone material at depths of up to 135 m has an hydraulic conductivity in the range 10^{-4} to 10^{-3} m/day (Appendix F).

Recharge of the coal seams is likely to occur via elevated areas to the north-west of Wambo Coal Mine where the coal seams subcrop. Existing flooded pits and flooded underground mines are also potential recharge sources for the coal seam aquifers, although the Homestead and Wollemi Underground Mines (Whybrow Seam) and the United Colliery Underground Mine (Arrowfield Seam) would currently act as large hydraulic sinks towards which groundwater in the respective seams would flow (Appendix F).

The occurrence and pressure distribution of groundwater within the coal measures has changed since the commencement of mining. The pre-mining piezometric surface is likely to have reflected topography, with elevated water levels/pressures in areas distant from the major drainages and reduced levels in areas adjacent to the alluvial lands (Appendix F). Open cut and underground mining in the area has created groundwater sinks which may have merged, generating a regional zone of depressurization within the Permian sequence (Appendix F).

Local Groundwater Quality

Alluvial Aquifers

Data from various alluvial monitoring bores is summarised in Table 3-9.

Table 3-9 indicates that groundwater in the alluvium of Wambo Creek is of relatively high quality with respect to TDS and pH. Results indicate that groundwater quality has not changed significantly between 1993 and the more recent 2001-2002 AEMR monitoring period.

Table 3-9
Groundwater Quality – Alluvial Aquifers

Parameters[1]	Wambo Creek					North Wambo Creek		Wollombi Brook	
	GW02		GW04		GW03	UC1	UC2	P12	P13
	August 1993	July 01 to June 02	August 1993	July 01 to June 02	August 1993	January 2002		January 2002	
pH	6.7	6.2-7.5	7.0	6.4-7.5	6.7	7.1	7.3	6.5	6.1
EC	408	461-546	571	452-739	492	1,273	3,720	5,360	1,270
TDS	226	228-310	311	104-416	262	710	2,690	-	-
Total Alkalinity	82	-	85	-	74	-	-	-	-
Sodium	56.5	-	79.1	-	63.1	205	830	1,190	200
Potassium	4.05	-	3.95	-	3.4	700	12	10	12
Calcium	5.40	-	10.2	-	8.95	23	62	56	31
Magnesium	9.70	-	12.6	-	0.06	37	82	110	56
Chloride	66	-	108	-	90	230	650	1,680	440
Bicarbonate	-	-	-	-	-	350	480	900	140
Sulfate	13	-	21	-	20	53	650	24	7
Iron	0.07	-	<0.01	-	486	0.16	0.18	15	0.73
Manganese	-	-	-	-	-	0.11	1.8	1.7	0.66
Nitrate	0.34	-	1.62	-	11.6	<0.01	<0.01	0.22	0.13
Phosphorus	0.03	-	0.07	-	0.04	0.17	0.17	<0.1	<0.1
Copper	-	-	-	-	-	0.001	0.003	0.001	0.002
Lead	-	-	-	-	-	<0.001	0.002	<0.001	<0.001
Zinc	-	-	-	-	-	0.004	0.005	0.17	0.17
Cadmium	-	-	-	-	-	-	-	-	-

Source: Appendix F
Note: All concentrations in mg/L except pH and EC which are measured in pH units and µS/cm respectively

There is little data on water quality in the alluvium in North Wambo Creek. Analysis undertaken in 1981 indicated that groundwater in Wambo Creek was of slightly higher quality than in the North Wambo Creek alluvium (Appendix F). Measurements conducted in January 2002 returned a TDS concentration range from 710 to 2,690 mg/L in North Wambo Creek during a period of extended drought.

Permian Aquifers

Table 3-10 presents groundwater quality data recorded in 1979 and 1981 for selected coal seams of the Permian aquifers at the Wambo Coal Mine.

Results presented in Table 3-10 indicate an EC range from 1,400 µS/cm to 13,000 µS/cm, while pH is generally mildly alkaline.

Additional data provided by WCPL indicates that the typical quality of groundwater discharge from the No. 1 and No. 2 dewatering bores for the Homestead and Wollemi Underground Mines was in the range 10,500 to 11,000 µS/cm for the period July 2001 to June 2002.

Table 3-10
Groundwater Quality – Permian Aquifers

Parameters	Homestead Underground (Whybrow Seam)[1]	Western Open Cut (Whybrow Seam)[1]	Whybrow Seam[2]	Wambo Seam[1]	Whynot Seam[1]
pH	6.6-7.4	8.2-9.1	7.8-8.0	8.1	8.1
EC	3,400-8,800	1,400-7,200	2,450-12,500	13,000	10,500
TDS	1,900-5,076	714-4,200	-	10,690	8,775
Total Alkalinity	436-1,050	255-1,150	528-1,480	975	1,035
Sodium	1,000-1,560	235-1,560	470-2,600	2,810	2,510
Potassium	10-48	6.1-29.5	17-26	64	52
Calcium	24-137	8.9-25	60-70	80	110
Magnesium	42-208	12-67	68-160	708	516
Chloride	840-2,140	300-1,645	620-3,500	3,819	3,149
Bicarbonate	483-1,050	225-865	635-1,780	-	-
Sulfate	73-425	41-299	67-249	1,320	900
Iron	<100-800	<100-2,100	0.52-2.5	ND	1.4
Manganese	<4-85	<4	-	ND	ND
Nitrate	<0.01	<0.01-3.9	<0.02	4.2	0.5
Phosphorus	<0.03	<0.03-0.12	0.016-0.57	-	-
Copper	<2-9	<2	-	ND	ND
Lead	<4	<4	-	-	-
Zinc	<1-10	<1.5	-	0.26	ND
Cadmium	<0.5	<0.5	-	-	-

Source: Appendix F
Note: All concentrations in mg/L except pH and EC which are measured in pH units and µS/cm respectively
ND Not detected
1 Data recorded in 1981
2 Data recorded in 1979

3.5 FLORA

3.5.1 Regional Setting

Vegetation in the Hunter Valley has been significantly altered in floristics and structure since the arrival of Europeans in the early 1800's, primarily due to the clearing of vegetation for agriculture, mining, forestry and settlement (Peake, 2000; DMR, 1999). Nevertheless, a diverse array of vegetation types occur in the Upper Hunter region including dry rainforest, semi-evergreen vine thicket, riverine gallery forests, flood plain woodlands, upland ironbark and acacia forest, spotted gum forest and extensive box and ironbark woodlands (HCMT, 2002). Remnant vegetation occurring on the valley floor is generally more degraded and fragmented than that occurring on the slopes and foothills (DMR, 1999).

3.5.2 Local Setting

The Project is situated in the north-east corner of the Sydney Basin Bioregion (Thackway and Cresswell, 1995) and in the south-west corner of the North Coast Botanical Division, close to the junction of the North Coast, Central Coast and Central Western Slopes Botanical Divisions (Anderson, 1968; Harden, 2002). Botanically, the Project is situated in an area that comprises a mixture of flora species characteristic of the North Coast, Central Coast and Central Western Slopes Botanical Divisions.

The condition of native vegetation in the vicinity of the Project varies, with the most disturbed areas generally occurring along watercourses and on flat and undulating areas which have been cleared for grazing. Remaining areas of remnant vegetation have been semi-cleared, subjected to historical or current stock grazing and contain open areas with regeneration of various ages. The least disturbed areas occur on the steep rocky slopes and foothills which adjoin Wollemi National Park.

3.5.3 Flora Survey

Survey Timing and Methodology

A flora survey and assessment was conducted for the Project by Orchid Research in spring and summer 2002 and is presented in Appendix HA. Areas of remnant vegetation were systematically surveyed using quadrats and spot sampling sites (Figure 3-5) to compile a comprehensive species list and to detect threatened species which may have been present.

Mapping of the vegetation was conducted at two levels comprising general mapping in the vicinity of the Project and more detailed mapping of threatened vegetation communities. Details of the mapping undertaken for the Warkworth Sands Woodland and White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological communities is provided in Appendix HA.

Vegetation Communities

The varied topography, soils and watercourses in the vicinity of the Project (Sections 3.1 and 3.4) support a diversity of flora species and communities.

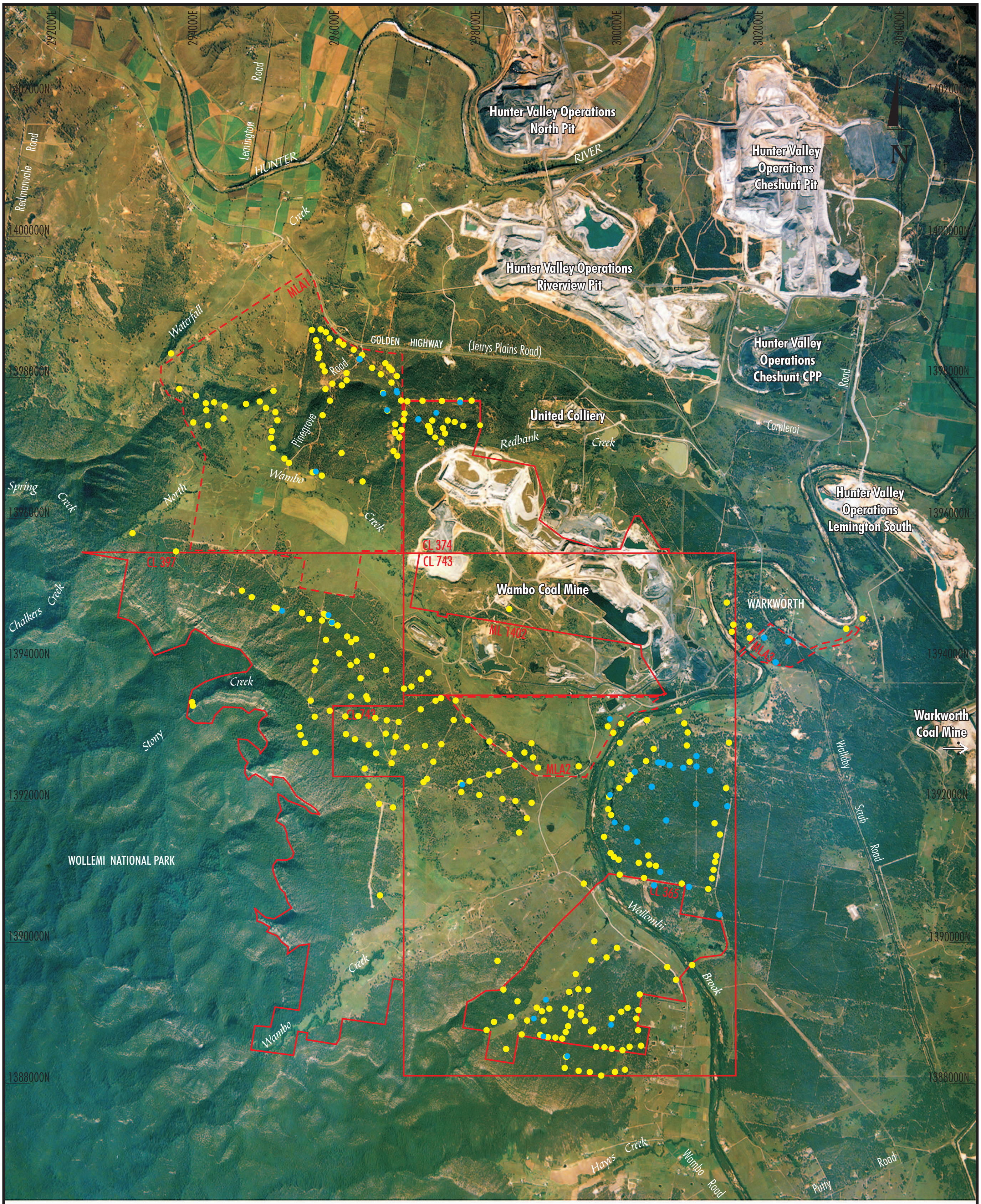
Remnant vegetation is dominated by eucalypt forests and woodlands, however thin strips of River She-oak (*Casuarina cunninghamiana*) occur along North Wambo Creek, Wambo Creek, Stony Creek and Wollombi Brook. Sand dune heathy woodlands and patches of dry rainforest are also present.

A number of tree species including Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*) and Bulloak (*Allocasuarina luehmannii*) are widespread and common and associate within many other species. Other dominant tree species include Spotted Gum (*Corymbia maculata*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Rough-barked Apple (*Angophora floribunda*) and Drooping She-oak (*Allocasuarina verticillata*). Table 3-11 and Figure 3-6 provide a summary of the 16 vegetation communities recognised in the study area (Appendix HA).

Table 3-11
Vegetation Communities Recognised in the Vicinity of the Project

Community Number	Scientific Names	Common Names
1	*Casuarina cunninghamiana/Angophora floribunda*	River Oak/Rough-barked Apple
2	*Eucalyptus camaldulensis*	River Red Gum
3	*E. melliodora/E. blakelyi/A. floribunda*	Yellow Box/Blakely's Red Gum/Rough-barked Apple
4	*E. tereticornis/Melaleuca decora*	Forest Red Gum/Honeymyrtle
5	*B. integrifolia/A. floribunda/E. blakelyi*	Coast Banksia/Rough-barked Apple/Blakely's Red Gum
6	*E. crebra/E. moluccana/Allocasuarina luehmannii/ M. decora*	Narrow-leaved Ironbark/Grey Box/Bulloak/Honeymyrtle
7	*A. floribunda/E. crebra/E. moluccana/ A. luehmannii*	Rough-barked Apple/Narrow-leaved Ironbark/Grey Box/ Bulloak
8	*E. moluccana/ E. crebra/Allocasuarina verticillata*	Grey Box/Narrow-leaved Ironbark/Drooping She-oak
9	*Corymbia maculata/ E. crebra/ E. moluccana/ A. luehmannii/M. decora*	Spotted Gum/Narrow-leaved Ironbark/Grey Box/ Bulloak/Honeymyrtle
10	*E. dawsonii/ E. crebra/A. luehmannii ± M. decora*	Slaty Gum/Narrow-leaved Ironbark/Bulloak ± Honeymyrtle
11	*E. punctata/E. crebra/A. luehmannii M. decora*	Grey Gum/Narrow-leaved Ironbark/Bulloak/Honeymyrtle
12	*E. blakelyi/A. floribunda/E. crebra*	Blakely's Red Gum/Rough-barked Apple/Narrow-leaved Ironbark
13	*E. acmenoides/A. floribunda*	White Mahogany/Rough-barked Apple
14	*Geijera salicifolia/Notelaea microcarpa*	Brush Wilga/Native Olive
15	*Acacia aneura*	Mulga
16	Not applicable	Vine Thicket (Dry Rainforest)

Source: Appendix HA



1386000N 1386000N

LEGEND
- Mining & Coal Lease Boundary
- Mining Lease Application Boundary
- Quadrat Sample Site
- Spot Sample Site

0 1 2
Kilometres

294000E 296000E 298000E 300000E

ResourceStrategies

Source: *Orchid Research (2003)*

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FIGURE 3-5
Flora Survey Sites

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VEGETATION COMMUNITIES

Riverine Communities (Alluvial Soils)
1. *Casuarina cunninghamiana/Angophora floribunda*
2. *Eucalyptus camaldulensis*
3. *E. melliodora/E. blakelyi/A. floribunda*

Colluvial Soil Communities
4. *E. tereticornis/Melaleuca decora*

Aeolian Soil Communities (Warkworth Sands Woodland)
5. *Banksia integrifolia/A. floribunda/E. blakelyi*

Soils Derived from Sandstone, Shale, Conglomerate
6. *E. crebra/E. moluccana/Allocasuarina luehmannii/M. decora*
7. *A. floribunda/E. crebra/E. moluccana/A. luehmannii*
8. *E. moluccana/E. crebra/Allocasuarina verticillata*
9. *Corymbia maculata/E. crebra/E. moluccana/A. luehmannii/M. decora*
10. *E. dawsonii/E. crebra/A. luehmannii/M. decora*
11. *E. punctata/E. crebra/A. luehmannii/M. decora*
12. *E. blakelyi/A. floribunda/E. crebra*
13. *E. acmenoides/A. floribunda*
14. *Geijera salicifolia/Notelaea microcarpa*
15. *Acacia aneura*
16. Vine Thicket (Dry Rainforest)

0 1 2
Kilometres

LEGEND
Mining & Coal Lease Boundary
Mining Lease Application Boundary

Source: Orchid Research (2003)

ResourceStrategies

294000E 296000E 298000E 300000E

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FIGURE 3-6
Vegetation Communities of Remnants in the Vicinity of the Project

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WAM-02-01-Sect 3_006I

Flora Species

A total of 357 plant species were recorded by the survey, including 252 native and 105 introduced plant species (Appendix HA). Plant families with the highest number of species were the Daisy family (Asteraceae), the Pea Flowers (subfamily Faboideae), the Grasses (Poaceae), the Eucalypts and related genera in the family Myrtaceae and the Wattles (subfamily Mimosoideae).

Introduced Species and Weeds

The highest proportions of introduced species and weeds were found in cleared pasture areas and along watercourses, while the least number of weeds were found in undisturbed natural communities on steeper slopes and stony soils. Semi-cleared, grazed natural communities and disturbed sites in bushland areas contained intermediate weed levels.

A number of weeds recorded by the survey are regarded as noxious in the Singleton LGA including the Prickly Pears (*Opuntia* spp.), African Boxthorn (*Lycium ferocissimum*), Blackberry (*Rubus fruticosus*), Mother-of-Millions (*Bryophyllum delagoense*), Paterson's Curse (*Echium plantagineum*), Silver-leaf Nightshade (*Solanum elaeagnifolium*), Sweet Briar (*Rosa rubiginosa*) and Willows (*Salix* spp.). None of these species were abundant in the survey area, even though the *Opuntia* species were widespread.

Threatened Flora Species and Ecological Communities

Eight Part Tests of Significance have been undertaken for 17 threatened flora species and three endangered ecological communities under Section 5A of the EP&A Act in order to ascertain the likely impacts of the Project on these threatened flora species, ecological communities and/or their habitats. The findings of the assessment are discussed in Section 4.8.

No plant species listed as threatened under the TSC Act or Commonwealth EPBC Act were recorded in the vicinity of the Project (Appendix HA). However, the following endangered ecological communities were identified by the Project flora survey:

- Warkworth Sands Woodland (listed under the TSC Act); and
- White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands (listed under both the TSC Act and EPBC Act).

Warkworth Sands Woodland

The Warkworth Sands Woodland was listed as an endangered ecological community in the TSC Act in December 2002. Prior to its listing, the significance of the Warkworth Sands Woodland community had been recognised by a number of authors including Pickard and Benson (1975), Benson (1981), NPWS (1992) and Peake (2000). There is also evidence that the NPWS (1992) had been considering the long-term protection of the lands known as Warkworth Sands since 1978.

The distribution of the Warkworth Sands Woodland endangered ecological community is highly restricted, occurring on Aeolian sand deposits south-west of Singleton in the Hunter Valley (NSW Scientific Committee, 2002a). The community occupies sand dunes generally 1 m to 6 m high and is generally comprised of woodland to low woodland structure with trees of *Angophora floribunda* and *Banksia integrifolia* (NSW Scientific Committee, 2002a). Shrubs and ground cover species include *Acacia filicifolia*, *Pteridium esculentum*, *Imperata cylindrica*, *Brachyloma daphnoides* and *Melaleuca thymifolia* (*ibid.*). Areas where woodland occurs on a shallow A-horizon of sand are included within this community (NSW Scientific Committee, 2002a).

Woodlands occurring adjacent to the sand dunes on Permian clays share many species with the Warkworth Sands Woodland, however they also have a higher abundance of Permian substrate species such as *Corymbia maculata, Eucalyptus moluccana, Allocasuarina luehmannii* and *Eucalyptus crebra* (NSW Scientific Committee, 2002a). These areas are not considered to be part of the Warkworth Sands Woodland endangered ecological community by the NSW Scientific Committee (2002a), except in ecotones where the species of the Warkworth Sands Woodland are dominant (generally where a thin sandy veneer overlies the Permian substrate).

Mapping of the occurrence of the Warkworth Sands Woodland within the study area was undertaken as part of the flora assessment (Appendix HA) and the results of this mapping are shown on Figure 3-6. Surveys of the Warkworth Sands Woodland (Appendix HA) indicate that the community has a patchy, yet extensive distribution on lands to the east of Wollombi Brook around Warkworth, and between Wollombi Brook and Wallaby Scrub Road (Figure 3-6).

Warkworth Sands Woodland identified in the vicinity of Warkworth and the Project rail loop is heavily invaded by weeds, fragmented and in poor condition. In comparison, the Warkworth Sands Woodland identified between Wollombi Brook and Wallaby Scrub Road (Figure 3-6) is in good condition.

White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands

In NSW, the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands occurs in the New England Tableland, Nandewar, Brigalow Belt South, NSW North Coast, Sydney Basin, NSW South Western Slopes and South Eastern Highlands bioregions, although the community predominantly occurs on the tablelands and western slopes of NSW (NSW Scientific Committee, 2002b).

White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands includes woodlands where the characteristic tree species include one or more of the following species in varying proportions and combinations – White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) or Blakely's Red Gum (*Eucalyptus blakelyi*) (NSW Scientific Committee, 2002b; NPWS, 2002). Grass and herbaceous species generally characterise the ground layer, and shrubs are generally sparse or absent, though they may be locally common (*ibid.*).

This woodland community occurs on soils that are moderately to highly fertile and as a result has been extensively cleared and modified in the past by thinning, clearing, grazing, pasture improvement and cultivation (NPWS, 2002).

The occurrence of the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological community within the study area is assessed in Appendix HA and is summarised below. The White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands is represented by scattered occurrences of Yellow Box in small isolated groups and individuals along both sides of Wollombi Brook and by one patch of an association of Blakely's Red Gum/Rough-barked Apple/Narrow-leaved Ironbark in the south. Patches of Box-Gum Woodland within the study area have been mapped (Appendix HA) and are presented on Figure 3-6 as vegetation Communities 3 and 12.

Rare or Threatened Australian Plants

One species listed as rare, *Acacia bulgaensis*, and one listed as poorly known, *Grevillea montana*, in *Rare or Threatened Australian Plants* (ROTAP) (Briggs & Leigh, 1996) were found within the study area. *Acacia bulgaensis* was found only beside Stony Creek. By contrast, *Grevillea montana* was found to be widespread and relatively common in the vicinity of the Project, occurring in nearly all communities, except those on wet or poorly drained sites, or in rainforests with closed canopies (Appendix HA).

Regionally Significant Flora

The Rare Plants Committee of the Hunter Region Botanic Gardens has compiled a Preliminary List of Regionally Significant Plants (Bell *et al.*, in prep), comprising 1,217 species. A total of 65 species listed in the *Preliminary List of Regionally Significant Plants of the Hunter Catchment* (Bell, *et al.*, in prep) were recorded within the study area.

Although largely cleared and heavily infested with weeds, regionally significant populations of the River Red Gum occur in small scattered patches along Wollombi Brook. A number of vegetation communities identified in the vicinity of the Project also contain *Melaleuca decora*. Paperbark woodlands dominated by *M. decora* are also considered to be regionally significant. In addition, a small area of vine thicket considered to be regionally significant occurs on a steep south-east facing slope on the north side of Waterfall Creek to the north-west of MLA1. Vine thicket vegetation is a relict of a period when the Australian climate was wetter than today and rainforest vegetation was more widespread (Curran, 2001).

3.6 TERRESTRIAL FAUNA

3.6.1 Fauna Surveys

Avifauna, mammals, reptiles and amphibians were surveyed in September and October 2002 as part of the Project terrestrial fauna assessment (Appendix HB). Bat fauna were surveyed separately in September 2002 as part of the Project bat fauna assessment (Appendix HC). A number of reference sources containing the results of regional fauna surveys and database records (e.g. NPWS Atlas of NSW Wildlife, Birds Australia, Australian Museum and Hunter Bird Observers Club) were also reviewed and, where appropriate, included in these assessments.

Survey Methodology

A total of 34 fauna sampling sites including 16 terrestrial fauna sites (Sites A to P) and 18 bat fauna sites (Sites 1 to 18) were surveyed (Figure 3-7). The fauna surveys employed a variety of methods including Elliott traps, pit fall traps, cage traps, spotlighting, hair tubes, herpetofauna searches, call playback, echolocation call detector systems and general observations. Details of the survey methodologies utilised are provided in Appendices HB and HC.

Species Composition

The number of terrestrial fauna species identified during the surveys is provided per fauna type in Table 3-12.

Table 3-12
Terrestrial Fauna Species

Fauna Type	Number of Species Identified
Amphibians	10
Reptiles	15
Birds	117
Mammals	23
Total	**165**

Source: Appendix HB and Appendix HC

The majority of amphibians recorded by the surveys were associated with waterbodies, however, several species not closely associated within open water were also recorded, including Sudell's Frog (*Neobatrachus sudelli*), Smooth Toadlet (*Uperoleia laevigata*) and several *Limnodynastes* species. Four species of tree frogs were recorded by the surveys, namely, the Eastern Dwarf Tree Frog (*Litoria fallax*), Broad-palmed Frog (*Litoria latopalmata*), Rocket Frog (*Litoria nasuta*) and Peron's Tree Frog (*Litoria peronii*) (Appendix HB).

Although the species richness of reptiles was high, some species were found to be in low abundance. The Eastern Snake-necked Turtle (*Chelodina longicollis*), Lace Monitor (*Varanus varius*), Bearded Dragon (*Pogona barbata*) and Robust Ctenotus (*Ctenotus robustus*) were the most common reptile species recorded during the surveys.

The fauna surveys recorded a relatively large number of woodland birds and birds associated with waterbodies. The surveys also recorded a high diversity of woodland bird species including a number of woodland birds observed to have a declining population status in NSW.

Twenty-three native mammals were recorded by the surveys including the Short-beaked Echidna (*Tachyglossus aculeatus*), Yellow-footed Antechinus (*Antechinus flavipes*), Common Wombat (*Vombatus cucula*), Squirrel Glider (*Petaurus norfolcensis*), Common Brushtail Possum (*Trichosurus vulpecula*), four macropods (Kangaroos and Wallabies) and 14 bat species. The Eastern Grey Kangaroo (*Macropus giganteus*) and Red-necked Wallaby (*Macropus rufogriseus*) were recorded in high numbers. The highest number of bat calls was recorded at waterbodies, however the majority of bat fauna utilised the wide variety of habitats available.

Introduced Fauna Species

Eleven introduced species were recorded by the surveys, including the House Sparrow (*Passer domesticus*), Common Starling (*Sturnus vulgaris*), Common Mynah (*Acridotheres tristis*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Cat (*Felis catus*), Dog (*Canis familiaris*), Red Fox (*Vulpes vulpes*), Brown Hare (*Lepus capensis*), European Rabbit (*Oryctolagus cuniculus*) and Cow (*Bos taurus*).

Threatened Fauna Species

Threatened fauna species recorded in the vicinity of the Project are summarised in Table 3-13 and included eight birds and five mammals. Figure 3-8 illustrates the location of threatened species recorded by the Project surveys.

Eight Part Tests of Significance conducted for 41 threatened fauna species, including those listed in Table 3-13, are presented in Appendix HE. Findings of the Eight Part Tests of Significance are discussed in Section 4.9.

3.6.2 Migratory Species

Table 3-14 presents the migratory species listed under the EPBC Act that have been recorded in the vicinity of the Project by various sources, including Project surveys (Mount King Ecological Surveys, 2003), Birds Australia (2002), the Hunter Bird Observers Club (2002) and/or the Australian Museum (2002).

LEGEND

- Mining & Coal Lease Boundary
- Mining Lease Application Boundary
- F Terrestrial Fauna Survey Site (Sites A to P)
- 15 Bat Fauna Survey Site (Sites 1 to 18)
- W1 Aquatic Fauna Sampling Site (Sites NW1-NW8 and W1, W2)

0 1 2
Kilometres

Source: Mount King Ecological Surveys (2003) & Greg Richards and Associates Pty Ltd (2003)

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FIGURE 3-7
Fauna and Habitat Survey Sites

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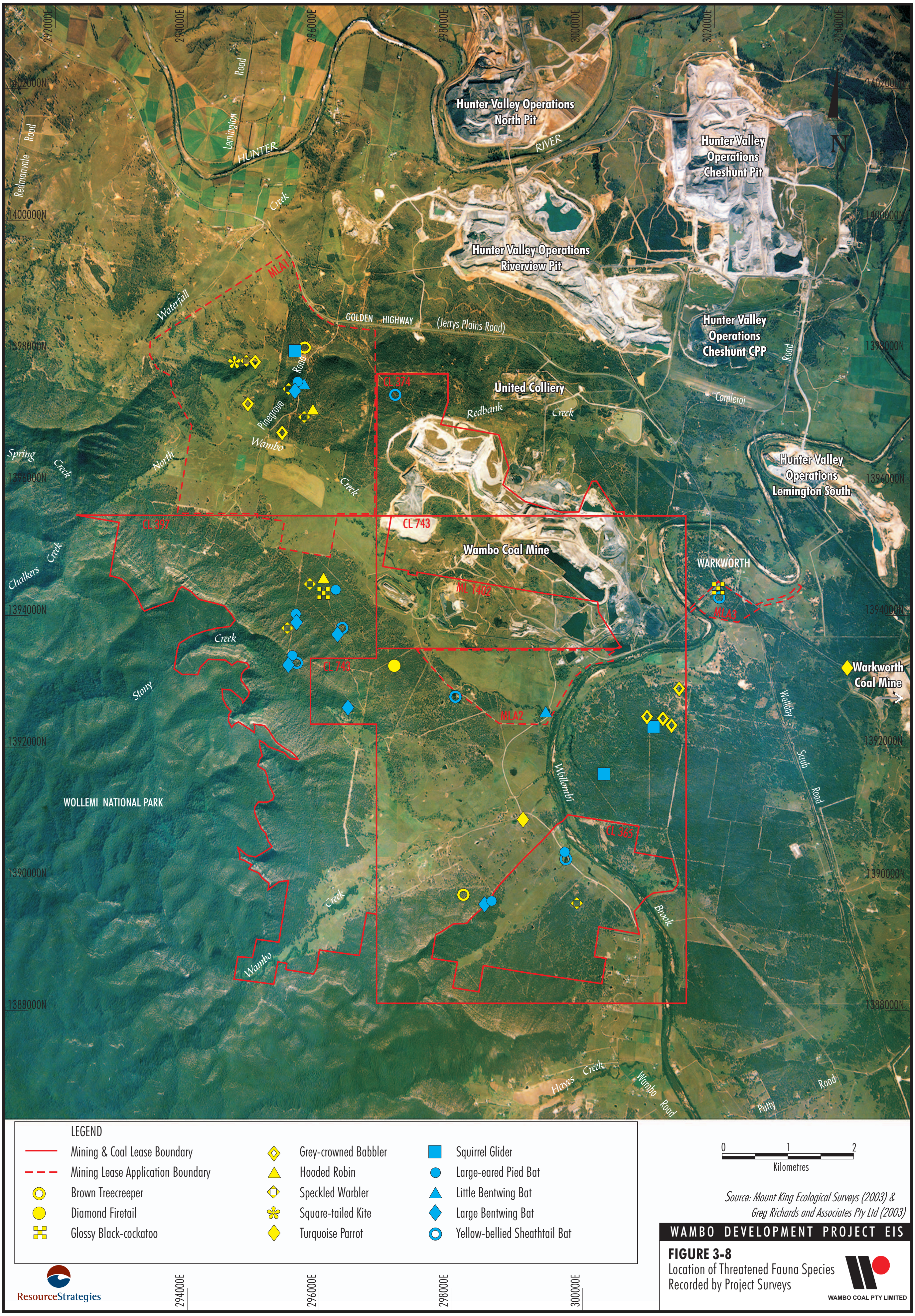

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FIGURE 3-8
Location of Threatened Fauna Species Recorded by Project Surveys

WAM-02-01-Sect 3_001I

Table 3-13
Threatened Fauna Species

Common Name	Scientific Name	Conservation Status	
		TSC Act[1]	EPBC Act[2]
Square-tailed Kite	*Lophoictinia isura*	V	-
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V	-
Turquoise Parrot	*Neophema pulchella*	V	-
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-
Speckled Warbler	*Pyrrholaemus sagittatus*	V	-
Hooded Robin	*Melanodryas cucullata cucullata*	V	-
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-
Diamond Firetail	*Stagonopleura guttata*	V	-
Squirrel Glider	*Petaurus norfolcensis*	V	-
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	V	-
Little Bentwing Bat	*Miniopterus australis*	V	-
Large Bentwing Bat	*Miniopterus schreibersii*	V	CD
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V

Source: Appendix HB and Appendix HC
1 *Threatened Species Conservation Act, 1995*
2 Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
V Vulnerable
CD Conservation Dependent

Table 3-14
Migratory Species

Common Name	Scientific Name	Project Surveys[1]	Birds Australia[2]	Hunter Bird Observers Club[3]	Australian Museum[3]
Anatidae					
Black Swan	*Cygnus atratus*	•	•		
Australian Wood Duck	*Chenonetta jubata*	•	•	•	
Pacific Black Duck	*Anas superciliosa*	•	•	•	
Grey Teal	*Anas gracilis*		•	•	
Chestnut Teal	*Anas castanea*	•	•		
Hardhead	*Aythya australis*	•			
Phalacrocoracidae					
Great Cormorant	*Phalacrocorax carbo*	•			
Ardeidae					
Cattle Egret	*Ardeola ibis*	•			
Accipitridae					
Black-shouldered Kite	*Elanus axillaris*			•	
Square-tailed Kite	*Lophoictinia isura*	•			
Whistling Kite	*Haliastur sphenurus*	•		•	
White-bellied Sea-eagle	*Haliaeetus leucogaster*	•	•	•	
Spotted Harrier	*Circus assimilis*		•		
Swamp Harrier	*Circus approximans*	•			
Brown Goshawk	*Accipiter fasciatus*		•	•	
Grey Goshawk	*Accipiter novaehollandiae*	•			
Collared Sparrowhawk	*Accipiter cirrhocephalus*		•	•	
Wedge-tailed Eagle	*Aquila audax*	•		•	
Little Eagle	*Hieraaetus morphoides*	•	•	•	

Table 3-14 (Continued)
Migratory Species

Common Name	Scientific Name	Project Surveys[1]	Birds Australia[2]	Hunter Bird Observers Club[3]	Australian Museum[3]
Falconidae					
Brown Falcon	*Falco berigora*	•	•	•	
Australian Hobby	*Falco longipennis*	•	•	•	
Grey Falcon	*Falco hypoleucos*				•
Black Falcon	*Falco subniger*	•			
Peregrine Falcon	*Falco peregrinus*	•	•	•	
Nankeen Kestrel	*Falco cenchroides*	•	•	•	
Recurvirostridae					
Black-winged Stilt	*Himantopus himantopus*	•			
Charadriidae					
Banded Lapwing	*Vanellus tricolor*	•			
Masked Lapwing	*Vanellus miles*	•	•	•	
Apodidae					
White-throated Needletail	*Hirundapus caudacutus*		•	•	
Meropidae					
Rainbow Bee-eater	*Merops ornatus*	•	•	•	
Meliphagidae					
Regent Honeyeater	*Xanthomyza phrygia*			•	
Yellow-tufted Honeyeater	*Lichenostomus melanops*			•	
Sylviidae					
Clamorous Reed-Warbler	*Acrocephalus stentoreus*		•	•	
Rufous Songlark	*Cincloramphus mathewsi*		•	•	
Golden-headed Cisticola	*Cisticola exilis*		•		
Muscicapidae					
Bassian Thrush	*Zoothera lunulata*			•	
Common Blackbird	*Turdus merula*		•		

Source: Appendix HB
1 Mount King Ecological Surveys (2003)
2 Database records for the search area – 150°53' to 151°05'E by 32°30' to 32°40'S (October 2002)
3 Database records for the search area – 150°53' to 151°05'E by 32°30' to 32°40'S (November 2002)

3.6.3 Marine Protected Species

The White-bellied Sea-eagle was recorded during Project surveys and is covered by the marine provisions of the EPBC Act. The Swift Parrot and White-throated Needletail have also been recorded in the local area and while considered to be predominantly non-marine, these species are known to overfly or occasionally visit Commonwealth marine areas (Birds Australia, 2002; Hunter Bird Observers Club, 2002; ERM, 2002).

3.7 AQUATIC FAUNA

Aquatic macroinvertebrate, fish and water quality sampling was conducted in March 2003 at sites on North Wambo Creek (NW1 to NW8) and Wambo Creek (W1 and W2) (Figure 3-7) as part of the aquatic assessment presented in Appendix HD.

The ten sampling sites displayed considerable variation in terms of stream structure (e.g. pool/run sequence or isolated pools), stream flow and the condition of the riparian zone. A summary of the stream reach characteristics for each site is presented in Appendix HD. Stony Creek was not sampled due to the absence of water within this stream at the time of survey.

3.7.1 Macroinvertebrates

A total of 41 taxa were recorded from North Wambo Creek and 22 taxa from Wambo Creek. The higher number of taxa recorded from North Wambo Creek is likely to reflect the higher proportion of habitat available for sampling in North Wambo Creek at the time of survey. The taxon classification and abundance of macroinvertebrates collected from each site on North Wambo Creek and Wambo Creek are presented in Appendix HD.

The taxa collected are common to the streams of the Hunter River catchment (Chessman *et. al*, 1997).

Insects dominated the macroinvertebrate assemblage recorded for each stream, accounting for approximately 79% of the taxa recorded in North Wambo Creek and 74% of taxa in Wambo Creek (Appendix HD). Results indicate that while the macroinvertebrate assemblage had a relatively low occurrence of sensitive taxa, a small number of sites within North Wambo and Wambo Creeks are able to support some sensitive taxa. The macroinvertebrate communities also contained a high occurrence of silt-tolerant taxa.

SIGNAL A values calculated for North Wambo Creek and Wambo Creek (in accordance with the methodology presented in Appendix HD) suggest the water quality at the sampling sites (Figure 3-7) is "*possibly mildly polluted*" to "*probably moderately polluted*" (Appendix HD).

3.7.2 Fish Fauna Assemblage

The composition and abundance of fish fauna species collected from each site on North Wambo Creek and Wambo Creek are presented in Appendix HD. A total of three fish species were recorded from North Wambo Creek, namely, the Short-finned Eel (*Anguilla australis*), Striped Gudgeon (*Gobiomorphus australis*) and the introduced Mosquito Fish (*Gambusia holbrooki*). The Striped Gudgeon and Mosquito Fish were also recorded in Wambo Creek, as well as the Long-finned Eel (*Anguilla reinhardtii*) and Australian Smelt (*Retropinna semoni*). The results indicate a relatively species-poor fish fauna assemblage in North Wambo Creek and Wambo Creek.

Native fish species (i.e. the Short-finned Eel, Long-finned Eel, Australian Smelt and Striped Gudgeon) were only recorded at sites where the Mosquito Fish was absent, with the exception of site NW8.

An assessment of North Wambo Creek and Wambo Creek using the Fish Habitat Classification Scheme (NSW Fisheries, 1999) indicates that these creeks represent minimal fish habitat. These creeks flow intermittently, contain semi-permanent pools and provide some refuge, breeding or feeding areas for some aquatic fauna. In general, North Wambo and Wambo Creeks have catchment characteristics, water quality and stream riparian, bank and channel characteristics which are unlikely to support a species-rich fish assemblage.

These watercourses are therefore not considered to be regionally significant.

3.8 COMMUNITY INFRASTRUCTURE

A community infrastructure assessment was prepared by Resource Strategies and is presented in Appendix J. A summary of the study in relation to background demographics, employment and community infrastructure is provided below.

The Project is located in the Hunter Statistical Division (SD) of NSW which covers approximately 31,000 km^2 and extends from Tuncurry to Lake Macquarie and west to the Great Dividing Range. The Hunter SD comprises the Newcastle and the Hunter Statistical Subdivisions. Each Statistical Subdivision is further broken down into a series of Statistical Local Areas (SLAs) that correspond to LGAs.

The Project is located in the Singleton SLA and the existing Wambo Coal Mine workforce resides predominantly within the SLAs of Singleton, Muswellbrook, Maitland and Cessnock. Approximately 70% of the 2001/2002 Wambo Coal Mine workforce resided within the Cessnock and Singleton SLAs, while the Maitland SLA provided most of the remaining workforce (Table 3-15).

Table 3-15
2001/2002 Place of Residence of Wambo Coal Mine Employees

Local Government Area	Approximate % of Employees
Cessnock	52
Singleton	20
Muswellbrook	1
Maitland	27

Source: Appendix J

3.8.1 Population Profile

Table 3-16 compares population growth experienced at the state, regional (Hunter SD) and local (SLAs of Singleton, Muswellbrook, Maitland and Cessnock) levels for the period 1991 to 2001.

Table 3-16
NSW, Hunter Region and Local Area
Population Growth 1991-2001

Area	1991	1996	2001	% Increase 1996-2001	% Increase 1991-2001
State of NSW	5,898,731	6,038,696	6,371,745	5.5	8.0
Hunter Statistical Division	513,693	540,491	563,587	4.2	9.7
Local Area	124,530	129,998	134,187	3.2	7.7
• Singleton SLA	18,661	20,133	20,384	1.2	9.2
• Muswellbrook SLA	15,111	15,562	14,796	-4.9	-2.1
• Maitland SLA	46,909	49,941	53,803	7.7	15
• Cessnock SLA	43,849	44,362	45,204	1.9	3.1

Source: Appendix J

Over this period the following observations can be made:

- relatively high growth was experienced within the Maitland SLA;
- negative growth was experienced within the Muswellbrook SLA;
- a low level of growth was experienced within the Cessnock SLA; and
- moderate growth was experienced within the Singleton SLA.

Overall the local area has experienced growth in the order of 7.7% over the period 1991 to 2001, which is consistent with the state population growth rate over the same period of 8.0%. Population growth in the 1996-2001 period has been lower than for the 1991-2001 period.

Demographics

Table 3-17 summarises the age distribution of the SLAs within the local area and provides a comparison with the Hunter region.

Data presented in Table 3-17 indicates that the SLAs in the local area possess a significantly younger population than the Hunter region with a higher percentage of the population under the age of 15 and in the 25-44 year age group.

Persons aged over 65 years constitute a relatively low percentage of the population within the local area.

3.8.2 Employment Profile

A summary of the economic structure of the local and regional areas is presented in Table 3-18. At the time of the 2001 census the economic structure of the Hunter region was reasonably diverse with the retail sector providing the highest percentage of employment with 16.6% of the workforce (Table 3-18), while manufacturing, and health and community services were also significant with 11.6% and 11.1% of the workforce, respectively.

The proportion of the workforce working in the mining sector has dropped considerably throughout all SLAs in the local area and the Hunter region since the 1996 census. The Hunter region has experienced a dramatic decrease in the relative percentage of total employment in this sector with a decline from 9.7% in 1996 to 3.1% in 2001. The Cessnock SLA experienced the most significant drop in the local area with a decrease in mining employment from 12.0% in 1996 to 7.7% in 2001.

Table 3-17
Age of the Population

Age Group	Singleton SLA (%)	Cessnock SLA (%)	Muswellbrook SLA (%)	Maitland SLA (%)	Hunter Region (%)
Under 15 years	25	23	25	24	21.0
15 – 24 years	14	13	13	14	13.0
25 – 44 years	31	28	31	29	27.4
45 – 64 years	22	23	22	22	23.5
65 and over	9.1	13	9.4	11	15.1
Total	100	100	100	100	100

Source: Appendix J

Table 3-18
Employment Distribution by Industry (1996 and 2001)

Industry	Cessnock SLA (%)		Singleton SLA (%)		Muswellbrook SLA (%)		Maitland SLA (%)		Hunter Region	
	1996	2001	1996	2001	1996	2001	1996	2001	1996	2001
Manufacturing	15.9	15.6	4.9	8.0	8.0	9.1	16.9	14.7	7.8	11.6
Retail Trade	13.8	16.7	11.6	12.9	11.8	13.8	15.8	17.6	13.0	16.6
Mining	12.0	7.7	18.8	15.5	16.4	12.7	4.5	3.5	9.7	3.1
Health and Community Services	10.2	10.3	6.2	6.0	5.7	6.1	9.3	10.2	7.1	11.1
Accommodation, Cafes and Restaurants	6.0	7.6	3.9	5.0	4.4	4.7	4.0	4.5	5.7	5.5
Construction	5.5	6.6	6.6	6.8	6.6	7.2	6.4	7.3	6.7	7.5
Property and Business Services	5.7	6.4	6.3	7.0	5.9	6.4	7.9	8.3	5.7	8.7

Source: Appendix J

Unemployment Characteristics and Trends

Unemployment in the local area is summarised in Table 3-19.

Table 3-19
Unemployment Rate

Statistical Area	1996 (%)	2002 (%)	Labour Force June 2002
Hunter Region	9.9	9.9	244,820
Cessnock	13.1	12.4	20,185
Singleton	6.8	5.2	9,597
Muswellbrook	9.2	8.7	7,096
Maitland	10.5	10.3	25,307

Source: Appendix J

At a regional level the unemployment rate has remained static since 1996.

At the local level the unemployment rate has decreased marginally in the Cessnock, Muswellbrook and Maitland SLAs since 1996 (Table 3-19), although these rates remained above the national unemployment rate of 6.5% for the corresponding period in 2002 (Appendix J). The Singleton SLA continues to experience the lowest rate of unemployment in the local area.

3.8.3 Housing and Short-term Accommodation

An investigation of local housing and short-term accommodation indicated that (Appendix J):

- a very high proportion of the dwelling structures in the local area are separate houses;
- approximately 9% of all private dwellings were unoccupied in the Cessnock, Singleton and Muswellbrook SLAs; and
- approximately 5.6% of all private dwellings were unoccupied in the Maitland SLA.

Consultation with local real estate agents suggested that the Singleton and Maitland SLAs are experiencing a shortage of available vacant land and housing, including rental housing. The Cessnock SLA has a higher number of available houses, for sale or rent.

An increase in housing demand throughout the local area has resulted in an increase in property prices of up to 50% over the past three years (Appendix J).

Short-term Accommodation

Short-term accommodation facilities are abundant in the Hunter region with over 6,500 bed spaces available in motels, hotels or guesthouses (Appendix J).

Vacancy rates for motels in Singleton are generally around 30% despite seasonal variations. Other short-term accommodation facilities in the town include nine hotels, three caravan parks and six bed and breakfast establishments. Similar facilities are available in the Cessnock, Muswellbrook and Maitland SLAs.

3.8.4 Community Facilities

Education

The Cessnock, Maitland and Singleton SLAs are well equipped with education facilities including a range of kindergartens, pre-schools, and primary and secondary schools.

Tertiary education opportunities are available at Technical and Further Education facilities in Cessnock, Singleton and Maitland, while the University of Newcastle is situated approximately 25 minutes from Maitland.

Community Services

Maitland is the major sub-regional centre for the local area and surrounding districts offering a wide range of recreational and retail facilities such as an art gallery, libraries, community swimming pools, golf courses, shopping centres and restaurants.

Services available within the local area include Rotary and Lions Clubs, aged care facilities and recreational sporting clubs that cover activities such as football, cricket, swimming, tennis, netball and bushwalking. Community support services are also provided by organisations such as Lifeline, the Australian Red Cross, Women's Information and Referral Service and Singleton Neighbourhood Centre. Before and after school childcare, kindergarten, day care and playgroups are also available.

Health

The Maitland Hospital services a population of approximately 72,000 including the Maitland, Cessnock, Singleton and Muswellbrook SLAs and is the referral facility for the Upper and Lower Hunter Regions. Coronary care and emergency, surgical and mental health facilities are included in the hospital's comprehensive range of health services. The Maitland Hospital is supplemented by the Maitland Private Hospital, and district hospitals in Singleton (53 beds), Cessnock (68 beds) and Kurri Kurri (41 beds). Private health providers in the region offer a range of services including podiatry, physiotherapy, optometry, naturopathy, radiology and pathology.

The local area is also serviced by Community Health Centres which provide specialised care in the form of social workers, community nurses, women's health nurses, home nursing, palliative care, early childcare nurses, counselling and mental health support.

3.9 OVERVIEW OF THE REGIONAL ECONOMY

A benefit cost analysis and regional economic assessment was prepared for the Project by Gillespie Economics and is presented as Appendix I. A summary of the results of the assessment with regard to the existing regional economy is provided below.

The regional economic assessment is based on a 2001 input-output analysis for the Hunter SD. The Hunter SD comprises the SLAs of Cessnock, Lake Macquarie, Maitland, Newcastle, Port Stephens, Dungog, Gloucester, Great Lakes, Merriwa, Murrurundi, Muswellbrook, Scone and Singleton.

In 2001 the gross regional product (GRP) (household income and other value added contributions) for the Hunter economy was \$17,259M and included \$9,096M in wages and salaries and \$8,163M in other value added contributions (includes gross operating surplus, depreciation and net indirect taxes and subsidies). The workforce of the region was approximately 222,000 with the average salary being approximately \$41,000 per person (Appendix I).

The comparative distribution of various industry sectors to the GRP, employment and output earnings for the Hunter region, is presented in Table 3-20.

Table 3-20
Contributions to Gross Regional Product, Employment and Output by Industry Sector – Hunter Statistical Division 2001

Sector	Total Employment (%)	Contribution to GRP (%)	Contribution to Output (%)
Agriculture/Forestry and Fishing	3	2	2
Mining	3	21	18
Manufacturing	12	12	20
Utilities	1	4	4
Building	8	7	8
Services	73	52	48

Source: After Appendix I

Comparison with the state economy reveals that the mining, utilities and building sectors are of greater relative importance to the economy of the Hunter SD. The manufacturing, mining and services sectors contribute 97% of exports from the Hunter SD while imports are more evenly spread across economic sectors.

Agricultural and Wine Production

Agriculture is an important contributor to the regional economy employing in the order of 7,000 people and producing approximately $150M of agricultural exports during 2001 (Appendix I). Agricultural activities in the region include sheep, beef cattle, grains, dairy cattle, viticulture, irrigation cropping and vegetables.

The wine industry also has a significant presence in the Hunter Valley, with production in the order of 39 ML of wine in 1998-1999, resulting in a total wine production output of $594M (Cessnock City Council, 2002).

Electricity Generation and Manufacturing Activities

Located within the Muswellbrook SLA, within the Hunter SD, the Bayswater and Liddell thermal power stations generate approximately 40% of the State's total power (Macquarie Generation, 2003).

Hydro Aluminium located at Kurri Kurri within the Cessnock SLA generates 15% of Australia's output of aluminium, with the majority (approximately 75%) being exported (Cessnock City Council, 2002).

Mining

The coal mining sector is the most productive sector of the Hunter SD when measured in terms of GRP per employee and has the highest average wage of all the economy sectors (Appendix I). The coal mining sector is also responsible for a major part of the exports from the region. The Hunter region produces up to 80% of NSW's total coal production (Hunter Valley Research Foundation, 2003).

Retail and Service Industries

The retail trade sector is the most significant sector in terms of employment numbers and total wages to employees, with 16.6% of the workforce (Appendix J). The Hunter SD also has a significant percentage of the workforce in the services and building and construction sectors reflecting the labour intensive nature of these sectors.

Maitland has a wide range of recreational, retail and community support facilities and is regarded as the major sub-regional service centre for the local study area and surrounding districts. It supplies medical facilities to an estimated population of 72,000 (Appendix J).

Defence

The Singleton Military Area was established in 1941 and is a major employer in the Singleton SLA. During 2002 a total of 180 permanent personnel were involved in training and weapons development (Singleton Shire Council, 2003).

3.10 ABORIGINAL HERITAGE

3.10.1 Background

Aboriginal History

The Project is located within the Wonnarua Aboriginal linguistic or tribal area, which extends throughout the Hunter Valley. The archaeological record indicates that the general view of a single homogenous and unified tribe did not describe the dynamics and complexities of life in the Hunter lowlands in the early historic and late pre-contact periods (Appendix D).

While the boundaries of the territorial groups are not certain, it is possible that the Project is located near the borders of the Geawegal, Wollombi, Comnaroy and possibly the Macdonald River or other group occupying the sandstone country to the south-west. The area around the confluence of Wollombi Brook and the Hunter River would have been conveniently located for meetings of these groups (Appendix D).

It is likely that the Project is situated on land that once fell within the territory of one of these groups and that was occupied as part of the daily or seasonal round of the group. It would probably have supported a combination of transient residential sites as well as day-time sites, though the possibility of more sedentary occupation in certain favoured locations should not be discounted (Appendix D).

The Hunter region was officially opened for white settlement in the early 1820s and by 1825 more than 360,000 acres had been occupied. The introduction of diseases such as smallpox and influenza combined with agricultural activities of the settlers that altered land and other resources, resulted a decline in the number of Aboriginal people practising traditional lifestyles (Appendix D).

Records from State blanket distributions undertaken within the Hunter Valley in the 1830s indicate people living at Lake Macquarie, Port Stephens, Gloucester, Stroud, Dungog, Williams River, Glendon, Patricks Plains, Wollombi, Fal Brook, "Merton"/Denman and Scone (Appendix D). In the more settled areas, notes on blanket distributions in the 1850s and 1860s indicate that surviving Aboriginal groups focussed their occupation at Dungog, Paterson, Maitland, Singleton, Wollombi, Muswellbrook and Scone. There is also evidence that Aboriginal people may have continued to practice a traditional lifestyle in the mountains near Bulga until at least 1879 (Appendix D).

Natural Resources

Literature reviewed as part of the Aboriginal heritage assessment suggests that people in the Hunter Valley were essentially foragers, moving to new areas to obtain food and other resources, although preferences for certain locations were apparent among some groups.

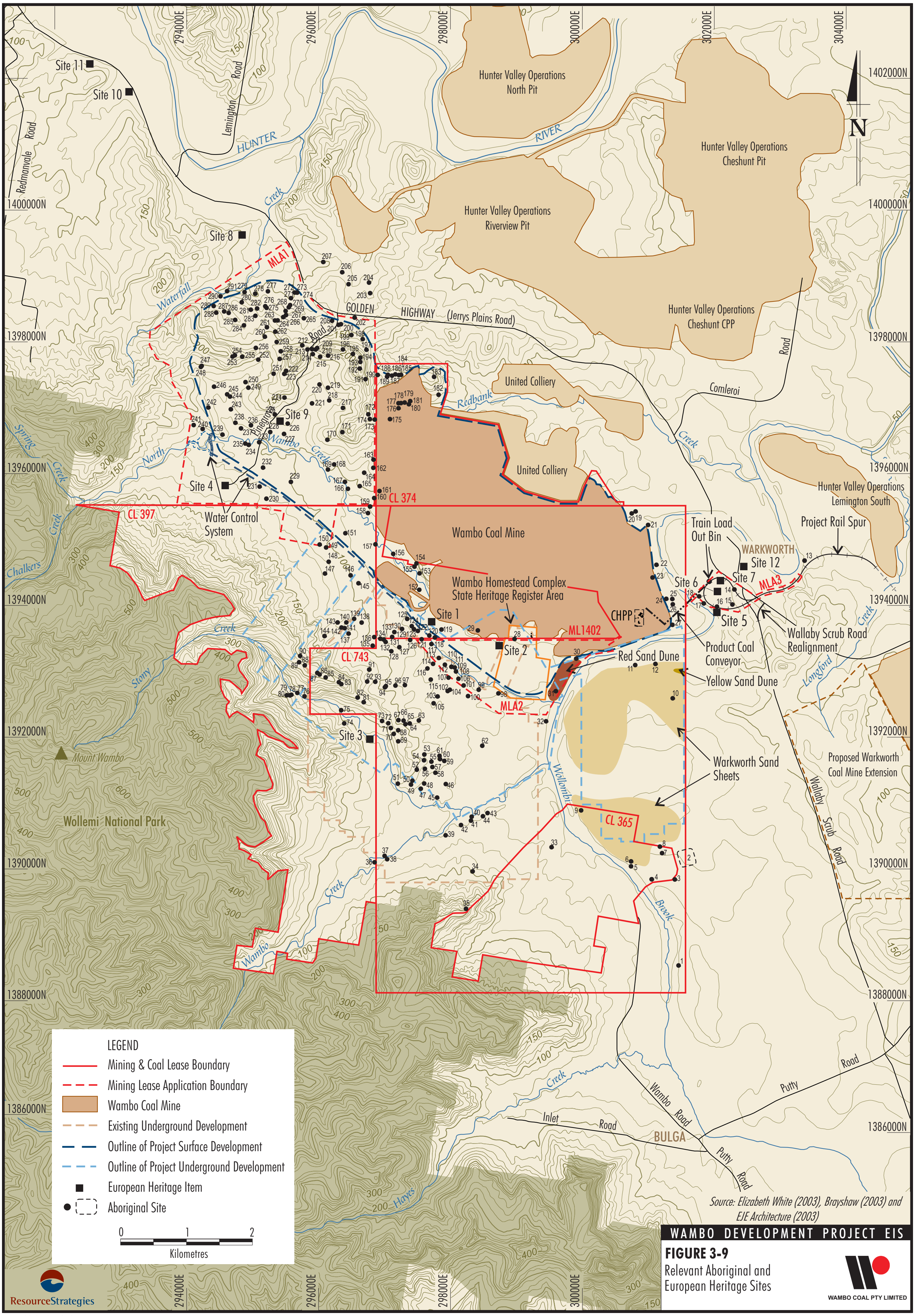
As described in Section 3.4.1, a number of natural surface water resources exist in the vicinity of the Project including the Hunter River, Wollombi Brook and their tributaries.

The description of the local landscape provided in Section 3.1 identifies local topographic features, such as valleys, hillslopes, escarpments and ridgelines that may have been used as access routes and vantage points by Aboriginal peoples (Appendix D).

A description of geology and soils present in the vicinity of the Project is provided in Sections 3.1.3 and 3.1.4 respectively. Appendix D also contains a discussion on the possible use of stone resources in the area as tools. Hunter River gravels, which contain silicified tuff, silcrete, quartz, petrified wood and a wide range of other igneous and metamorphic rock types, were probably the main source of stone used for the production of stone tools. Silcrete outcrops also occur on some high terraces above the Hunter River in the vicinity of the Project at Hunter Valley Operations Lemington South (Figure 3-9) and near Jerrys Plains (Appendix D). Quartz pebbles of varying quality were identified during the surveys undertaken as part of the Aboriginal heritage assessment.

Prior to European contact the area in the vicinity of the Project would have supported a wide range of plant and animal resources. Surveys conducted as part of the flora assessment (Appendix HA) identified a number of plants that may have provided food and other resources to Aboriginal people, including (Appendix D):

- Kurrajong trees (*Brachychiton populneus*).
- Cycads (*Macrozamia sp.*).
- Long-leaf mat rush (*Lomandra longifolia*).
- Native cherry (*Exocarpus cupressiformis*).
- Banksia (*Banksia integrifolia*) and Bracken (*Pteridium esculentum*).
- Rusty Fig (*Ficus rubininosa*).
- Mulga (*Acacia aneura*).



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 3-9
Relevant Aboriginal and European Heritage Sites

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In the mid 1820s kangaroos and/or wallabies were abundant in the Denman area, and probably also on Wollombi Brook (Appendix D).

Previous Archaeological Surveys

Several archaeological studies have previously been carried out in the vicinity of the Project. These include studies by Brayshaw (1981), Brayshaw *et al*. (1996), Corkill (1990), Dyall (1980, 1981), Effenberger (1992), ERM Mitchell McCotter (information on NPWS site forms), Kuskie (1998, 2000), Rich (1991a, 1991b), Silcox (1998), and Sutton (2002). Most of these studies were carried out primarily to identify sites and provide management advice. Data recorded on these sites has been incorporated where possible into analysis of sites and assemblages in Appendix D.

3.10.2 Project Surveys

The Aboriginal heritage assessment (Appendix D) utilised the results of a search of the NPWS Aboriginal Sites Register and the results of Project surveys conducted by an archaeological team and representatives of the Lower Wonnarua Tribal Council, Upper Hunter Wonnarua Council and Ungooroo Aboriginal Corporation in November and December 2002. Results of the NPWS search and Project surveys were supplemented by a geomorphological study (Attachment D-2 of Appendix D).

A total of 292 sites were identified and consist of:

- a carved tree/ceremonial site;
- grinding groove sites;
- possible grinding groove sites;
- probable scarred tree;
- contact sites with flaked glass objects;
- possible contact sites with scatters of historic material together with stone objects; and
- isolated objects and object scatters (open sites).

These sites are described in detail in Appendix D and summarised in Table 3-21. The locations of sites identified during the Project surveys are illustrated on Figure 3-9.

Carved Tree/Ceremonial Site

The carved tree/ceremonial area is identified as Site 2 on Figure 3-9 and is considered to be of high archaeological significance because of the site type (ceremonial ground), its connectedness to the other sites in the area and because of the known chronology of the site. Records indicate the carved tree site was last used in 1852 for a ceremony that was attended by 500 to 600 Aboriginal people from various tribes from as far as Mudgee and Goulburn (Appendix D).

The carved tree/ceremonial site was originally recorded by the Australian Museum in 1918, following information provided by a local resident. At this time the site consisted of approximately 12 carved trees, a clearing and several intact mounds and was described as a bora ground (Appendix D). The carved trees were red gum and apple trees and the carvings were reportedly made into the tree bark. Four of the carved trees were photographed for the Australian Museum record. Mounds of heaped earth were present amongst the trees, along with a crescent-shaped mound approximately 60 cm high and 5 m long.

The Australian Museum photographs indicate that the trees were dead in 1918, and the NPWS site form indicates there had been several bushfires since that time and the site had been destroyed. In the 1930s only one tree stump remained, though several earth mounds were apparently still present (Appendix D).

The carved tree/ceremonial area (Site 2) is located to the east of Wollombi Brook, outside of the outline of Project surface and underground development (Figure 3-9). As part of the Aboriginal heritage assessment research was undertaken by Helen Brayshaw to both locate and learn more about the site (Attachment D-1 of Appendix D). Brayshaw (2003) concludes that it is “beyond doubt” that the site is located in the vicinity as indicated on Figure 3-9. No physical evidence of the carved tree/ceremonial site was found during these field surveys (Brayshaw, 2003).

Table 3-21
Summary of Aboriginal Heritage Sites

Site	Description
1	Several grinding grooves on sandstone bedrock adjacent to Wollombi Brook.
2	Carved trees/ceremonial area on eastern side of Wollombi Brook (no physical evidence found by Project surveys).
32	Scarred tree located adjacent to the western bank of Wollombi Brook.
30 & 31	Open sites located to the west of Wollombi Brook on the red sandbody (estimated to be 700 m in length). Both sites are open sites.
98-102, 104, 106-114, 117, 118, 120-125, 151, 152, 229-232	Open sites located south of North Wambo Creek.
89	Open site located on the ridge top watershed between Stony and North Wambo Creeks. Highest recorded site in study area.
268	100 objects were recorded on an exposure within the Waterfall Creek catchment adjacent to a 2nd order stream.
258 & 259	Open sites located on a broad upper slope on the north face of the watershed between Waterfall Creek & Splitters Hollow. The 2 sites are separated by ground with poor visibility, so may be one continuous site.
239	Open site located on the east face of a crest sloping down towards North Wambo Creek. 150 objects were recorded on a track over a distance of 130 m.
62	Open site located on edge of minor creek 1 km west of Wollombi Brook and between Wambo and North Wambo Creeks. Piece of glass with a worked edge.
13	Large open site located adjacent to the Project rail spur south of Wollombi Brook.
45-61, 63-68, 91-97, 103, 105, 115, 116, 126-136, 138,146-150	Open sites located between North Wambo Creek and Stony Creek
69-73, 81-88	Open sites located along ridgeline north of Stony Creek
74-77	Open sites located adjacent to the bank of Stony Creek.
175-181,184-189	Open sites located north-west of Redbank Creek.
227, 247-250, 260-264, 269, 271, 285-287	Open sites located south of Golden Highway and south-east of Waterfall Creek.
203-207	Open sites located north of Golden Highway and east of Waterfall Creek.
14-18	Open sites located adjacent to the Project rail spur east of Wollombi Brook.
19-27	Open sites located adjacent to the Project rail spur west of Wollombi Brook.
3-12	Open sites located on the eastern side of Wollombi Brook.
40, 41, 43-44	Open sites located on the southern side of Wambo Creek.
33-39, 42	Open sites south of Wambo Creek.
78-80	Open sites located south of Stony Creek.
90, 137, 139, 140-145	Open sites located north of Stony Creek.
153-159	Open sites located adjacent of the north-eastern side North Wambo Creek.
28-29, 119, 160-174, 182, 183	Open sites located north of North Wambo Creek.
190-202, 208-226, 228, 233-238, 242-246, 251-257, 265-267, 270, 272-284, 288-291	Open sites located south to south-east of Waterfall Creek.
240-241	Open sites located outside the surface development area and to the north-west of North Wambo Creek.

Source: Appendix D

Geomorphologic Features

A geomorphologic assessment conducted as part of the Aboriginal heritage assessment (Appendix D) investigated the potential for the occurrence of stratified or dateable materials. Stratified or dateable materials have the potential to contribute to the history of an area by assigning objects with a relative chronology.

The geomorphologic assessment identified the following features with the potential to provide a chronology of occupation (Figure 3-9):

- a red sand dune some 100 m wide and 750 m long near the western side of Wollombi Brook;
- sand sheets on the eastern side of Wollombi Brook that extend eastward into the Warkworth Coal Mine area (Appendix D); and
- a yellow sand dune 200 m long and less than 100 m wide that is located on the eastern side of Wollombi Brook.

The Project design has been refined so that the above features would not be impacted.

3.11 NON-ABORIGINAL HERITAGE

The following section summarises the results of the non-Aboriginal heritage assessment presented in Appendix C.

Lands in the vicinity of the Project were originally explored in 1819 by a party led by John Howe. John Howe was subsequently granted 700 acres of land at Patrick Plains as a reward for his discoveries and expeditions in the Hunter Valley, and the remainder of the Warkworth area was opened for settlement in 1821 (Collins, 1994).

During the 1830's former convict James Hale acquired lands in the area and by 1842 owned land to the south and east of the WHC. Land to the north was not settled until after 1842. Hale retained ownership of the majority of the site until his death in 1857 when the land transferred to his stepson, William Durham Jnr. In 1892 the land was inherited by Durham's sons, William James Hill Durham and Charles MacQuade Durham, who sold the land to Charles Durham's father in law, Ben Richards (Appendix C).

In 1900 Richards sold the land to R C Allen and Frank McDonald and in 1908 the property was subdivided (Appendix C).

In 1968 the majority of the subject land with the exception of the WHC site (which was purchased in 1983) was sold to the Wambo Mining Corporation (now WCPL).

3.11.1 Wambo Homestead Complex

The WHC is located on the western side of Wollombi Brook to the south of the existing Wambo Coal Mine (Figure 3-9). The WHC comprises eight distinct buildings and the remnants of barns with many fences to mounting yards and paddocks still in existence.

Components of the WHC include (Appendix C):

- **Kitchen Wing (circa 1830) -** A two storey exposed sandstone and brick structure with a basement and progressive additions. The roof, of galvanised iron over timber shingles, is of medium pitch with boxed eaves and the verandahs are under separate roofs with slender posts. Verandah rooms and a modern laundry wing have been added to the west elevation.

- **The New House (circa 1840)** - A single storey, stuccoed brick structure on an exposed sandstone plinth which appears as a platform. The roof is timber shingles with a later covering of corrugated iron. The pitch is medium and the eaves are boxed. The verandahs are under separate roofs supported on a colonnade of hardwood columns. Verandah rooms skirt the house which consists of a central entry hall and four rooms. The New House is linked to the Kitchen Wing by a breezeway between the two buildings.

- **Servants' Wing (circa 1840)** - The format of this building suggests that it was originally built as a kitchen with servant's quarters above. It was probably part of the expansion of the Homestead in the 1840s. The ground floor consists of two rooms including a large kitchen with open fireplace and bordered hearth, and a separate externally accessed store room. Externally the building is of facebrick walls with gabled roof and separate verandahs to the east and west. The brickwork has been laid in a crude combination of Flemish bond and English bond and windows have stone lintels and sills. The original roof covering of timber shingles still exists below corrugated iron which dates from the beginning of the 20th century. The verandah roofs are supported by octagonal timber columns and a large verandah beam.

- **Stud Master's Cottage (circa 1840)** - "Old Colonial Georgian" in style and is a characteristic single storey country dwelling of the 1840s with verandahs. Other style indicators which help classify this building include: symmetrical façade, exposed brick, medium pitched shingled roof with verandah under broken back roof, timber roof shingles, slender verandah posts, sash windows with small panes and flat arches, louvred shutters and simple chimney.

- **Carriage House with Stables and Granary (circa 1844)** - A crude building of four bays and two storeys with a verandah under a simply pitched roof. A full length skillion has been added with its floor at a lower level. This building is a large timber structure, with two storey square ironbark columns. These columns take equally large ironbark upper floor beams bolted to the columns to form the structural frame.

- **Slab Butcher's Hut (circa 1900)** - The main frame is of vertical logs which have been dressed to take horizontal hardwood slabs internally and externally. Rammed earth has been packed into the space between the horizontal slabs. The floor is unreinforced concrete and the ceiling is of adzed slabs with a covering of earth supported by log beams. The interior was completely lined with a perforated zinc mesh. A butcher's cutting table, showing significant evidence of use, is located in the north-west corner of the room.

- **Slab Horse Boxes (circa 1900)** - The original structure consists of a pole frame construction with a cladding of vertical timber slabs and a timber shingled roof. Deterioration of the shingled roof has necessitated the installation of a corrugated iron roof. A half round eaves gutter has also been added to collect water and direct it to a galvanised storage tank on the northern elevation. The building is divided by a slab partition wall. A robust timber manger has been purpose built and is shared between the two horse boxes. Timber stable doors provide entry, and ventilation is increased by timber grille windows. A concrete floor has been poured inside the original construction. Nails used in construction and door hardware date from the beginning of the 20th Century.

- **Mounting Yard Horse Boxes (circa 1906)** - These buildings were constructed at the beginning of the 20th Century to be used in association with the mounting yards. The buildings are rectangular in shape with verandahs along the longitudinal sides. The type of construction used is like no other timber building to be found within the WHC and consists of light timber framing clad with splayed weatherboards. The actual studs are simply stripped saplings. Internal partitions, used to form the horse stalls, have been lined with thicker, close fitting boards for greater strength and to provide protection to both studs and the horses they enclosed. The roofs to these buildings are simple gables with broken backs to form the verandahs. The roof covering is corrugated iron with eaves gutters being used to collect roof water. The floor of the larger building was made using log bearers covered by timber slabs thick enough to take the wear generated by the horses. In contrast, the smaller building has been constructed with an unreinforced concrete floor.

The WHC (Figure 3-9) is 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."*

Review of Cultural Significance

Since this Statement of Cultural Significance was written in 1994, the land surrounding the WHC curtilage has been subject to further mining development. As a consequence, some components of the Statement of Cultural Significance no longer reflect the current heritage status of the WHC.

Changes to the heritage values of the WHC include (Appendix C):

- The site of the WHC no longer supports pastoral activities or horse breeding and has been significantly disturbed by mining activities. The historical significance of the WHC has been compromised as a result.
- Evidence relating to the occupation of James Hale (still retained in the buildings of the Homestead) is lost in terms of the subdivision and surrounding land use (mining activities) which have rendered the WHC irrelevant in terms of the recent and future economic development of the Hunter Valley. It still remains as a reminder of past economic activity; however given the impact of mining activities it has completely lost its context.
- The military crest on which the WHC was sited and which is considered to "exemplify the evolution of early colonial homesteads" has been modified by mining operations which have impacted the ridgeline behind the Homestead. The Homestead is no longer sited on a military crest.
- Due to mining operations in the vicinity and restricted access, the WHC no longer provides a social focus for the residents of the surrounding district.
- Although the WHC is considered to be a rare example of construction technique and an archaeological resource and evidence of the buildings remains, access to the site and interpretation of the buildings has been significantly compromised due to the proximity of mining operations.

While there have been additional losses and changes to the physical integrity and setting of the WHC, many of the individual buildings still retain some historic, social, aesthetic and technical importance. The ability to interpret the early history of these buildings has and continues to be compromised by mining development and natural deterioration due to ageing and environmental factors.

3.11.2 Other Items of Non-Aboriginal Heritage

The heritage assessment (Appendix C) included surveys of lands in the vicinity of the Project with a specific focus on surface development areas. Of the 12 items identified during the assessment (Figure 3-9), eight sites were considered of heritage significance in accordance with the *NSW Heritage Manual*. These sites are described in Table 3-22.

Sites 1, 2, 7 and 9 were not considered to be of heritage significance and are described in Appendix C.

Table 3-22
Items Considered of Heritage Significance

Site Number	Site Name	Description	Significance
Site 3	Abandoned Homestead A	Located adjacent to Stony Creek within the underground mining footprint. The site consists of the remains of a cottage, four outbuildings and a pit mine. A number of moveable items are located at the site. The remains are ruins and therefore in very poor physical condition.	Minor Local Significance
Site 4	"Whynot" Homestead	Located to the south-west of the open cut footprint. The site is a federation period small farm site consisting of a weatherboard cottage and outbuildings. Overall the buildings are in sound condition.	Limited Local Significance
Site 5	Abandoned Homestead B	Located adjacent to Wollombi Brook in the vicinity of the Project rail loop. Homestead B consists of an abandoned cottage and shed. The physical condition of the buildings is poor.	Local Significance
Site 6	Piggery and Butcher's Hut	Located within the footprint of the Project rail loop. The Piggery and Butcher's Hut are dilapidated and beginning to fall apart.	Minor Local Significance
Site 8	"Montrose" Homestead	Located 400 m north-west of the open cut mine footprint. It consists of a brick and weatherboard homestead and a number of outbuildings including an old wool shed. The buildings are in good condition.	Slightly Significant
Site 10	Roman Catholic Cemetery	Old Roman Catholic Cemetery is located at Jerrys Plains.	Local Significance
Site 11	Old Anglican Cemetery	Old Anglican Cemetery is located at Jerrys Plains.	Regional Significance
Site 12	St. Philips Anglican Church and Cemetery	St. Philips Anglican Church and Cemetery are located at Warkworth. The buildings and cemetery are in good condition.	Regional Significance

Source: Appendix C

St. Philips Anglican Church (Site 12) and the Roman Catholic Cemetery (Site 10) and Old Anglican Cemetery (Site 11) are located well outside the outline of Project surface development (Figure 3-9).

The “Whynot” and “Montrose” Homesteads (Sites 4 and 8) would not be directly affected by Project surface development. Potential indirect impacts associated with Project blasting activities are discussed in Section 4.4.4.

Site 6 (Piggery and Butcher’s Hut) was recorded within the footprint of the Project rail spur. This site is of minor local significance as the buildings clearly demonstrate a facet of life for Warkworth residents during the period of its use (Appendix C).

The remaining four sites were not considered to be items of heritage significance and include:

- grain silos and associated infrastructure (Sites 1 and 2);
- an aerial footing (Site 7); and
- an abandoned tractor (Site 9).

3.12 TRANSPORT

The existing road system and traffic flows in the vicinity of the Project are described in detail in Appendix M and are summarised below.

3.12.1 Road Hierarchy

The main classified roads under the administration of the RTA in the vicinity of the Project are illustrated on Figure 3-10 and are listed below:

- The New England Highway (National Highway 15), which is the inland route between Sydney and Brisbane. Although not located in the immediate area, the New England Highway is the major arterial road in the region and provides a component of the route for suppliers and staff to access the Wambo Coal Mine from regional centres such as Maitland (Figure 1-1).
- The Golden Highway (State Highway 27) (Jerrys Plains Road), which links the New England Highway south of Singleton to the Newell and Mitchell Highways to the west of the State.
- Putty Road (Main Road 503) (south of the Golden Highway), which links the Hunter region to the upper Hawkesbury region and the north-western suburbs of Sydney via the Yengo and Wollemi National Parks.

Classified roads in the vicinity of the Project under the management of the SSC include a section of Putty Road (Main Road 128) (north of the Golden Highway), which provides a link between Singleton and the Wambo Coal Mine (Figure 3-10).

Local roads that are administered by the SSC and that are considered relevant to the Project include (Figure 3-10):

- Wallaby Scrub Road, which is a sealed road that provides a link between Putty Road and the Golden Highway at Warkworth; and
- Pinegrove Road, which is an unsealed road that provides access to properties in the MLA1 area.

The majority of roads in the vicinity of the Project have good surface conditions, signage and intersection geometry. The following section summarises the condition of roads considered relevant to the Project.

Golden Highway

The Golden Highway is a typical two lane bitumen-sealed collector road with a carriageway width of approximately 7 m and a 100 kilometre per hour (km/hr) speed limit, which is reduced to 80 km/hr as it passes through Warkworth. The Golden Highway carries a significant volume of mining related traffic, including coal haulage trucks travelling between local mines and the MTCL.

East of Warkworth the Golden Highway is line-marked and guide-posted, however edge lines are intermittent and the shoulders soft. The road surface is generally good, however some surface damage is evident as it approaches Putty Road.

Putty Road and the Golden Highway intersect and share their names for a distance of approximately 2 km before Putty Road continues northward to Singleton and the Golden Highway continues east to its intersection with the New England Highway (Figure 3-10).

Access to the Wambo Coal Mine is via a Type C intersection with the Golden Highway which provides auxiliary turning lanes for vehicles entering or exiting the Wambo Coal Mine.

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Putty Road

North of the Golden Highway, Putty Road is a major route to and from Singleton for local and regional traffic. The road carries a large range of traffic from Singleton to the Mount Thorley industrial area and coal mines located on Putty Road (e.g. Mount Thorley Operations). The road also carries a large range of traffic from Singleton to the coal mines on the Golden Highway (e.g. Wambo Coal Mine). Putty Road is a two lane sealed road for the majority of its length and the road surface is in moderate condition and generally has line markings and edgelines.

Wallaby Scrub Road

Wallaby Scrub Road is a two lane, bitumen sealed local road with narrow grassed or gravel shoulders. The road is unmarked, has a good quality bitumen surface and guideposts and has a speed limit of 100 km/hr along the majority of its length.

Pinegrove Road

Pinegrove Road (Figure 3-10) is a formed gravel road that is generally one lane wide and has a cattle grid located close to the Golden Highway to control stock. The gravel surface is generally in good condition and is easily passable in a conventional vehicle.

Wambo Access Road

The Wambo Access Road is a sealed two lane road that provides access from the Golden Highway to the Wambo Coal Mine and associated administration and CHPP facilities from the Golden Highway.

3.12.2 Existing Traffic Conditions

Daily Traffic Flows

A review of traffic flow data has been undertaken to establish background levels against which potential traffic impacts associated with the Project can be assessed. RTA traffic count station locations are shown on Figure 3-10. The measured RTA Average Annual Daily Traffic (AADT) and other available traffic flow records are summarised in Table 3-23.

The percentage of heavy vehicles is generally not recorded in RTA AADT traffic counts, however, the level of heavy vehicles on the Golden Highway where coal haul trucks operate between the MTCL and the Project is generally accepted to be as high as 40% during peak coal haulage campaigns.

Coal Haulage Traffic Flows

Product coal from the Hunter Valley Operations Lemington Mine, United Colliery and the Wambo Coal Mine is hauled to the MTCL using a fleet of 37 t payload B-double trucks and single trailer 28 t payload trucks.

Truck movements (i.e. in and out) associated with haulage of approximately 6.7 Mt of product coal for the period July 2000 to June 2001 have been reported as approximately 388,000 truck movements averaging approximately 1,090 movements per day Monday to Saturday and 904 movements per day on Sunday (HLA Envirosciences Pty Ltd, 2002).

Table 3-23
Daily RTA AADT and Other Measured Traffic Flows 1982-2002

Station Number	Location	RTA AADT Traffic Counts							Other Counts
		1982	1988	1990	1992	1995	1998	2001	2002
05485	Golden Highway at Hunter River Bridge	-	1,351	-	1,502	1,528	2,213	2,337	-
-	Golden Highway – at the intersection of Pinegrove Road	-	-	-	-	-	-	-	2,300
-	Golden Highway – east of the United Colliery Haul Road	-	-	-	-	-	-	-	3,664
05638	Golden Highway/Putty Road east of Mount Thorley	4,759	-	4,800	-	6,447	7,164	7,966	-
05481	Golden Highway North of Putty Road	4,757	-	4,508	-	7,957	6,256	7,059	-
05840	Wallaby Scrub Road 900 m south of the Golden Highway	-	698	-	-	-	-	-	660
05167	Putty Road south of Milbrodale	-	1,420	1,072	1,075	860	799	793	-

Source: Appendix M

Over the 2002 calendar year, approximately 7 Mt of product coal was transported to the MTCL from the Wambo Coal Mine, Lemington Mine and United Colliery (WCPL, 2003). The number of truck movements for 2002 was approximately 390,000 truck movements or 1,070 movements per day (7 day average).

Coal and Allied has indicated that it intends to cease the haulage of coal from the Lemington Mine along the Golden Highway in 2003, for the foreseeable future (WCPL, 2003).

Wambo Coal Mine Traffic Generation

The majority of the current Wambo Coal Mine workforce and other vehicles access the site from the east as the workforce primarily resides in Singleton, Cessnock and Maitland and supplies generally originate from these areas and Newcastle. On a typical weekday the Wambo Coal Mine generates in the order of 164 light vehicle movements (Appendix M).

Other vehicles accessing the site include explosives contractors, diesel tankers, deliveries of other consumables and couriers.

Wambo Coal Mine is currently permitted to transport up to 3 Mtpa of coal to the MTCL, resulting in an average of approximately 230 trips (i.e. 460 movements) per day. Generally 10 to 15 B-Doubles are utilised for product coal haulage to the MTCL. Up to 35 trucks may be employed during short-term peak haulage campaigns, when peak haul truck movements can be as high 160 movements per hour (i.e. 80 in and 80 out) (Appendix M).

Table 3-24 summarises the existing estimated vehicle movements on the Wambo Access Road.

Table 3-24
Traffic Generation – Wambo Coal Mine

Vehicle Type	Average Daily Vehicle Movements
Light Vehicles	164
Total Heavy Vehicles	484
• *General Heavy Vehicles*	*24*
• *Coal Haul Trucks*	*460*
Total	**648**

Source: Appendix M

Table 3-24 indicates that the Wambo Coal Mine generates approximately 648 vehicle movements per day on the Golden Highway, the majority of which travel to and from the east (i.e. Singleton, Cessnock and Maitland).

3.12.3 Traffic Safety

Over the 1998 to 2002 period on the Golden Highway, some 67 accidents were recorded that required towing or involved an injury (1 fatality, 24 injuries and 42 tow away accidents). The most common accidents included drivers leaving the carriageway and collisions with animals. A single fatality, involving a motorcycle, was recorded in the Mount Thorley section of the highway.

There were no injury or tow away accidents recorded at the Wambo Access Road and Golden Highway intersection.

Traffic records indicate that there have been a number of accidents recorded near the intersection of Wallaby Scrub Road and the Golden Highway (Appendix M).

The majority of accidents recorded on the Golden Highway and Wallaby Scrub Road were single light vehicle accidents with very few recorded accidents involving heavy vehicles (Appendix M).

WAMBO DEVELOPMENT PROJECT

MAIN REPORT

Section Four
Potential Impacts and Mitigation Measures

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4 POTENTIAL IMPACTS AND MITIGATION MEASURES

This section describes the potential environmental and socio-economic impacts of the Project, including assessment of potential cumulative impacts from the combined effects of the Project and surrounding mining operations. Mitigation measures are presented where applicable.

4.1 LAND RESOURCES

Section 3.1 provides a description of the land resources in the vicinity of the Project. In relation to land resources, the Project has the potential to alter:

- topography and landscape features;
- soils and erosion rates;
- land use and land capability;
- land contamination status; and
- the level of bushfire hazard.

These aspects and applicable mitigation measures are provided in the following subsections.

4.1.1 Topography and Landscape Features

Potential Impacts

The main modifications to the existing topography that would result from the Project relate to open cut mining operations, mine waste rock emplacements and landform alterations associated with the construction of:

- hardstand areas for various mining infrastructure components;
- haul roads and access roads;
- water management structures including the North Wambo Creek water control system;
- erosion and sediment control features;
- the Wallaby Scrub Road realignment; and
- the rail spur (including an underpass beneath the Golden Highway), rail loop and train loading system.

In addition to the above, underground mining would result in subsidence of the land surface. The potential impacts of subsidence are addressed in Section 4.2.

At the completion of mining the majority of the open cut would have been backfilled except for two final voids (Figure 4-1). Mine waste rock emplacements would cover an area of approximately 1,300 ha and would be rehabilitated to a final landform rising to an elevation of approximately 160 m AHD with outer batter slopes at a maximum of 10 degrees from the horizontal (1V to 5.7H). Section 5.3 presents the final landform concepts for the Project.

Mitigation Measures

Mine infrastructure and landforms have been designed and located to integrate with existing topography and landscape features via:

- maximum utilisation of Wambo Coal Mine infrastructure, services and amenities;
- integration of the Project surface infrastructure with Wambo Coal Mine infrastructure areas;
- backfilling of the Project open cut with mine waste rock emplacements (Figures 2-5 to 2-10) to assist the integration of Project landforms with existing topography and to reduce the need for remnant vegetation clearance; and
- rehabilitation of Project landforms in a manner that maximises integration with the surrounding landscape.

Project rehabilitation strategies are detailed in Section 5. Section 4.3.4 discusses additional measures for mitigating potential impacts of the Project on landscape character.

4.1.2 Soils and Erosion Potential

A description of the soils of the Project area is presented in Appendix L and summarised in Section 3.1.4. A survey of the Project area in conjunction with a review of previous studies revealed that the soil types include alluvials, red podzolic, yellow podzolic and solodic intergrades, soloths, lithosols and siliceous sands.

Potential Impacts

Potential impacts of the Project on soils relate primarily to:

- loss of *in-situ* soil resources beneath mine landforms;

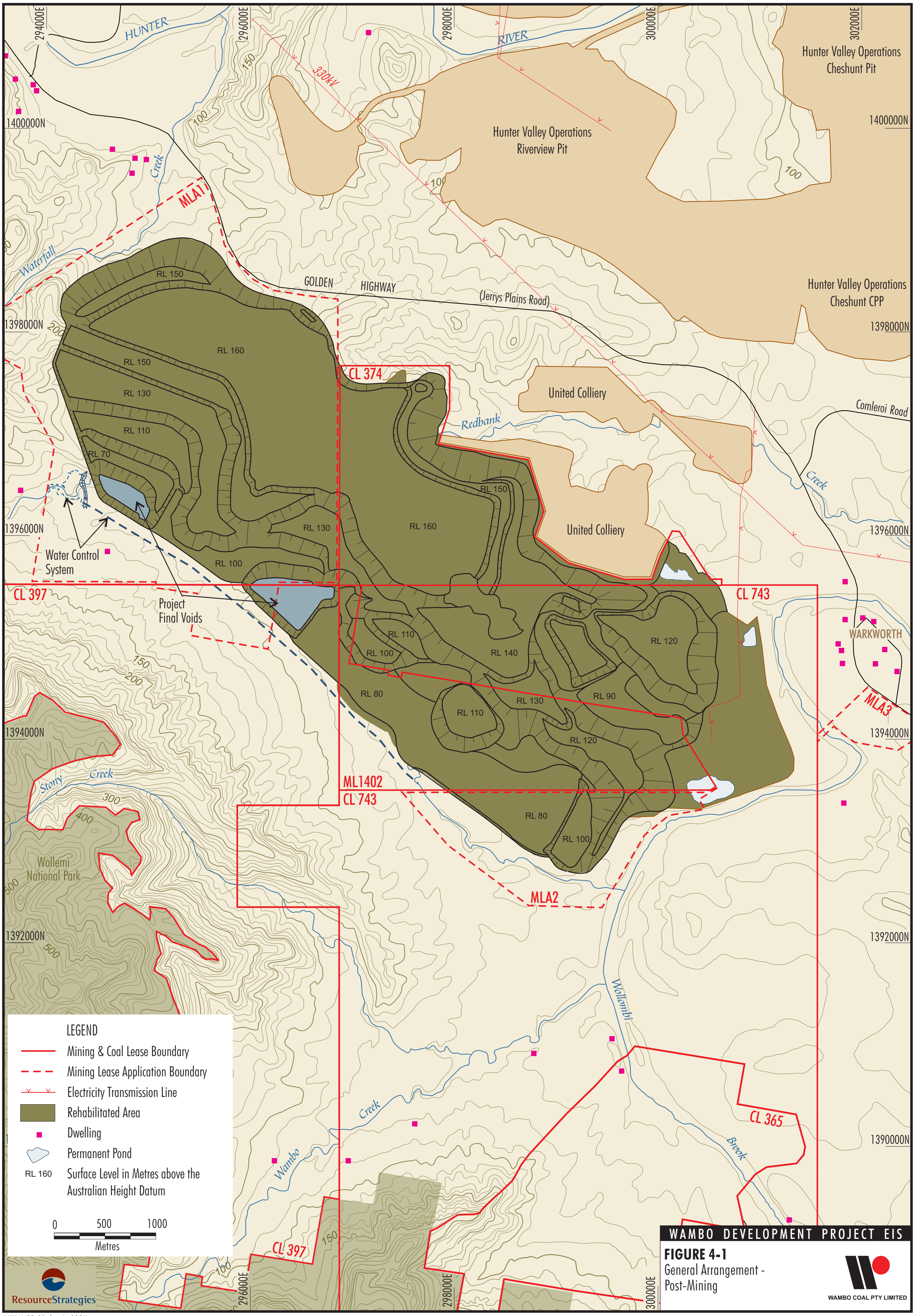

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FIGURE 4-1
General Arrangement - Post-Mining

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- alteration of soil structure beneath infrastructure and hardstand areas, stockpile areas (soil, ROM and product coal) and roads;
- soil contamination as a result of spillage of fuels, lubricants and other chemicals (Section 4.1.4);
- increased erosion and sediment movement due to exposure of dispersive soils and during construction of mine infrastructure; and
- alteration of physical and chemical soil properties (e.g. structure, fertility and microbial activity) during stripping and stockpiling operations.

The alluvial soil deposits (Quaternary alluvium) within the Project area, and the geomorphological environment in which they occur, are not conducive to the formation of acid sulphate soils which are generally confined to the occurrence of "recent" Holocene deposits in coastal estuaries and floodplains of major rivers (i.e. below 5 m above sea level).

Mitigation Measures

Erosion and sediment control strategies for the Project would be based on accepted practices established for the existing Wambo Coal Mine and would be further developed and documented in an erosion and sediment control plan (Section 6.2.3).

The primary objectives of these erosion control measures would be to:

- control soil erosion and sediment generation from areas disturbed by mining and construction activities; and
- maintain water quality (primarily in terms of total suspended solids content) in local watercourses.

Specific mitigation measures to control soil erosion and sediment migration would include:

- minimising surface disturbance and restricting access to undisturbed areas;
- progressive rehabilitation and revegetation of mine infrastructure areas;
- minimising compaction during soil excavation and movement;
- use of erosion control features (e.g. silt fences and temporary sediment traps, diversion banks, channels and rip-rap structures) to minimise sediment migration, divert surface water around disturbed areas and to control runoff velocity; and
- use of sediment retention storages to contain runoff from disturbed areas.

In addition to the above, soil resource management practices have been developed and are detailed in Appendix L. These practices would be further developed as part of the Project rehabilitation programme and are summarised in Section 5.2.4.

Wherever practicable, recovered topsoil would be spread directly onto mine waste rock emplacement areas prepared for rehabilitation. Where direct spreading is not practicable, the material would be stockpiled.

Soil stockpiles would be managed to ensure long-term viability through implementation of the following management practices:

- Soil stockpiles to be located outside of active mining areas.
- Construction of stockpiles with a "rough" surface condition to reduce erosion hazard, improve drainage and promote revegetation.
- Where stockpiles are to be inactive for extended periods they would be fertilised and seeded to maintain soil structure, organic matter and microbial activity.
- Quantification of soil resources available for rehabilitation works, stripping and re-application schedules and stockpiling inventories would be included as part of the Mining Operations Plan (MOP) in accordance with the requirements of the DMR.

4.1.3 Land Use and Land Capability

The general landscape of the Project area is characterised by cleared, predominantly grazing land scattered with vegetated hills. The dominant land use is grazing.

Land capability and agricultural suitability classifications for the Project area are detailed in Appendix L and summarised in Section 3.1.4.

Potential Impacts

The staged development of the Project open cut along with progressive rehabilitation strategies would limit the area disturbed at any one time. Where required, stock would be excluded from the mining operations areas and areas undergoing rehabilitation. As described in Section 5, rehabilitated landforms would be returned to woodland and mixed woodland/pasture areas. The open cut would be backfilled with the exception of two final voids and the North Wambo Creek water control structure and channel would be retained.

The impacts on land use would therefore comprise the loss of some grazing land and vegetation remnants followed by a net gain of woodland vegetation post-rehabilitation.

Mitigation Measures

As at May 2003, WCPL controls approximately 3,560 ha of land in the Project area. WCPL would either purchase properties or negotiate lease or compensation agreements with landholders directly affected by the Project.

Land management practices would be undertaken in accordance with the Land Management Plan (Section 6.2.2).

Rehabilitation concepts for the Project provide for the ability to return much of the mine affected land to a mixture of agricultural use and endemic woodland habitat (Section 5). Following mine closure and final Project rehabilitation, the final landform would comprise areas of woodland vegetation aligned to link remnant vegetation to the north and east of the Project with the eastern borders of the Wollemi National Park.

Final rehabilitation requirements and post-mining land use would be determined in consultation with relevant statutory authorities and stakeholders (Section 5).

4.1.4 Land Contamination Potential

Section 4.16 summarises the results of the preliminary hazard analysis conducted for the Project (Appendix K) and identifies sources of potential risk to the environment. The following section focuses on management issues related to potential land contamination.

Potential Impacts

The main potential land contamination risks have been identified as spills, fires or explosions associated with the transport, storage and usage of fuels, chemicals and explosives.

Mitigation Measures

Measures to prevent or reduce the potential for contamination of land from fuel, chemicals and explosives include the following:

- Contractors carrying dangerous goods loads would be appropriately licensed in accordance with the provisions of the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) (DTRS, 2000). Contractors would operate under the provisions of the WCPL Contractor Management Plan to ensure safety standards and work procedures meet statutory requirements.
- Carriers of dangerous goods would maintain a communications system (e.g. two-way radio or mobile telephone) in truck cabs to allow for prompt notification in the event of an accident. Trucks would carry fire fighting equipment.
- On-site consumables storage areas would be designed with appropriate bunding and would continue to be operated, where applicable, in compliance with the requirements of AS 1940-1993 *The Storage and Handling of Flammable and Combustible Liquids* and AS 2187.1-1998 *Explosives – Storage, Transport and Use – Storage*. Storage areas would be regularly inspected and maintained as required.
- Project rail infrastructure and signalling systems would be designed in accordance with the relevant standards. Project train loading activities and rail infrastructure would be regularly inspected and maintained as required. Rail transport contractors would operate under the provisions of the WCPL Contractor Management Plan to ensure safety standards and work procedures meet statutory requirements.

4.1.5 Bushfire Hazard

A description of the existing bushfire regime associated with the Project area and surrounds is presented in Section 3.1.6. The potential impacts of the Project on bushfire hazards and associated mitigation measures are presented below.

Potential Impacts

Fires moving on or off the Project area present potentially serious impacts to surrounding properties as well as WCPL personnel and equipment. The degree of potential impact would vary with climatic conditions (e.g. temperature and wind) and the vegetative cover present in these areas.

Mitigation Measures

The Wambo Coal Mine currently has a Bushfire Management Plan that identifies bushfire hazards and assesses fire risks to various land uses and ecological values. The plan provides fire prevention, protection and suppression strategies for the mine and adjacent land and describes how WCPL fire management activities integrate with management strategies developed by the NPWS, SSC and other fire authorities.

The Bushfire Management Plan would be reviewed and revised to cover the Project in consultation with the SSC and Rural Fire Service. Elements of the Project Bushfire Management Plan are detailed in Section 6.2.4.

Fire awareness and fire safety training are covered during the site specific induction which all WCPL staff and contractors are required to undertake prior to working at the Wambo Coal Mine. Fire awareness and fire safety training would continue to be undertaken as part of the site induction and training programme (Section 6).

In addition to environmental responsibilities, there exists significant economic incentive to prevent fire damage to mining infrastructure and equipment.

4.2 SUBSIDENCE

Subsidence is the lowering of the land surface as a result of the extraction of underlying coal seams. As described in Section 2.6, the Project includes underground mining (by longwall mining methods) of the Whybrow, Wambo, Arrowfield and Bowfield Seams.

Longwall mining is undertaken as a series of consecutive parallel panels. Subsidence of the land surface resulting from underground mining would occur as a series of small movements as longwall extraction proceeds along each panel. This would be expressed at the surface as an elongated depression which broadens as the number of panels mined in each seam increases. The subsidence process would repeat for each level of mining (i.e. in response to the mining of deeper underlying seams).

Subsidence would be restricted to the areas above and immediately adjacent to the extracted longwall panels. The distance by which the subsidence extends laterally is typically in the order of half the depth of the coal seam below the land surface.

The Project underground mines would be constrained and designed such that subsidence does not impact on Wollemi National Park or Wollombi Brook. The Wollemi National Park escarpment would not be subsided by the extraction of Project longwall panels (Appendix O). The protection of Wollombi Brook is discussed in Section 4.2.3 below.

The potential impacts of subsidence on the land surface above the longwall panels include cracking, erosion and the ponding of surface water in low-lying areas (Appendix O). Figure 4-2 has been developed with G.E. Holt and Associates and the various specialists who have contributed to the EIS to illustrate the potential location and nature of subsidence impacts on the land surface.

The potential impact of subsidence on heritage items is assessed in Appendices C and D, and summarised in Sections 4.13 and 4.14. The potential impacts of subsidence on flora are discussed in Section 4.8.1.

Appendix O presents maximum predicted subsidence magnitudes and assesses associated potential impacts on surface features and improvements (e.g. creek systems and farm dams). A summary of the predicted subsidence magnitudes and potential impacts is presented below.

4.2.1 Magnitude of Subsidence

The magnitude of subsidence varies depending on the thickness of the seam extracted and the depth of the seam below the land surface. The maximum predicted subsidence over each of the coal seams to be mined by the Project is provided in Table 4-1. The cumulative subsidence predictions are discussed below.

Table 4-1
Maximum Predicted Subsidence for the Project Coal Seams

Coal Seam	Maximum Subsidence (m)
Whybrow Seam	1.86
Wambo Seam	1.91
Arrowfield Seam – West of Wollombi Brook	1.96
Bowfield Seam – West of Wollombi Brook	2.29
Arrowfield Seam – East of Wollombi Brook	2.46
Bowfield Seam – East of Wollombi Brook	2.54

Source: Appendix O

West of Wollombi Brook in the areas where the mining of the Wambo, Arrowfield and Bowfield Seams overlaps (Figure 4-2), the maximum cumulative subsidence is predicted to range from 4.66 m along the eastern extent of this mining area to 4.95 m in the north-west. As shown on Figure 4-2 underground mining has previously been undertaken within these areas. This mining has resulted in subsidence of up to 1.6 m (Holt, 2001) due to the mining of the Whybrow Seam. Project-related mining of the Whybrow Seam to the north-west (Figure 4-2) is predicted to result in maximum subsidence ranging from 1.47 m in the south to 1.86 m at the northern extent of the longwall panels.

East of Wollombi Brook the longwall panels that would be developed in the Bowfield Seam directly underlie those in the Arrowfield Seam (Figure 4-2). Consequently, this area of land would be subjected to two phases of subsidence with a predicted cumulative maximum subsidence ranging from 4.21 m in the south up to 4.86 m in the north.

4.2.2 Land Surface

Potential Impacts

Subsidence may result in surface cracking, increased erosion potential and the potential for ponding in areas where isolated depressions form. These impacts have been observed to occur in the existing underground mining areas at the Wambo Coal Mine. Where subsidence occurs within, or adjacent to, an existing flood plain it may result in an increase in the depth and duration of inundation during flood events. These potential subsidence impacts are discussed below.

Surface Cracking

As subsidence occurs surface cracking may develop above the extracted longwall panels. Surface cracking would primarily occur across each panel (during extraction of the coal) and along the sides of each panel (after extraction of the coal). The cracks that occur across the panel would be temporary in nature and would be expected to close as the longwall extraction progresses. The cracks along the sides of the longwall panels would be expected to remain until such time as they in-fill due to natural processes (e.g. sedimentation) or are manually in-filled (e.g. with soil or mulch material).

The areas where surface cracking would potentially occur are shown on Figure 4-2. The greatest extent of cracking would be expected to occur over the shallower underground workings (i.e. Whybrow and Wambo Seams).

Due to the depth of the Arrowfield and Bowfield Seams to the east of Wollombi Brook only minor surface cracking would be expected (Figure 4-2). The northern portions of the longwall panels in this area are overlain by tertiary-sands. Due to the mobility of the sands and their ability to in-fill cracks, surface cracking would be transient (i.e. subject to rapid in-fill as sands mobilise into any surface cracks that develop). To the west of Wollombi Brook in areas where the Arrowfield and Bowfield Seam longwall panels are not overlain by the Wambo Seam longwall panels, the potential for surface cracking is considered to be low due to the significant depth of these seams below the land surface (Appendix O).

Potential impacts of surface cracking on creeks above the Project longwall panels are discussed in Section 4.2.3.

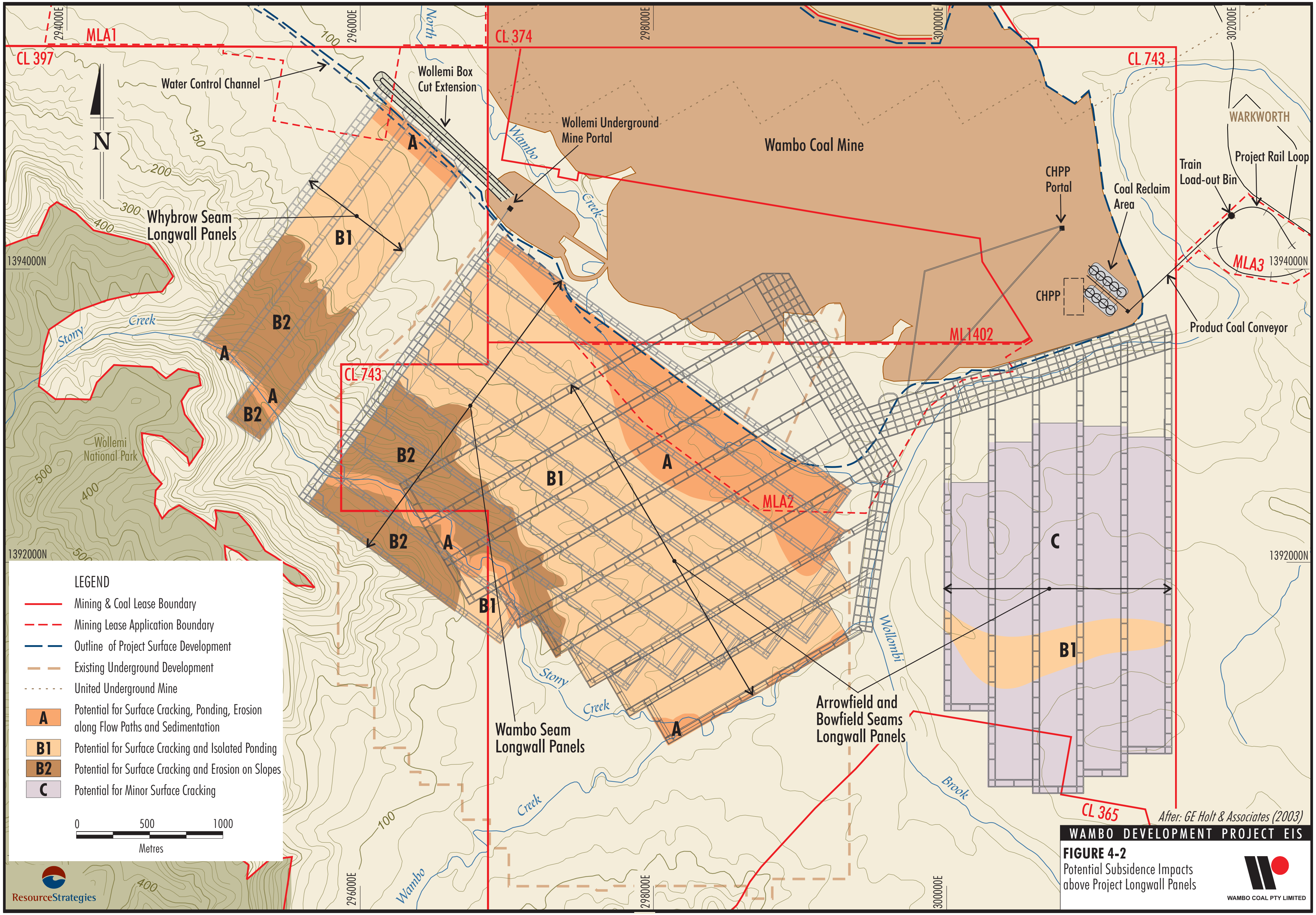

FIGURE 4-2
Potential Subsidence Impacts above Project Longwall Panels

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Ponding/Flooding

Subsidence would alter existing surface drainage patterns to some extent, which may result in areas of isolated ponding. Based on maximum subsidence predictions, isolated ponding would potentially occur in low-lying areas within the flood plains of the creeks crossing the Project underground mining areas (i.e. North Wambo, Wambo and Stony Creeks). Areas where ponding would potentially occur are shown on Figure 4-2.

The flood plain along the lower reaches of North Wambo Creek, Stony Creek and Wambo Creek would also be modified as a result of subsidence. Detailed subsidence magnitude contours for each seam are presented in Appendix O. The potential impacts on these creek systems due to subsidence are discussed further in Section 4.2.3.

Erosion

Depending on ground conditions (i.e. slope, status of vegetative cover, topsoil/substrate material characteristics) subsidence may cause localised erosion of the land surface. Erosion would be limited to isolated areas where the ground strain and curvature arising from progressive subsidence produces abrupt changes of grade at the surface. The erosion effects would be more prevalent in the steeper terrain and along drainage flow paths (Appendix O).

The potential for erosion impacts as a result of subsidence is considered more likely to occur along North Wambo Creek, in the low hills to the south-west of the Project area along Stony Creek and also in sections of Wambo Creek immediately overlying Project underground longwalls (Figure 4-2). This would be primarily due to localised steepening of the creek gradients in these areas. Potential impacts on these creek systems are discussed in more detail in Section 4.2.3.

Mitigation Measures

During the development of the Project underground mines, areas subject to subsidence would be monitored to validate subsidence predictions and to identify areas where the above potential impacts may occur (Section 6.3.5). Potential subsidence impacts on the land surface (i.e. surface cracking, ponding/flooding and erosion) would be assessed and, where necessary, remediated through the implementation of one or a combination of the following mitigation measures:

- filling of minor cracks with appropriate material (e.g. soil or mulch) to prevent injury to stock and to avoid the creation of drainage channels;
- contour ripping of exposed surfaces and revegetation to minimise erosion of subsidence cracks;
- re-grading of isolated depressions or highpoints and revegetation;
- re-grading of slopes to minimise the potential for erosion; and
- remediation of creek beds to minimise bank and headward erosion (Section 4.2.3).

A Subsidence Management Plan (Section 6.2.5) would be developed for the Project as part of the approval for longwall mining under section 138 of the *Coal Mines Regulation Act, 1982*. In addition, details of the mitigation of subsidence impacts to the land surface would be developed in the Land Management Plan (Section 6.2.2) in consultation with the relevant authorities.

Subsidence monitoring would be conducted as described in Section 6.3.5.

4.2.3 Creek Systems

Potential Impacts

Potential subsidence impacts on the local creek systems crossing Project underground mining areas are discussed below.

North Wambo Creek

As described in Section 2.10.2, the Project would require the development of a water control structure across North Wambo Creek and a channel to facilitate the passage of flows around the perimeter of the open cut mine and associated mine waste rock emplacement areas. As this portion of the water control system would be constructed following the extraction of the Whybrow Seam longwall panels a majority of the predicted subsidence in this area would have already occurred. Due to the shallow depth of the Whybrow Seam in this area (approximately 60 m to 80 m) subsidence is predicted to be variable resulting in a hump and hollow effect along the channel alignment. As discussed in Section 4.6.2, these effects would be accommodated in the channel design.

Mining is planned to commence beneath the lower reaches of North Wambo Creek by Year 5 with development of the Wambo Seam workings (Figures 2-6 and 2-7), followed by development of the underground mines in the Arrowfield and Bowfield Seams (Figures 2-7 to 2-10).

The maximum predicted subsidence of North Wambo Creek would be up to 4.23 m in areas where the Wambo, Arrowfield and Bowfield Seams overlap (Figure 4-2). This would be expected to result in areas of ponding and the potential for surface erosion along, and adjacent to, the creek alignment as the creek attempts to re-establish its original gradient (i.e. by eroding high points and accreting sediment in the low points in the new bed profile).

An elongated on-stream pond would be expected to form in the lower reaches of North Wambo Creek. Smaller on-stream ponds would also potentially form further upstream as a result of subsidence (Appendix E). On-stream ponds would likely become depositional zones for sediment carried in flows in North Wambo Creek. The shallower off-stream depressions would likely become wetlands over time with periodic connection to North Wambo Creek as has been observed in existing subsidence areas (Appendix E).

Some additional areas of the North Wambo Creek catchment would likely be inundated during floods either from its own catchment or backwater flooding from Wollombi Brook due to subsidence (Appendix O).

With mining of the Wambo Seam, cracking in the alluvials along North Wambo Creek would potentially occur along the sides of the panels, and in curvilinear fashion across the panels. Cracking in the underlying rocks may result in short-term drainage of groundwater out of the alluvials. These cracks would however be expected to in-fill quickly with sediment or close (Appendix O). The minimum depth of cover between North Wambo Creek and the Wambo Seam longwall panels is not expected to cause connection from the surface to the underground workings (Appendix O). Cracking is not expected to cause connection from the alluvials to the underground workings although there is some potential for connection in areas where geological structures exist (Appendix O).

Due to the depth of cover, mining of the Arrowfield and Bowfield Seams is not likely to cause surface cracking or sub-surface strata disruption that would result in stream capture (Appendix O).

Further assessment of potential impacts on North Wambo Creek is provided in the Appendix E and Section 4.6.2.

Stony Creek

The upper reaches of Stony Creek that have previously been undermined would again be affected by subsidence (Figure 4-2). An assessment of the impacts of previous subsidence on the stability of the bed and banks of Stony Creek (Geoterra Pty Ltd, 2002a) concluded that there had been no adverse effects on the stability of the streambed or banks in the upper reaches.

Extraction of the western most portions of the Whybrow Seam longwall panels would result in subsidence of Stony Creek (Figure 4-2). Potential impacts in this area include bank and headward erosion. The lower reaches of Stony Creek that would undergo episodes of subsidence (i.e. above the Wambo, Arrowfield and Bowfield Seam workings) could potentially be impacted by subsidence induced erosion as well as some ponding.

A small amount of cracking would most likely occur along Stony Creek over the north-westernmost ends of Wambo Seam longwall panels because of the steep surface topography and nature of the overlying strata (i.e. sandstone outcrops). The creek bed is located in rock in the steeper terrain therefore cracking depths would be limited and would be expected to in-fill with loose stream wash material when there is water flow (Appendix O).

The Arrowfield and Bowfield Seam workings occur beneath Stony Creek where stream gradients are high. Due to the depth of cover, the predicted ground strains for the Arrowfield and Bowfield Seams are considered too low to cause surface cracking (Appendix O). Provided that there are no major geological structures that could provide a pathway for water movement the potential for connection between the surface and underground workings is considered low. Further, the potential for ponding to occur along the alignment of Stony Creek is considered to be low due to its relatively steep gradient in these areas (Appendix O).

Further assessment of potential impacts on Stony Creek is provided in Appendix E and Section 4.6.2.

Wambo Creek

Wambo Creek has previously been affected by the historical Whybrow Seam workings which resulted in creek bed and bank instability and loss of flow through subsidence induced cracks and fissures from the underground workings to the surface (Appendix E). WCPL implemented an extensive programme of restoration works to seal surface cracks by grouting and construction of a buried, low permeability earthfill liner beneath the creek. Extensive channel reshaping and stabilisation works were also conducted to restore channel stability (WCPL, 2002).

The lower reaches of Wambo Creek that have previously been undermined by the Whybrow Seam workings would be affected by subsidence due to mining of the Arrowfield and Bowfield Seams. The edge of the southern most longwall panel in each of these seams coincides with portions of the creek alignment and finishes under the confluence of Stony and Wambo Creeks (Figure 4-2).

The maximum predicted subsidence range from Arrowfield Seam workings is between 0.5 m to 0.9 m where the creek alignment meanders over the longwall panel. Sections of the stream that meander away from the panel edge would undergo as little as 20 mm of subsidence (Appendix O). The maximum predicted subsidence range from Bowfield Seam workings is between 0.8 m and 0.9 m along the edge of the longwall panel, tailing out to 30 mm where the stream meanders away from the longwall panel (Appendix O).

Due to the depth of these longwall panels and low surface tensile strains generated by their extraction, surface cracking is considered unlikely (Appendix O). The extraction of these panels is unlikely to exacerbate the effects of past subsidence on Wambo Creek (Appendix O). Provided that there are no major geological structures that could provide a pathway for water movement the potential for inter-connection is considered low (Appendix O).

A minor increase in ponding is expected along sections of Wambo Creek which have been previously subsided. There would also be a slight increase in areas of flooding during high flow events in the lower portions of Wambo Creek due to subsidence within the creeks flood plain.

Wollombi Brook

Underground longwall mining subsidence would not impact on Wollombi Brook. The main development driveages beneath the Wollombi Brook would be designed to be permanently stable so there would be no subsidence associated with them (Appendix O). A combined CSIRO/Japan Coal Energy Centre research report (CSIRO, 2001) details geotechnical conditions for the Arrowfield and Bowfield Seam roof and floor within the Wambo Coal Mine leases. These data indicate that with pillars (i.e. *in-situ* coal that remains in place to support the roof of the underground mine) under Wollombi Brook designed with a Factor of Safety of 3 or more, it is highly unlikely that pillars would fail under load or by settlement of the roof or floor of the underground workings. The record of mining in the Arrowfield Seam at the United Colliery for the last 13 years also demonstrates the long-term stability of roof and floor. Further, the depth of the development (between 200 m and 240 m below the land surface) means that any isolated failure of a portion of pillar would not propagate to the surface or form a connection to water bearing strata, or Wollombi Brook (Appendix O).

In providing additional assurance of permanent stability only one set of main driveages would be developed under Wollombi Brook at the Arrowfield Seam level. Bowfield Seam workings would be accessed via driveages (between the seams) located away from Wollombi Brook. Further details are provided in Appendix O.

Mining of the longwall panels in the vicinity of Wollombi Brook would be constrained to an angle of 26.5 degrees from the vertical to “Protected Land” (i.e. within 40 m of Wollombi Brook as defined by the *Rivers and Foreshore Improvement Act, 1948*). Further, the extent of the longwall panels in the Arrowfield and Bowfield Seams would be limited so as there would be no encroachment into the Wollombi Brook 1 in 100 year flood plain except for isolated low-lying areas to which backwaters may extend during a high flow event (i.e. east of Wollombi Brook and along North Wambo and Wambo Creeks) (Appendix O).

Mitigation Measures

The remediation of historical subsidence impacts to creeks at the Wambo Coal Mine has been extensively researched by WCPL and the DLWC. Previous subsidence impacts on Wambo Creek due to longwall mining of the Whybrow Seam (Homestead Underground Mine) resulted in the preparation of a Wambo Creek Rehabilitation Plan by the DLWC in 1997. The plan was developed in consultation with the affected landholders and outlined the proposed remedial works to address subsidence impacts. The plan also detailed a monitoring strategy including the coordination of creek bed surveys and regular visual inspections.

In accordance with the Wambo Creek Rehabilitation Plan (DLWC, 1997), a number of creek management plans have since been developed for both WCPL owned and privately owned land (in consultation with the relevant landholders and the DLWC) including:

- *South Wambo Creek Rehabilitation – Wambo Property* (Geoterra, 2003b).
- *South Wambo Creek Rehabilitation – Fenwick Property* (Geoterra, 2002c).
- *South Wambo Creek Rehabilitation – Brosi Property* (Geoterra, 2003a).
- *Stony Creek Rehabilitation – Wambo Property* (Geoterra, 2003c).

The creek management plans outline specific requirements to address:

- Bank erosion and instability – remediation includes the removal of trees and debris to limit diversion of flow onto the banks, removal of wombat burrows, battering back, armouring and stabilisation of subsidence-affected banks and installation of creek crossings for vehicles and stock.
- Bed erosion – remediation includes the installation of bed control structures in the form of low rock weirs to manage headward channel erosion, widening and rehabilitation of incised channels, filling, ripping and revegetation of surface cracks, and installation of contour banks upslope of surface cracks in the stream bed.
- Stream flow loss – remediation includes bedrock grouting of subsidence cracks and installation of a clay liner.
- Revegetation – remediation includes establishment of grasses, shrub and trees within the riparian zone (i.e. creek banks and alluvial terraces) and fencing of riverine vegetation to promote regrowth.
- Weed management – remediation includes removal of prickly pear and implementation of the Weed Management Plan (Global Soil Systems, 2000).

The performance of the remediation works is monitored, including the ongoing monitoring of the affected creek bed and banks, creek flows, water quality, groundwater levels and groundwater quality. The results of this monitoring are reported in the AEMR.

Prior to the commencement of longwall mining, a Subsidence Management Plan (Section 6.2.5) would be developed for the Project and would include a subsidence monitoring programme (Section 6.3.5). The effects of the Project-related subsidence on the local creek systems would be monitored. Where necessary, remedial works would be developed in consultation with the DLWC and may include those described above.

4.2.4 Improvements and Private Land Holdings

Potential Impacts

The potential subsidence impacts on improvements (i.e. electricity transmission lines, dams, fences, roads and dwellings) and private land holdings are assessed in Appendix O and summarised below.

Improvements located in the Project underground mining areas which would potentially be impacted by subsidence include:

- one rural 11 kV feeder powerline west of Wollombi Brook;
- stock dams located on WCPL owned property; and
- fencing on both WCPL owned and privately owned properties.

All roads within the areas potentially affected by subsidence are owned and managed by WCPL. No public roads would be affected by subsidence.

There are no occupied dwellings in the Project underground mining areas. Parcels of land in the Project underground mining areas owned by other landholders which may be impacted by subsidence include:

- Warkworth Mining Limited (Property No. 8 – Figure 1-6) - east of Wollombi Brook.
- H. Upward (Property No. 9 – Figure 1-6) - east of Wollombi Brook.
- A.J. Long (Property No. 24 – Figure 1-6) - west of Wollombi Brook.

Mitigation Measures

Improvements such as fencing, dams and farm tracks within the area of land to be subsided would be visually monitored and remedial action undertaken if required. Fences would be inspected and repaired where posts are moved out of alignment or wire is broken as a result of subsidence. Powerlines would also be monitored and the power authority liaised with in order to maintain their integrity. Subsidence monitoring would be conducted as described in Section 6.3.5.

A Subsidence Management Plan (Section 6.2.5) would be developed under section 138 of the *Coal Mines Regulation Act, 1982*. Agreements would be formed with affected landholders in accordance with the provisions of the *Mine Subsidence Compensation Act, 1961*.

4.3 VISUAL

Visual impacts that are expected to arise as a result of Project activities, including potential cumulative impacts, were assessed in accordance with the methodology presented in Appendix N and summarised below.

4.3.1 Assessment Methodology

Visual impacts were assessed by evaluating the degree of visual modification resulting from the development in the context of the visual sensitivity of surrounding land use areas, where visual modification and visual sensitivity are defined as follows:

Visual Modification:

> The degree of visual modification of a development is a function of the contrast between the development and the existing visual landscape, and is generally considered to decrease with distance (Appendix N).

Visual Sensitivity:

> Visual sensitivity is a measure of how critically a modification to the existing landscape will be viewed from various land use areas, where different activities are considered to have different sensitivity levels (Appendix N).

Visual impacts were then determined generally in accordance with the matrix presented in Table 4-2 below.

Table 4-2
Visual Impact Matrix

Sensitivity	Modification: L	Modification: M	Modification: H
L	L	L	M
M	L	M	H
H	M	H	H

L= low; M= moderate; H= high
Source: Appendix N

4.3.2 Visual Landscape Impacts

The *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (DMR, 1999) identifies land clearing, modification of landforms, mine infrastructure and night-lighting as potential causes of visual impacts arising from coal mining. Elements of the Project considered to have the potential to impact on the visual landscape include:

- clearance of vegetation from within the footprint of surface disturbance;
- open cut mining (particularly waste rock stripping in elevated areas);
- modification of topographic features (e.g. open cut mining of elevated landforms and development of mine waste rock emplacements up to 160 m AHD);
- placement of waste rock and coarse rejects within mine waste rock emplacements (up to 160 m AHD);
- progressive rehabilitation of completed landforms;
- construction of water management structures;
- realignment of Wallaby Scrub Road;

- construction and operation of a rail spur (including underpass beneath the Golden Highway), rail loop and train load-out bin; and
- lighting associated with night-time operations.

Mine waste rock emplacements would, over time, vary in appearance from freshly placed waste rock to rehabilitated landforms (Section 5.4) complete with topsoil and vegetation. As such, the level of visual modification created by these emplacements would change, reducing as vegetation becomes established and matures.

Progressive development of open cut mining operations would necessitate the construction of a water control structure across North Wambo Creek and a channel to allow the passage of flows around the limit of the open cut development. These features may be visible from rural dwellings with views over North Wambo Creek.

Post-mining landforms presented on Figure 4-1 would range in elevation from approximately 70 m AHD adjacent to the final voids to 160 m AHD along the north-western mine waste rock emplacements. These landforms would be topsoiled and revegetated (Section 5.4). Following the exhaustion of coal reserves, mining infrastructure including administration areas, CHPP and rail infrastructure would be removed and the land beneath rehabilitated.

4.3.3 Visual Impacts

The Upper Hunter region covers an area of approximately 18,000 km^2 with a diverse visual character, including mining (approximately 147 km^2) and associated infrastructure (DUAP, 1997). Regionally significant visual features such as the landforms of the Wollemi National Park, Wollombi Brook and Hunter River would not be affected by the Project. The regional visual setting would therefore remain largely as described in Section 3.1.5.

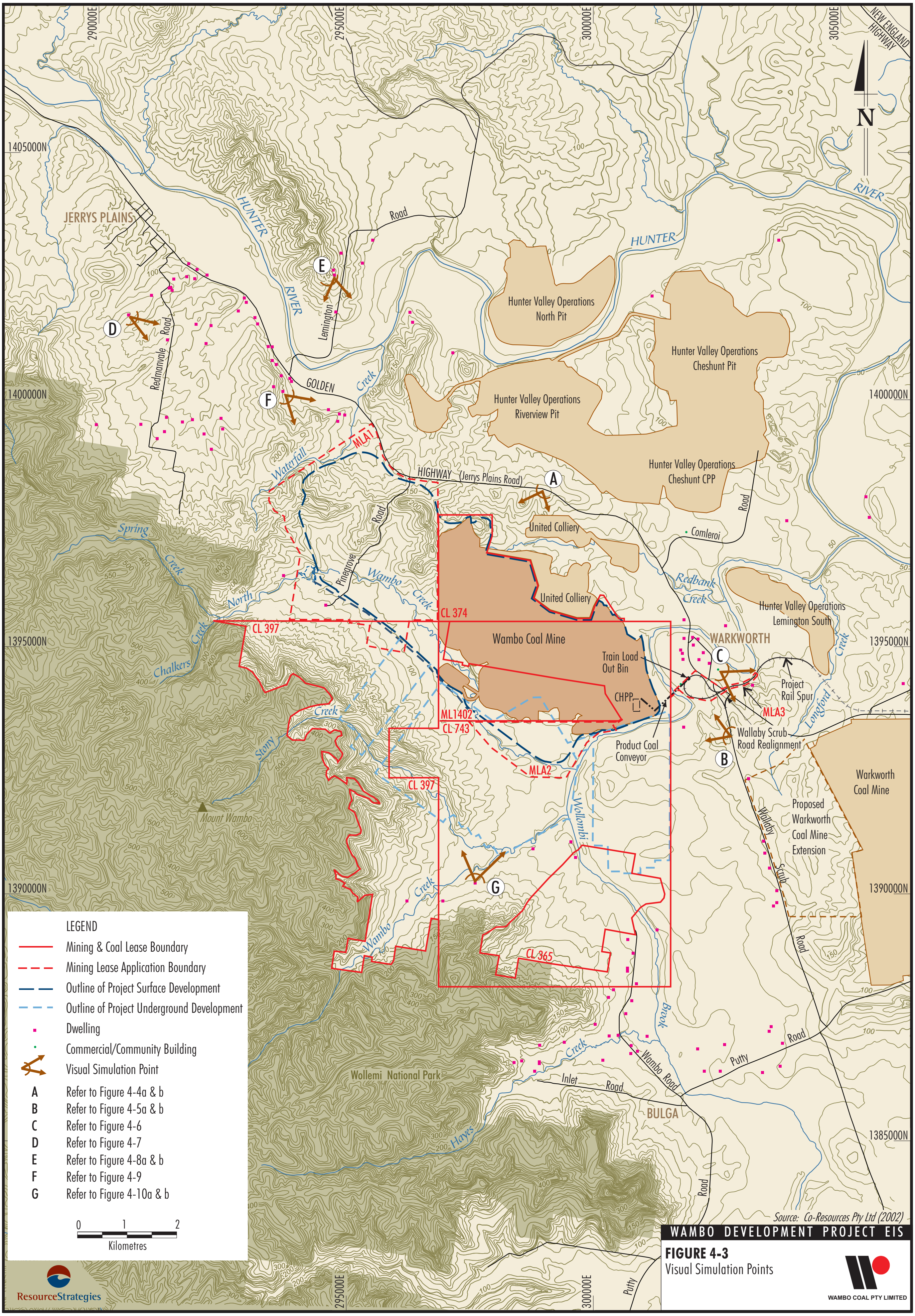
At the local level, simulations were prepared for the locations identified in Table 4-3 and shown on Figure 4-3 and used in the assessment of local landscape impacts. These simulations are shown on Figures 4-4a to 4-10b. Simulations presented for Project landforms during Year 7 and/or Year 9 of operation represent stages in the Project life considered to have the greatest potential for visual impact (Appendix N). The post-mining simulation illustrates the conceptual landform following the completion of mining and rehabilitation activities (Section 5).

Preliminary drafts of selected simulations were presented to the Project CCC in March 2003, and comments received in relation to mitigation of potential visual impacts have been incorporated in Section 4.3.4.

Table 4-3
Locations of Visual Simulations

Viewpoint	Potential View of Project	Simulation
A - Golden Highway north of the United Colliery	South-west from an elevated position toward the Project open cut mining operations. Overlooks existing Wambo Coal Mine and United Colliery landforms and coal stockpiles.	Figure 4-4a&b
B - Wallaby Scrub Road east of the Wambo Coal Mine CHPP	North-west over partially cleared grazing land toward the south-eastern portion of the Project.	Figure 4-5a&b
C - From an easement immediately adjacent St. Philips Anglican Church	South-east toward the Project rail spur and realigned intersection of Wallaby Scrub Road and the Golden Highway.	Figure 4-6
D - Adjacent to the Holt Dwelling	South-east over elevated landforms toward open cut mining operations in the MLA1 area.	Figure 4-7
E - Adjacent to the Moses Dwelling	South over Lemington Road and the Hunter River toward the open cut mining operations in the MLA1 area.	Figure 4-8a&b
F - From the Verandah of the Muller Dwelling	South-east over elevated landforms toward open cut mining operations in the MLA1 area.	Figure 4-9
G - Adjacent to the Fenwick Dwelling	North-northeast over Wambo Creek, North Wambo Creek, remnant vegetation and cleared grazing land toward Project infrastructure.	Figure 4-10a&b

Source: Appendix N



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-3
Visual Simulation Points

WAM-02-01-Sect4_010J

EXISTING VIEW

YEAR 7 SIMULATION

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-4a
Existing View and Visual Simulations
- Golden Highway

WAMBO COAL PTY LIMITED

WAM-02-01-Sect4_003F

YEAR 9 SIMULATION

POST-MINING SIMULATION (Landform completed Year 9)

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-4b
Existing View and Visual Simulations - Golden Highway

WAMBO COAL PTY LIMITED

WAM-02-01-Sect4_018E

EXISTING VIEW

YEAR 7 SIMULATION

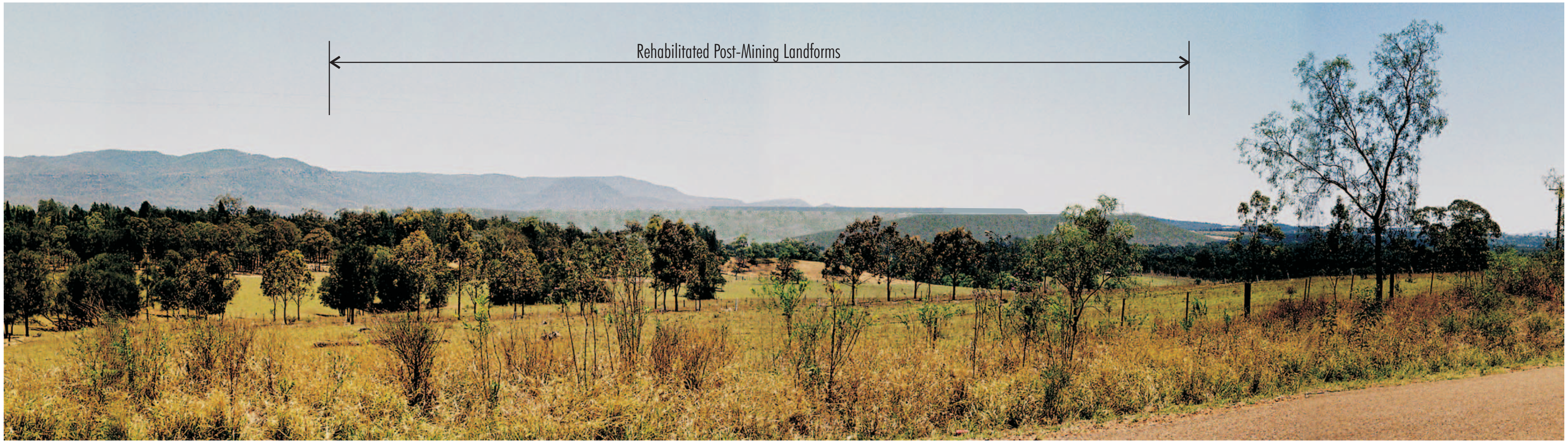
WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-5a
Existing View and Visual Simulations
- Wallaby Scrub Road

WAMBO COAL PTY LIMITED

ResourceStrategies

YEAR 9 SIMULATION



POST-MINING SIMULATION (Landform completed Year 10)

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-5b

Existing View and Visual Simulations - Wallaby Scrub Road

WAMBO COAL PTY LIMITED

EXISTING VIEW

YEAR 7 SIMULATION

POST-MINING SIMULATION

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-6
Existing View and Visual Simulations
- St Philips Anglican Church, Warkworth

WAMBO COAL PTY LIMITED

ResourceStrategies

WAM-02-01-Sect4_005G

EXISTING VIEW

YEAR 7 SIMULATION

POST-MINING SIMULATION (Landform completed Year 9)

WAMBO DEVELOPMENT PROJECT EIS

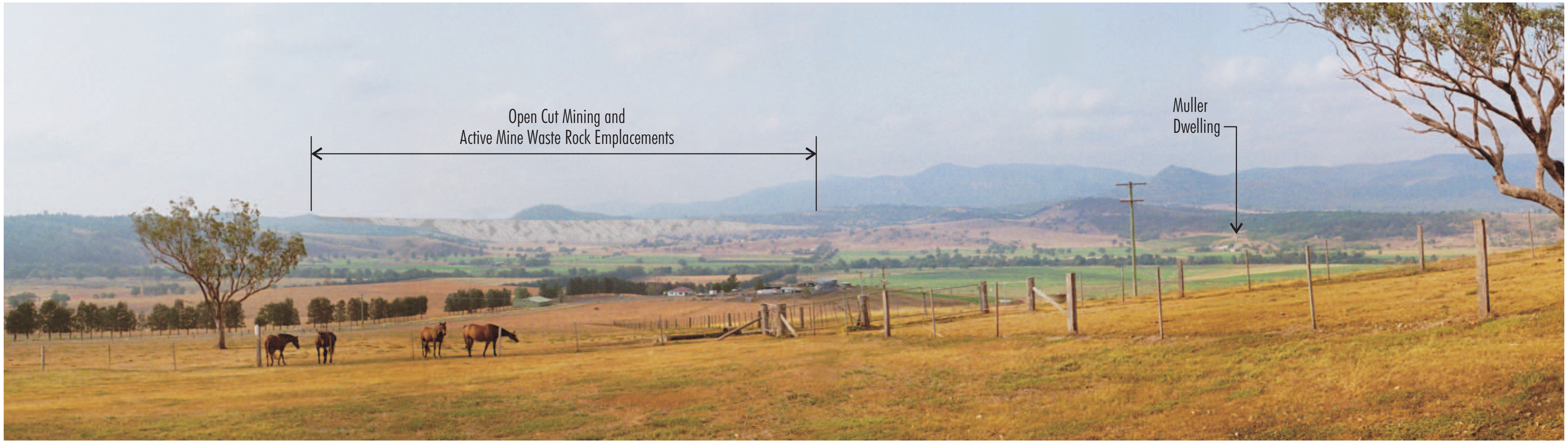
FIGURE 4-7
Existing View and Visual Simulations
- Holt (Adjacent to Dwelling)

WAMBO COAL PTY LIMITED

ResourceStrategies

WAM-02-01-Sect4_006G

EXISTING VIEW



YEAR 7 SIMULATION

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-8a
Existing View and Visual Simulations
- Moses (Adjacent to Dwelling)

WAMBO COAL PTY LIMITED

WAM-02-01-Sect4_007H

YEAR 9 SIMULATION

POST-MINING SIMULATION (Landform completed Year 11)

ResourceStrategies

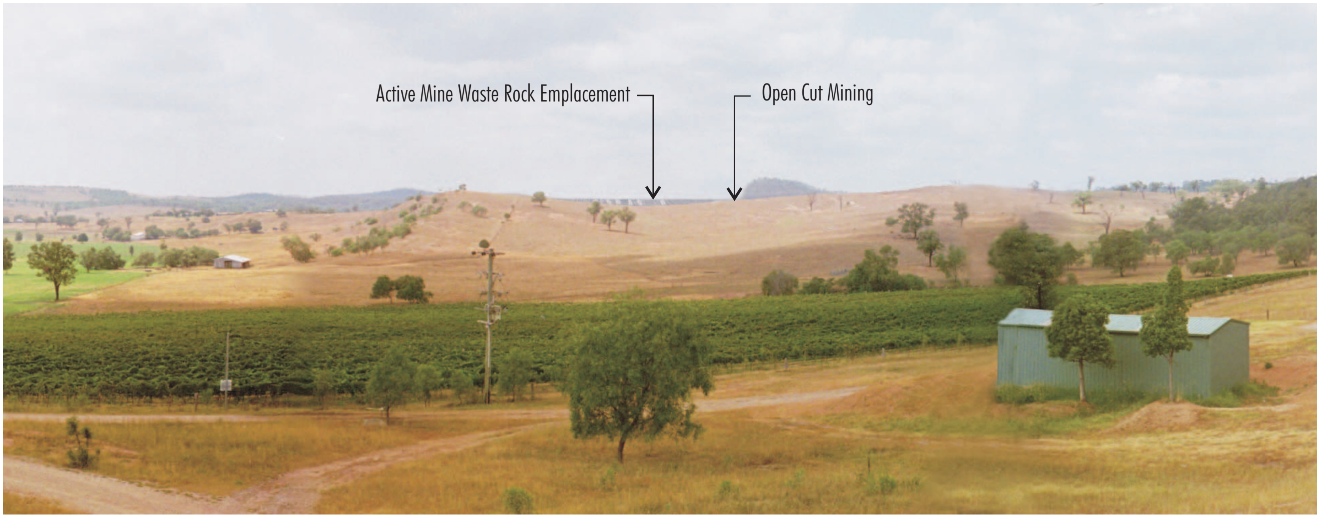
WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-8b
Existing View and Visual Simulations
- Moses (Adjacent to Dwelling)

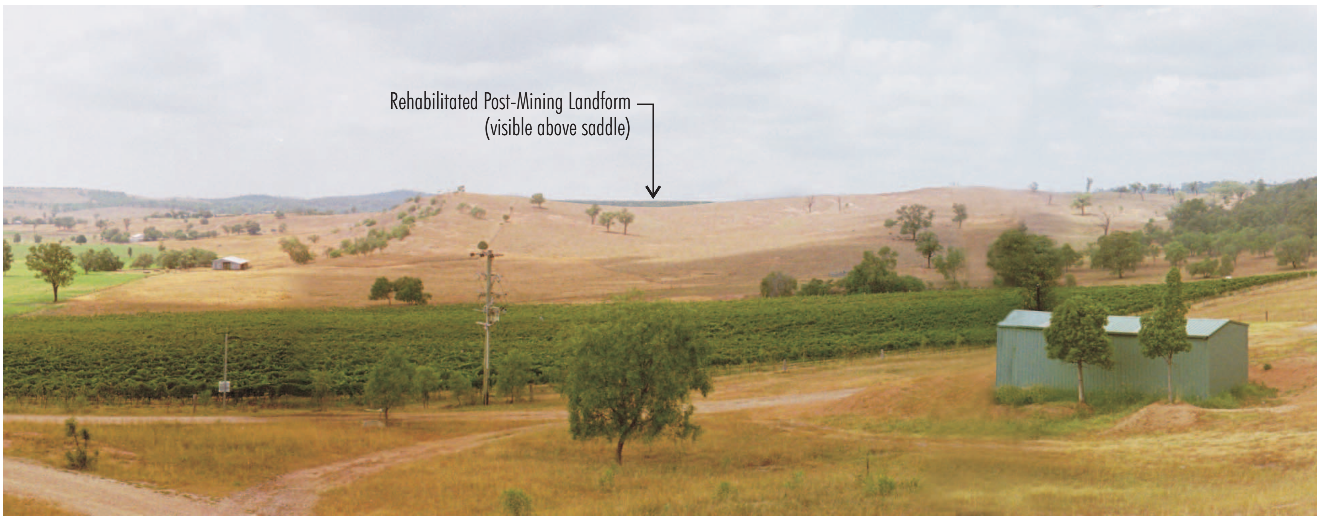
WAMBO COAL PTY LIMITED

WAM-02-01-Sect4_020G

EXISTING VIEW



YEAR 7 SIMULATION



POST-MINING SIMULATION (Landform completed Year 9)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-9
Existing View and Visual Simulations
- Muller (From Verandah of Dwelling)

WAMBO COAL PTY LIMITED

ResourceStrategies

WAM-02-01-Sect4_008G

EXISTING VIEW

YEAR 7 SIMULATION

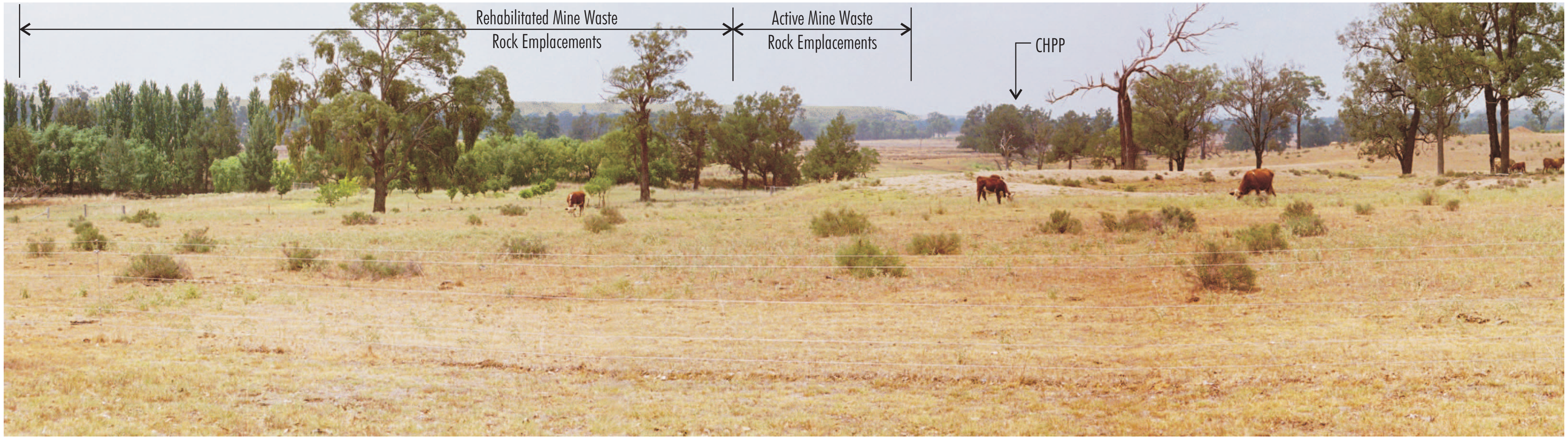
ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-10a
Existing View and Visual Simulations
- Fenwick (Adjacent to Dwelling)

WAMBO COAL PTY LIMITED

WAM-02-01-Sect4_009G



YEAR 9 SIMULATION

POST-MINING SIMULATION (Landform completed Year 13)

ResourceStrategies

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-10b
Existing View and Visual Simulations
- Fenwick (Adjacent to Dwelling)

WAMBO COAL PTY LIMITED

WAM-02-01-Sect4_021F

Predicted visual impacts, based on expected maximum visual modification, are summarised in Table 4-4 and discussed below.

Roads

Golden Highway – East of Wollombi Brook

Views of the Project from this section of the Golden Highway would include the realignment of Wallaby Scrub Road, the rail spur, rail spur underpass, train load-out bin and rail operations. Vegetation clearance associated with the construction of these items would reduce the screening effect of roadside vegetation, enabling partial views of the rail spur, train load-out bin and rail operations to the west.

The visual contrast between the rail spur, rail spur underpass, train load-out bin, rail operations and the surrounding landscape, and the proximity of these items to this section of the Golden Highway is expected to be similar to the many existing views of rail and other industrial infrastructure along the highway.

Golden Highway – West of Wollombi Brook to the Hunter River Flood Plain

Views of the Project from the elevated section of the Golden Highway west of Wollombi Brook to the Hunter River flood plain would include mine waste rock emplacements and open cut mining operations. The majority of potential views to the south from this section of the Golden Highway are screened by roadside vegetation and intervening topography (Appendix N).

Limited, indirect views of mine waste rock emplacements would be available where roadside vegetation and elevated topography are reduced. The simulation on Figure 4-4a&b indicates that open cut mining operations would also result in modification to the visual landscape between foreground vegetation and the horizon. In these areas the contrast between mine waste rock emplacements and the surrounding environment would be reduced by distance and a degree of integration with the surrounding landforms resulting from the shaping and progressive rehabilitation of the outer slopes of these emplacements. Views of Project mine waste rock emplacements would be further reduced by continued growth of roadside vegetation given the lead time prior to development.

Table 4-4
Summary of Visual Impacts

Viewing Location	Sensitivity	Modification	Potential Impact
Roads			
Golden Highway – East of Wollombi Brook	M	L	L
Golden Highway – West of Wollombi Brook to the Hunter River Flood plain	M	L-H	L-H
Golden Highway – Hunter River Flood plain to Jerrys Plains	M	L	L
Wallaby Scrub Road	L	N-H	L-M
Townships/Localities			
Bulga	H	N	L
Warkworth	H	L	M
St. Philips Anglican Church	M	M	M
Jerrys Plains	H	N	L
Rural Dwellings			
Various Rural Dwellings	H	N-H	L-H
Holt Dwelling	H	L	M
Moses Dwelling	H	M	H
Muller Dwelling	H	M	H
Fenwick Dwelling	H	M	H

Source: Appendix N
L = low; M = moderate; H = high; N = negligible

A section of the Golden Highway from Pinegrove Road towards the Hunter River flood plain is expected to experience close-up views of open cut mining operations and subsequent mine waste rock placement which would reduce the east-west trending ridge from up to approximately 220 m AHD to approximately 160 m AHD.

Golden Highway – Hunter River Flood Plain to Jerrys Plains

The section of the Golden Highway from the Hunter River flood plain to Jerrys Plains would have limited views of Project open cut mining operations and mine waste rock emplacements. Elevated landforms (up to approximately 210 m AHD) would screen potential views of the Project along the majority of this section of the Golden Highway.

Wallaby Scrub Road

Views of the Project from Wallaby Scrub Road would be similar to those of the Wambo Coal Mine (Section 3.1.5). The realignment of the intersection of Wallaby Scrub Road and the Golden Highway would provide limited views of the Project rail spur through roadside vegetation. Roadside vegetation, an elevated spur and the location of active operations up to 300 m below the natural surface would generally preclude views of the proposed Warkworth Coal Mine extension to the east (Coal and Allied, 2002).

Figure 4-5a&b simulates a view of the Project from a location on Wallaby Scrub Road (Figure 4-3). This simulation demonstrates that Project activities would result in the raising of mine waste rock emplacements above existing levels. Mine waste rock emplacements would be visible and would contrast with foreground vegetation, resulting in the modification of the horizon at this location on Wallaby Scrub Road. Landforms of the Wollemi National Park would continue to dominate the horizon to the west.

Townships/Localities

Bulga

The visual landscape, as viewed from the township of Bulga, would remain largely as described in Section 3.1.5. Views of the Project would be largely precluded by the elevated, vegetated spurs protruding from the Wollemi National Park. Limited and distant views may be available from elevated positions along Inlet Road.

Warkworth

In general, views from dwellings within Warkworth would not be altered by the Project. Limited views of the train load-out bin may be available above existing vegetation. Dwellings within Warkworth to the north of the Golden Highway may have views of rail operations and the Project rail spur as it crosses the Hunter River flood plain to the south-east.

Figure 4-6 simulates the view from the easement immediately beside St. Philips Anglican Church looking toward the Project rail spur. This easement has an uninterrupted view over the Wollombi Brook flood plain and represents the easternmost view point in Warkworth. Views from this location would include rail operations and the Project rail spur as it passes westward from behind vegetation on the banks of Wollombi Brook to cross under the Golden Highway. The rail spur underpass would be obscured from view by gently rising topography as it approaches the Golden Highway. Coal trains would be visible on the rail spur at an average frequency of approximately four per day (Section 2.8).

Jerrys Plains

The visual landscape, as viewed from the township of Jerrys Plains, would remain largely as described in Section 3.1.5. Views of the Project would be largely precluded by the elevated intervening topography.

Some dwellings along Redmanvale Road, which travels south of Jerrys Plains, and at elevated locations at the edge of Jerrys Plains township would have views of the Project over intermediate vegetation and topography. These views would generally be sporadic, distant and represent a small fraction of the landscape.

Rural Dwellings/Properties

Views from rural dwellings/properties in the vicinity of the Project would include mine waste rock emplacements, open cut mining operations, the water control system and other items of Project infrastructure. Rural dwellings/properties such as the Skinner and Long properties south of Pinegrove Road would have views of mine waste rock emplacements and open cut mining operations where intervening topography and/or vegetation permit.

Figures 4-7, 4-8a&b, 4-9 and 4-10a&b simulate views from rural dwellings south of Jerrys Plains, on Lemington Road, the Golden Highway (south of Jerrys Plains) and Wambo Creek respectively.

Dwellings/Properties

Holt Dwelling

Figure 4-7 simulates the potential visual impact of the Project from adjacent to the Holt dwelling south of Jerrys Plains. The existing view on Figure 4-7 shows that the elevated east-west trending ridge in the north-eastern corner of the MLA1 area is visible on the horizon above the intervening topography. Visual impacts from this location involve the permanent removal of a distant portion of the horizon.

Moses Dwelling

As simulated on Figure 4-8a&b mine waste rock emplacements and open cut mining operations would be visible from adjacent to the Moses dwelling (Figure 4-3). Open cut mining operations would modify a significant proportion of the existing horizon and would provide a notable contrast with the existing landscape. This contrast would however be mitigated by the distance between the dwelling and the Project. Views from this location also include the various workings of the Hunter Valley Operations to the east.

Muller Dwelling

Project views from the verandah of the Muller dwelling on the southern side of the Golden Highway, south of Jerrys Plains, would include open cut mining operations on elevated areas and elevated mine waste rock emplacements (Figure 4-9). These activities would modify a significant proportion of the existing background horizon, without changing foreground and mid-ground views.

Fenwick Dwelling

Views of Project mine waste rock emplacements would be apparent from the Fenwick dwelling, which is situated on Wambo Creek. Figure 4-10a&b simulates one aspect of these mine waste rock emplacements from adjacent to the Fenwick dwelling.

Some elevated locations in the vicinity of the Fenwick dwelling (e.g. to the south along the property access track) would afford increased views of mine waste rock emplacements above foreground vegetation. While Project mine waste rock emplacements would contrast with the existing landscape, intervening vegetation and topography act as a visual screen.

Night-Lighting

As described in Section 3.1.5, the glow produced by night-lighting at the Wambo Coal Mine is visible at nearby dwellings and along transport routes, while direct views of mobile machinery lights and operational lighting are available from some exposed positions. Project night-lighting would be similar to that used at the existing Wambo Coal Mine. The continued development of open cut mining operations and mine waste rock emplacements would however vary the source and effects over the Project life.

The glow above operational areas contrasts with the night sky. This effect is exacerbated during overcast conditions and would decrease with distance as the light disperses.

4.3.4 Mitigation Measures

Measures that would be employed to mitigate potential visual impacts include:

- design and construction of Project infrastructure in a manner that minimises visual contrasts; and
- progressive rehabilitation of mine waste rock emplacements (particularly outer batters), including partial rehabilitation of temporarily inactive areas.

The following additional measures would be investigated and, where feasible, implemented for locations assessed as having a high potential visual impact:

- implementation of landscaping works in consultation with affected rural residents; and/or
- placement and maintenance of visual screens between Project infrastructure and the viewing location.

Project Design

Mine waste rock emplacements would be designed and constructed to maximise available visual shielding to active open cut mining operations and to maximise potential for integration with the surrounding environment. As discussed further below, evening and night-time mine waste rock emplacement operations within the MLA1 area would be managed so as to minimise the potential for direct views of night-lighting.

Project infrastructure, such as the train load-out bin, would be coloured to minimise the contrast with the surrounding environment.

Progressive Rehabilitation

Progressive rehabilitation of mine waste rock emplacements and other areas of disturbance would be undertaken in order to reduce the contrast between Project landforms and the surrounding environment. This would include partial rehabilitation with selected grass species with a particular focus on the outer batters of mine waste rock emplacements.

Landscaping Works

Landscaping works, including the installation of bunds at appropriate locations and the planting of selected flora species to screen Project views, would be investigated for rural dwellings identified in Section 4.3.3 as having a high potential visual impact. Where practicable, these works would then be implemented in consultation with the affected landholder.

Visual Screening

Planting of selected flora species would be undertaken in order to increase the degree of visual screening at locations where the visual impact has been assessed as high. The visual impact assessment conducted in Section 4.3.3 identified a section of the Golden Highway from Pinegrove Road towards the Hunter River flood plain as a high potential visual impact zone. Consistent with feedback from the Project CCC, screening vegetation would be planted, where practicable, in close proximity to the Golden Highway in order to mitigate the visual impact from this location.

Based on planned production and mine progression, Project activities in this area would become prominent from approximately Year 5 of the Project. Screening vegetation would be planted at the commencement of Project operations and monitored on a regular basis with remedial works undertaken as required in order to provide a functional visual barrier.

Planting and monitoring of screening vegetation to provide a functional visual barrier would also be considered at the following locations (as suggested by the Project CCC):

- Between the Project rail spur (Wollombi Brook to the Golden Highway) and St. Philips Anglican Church, and some dwellings in Warkworth.
- Along the intervening ridgeline south-east of the Muller dwelling.

The planting and monitoring of screening vegetation would be undertaken on WCPL owned land wherever possible. Planting and monitoring of screening vegetation outside WCPL land would be undertaken, where practicable, subject to agreement by the relevant landholder.

Night-Lighting

Night-lighting would be restricted to the minimum required for operational and safety requirements and would be directed away from incoming views. All lighting above natural topographic screens would be directed downwards. As open cut mining progresses into the MLA1 area, evening and night-time mine waste rock emplacement operations within the MLA1 area would be managed such that waste rock haulage and dumping would occur:

- within internal mine waste rock emplacement areas (i.e. no external dumping); and/or
- behind a minimum 10 m high bund or equivalent shielding mine landform.

Alternatively, mine waste rock emplacement areas in the south-eastern sections of the MLA1 area would be utilised for waste rock dumping.

In addition, overburden removal in areas on the top and outer sides of topographic ridges where bunding is not considered feasible would be restricted to daytime only. This would limit direct views of Project night-lighting in the vicinity of the MLA1 area.

Project night-lighting impacts would therefore be largely restricted to the production of a glow above operational areas. This glow would be visible at nearby dwellings and along transport routes, while direct views of mobile machinery lights and operational lighting may be available from some elevated positions.

4.4 ACOUSTICS

A noise, blast and vibration assessment for the Project is presented in Appendix A. The assessment covers both the construction and operation of the Project. This section presents a summary of the findings of the assessment.

4.4.1 Noise Impact Assessment

The noise impact assessment presented in this section has been undertaken in accordance with the NSW EPA Industrial Noise Policy (INP) (EPA, 2000). The INP provides the framework and process for Project noise impact assessment.

In accordance with INP objectives, background noise levels for the Project area and surrounds have been characterised (Section 3.2.1). Noise assessment criteria, which form the basis for impact assessment and determining mitigation requirements, have been derived for the Project based on the background levels. Consequently, the Project specific assessment criteria vary relative to the RBLs presented in Section 3.2.1. Project specific noise assessment criteria derived from this approach (Appendix A) are outlined in Table 4-5. Landowner reference numbers refer to Figure 1-6.

Table 4-5
Project Specific Noise Assessment Criteria (dBA re 20 μPa)

Locality	Land Owner	Project Specific Assessment Criteria					
		Intrusive $L_{Aeq(15minute)}$			Amenity $L_{Aeq(period)}$ [1]		
		Day	Evening	Night	Day	Evening	Night
Wambo Road (INP Rural)	2 Lambkin	35	35	35	50	45	40
	25 Fenwick	35	35	35	50	45	40
	Other Residential	35	35	35	50	45	40
Warkworth Village (INP Suburban)	19(A, B) Kelly	40	38	38	55	45	40
	51 Hawkes	38	36	36	55	45	40
	56 Haynes	39	37	36	55	45	40
	Other Residential	39	37	36	55	45	40
INP Place of Worship	St Philips Anglican Church (Internal)	Intrusive criteria apply only to residential receivers		Not in use	40	40	Not in use
INP Passive/Active Recreation Area	St Philips Anglican Church Grounds (External)				50-55	50-55	
Gouldsville (INP Suburban)	23(C) Kannar	38	38	38	55	45	38
	Other Residential	35	35	35	55	45	40
Maison Dieu (INP Suburban)	Residential	38	38	38	55	45	40
Redmanvale/ Pinegrove Roads (INP Rural)	15(B) McGowen/Caslick	35	36	35	50	45	40
	24 Long	36	35	35	50	45	40
	Other Residential	35	35	35	50	45	40
Golden Highway (INP Suburban)	31(D) Fisher	39	40	35	55	45	40
	Other Residential	39	40	35	55	45	40

Source: Appendix A

1 Daytime 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 7.00 am.

In those cases where the INP Project specific assessment criteria in Table 4-5 are not achieved, it does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable. In subjective terms, exceedances of the INP Project specific assessment criteria can be generally described as follows:

- negligible noise level increase (less than 1 dBA) (not noticeable by all people);
- marginal noise level increase (between 1 dBA and 2 dBA) (not noticeable by most people);
- moderate noise level increase (between 3 dBA and 5 dBA) (not noticeable by some people but may be noticeable by others); and
- appreciable noise level increase (greater than 5 dBA) (noticeable by most people).

For the purposes of assessing potential noise impacts, exceedances can be separated into the Noise Management Zone (i.e. 1 dBA to 5 dBA above the criteria) and the Noise Affectation Zone (i.e. greater that 5 dBA above the criteria). Section 3.2 presents a description of noise levels from various common noise sources for comparative reference.

Noise Modelling

An acoustic computer model was developed that simulates Project components and noise source information (sound levels and locations). The model also considers meteorological effects, surrounding terrain, distance from source to receiver and noise attenuation.

The meteorological effects included in the modelling are those characterised as prevailing in accordance with INP assessment methodologies. The definition of prevailing conditions included statistical analysis of site meteorological data (including consideration of wind speed and direction, as well as temperature lapses and inversions).

Noise emissions were modelled for the following prevailing conditions:

- daytime non-adverse (annual wind speed of 0 m/s and a temperature gradient of 0°C/100 m);
- evening and night-time summer, autumn and spring adverse (summer, autumn and spring wind speed of 3 m/s from the south-east and a temperature gradient of 0°C/100 m); and
- evening and night-time winter adverse (winter wind speed of 2 m/s from the west and a temperature inversion gradient of 3°C/100 m).

Predicted Noise Emissions

Predictive noise emission modelling has been undertaken for four snapshots in the Project life (Year 1.5 - including construction activities and Years 2, 7 and 9 of operations). These snapshots are based on the planned Project production. The first snapshot (construction Year 1.5) was assessed cumulatively as works would occur concurrently with existing Wambo Coal Mine operations. Thereafter, the Project snapshots were assessed individually. The snapshots are based on planned Project production. The actual timing of the Project development would depend on actual Project production and progression. The basis for the selection of these Project snapshots is provided below.

A separate worst case cumulative assessment was also undertaken which included the Project operating together with the Warkworth Coal Mine, United Colliery and Hunter Valley Operations. The results of this assessment are also presented below.

Construction Year 1.5

Existing Wambo Coal Mine operations would coincide with Project construction activities (Section 2.4) and the extension of the Wollemi Underground Mine Box Cut.

Operation Year 2

Representative of the nearest open cut mining operations (with increased ROM coal production) to Warkworth and including the operation of the Whybrow Underground Mine, CHPP and train loading system.

Operation Year 7

Representative of the nearest open cut mining operations to Jerrys Plains and including the operation of the Wambo and Arrowfield Underground Mines, CHPP and train loading system.

Operation Year 9

Representative of the nearest open cut mining operations to Bulga including the operation of the Wambo and Arrowfield Underground Mines, CHPP and train loading system.

Modelling of daytime, evening and night-time noise emissions from the Project indicates that there would be exceedances of the Project specific noise assessment criteria (Table 4-5) at a number of nearby dwellings and at privately owned vacant lands.

Table 4-6 summarises the privately owned dwellings where the $L_{Aeq(15minute)}$ intrusive emissions are predicted to exceed the criteria during operation. Predicted potential intrusive noise emissions for mine owned dwellings (e.g. WCPL or Coal and Allied) are tabulated in Appendix A.

Figures 4-11, 4-12 and 4-13 present predicted noise emission contours. The noise contours are indicative only of the potential noise emissions and in some cases may differ slightly (+ or -2 dBA) from the more accurate values presented in the tables below.

Privately owned vacant land was also assessed against the Project specific noise assessment criteria. Privately owned vacant land where the criteria was predicted to be exceeded over more than 25% of the land area is presented in Table 4-7.

Cumulative Mine Noise Assessment

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable and maximum cumulative amenity levels for all industrial noise in an area.

The potential for the simultaneous operation of the adjoining mine developments to exceed the acceptable and maximum noise amenity criteria can be assessed on a worst case scenario by adding the anticipated intrusive noise limits from the Project and Warkworth Coal Mine together with the approved noise limits from the United Colliery and Hunter Valley Operations. The cumulative intrusive level is then compared with the acceptable and maximum noise amenity criteria (Appendix A).

For all six assessment localities listed in Table 4-6 the non-adverse cumulative noise emissions from the Project and adjoining mining operations were below the relevant acceptable amenity criteria for industrial noise during the daytime, evening and night-time (Appendix A).

Similarly, at all six assessment localities the worst case adverse cumulative noise emissions from the Project and adjoining mines were below the relevant maximum amenity criteria for industrial noise. Further, the likelihood that all mines simultaneously emit their maximum noise emissions under adverse weather conditions to any one receiver locality is considered minimal (Appendix A).

Project Noise Mitigation Measures

During the noise assessment a number of iterative steps were undertaken to develop noise mitigation measures for the Project, including:

- preliminary noise modelling of critical years to identify potential areas of affectation as well as investigating various noise mitigation measures to assess their relative effectiveness;
- consideration of various combinations of noise mitigation measures to minimise the potential noise affectation zone; and
- adoption by WCPL of a range of noise mitigation measures that significantly reduce Project noise emissions, particularly during Year 5 to Year 13. The actual timing of the implementation of the adopted measures would be dependent on actual production and mine progression.

The noise mitigation measures included in the predictive modelling are described below.

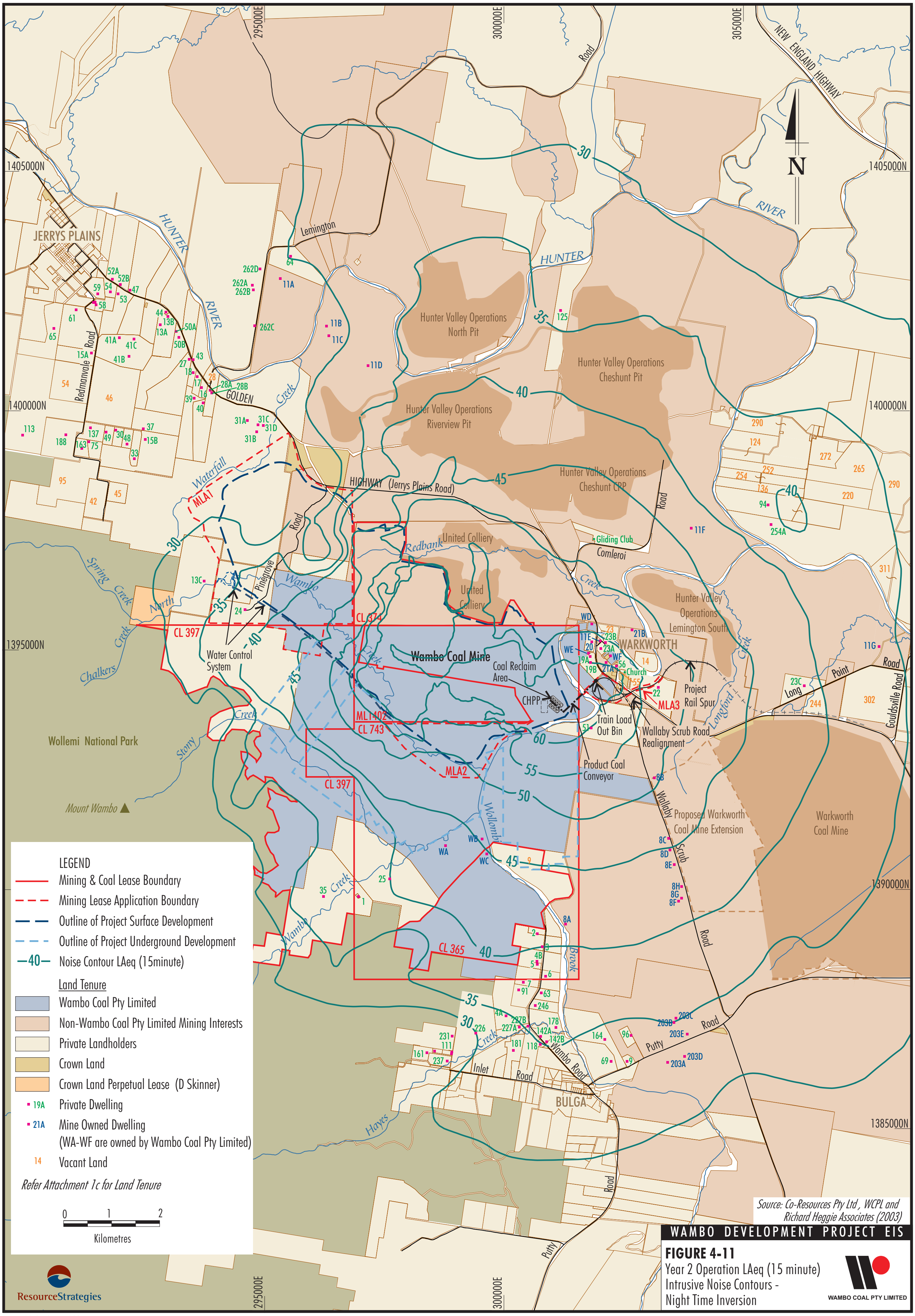
Construction Noise Mitigation Measures

- Surface construction works would generally be undertaken during daytime hours, up to seven days per week.
- Underground construction works (i.e. excavation blasting to develop drift access for the Wambo, Arrowfield and Bowfield Seam Underground Mines) would be undertaken in a manner to ensure off-site blast emissions are negligible (e.g. by limiting the size of each blast).

Table 4-6
Private Dwellings within Noise Management and Affectation Zones

Locality	Period	Noise Management Zone		Noise Affectation Zone
		1 dBA to 2 dBA above Project Specific Criteria	3 dBA to 5 dBA above Project Specific Criteria	>5 dBA above Project Specific Criteria
Wambo Road	Adverse W Wind and Inversion Winter Evening/Night	35 Brosi 178 Smith 246 Bailey	1 Brosi 3 Birrell 4(B) Circosta 5 Strachan 6 Merrick 7 Maizey 25 Fenwick 63 Abrocuff 91 Bailey	2 Lambkin
Warkworth	Non-Adverse Annual Daytime	Nil	22 Henderson	19(A, B) Kelly 23(A, B) Kannar 51 Hawkes 56 Haynes
	Adverse SE Wind Summer, Autumn, Spring Evening/Night	Nil	22 Henderson	19(A, B) Kelly 23(A, B) Kannar 51 Hawkes 56 Haynes
	Adverse W Wind and Inversion Winter Evening/Night	Nil	Nil	19(A, B) Kelly 22 Henderson 23(A, B) Kannar 51 Hawkes 56 Haynes
Gouldsville	Adverse W Wind and Inversion Winter Evening/Night	23(C) Kannar	Nil	Nil
Maison Dieu	Adverse W Wind and Inversion Winter Evening/Night	254(A) Algie	94 Curlewis	Nil
Redmanvale/ Pinegrove Roads	Non-Adverse Annual Daytime	Nil	Nil	24 Long
	Adverse SE Wind Summer, Autumn, Spring Evening/Night	137 Woodruff 163 Rodger/Williams 188 Fuller	15(B)McGowen/Caslick 30 Williams 33 Thelander/O'Niell 37 Lawry 48 Ponder 49 Oliver 75 Barnes	13(C) Skinner 24 Long
	Non-Adverse Annual Daytime	Nil	Nil	24 Long
	Adverse W Wind and Inversion Winter Evening/Night	13(C) Skinner	Nil	24 Long
Golden Highway	Adverse SE Wind Summer, Autumn, Spring Evening/Night	13(B) Skinner 27 Birralee 43 Carmody 262(A, B, C) Moses	16 Cooper 17 Carter 18 Denney 28(A, B) Garland 39 Northcote 40 Muller 50(A, B) Nowland	31(A, B, C, D) Fisher

Source: Appendix A



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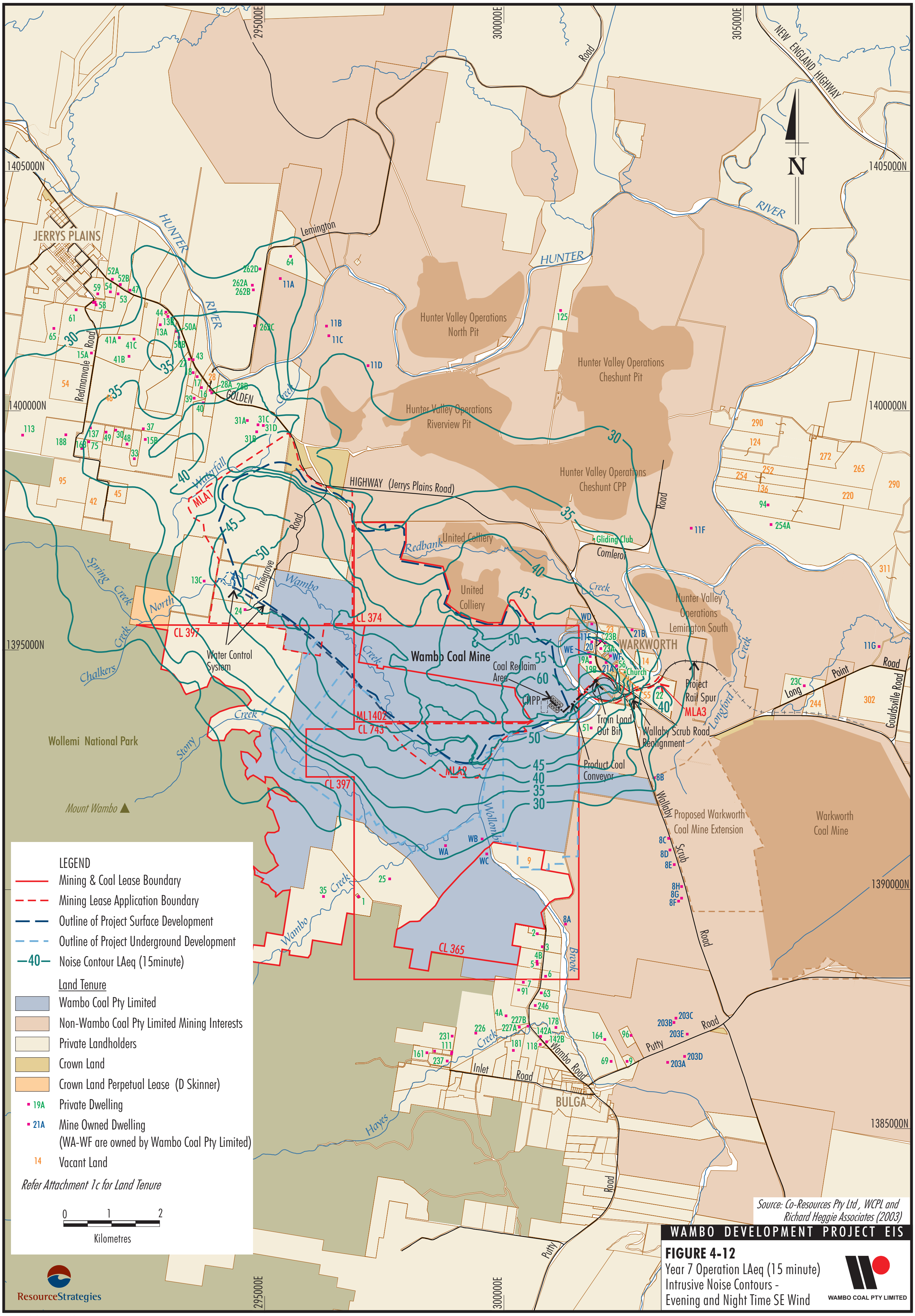

Source: Co-Resources Pty Ltd, WCPL and Richard Heggie Associates (2003)

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-12
Year 7 Operation LAeq (15 minute) Intrusive Noise Contours - Evening and Night Time SE Wind

WAMBO COAL PTY LIMITED

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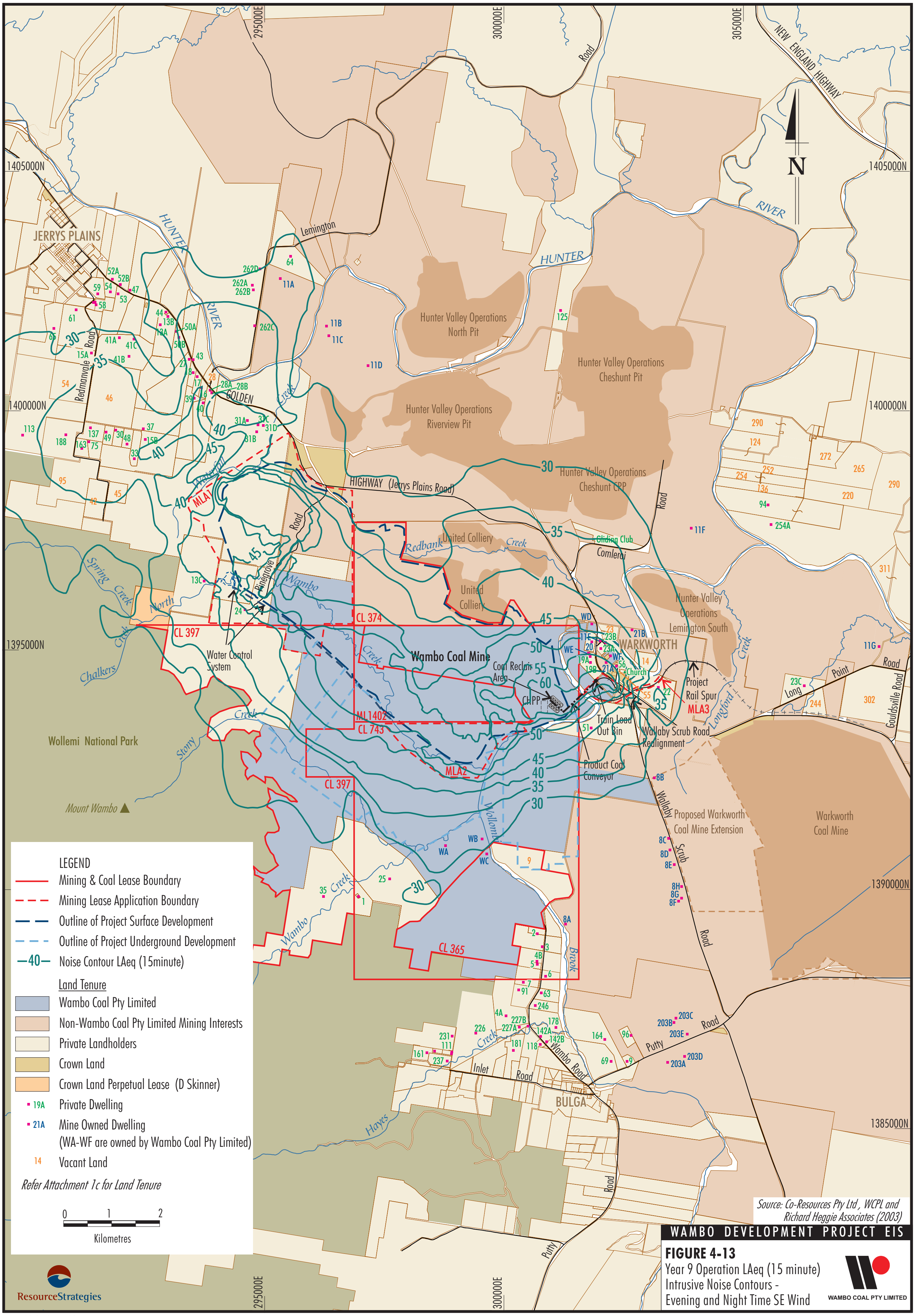

FIGURE 4-13
Year 9 Operation LAeq (15 minute) Intrusive Noise Contours - Evening and Night Time SE Wind

WAM-02-01-Sect4_025K

Table 4-7
Private Vacant Land within Noise Management and Affectation Zones

Locality	1 dBA to 2 dBA above Project Specific Criteria[1]	3 dBA to 5 dBA above Project Specific Criteria[1]	>5 dBA above Project Specific Criteria[1]
Wambo Road	Nil	Nil	9 Upward
Warkworth Village	Nil	14 Keys	23 Kannar 55 Burley
Gouldsville	Nil	Nil	Nil
Maison Dieu	136 Ernst 254 Algie	Nil	Nil
Redmanvale/ Pinegrove Roads	42 Redman 45 Mansfield 54 Nichols 95 Gee	46 Ball	Nil
Golden Highway	Nil	28 Garland	Nil

Source: Appendix A
[1] Over more than 25 % of the land area

Operation Noise Mitigation Measures

- Based on current mine planning and predictive noise modeling, select Project mobile equipment would be modified from Year 5 to meet current “achievable” maximum noise suppression standards. The timing of this would be confirmed based on noise monitoring data collected as the Project progresses toward the noise sensitive areas.
- From Year 5, evening and night-time controls would be implemented for operations in the open cut to the north and would include overburden haulage and dumping operations within internal mine waste rock emplacement areas (i.e. no external dumping) and/or behind a minimum 10 m high bund or equivalent shielding mine landform. Alternatively, mine waste rock emplacement areas to the south of the open cut would be utilised for waste rock dumping. In addition, overburden removal in areas on the top and outer sides of topographic ridges where bunding is not feasible would be restricted to daytime only.

The implementation of these controls would be mine progression dependent, i.e. these controls would be implemented as mining progresses into the areas described above in order to achieve the necessary potential impact mitigation in relation to noise emissions.

In addition to the above, WCPL would investigate the use of a real-time noise monitoring system that may assist in providing greater flexibility to mine operations under favourable weather conditions.

In order to minimise any residual noise impact at the St. Philips Anglican Church from the rail transport of coal, WCPL would liaise with the rail service provider to minimise the potential impact of noise emissions on St. Philips Anglican Church (where practicable) particularly on Friday evenings (i.e. approximately 6.00 pm to 9.00 pm) and Sunday mornings (i.e. approximately 9.00 am to 12.00 pm).

As detailed in Table 4-6, the private dwellings where noise emissions are predicted to be above Project specific noise assessment criteria can be divided into a noise management zone (1 to 5 dBA above Project specific criteria) and a noise affectation zone (greater than 5 dBA above Project specific criteria). Proposed noise management procedures for these zones are detailed below.

Noise Management Zone

Depending on the degree of exceedance of the Project specific criteria (1 dBA to 5 dBA) noise impacts could range from negligible to moderate within the noise management zone. In addition to the noise mitigation measures included in the predictive modelling, noise management procedures would include:

- noise monitoring on site and within the community;
- prompt response to any community issues of concern;
- refinement of on-site noise mitigation measures and mine operating procedures where practicable;

- discussions with relevant landowners to assess concerns;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with landowners.

Noise Affectation Zone

Exposure to noise levels greater than 5 dBA above the Project specific noise criteria may be considered unacceptable by some landowners. Management procedures for noise affectation zones would include:

- discussions with relevant landowners to assess concerns and develop practical mitigation;
- implementation of acoustical mitigation at receivers (e.g. bunding, double glazing of windows); and
- negotiated agreements with landowners if required.

Recommended Project Noise Limits

In accordance with the procedures described in the INP, recommended noise limits for nearby dwellings and the St. Philips Anglican Church have been assessed using the following procedure:

- where the predicted noise emission is less than (or equal to) the Project specific criteria then the Project specific criteria is the noise limit;
- where the predicted noise emission is within the noise management zone then the predicted noise level is applied as the achievable noise limit; and
- where the predicted noise emission is within the noise affectation zone then the upper limiting level applying to the noise management zone is the noise limit.

Based on the above procedure the recommended operating noise limits for privately owned dwellings and the St. Philips Anglican Church are presented in Table 4-8. Figures 4-11 to 4-13 show the location of each dwelling and the church. Appendix A tabulates the recommended operating noise limits for mine owned dwellings in the vicinity of the Project.

4.4.2 Road Transportation Noise Assessment

Wambo Coal Mine's existing development consent permits the transport of product coal to the MTCL via the Golden Highway. Subsequent to the commissioning of the Project rail spur, loop and train loading infrastructure, the need to transport product coal by road to the MTCL would cease.

Based on the *Environmental Criteria for Road Traffic Noise* policy (ECRTN) (EPA, 1999), the Golden Highway is classified as an "arterial road". The applicable road traffic noise criteria are presented in Table 4-9.

In cases where the applicable criteria above are already exceeded, the ECRTN policy requires that traffic associated with the development should not lead to an increase in the existing road traffic noise levels of more than 2 dBA.

In order to estimate the existing road traffic noise levels in the absence of a majority of the existing WCM vehicles, road traffic noise measurements were conducted at an offset distance of 20 m from the Golden Highway near the Fisher property (at dwelling 31D on Figures 4-11 to 4-13). Road traffic noise data were then processed in accordance with the requirements of the ECRTN to derive the Monday to Sunday road traffic noise levels presented in Table 4-10.

Table 4-10 indicates that existing road traffic noise levels at the nearest dwellings to the Golden Highway exceed the guideline criteria in the absence of a majority of Wambo Coal Mine vehicles. Therefore, in accordance with ECRTN Policy, any increase in traffic noise due to the Project should be limited to a marginal 2 dBA at the nearest dwelling to the Golden Highway and conservatively at all other dwellings. This requirement is achieved when the Project-related percentage increase in existing light and heavy vehicle movements is no greater than 60% (Appendix A).

The Project-related increase in vehicle movements is less than 60% for both daytime and night-time periods (Appendix M), consequently the resulting increase in road traffic noise is less than 2 dBA (Appendix A).

Table 4-8
Recommended Operating Noise Limits

General Locality	Reference/ Landowner	NSW INP (2000) Noise Amenity Area	$L_{Aeq(15minute)}$ Intrusive Noise Emission		
			Non-Adverse	Adverse	
			Daytime	Evening	Night
Wambo Road	1 Brosi	Rural	35	38	38
	2 Lambkin		35	40	40
	3 Birrell		35	40	40
	4(B) Circosta		35	40	40
	5 Strachan		35	39	39
	6 Merrick		35	39	39
	7 Maizey		35	39	39
	25 Fenwick		35	40	40
	35 Brosi		35	36	36
	63 Abrocuff		35	38	38
	91 Bailey		35	38	38
	178 Smith		35	36	36
	246 Bailey		35	37	37
	Other Residential		35	35	35
Warkworth	19(A,B) Kelly	Suburban	45	43	43
	22 Henderson		42	42	41
	23(A,B) Kannar		44	42	41
	51 Hawkes		43	41	41
	56 Haynes		44	42	41
	Other Residential		39	37	36
	St Philips Anglican Church[1] (Internal)	Place of Worship	40	40-45	Not in Use
	St Philips Anglican Church[1] (External)	Passive/Active Recreation Area	50-55	50-55	
Gouldsville	23(C) Kannar	Suburban	38	40	40
	Other Residential		35	35	35
Maison Dieu	94 Curlewis	Suburban	38	41	41
	254(A) Algie		38	40	40
	Other Residential		38	38	38
Redmanvale/ Pinegrove Roads	13(B) Skinner	Rural	35	40	40
	15(B) McGowen/Caslick		35	39	39
	24 Long		40	40	40
	30 Williams		35	37	37
	33 Thelander/O'Niell		35	39	39
	37 Lawry		35	38	38
	48 Ponder		35	38	38
	49 Oliver		35	36	36
	75 Barnes		35	36	36
	137 Woodruff		35	35	35
	163 Rodger/Williams		35	37	37
	188 Fuller		35	36	36
	Other Residential		35	35	35

Table 4-8 (Continued)
Recommended Operating Noise Limits

General Locality	Reference/ Landowner	NSW INP (2000) Noise Amenity Area	$L_{Aeq(15minute)}$ Intrusive Noise Emission		
			Non-Adverse	Adverse	
			Daytime	Evening	Night
Golden Highway	13(B) Skinner	Suburban	39	40	36
	16 Cooper		39	40	39
	17 Carter		39	40	38
	18 Denney		39	40	38
	27 Birralee		39	40	37
	28(A,B) Garland		39	40	40
	31(A,B,C,D) Fisher		39	43	40
	39 Northcote		39	40	40
	40 Muller		39	40	40
	43 Carmody		39	40	37
	44 Skinner		39	40	35
	262(A,B,C) Moses		39	40	36
	Other Residential		39	40	35

Source: Appendix A

Table 4-9
EPA Environmental Criteria for Road Traffic Noise

Road	Policy	Descriptor	Traffic Noise Goal
Golden Highway	Land use developments with the potential to create additional traffic existing on freeways/arterials	Daytime LAeq(15hour)	60 dBA
		Night-time LAeq(9hour)	55 dBA

Source: Appendix A

Table 4-10
Golden Highway Road Traffic Noise – December 2002 (dBA re 20 µPa)

Locality	Daytime/Evening $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
Golden Highway – 20 m offset	67 dBA	64 dBA

Source: Appendix A

4.4.3 Rail Transportation Vibration

Product coal would be transported off-site using nominal 8,600 t capacity trains requiring an average of approximately four train trips (i.e. four arrivals and four departures) per day (Sections 2.4.3 and 2.8).

Rail transport vibration was assessed against German Standard DIN 4150-3 (1999) *Structural Vibration: Effects of Vibration on Structures*. The criteria for evaluating the long-term (or continuous) effects of vibration on structures are presented in Table 4-11.

The two potentially affected structures proximal to the Project rail line (i.e. St. Philips Anglican Church and the Henderson dwelling) were assessed for potential train generated vibration. The assessment was based on the "Generalised Ground Surface Vibration Curves" presented in the *"Transit Noise and Vibration Impact Assessment"* (US Department of Transportation, April 1995). These predictions yielded the following results (Table 4-12).

The predicted peak vibration levels are well below the relevant potential damage criteria (Appendix A).

4.4.4 Blast Impact Assessment

Section 3.2.4 provides an overview of monitored blasting overpressure (airblast) and ground vibration levels at the Wambo Coal Mine and applicable blast emission guidelines.

In order to predict Project blast emissions at surrounding dwellings, measured ground vibration and airblast levels from the Wambo Coal Mine monitoring programme were reviewed.

Ground vibration and airblast overpressure were calculated for both open cut and underground blasting and were based on Project blast configurations. The maximum instantaneous charge (MIC) mass per delay ranged from 1,600 kg for open cut blasting to 24 kg for underground blasting. Blasting emissions calculated were compared against building damage criteria and human comfort criteria. The EPA advocates the use of the ANZECC guidelines for assessing potential residential disturbance (human comfort) arising from blast emissions.

Table 4-11
Continuous Vibration Criteria for Long-term Effects on Structures (DIN 4150-3)

Line	Type of Structure	Vibration Velocity in Horizontal Plane
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	10.0 mm/s
2	Dwellings and buildings of similar design and/or occupancy	5.0 mm/s
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5 mm/s

Source: Appendix A

Table 4-12
Predicted Train Generated Peak Component Vibration Levels

Structure/ Dwelling	Near Point Distance	Predicted Peak Vibration Levels		Vibration Criteria
		Train Passby Speed		
		10 km/hr	*30 km/hr*	
St. Philips Anglican Church	300 m	<0.03 mm/s	<0.09 mm/s	2.5 mm/s
22 Henderson Dwelling	100 m	0.03 mm/s	0.09 mm/s	5.0 mm/s

Source: Appendix A

The ANZECC guidelines for the control of blasting impact at a dwelling are as follows:

- The recommended maximum level for airblast is 115 dBL.
- The level of 115 dBL may be exceeded on up to 5% of the total number of blasts over a period of 12 months, however, the level should not exceed 120 dBL at any time.
- The recommended maximum level for ground vibration is 5 mm/s PVS vibration velocity. It is recommended however that 2 mm/s PVS vibration velocity be considered as the long-term regulatory goal for the control of ground vibration.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months, however levels should not exceed 10 mm/s at any time (at a sensitive receiver).

In addition, the ANZECC guidelines specify blasting should generally only be permitted during the hours between 9.00 am and 5.00 pm Monday to Saturday. Blasting should not take place on Sundays and public holidays and should generally take place no more than once per day. Blasting may however be conducted outside of these hours in accordance with the applicable blast emission assessment criteria provided in the EPA's *Environmental Noise Control Manual* (1994).

AS 2187.2-1993 *Explosives – Storage, Transport and Use – Use of Explosives* nominates blast vibration building damage assessment criteria which range from 5 mm/s to 25 mm/s PVS according to building type and use. The airblast criteria for building damage is 133 dBL (peak).

Predicted Blast Emission Levels and Mitigation Measures

The Project open cut development would require an average of five blasts per week during Years 1 to 13. The blast emission assessment found that the building damage criteria of 10 mm/s and 133 dB Linear (dBL) would be met at all dwellings. Similarly, all emission levels would be well below the damage criteria (5 mm/s and 133 dBL) for heritage structures.

The potential impact of blasting on the WHC is discussed in Section 4.14.1.

Predictive modelling indicates that the ANZECC human comfort vibration criterion of 5 mm/s and the long-term regulatory target of 2 mm/s would be exceeded at a number of dwellings without the application of special blasting techniques. A description of the predicted airblast and ground-borne vibration levels at these dwellings is provided below.

Long Dwelling (Non-Aboriginal Heritage Site 4)

Predictive modelling indicates that the PVS vibration level of 5 mm/s for human comfort would be exceeded by approximately 0.4 mm/s. However, compliance with the long-term regulatory target of 2 mm/s can be achieved by changes in blast design by methods such as reducing the charge weight (i.e. quantity of explosive used) for each hole (Appendix A). The 5% exceedance airblast levels also exceed the 115 dBL criteria, with the predicted level being 127 dBL. Changes in blast design to conform with the criteria are unlikely to be practicable (Appendix A).

Fisher Dwelling (Non-Aboriginal Heritage Site 8)

The predicted vibration level of 3.1 mm/s exceeds the long-term regulatory target of 2 mm/s. The 2 mm/s target can be achieved with the use of a lower charge weight of approximately 410 kg per hole when blasting within the northern extent of the Project open cut development (Appendix A). The 115 dBL airblast criteria would be exceeded, with the predicted level being 120 dBL. The criteria can be achieved by detonating single holes per delay with a lower charge weight of approximately 260 kg/hole when blasting within the northern extent of the Project open cut (Appendix A).

Skinner Dwelling

The predicted vibration level of 4 mm/s exceeds the long-term regulatory target of 2 mm/s. The airblast levels also exceed the 115 dBL criteria, with the predicted level being 123 dBL. Changes in blast design to conform with the criteria are unlikely to be practicable (Appendix A).

Garland and Muller Dwellings

The predicted airblast levels exceed the 115 dBL criteria, with the predicted levels both being 116 dBL. The criteria can be achieved by detonating single holes per delay with a lower charge weight of approximately 260 kg/hole when blasting within the northern extent of the Project open cut development (Appendix A).

All emission levels are well below the damage criteria for heritage structures of 5 mm/s and 133 dB (linear) at St. Philips Anglican Church and the cemeteries in the vicinity of the Project (Appendix A).

The actual development areas within which the above mitigation would be implemented would be established based on empirical data obtained in the earlier years of the Project life.

4.5 AIR QUALITY

The air quality impact assessment is presented as Appendix B. The assessment considered the air emissions likely to be generated by the Project and the likely impact of these emissions in combination with existing and proposed future emissions of relevant surrounding mining operations (i.e. Warkworth Coal Mine, Hunter Valley Operations and United Colliery). Air emissions include particles that are derived primarily from the mechanical disturbance of soils, overburden and coal as well as a relatively small contribution from particles from diesel exhausts (i.e. from activities where diesel powered equipment is used).

Project impacts were modelled for operational Years 2, 7 and 9. Year 2 was selected as it represents the critical period for receptors to the east of the Project, particularly Warkworth and immediate surrounds. At the completion of construction ROM coal production and waste handling activities would increase and would not have yet moved to the north-west away from these receptors. Year 7 is considered to represent the critical scenario for receptors to the north and north-west (including Redmanvale Road and Jerrys Plains). In Year 7 the Project would be at its northern most extent (and at its maximum open cut ROM coal production rate), thereafter moving in a southerly direction along the western limit of the open cut development. Year 9 is considered to represent the critical scenario for sensitive receptors to the south (including Bulga and surrounds) as the open cut at the south western limit of the development would have commenced. The provisional production schedule is presented in Table 2-2.

Impacts from other mining operations in the area (i.e. Warkworth Coal Mine, Hunter Valley Operations and United Colliery) were modelled using results from recent EISs as well as the requirements of relevant development consents.

4.5.1 Air Quality Criteria

Dust Deposition

The NSW EPA amenity criteria for dust deposition seek to limit the maximum increase in the mean annual rate of dust deposition from a new development to 2 g/m^2/month and total dust deposition to 4 g/m^2/month.

Concentrations of Suspended Particulate Matter

Human health effects of dust are related to exposure to suspended particulates rather than deposited dust. The effects of dust particles when inhaled are related to the types of particles inhaled, particle sizes and the ability of the respiratory tract to capture and eliminate the particles. Such particles (total suspended particulate) are typically less than 50 micrometers (µm) in size and can be as small as 0.1 µm. Fine particles less than 10 µm are referred to as PM_{10}.

Air quality criteria used in the assessment comprised the following:

- The United States (US) EPA 24 hour 150 µg/m^3 PM_{10} standard has been utilised as a target that should be met at all dwellings in the vicinity of the Project (concentrations due to the Project and other mining operations).
- The National Health and Medical Research Council's (NHMRC) annual goal for Total Suspended Particulate (TSP) of 90 µg/m^3 has been interpreted as a goal that should be met at all locations in the vicinity of the Project where there are dwellings (concentrations due to the Project and other mining operations).
- The National Environment Protection Measure (NEPM) 24 hour long-term reporting standard for PM_{10} of 50 µg/m^3 and the NSW EPA 24 hour PM_{10} reporting goal of 50 µg/m^3 (for concentrations due to the Project alone).
- The NSW EPA annual goal for 30 µg/m^3 has been interpreted as a goal for PM_{10} that should be met within the region (concentrations due to the Project and other mining operations).

Details of the air quality criteria for concentrations of particulate matter are provided in Table 4-13.

Table 4-13
Health Based Air Quality Standards/Goals for Particulate Matter Concentrations

Pollutant	Standard/Goal	Agency
Total Suspended Particulate Matter (TSP)	90 $\mu g/m^3$ (annual mean)	NHMRC
Particulate Matter < 10 µm (PM_{10})	150 $\mu g/m^3$ (average of 99th percentile of 24 hour averages over three years)	US EPA Standard
	50 $\mu g/m^3$ (24 hour maximum)	NSW EPA Reporting Goal
	30 $\mu g/m^3$ (annual mean)	NSW EPA Long-term Reporting Goal
	50 $\mu g/m^3$ (24 hour average, 5 exceedances permitted per year)	NEPM Long-term Reporting Standard

Source: Appendix B

4.5.2 Dust Deposition

Potential Impacts

The Project would produce two primary sources of dust, *viz.* wind blown dust from exposed areas and dust generated from mining activities. Cumulative dust deposition impacts were assessed by estimating Project dust emissions (Years 2, 7 and 9) and adding relevant contributions from surrounding mining operations (i.e. Warkworth Coal Mine, Hunter Valley Operations and United Colliery). Detailed results are provided in Appendix B, and a summary is provided below.

Year 2

Project-only increases in annual average dust deposition at all non-WCPL owned dwellings are predicted to remain below the applicable 2 g/m^2/month EPA amenity criteria.

Predicted cumulative increases in annual average dust deposition during Year 2 are illustrated on Figure 4-14. Annual average dust deposition at all privately owned dwellings within the vicinity of the Project are predicted to remain below the applicable 4 g/m^2/month EPA amenity criteria.

Year 7

Project-only increases in annual average dust deposition at all privately owned dwellings during Year 7 are predicted to remain below the applicable 2 g/m^2/month EPA amenity criteria.

Predicted cumulative increases in annual average dust deposition during Year 7 are illustrated on Figure 4-15. Annual average dust deposition at all privately owned dwellings in the vicinity of the Project are predicted to remain below the applicable 4 g/m^2/month EPA amenity criteria.

Six dwellings owned by Warkworth Coal Mine (8C, 8D, 8E, 8F, 8G and 8H) are predicted to exceed the applicable dust deposition levels during Year 7 due to the development of the Warkworth Coal Mine.

Year 9

Project-only increases in annual average dust deposition at all non-WCPL owned dwellings during Year 9 are predicted to remain below the applicable 2 g/m^2/month EPA amenity criteria. Incremental levels of greater than 2 g/m^2/month are predicted to be contained within Project MLA areas.

Predicted cumulative increases in annual average dust deposition during Year 9 are illustrated on Figure 4-16. Annual average dust deposition at all privately owned dwellings in the vicinity of the Project are predicted to remain below the applicable 4 g/m^2/month EPA amenity criteria. Seven dwellings owned by Warkworth Coal Mine (8B, 8C, 8D, 8E, 8F, 8G and 8H) are predicted to exceed the applicable dust deposition levels during Year 9 due to the development of the Warkworth Coal Mine

Mitigation Measures

A range of controls would be employed by WCPL to reduce dust emissions from the Project. These controls are based on current procedures developed at the Wambo Coal Mine and techniques recommended by the NSW EPA.

The main components of controls for wind blown dust may include:

- Disturbing only the minimum area necessary for mining with reshaping, topsoiling and rehabilitation of mine waste rock emplacement areas to occur progressively and as soon as practicable.

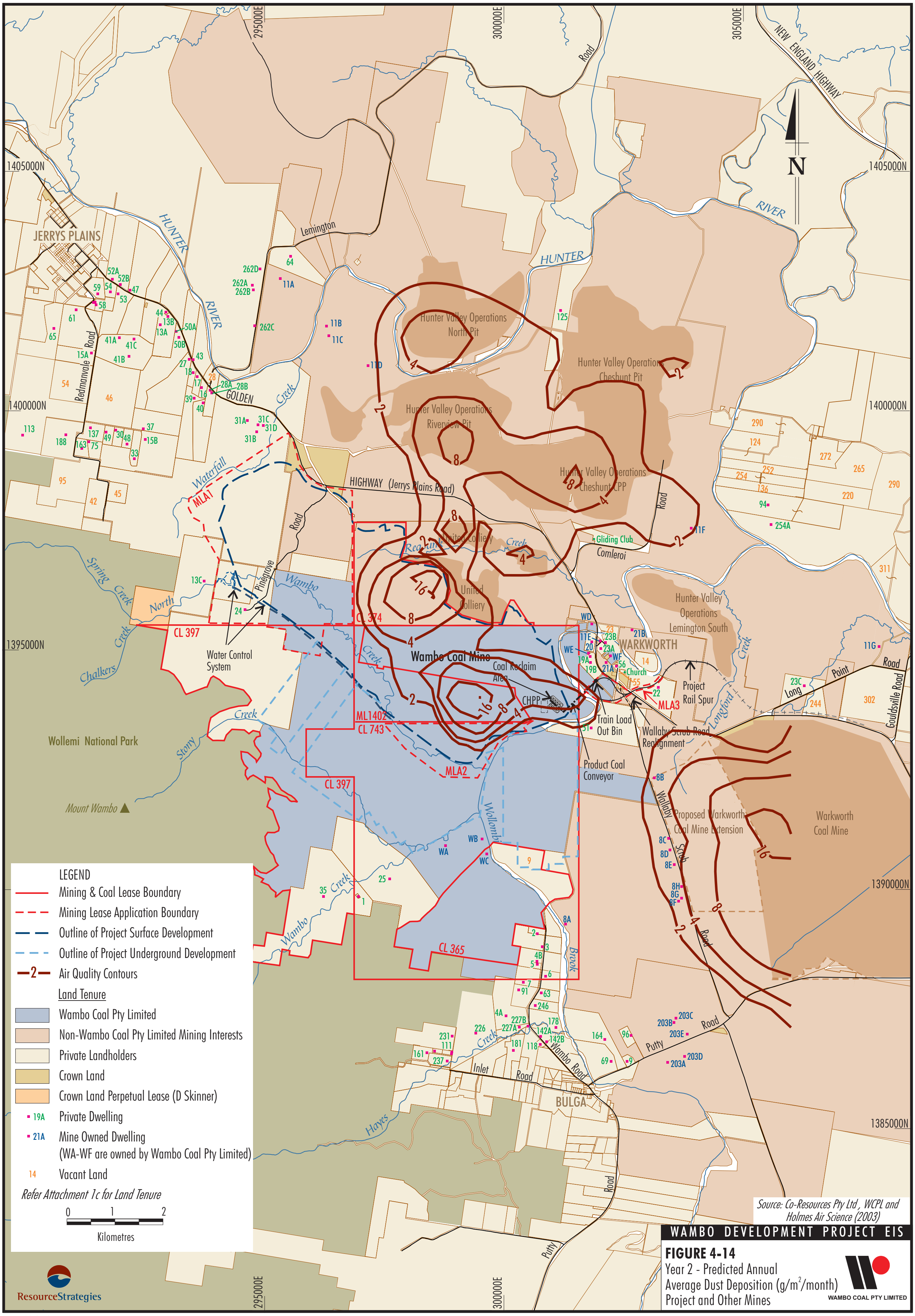

FIGURE 4-14
Year 2 - Predicted Annual Average Dust Deposition ($g/m^2/month$)
Project and Other Mines

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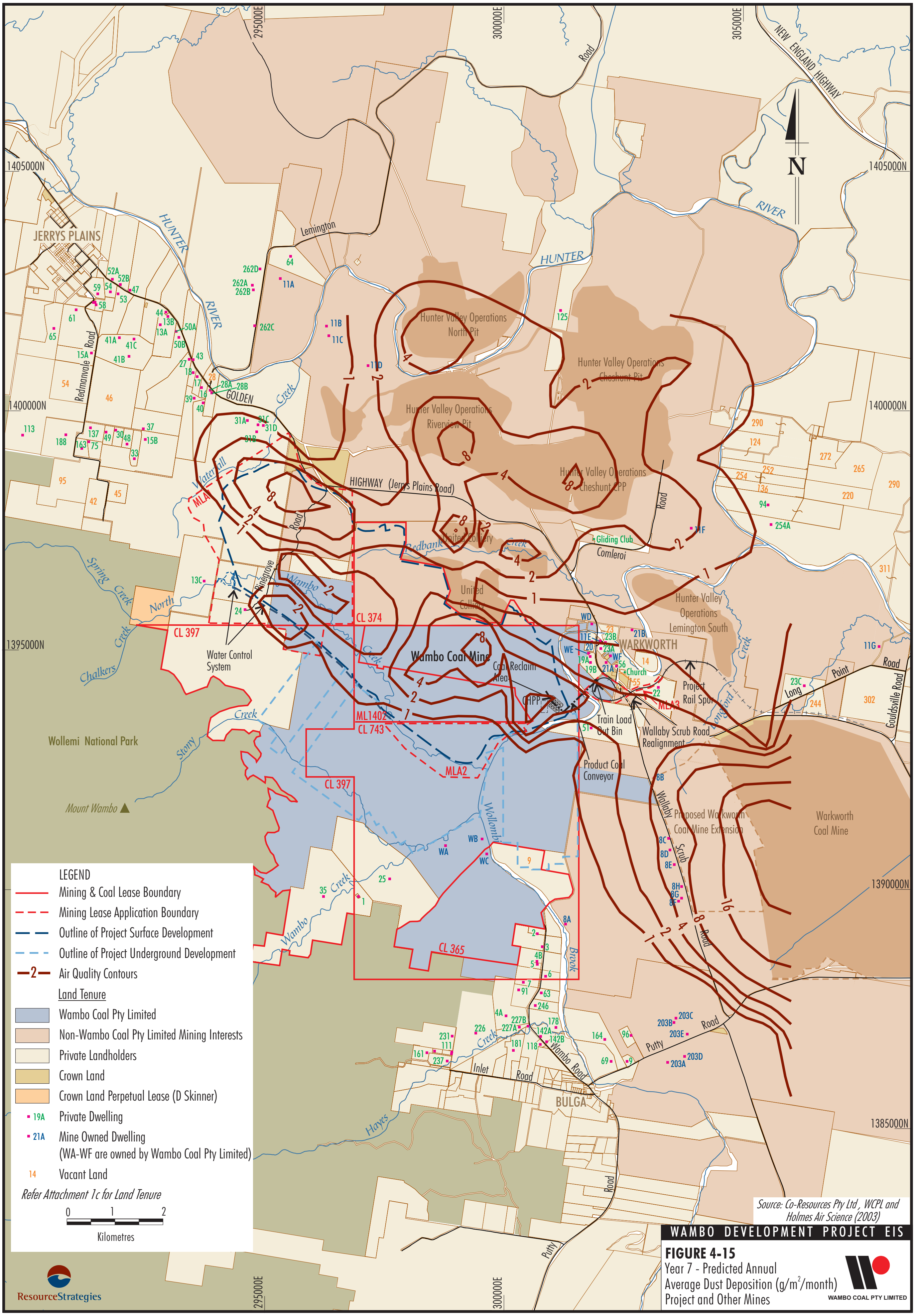

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FIGURE 4-15
Year 7 - Predicted Annual Average Dust Deposition ($g/m^2/month$) Project and Other Mines

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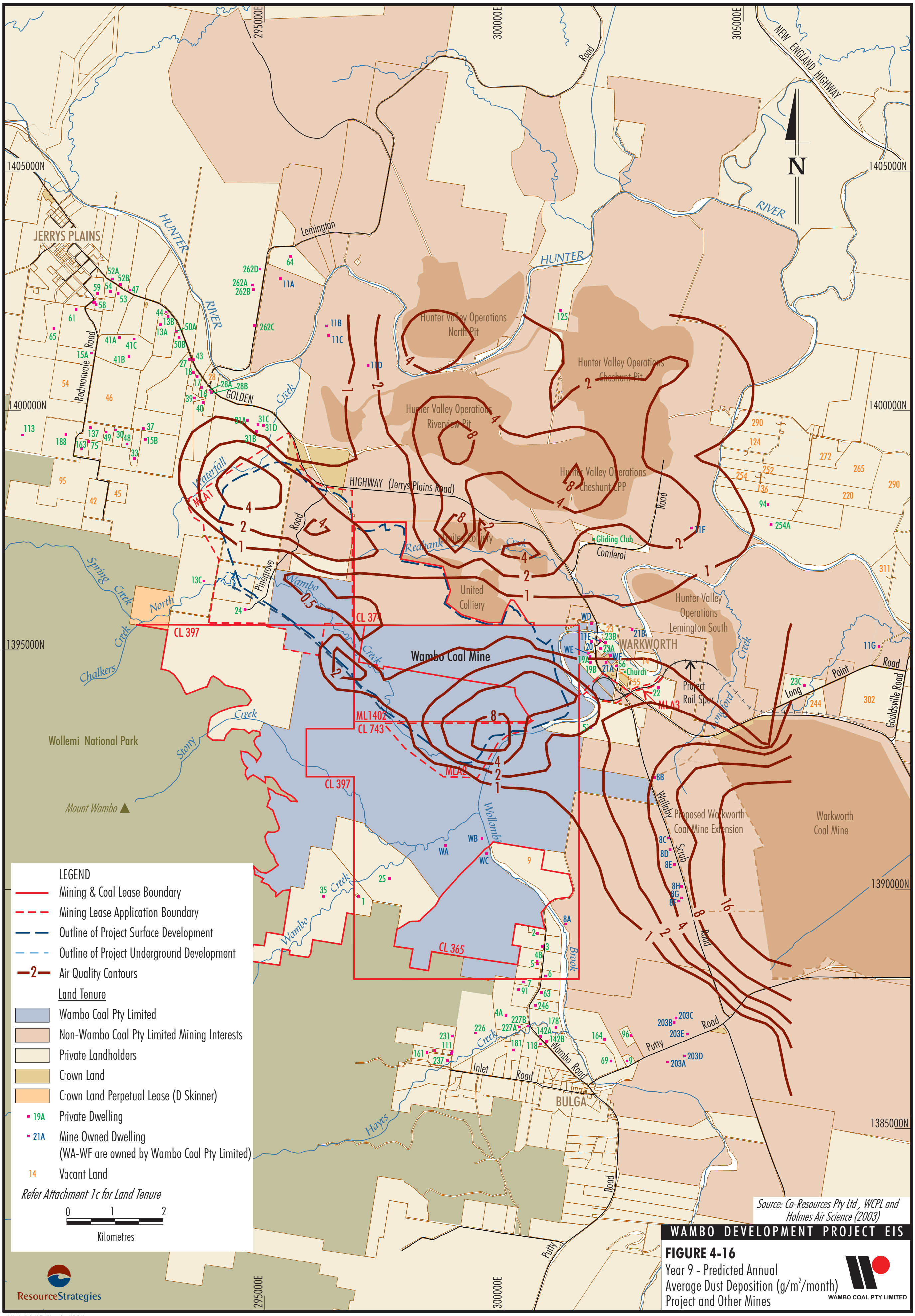

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- Maintaining coal-handling areas in a moist condition using water carts to minimise wind blown and traffic generated dust.
- Maintaining water sprays on product coal stockpiles and use of sprays to reduce the risk of airborne dust.

Controls for mine generated dust may include the following:

- Fixed irrigation and/or chemical dust suppressants would be used on select permanent (trunk) haul roads to minimise the generation of dust.
- All active roads and traffic areas would be watered using water carts to minimise the generation of dust.
- The number of active haul roads would be minimised and clearly defined.
- Development of minor roads would be limited and the locations of these would be clearly defined.
- Minor roads used regularly for access would be constructed so as to minimise dust generation (well-compacted select material) and watered as required.
- All obsolete roads would be rehabilitated.
- Access tracks used by topsoil stripping equipment during their loading and unloading cycle would be watered.
- Topsoil stockpiles which are not planned to be used for over six months would be revegetated.
- Dust aprons would be lowered during drilling.
- Drill rigs would be equipped with dust suppression equipment which would be operated whenever the potential for high levels of dust generation is identified.
- Blast stemming would be designed to provide optimum confinement of the blast charge.
- Automatic sprays or other dust control mechanisms would be used when tipping raw coal generates excessive dust quantities.
- Spillage of CHPP materials would be cleaned up to prevent dust.
- Dust suppression systems would be fitted at transfer points to prevent high dust levels where necessary.

4.5.3 Concentrations of Suspended Particulate Matter

Potential Impacts

Potential impacts associated with concentrations of suspended particulate matter were calculated as 24 hour average and annual average PM_{10} concentrations and annual average TSP concentrations for comparison against the applicable criteria (Table 4-13). The cumulative impacts of the Project (Years 2, 7 and 9) and relevant surrounding mining operations (Warkworth Coal Mine, Hunter Valley Operations and United Colliery) were calculated. The non-cumulative impacts of the Project were also calculated (Years 2, 7 and 9).

Detailed results are presented in Appendix B and a summary is provided below.

Project Only

Results of the non-cumulative modelling (Project only) for Years 2, 7 and 9 indicate that predicted concentrations of annual average TSP, 24 hour average PM_{10} and annual average PM_{10} remain below the applicable health based air quality standards/goals for particulate matter (Table 4-13) at all dwellings in the vicinity of the Project.

Project and other Operations

Year 2

Predicted cumulative annual average PM_{10} concentrations were calculated above the EPA long-term goal of 30 $\mu g/m^3$ at three privately owned dwellings for Year 2 (Figure 4-17): Henderson (22), Hawkes (51) and the estate of the late JE Barry (125). Annual average PM_{10} concentrations were also calculated above the EPA goal at nine mine owned dwellings (Figure 4-17): Warkworth Coal Mine (8B, 8C, 8D, 8E, 8F, 8G and 8H) and Coal and Allied (11D and 11F). Each of these dwellings, except Hawkes (51), are predominantly affected by other mining operations. Figure 4-17 illustrates the predicted cumulative annual average PM_{10} concentrations for Year 2.

Cumulative annual average TSP and 24 hour PM_{10} concentrations were not predicted to be above the applicable standards/goals at any dwelling for Year 2.

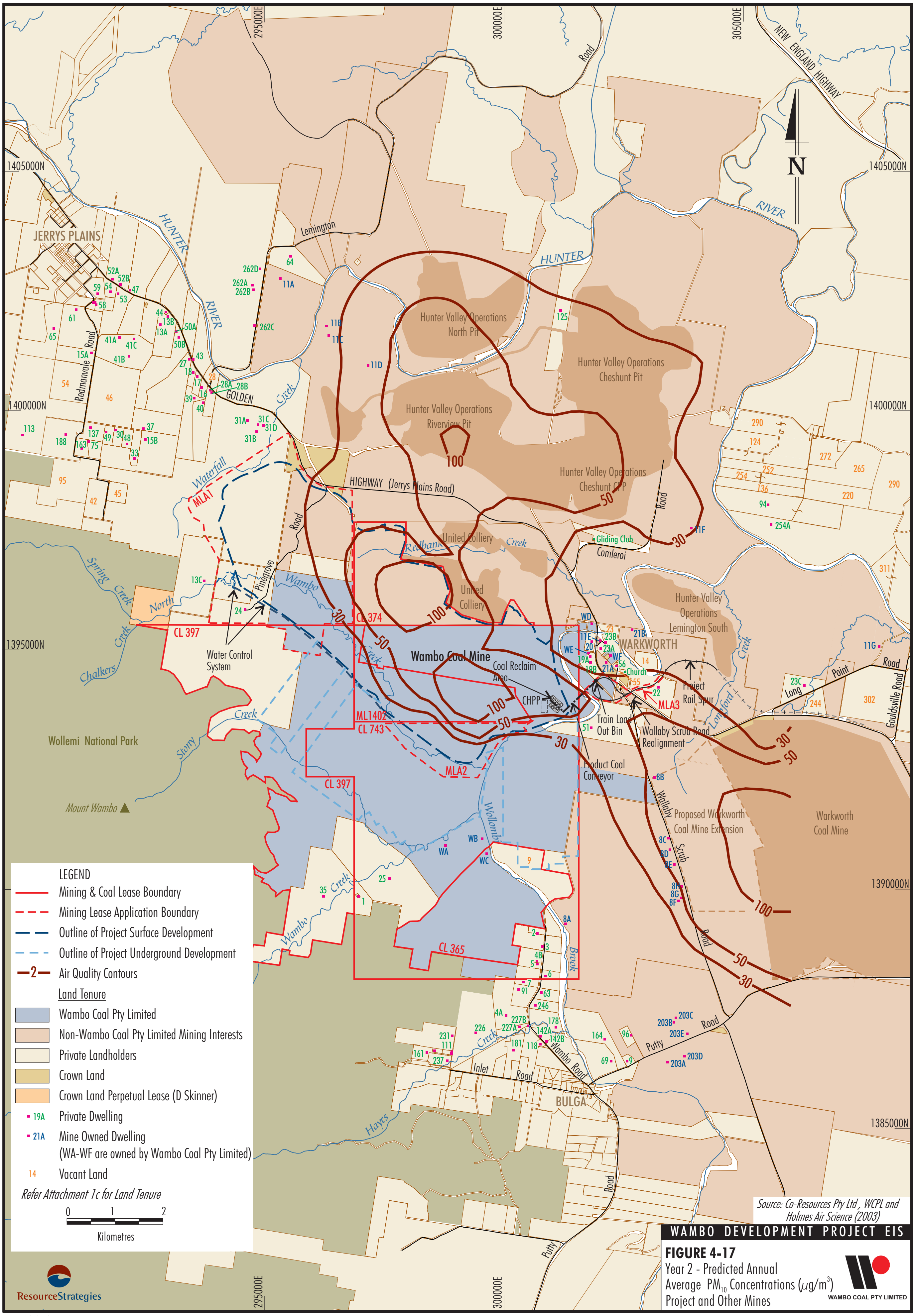

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FIGURE 4-17
Year 2 - Predicted Annual Average PM_{10} Concentrations ($\mu g/m^3$) Project and Other Mines

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Year 7

Predicted cumulative annual average PM_{10} concentrations were calculated above the EPA long-term goal of 30 µg/m^3 at 12 privately owned dwellings for Year 7 (Figure 4-18): Henderson (22), Hawkes (51) the estate of the late JE Barry (125), Kelly (19A & 19B), Kannar (23A and 23B), Haynes (56), and Fisher (31A, 31B, 31C, and 31D). In addition, annual average PM_{10} concentrations were calculated above the EPA goal at three parcels of private vacant land: Burley (55), Keys (14) and Kannar (23) and at the Newcastle Gliding Club (Gliding Club) and St. Philips Anglican Church (Church).

For Year 7, concentrations of annual average PM_{10} were also calculated above the EPA goal at two WCPL owned dwellings (WE and WF) and 12 mine owned dwellings: Warkworth Coal Mine (8B, 8C, 8D, 8E, 8F, 8G and 8H), Coal and Allied (21A, 11D, 11E and 11F) and Jerrys Plains Coal Terminal (20). Figure 4-18 illustrates the predicted cumulative annual average PM_{10} concentrations for Year 7.

Of the above potentially affected receptors, 8B, 8C, 8D, 8E, 8F, 8G, 8H, 11D, 11F, 125 and the Gliding Club would be predominantly affected by other mining operations.

Cumulative annual average TSP and 24 hour PM_{10} concentrations were not predicted to be above the criteria levels at any privately owned dwellings or vacant land. However, cumulative annual average TSP concentrations for Year 7 were predicted to be above the applicable NHMRC goal of 90 µg/m^3 at seven mine owned dwellings: Warkworth Coal Mine (8B, 8C, 8D, 8E, 8F, 8G and 8H). In addition, predicted cumulative 24 hour average PM_{10} concentrations were calculated above the US EPA Standard of 150 µg/m^3 at four mine owned dwellings: Warkworth Coal Mine (8C, 8D, 8G and 8H). These potential exceedances are due to the development of the Warkworth Coal Mine (Appendix B).

Year 9

Predicted cumulative annual average PM_{10} concentrations were calculated above the EPA long-term goal of 30 µg/m^3 at seven privately owned dwellings for Year 9: Henderson (22), Hawkes (51) the estate of the late JE Barry (125), Kelly (19A & 19B), Kannar (23A) and Haynes (56). In addition, annual average PM_{10} concentrations were calculated above the EPA goal at three parcels of private vacant land: Burley (55), Keys (14) and Kannar (23) and at the Gliding Club and the Church.

For Year 9, concentrations of annual average PM_{10} were calculated above the EPA goal at two WCPL owned dwellings (WE and WF) and 10 mine owned dwellings: Warkworth Coal Mine (8B, 8C, 8D, 8E, 8F, 8G and 8H) and Coal and Allied (21A, 11D, and 11F). Dwellings 8B, 8C, 8D, 8E, 8F, 8G, 8H, 11D, 11F, 125 and the Gliding Club are predominantly affected by other mining operations. Figure 4-19 illustrates the predicted cumulative annual average PM_{10} concentrations for Year 9.

Predicted cumulative annual average TSP and 24 hour PM_{10} concentrations were not calculated above criteria levels at any privately owned dwellings. However, predicted cumulative annual average TSP concentrations for Year 9 were calculated above the applicable NHMRC goal of 90 µg/m^3 at seven mine owned dwellings: Warkworth Coal Mine (8B, 8C, 8D, 8E, 8F, 8G and 8H). In addition, predicted cumulative 24 hour average PM_{10} concentrations were calculated above the US EPA Standard of 150 µg/m^3 at four mine owned dwellings: Warkworth Coal Mine (8C, 8D, 8G and 8H). These dwellings are predominantly affected by the Warkworth Coal Mine.

Short-Term Reporting Standards

No privately owned dwellings in the vicinity of the Project are predicted to experience worst case 24 hour PM_{10} concentrations above the NEPM 24 hour Standard of 50 µg/m^3 (with 5 exceedances allowed per year) due to Project emissions alone.

During operational Years 7 and 9, maximum 24 hour PM_{10} concentrations associated with the Project and other mining operations are predicted to occur above the US EPA Standard of 150 µg/m^3 during worst case meteorological conditions at five mine owned dwellings: Warkworth Coal Mine (8B, 8C, 8D, 8G and 8H). All other dwellings in the vicinity of the Project are predicted to experience worst case 24 hour PM_{10} concentrations below the standard of 150 µg/m^3.

Mitigation Measures

The dust generation mitigation measures outlined in Section 4.5.2 would also be effective in reducing the potential for generation of suspended particulate matter. A programme of PM_{10} monitoring is provided in Section 6.3.2.

4.5.4 Summary

In summary, a total of 26 dwellings, the Gliding Club, the Church and three parcels of vacant land are predicted to experience either suspended particulates or deposition levels above the EPA assessment criteria at some time over the Project life.

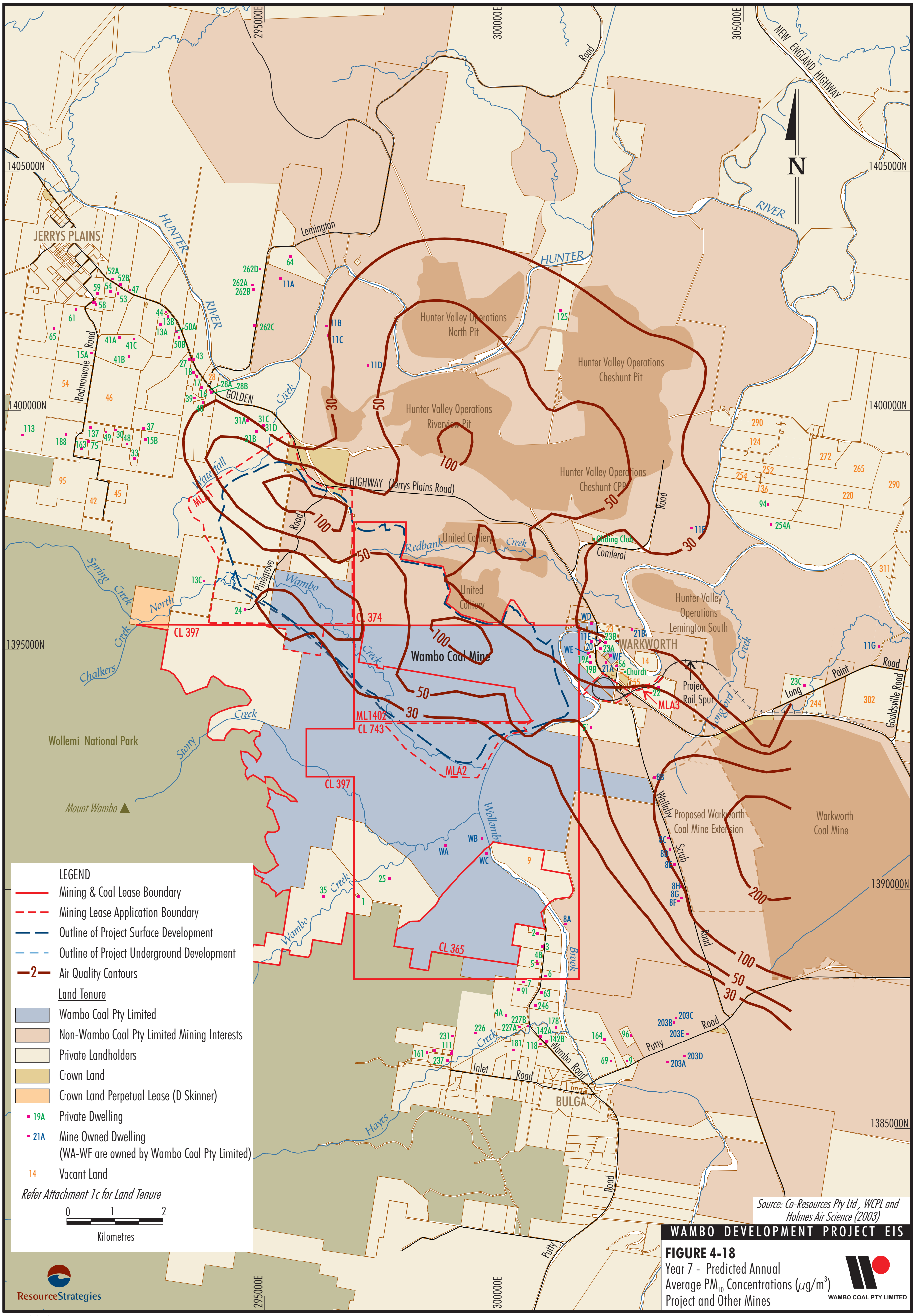

FIGURE 4-18
Year 7 - Predicted Annual Average PM_{10} Concentrations ($\mu g/m^3$) Project and Other Mines

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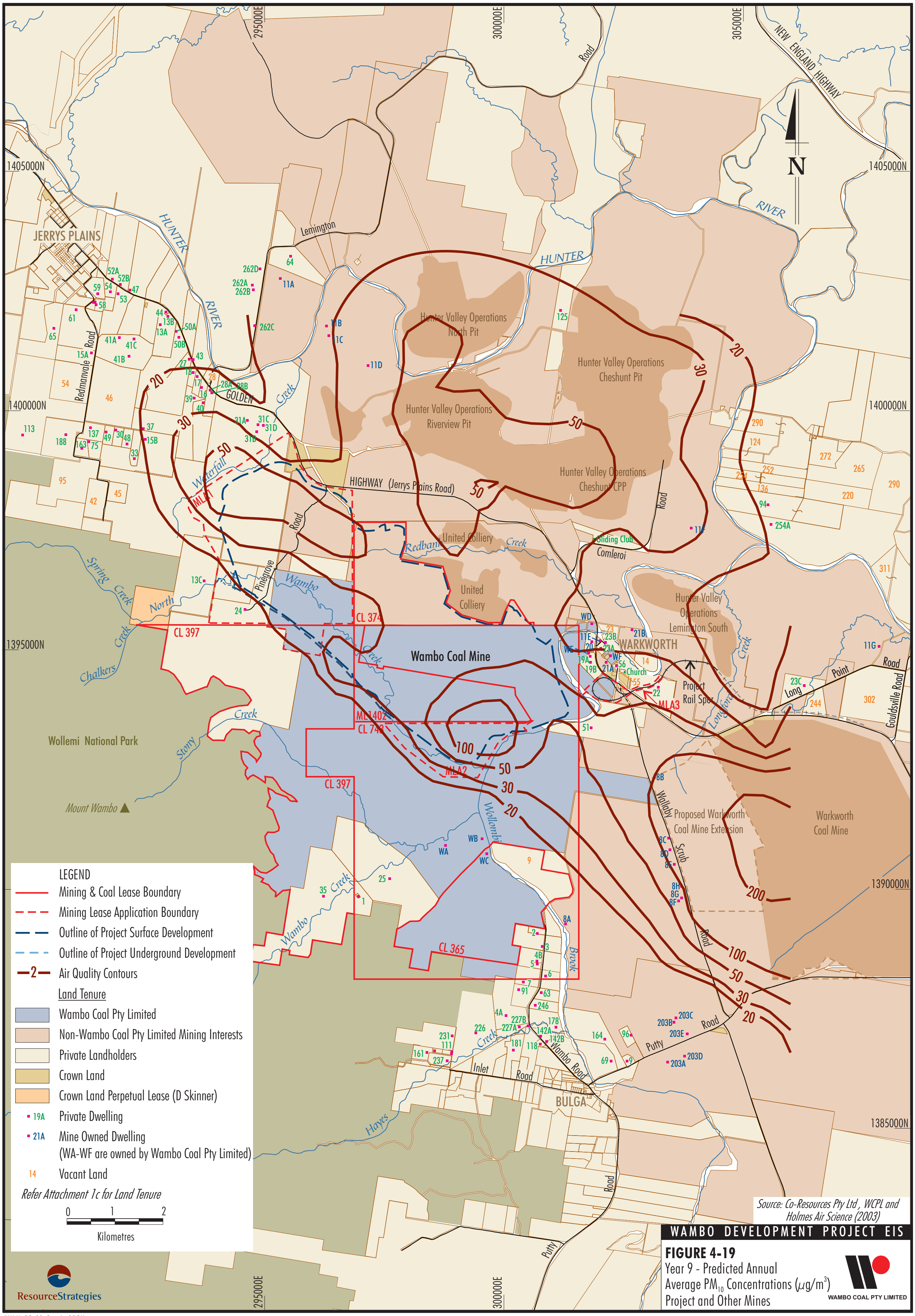

FIGURE 4-19
Year 9 - Predicted Annual Average PM_{10} Concentrations ($\mu g/m^3$) Project and Other Mines

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These impacts would be a consequence of cumulative effects with seven of the dwellings (8B to 8H) predominantly affected by the Warkworth Coal Mine and three dwellings (11D, 11E and 11F) predominantly affected by Hunter Valley Operations to the north.

The remaining properties that are predicted to be affected are 21A, 22, 23A, 56, the Church, 51, 23B, the Gliding Club, 125, 31A, 31B, 31C, 31D, WE, WD and WF. These impacts are due to cumulative effects (i.e. dust emissions from the Project combined with the emissions other mines).

4.6 SURFACE WATER

A surface water management study was undertaken as part of the development of surface water management systems for the Project and to assess potential impacts on surface water resources (Appendix E).

The study included a description of existing surface water resources, quantification of Project water management requirements, water balance modelling, water management planning and post-mining water management concepts.

A description of existing water quality in streams and catchments in the Project area is provided in Section 3.4.1. An assessment of potential impacts of the Project on aquatic ecosystems local to the Project area including North Wambo Creek, Wambo Creek and Stony Creek is presented in Section 4.10 and Appendix HD.

4.6.1 Surface Water Quality

Potential Impacts

Surface water runoff from mine landforms and disturbed areas could potentially contain sediments, soluble salts, process reagents (i.e. flocculant), fuels, oils and grease. The potential surface water quality impacts of the Project that relate to these contaminants are summarised in Table 4-14.

Table 4-14
Potential Surface Water Quality Impacts

Operational Areas	Potential Impact Scenario	Type of Potential Contamination
Open cut and mine waste rock emplacement areas	Drainage of sediment laden runoff to downstream surface waters during pre-stripping and initial pit/waste emplacement development. Uncontrolled drainage to downstream surface waters during operation.	Sediments and soluble salts.
ROM and product coal stockpiles	Drainage of sediment laden runoff to downstream surface waters during initial stockpile development. Uncontrolled drainage from stockpiles to downstream surface waters during operation.	Sediments, soluble salts and reduced pH.
Tailings delivery pipeline and tailings disposal area	Drainage of supernatant and internal runoff from the tailings disposal area to downstream surface waters during operation. Spillage to downstream surface waters resulting from rupture of pipeline.	Sediments, soluble salts and process reagents (i.e. flocculant).
Underground mine dewatering pipeline	Spillage to downstream surface waters resulting from rupture of pipeline during operations.	Sediments and soluble salts.
CHPP and stores	Drainage of sediment laden runoff to downstream surface waters during construction. Spillage to downstream surface waters during operation.	Sediments, soluble salts, process reagents (i.e. flocculant), fuels, oils and grease.
Infrastructure (i.e. haul and access roads, hardstands and train loading system)	Drainage of sediment laden runoff to downstream surface waters during construction. Spillage to downstream surface waters during operation.	Sediments, soluble salts, fuels, oils and grease.
North Wambo Creek water control system	Drainage of sediment laden runoff to downstream surface waters during construction and prior to channel stabilisation.	Sediments.
Wallaby Scrub Road realignment	Drainage of sediment laden runoff to downstream surface waters during construction of road realignment. Potential erosion and sedimentation resulting from runoff from road surface and associated drainage system.	Sediments.
Project rail loop and rail spur	Drainage of sediment laden runoff to downstream surface waters during construction of the rail loop and rail spur. Potential erosion and sedimentation resulting from runoff from rail surface and associated drainage system.	Sediments.
Effluent from the domestic sewage treatment facility	Spillage of treated or untreated sewage to downstream surface waters during operation.	Nutrients and organic matter.

Source: Appendix E

Results of geochemical testwork undertaken for the Project indicate that mine waste rock is considered unlikely to generate environmentally harmful leachate when exposed to surface oxidation processes (Appendix G). Acid mine drainage has not been identified at the Wambo Coal Mine and is not expected to occur during the life of the Project provided that the appropriate CHPP reject management practices are implemented, as described in Section 2.9.

The long-term water balance of the final voids (Appendix E) indicates that the salinity of void waters would slowly increase with time, as a result of ongoing migration of saline groundwater and mine waste rock emplacement infiltration into the voids. In the longer term salt concentrations would also be affected by evapo-concentration. The void would slowly fill with water and approach an equilibrium level below the overflow level of the final voids in the long-term (Appendix E). Groundwater inflows to the voids are predicted to be small with direct rainfall and infiltration through the mine waste rock emplacements dominating inflows. Groundwater inflows would reduce as the water level in the voids reaches the equilibrium level (Appendix E).

Rehabilitation concepts for the final voids are discussed in Section 5.3.4.

Mitigation Measures

A surface water assessment was undertaken in order to develop a water management system for the Project to minimise any potential surface water quality impacts (Appendix E). The Project water management system would be integrated with the existing Wambo Coal Mine water management system and be detailed in the Project Site Water Management Plan (Section 6.2.6).

The water management system would be developed in accordance with accepted water management principles including minimising contamination of site water, maximising re-use of mine water and managing water so that any releases from site are controlled in accordance with the HRSTS and the requirements of the Project Environment Protection Licence.

The surface water monitoring programme at Wambo Coal Mine would be expanded to accommodate the additional disturbances resulting from the Project. The frequency, parameters and locations monitored as part of the surface water quality monitoring programme would be reviewed on an annual basis. Further details are provided in Section 6.3.6.

Minimising Disturbance Areas

Areas disturbed by active mining would be minimised as far as practicable. The site would be segregated into undisturbed runoff areas, development/construction runoff areas, operation runoff areas and rehabilitated areas to minimise the generation of waters requiring on-site containment.

Isolation, Containment and Recycling

The approach to managing runoff from catchment areas which are undisturbed by surface mining activities is to isolate them and, where necessary, divert them around disturbance areas. The objective of this strategy is to control the contamination of water and consequently the volumes of water that are required to be managed on site. Over the life of the Project this would involve the construction of diversion bunds, drains and a water control system around the open cut and mine waste rock emplacement areas. Toe drains and isolation bunds would also be constructed around the perimeter of mine waste rock emplacements and other areas disturbed by mining to collect and convey drainage from these areas to containment storages, thereby isolating Project area drainage from undisturbed area runoff.

Runoff from development/construction areas and operation areas would be intercepted and channelled to containment storages across the site. Sediment retention and containment storages would be sized to contain runoff from rainfall events between a 1 in 10 year and 1 in 100 year ARI, depending on the function of the storage and the potential consequences of uncontrolled release. Secure storages would be provided for the containment of spills and runoff from within these areas. Supernatant water recovered from tailings disposal areas would be reticulated to the CHPP water supply system for re-use. Water recovered from open cut and underground operations would be pumped to dewatering dams and would also be used to supplement supply to the CHPP.

In circumstances where the volume of water being held on site was in excess of that required to ensure water supply security and where there was an increased risk of an uncontrolled spill occurring, opportunities to either transfer water to adjacent mines (that could benefit from additional water) or to discharge it to the Hunter River during periods of high flows under the HRSTS would be pursued.

Runoff from haul roads and hardstand areas would be captured in sediment retention storages sized to trap silt and other settleable material. Water in sediment storages would be used for dust suppression around the site or would be released following settlement.

Runoff from workshop areas and vehicle re-fuelling areas would be diverted to an oil/water separator and sediment retention storage. Treated water would either be used for dust suppression on local haul roads or would be reticulated to the CHPP for re-use.

Effluent from the domestic sewage treatment plant would continue to be irrigated over vegetated and garden areas around the administration and workshop facilities.

Runoff from rehabilitated and revegetated areas would initially be directed to sediment retention storages prior to being allowed to drain to local drainages.

Progressive Stabilisation and Revegetation of Disturbed Areas

Development/construction areas and operation areas would be progressively rehabilitated during the Project life. It is anticipated that once rehabilitated areas become established, surface runoff would be of comparable quality to undisturbed areas. Passive treatment systems in the form of temporary sediment retention storages, silt fences and vegetation buffers would be employed as interim erosion and sediment control measures during the rehabilitation process.

Post-mining runoff from rehabilitated and re-vegetated areas of the mine would be directed to the local drainage network. Progressive rehabilitation of the Project disturbance areas is described in Section 5.

Erosion and Sediment Control

Erosion and sediment control measures would be designed in accordance with the above water management principles and would involve the preparation and implementation of an Erosion and Sediment Control Plan (ESCP) (Section 6.2.3).

The ESCP would entail sequencing construction works so as to minimise the area of disturbance at any given time in conjunction with the implementation of a progressive rehabilitation programme. Specific mitigation measures to control soil erosion and sediment migration are described in Section 4.1.2.

4.6.2 Surface Water Resources

Potential Impacts

Appendix O assesses the potential impacts of the Project on the local creek systems and the potential for interconnection between the creeks and the underground workings (Section 4.2.3).

In addition to these potential impacts the Project open cut mining areas would reduce the contributing catchments of North Wambo, Waterfall and Redbank Creeks by up to a maximum 10 km^2, 2.1 km^2 and 3.6 km^2 respectively, as a result of runoff capture in the Project water management system. The total catchment areas of these creeks are 48.5 km^2, 6.6 km^2 and 12.3 km^2, respectively (Appendix E). The catchment of these creeks would be progressively reinstated as the mine waste rock emplacements are rehabilitated and become free draining.

As described in Section 2.5, the Project open cut would mine through the middle reaches of North Wambo Creek (Figures 2-7 to Figure 2-9).

Mitigation Measures

The Project would include the construction of a water control structure across North Wambo Creek and channel (Section 2.10.2) to facilitate the passage of creek flows around the southern limit of the open cut mine and its associated mine waste rock emplacement areas.

A permanent bund would be constructed to act as a flood levee between the channel and the open cut/mine waste rock emplacements to reduce the risk of floodwater entering the mine area. The actual flow capacity of the channel and bund would be determined as part of detailed design studies using a risk analysis approach and would be documented in the MOP (Section 6.1.1) and Site Water Management Plan (Section 6.2.6) to be developed in consultation with the relevant authorities.

Where the channel is constructed over a subsidence area, the design and form of the channel would be such that it accommodates the effects of subsidence and would be documented in a revision of the Site Water Management Plan. The channel design would include (Appendix E):

- Consideration of the development of pools and riffle zones within the channel alignment to provide for aquatic habitat.

- Incorporation of a series of narrower, steeper riffle reaches in stretches corresponding to pillar areas where subsidence is less than in other areas and wider reaches along the sections of greatest subsidence where bed slopes would be lower.
- A channel geometry that would limit flow velocities and boundary shear stresses so as to provide long-term stability. These limiting velocities and boundary shear values would be determined through an assessment of the post subsided creek geometry and associated geomorphological stability.
- Consideration would be given to lining portions of the channel where surface cracking is observed.

The surface water monitoring programme at Wambo Coal Mine would be expanded to accommodate the additional disturbances resulting from the Project. The monitoring frequency, parameters and location would be reviewed on an annual basis. Further details are included in Section 6.3.6.

4.6.3 Acid Mine Drainage

Potential Impacts

Waste rock samples were taken from exploration drillholes within the Project open cut area and were assessed for acid mine drainage (AMD) potential and element leaching (Appendix G). Results of the testwork undertaken classified the waste rock samples as NAF and unlikely to generate environmentally harmful leachate when exposed to surface oxidation processes. These results are consistent with the observed behaviour of waste rock at the Wambo Coal Mine.

CHPP reject samples (coarse reject and tailings) taken from the Wambo Coal Mine CHPP were classified as indeterminate (IND) and PAF, respectively. However, AMD has not been identified at the Wambo Coal Mine and is not expected to occur during the life of the Project provided that appropriate CHPP reject management practices are implemented, as described in Section 2.9, whereby tailings are incorporated and encapsulated and/or capped with bulk NAF waste rock.

Mitigation Measures

Samples of mine waste rock, rejects and runoff would be periodically taken to confirm that the existing management strategies are successful in preventing acid generation.

In the event that PAF materials are identified, appropriate mitigation strategies would be developed to limit the potential for acid drainage and element leaching (i.e. encapsulation with bulk NAF waste rock). Such measures would be documented in the MOP.

4.7 GROUNDWATER

Appendix F presents an assessment of the potential cumulative impacts of the Project and surrounding mining operations (i.e. United Colliery and Warkworth Coal Mine) on groundwater resources.

As described in Section 3.4.2, the hydrogeological regime of the Project area comprises two main systems (Appendix F):

- a Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek; and
- underlying Permian strata of hydrogeologically “tight” and hence very low yielding to essentially dry sandstone and lesser siltstone and low to moderately permeable coal seams which are the prime water bearing strata within the Permian sequence.

Existing mining at the Wambo Coal Mine and surrounding mining operations have created a sink in the local groundwater regime towards which groundwater within the Permian sequence flows. Existing underground operations (United Colliery Underground Mine) and recently closed mines at the Wambo Coal Mine act as hydraulic sinks.

The alluvial flow in North Wambo Creek has been altered by the box cut constructed as access for the Wollemi Underground Mine since 1997. The Wollemi Underground Mine Portal has been constructed through the alluvium and acts as a sink, capturing groundwater flow (Figure 4-2). Steady-state inflows of approximately 15 L/s from the alluvium have been observed.

As a component of the groundwater assessment, a numerical groundwater flow model was developed in order to provide a prediction of the rate of groundwater inflow to the Project open cut and underground operations and the potential extent of drawdown within the alluvial aquifers and depressurisation of the Permian strata that could occur in the vicinity of the mining operations.

A summary of the potential impacts on local groundwater aquifers and mitigation measures is presented below.

4.7.1 Alluvial Aquifers

Potential Impacts

The coal seams that would be mined in the vicinity of Wollombi Brook are deep and cracking would not extend to the surface from the underground workings (Appendix F). Further, as stated in Appendix O there would be no subsidence, or associated cracking, of Wollombi Brook. Consequently, groundwater levels and/or surface flow would generally remain unchanged due to underground mining (Appendix F).

The Wollemi Underground Mine Box Cut, constructed within the North Wambo Creek alluvium, is planned to be extended in Year 2 to provide access for the Project Whybrow Seam Underground Mine (Figure 2-5). The box cut extension would intersect a linear distance of up to 100 m of alluvium up-gradient of the existing box cut. This is not expected to significantly exaggerate the effect of the existing box cut on the groundwater regime (Appendix F).

Open cut mining would remove the mid-section of the existing channel along with the majority of the alluvium in North Wambo Creek. A water control system in the alluvium upstream of the open cut would divert baseflow around the open cut to the lower sections of North Wambo Creek and is described in Section 2.10.2 and Appendix E. The water control system is expected to maintain water levels in any upstream alluvium therefore the impact of mining on the upstream groundwater is expected to be minor and the processes governing the hydrogeological regime of this area of alluvium (such as recharge from the up-gradient Permian strata and runoff) would continue to occur. Bores in the alluvium in this upstream area should not be impacted by the Project (Appendix F). The removal of the alluvium in North Wambo Creek by open cut mining would result in little further drainage (i.e. additional to that drained by the existing box cut) of the alluvials. Leakage from the alluvium would be limited to residual stored waters due to the development of the water control system.

Further removal of the North Wambo Creek alluvium is planned for Year 9 of the Project when mining near the confluence of North Wambo Creek and Wollombi Brook would commence. As the open cut would be excavated well below the level of Wollombi Brook and to within 300 m of Wollombi Brook, it is expected that some inflow or reversal of hydraulic gradient within the alluvials in the lower reaches of North Wambo Creek would result.

Once mining through the alluvium commences predictive modelling shows that flow from the North Wambo Creek alluvium towards the open cut would be of the order of 6.5 L/s as the hydraulic gradient is reversed. The magnitude of this flow however is dependent upon a number of factors, *viz:*

- actual distance from the open cut excavation to Wollombi Brook (i.e. potential for the Wollombi Brook alluvium to recharge the North Wambo Creek alluvium);
- elevation of the base of the alluvium at the open cut relative to the water level in Wollombi Brook. The elevation of the base of alluvium at the open cut limits is approximately 2 m below that of the Brook level; and
- hydraulic conductivity of the alluvium and upper interburden unit in the area between Wollombi Brook and the pit excavation, in particular the presence and continuity of discrete zones of high permeability sands or gravels.

Subsidence contour plots generated by Holt (2003) show that approximately 0.5 m of subsidence can be expected in the southern corner of the open cut due to underground mining of the Wambo, Arrowfield and Bowfield Seams. The predicted subsidence increases to a maximum of approximately 3.5 m at a distance of approximately 250 m along the western edge of the open cut. The subsidence would result in a lowering of the base of the North Wambo Creek alluvium which may also affect the groundwater leakage rates. Bores set in the alluvium between the southern extent of the open cut and the confluence of Wollombi Brook may be impacted by a declining water level and yield. These bores are owned by WCPL. It is expected that with the implementation of appropriate mitigation measures (see below) there would be no impacts on groundwater bores or wells along Wollombi Brook (Appendix F).

Project underground mine areas are distant to the Hunter River and the Project open cut, although expanding to the north-west towards the Hunter River, would not intersect the alluvium. The Project would therefore not impact groundwater users along the Hunter River (Appendix F).

Impact on groundwater quality due to the Project would be limited to the coal seams and Permian aquifers. As a result no water quality impact is expected on the local alluvial groundwater system (Appendix F).

Mitigation Measures

The potential for inflows from alluvial aquifers to the open cut would be monitored. Mitigation measures to manage inflows from alluvium aquifers would include the installation of sumps on open cut benches with pump systems (as currently used in the Wollemi Underground Mine Box Cut) to collect alluvium derived inflows before they reach the floor of the open cut. These waters could then be returned to the local creek systems and/or managed in accordance with the relevant licence/permits.

The above measures would be developed further in the Site Water Management Plan (Section 6.2.6) and revised as empirical data becomes available and mine plans/open cut designs are finalised.

Although connectivity between the underground workings and Stony and Wambo Creeks is considered to be unlikely (Appendix O), careful monitoring of alluvial groundwater levels via a network of piezometers and stream flows along Wambo and Stony Creeks would be conducted. Should connectivity of the creek(s) to the workings be detected, a mitigation option would be to grout and seal any cracks in the creek bed similar to the remediation undertaken of cracking above the existing underground workings at the Wambo Coal Mine.

Groundwater levels and quality would be monitored during the Project life (Section 6.3.7).

4.7.2 Permian Aquifers

Potential Impacts

The available data indicates that substantial dewatering of the coal seams in the Wambo Coal Mine area has already taken place and that the Project would result in further dewatering of the Permian aquifers and lowering of groundwater levels, particularly in the Permian strata around the Project underground workings.

Numerical modelling of the aquifer drawdown in the overburden of the Warkworth Coal Mine pits by Mackie Environmental Research (2002) indicates a radius of the cone of depression of approximately 3 km (Appendix F). A similar impact may be expected around the existing Wambo Coal Mine and adjoining United Colliery open pits.

The assessment undertaken for the Project has shown that the potential impacts of the mining on water quality would be limited to the coal seams and Permian strata (Appendix F). Due to the poor quality of the water, it is considered that the resource is of limited benefit and as a result, any loss through mining activities would not be detrimental to the area.

Loss of aquifer pressures in the Permian strata is not predicted to impact any existing licensed water supply bores within the coal measures. Water supply bores in the vicinity of the Project are located within the shallow alluvium aquifer system.

An assessment of groundwater recovery following cessation of mining indicates that it would take up to approximately 200 years for water levels in the Permian strata from the Wambo Seam and above to fully recover. With respect to the deeper Arrowfield and Bowfield Seams, it has been assessed that it would take approximately 265 years for the water levels to recover to -110 m AHD following the completion of underground mining. The rate of groundwater recovery would accelerate in all cases should surface flow from the open cut voids be diverted to the completed underground workings (Appendix F).

Mitigation Measures

Given the lack of licensed water supply bores within the coal measures and the generally poor water quality, no specific groundwater impact management measures are proposed for the Permian aquifer system.

Groundwater levels and quality would be monitored during the Project life to validate model predictions (Section 6.3.7).

4.8 FLORA

A description of the flora in the vicinity of the Project is presented in Appendix HA and summarised in Section 3.5.

4.8.1 Potential Impacts

Vegetation Clearance

Approximately 473 ha of remnant vegetation would be removed by the Project (Table 4-15). The majority of vegetation clearance would occur within the open cut operations area (some 460 ha). Of this some 320 ha is in the form of a large remnant in the northern part of the open cut (Figure 4-20).

WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-20
Location of Selected Remnant Woodland Enhancement Programme Areas

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Table 4-15
Project Vegetation Clearance

Vegetation Community		Vegetation Clearance (ha, approximate)		
		Open Cut Operations Area	Infrastructure Areas	Total Vegetation Clearance
1	*Casuarina cunninghamiana/Angophora floribunda*	22	<1	22
2	*Eucalyptus camaldulensis*	0	0	0
3	*E. melliodora/E. blakelyi/A. floribunda*	0	0	0
4	*E. tereticornis/Melaleuca decora*	3	0	3
5	*Banksia integrifolia/A. floribunda/E. blakelyi*	0	1	1
6	*E. crebra/E. moluccana/Allocasurina luehmannii/M. decora*	371	12	383
7	*A. floribunda/E. crebra/E. moluccana /A. luehmannii*	46	0	46
8	*E. moluccana/E. crebra/A. verticillata*	10	0	10
9	*C. maculata/E. crebra/A. luehmannii/M. decora*	0	0	0
10	*E. dawsonii/E. crebra/A. luehmannii/M. decora*	1	0	1
11	*E. punctata/E. crebra/A. luehmannii/M. decora*	0	0	0
12	*E. blakelyi/A. floribunda/E. crebra*	0	0	0
13	*E. acmenoides/A. floribunda*	0	0	0
14	*Geijera salicifolia/Notelaea microcarpa*	7	0	7
15	*Acacia aneura*	0	0	0
16	Vine Thicket (Dry Rainforest)	0	0	0
	Total	**460**	**13**	**473**

Source: WCPL (2003)

Underground mining within this area was assessed as a potential alternative to mining by open cut methods, thereby, avoiding disturbance to remnant vegetation. However, underground mining was deemed not viable in this area due to the absence of coal reserves that could be mined economically by underground methods (Section 1.7.1).

Project infrastructure has, where practicable, been situated in cleared agricultural areas to minimise the amount of vegetation clearance required. Construction of Project infrastructure would remove approximately 13 ha of remnant vegetation.

Table 4-15 details the proposed clearance of each vegetation community identified in the vicinity of the Project and whether the disturbance is associated with the open cut mining operations and/or infrastructure areas. Eight of the 16 vegetation communities identified would be disturbed by the Project. However, the majority of disturbance would occur to vegetation community 6 (*E. crebra/E. moluccana/A. luehmannii/M. decora)* (some 383 ha or 81%), vegetation community 7 (*A. floribunda/E. crebra/E. moluccana/A. luehmannii*) (some 46 ha or 10%) and vegetation community 1 (*C. cunninghamiana/A. floribunda)* (some 22 ha or 5%) (Table 4-15).

Habitat Fragmentation and Regional Connectivity

There is considerable information about the value of vegetation corridors to flora and fauna in Australia (Saunders and Hobbs, 1991). A corridor has been defined as a "*linear two-dimensional landscape element that connects two or more patches of wildlife habitat that have been connected in historical time*" (Soule and Gilpin, 1991). Vegetation clearance has the potential to fragment vegetation remnants and impact on the continuity of corridors.

As described above, the majority of vegetation clearance for the Project would occur within the open cut mining operations area. Vegetation clearance within the open cut operations area would be undertaken progressively. Figures 2-5 to 2-9 show the planned progressive development of open cut mining operations for Years 2, 4, 7, 9 and 13. Clearance of remnant vegetation in the north of the Project is not planned to commence until approximately Year 5. In regard to connectivity, the landscape within which the open cut operations are situated is already fragmented from proximate areas of woodland vegetation.

Subsidence and Vegetation

The potential impacts of subsidence as a result of underground mining activities are discussed in Appendix O.

Potential impacts of subsidence of relevance to flora include surface cracking, erosion and ponding of surface water in areas where isolated depressions form. Disturbance to the land surface and associated vegetation as a result of surface cracking, erosion and isolated ponding is however predicted to be minimal. Any such impacts are considered to be capable of repair through the implementation of appropriate mitigation measures.

Increased areas of ponding are expected to occur along and adjacent to the lower reaches of North Wambo Creek and Wambo Creek (Figure 4-2). Some of these areas are likely to become wetlands over time. As a result, a change in flora species composition and structure would be expected to occur as the creation of wetland habitat provides greater opportunities for wetland species.

There would be no subsidence of the adjoining Wollemi National Park escarpment or Wollombi Brook (Appendix O).

Threatened Flora Species, Populations and Communities

Threatened Flora Species and Populations

No threatened flora species or endangered populations listed in the schedules of the TSC Act and/or EPBC Act have been identified in the vicinity of the Project.

Endangered Ecological Communities

Two endangered ecological communities have been identified in the vicinity of the Project, namely, the Warkworth Sands Woodland endangered ecological community (listed in the TSC Act) and the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological community (listed in both the TSC Act and EPBC Act).

Discussion of the potential impacts of the Project on these communities is provided below.

Warkworth Sands Woodland

The Warkworth Sands Woodland has a patchy, yet extensive distribution on lands to the east of Wollombi Brook around Warkworth, and between Wollombi Brook and Wallaby Scrub Road (vegetation community 5, Figure 3-6). This community is considered to be the most threatened vegetation community occurring within the region (Peake, in prep. in Peake *et. al*., 2002) due to its restricted distribution and absence within any conservation reserve.

The Project would entail the removal of less than 1 ha of the Warkworth Sands Woodland to accommodate the rail loop. The area of Warkworth Sands Woodland that would be disturbed by the rail loop is heavily invaded by weeds, fragmented and in poor condition.

Approximately 105 ha of Warkworth Sands Woodland are located above the Project underground mining operations area. Potential impacts of underground mining activities on the Warkworth Sands Woodland primarily relate to the potential for minor surface cracking as a result of subsidence. Due to the depth of the Arrowfield and Bowfield Seams to the east of Wollombi Brook only minor surface cracking would be expected (Figure 4-2). The northern portions of the longwall panels in this area are overlain by tertiary-sands that due to their mobility would be expected to in-fill any cracks rapidly (Appendix O). As a result, it is not expected that subsidence would significantly impact the Warkworth Sands Woodland community in this area.

White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands

The White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands (Box-Gum Woodland) endangered ecological community is represented by scattered occurrences of Yellow Box trees in small isolated groups and individuals along both sides of Wollombi Brook, and by one patch of Blakely's Red Gum/Rough-barked Apple/Narrow-leaved Ironbark. The patches of Box-Gum Woodland represented by vegetation communities 3 and 12 in Figure 3-6 would not be removed by the Project, being situated outside of the Project open cut operations and infrastructure areas.

Of the 21 ha mapped by Orchid Research (2003), approximately 4 ha are located above Project underground mining areas. Potential impacts of underground mining activities relate to the potential for subsidence to cause surface cracking and to alter existing surface drainage patterns which may result in isolated ponding in some areas. Disturbance to the land surface and to the Box-Gum Woodland as a result of surface cracking and ponding is however predicted to be minimal given the depth of the underground workings. Notwithstanding this, surface monitoring would be conducted to confirm the above. In the event that monitoring indicates the need for remediation, these works would be undertaken (Section 4.2.2).

Eight Part Tests of Significance

In accordance with the provisions of Section 5A of the EP&A Act, Eight Part Tests of Significance have been prepared for 17 threatened flora species and three endangered ecological communities considered possible occurrences in the vicinity of the Project (Appendix HE). Based on the information presented in the Eight Part Tests it was determined that the Project is unlikely to place any threatened flora species, populations, ecological communities, or their habitats at risk of extinction.

ROTAP and Regionally Significant Flora

One species listed as rare, *Acacia bulgaensis*, and one listed as poorly known, *Grevillea montana*, in *Rare or Threatened Australian Plants* (ROTAP) (Briggs & Leigh, 1996), were recorded in the vicinity of the Project. Situated in rugged country near Stony Creek, *A. bulgaensis* would not be affected by the Project. *G. montana* was found to be widespread and relatively common, occurring in the majority of vegetation communities present. As a result, the Project is unlikely to affect the long-term viability of either *A. bulgaensis* or *G. montana* in the vicinity of the Project.

Sixty-five plant species listed in the *Preliminary List of Regionally Significant Plants of the Hunter Catchment* (Bell *et al.*, in prep) were recorded within the study area. While some specimens of regionally significant species could potentially be affected by open cut operations and construction of Project infrastructure, the Project is considered unlikely to affect the long-term viability of these species in the vicinity of the Project.

Regionally significant populations of the River Red Gum (*Eucalyptus camaldulensis*) occur in small scattered patches along Wollombi Brook and an area of vine thicket occurs to the north-west of MLA1 (Figure 3-6). Neither the River Red Gum nor the vine thicket would be disturbed by the Project, being situated outside proposed disturbance areas.

Paperbark woodlands dominated by *Melaleuca decora* are also considered to be regionally significant. A number of vegetation communities identified in the vicinity of the Project include *M. decora* as a dominant species (Figure 3-6). Remnants that are representative of these communities occur outside of the Project disturbance areas.

Introduced Species

A total of 356 plant species were recorded in the vicinity of the Project, composed of approximately 30% introduced plant species (Appendix HA). A number of species recorded by the flora surveys are regarded as noxious in the Singleton LGA, namely, the Prickly Pears (*Opuntia* spp.), African Boxthorn (*Lycium ferocissimum*), Blackberry (*Rubus fruticosus*), Mother-of-Millions (*Bryophyllum delagoense*), Paterson's Curse (*Echium plantagineum*), Silver-leaf Nightshade (*Solanum elaeagnifolium*), Sweet Briar (*Rosa rubiginosa*) and Willows (*Salix* spp.).

The presence and possible introduction of weed species poses a potential threat to native plant species by reducing floristic structure and diversity. Disturbance can act as a catalyst for weed incursion and if management initiatives are not implemented, proliferation of weeds can occur.

Dust and Vegetation

Studies have shown that excessive dust generation can impact on the health and viability of surrounding vegetation. Dust can affect vegetation by inhibiting physiological processes such as photosynthesis, respiration and transpiration, and allow penetration of phytotoxic gaseous pollutants (Farmer, 1993; Eller, 1977). Open cut mining operations have the potential to result in the generation and dispersion of atmospheric dust. Air emissions associated with the Project are discussed in Section 4.5 and Appendix B. Given the predicted dust deposition associated with the Project, the health and viability of surrounding vegetation is unlikely to be deleteriously affected.

Cumulative Impacts

Vegetation in the Hunter Valley has been significantly altered in floristics and structure since the arrival of Europeans in the early 1800's, primarily due to the clearing of vegetation for agriculture, mining, forestry and settlement (Peake, 2000; DMR, 1999). The cumulative impacts of the Project are assessed below. Coal mines located in the vicinity of the Project include the United Colliery and Hunter Valley Operations to the north and east, the Warkworth Coal Mine to the east and the Mount Thorley Coal Mine, Bulga Coal Mine and Beltana Coal Mine to the south. In addition, a sand mining operation has recently been approved by the SSC to the east of the Project.

The extent of vegetation clearance varies from development to development. For example, the proposed extension of underground mining activities at the United Colliery (HLA Envirosciences Pty Ltd, 2002) includes minimal vegetation clearance, which would primarily be restricted to an exotic grassland community. In comparison, the proposed expansion of the Warkworth Coal Mine (Environmental Resources Management, 2002) would include the removal of some 569 ha of vegetation to accommodate open cut operations.

Many of the existing or proposed developments include a variety of management measures and rehabilitation initiatives to mitigate and/or ameliorate the potential impacts of the development on flora. For example, the proposed expansion of the Warkworth Coal Mine (Environmental Resources Management, 2002) includes a strategy to conserve and enhance areas of remnant woodland and a rehabilitation programme involving the revegetation of disturbance areas with woodland vegetation. Similarly, the recently approved sand mining operation to the east requires a rehabilitation plan to be prepared in consultation with the SSC and NPWS, with a focus on the progressive revegetation of disturbance areas with native species.

Eight Part Tests of Significance undertaken for various regional coal mines and the sand mining operation have concluded that the developments are unlikely to place any threatened flora species, populations, ecological communities, or their habitats at risk of extinction.

The Project would involve the removal of approximately 473 ha of remnant vegetation (Table 4-15). The EIS has assessed the cumulative impacts of the Project on protected, regionally significant and threatened flora by taking into consideration the extent and type of vegetation disturbance associated with other regional developments, the ameliorative measures that have been proposed, the vegetation characteristics of the Project and surrounds and the essential lifecycle components of local flora. The assessments have concluded that the Project is unlikely to place any protected, regionally significant or threatened flora, or their habitats at risk. A range of mitigation and ameliorative measures have been incorporated into the Project to minimise the potential impacts of the Project, including regional cumulative impacts on flora. The mitigation measures developed for flora are detailed below.

4.8.2 Mitigation Measures

The following measures have been developed to mitigate the potential impacts (including cumulative impacts) of the Project on flora.

Flora Management

Flora management strategies, including those listed below, would be detailed in the Flora and Fauna Management Plan (FFMP) to be prepared for the Project prior to construction (Section 6.2.7 contains further detail regarding the contents of the FFMP).

Vegetation Clearance Activities

Mitigation measures relevant to vegetation clearance activities include the following:

- Wherever practicable, existing native vegetation would be retained and vegetation clearance avoided.
- A vegetation clearance protocol would be developed to minimise the impact of Project vegetation clearance activities on flora. As a component of the Protocol, vegetation adjoining proposed clearance areas would be delineated and clearly marked or fenced to prevent accidental damage.

- In circumstances where vegetation removal is necessary, clearing operations would be managed to maximise the re-use of cleared vegetative material. This would include implementation of a seed collection programme prior to disturbance for use in the rehabilitation programme and the re-use of cleared vegetation (e.g. provision of habitat for fauna associated with the rehabilitation and remnant woodland enhancement programmes, fence posts etc.), wherever practicable.
- In areas of significant earthworks, topsoil resources would be identified, stripped and stockpiled. Soil resources would be stockpiled for short time periods, where practicable, and would be re-spread and seeded.
- As indicated on Figures 2-5 to 2-10, open cut mining operations and corresponding vegetation clearance would be undertaken progressively.

Revegetation Programme

- While some 473 ha of remnant woodland would be removed by the Project, the rehabilitation programme would establish significant areas (some 1,570 ha) and a net increase in woodland vegetation over the long-term (Table 4-16). Project rehabilitation objectives and concepts are detailed in Section 5.
- Rehabilitation of the open cut operations area would be undertaken progressively as shown on Figures 2-5 to 2-10. Prior to the clearance of remnant vegetation in the north of the Project, the rehabilitation of approximately 510 ha of land would have already commenced within the open cut operations area (i.e. in Years 1 to 4). In addition, the enhancement of some 1,080 ha of remnant woodland would have also commenced. The gradual removal of vegetation in the north of the Project would be accompanied by the progressive revegetation of disturbance areas (including revegetation with woodland vegetation), as well as the continuation of the remnant woodland enhancement programme. Completion of open cut mining operations is scheduled to occur in approximately Year 13, at which time rehabilitation of the remaining mined out areas would be undertaken. Underground mining activities would continue past Year 20 at which time some 1,570 ha would have been revegetated with woodland vegetation.
- The objectives of the revegetation programme are in keeping with the intent of the native vegetation/biodiversity target of the *Integrated Catchment Management Plan for the Hunter Catchment 2002* (HCMT, 2002b) to increase the amount of native vegetation, particularly in those landscapes that have been extensively cleared. The final distribution of woodland to be established on the rehabilitated landforms would ultimately depend on the outcome of Project closure planning including the shape of final landforms and agreed post closure land use.
- A primary objective of native vegetation management in the Upper Hunter is to address the discontinuity in remnant vegetation across the Hunter Valley floor, particularly between the Sydney Basin and NSW North Coast bioregions (DMR, 1999). Accordingly, the establishment of vegetated corridors across the valley is considered to be a high priority by land use managers (ibid.). *The Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (DMR, 1999) (herein referred to as the Synoptic Plan) conceptually illustrates proposed locations for the development of regional corridors. This includes a broad scale vegetation corridor across the valley floor with a vision of connecting Wollemi National Park to the Barrington Tops National Park.
- In recognition of the importance of vegetation corridors to regional biodiversity, rehabilitation initiatives for the Project would aim to increase the continuity of vegetation in the region through the establishment of woodland corridors. Accordingly, the rehabilitation programme has been specifically designed to establish linkages between rehabilitation areas, existing remnant vegetation and Wollemi National Park (Section 5). In doing so, WCPL would be addressing the issue of discontinuity in remnant vegetation across the Hunter Valley floor and contributing to the broad-scale vegetation corridor proposed to be established across the valley floor. Further detail on the Project's contribution to regional vegetation strategies is provided in Section 5.

Table 4-16
Estimate of Vegetation Clearance, Revegetation and Woodland Enhancement Areas

Project Component	Area (ha)
Project Vegetation Clearance[1] Open cut operations area (460 ha) and Infrastructure areas (13 ha)	**473**
Revegetation of Open Cut Operations Area Revegetation to woodland[2, 3]	**1,570**
Remnant Woodland Enhancement Programme Woodland enhancement areas[4]	**1,080**

Source: WCPL (2003)

1 The areas shown do not include the area approved to be disturbed by the existing Wambo Coal Mine (some 1,090 ha).

2 May vary depending on the shape of the final landforms and agreed post closure land use. The calculation is based on the establishment of 50% woodland within the mixed woodland/pasture areas. The final rehabilitation strategy would be determined during closure planning in consultation with relevant regulatory authorities and key stakeholders. The calculation does not include areas to be revegetated with *Angophora floribunda* and *Banksia integrifolia* in the vicinity of the rail loop, nor the planting of the primary channel and secondary overflow zone of the water control system with riparian vegetation.

3 Includes rehabilitation of areas approved to be disturbed by the existing Wambo Coal Mine which are subject to this development proposal.

4 Existing areas of remnant woodland would be fenced to exclude stock during the initial stages of Project development to allow natural regeneration of native trees, shrubs and grasses. Woodland areas to be conserved and enhanced include the Warkworth Sands Woodland endangered ecological community, Box-Gum Woodland endangered ecological community, known habitat for threatened fauna species such as the Grey-crowned Babbler, Hooded Robin, Glossy Black-cockatoo, Speckled Warbler, Diamond Firetail, Squirrel Glider, Large Bentwing Bat, Yellow-bellied Sheathtail Bat and Large-eared Pied Bat and potential habitat for a number of other threatened species. Further information regarding the enhancement of woodland areas is provided in Section 4.9.2.

- As detailed in Section 4.8.1, eight vegetation communities would be disturbed by the Project. The majority of disturbance however would occur to vegetation community 6 (*E. crebra/E. moluccana/ A. luehmannii/M. decora*) (some 383 ha or 81%), vegetation community 7 (*A. floribunda/E. crebra/ E. moluccana/A. luehmannii*) (some 46 ha or 10%) and vegetation community 1 (*C. cunninghamiana/ A. floribunda*) (some 22 ha or 5%) (Table 4-15). The revegetation strategy includes the revegetation of disturbance areas with areas of woodland, areas which contain a mixture of woodland and pasture, and riparian vegetation, as described below. Further detail on the revegetation programme is provided in Section 5.4.

- *Woodland Corridors* - The revegetation programme would aim to re-establish as much of the floristic diversity as possible within woodland areas. This objective is consistent with the strategy actions proposed in the Synoptic Plan (DMR, 1999). Endemic plant species which are characteristic of the vegetation communities to be disturbed within the open cut operations area would be utilised in the woodland revegetation programme. Overstorey species would include *E. crebra, E. moluccana, A. luehmannii, M. decora, A. floribunda, A. verticillata, E. dawsonii, Geijera salicifolia* and *Notelaea microcarpa*. Mid and lower storey native vegetation would also be established within the woodland areas. A provisional list of species for use in the revegetation programme is provided in Section 5.4. Where practicable and appropriate, regionally significant flora species and the ROTAP species *Grevillea montana* would also be utilised in the revegetation of woodland areas.

- *Mixed Woodland/Pasture Areas* - Areas that would contain a mixture of woodland and pasture would be rehabilitated in a manner that results in contiguous strips of woodland which are connected to the woodland corridors, as opposed to scattered patches of woodland within the pasture areas. The strips of woodland would be revegetated in a similar manner and with similar species to that described for the woodland corridors above. Areas to be revegetated with pasture would be sown using native grasses, where practicable. A preliminary selection of native grasses that could be used in the rehabilitation programme is provided in Section 5.4.

This list would be used to initiate consultation with regulatory authorities and key stakeholders regarding plant species selection.

- *Riparian Zone* – The Project would entail the removal of some 22 ha of vegetation community 1 (*C. cunninghamiana/A. floribunda*) along North Wambo Creek. The rehabilitation programme would include planting of the banks of the North Wambo Creek water control channel with *C. cunninghamiana* and *A. floribunda* (Section 5.4), resulting in a net increase in the quantity of riparian vegetation along North Wambo Creek.
- A flora monitoring programme would be developed for the rehabilitation areas and documented in the FFMP. A detailed description of the flora monitoring programme is provided in Section 6.3.8.

Remnant Woodland Enhancement Programme

A remnant woodland enhancement programme (RWEP) would be developed and documented in the FFMP to help conserve regional biodiversity, whilst enhancing the habitat available to flora and fauna. During the initial stages of Project development remnant woodland vegetation (some 1,080 ha, refer Table 4-16) located within WCPL owned land and outside of the Project open cut operations area would be managed to maintain and enhance their inherent conservation values. This initiative is consistent with the objectives of the native vegetation/biodiversity target of the *Integrated Catchment Management Plan for the Hunter Catchment 2002* (HCMT, 2002) to conserve existing regionally significant vegetation communities.

Three areas of remnant woodland have been selected for enhancement and are shown on Figure 4-20. The areas selected would be subject to further consultation with regulatory authorities and key stakeholders during preparation of the FFMP. The flora values of the enhancement areas are described in Table 4-17. The fauna values of the selected enhancement areas are described in Section 4.9.1.

The RWEP includes the conservation and enhancement of a variety of vegetation communities, including vegetation community 6 (*E. crebra/E. moluccana/A. luehmannii/M. decora)*, which is the community that would primarily be disturbed by the open cut operations.

Details of the vegetation communities to be conserved and enhanced within each enhancement area are provided in Table 4-17.

The programme includes the conservation and enhancement of areas of remnant woodland situated adjacent to Wollemi National Park (Figure 4-20). While many of the remnants in the vicinity of the Project have been semi-cleared, subjected to historical disturbance or current stock grazing, the least disturbed remnants occur on the steep rocky slopes and foothills which adjoin Wollemi National Park. Inclusion of these remnants in the woodland enhancement programme would strengthen the linkages to be developed between Wollemi National Park, existing remnant woodland and woodland rehabilitation areas.

The management measures to be implemented within the enhancement areas would be detailed in the FFMP. Management measures relevant to flora would include the fencing of remnants to exclude stock to allow the natural regeneration of native species, the implementation of weed control measures and selective planting of native vegetation to enlarge the remnants and to link existing remnant vegetation, where appropriate.

It is anticipated that the remnant woodland enhancement programme would achieve:

- an improvement in the quality of woodland habitat available to flora and fauna;
- an expansion in the extent of the remnants;
- an increase in the diversity and/or abundance of native flora and fauna within the remnants; and
- a significant contribution to the conservation of regional biodiversity.

A flora monitoring programme would be developed for the remnant woodland enhancement programme to monitor the effectiveness of the woodland enhancement initiatives. The monitoring programme would be established as a component of the FFMP in consultation with relevant regulatory authorities. A number of permanent flora survey quadrats would be established within the enhancement areas to obtain quantitative data on plant species diversity and abundance. A description of the flora monitoring programme is provided in Section 6.3.8.

Table 4-17
Flora Values of the Woodland Enhancement Areas

Woodland Enhancement Area (Figure 4-20)	Flora Values
Area A	The flora values of Area A include the occurrence of: • The Warkworth Sands Woodland endangered ecological community (listed in the TSC Act). As noted earlier, this community is considered to be the most threatened vegetation community occurring within the region due to its restricted distribution and absence within any conservation reserve. As indicated by Peake *et. al.* (2002), no areas of Warkworth Sands Woodland currently occur within a conservation reserve. While there has been patchy clearing and regeneration within this remnant, overall the community is in good condition and is considered to be capable of recovery close to its original condition if grazing is limited to minimise damage to the natural regeneration of native species. • White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands (Box-Gum Woodland) endangered ecological community. This community is listed in both the TSC Act and EPBC Act. This particular stand of Box-Gum Woodland is considered to be in close to pristine condition. • Regionally significant populations of the River Red Gum (*Eucalyptus camaldulensis*) within the flood plain of Wollombi Brook. • Vegetation community 6 (*E. crebra*/E. *moluccana/A. luehmannii/M. decora),* the community that would primarily be disturbed by the open cut mining operations. • The ROTAP species, *Grevillea montana*.
Area B	The flora values of Area B include the occurrence of: • The same dominant overstorey species that would be removed by the open cut operations (such as *E. crebra*, *A. luehmannii*, *M. decora*, *A. floribunda*, *G. salicifolia* and *N. microcarpa*). • A variety of vegetation communities, specifically vegetation communities 6, 9, 10, 3 and 14, thereby increasing the Project's contribution to regional biodiversity.
Area C	The flora values of Area C include the occurrence of: • Vegetation community 6 (*E. crebra/E. moluccana/A. luehmannii/M. decora),* the community that would primarily be disturbed by the open cut operations. • Vegetation communities 10 and 11. Only relatively small patches of vegetation community 11 (*E. punctata/E. crebra/A. luehmannii/M. decora)* occur in the vicinity of the Project. Conservation and enhancement of this patch would further contribute to regional biodiversity.

Source: after Appendices HA, HB and HC.

Endangered Ecological Communities

- Vegetation clearance required for the rail loop, rail spur and train loading system would be undertaken to minimise disturbance to the Warkworth Sands Woodland endangered ecological community. To compensate for the removal of a small portion (less than 1 ha) of Warkworth Sands Woodland, areas in the vicinity of the rail loop would be revegetated with native species characteristic of the Warkworth Sands Woodland (such as *Angophora floribunda* and *Banksia integrifolia*).

- In recognition of the high conservation value of the Warkworth Sands Woodland endangered ecological community, areas of Warkworth Sands Woodland located on WCPL land between Wollombi Brook and Wallaby Scrub Road would be enhanced and conserved (Area A as discussed above).

- The occurrence of the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological community located on WCPL owned land between Wollombi Brook and Wallaby Scrub Road would also be enhanced and conserved (Area A as discussed above).

Weed Control

A weed control programme would be implemented to limit the spread of weeds into Project areas. A Weed and Animal Pest Control Plan would be prepared for the Project prior to construction.

Bushfire Management

High frequency bushfire resulting in the disruption of lifecycle processes in plants and animals, and loss of vegetation structure and composition, is listed as a threatening process in Schedule 3 of the TSC Act. The Wambo Coal Mine Bushfire Management Plan would be revised to include Project activities.

Employee Education

An environmental education programme would be included in the employee and contractor inductions and would provide relevant training in the management of native flora.

4.9 TERRESTRIAL FAUNA

A description of terrestrial fauna recorded in the vicinity of the Project is presented in Appendices HB and HC and summarised in Section 3.6.

4.9.1 Potential Impacts

Habitat Disturbance

The condition of native vegetation in the vicinity of the Project varies. In general, the most disturbed areas are located along the watercourses and on the flat and undulating areas which have been cleared for grazing. The least disturbed areas occur on the steep rocky slopes and foothills which adjoin Wollemi National Park. The remaining areas of remnant vegetation have been semi-cleared, subjected to historical or current stock grazing and contain open areas with regeneration of various ages. Details of the proposed clearance of each vegetation community identified within the study area are provided in Table 4-15.

Remnant vegetation within the Project area and surrounds provides (to varying degrees) opportunities for foraging, breeding, nesting, predator avoidance and movement between areas thus promoting genetic diversity and facilitating dispersal/migration. These opportunities could potentially be reduced as a result of clearance activities associated with the Project.

Habitat Fragmentation and Connectivity

Vegetation clearance can fragment remnant vegetation and as a result create a barrier to the movement/dispersal of fauna. In relation to the movement of fauna, different species possess a variety of dispersal mechanisms by which they are able to colonise new habitats or maintain genetic health. For example, amphibians are typically restricted to water bodies such as rivers, creeks or lagoons; however they may undertake forays across elevated terrain in damp conditions. By comparison, birds are generally highly mobile and are able to cover relatively large areas of land. The type of barrier and the species involved would determine the level of impact on dispersal capability or the degree of isolation. Notwithstanding, vegetation clearance associated with the Project has the potential to fragment vegetation remnants, impact on the continuity of corridors and affect the movement/dispersal of fauna.

As described in Section 4.8.1, the majority of vegetation clearance for the Project would occur within the open cut operations area and would be undertaken progressively. In regard to the connectivity of remnants for the dispersal of fauna, clearance of remnant vegetation in the north of the Project would, in the short-term, further fragment existing vegetation (Figure 4-20).

Threatened Fauna Species

Thirteen threatened fauna species were recorded in the vicinity of the Project, including eight birds and five mammals (Table 3-13). In accordance with the provisions of Section 5A of the EP&A Act, Eight Part Tests of Significance were completed (Appendix HE) for 41 threatened fauna species considered possible occurrences within the Project area and/or surrounds. Based on the information presented in the Eight Part Tests, it was determined that the Project is unlikely to significantly affect any threatened fauna species to the extent of undermining the viability of a local population of that species.

Migratory Species

A number of migratory species listed under the EPBC Act have been recorded in the vicinity of the Project (Section 3.6.2). A number of the migratory species (e.g. Australian Wood Duck, Chestnut Teal, Great Cormorant and Masked Lapwing) are associated with waterbodies and farm dams, habitats which would not be deleteriously impacted by the Project. Many of the migratory raptor species are likely to hunt over the open woodland, open forest, treed watercourses and grasslands in the vicinity of the Project. Remnant vegetation within the Project disturbance areas offers habitat for a number of migratory species. However, any local population is unlikely to be dependent upon the area of vegetation to be removed (some 472 ha) given the occurrence of proximal habitat resources, the mobility of the species and/or the ability of many of the species to utilise a variety of habitat types.

Eight Part Tests of Significance have been undertaken for a number of threatened migratory species including the Square-tailed Kite and Regent Honeyeater (Appendix HE). The tests concluded that the species are unlikely to be significantly affected by the Project to the extent of undermining the viability of a local population of that species.

Introduced Fauna Species

Eleven introduced terrestrial fauna species were recorded in the vicinity of the Project (Appendix HB) including the Fox (*Vulpes vulpes*), Feral Cat (*Felis catus*) and European Rabbit (*Oryctolagus cuniculus*) which present significant risks to native fauna in the area. Predation by the Fox and the Feral Cat, and competition and grazing by the European Rabbit are listed in Schedule 3 of the TSC Act as key threatening processes.

Due to the potential for habitat disturbance, increased refuge and scavenging areas (i.e. discarded food scraps and other rubbish), populations of introduced species could increase or become concentrated in and around the Project.

Fauna and Noise

Numerous studies have been undertaken on the effects of noise on wildlife (e.g. Algers *et al.*, 1978 in Richard Heggie Associates, 1997; Allaire, 1978; Ames, 1978; Busnel, 1978; Lynch and Speake, 1978; Shaw, 1978; Streeter *et al.*, 1979; Poole, 1982 in Richard Heggie Associates, 1997). In essence, the studies indicate that many species are well adapted to human activities and noise.

Notwithstanding, the Project is expected to increase the existing level of noise, which has the potential to disrupt the routine activities of vertebrate fauna.

Fauna and Road Traffic

The movement of vehicles (both within the Project area and transport to and from the site) has the potential to increase the incidence of fauna mortality via vehicular strike.

Fauna and Artificial Lighting

Project lighting has the potential to affect the behavioural patterns of some species. Some bird and bat species, for example, are attracted to insects around lights. As a consequence of this, they could become prey for larger predators (e.g. owls) which may lead to changes in population structure and community composition.

State Environmental Planning Policy No. 44 (Koala Habitat Protection)

In response to a state-wide decline of Koala populations, the Department of Urban Affairs and Planning (now PlanningNSW) gazetted SEPP 44 in January 1995. The policy aims to "….*encourage the conservation of proper management of areas of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline.*"

In order to determine whether SEPP 44 applies to the Project, it is necessary to consider the following points:

(1) *Does the subject land occur in a Local Government Area identified in Schedule 1?*

The Project is located within the Singleton LGA, which is listed in Schedule 1 of SEPP 44.

(2) *Is the landholding to which the DA applies greater than 1 hectare in area?*

The Project is larger than 1 hectare in area.

(3) *Is the land potential Koala habitat? That is, does the site "contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?"*

In accordance with Schedule 2 of SEPP 44, potential Koala food trees present in the vicinity of the Project include Grey Gum (*E. punctata*), River Red Gum (*E. camaldulensis*) and Forest Red Gum (*E. tereticornis*) (Appendix HA). These species represent less than 15% of the upper or lower strata tree component. Based on this the land is not potential Koala habitat.

(4) *Is there core Koala habitat on the subject land and is there a requirement for the preparation of a Plan of Management for the identified core Koala habitat?*

SEPP 44 describes core Koala habitat as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

The Project does not fall within the definition of core Koala habitat and does not have a resident population of Koalas. The Koala has not been recorded in the vicinity of the Project despite numerous surveys and no recent records exist of a population occurring in the area.

Based on the above, it is concluded that the provisions of SEPP 44 do not apply.

Cumulative Impacts

Cumulative impacts of the Project on terrestrial fauna predominantly relate to habitat disturbance and fragmentation which are associated with the clearance of vegetation. The cumulative impacts of Project vegetation clearance are discussed in Section 4.8.1. Similarly to the assessment for flora, the EIS has assessed the cumulative impacts of the Project on fauna by taking into consideration the extent and type of habitat disturbance associated with existing and proposed regional developments, the ameliorative and rehabilitation measures proposed by these regional developments, the fauna species recorded in the vicinity of the Project and the essential lifecycle components of fauna.

Eight Part Tests of Significance undertaken for various regional coal mines and the sand mining operation concluded that existing and proposed developments are unlikely to place any threatened fauna species, populations, ecological communities, or their habitats at risk of extinction.

The Eight Part Tests of Significance undertaken for the Project (Appendix HE) have also assessed the cumulative impacts of the Project on threatened fauna, taking into consideration the extent and type of habitat disturbance associated with regional developments. The Eight Part Tests concluded that the Project is unlikely to place any threatened fauna species, populations, ecological communities, or their habitats at risk of extinction.

Rehabilitation initiatives for the Project would establish a net increase in woodland vegetation in the long-term (Table 4-16). Rehabilitation concepts have been designed to increase the level of connectivity of remnant vegetation in the local area and contribute to the broad scale vegetation corridor across the valley floor connecting to Wollemi National Park.

The Project would include the enhancement of approximately 1,080 ha of remnant woodland vegetation. The remnant woodland enhancement programme would contribute to the conservation of regional biodiversity and would include the conservation of areas of known habitat for a number of threatened fauna species including the Squirrel Glider, Grey-crowned Babbler, Glossy Black-cockatoo, Speckled Warbler, Diamond Firetail, Yellow-bellied Sheathtail Bat, Large Bentwing Bat and Large-eared Pied Bat.

Measures developed to mitigate the potential cumulative impacts of the Project on fauna are outlined below.

4.9.2 Mitigation Measures

In addition to the measures presented in regard to flora (Section 4.8.2), the following initiatives have been developed to mitigate the potential impacts (including cumulative impacts) of the Project on fauna.

Fauna Management

Fauna management strategies, including those listed below, would be detailed in the FFMP to be prepared for the Project prior to construction. The proposed content of the FFMP is described in Section 6.2.7.

Vegetation Clearance Activities

Mitigation measures relevant to vegetation clearance activities include the following:

- The FFMP would include a vegetation clearance protocol to minimise the potential impacts of vegetation clearance on fauna. The Protocol would include the delineation of areas to be cleared of vegetation, pre-clearance surveys, identification of fauna management strategies and specific procedures for vegetation clearance.
- Prior to ground disturbance works, mature trees and stags with hollows would be identified, marked and retained wherever feasible.
- The removal of native vegetation would be undertaken, where practicable, in consideration of seasonal factors to minimise disturbance to potential breeding and hibernation activities. This process would be facilitated by the Project's vegetation clearance protocol which would specify pre-clearance surveys to identify potential roosting/nesting habitat, their usage by fauna, and the identification of fauna management strategies.
- Fauna management strategies would be developed to minimise the impact of clearing activities on resident fauna in the short-term and minimise the impact of loss of habitat in the long-term. Fauna management strategies would be implemented in accordance with the FFMP developed for the Project.
- Where practicable, habitat features (e.g. large hollows) identified during the pre-clearance surveys would be salvaged and utilised in the rehabilitation or woodland enhancement programmes.
- Consideration would be given to the utilisation of artificial nesting/roosting boxes for fauna to replace those removed by vegetation clearance activities.

Threatened Fauna Species

- Pre-clearance surveys would include the identification and survey of potential roosting habitat for the Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*). Surveys and vegetation clearance activities would be conducted, where practicable, to avoid the hibernation period of the Yellow-bellied Sheathtail Bat.

  Where practicable, any Yellow-bellied Sheathtail Bat roosts would be relocated to suitable proximal habitat. Roost relocation would not be attempted during the hibernation period, and would, where practicable, avoid the breeding season (i.e. December to mid-March).
- Pre-clearance surveys would include, but not necessarily be limited to, the identification and survey of potential nesting/breeding habitat for the Glossy Black-cockatoo, Spotted-tailed Quoll, Brush-tailed Phascogale and Squirrel Glider.
- A threatened species management protocol would be developed as a component of the FFMP to facilitate the:
  - assessment of threatened species identified during any Project activity and not previously assessed by the Project Eight Part Tests of Significance; and
  - implementation of threatened species management strategies to minimise potential impacts on all threatened flora and fauna species.

Revegetation Programme

- The revegetation programme would include the use of native species with the potential to offer habitat resources for native wildlife (e.g. breeding, roosting/nesting or foraging resources), including threatened fauna species. For example, the rehabilitation programme would include the use of food tree species for the Grey-headed Flying Fox (e.g. *E. crebra* and *E. moluccana*); Allocasuarina and Casuarina for the Glossy Black-cockatoo; and Box-Ironbark species local to the area for the Black-chinned Honeyeater.
- As detailed in Section 4.8.2, rehabilitation of the open cut operations area would be undertaken progressively. The rehabilitation of some 510 ha of land would have commenced in Years 1 to 4 prior to the removal of remnant vegetation in the north of the Project at approximately Year 5. In addition, the enhancement of some 1,080 ha of remnant woodland would have commenced (Figure 4-20). The gradual removal of vegetation in the north of the Project would be accompanied by progressive rehabilitation and the continuation of the remnant woodland enhancement programme.

- The rehabilitation programme would establish significant areas (some 1,570 ha) and a net increase in woodland vegetation over the long-term (Table 4-16). A key objective of the rehabilitation programme is to establish linkages between the woodland rehabilitation areas, existing remnant vegetation and Wollemi National Park to increase the continuity of vegetation, thereby maximising opportunities for the creation of wildlife corridors (Section 5).
- The quality of the rehabilitation would be monitored using the Commonwealth Scientific and Industrial Research Organisation (CSIRO) developed Ecosystem Function Analysis (EFA), or a similar systems-based approach, and would include the assessment of habitat complexity. The monitoring of habitat complexity is based on the assumption that more environmental niches for fauna develop as the diversity of vegetation and ground cover increases. A detailed description of the flora and fauna monitoring programmes is provided in Section 6.3.8.

Remnant Woodland Enhancement Programme

As discussed in Section 4.8.2, a RWEP would be developed to help conserve regional biodiversity, whilst enhancing the habitat available to flora and fauna. During the initial stages of Project development remnant woodland vegetation (some 1,080 ha - Table 4-16) located within WCPL owned land and outside of the Project open cut operations area would be managed to maintain and enhance their inherent conservation values. The three areas selected for enhancement are shown on Figure 4-20. The fauna values of the enhancement areas are described in Table 4-18. The flora values of the enhancement areas are described in Section 4.8.2.

The programme includes the conservation and enhancement of areas of remnant woodland adjacent to Wollemi National Park. Conservation and enhancement of these areas would strengthen the linkages to be developed between Wollemi National Park, existing remnant woodland and the rehabilitation areas and assist in the faunal recolonisation of the rehabilitation areas.

Table 4-18
Fauna Values of the Woodland Enhancement Areas

Woodland Enhancement Area (Figure 4-20)	Fauna Values
Area A	The fauna values of Area A include the occurrence of: • Known habitat for the threatened Squirrel Glider and Grey-crowned Babbler. The exclusion of grazing, which is recognised as a threatening process to this species, would improve the habitat for the Grey-crowned Babbler, as well as a number of other threatened species. • Potential habitat for a number of other threatened species including those listed under the TSC Act and EPBC Act (e.g. the Swift Parrot and Regent Honeyeater, both listed as Endangered under the EPBC Act).
Area B	The fauna values of Area B include the occurrence of: • Known habitat for threatened fauna species including the Large Bentwing Bat, Yellow-bellied Sheathtail Bat and Large-eared Pied Bat. • Potential habitat for a number of other threatened species including the Glossy Black-cockatoo, Square-tailed Kite, Brown Treecreeper, Speckled Warbler, Grey-crowned Babbler, Hooded Robin, Squirrel Glider and Grey-headed Flying Fox.
Area C	The fauna values of Area C include the occurrence of: • Known habitat for a number of threatened species including the Glossy Black-cockatoo, Speckled Warbler, Hooded Robin, Yellow-bellied Sheathtail Bat, Large Bentwing Bat and Large-eared Pied Bat. • Potential habitat for a number of other threatened species including the Square-tailed Kite, Diamond Firetail, Brown Treecreeper, Grey-crowned Babbler, Squirrel Glider and Grey-headed Flying Fox.

Source: After Appendices HA, HB and HC

The management measures to be implemented within the enhancement areas would be detailed in the FFMP. Management measures would include the fencing of remnants to exclude stock and to allow natural regeneration of native species, feral animal control, habitat enhancement initiatives (such as the provision of nest boxes and resources for threatened fauna species) and selective planting of native vegetation to enlarge the remnants and to link existing remnant vegetation, where appropriate.

Fauna surveys would be conducted to monitor the usage of the enhancement areas by vertebrate fauna, including threatened species. Consideration would also be given to the monitoring of specific enhancement initiatives, such as the provision of nesting/roosting boxes. A detailed description of the fauna monitoring programme is provided in Section 6.3.8.

Introduced Fauna Species

A clean, rubbish-free environment would be mandated to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (e.g. introduced rodents, birds).

A feral animal control programme would be implemented in accordance with the control strategies detailed in the Weed and Animal Pest Control Plan to be prepared for the Project prior to construction (Section 6.2.8).

Fauna and Road Traffic

Speed limits would be imposed on roads and tracks within the Project area and signposting installed, to reduce the potential for vehicle strike on native fauna.

Bushfire Management

High frequency bushfire resulting in the disruption of lifecycle processes in plants and animals, and loss of vegetation structure and composition is listed as a threatening process in Schedule 3 of the TSC Act. The Wambo Coal Mine Bushfire Management Plan would be reviewed so as to include Project-related activities.

Employee Education

An environmental education programme would be included in the employee and contractor inductions and would include relevant training in the management of native fauna.

Domestic pets would be prohibited from the Project area and employees and contractors would not be permitted to take native fauna or encourage fauna through feeding.

4.10 AQUATIC ECOSYSTEMS

A detailed description of the aquatic ecosystems of the Project and surrounds is presented in Appendix HD. A summary of the potential impacts of the Project on aquatic ecosystems is provided below.

North Wambo, Wambo and Stony Creeks are intermittent streams which cease to flow in extended dry periods. North Wambo, Wambo and Stony Creeks have been highly disturbed by historic and present day grazing activities. In some locations on Wambo and Stony Creeks, earthworks have been conducted to re-contour the stream channel and banks to remediate subsidence effects from past underground mining activities.

The riparian vegetation is generally sparse and discontinuous. Where riparian vegetation does occur, it exists as a thin strip of *Casuarina cunninghamiana* and *Angophora floribunda*. The adjacent land use consists of pasture for cattle grazing. Grasses and weeds often cover the stream banks and bed in areas which are dry.

At the time of Project aquatic surveys, North Wambo Creek was characterised by a flowing pool-riffle or pool-run sequence near the confluence with Wollombi Brook; a series of isolated pools in the middle reaches and a dry channel in the upper reaches. Wambo Creek was predominantly dry at the time of the survey with some isolated small pools, and Stony Creek was completely dry.

The SIGNAL A biotic index was utilised, with a range of other biological indices to assess the ecological condition of the sites sampled. Calculation of the Signal A biotic index (Chessman, 1995) indicated the water quality of these streams is "*possibly mildly polluted*" to "*probably moderately polluted*", an assessment supported by the historical land use and stream characteristics.

North Wambo and Wambo Creeks are considered to represent minimal fish habitat. Two native and one introduced fish species were recorded from North Wambo Creek, and three native and one introduced species recorded from Wambo Creek.

The results indicate a relatively species-poor fish fauna assemblage. The most widespread and numerically dominant species was the Mosquito Fish (*Gambusia holbrooki*). The majority of native fish species were only recorded at sites where the introduced Mosquito Fish was absent.

North Wambo and Wambo Creeks have catchment characteristics, water quality and stream riparian, bank and channel characteristics which are considered unlikely to support a species-rich fish assemblage.

Potential impacts of the Project on the aquatic ecosystems of North Wambo, Wambo and Stony Creeks are primarily associated with the:

- development of the open cut operations area and water control system (water control structure and channel to divert flows to the lower reaches of North Wambo Creek); and
- effects of subsidence as a result of underground mining activities. The potential impacts on North Wambo, Wambo and Stony Creeks as a result of mine subsidence primarily relate to surface cracking, ponding/flooding, erosion and alterations to surface water and groundwater regimes above the Project longwall panels. These potential impacts are described in detail in Appendices O (Subsidence), E (Surface Water) and F (Groundwater).

Alteration of the natural flow regimes of rivers and streams and the degradation of native riparian vegetation along watercourses are recognised as key threatening processes under the TSC Act and/or NSW *Fisheries Management Act, 1994.* However, any alterations to aquatic habitat as a result of the Project are unlikely to significantly alter the macroinvertebrate or fish community composition, or the conservation values of these streams given the high degree of historical disturbance to these streams.

4.11 COMMUNITY INFRASTRUCTURE ASSESSMENT

The results of a community infrastructure assessment conducted for the Project are summarised below and are presented in full in Appendix J. Potential Project impacts on housing, education facilities and community services are addressed as well as potential direct and indirect impacts on employment and population.

For the purpose of the community infrastructure assessment, the local area is taken to include the SLAs of Cessnock, Maitland, Muswellbrook and Singleton.

4.11.1 Initial Development

Workforce

It is anticipated that up to 100 people would be employed to undertake initial development activities, which would include construction of the Project rail and train loading infrastructure. These activities would be undertaken in parallel with current open cut mining operations.

The operational Project workforce during this period would increase from 137 to in the order of 145 full-time employees.

Population and Housing

As a result of the high concentration of coal mines in the Hunter Valley and the existing industries in the region that support these mines, it is anticipated that in the order of 90% of the construction workforce would be provided from within the local area or the wider Hunter region. The remainder of the workforce would be expected to reside primarily in Singleton. A transient population increase of this scale is expected to have a minimal impact on local community services, health, education and short-term accommodation facilities in the town due to the extensive range of services available (Appendix J).

4.11.2 Increased Production Phase

Workforce

Project employment would range from 160 full-time jobs during the period of exclusively underground mining operations (expected in Years 14 to 21) to in the order of 370 full-time jobs during the period of maximum coal production (expected in Years 3 to 13). These numbers represent the creation of up to 233 full-time jobs in addition to the existing 137 full-time WCPL employees.

It is estimated that 90% of the operational workforce and flow-on jobs would be sourced from within the Hunter region (Appendix J). The following sections assess the potential impact on community infrastructure of the 10% of Project-generated employment (i.e. direct and indirect jobs) that would be sourced from outside the Hunter region.

Potential Project impacts on community services and facilities presented below assume that the peak period where 233 additional full-time jobs are created represents the greatest potential for direct impacts on population, housing requirements and community infrastructure in the local area (Appendix J).

Population and Housing

Of the 233 additional full-time employees, approximately 10% (i.e. 23 employees) are expected to originate from outside the Hunter region.

In addition to direct Project employment, potential indirect, or flow-on, employment generation resulting from the Project has been estimated at 388 full-time jobs within the Hunter region (Appendix I). Of these 388 additional indirect full-time jobs, it is assumed that approximately 10% (i.e. 39) would be filled by people who originate from outside the Hunter region (Appendix J). It is further assumed that approximately 50% (i.e. 20 people) of the indirect workforce sourced from outside the Hunter region would reside within the local area.

The estimated total Project-related population increase in the local area presented in Table 4-19, assumes that half of the 43 people moving to the local area from outside the Hunter region bring spouses and that half of these spouses are accompanied by two children.

Table 4-19
Projected Total Population Increase in the Local Area During Peak Production

Workforce	**43**
Direct	23
Indirect	20
Spouses/Children	**44**
Spouses	22
Children	22
Total Project-induced Population Increase	**87**

Source: Appendix J

With housing requirements expected to be divided primarily between the Cessnock, Singleton and Maitland SLAs, this minimal increase in population is expected to have a negligible impact on the housing market in the local area (Appendix J).

School Facilities and Services

The impact of the total increase in population attributable to the Project on school facilities is not expected to be significant at any stage throughout the Project life. Considering the range of education facilities available (Section 3.8.4), it is anticipated that the Project would have a negligible impact on education facilities in the local area (Appendix J).

Health Services and Facilities

Consultation with the Cessnock/Kurri Kurri Health Service in Cessnock, Singleton District Hospital and Maitland Hospital in January 2003 suggested that the expected minor population increases (Table 4-19) would not have a significant impact on the delivery of hospital services in the local area (Appendix J).

Population increases in the Cessnock area may place additional pressure on general practitioner services which are currently under-supplied. This pressure is likely to be short-term as the current doctor shortage is being addressed through the development of a general practitioners centre at the Cessnock District Hospital (Appendix J).

Community Organisations and Support Services

Community organisations and support services are expected to experience a negligible impact as a result of the minor population increases in the local area.

4.11.3 Potential Cumulative Impact

Examination of current mine development proposals in the local area indicates that these developments [e.g. Extension of Warkworth Coal Mine EIS (Coal and Allied, 2002) and United Colliery Extension of Mining Operations EIS (HLA Envirosciences, 2002)] do not include significant increases in employment.

The coal mining sector is the most productive sector of the regional economy (as measured through Gross Regional Product per employee) and is also the major sector responsible for exports from the region (Appendix I). The Project would reduce the current trend of decreasing employment in the mining sector and contribute to the regional productivity of the mining industry (Appendix I).

The regional mining workforce is of a transient nature with many mine employees having worked at several different mines due to regular restructuring of the various mining operations throughout the Hunter Valley coalfields. In response to the transient nature of the mining workforce, services and facilities in the region have adapted to accommodate a fluctuating population and the levels of community services available in the local area are generally high. No significant cumulative effects are therefore expected (Appendix J).

4.12 BENEFIT COST ANALYSIS AND REGIONAL ECONOMIC IMPACT ASSESSMENT

Economic analysis is primarily concerned with weighing up the potential economic costs and benefits of a project to the community (i.e. consideration of economic efficiency) (Appendix I). The primary technique used to evaluate proposals with respect to economic efficiency is a benefit cost analysis. As part of the economic assessment presented in Appendix I, a benefit cost analysis was performed for the Project.

Information on the regional economic impact or economic activity generated by development proposals is also of interest to decision-makers. A regional economic impact analysis that considers the likely contribution of the Project to annual direct and indirect output, value-added, income and employment (refer Section 8 for definition of terms) is also presented in Appendix I.

A summary of the assessment within these two frameworks is presented below.

4.12.1 Benefit Cost Analysis

In benefit cost analysis a resource is anything that is capable of affecting the utility of individuals and the community (through direct use of the resource as well as non-use) and includes man-made as well as natural resources. Benefit cost analysis is essentially concerned with how a change in the allocation of resources affects the net benefits (benefits minus costs) to consumers and producers, referred to as consumers' surplus and producers' surplus, respectively.

Identification and measurement of the changes in consumers' surplus and producers' surplus that may result from a proposal requires an examination of a range of information on physical, ecological, cultural and social impacts. This information is then interpreted in terms of economic efficiency.

As part of a benefit cost analysis it is necessary to identify the incremental costs and benefits of a proposal over time, which in turn requires the identification of the "base case" or "without" Project option. For the purposes of the benefit cost analysis conducted in Appendix I the "without" Project case involves continuation of Wambo Coal Mine operations in accordance with current approvals.

The main potential economic benefits and costs of the Project are discussed below.

Economic Costs

Opportunity Cost of Land

There is generally an opportunity cost associated with the use of land for mining or other purposes instead of its next best economic use permissible under existing land use regulations and limitations. An indication of the opportunity cost of the land can be gained from its current market value, which reflects its potential uses.

Opportunity Cost of Capital

Similar to land, capital equipment has an opportunity cost of using it for mining instead of sale. The correct measure of opportunity cost of capital equipment is its resale value. All new mining equipment that would be purchased for the Project is included in the estimates of capital costs.

Capital Cost of Mine and Infrastructure Establishment

This includes capital costs associated with the Project (i.e. open cut and underground mine development, upgrade of the CHPP, upgrade of internal road systems, and construction of rail and train loading infrastructure).

Annual Mine and Processing Operating Costs

The annual operating costs of the Project include on-site operating costs, which contains an allowance for rehabilitation, as well as off-site operating costs such as transportation.

It should be noted that while royalties are a cost to WCPL, they are part of the overall producer surplus benefit of the mining activity that is redistributed by government. Royalties have therefore not been included in the calculation of operating costs.

Economic Benefits

Sale Value of Mine Products

The estimated average annual revenue utilised planned production rates and projected coal prices.

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land may have some residual value that is of benefit to WCPL. For the purpose of this analysis capital equipment is assumed to have no residual value.

External Costs and Benefits

Potential external environmental impacts were also identified as part of the analysis. These impacts are only considered economic costs to the extent that they have the potential to affect individual and community wellbeing through direct use or non-use of resources by individuals. Where the potential impacts are mitigated such that community wellbeing is insignificantly affected, no external economic costs arise (Appendix I).

Benefit Cost Analysis

It is traditional and continuing practice in benefit cost analysis to take a nationalistic definition of society and hence to include all costs and benefits of a proposal that accrue within, in this case, Australian borders (Sinden and Thampapillai, 1995). The Project therefore results in incremental production benefits of approximately $547M accruing to Australia (Appendix I).

The main decision criterion for assessing the economic desirability of a proposal is usually the Net Present Value (NPV), which is the sum of the discounted benefits less the sum of the discounted costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to a project, because the community would obtain net benefits. In this instance, because the potential residual (i.e. post-mitigation) environmental impacts of the proposal have not been valued, the NPV represents a threshold value. The figure of $547M therefore represents the opportunity cost to Australian society of not proceeding with the proposal. Interpreted another way, any residual environmental impacts from the proposal, after mitigation by WCPL, would need to be valued at greater than $547M to make the proposal questionable from an Australian economic efficiency perspective.

This is equivalent to each household in the Hunter region being willing to pay $2,426 to avoid any of the residual environmental and social impacts of the Project, after mitigation by WCPL.

4.12.2 Regional Economic Impact

Regional economic impact assessment is primarily concerned with the effect of an impacting agent on an economy in terms of specific indicators, such as employment, income, gross regional product and gross regional output.

Existing Wambo Coal Mine Operations

It is estimated that the existing operations of the Wambo Coal Mine currently contribute in the order of (Appendix I):

- $298M in annual direct and indirect regional output or business turnover;
- $116M in annual direct and indirect regional value added;
- $51M in annual direct and indirect household income; and
- 869 regional jobs.

Project Development

The incremental, or additional, regional economic impacts of the Project are estimated to be in the order of:

- $334M in annual regional output or business turnover;
- $103M in annual value added;
- $38M in annual household income; and
- 529 regional jobs (i.e. an average of 141 direct full-time jobs and 388 indirect full-time jobs over a 21 year period).

In the absence of the Project, the economic impacts of the Wambo Coal Mine would cease in some six years time.

End of Mine Life

The construction and operation of the Project would stimulate demand in the local and regional economy leading to increased business turnover in a range of sectors and increased employment opportunities. Cessation of the Project would, however, lead to a reduction in economic activity.

The regional economic impetus of the Project may also stimulate a "virtuous cycle" of growth. This theory of regional economic growth suggests that places that are able to attract population migration create increased demands for goods and services and thus more jobs (Appendix I). The socio-economic significance of cessation of the Project would depend on the relative significance of the Project to the regional economy and other regional economic factors at the time. Impacts associated with Project cessation are likely to be greater in a declining economy than in a growing diversified economy.

The magnitude of the regional economic impacts of cessation of the Project would largely depend on whether affected workers and families leave the region. Minimisation of the impacts for the regional economy associated with mine cessation can occur through retention of displaced workers within the region, even if they remain unemployed. This is because continued expenditure by the unemployed who stay in the region would contribute to the final demand. Additional economic activities or developments would also assist in enticing displaced workers to remain in the region.

The reasonably strong growth in employment and population in the region indicates that regional economic impacts of mine cessation may be able to be absorbed by the growing economy, although adjustments would not be without social impacts at community, business and individual levels.

WCPL would work with the SSC and the community to investigate how to minimise the potential adverse socio-economic effects of a significant reduction in local employment levels and closure of the mine at the end of its life.

4.13 ABORIGINAL CULTURAL HERITAGE

A survey and assessment of Aboriginal cultural heritage within the Project area was conducted (Appendix D) and the findings are summarised in Section 3.10.2.

The survey was conducted in conjunction with local Aboriginal groups (the Upper Hunter Wonnarua Council, the Lower Wonnarua Tribal Council, the Wanaruah Local Aboriginal Land Council (LALC), the Ungooroo Aboriginal Corporation, the Combined Council of Hunter Valley Elders and the Wonnarua Nation Aboriginal Corporation) with a number of Aboriginal cultural heritage sites and isolated Aboriginal objects being identified.

The following discussion focuses on the potential impacts and mitigation measures applicable to the Aboriginal cultural heritage sites identified in the surveys (Figure 4-21).

Potential Impacts

Potential impacts include those associated with the Project surface development area, subsidence from underground mining operation areas, rail spur, realignment of Wallaby Scrub road and the construction of the water control system.

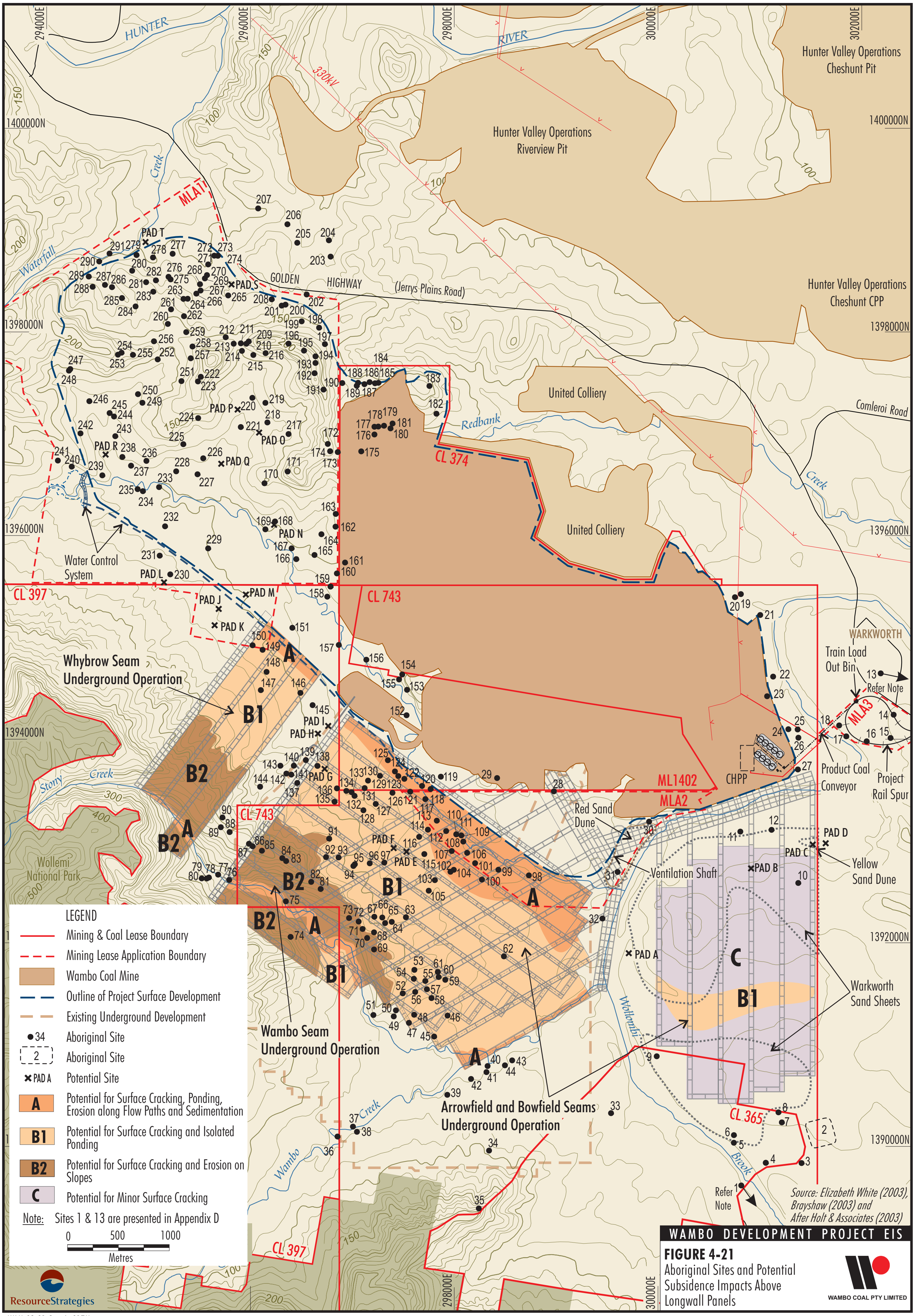
Project Surface Development

Aboriginal objects were identified at Sites 23, 28-29, 119, 151-174, 190-201, 208-229, 232-339 and 242-289 located within the Project surface development area. In addition, Aboriginal objects were recorded within an undisturbed portion of land located within the existing Wambo Coal Mine working areas (Sites 175-190). Project surface development (e.g. open cut and mine waste rock emplacement operations) would require the disturbance of these sites (Figure 4-21). In addition to these identified sites, six potential sites, PAD M – PAD S were recorded within the surface development area. PAD sites are sites with a high potential for containing Aboriginal objects due to factors including landscape setting and the presence of raw materials. As the Project surface development would damage or destroy Aboriginal objects, consent to destroy all sites located within this area would be sought under section 90 of the *National Parks and Wildlife Act 1979 (NPW Act)*.

Underground Mining Operation Areas

Potential impacts from underground mining operations have been identified in Zones A, B1, B2 and C as illustrated on Figure 4-21. The potential impacts of subsidence are discussed further in Appendix O. The effect of these impacts on Aboriginal objects is summarised below and described further in Appendix D.

Aboriginal objects were recorded at Sites 75, 98-102, 104, 106-114, 117-118 and 120-125 located within subsidence Zone A (Figure 4-21). The potential impacts on Aboriginal objects within subsidence Zone A have been identified as cracking, ponding, erosion along flow paths and sedimentation. These impacts have the potential to damage or destroy Aboriginal objects located in Zone A, however some sites may remain unaffected.



WAMBO DEVELOPMENT PROJECT EIS

FIGURE 4-21
Aboriginal Sites and Potential Subsidence Impacts Above Longwall Panels

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As the impacts of the underground mining operations could potentially damage Aboriginal objects, consent to destroy all sites located within Zone A would be sought under section 90 of the *NPW Act.*

Potential impacts on Aboriginal objects within subsidence Zone B1 include cracking and isolated ponding. Aboriginal objects were recorded at 49 sites, namely, 45-48, 52-68, 91-97, 103, 105, 115-116, 126-136, 138, and 146-150 in Zone B1 (Figure 4-21). In addition, three potential sites (PAD E – PAD G) were recorded. The potential impacts of underground mining operations in Zone B1 have the potential to damage or destroy Aboriginal objects, however some sites may remain unaffected. As the impacts of the underground mining operations could potentially damage Aboriginal objects, consent to destroy all sites located within Zone B1 would be sought under section 90 of the *NPW Act.*

Potential impacts from underground mining operations in Zone B2 include cracking and erosion on slopes. These effects may impact on Sites 69-74 and 81-85 (Figure 4-21). Consequently consent to destroy all sites located within Zone B2 would be sought under section 90 of the *NPW Act.*

Only one site (Site 10) containing Aboriginal objects and one potential site (PAD B) were recorded within Zone C (Figure 4-21). The potential effects of subsidence in Zone C include minor surface cracking. These surface effects are not expected to damage or destroy Aboriginal objects located in Zone C.

Infrastructure Areas

As part of the Project detailed design phase the final alignment of the rail spur, Wallaby Scrub Road intersection and water control structure would be determined. Prior to construction, pre-clearance surveys would be conducted to identify Aboriginal objects located within the footprint of these works. Consent to destroy would be sought under section 90 of the *NPW Act* for Aboriginal objects unable to be avoided by these Project components.

Mitigation Measures

The mitigation measures detailed below were developed in consultation with the Upper Hunter Wonnarua Council (also representing the Wonnarua Nation Aboriginal Corporation), the Lower Wonnarua Tribal Council, the Wanaruah LALC, the Ungooroo Aboriginal Corporation, and the Combined Council of Hunter Valley Elders both during and after the Aboriginal cultural heritage survey.

The consultation process is documented in Appendix D.

In recognition of issues raised during the consultation process with Aboriginal groups and based on the results of the archaeological studies a number of modifications were made to the Project layout including (Figure 4-21):

- Limiting the southern extent of the underground mining operations east of Wollombi Brook in the vicinity of the Ceremonial Ground (Site 2) and Sites 1 and 3-9 (associated with Site 2) so that there are no Project-related impacts.
- Relocating the extent of surface development west of Wollombi Brook so as to avoid the disturbance of two large open sites (Sites 30 and 31).
- Modifying the extent of the Project surface development and underground mining operations areas to avoid the red and yellow sand dunes.
- Fencing Site 32 (a scar tree) to ensure no impact from surface development.
- Withdrawing the surface development back from Waterfall Creek to avoid Sites 290 and 291. These sites would be fenced.
- Aligning the rail spur, the Wallaby Scrub Road intersection and the water control system so to avoid Aboriginal objects wherever possible (after formal surveying).

Mitigation measures for Aboriginal cultural heritage objects which cannot be avoided by the Project were also discussed during consultation with the Aboriginal community (Appendix D). Consent would be sought under section 90 of the *NPW Act* to cover the life of the mine to allow for staged archaeological works. Mitigation measures for Aboriginal objects which would be impacted include:

- Prior to disturbance, Aboriginal objects located within the Project surface development footprint would be collected and relocated to a “Keeping Place” where the objects would be analysed, documented and stored. Excavation, analysis and reporting would occur at Sites 154, 168/PADN, 239, PAD R, 247-248, 258-259, 263, 268, 286-287 (Figure 4-21). Aboriginal objects would be replaced in the landscape once final rehabilitation works are completed. The above process would be documented in the Aboriginal Cultural Heritage Management Plan as outlined in Section 6.2.10.

- Monitoring of Aboriginal objects located within the underground mining operations areas (Figure 4-21) would occur to determine impacts from subsidence and would be undertaken by members of the Aboriginal community. Any Aboriginal objects likely to be impacted by subsidence would be collected, documented and stored in the "Keeping Place". Collected objects would be returned to the landscape once final rehabilitation works are completed. The above process would be documented in the Aboriginal Cultural Heritage Management Plan as outlined in Section 6.2.10.

4.14 NON-ABORIGINAL HERITAGE

4.14.1 Wambo Homestead Complex (WHC)

An assessment of the heritage value of the WHC was conducted in 1994 and the WHC was subsequently listed on the State Heritage Register. The details of this listing are provided in Section 3.11.1 and Appendix C.

Current Status

The heritage status of the WHC has been reviewed to reflect the current setting and condition of the buildings (Appendix C). The heritage significance of the WHC has diminished over the last decade due to changes in the physical surrounds and setting of the WHC. A discussion of the current physical attributes of the WHC is provided in Section 3.11.1.

Project Impacts

The WHC and surrounding grounds are located within the Project open cut mining area. As presented on Figure 2-8, surface development within the WHC curtilage is planned to commence during Year 9. The impacts of open cut mining operations include destruction of the buildings (if they are not relocated), and modification of the surrounding landscape. In addition, the WHC would be subject to blasting and vibration impacts when open cut mining is scheduled to commence in the vicinity of the WHC during Year 2.

Underground mining operations (Wambo, Arrowfield and Bowfield Seams) under the WHC are scheduled to occur after surface disturbance of the WHC.

The rehabilitation programme outlined in Section 5 comprises substantial areas of native woodland to enhance flora and fauna values in the surrounding area. The land in the vicinity of the WHC would form part of a future wildlife corridor between the Wollemi National Park and the vegetation remnants to the east. Rehabilitation works would further erode the pastoral setting of the WHC which is a major component of its significance.

Restricted Proposal

An alternative to the Project has been considered whereby mining operations would be restricted to areas beyond the WHC curtilage (Attachment C-A of Appendix C). However, this proposal would not eliminate the ongoing trend of diminishing heritage value and would result in substantial economic losses from the sterilisation of coal reserves under the WHC curtilage.

Further details of the restricted mining alternative are provided in Section 1.7.2.

Heritage Impacts

Restriction of mining operations to areas outside the curtilage of the WHC would ensure the retention of buildings comprising the WHC. However, the impact on heritage value would be significant given that access by the public and any future use of the WHC would be restricted. Additionally, vibration and safety issues would exclude any practical use of the WHC and increase expenditure with regard to maintenance and upkeep of the buildings and property (Appendix C).

The aesthetic value of the WHC relates to the landscape setting, orientation of the building, its form, scale, colour, texture and material of the fabric, the smells and sounds associated with the place and its use, and the emotional response to these attributes. It would be difficult to retain this value under a restricted mining proposal (Appendix C).

A restricted mining proposal would significantly affect the setting and heritage significance of the WHC both in the short and long-term. The fragile condition of the buildings and their location adjacent to both the existing mining operation and Project area would further restrict access by users and the public due to safety requirements around the mining operations and the permanent landform modifications that would result from mining operations.

Economic Impacts

In addition to heritage impacts, a restricted mining proposal would have a significant economic impact.

Under a restricted mining proposal open cut mining operations must stand back from the WHC and its curtilage and prescribed blasting buffer zones, due to the potential for deleterious effects caused by blasting during open cut mining.

Blasting buffer zones for MIC 1,600 kg and MIC 400 kg blast designs (Attachment C-A of Appendix C) are calculated as the minimum distances from the WHC where blasts can be fired and not exceed the criteria for sensitive and heritage sites of 5 mm/s PVS (Appendix A) at the WHC.

The practicable minimum blast design is MIC 400 kg, therefore coal located within the MIC 400 kg blasting buffer zone (Appendix C) would not be able to be mined using conventional open cut blasting techniques. The coal located outside the MIC 400 kg blasting buffer zone, but within the MIC 1,600 kg blasting buffer zone, would be mined (using a modified blast design of nominal MIC 400 kg) but at an increase in drilling and blasting costs.

The four target open cut mining coal seams located within the WHC curtilage are the Whybrow, Redbank Creek, Wambo and Whynot Seams (Section 2.1). Table 4-20 details the coal reserves within the two buffer zones.

It is not feasible to mine these seams by methods other than conventional open cut techniques. In the WHC curtilage, the Redbank Creek, Wambo and Whynot seams do not have a working section of sufficient thickness to support underground mining methods and the Whybrow seam does not have a sufficient reserve to support underground mining operations.

Table 4-20
Coal Reserves Located within Blasting Buffer Zones

Coal Seam	MIC 1,600 kg Saleable Tonnes ('000)	MIC 400 kg Saleable Tonnes ('000)
Whybrow	2,440	1,660
Redbank Creek	3,820	1,730
Wambo	4,260	1,790
Whynot	2,720	1,030
Total	**13,240**	**6,210**

Source: WCPL (2003)

At a coal price of A$48 per tonne, not mining the area within the MIC 400 kg blasting zone (some 6.2 Mt of coal) results in a loss to the NSW economy of A$298 million. The royalty payable to the NSW Government on this coal would equate to A$10.6 million. A further (approximately) 7 Mt of coal (located between the buffer zones) would be more expensive to mine. The net effect of this is that a portion of this 7 Mt of coal would be rendered uneconomic.

The preservation of the WHC and curtilage would also sterilise reserves in the Wambo, Arrowfield and Bowfield Seam Underground Mines (Section 2.6). The coal sterilised is that in the longwall panels which if mined would cause subsidence of the curtilage area. The mine development or first workings could proceed underneath the curtilage without causing surface subsidence. Table 4-21 details the underground coal reserves that would be sterilised by a restricted mining proposal.

Table 4-21
Underground Coal Reserves Located within the Wambo Homestead Complex Curtilage

Coal Seam	Saleable Tonnes ('000)
Wambo	440
Arrowfield	1,210
Bowfield	1,510
Total	**3,160**

Source: WCPL (2003)

At a coal price of A$48 per tonne[1], not mining these reserves (some 3.16 Mt of coal) results in a loss to the NSW economy of A$152 million. The royalty payable to the NSW Government on this coal would equate to A$5.4 million.

1 Based on historic and current contract coal prices (weighted average) and future market considerations (WCPL, 2003).

The total loss to the NSW economy and the loss of royalty is shown in Table 4-22.

Table 4-22
Economic Impact of Loss of Mining Reserves

Mining Method	Loss to NSW Economy (A$M)	Loss of Royalty (A$M)
Underground	152	5.4
Open Cut	298	10.6
Total	**450**	**16**

Source: WCPL (2003)

Relocation Proposal

It is proposed to relocate the WHC to other locations both within the Singleton LGA and the wider Hunter region. The form of relocation would be dependent on both the nature and characteristics of the element to be relocated and the relocation destination.

Relocation or protective measures would occur prior to physical damage to the WHC. Blast and vibration impacts may occur due to open cut mining operations scheduled to commence in the vicinity of the WHC during Year 2 (Figure 2-5). Relocation would likely occur in a staged manner between Year 2 and Year 9 (prior to mining of the WHC curtilage). Where impacts from blasting and vibration are likely to occur, protective measures would be undertaken.

For a number of the individual elements/buildings in the WHC (Appendix C) substantial relocation and re-erection is desirable and would be of benefit by simply retaining the physical and technical significance of the structure at another location where it can be available for public access and interpretation. In this regard it is proposed to substantially relocate the following items (Attachment C-B of Appendix C contains listing details):

- Stud Master's Cottage;
- Slab Horse Boxes;
- Butcher's Hut;
- Carriage House; and
- Mounting Yards.

Relocation sites would be selected through a consultative process with the SSC, Tourism Singleton, the local community and stakeholders in the Hunter region. Interest has already been registered by members of the Project CCC in regard to relocating part of the WHC to Jerrys Plains.

For the remaining components of the WHC the relocation proposal would involve relocation of substantial elemental fabric. All significant fabric which retains its integrity would be salvaged and used elsewhere for interpretation purposes. Sandstone flagging, timber joinery, timber roof structures and sandstock bricks can be used at other local historic sites to repair and reinstate lost elements with the addition of interpretative plaques and material to identify the material as originally from the WHC. Additionally, this material could be used in conjunction with some of the relocated items to enhance their provenance or as fabric available for re-use on other Heritage listed properties (e.g. repair projects). The following components of the WHC would be treated in this manner:

- Servants' Wing (a significant amount of original fabric as already been lost due to environmental and decay factors);
- Kitchen Wing; and
- New House.

A consultative process as described above would be followed in determining appropriate relocation sites and projects for interpretation purposes and for the re-use of fabric.

Native vegetation located within the WHC is unlikely to be feasibly relocated. It is envisaged that gardens planted with the original vegetation type would be established in the relocation areas to give a level of context of the original landscape setting, design and character.

It would not be feasible to re-establish the WHC in its original location after mining. The settling of the mine waste rock emplacements would not provide a landform which would ensure the structural integrity of the WHC building. In addition, the pastoral setting would be diminished due to the Project rehabilitation programme (Section 5).

4.14.2 Other Non-Aboriginal Heritage

A description of other items of non-Aboriginal heritage identified in the Project area is provided in Section 3.11.2 and Appendix C.

Potential Impacts

As outlined in Section 3.11.2, 12 non-Aboriginal heritage items were identified in the Project area and surrounds. Sites that may be affected by the Project are discussed below.

Open Cut Mining Operations Area

Two heritage items (Site 1 and Site 2) were identified within the open cut mining operations area. Both sites are abandoned grain silo and shed complexes and are considered to be in poor physical condition (Figure 3-9).

One movable heritage item (Site 9) was also identified within the open cut mining operations area. Site 9 is an abandoned Massey Ferguson tractor (Figure 3-9).

Underground Mining Operations Areas

One heritage item was recorded within the underground mining operations area. Site 3 (Figure 3-9) is an abandoned homestead building. Impacts from subsidence are likely to exacerbate the dilapidated condition of the building.

Rail Spur and Realignment of Wallaby Scrub Road

Two heritage items were identified in the vicinity of the rail spur. Site 5 is an abandoned homestead building and Site 6 consists of a timber piggery and butchers hut (Figure 3-9).

An aerial footing (Site 7) located in the vicinity of the Project rail spur may be affected by construction works. No mitigation measures are considered necessary for this site.

The realignment of Wallaby Scrub Road would not affect any identified heritage sites.

Mitigation Measures

The following mitigation measures (Appendix C) would be implemented for the above heritage items identified within the Project disturbance areas:

- Prior to disturbance, heritage Sites 1, 2 and 3 would be recorded to an archival standard (written description and photographic record). These records would be provided to Tourism Singleton and the State Library of NSW.
- Prior to construction of the rail spur, Sites 5 and 6 would be identified and avoided during both the construction and operation of the rail spur. If this is not practicable, Sites 5 and 6 would be managed as per Sites 1, 2 and 3 above.
- Where moveable heritage items are likely to be disturbed (Site 9), they would be placed in a permanent repository, in consultation with the relevant stakeholders.

4.15 ROAD TRANSPORT

Project-related traffic impacts on the local road network are assessed in Appendix M and summarised below.

4.15.1 Project Generated Traffic

Table 4-23 summarises predicted daily vehicle movements generated by the initial development and peak production periods of the Project and compares them to the Wambo Coal Mine. Light vehicle estimates presented in Table 4-23 assume that 90% of staff access the site on any given day and some car pooling (i.e. 85% car usage).

Initial development activities would be completed within approximately two years and would involve the construction of Project rail and train loading infrastructure and the continuation of current open cut mining operations. In the order of 100 people would be employed during the construction of Project rail and train loading infrastructure, which would be undertaken generally during daytime hours up to seven days per week. Predicted traffic generation for this period would comprise an increase in both light and heavy vehicle movements.

During the peak production period increased levels of employment would result in an increase in light vehicle traffic movements. The increased volumes of light vehicle traffic generated by the Project during this period would be offset by the removal of in the order of 160,000 annual coal haulage movements following the commissioning of Project rail and train loading infrastructure. Predicted traffic generation for this period would comprise a net decrease in total vehicle movements.

Traffic generated by the Project is predicted to originate predominantly from the regional centres of Singleton, Cessnock and Maitland and, to a lesser extent, from Newcastle (Appendix M). Table 4-24 presents predicted daily traffic flows on the local road network for the peak Project traffic generation periods. The predicted distribution of Project traffic assumes that 100% of heavy vehicles and 90% of light vehicles would travel to and from the east along the Golden Highway (i.e. the workforce and supplies would originate predominantly from Singleton, Cessnock, Maitland and Newcastle).

Examination of turning movements at the Wambo Access Road/Golden Highway intersection indicates that during periods of peak Project traffic generation (i.e. a peak coal haulage campaign during the initial development period), the intersection would continue to operate at a level of service with acceptable delays and spare capacity during morning and afternoon peak periods.

Peak hour flows would be lower during the peak production period, as road haulage of product coal would have ceased, significantly reducing the number of truck movements into and out of the site.

Table 4-23
Estimated Daily Vehicle Movements – Existing and Project Peak Traffic Generation

Period	Employment	Traffic Movements		
		Light	Heavy	Total
Wambo Coal Mine Includes workforce light vehicle movement, average coal haulage movements and heavy vehicle deliveries.	137	164	484*	648
Initial Development Continuation of the operation of the Wambo Coal Mine with additional Project construction traffic. Existing levels of coal haulage on the public road network would continue until Project rail and train loading infrastructure is commissioned.	245	375	544*	919
Peak Production Coal haulage on the public road network would have ceased. Project traffic generation would be largely limited to light vehicle movements and consumable deliveries.	370	566	60	626

Source: Appendix M
* Includes existing average coal haulage movements between the Wambo Coal Mine and MTCL.

Table 4-24
Predicted Peak Period Daily Traffic Flows on the Local Road Network

RTA Station Number	Location Description	Baseline Total Traffic Movements[1]	Initial Development Period	% Change (rounded)	Peak Production Period	% Change (rounded)
5485	Golden Highway at Hunter River Bridge	2,337	2,344	0	2,352	1
-	Golden Highway at Pinegrove Road	2,300	2,321	1	2,340	2
-	Golden Highway east of the United Colliery Haul Road	3,824	3,845	1	3,864	1
-	Golden Highway at Wallaby Scrub Road	4,456	4,706	6	4,390	-1
5481	Golden Highway North of Putty Road	7,219	7,463	3	7,153	-1
5638	Golden Highway/Putty Road east of Mount Thorley	8,126	8,370	3	8,060	-1
-	Wambo Coal Mine Access Road	648	919	42	626	-3
5840	Wallaby Scrub Road 900m south of Golden Highway	660	666	1	660	0
05167	Putty Road – south of Milbrodale	793	793	0	793	0

Source: Appendix M
[1] Includes traffic currently generated by the Wambo Coal Mine.

4.15.2 Management Measures

All works undertaken on the public road network as part of the Project would be undertaken by a RTA-approved contractor in accordance with relevant RTA and Austroads design standards and relevant quality assurance specifications. Potential impacts arising from works affecting the public road network would be managed in accordance with a Traffic Management Plan that would be prepared in consultation with the relevant authorities. The Traffic Management Plan would contain detailed engineering plans for Project roadworks and traffic control measures to be adopted during roadworks. Details relating to the management of the closure or partial closure of public roads would be included as necessary. Road closure issues to be addressed include:

- method of road closure;
- signage providing advance warning and at the road closure;
- review of traffic volumes;
- lengths of closures and expected queue lengths;
- access for emergency services;
- notification process; and
- monitoring and reporting requirements.

The Traffic Management Plan would address blasting-related road closures on the Golden Highway and would be developed in consultation with the RTA and in accordance with the RTA *Traffic Control at Worksites Manual.*

4.16 HAZARD AND RISK

A preliminary hazard analysis (PHA) was conducted to gain an understanding of the potential hazards and risks associated with the Project (Appendix K). The PHA was conducted in accordance with the general principles of risk evaluation and assessment provided in the PlanningNSW guidelines for *Multi-Level Risk Assessment* (DUAP, 1999).

4.16.1 Hazard Identification and Risk Assessment

Potentially hazardous materials required for the Project are generally limited to conventional explosives and diesel. The annual explosive consumption for the Project would be approximately double the existing usage at the Wambo Coal Mine. Consequently the delivery of materials used to produce explosives would increase. Additional diesel transport requirements and increased diesel storage and usage would also be required.
The incremental risks posed by the usage of these materials for the Project would include increases in their transport, handling and consumption.

For the purposes of risk identification, the Project was subdivided into a number of operational areas (Appendix K) and potential incidents were identified and divided into generic classes for each operational area including:

- fire;
- explosion;
- leaks/spills;
- theft;
- unexpected rapid subsidence;
- unplanned movement to off-site; and
- vehicle accident.

The potential risks identified in the PHA related to the following Project elements/activities:

- development of the Project open cut and mine waste rock emplacements (e.g. fires, leaks/spills, explosions and unplanned movement to off-site);
- Project underground mining operations (e.g. unexpected rapid subsidence);
- CHPP (e.g. leaks/spills);
- transport of general or potentially hazardous goods to site, on-site and from site (e.g. fires, leaks/spills, theft and vehicle accident); and
- increase in diesel and explosive consumption and additional storage facilities (e.g. fire and leaks/spills).

Following the identification of the potential hazards associated with the Project, a qualitative assessment of risks to the public, property and the environment associated with the development and operation of the Project was undertaken (Appendix K). Incremental risks were also assessed by comparing the Project risks with those at the existing Wambo Coal Mine.

Given the in-place or proposed mitigation measures outlined below and considering that the incremental Project risks associated with some increase in consumable usage and storage are more than off-set by the cessation of road coal transport, no incremental risks posing significant off-site impacts have been identified.

4.16.2 Hazard Prevention and Mitigation Measures

A number of hazard prevention and mitigation measures are currently in-place for the existing Wambo Coal Mine. These measures are documented in the existing Wambo Coal Mine management plans including:

- Mining Operation Plan;
- Open Cut Mine Environmental Management Plan;
- Open Cut Emergency Procedures;
- Wollemi Underground Mine Environmental Management Plan;
- Wollemi Underground Mine Emergency Response Manual;
- Coal Handling and Preparation Plant Environmental Management Plan;
- Coal Handling and Preparation Plant Emergency Response Procedure (Draft);
- Wambo Coal Mine Spontaneous Combustion Plan; and
- Bushfire Management Plan.

The above plans would be revised where necessary to address the Project requirements.

The following hazard mitigation and/or preventative measures would be adopted by WCPL to reduce the likelihood and/or consequences of potentially hazardous incidents associated with the Project:

- **Maintenance** – Ongoing and timely maintenance of all mobile and fixed plant and equipment in accordance with the recommended maintenance schedule. Only vehicles permitted to carry dangerous goods would be used for explosive transport.
- **Staff Training** – Operators and drivers would be trained and (where appropriate) licensed for their positions. Only those personnel licensed to undertake skilled and potentially hazardous work would be permitted to do so.
- **Rail Spur and Coal Terminal** – Construction of the Project rail spur and coal terminal would provide a method of product coal transport that does not include public road haulage. This would significantly reduce the number of truck movements on the 13 km public road route to the MTCL and thereby reduce the potential for vehicle accidents.
- **Engineering Structures** – Mining and civil engineering structures would be constructed in accordance with applicable codes, guidelines and Australian Standards. Where applicable, WCPL would obtain the necessary licences and permits for engineering structures (e.g. Dam Safety Committee approvals).
- **Blast Management** – As reported in Appendix A, site specific management measures would be implemented to reduce the potential for off-site impacts of blast vibration and overpressure. These include temporary closures of a short section of the Golden Highway when open cut blasting is within 500 m of the road. These brief closures would be undertaken in accordance with RTA traffic control requirements and would halt vehicle traffic for 15 to 20 minutes per blast.
- **Water Management** – As reported in Appendix E, water management structures would be constructed to separate runoff from undisturbed areas and disturbed areas. Components of the existing Wambo Coal Mine water management system would be upgraded to include the Project (Section 4.6). The collection drain and sediment retention storage system would be designed and constructed with capacity to contain potential spills or fire suppression water runoff within operational areas.

- **Realignment of Wallaby Scrub Road Intersection** – The intersection of Wallaby Scrub Road and the Golden Highway would be realigned to allow construction of the Project rail loop. The relocated intersection would be constructed with improved intersection geometry in accordance with RTA requirements (Section 2.4.4).
- **Consultation with United Colliery** – Due to the close proximity of the Wambo Coal Mine and United Colliery operations, WCPL and United Collieries Pty Ltd have a range of protocols that have been developed to minimise the risks to the neighbouring operation from activities such as blasting, dewatering and mine subsidence.
- **Emergency Response** – Revision of the existing emergency response procedures manuals and systems to include consideration of the expanded Project operations.
- **Storage Facilities** – Existing fuel and lubricant storage facilities would be upgraded to accommodate any increases in consumption that may be required for the Project.

WAMBO DEVELOPMENT PROJECT

ENVIRONMENTAL IMPACT STATEMENT

MAIN REPORT

Section Five
Rehabilitation

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5 REHABILITATION

This section outlines the proposed concepts for the final rehabilitation of areas to be disturbed by the Project. As a prescribed condition under the *Mining Act, 1992*, rehabilitation is subject to regulatory authority agreement and approval. The rehabilitation programme, final landform design and revegetation strategy presented in this section should be regarded as conceptual to allow a degree of flexibility for consideration of future research and design studies. Final rehabilitation requirements would ultimately be formulated in consultation with key government authorities and other relevant stakeholders and reported in the Mining Operation Plan (MOP) for approval prior to implementation. The MOP would include detailed mining and rehabilitation plans, environmental controls and compliance procedures as described in Section 6.1.1.

5.1 REHABILITATION PRINCIPLES AND OBJECTIVES

5.1.1 Project Rehabilitation Principles

The following principles would form the basis for Project rehabilitation planning and design:

- 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 mine 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* (DMR, 1999).
- Consideration of issues of public safety in the design of final landforms.
- Consultation with the relevant authorities (e.g. DMR, DLWC and NPWS), SSC and the Project 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.

5.1.2 Project Rehabilitation Objectives

Rehabilitation objectives for the Project 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 the Project with the eastern borders of Wollemi National Park;
- preservation of existing beneficial use of water resources; and
- development of a sustainable post-mining land use plan towards the end of the Project life.

5.1.3 Local and Regional Planning Instruments

Relevant planning instruments and guidelines include the following:

- *Singleton Local Environmental Plan,* 1996 (LEP) under the EP&A Act;
- *Hunter Regional Environmental Plan,* 1989 (REP) under the EP&A Act;
- *Integrated Catchment Management Plan for the Hunter Catchment 2002* (ICMP) (HCMT, 2002b); and
- *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (Synoptic Plan) (DMR, 1999).

The following land use objectives relevant to Project rehabilitation planning have been established for lands zoned Rural 1(a) under the Singleton LEP:

(a) *to protect and conserve agricultural land and to encourage continuing viable and sustainable agricultural land use;*

(b) *to promote the protection and preservation of natural ecological systems and processes;*

(c) *to allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining;*

(d) *to maintain the scenic amenity and landscape quality of the area; and*

(e) *to provide for the proper and co-ordinated use of rivers and water catchment areas.*

Relevant to Project rehabilitation planning the Hunter REP aims to:

(a) *to promote the balanced development of the region, the improvement of its urban and rural environments and the orderly and economic development and optimum use of its land and other resources, consistent with conservation of natural and man-made features and so as to meet the needs and aspirations of the community.*

The ICMP was completed in July 2002 to address key natural resource management issues in the Hunter River catchment. Relevant to Project rehabilitation planning this document establishes natural resource management targets that, by 2012, specifically aim to:

- improve water quality by improving streambank stability and vegetation along 125 km of streams in a variety of catchments, including the Wollombi Brook catchment;
- increase the area of native vegetation cover by 12,700 ha in the riverine corridor, the valley floor and the Merriwa plateau, while protecting regionally significant vegetation from further clearing;
- increase deep rooted vegetation and/or permanent groundcover by 7,500 ha on salinity recharge areas and discharge sites in priority areas in a number of catchments, including the Wollombi Brook catchment; and
- improve land management practices on highly erodible soils in areas including the Wollombi Brook catchment through an increase in native vegetation cover by 5,000 ha and rehabilitation of 550 ha of existing major erosion sites.

The Synoptic Plan was developed to provide a basis for the development of a long-term integrated strategy for the rehabilitation of coal mines in the Hunter Valley.

The Synoptic Plan proposes objectives for mine rehabilitation including:

- creation of a stable final landform;
- facilitation of a sustainable post-mining land use;
- mitigation of visual impacts and enhancement of landscape amenity; and
- preservation of downstream of water quality.

The Synoptic Plan also presents a strategy to coordinate rehabilitation across coal mines within the region to achieve multiple regional objectives including visual amenity, biodiversity and sustainable post-mining land use. This strategy identifies the following priorities for rehabilitation:

- Establishment of vegetated corridors across the Hunter Valley, taking into account issues such as topography, soils, water availability, mine operations planning and intended post-mining land use.
- Creation of landform elements, such as drainage paths, contour drains, ridgelines, emplacements and visual bunds in keeping with the surrounding environment.
- Establishment of clear objectives in relation to interim and post-mining land use.

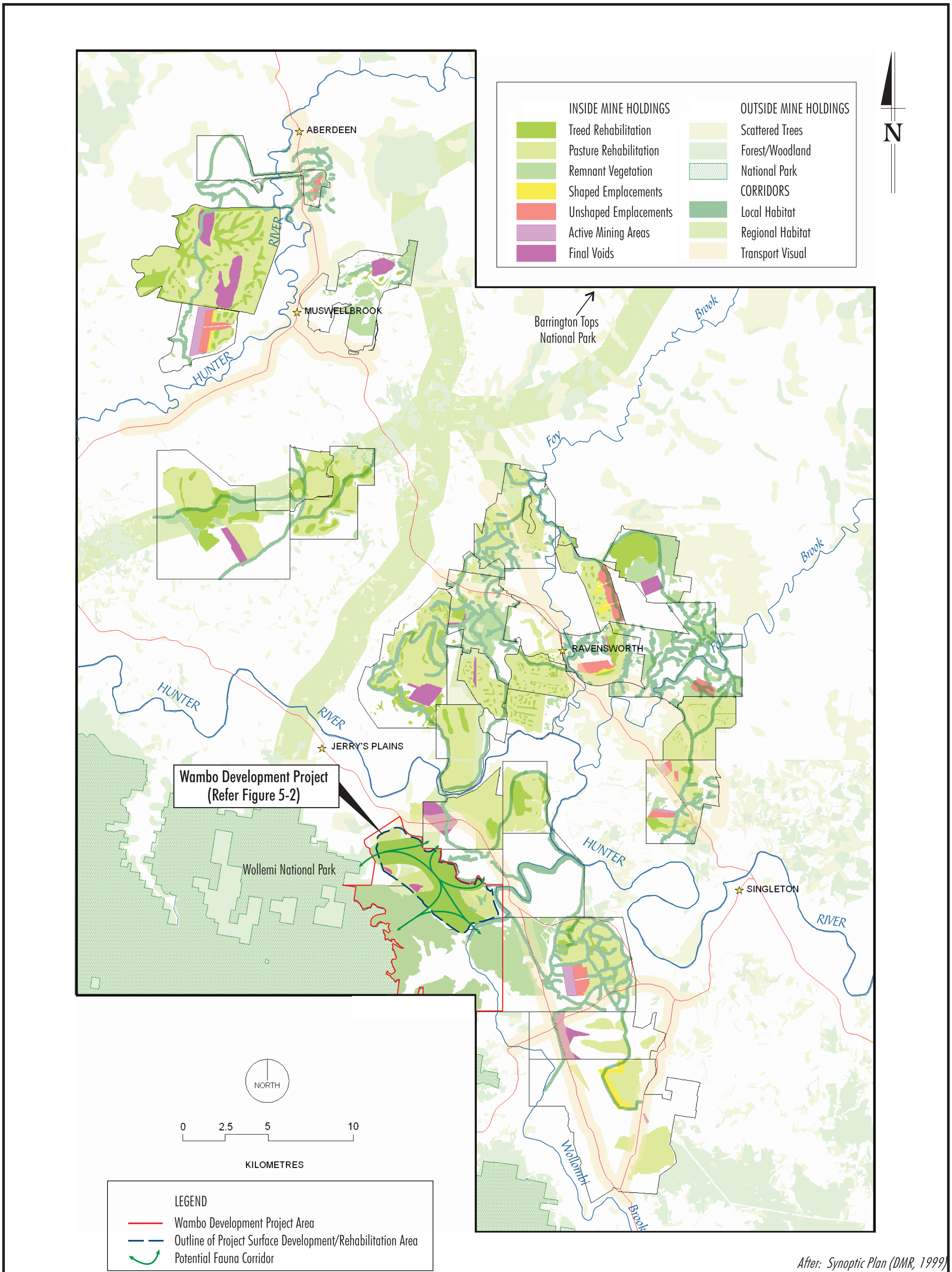
Figure 5-1 shows the concept contained in the Synoptic Plan for integrated landscape rehabilitation across the Upper Hunter Valley. Figure 5-1 also shows how the rehabilitation and revegetation concepts developed for the Project would fit within this integrated landscape.

5.2 PROJECT REHABILITATION PROGRAMME

5.2.1 Rehabilitation Goals and Planning

Consistent with the principles and objectives outlined in Section 5.1, the following interim set of rehabilitation goals would be established for the Project. These goals would require:

- the area of land requiring disturbance to be kept to a practicable minimum;
- previously disturbed areas to be rehabilitated as soon as practicable;
- soil erosion to be controlled to regulatory standards;



After: Synoptic Plan (DMR, 1999)

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FIGURE 5-1
Concept for Integrated Landscape Rehabilitation

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- any impacts on surface water quantity or quality to conform to regulatory requirements and not compromise existing beneficial use;
- the entrances to underground workings (i.e. portals, drift accesses and ventilation shafts) to be made safe so that, in the long-term, human activities and land management practices are not compromised;
- the restriction of livestock access to Project rehabilitation areas while growth is stabilised and the preclusion of livestock from selected areas identified for enhancement and regeneration;
- the creation of appropriate post-mining landforms and the use of appropriate plant species to facilitate proposed final land uses (e.g. pastures and woodlands); and
- the linkage of existing remnant woodland to woodland rehabilitation areas using corridor planting of endemic plant species including Box, Ironbark, *Casuarina* and *Allocasuarina* species found within the Project area and surrounds.

Rehabilitation planning would encompass:

- the production and periodic updating of rehabilitation plans as part of the MOP process;
- the preparation and revision of rehabilitation objectives and corresponding budgets by a site team that includes senior management representatives;
- the development of implementation schedules and specific “domain” based rehabilitation plans to guide the execution of rehabilitation works; and
- annual reporting in the AEMR (refer Section 6.1.2).

5.2.2 Progressive Rehabilitation

As the Project is developed both land disturbance and rehabilitation would occur progressively as detailed in Section 2 and shown on Figures 2-5 to 2-10.

The amount of disturbed land at any one time would primarily be associated with the advancing open pit and active mine waste rock emplacement areas.

As an integral component of staged mining operations, rehabilitation of the mine waste rock emplacements and other areas of disturbance would be conducted progressively over the life of the Project and would be scheduled to occur as soon as possible to minimise the disturbed area at any point in time. Particular focus would be placed on the outer batters of the mine waste rock emplacements. Cover crops would also be applied to incomplete mine waste rock emplacement areas where they may remain inactive for an extended period. These measures would reduce the visual impact of the Project and minimise the potential for generation of wind blown dust and sediment-laden runoff.

Progressive rehabilitation of mine waste rock emplacements during the first nine years of the Project (Figures 2-5 to 2-8) would focus on revegetation with woodland species to compensate for and exceed the total area of woodland progressively cleared in the north-west of the Project area. Some 473 ha of vegetation would be progressively cleared over the life of the Project with approximately 1,570 ha of the total Project surface disturbance being revegetated with woodland species in the long-term.

5.2.3 Erosion and Sediment Control

As described in Section 6.2.3, an erosion and sediment control plan (ESCP) would be developed in consultation with the relevant authorities prior to the commencement of vegetation clearance and soil stripping activities. The ESCP would address erosion and sediment control requirements for Project landforms until the landforms are stabilised and rehabilitated.

5.2.4 Soil Removal, Handling and Placement

Topsoil resources would be identified, stripped and stockpiled. Soil resources would be stockpiled for short time periods, where practicable, and would be re-spread and seeded.

Details of soil management strategies and practices including timing of implementation and relevant methodology would be included in the MOP (Section 6.1.1) and would address the components of Table 5-1.

Table 5-1
Conceptual Soil Resource Management Strategies

Prior to Soil Stripping	During Soil Stripping and Stockpiling	Awaiting use in Rehabilitation Works
• Quantification of soil resources. • Characterisation of the suitability of material for rehabilitation works. • Formulation of stripping and stockpiling guidelines including the nomination of appropriate depths, scheduling and the location of areas to be stripped and stockpile locations.	• Minimisation of vegetation clearance. • Selective stockpiling of soil according to soil type (i.e. Great Soil Group, topsoil or subsoil). • Storage of soils in a manner that does not compromise the long-term viability of the resource.	• Implementation of measures to ensure long-term viability of the soil resources.

Source: Appendix L

Soil stockpiles would be managed to ensure long-term viability as described in Section 4.1.2.

Once the landform has been contoured, stockpiled topsoil would be respread to approximately 100 mm depth to assist in vegetation establishment and levelled in accordance with the final landform design. If topsoil is unsuitable or unavailable, appropriate ameliorative measures (as described in Section 5.2.5) would be applied.

The proposed rehabilitated area would be ripped with a chisel plough or similar implement to encourage infiltration, relieve soil compaction, increase the volume of soil readily accessible to plant roots and to bind the topsoil/subsoil to underlying overburden material. Ripping would be undertaken on contour to avoid channelised flow effects.

Where rehabilitated areas are to be seeded a suitable seedbed would, where practicable, be prepared using appropriate agricultural equipment to increase the chances for successful seedling establishment.

5.2.5 Amelioration

WCPL has developed management strategies for existing operations to ameliorate mine waste rock/soil materials used in rehabilitation where necessary. These ameliorative measures include the use of lime, gypsum and/or fertiliser to improve the chemical and/or nutrient properties of the soil. These soil management strategies would continue to be utilised in order to optimise the potential for achieving rehabilitation objectives and maintaining a stable vegetation cover.

5.2.6 Revegetation

The Project revegetation strategy is provided in Section 5.4.

On completion of landforming, topsoiling and erosion and sediment control works, a vegetative cover would be applied as soon as practicable. Depending on the post-mining land use, this would involve sowing of cover pasture species and seeding and planting of selected shrub and tree species.

Where necessary, pasture seed would be sowed with fertiliser. Areas seeded may be lightly scarified to assist shallow seed burial. Both seeding and direct planting techniques would be utilised for tree and shrub species.

Seeding and planting activities would take into account seasonal factors and would be scheduled immediately prior to the expected onset of reliable rains, where practicable.

5.2.7 Replacement of Aboriginal Objects

As described in Section 4.13 and Appendix D, Aboriginal objects collected and temporarily stored in the “Keeping Place” would be replaced within the rehabilitated areas in consultation with the local Aboriginal groups and NPWS.

5.2.8 Studies and Trials

In order to maximise the number of vegetation communities available for revegetation works, ongoing site specific rehabilitation trials and studies would be conducted to examine rehabilitation options and to optimise revegetation techniques.

These trials and studies (some of which have already been conducted for the Wambo Coal Mine) would be undertaken over the Project life and would include:

- revegetation trials addressing plant species selection;
- geochemical and physical evaluation of waste rock characteristics that may influence plant growth;
- trials of various surface treatments on mine waste rock emplacements to aid revegetation including the use of topsoil directly over waste rock, subsoil and topsoil over waste rock and the applicability of these methods for the establishment of woodland vegetation;
- investigation of the effectiveness of direct seeding and manual planting techniques on various substrates and Project landforms;
- assessment of the efficiency of various native grass, shrub and tree seed harvesting techniques; and
- examination of the application of fertilisers and herbicides during revegetation.

5.2.9 Maintenance and Monitoring

Rehabilitated areas would be fenced to prevent the uncontrolled entry of grazing animals and to minimise vehicular traffic during the initial establishment phase.

Monitoring of rehabilitated areas would be conducted on a regular basis to ensure that the rehabilitation objectives are being achieved and to identify areas requiring maintenance works in order to maintain rehabilitation progress. The Project rehabilitation programme monitoring and maintenance activities are detailed in Section 5.6.

5.3 FINAL LANDFORM DESIGN CONCEPTS

The preferred final landform concepts discussed in this section would be revised and refined throughout the life of the Project, utilising the outcomes of ongoing consultation with relevant authorities, stakeholders and the results of rehabilitation trials.

Final landform design concepts would be consistent with the objectives presented in Section 5.1.

As shown on Figure 2-10, the conceptual final landform would consist of a single, broad ridgeline with a south-east to north-west alignment, which reaches approximately 160 m AHD. Two final voids would be located on the western side of the final landform.

Final landform drainage would be designed to integrate with the surrounding catchment and would include permanent diversions and contour drains. The progressive development of the final landform over the life of the Project is shown on Figures 2-5 to 2-10.

The final landform concept proposes a balanced rehabilitation outcome, recognising the alternative land uses that exist in the region and with the aim of establishing the potential for both sustainable agriculture and endemic woodland habitat. Wherever possible, it is proposed to link existing woodland with woodland rehabilitation areas to provide corridors for the movement of fauna and to establish a net increase in woodland areas in the Hunter catchment.

Figure 5-2 illustrates the final landform concept and revegetation strategy comprising a mixture of pasture and woodland communities.

5.3.1 Mine Waste Rock Emplacements

Rehabilitation of mine waste rock emplacements would be progressive and would be undertaken as soon as practicable.

A conceptual cross section of a portion of rehabilitated mine waste rock emplacement is provided on Figure 5-3.

Mine waste rock emplacements would cover an area of approximately 1,300 ha and be rehabilitated to a final landform up to 160 m AHD. Mine waste rock emplacements would generally be constructed with an overall outer batter slope of 10 degrees (1V:5.7H). Where long slopes are present, contour drains or deep staggered rips would be established.

The surface of mine waste rock emplacements would be constructed to form a pattern of ridges and valleys. The valley areas would be shaped into a network of constructed drainage structures. Mine waste rock emplacement surfaces would be formed to maximise rainfall absorption and to minimise the requirement for artificial drainage structures. Mine waste rock emplacement berms would generally be reverse graded with perimeter bunds constructed as necessary.

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LEGEND

- Mining & Coal Lease Boundary
- Mining Lease Application Boundary
- Outline of Project Surface Development
- Permanent Pond
- A Project Remnant Woodland Enhancement Programme Area
- Potential Fauna Corridor

294000E 296000E 298000E 300000E

0 1 2
Kilometres

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FIGURE 5-2
Final Landform Concepts
and Revegetation Strategy

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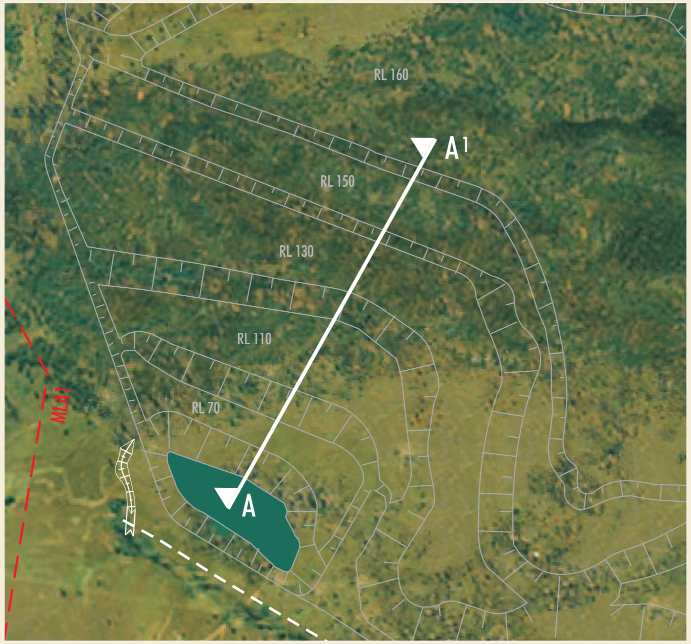


PLAN - REFER FIGURE 5-2

Rehabilitation Activities

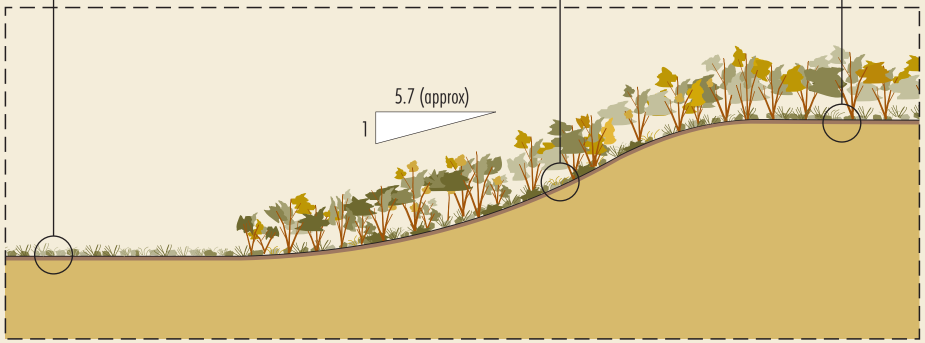
- Deep staggered ripped on contour
- Topsoil cover (where available)
- Direct seeding/planting with native grass/shrub species

Rehabilitation Activities

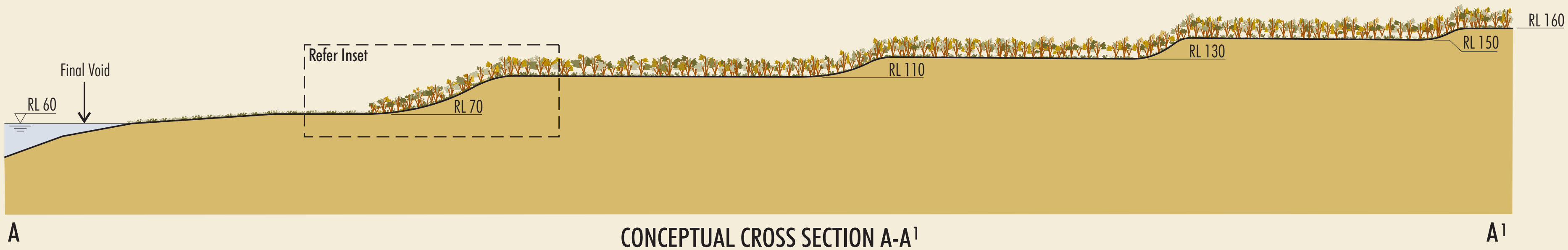
- Final outer batter to slopes of 10° (1V:5.7H approx)
- Slopes constructed to form 'S' shape with upper 20-30% convex and lower 70-80% concave
- Deep staggered ripped on contour and contour drains
- Topsoil cover (where available)
- Direct seeding/planting with native woodland and grass species

Rehabilitation Activities

- Reverse graded berm
- Deep ripped
- Topsoil cover(where available)
- Direct seeding/planting with native woodland and grass species



INSET - MINE WASTE ROCK EMPLACEMENT



CONCEPTUAL CROSS SECTION A-A1

Not to Scale

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FIGURE 5-3
Conceptual Cross Section
Mine Waste Rock Emplacement

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Natural slopes commonly evolve to form an 'S' shape as a result of natural erosion and deposition processes. Mine waste rock emplacement slopes would generally be constructed in profile to form an 'S' shape with the upper 20 to 30% being convex and the lower 70 to 80% being concave (Figure 5-3).

Following shaping of the landform the mine waste rock emplacements would be covered with approximately 100 mm of topsoil sourced from soil stockpiles or freshly stripped open cut mining areas. Site preparation works following the placement of topsoil would include chisel ploughing or deep ripping along contour, depending on the vegetation type to be established.

Mine waste rock emplacements would be progressively revegetated with a pasture cover crop and endemic woodland shrubs and trees planted on ridgelines and other selected areas, consistent with the proposed revegetation strategy (Section 5.4).

5.3.2 Tailings Disposal Areas

A detailed description of tailings disposal methods is provided in Section 2.9.3 and in Appendix G. Exhausted tailings ponds would be decommissioned either through incorporation/ encapsulation within coarse rejects and/or waste rock (Figures 2-12 and 2-13) or through a capping process in order to create a landform that is stable and can be rehabilitated as a mine waste rock emplacement as described in Section 5.3.1.

Unless justified otherwise on the basis of further cover trials, a minimum 5 m cover layer of waste rock material would be used to meet relevant DMR decommissioning criteria and to minimise the potential for plant roots reaching the underlying capping layer. Concepts would be subject to long-term stability analyses to be conducted during the mine life in consultation with the relevant authorities.

5.3.3 Surface Infrastructure

Infrastructure with no ongoing beneficial use would be removed from the site at the completion of the Project. Foundation slabs of certain buildings may be retained for suitable end-use goals in agreement with the relevant authorities and stakeholders. Alternatively, they would be excavated for disposal or buried in a void in an approved manner.

Process reagents and fuels unused at the completion of mining would be returned to the supplier in accordance with relevant safety and handling procedures.

Foundation soils would be chemically tested, contour ripped and chemically ameliorated, as required (in accordance with EPA requirements). Stockpiled soils would then be applied as necessary and stabilised. Revegetation would be undertaken with suitable endemic tree species or pastures, consistent with the Project revegetation strategy (Section 5.4).

Roads that have no specific post-mining use would be ripped, topsoiled and revegetated. Some access roads may be retained post-mining to enable access and for use in bushfire and other land management activities.

Ventilation infrastructure, including fans and vents would be removed. An accurate plan of each ventilation shaft would be prepared and the sealing/capping procedure determined in consultation with the relevant authorities and other stakeholders. Post-mining, ventilation shafts would be backfilled and sealed in accordance with DMR requirements.

Areas in the vicinity of the rail loop would be revegetated with native species characteristic of the Warkworth Sands Woodland (such as *Angophora floribunda* and *Banksia integrifolia*) to compensate for the removal of a small portion of Warkworth Sands Woodland (Section 4.8.2).

At the completion of underground mining operations all underground infrastructure (e.g. conveyors and dewatering systems) that can be recycled or reused would be removed. Groundwater levels would then commence the process of recovery. The various drift accesses and portals would be sealed to prevent the discharge of waters from the workings as they become flooded.

Portals would be sealed (or access restricted) in accordance with DMR requirements. The box cut areas would be regraded, where necessary, and revegetated using appropriate plant species.

Water management structures and sediment control structures would either be retained as wetland habitat/water features or decommissioned and rehabilitated.

5.3.4 Final Voids

At the completion of mining, the final landform would include two final voids and some minor permanent ponds on the eastern edge of the Project area (Figure 5-2).

Mine planning in the final years of open cut operations prior to mine closure would focus on battering down internal slopes and backfilling of the open cut with waste rock to minimise the size of the final voids. The surface catchment of the final voids would be minimised by the use of contour drains.

Perimeter bunding would be constructed around the final voids in order to restrict access to steeper slopes. Any further final void access restrictions (e.g. fencing) for safety and exclusion of stock would be designed and implemented in consultation with the relevant authorities.

Final void slopes and benches would be revegetated with a pasture cover crop and endemic woodland shrubs and trees consistent with the proposed revegetation strategy (Section 5.4).

A Final Void Management Plan would be developed as a component of the Mine Closure Plan in advance of mine closure and decommissioning in consultation with the relevant authorities. Further details are provided in Section 6.1.3.

5.4 REVEGETATION STRATEGY

The revegetation programme would establish significant areas (some 1,570 ha) and a net increase in woodland vegetation over the long-term (Table 4-16). The objectives of the revegetation programme are in keeping with the intent of the native vegetation/biodiversity target of the ICMP (HCMT, 2002b) to increase the amount of native vegetation, particularly in those landscapes that have been extensively cleared. The final distribution of woodland to be established on rehabilitated landforms would ultimately depend on the outcome of Project closure planning including the shape of final landforms and the agreed post closure land use.

In recognition of the importance of vegetation corridors to regional biodiversity, rehabilitation initiatives for the Project would 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 (Figure 5-2).

In doing so, WCPL would be addressing the issue of discontinuity in remnant vegetation across the Hunter Valley floor and would be contributing to the broad-scale vegetation corridor proposed to be established across the valley floor to connect Wollemi National Park with the Barrington Tops National Park (Figure 5-1). The Synoptic Plan indicates that this is a high priority for vegetation management in the region.

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, as described below.

5.4.1 Woodland Corridors

The revegetation programme would aim to re-establish as much of the floristic diversity as possible within the woodland areas. This objective is consistent with the strategic actions proposed in the Synoptic Plan (DMR, 1999). Revegetation of woodland areas would include the:

- use of endemic plant species which are characteristic of the vegetation communities to be disturbed within the open cut operations area;
- establishment of upper, mid and lower storey native vegetation; and
- use of regionally significant flora species and the ROTAP species, *Grevillea montana*, where practicable and appropriate.

A provisional list of species for use in the revegetation programme is provided in Table 5-2. This list would be used to initiate consultation with regulatory authorities and stakeholders regarding plant species selection.

5.4.2 Mixed Woodland/Pasture Areas

The areas proposed to contain a mixture of woodland and pasture would be rehabilitated in a manner that results in contiguous strips of woodland which are connected to the woodland corridors, as opposed to scattered patches of woodland within the pasture areas. The strips of woodland would be revegetated in a similar manner and with similar species to that described for the woodland corridors (refer Table 5-2 for a provisional species list).

Table 5-2
Provisional Species List for Woodland Corridors

Scientific Name	Common Name
Trees	
Allocasuarina luehmanii	Bulloak
Allocasuarina verticillata	Drooping Sheoak
Angophora floribunda	Rough-barked Apple
Eualyptus crebra	Narrow-leaved Ironbark
Eucalyptus dawsonii	Slaty Gum
Eucalyptus moluccana	Grey Box
Melaleuca decora	A Honeymyrtle
Notelaea microcarpa	Native Olive
Geijera salicifolia	Brush Wilga
Shrubs	
Acacia filicifolia	Fern-leaf Wattle
Acacia implexa	Hickory Wattle
Acacia salicina	Cooba
Acacia amblygona	Fan Wattle
Acacia falcate	Sickle Wattle
Acacia decora	Western Silver Wattle
Grevillea montana	A Grevillea
Hibbertia linearis	-
Cassinia quinquefaria	A Cough Bush
Grasses and Herbs	
Dianella revoluta	Blue Flax Lily
Lomandra multiflora	Many-flowered Matrush
Chloris venticosa	Tall Windmill Grass
Laxmannia gracilis	Wire Lily
Gahnia aspera	Rough Saw-sedge
Aristida vagans	Threeawn Speargrass
Austrodanthonia sp.	A Wallaby Grass
Austrostipa scabra ssp. *falcata*	Speargrass
Cymbopogon refractus	Barbwire Grass

The areas proposed to be revegetated with pasture would be revegetated using native grasses, where practicable. Rehabilitation of the pasture areas would be conducted in consideration of guidelines such as those presented in the *Rehabilitation of Open Cut Coal Mines using Native Grasses: Management Guidelines* (DLWC, 2003).

A preliminary selection of native grasses that could be used in the revegetation of pasture areas is provided in Table 5-3. This list would be used to initiate consultation with regulatory authorities and key stakeholders regarding plant species selection.

5.4.3 Riparian Zone

The revegetation strategy for the Project includes the planting of the banks of the North Wambo Creek water control channel with River Oak (*Casuarina cunninghamiana*) and Rough-barked Apple (*Angophora floribunda*) (Figure 5-2). A net increase in the quantity of riparian vegetation along North Wambo Creek is proposed. A selection of native grasses (such as those listed in Table 5-3) would also be utilised in the revegetation of the North Wambo Creek riparian zone.

Table 5-3
Provisional Species List for Pasture Areas

Common Name	Scientific Name
Bunderra Wallaby Grass	*Austrodanthonia*
Ringed Wallaby Grass	*A. caespitosa*
Hume Wallaby Grass	*A. richardsonii* cv. Hume
Taranna Wallaby Grass	*A. richardsonii* cv. Taranna
Smallflower Wallaby Grass	*A. setacea*
Plains Grass	*Austrostipa aristiglumis* or *A. bigeniculata*
Speargrass	*A. scabra*
Slender Bamboo Grass	*A. verticillata*
Shorthair Plumegrass	*Dichelachne micrantha*
Common Wheatgrass	*Elymus scaber*
Blown Grass	*Lachnagrostis filiformis*
Wiregrass	*Aristida ramosa*
Redgrass/Pitted Bluegrass	*Bothriochloa macra/decipiens*
Windmill Grass	*Chloris truncata*
Tall Windmill Grass	*Chloris ventricosa*
Barbed Wire Grass	*Cymbopogon refractus*
Queensland Bluegrass	*Dichanthium sericeum*
Cotton Panic Grass	*Digitaria brownii*
Umbrella Grass	*Digitaria divaricatissima*
Early Spring Grass	*Eriochloa pseudoacrotricha*
Native Millet	*Panicum decompositum*
Hairy Panic	*Panicum effusum*

Source: DLWC (2003)

5.5 REMNANT WOODLAND ENHANCEMENT PROGRAMME

During the initial stages of Project development, remnant woodland vegetation located within WCPL owned land and outside of the Project open cut operations area would be managed to maintain and enhance inherent conservation values. This initiative is consistent with the objectives of the native vegetation/biodiversity target of the ICMP (HCMT, 2002b) to conserve existing regionally significant vegetation communities.

Three areas of remnant woodland have been identified for potential enhancement (Figure 5-2), pending further consultation with key stakeholders during the preparation of the FFMP. Details of the three woodland areas selected for enhancement and their existing flora and fauna are provided in Sections 4.8.2 and 4.9.2, respectively.

The remnant woodland enhancement programme (RWEP) includes the conservation and enhancement of areas of remnant woodland adjacent to Wollemi National Park. While many of the remnants in the vicinity of the Project have been semi-cleared, subjected to historical disturbance or current stock grazing, the least disturbed remnants occur on the steep rocky slopes and foothills which adjoin Wollemi National Park. Conservation and enhancement of these areas would strengthen the linkages to be developed between Wollemi National Park, existing remnant woodland and woodland rehabilitation areas.

The management measures to be implemented within the RWEP areas would be detailed in the FFMP. Management measures may include the fencing of remnants to exclude stock and allow natural regeneration of native species, weed control, feral animal control, habitat enhancement initiatives (such as the provision of nest boxes and resources for threatened fauna species) and selective planting of native vegetation to enlarge the remnants and to link existing remnant vegetation, where appropriate.

In recognition of the high conservation value of the Warkworth Sands Woodland endangered ecological community, areas of Warkworth Sands Woodland located on WCPL land between Wollombi Brook and Wallaby Scrub Road would be enhanced and conserved. The occurrence of the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands endangered ecological community located on WCPL owned land between Wollombi Brook and Wallaby Scrub Road would also be enhanced and conserved. The RWEP is discussed further in Section 4.8.2.

5.6 REHABILITATION MONITORING, MAINTENANCE AND REPORTING

The quality of rehabilitation would be monitored using Ecosystem Function Analysis (EFA) or a similar systems-based approach. An overview of the EFA method is provided in Section 6.3.8.

Monitoring would include an assessment of landscape function and habitat complexity (Section 6.3.8).

Visual monitoring of rehabilitated areas would be conducted on a regular basis to ensure that revegetation is establishing and to determine the need for any maintenance and/or contingency measures. Routine monitoring of rehabilitation areas would include:

- checking soil erosion status and the effectiveness of erosion and sediment control measures (as part of the erosion and sediment control monitoring programme – Section 6.3.4);
- monitoring mine landform runoff water quality (as part of the surface water monitoring programme – Section 6.3.6);
- monitoring establishment of revegetation (as part of the flora and fauna monitoring programme – Section 6.3.8); and
- identification of the presence of weeds or feral animals (as part of the weed and animal pests monitoring programme – Section 6.3.9).

The meteorological station would also be maintained to provide data on climatic conditions as detailed in Section 6.3.1.

Based on monitoring results, maintenance works/contingency measures may include:

- repair of erosion (i.e. regrading of eroded areas);
- repair of drainage paths and de-silting of sediment control structures;
- re-seeding or re-planting;
- application of fertiliser;
- application of lime or gypsum to control pH and improve soil structure;
- watering of drier areas during the rehabilitation establishment phase;
- fire management activities; and
- implementation of weed and feral animal control measures (see Sections 4.8.2 and 4.9.2).

Monitoring and maintenance activities would be ongoing with the results assessed and utilised in the refinement of rehabilitation techniques.

Rehabilitation monitoring results and maintenance activities would be reported in the AEMR (Section 6.1.2). The AEMR would provide an annual review of rehabilitation progress and report mining lease disturbance areas, rehabilitated areas and areas undergoing rehabilitation to demonstrate that progressive rehabilitation goals are being met.

5.7 MINE CLOSURE AND LEASE RELINQUISHMENT

Upon the cessation of mining operations, it would be expected that tenure of the mining leases would be maintained by WCPL until such time as lease relinquishment criteria were satisfied. These criteria would be formulated and prescribed in consultation with relevant authorities and stakeholders.

It is anticipated that mine relinquishment criteria would include, but not necessarily be limited to the following:

- land tenure;
- landform stability and public safety;
- water quality;
- trajectory towards self-sustaining ecosystems; and
- fulfilment of mining lease and other statutory approval conditions.

Lease relinquishment criteria would be determined during preparation of the Mine Closure Plan (Section 6.1.3).

Rehabilitation performance would be considered to be satisfactory when the assessment process indicates a trajectory towards self-sustaining ecosystems across the rehabilitation areas. Once this rehabilitation status has been achieved, monitoring and maintenance programmes would be ceased in consultation with the relevant regulatory authorities and key stakeholders and a mining lease relinquishment process would be commenced.

The final determination of the success of rehabilitation prior to relinquishment would be made by the relevant authorities.

WAMBO DEVELOPMENT PROJECT

MAIN REPORT

Section Six
Environmental Management and Monitoring

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6 ENVIRONMENTAL MANAGEMENT AND MONITORING

This section presents an overview of the Project environmental management and monitoring programmes. These programmes have been formulated from experience gained at the Wambo Coal Mine and are based on the results of the environmental baseline studies and impact assessments undertaken for the Project.

The management and monitoring programmes described in the following sections should be viewed as provisional pending further input from the relevant authorities during the assessment phase of the EIS.

Environmental Management Responsibilities

Environmental management at the Wambo Coal Mine is the responsibility of all employees, with co-ordination provided by the Environmental Officer, who reports to the Mine Manager.

The Underground Manager, Open Cut Manager and CHPP Operations Manager are responsible for the implementation of environmental management and monitoring programmes in their respective operational areas. This management structure would be adopted for the Project.

Community Consultation

A formal community consultation programme was established at Wambo Coal Mine in 1998, including the formation of a Wambo Coal Mine CCC. The Wambo Coal Mine CCC currently comprises representatives from WCPL, the community, SSC, DMR, DLWC and EPA.

The Wambo Coal Mine CCC meets bi-annually, with the objective of monitoring Wambo Coal Mine's environmental performance and keeping the community informed of mining activities. Typical items on the agenda include review of the AEMR, mine progress, complaints received, rehabilitation activities and any environmental assessments or management plans undertaken during the previous six months.

The Project CCC has been established independently of the Wambo Coal Mine CCC (Section 1.5.1). The Project CCC has acted as a conduit between WCPL and the local community during the development of the EIS and associated studies, allowing WCPL to keep the community informed and giving community representatives the opportunity to raise issues for consideration. A full description of the function of the Project CCC is presented in Section 1.5.1.

At the commencement of the Project the two committees would be amalgamated. The resultant committee would then function in a similar nature to the Wambo Coal Mine CCC.

Community Complaints Register

A community complaints register is maintained by the Environmental Officer, who manages the receipt, recording and resolution of all complaints. The details of the complainant, date, nature of the complaint and actions taken to remedy the issue are recorded. The register is tabled at each Wambo Coal Mine CCC meeting for discussion. Complaints and subsequent actions undertaken are reported in the AEMR (Section 6.1.2).

The Wambo Coal Mine complaints register would be retained for the Project.

Induction and Environmental Awareness Programme

All employees and contractors would undertake an induction and environmental awareness programme prior to working independently on-site. As a component of this programme, employees would be given training in occupational health and safety requirements and an overview of the environmental issues associated with the Project.

6.1 MINING, REHABILITATION AND ENVIRONMENTAL MANAGEMENT PROCESS

The Mining, Rehabilitation and Environmental Management Process (MREMP) is a DMR initiative and incorporates the MOP and AEMR as primary regulatory reporting documents. The MREMP is a framework that encourages a cooperative and integrated approach to mine site management to meet the expectations of key government agencies, the mining industry and the community (DMR, 2000).

A MOP and AEMR are currently produced for the Wambo Coal Mine as part of the MREMP. The structure and content of these documents have been developed through consultation with various regulatory agencies including the DMR, EPA, DLWC, NPWS and SSC. As described below, the scope of the MOP and AEMR would be expanded to include Project-related activities.

As part of the MREMP, a Mine Closure Plan (MCP) would be developed in consultation with relevant authorities and the Project CCC prior to the completion of mining operations (Section 6.1.3).

6.1.1 Mining Operations Plan

The current Wambo Coal Mine MOP (WCPL, 2002) covers the 2002-2006 period and provides a description of the history of the mine, mining operations, mining approvals and licences, geology, surface infrastructure, land preparation, disturbance and rehabilitation, water management, flora and fauna management and archaeology. The MOP also describes the following:

- the proposed development of mining operations for the nominated term;
- general site procedures and protocols;
- mine waste rock emplacement sequences, quantities, timing and placement methods;
- CHPP reject characterisation and disposal methods;
- water management systems including clean water systems, runoff and erosion control and wastewater collection and treatment; and
- site access and security issues.

The current MOP would be revised and expanded to include Project-related operations.

6.1.2 Annual Environmental Management Report

Each AEMR spans the July to June financial year and provides a summary of mining operations, community consultation activities, recorded complaints and a review of the environmental performance for the reporting period.

Environmental monitoring data assessed includes meteorological, surface and groundwater quality, subsidence, air quality, noise, vibration and blast. Other areas assessed include rehabilitation performance, land use management, water supply, water use and discharge, erosion and sediment management, CHPP rejects management, general waste management and recycling, cultural and natural heritage conservation and hazardous and explosive materials management.

Recommended future environmental management and monitoring initiatives are also documented.

The scope of the AEMR would be expanded to include Project-related activities.

6.1.3 Mine Closure Plan

Prior to the completion of Project mining operations, a MCP would be developed in consultation with relevant authorities and the Project CCC. The MCP would document the mine closure process, final rehabilitation works and monitoring requirements appropriate to the proposed lease relinquishment criteria (Section 5.7).

The MCP would address the long-term land use for the site and would take into consideration:

- the outcomes of the Remnant Woodland Enhancement Programme (RWEP);
- experience and empirical data obtained from the rehabilitation programme;
- results of the flora and fauna monitoring programmes;
- relevant regional planning strategies; and
- integration with relevant conservation initiatives by surrounding mining operations.

A Final Void Management Plan (FVMP) would form a component of the MCP. Issues addressed by the FVMP would include:

- assessment of the predicted hydrological behaviour of the final voids (e.g. long-term water quality and quantity balance);
- groundwater and surface water management (e.g. bunding and surface water drains to minimise surface water inflows to the voids and minimise the potential for outflows);
- long-term geotechnical stability of the voids;
- public safety, including the construction of bunds;
- access requirements; and
- water quality monitoring requirements.

During the development of the FVMP, options for the future beneficial use of the final voids would be investigated.

6.2 INTEGRATED ENVIRONMENTAL MANAGEMENT PLANS

6.2.1 Environmental Management Plans

Three Environmental Management Plans (EMPs) exist for the Wambo Coal Mine, namely:

- the *Open Cut Mine Environmental Management Plan* (Egis Consulting, 2001c) which details environmental management procedures for the open cut mine;
- the *Wollemi Underground Mine Environmental Management Plan* (Egis Consulting, 2000b) which details environmental management procedures for the underground mine (currently on care and maintenance); and
- the *Coal Handling and Preparation Plant Environmental Management Plan* (Egis Consulting, 2000c) which provides procedures to ensure environmental protection during the operation of the CHPP.

These EMPs would be revised to include the Project open cut, underground mine and CHPP operations.

A number of management plans exist for the Wambo Coal Mine which support the above EMPs. These management plans would be updated to include Project-related activities. A number of new management plans would also be developed for the Project. A list of the proposed management plans for the Project is presented in Table 6-1 and discussed below.

6.2.2 Land Management Plan

The existing Land Management Plan (LMP) describes the physical attributes of the land within the Wambo Coal Mine area, including soils, landforms, vegetation and climate, identifies the land capability classes, describes mining operations, identifies potential land degradation issues and outlines measures to be undertaken to ameliorate potential impacts.

The LMP would be revised to include the Project development areas.

6.2.3 Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan (ESCP) would be developed for the Project detailing methods for the control of erosion and sediment from disturbed areas. The ESCP would be prepared progressively prior to the development of Project components involving land disturbance. The control measures presented in the ESCP would generally aim to:

- minimise soil erosion and sediment generation in areas disturbed during the development of the Project; and
- minimise the potential for Project activities to adversely affect the water quality of the Wollombi Brook or the Hunter River.

Table 6-1
Project Management Plans

Management Plan	Section
Land Management Plan*	6.2.2
Erosion and Sediment Control Plan	6.2.3
Bushfire Management Plan*	6.2.4
Subsidence Management Plan	6.2.5
Site Water Management Plan*	6.2.6
Flora and Fauna Management Plan	6.2.7
Weed and Animal Pest Control Plan*	6.2.8
Non-Aboriginal Cultural Heritage Management Plan	6.2.9
Aboriginal Cultural Heritage Management Plan	6.2.10
Traffic Management Plan	6.2.11
Open Cut Emergency Procedures*	6.2.12
Underground Mine Emergency Response Manual*	6.2.12
CHPP Emergency Response Procedures*	6.2.12

* Existing Wambo Coal Mine management plans to be revised to include Project-related activities.

The principles presented in the ESCP would be consistent with relevant guidelines such as the DLWC's *Establishment of Stable Drainage Areas on Rehabilitated Mine Sites*, the Department of Housing's *Managing Urban Stormwater: Soils and Construction* (1998) manual and the *Draft Guidelines for the Design of Stable Drainage Lines on Rehabilitated Minesites in the Hunter Coalfields* (DLWC, 2002). The ESCP would include:

- identification of activities that have the potential to cause soil erosion and sediment generation;
- description of the location and capacity of erosion and sediment control structures;
- description of measures to minimise soil erosion and the potential for the migration of sediments to downstream waters; and
- a programme to monitor the effectiveness of control measures.

The ESCP would be reviewed annually in consultation with the relevant authorities, where necessary.

6.2.4 Bushfire Management Plan

A Bushfire Management Plan (BMP) has been established for the Wambo Coal Mine. The BMP identifies bushfire management issues relevant to the local environment, analyses bushfire risk, discusses objectives and activities and outlines standard procedures to be followed in the event of a bushfire.

The BMP would be revised to include Project-related activities, including the development of fire breaks in strategic locations around the Project area. BMP standard procedures would be updated prior to the commencement of Project activities involving the clearing of vegetation. This review would be undertaken in consultation with SSC and the Rural Fire Service.

6.2.5 Subsidence Management Plan

Underground mining would be carried out in accordance with subsidence management provisions developed for previous underground mining activities at the Wambo Coal Mine. This would include the preparation of site-specific subsidence assessment and management plans prior to the commencement of longwall mining.

A Subsidence Management Plan (SMP) would be prepared in accordance with section 138 of the *Coal Mines Regulation Act*, 1982 in consultation with the Mine Subsidence Board and, where necessary, with any affected landholders. The SMP would document monitoring and management measures for potential subsidence impacts within underground mining areas.

The SMP would include:

- description of the physical landforms and environment of the area to be affected by subsidence, including watercourses, aquifers and archaeological sites;
- the predicted magnitude of subsidence in each area of mining;
- assessment of the potential impacts of subsidence on WCPL and privately owned land;
- description of surface infrastructure and surface improvements that may be subject to subsidence and measures to ensure impacts upon them are minimised as far as practicable;
- description of measures to minimise, and where necessary remediate, potential subsidence impacts on watercourses;
- agreements with potentially affected landholders; and
- a subsidence monitoring programme (Section 6.3.5).

6.2.6 Site Water Management Plan

A Site Water Management Plan (SWMP) would be developed for the Project. The SWMP would describe the Project site water management system, including:

- Project water supply balance, including the CHPP and dust suppression water supply circuit;
- details of the Project surface water diversion systems, including the design of the North Wambo Creek water control system;
- procedures that would be implemented to:
  - minimise any potential surface water impacts; and
  - preferentially use runoff from operational areas in the CHPP water supply circuit;

- downstream surface water quality criteria that would trigger an investigation by WCPL if exceeded;
- the predicted site water balance and details of any supply/controlled release arrangements and requirements to modify the volume of storages;
- details of a strategy for the decommissioning of water management structures;
- measures to manage waters that accumulate in mine workings, including potential inflows from the North Wambo Creek alluvium to the open cut as described in Section 4.7.1; and
- surface water and groundwater monitoring programmes (Sections 6.3.6 and 6.3.7).

The Project SWMP would be reviewed and revised annually, where necessary.

6.2.7 Flora and Fauna Management Plan

A Flora and Fauna Management Plan (FFMP) would be prepared to facilitate the successful integration of flora and fauna management with the operation of the Project.

The FFMP would contain a number of management strategies to minimise the potential impacts of the Project on protected and threatened flora, fauna and their habitats. The FFMP would include a Vegetation Clearance Protocol, Threatened Species Management Protocol (TSMP), Remnant Woodland Enhancement Programme (RWEP) and a variety of other flora and fauna management initiatives. These are discussed further in the following subsections.

Vegetation Clearance Protocol

A Vegetation Clearance Protocol (the Protocol) would be developed to minimise the impact of Project vegetation clearance activities on flora and fauna. Key components of the Protocol would include the delineation of areas to be cleared of remnant vegetation, pre-clearance surveys, identification of fauna management strategies and specific procedures for vegetation clearance.

Delineation of Disturbance Areas

Areas to be cleared of remnant vegetation would be clearly delineated to prevent accidental damage during vegetation clearance activities or construction works. Protection, where feasible, would be broadly defined in the protocol.

Pre-clearance Surveys

This component of the Protocol would involve:

- a preliminary habitat assessment stage involving the inspection of trees for features (e.g. hollows) with the potential to provide roosting and/or nesting resources for birds, bats and arboreal mammals; and
- a secondary habitat assessment stage to assess the usage of habitat features by fauna. This stage may include spotlighting for arboreal mammals, observations of hollows and nests for nesting bird species and bat surveys using Anabat electronic detectors. This stage would be conducted with consideration for seasonal and temporal factors.

Fauna Management Strategies

This part of the Protocol would involve the identification of management strategies to minimise the impact of clearing activities on resident fauna in the short-term and to minimise the loss of habitat in the long-term.

Short-term management strategies may include timing vegetation clearance to avoid nesting/breeding activities, capture and release of fauna, bat roost relocation and/or modification of the disturbance area. Long-term management strategies may include the placement of nesting boxes in suitable habitat for birds and arboreal mammals, the placement of roosting boxes in suitable habitat for bats, the relocation of habitat features salvaged from felled trees and the inclusion of hollow-developing tree species in the rehabilitation programme.

Vegetation Clearance

Specific vegetation clearance procedures would be developed and would include:

- implementation of fauna management strategies as above and where appropriate;
- inspection of trees felled for the presence of fauna;
- salvage of habitat features (e.g. hollows) for use in rehabilitation and/or the RWEP;

- collection of seed for use in the rehabilitation programme; and
- collection of harvestable timber for commercial purposes.

Threatened Species Management Protocol

A Threatened Species Management Protocol (TSMP) would be developed to facilitate the:

- assessment of threatened species that may be identified during Project activities; and
- implementation of threatened species management strategies to minimise potential impacts on all threatened flora and fauna species.

Key components of the TSMP would include observations/surveys for threatened species, regulatory consultation, threatened species assessment, threatened species management strategies and reporting. The observations/surveys phase of the Protocol would be facilitated by the pre-clearance surveys and the flora and fauna monitoring programme. The NPWS would be notified in the event that a threatened species not previously assessed by the Project EIS is identified within Project disturbance areas.

Remnant Woodland Enhancement Programme

The RWEP provides an opportunity to conserve regional biodiversity, whilst enhancing the habitat available to flora and fauna.

To enable the most appropriate and effective enhancement strategies to be implemented, a habitat assessment of the RWEP areas would be undertaken to obtain additional information on existing habitat resources and characteristics of each enhancement area.

The enhancement strategies identified for each RWEP area may include:

- the fencing of remnants to exclude livestock and to encourage natural regeneration;
- control measures to minimise the spread of weeds and competition with native flora;
- control measures to minimise the occurrence of feral pests;
- limiting vehicular traffic;
- selective planting of native vegetation to enlarge the remnants and to link existing remnant vegetation; and
- the provision of roosting/nesting resources for fauna (such as nest boxes, bat boxes and hollows identified during the pre-clearance surveys and salvaged during clearance operations).

6.2.8 Weed and Animal Pest Control Plan

A Weed and Animal Pest Control Plan (WAPCP) would be developed for the Project, incorporating the existing Wambo Coal Mine Weed Management Plan. The WAPCP would include management strategies to control the potential adverse impacts of weeds and feral animals.

Weeds would be controlled through mechanical removal and the application of approved herbicides. Feral animal control would be undertaken by a licensed contractor.

6.2.9 Non-Aboriginal Cultural Heritage Management Plan

A Non-Aboriginal Cultural Heritage Management Plan (NACHMP) would be developed for the Project for the management of the Wambo Homestead Complex (WHC) and other items of non-Aboriginal heritage.

The NACHMP would describe procedures for:

- the management and maintenance of the WHC prior to relocation;
- relocation and documentation of the WHC;
- recording and archiving of items of non-Aboriginal heritage; and
- the monitoring of potential subsidence impacts, blasting and vibration on non-Aboriginal heritage (Section 6.3.10).

The NACHMP would be developed in consultation with the NSW Heritage Office.

6.2.10 Aboriginal Cultural Heritage Management Plan

An Aboriginal Cultural Heritage Management Plan (ACHMP) would be prepared and would describe management procedures for Aboriginal objects identified within the Project area.

The management of Aboriginal cultural heritage in the Project area would be directed towards protecting/salvaging Aboriginal objects as well as enhancing local knowledge of Aboriginal cultural heritage in the area.

The ACHMP would include:

- a protocol for consultation with local Aboriginal groups;
- details of all statutory requirements to be met regarding the disturbance or removal of Aboriginal heritage under the *National Parks and Wildlife Act, 1974*.
- measures to avoid potential impacts on Aboriginal objects including the management of RWEP areas, implementation of fencing around sensitive sites and buffer areas;
- general land management measures to protect Aboriginal cultural heritage;
- a monitoring programme to determine the effectiveness of Aboriginal culture/heritage management measures;
- a monitoring programme for the assessment of subsidence impacts on Aboriginal objects;
- procedures for the collection, storage, curation and replacement of Aboriginal objects collected from Project disturbance areas and taken to a "Keeping Place";
- timeframes for which Aboriginal objects would be stored prior to replacement;
- actions to be undertaken in the event that an Aboriginal object is identified other than those already identified; and
- methods for the dissemination of cultural heritage information to the public and WCPL personnel (i.e. site inductions).

6.2.11 Traffic Management Plan

A Traffic Management Plan (TMP) would be prepared in consultation with the RTA and SSC. The TMP would address:

- temporary road closures on the Golden Highway due to blasting; and
- relocation of the Wallaby Scrub Road and Golden Highway intersection.

The TMP would be prepared in accordance with AS 1742.3-2002 *Manual of Uniform Traffic Control Devices – Traffic Control Devices for Works on Roads* and/or the manual for *Traffic Control at Work Sites* (RTA, 1998) prior to commencement of works on the public road network, and would include:

- detailed design of roadworks to be performed;
- traffic control measures to be adopted during roadworks; and
- road closure management measures, including:
  - method of road closure;
  - signage providing advance warning and at the road closure;
  - review of traffic volumes;
  - lengths of closures and expected queue lengths;
  - access for emergency services;
  - notification process; and
  - monitoring and reporting requirements.

Consultation with the RTA and SSC would continue as necessary throughout the construction and operation of the Project.

6.2.12 Emergency Response Plans

Emergency and safety response plans that currently exist at the Wambo Coal Mine comprise the following:

- *Coal Handling and Preparation Plant Emergency Response Procedure (Draft)* (Wambo Mining Corporation, 2001a).
- *Wollemi Underground Mine Emergency Response Manual* (Wambo Mining Corporation, 2001b).
- *Open Cut Emergency Procedures* (Roche, 2003).

The above documents address:

- emergency objectives and procedures;
- site emergency response structure;
- roles and responsibilities, including dedicated emergency personnel appointed by WCPL; and
- protocols for incident reporting.

These plans would be revised to address Project risk and emergency response requirements as outlined in Appendix K.

6.3 INTEGRATED ENVIRONMENTAL MONITORING

Environmental monitoring requirements for the Project would necessitate expansion of the Wambo Coal Mine environmental monitoring programme. Table 6-2 provides an overview of the Project environmental monitoring programme. Figure 6-1 depicts the location of each monitoring site.

The results of the Project environmental monitoring programme would be reported in the AEMR. The monitoring locations, parameters and frequencies would be reviewed annually through the AEMR process, in consultation with the relevant authorities and the Project CCC.

6.3.1 Meteorology

An automated meteorological station at the Wambo Coal Mine currently records temperature, humidity, net solar radiation, rainfall, evaporation, wind speed, wind direction, sigma theta (a measurement of wind shear) and atmospheric pressure. Meteorological data is continuously monitored and the data averaged over ten minute periods.

The meteorological station would continue to be utilised for the Project.

6.3.2 Air Quality

The Wambo Coal Mine air quality monitoring programme monitors dust deposition and concentrations of suspended particulates utilising a network of dust deposition gauges, a directional dust gauge and a high volume sampler.

The dust deposition gauges are analysed monthly for ash content and insoluble solids in accordance with AS 3580.10.1-1991 *Methods for Sampling and Analysis of Ambient Air – Determination of Particulates – Deposited Matter – Gravimetric Method*. The high volume sampler monitors 24 hour concentrations of particulates over a six day cycle in accordance with AS 2724.3-1984 *Ambient Air – Particulate Matter – Determination of Total Suspended Particulates (TSP) – High Volume Sampler Gravimetric Method*.

Table 6-2
Overview of the Project Environmental Monitoring Programme

Monitoring Focus	Section	Monitoring Sites	Frequency
Meteorology • Wind speed and direction. • Rainfall. • Temperature.	6.3.1	Automated meteorological station.	Continuous.
Air Quality • Dust deposition • High volume sampling (PM_{10}).	6.3.2	• D01, D03, D07, D11, D12, D14, D15, D16, D17 and D18. • W-HV01 and W-HV02.	• Monthly. • Continuous six day cycle.
Noise • Attended and unattended noise monitoring.	6.3.3	• N01, N02, N03, N05, N06, N07, N13, N16, N17, N18, N19 and N20.	Quarterly.
Blasting • Ground vibration and airblast overpressure. • Vibration monitoring.	6.3.3	• BM01, BM02, BM03, BM04 and BM05. • V01.	• Every blast event. • Quarterly.
Erosion and Sediment Control Structures	6.3.4	Sediment control structures.	Inspected monthly and following significant (>20 mm of rain in 24 hours) rainfall events.

Table 6-2 (Continued)
Overview of the Project Environmental Monitoring Programme

Monitoring Focus	Section	Monitoring Sites	Frequency
Subsidence • Potential subsidence impacts on land surface, watercourses and vegetation. • Potential subsidence impacts on surface infrastructure and improvements. • Potential subsidence impacts on items of Aboriginal and non-Aboriginal heritage.	6.3.5	Underground mining areas.	To be determined in the SMP, NACHMP and ACHMP.
Surface Water Quality, Levels and Flows • pH, EC, TDS, TSS. • Level, pH and EC. • Surface water flow.	6.3.6	• SW01 to SW08, SW34, SW35, SW36, SW37 and SW38. • Mine water storages. • V-notch weirs – V1 to V8[1] and SW05, SW37 and SW38.	• Monthly and following significant rainfall events (as above). • Monthly. • Quarterly.
Groundwater • Level, pH and conductivity. • pH, EC, Na, Mg, Ca, Cl, HCO_3, SO_4, Total Fe. • Level, pH and conductivity.	6.3.7	• GW01, GW02, GW04, GW05, GW06, GW07, GW10, GW11, GW12, GW13, GW14 and GW15. • As above. • Piezometers to be developed to monitor groundwater depressurisation due to the Project underground mines. Monitoring locations to be determined in the SWMP.	• Quarterly. • Biannually. • Monitoring frequencies to be determined in the SWMP.
Flora and Fauna	6.3.8	Project disturbance/rehabilitation and RWEP areas.	To be developed as a component of the FFMP.
Weeds and Animal Pests	6.3.9	WCPL owned land.	In accordance with the WAPCP (Section 6.2.8).
Non-Aboriginal Heritage	6.3.10	Non-Aboriginal heritage items.	To be developed as a component of the NACHMP.
Aboriginal Heritage	6.3.11	Aboriginal heritage areas.	• Pre-clearance survey. To be developed as a component of the ACHMP. • Periodic inspection. To be developed as a component of the ACHMP.

Source: WCPL (2003)
[1] Subject to review (Section 6.3.6).

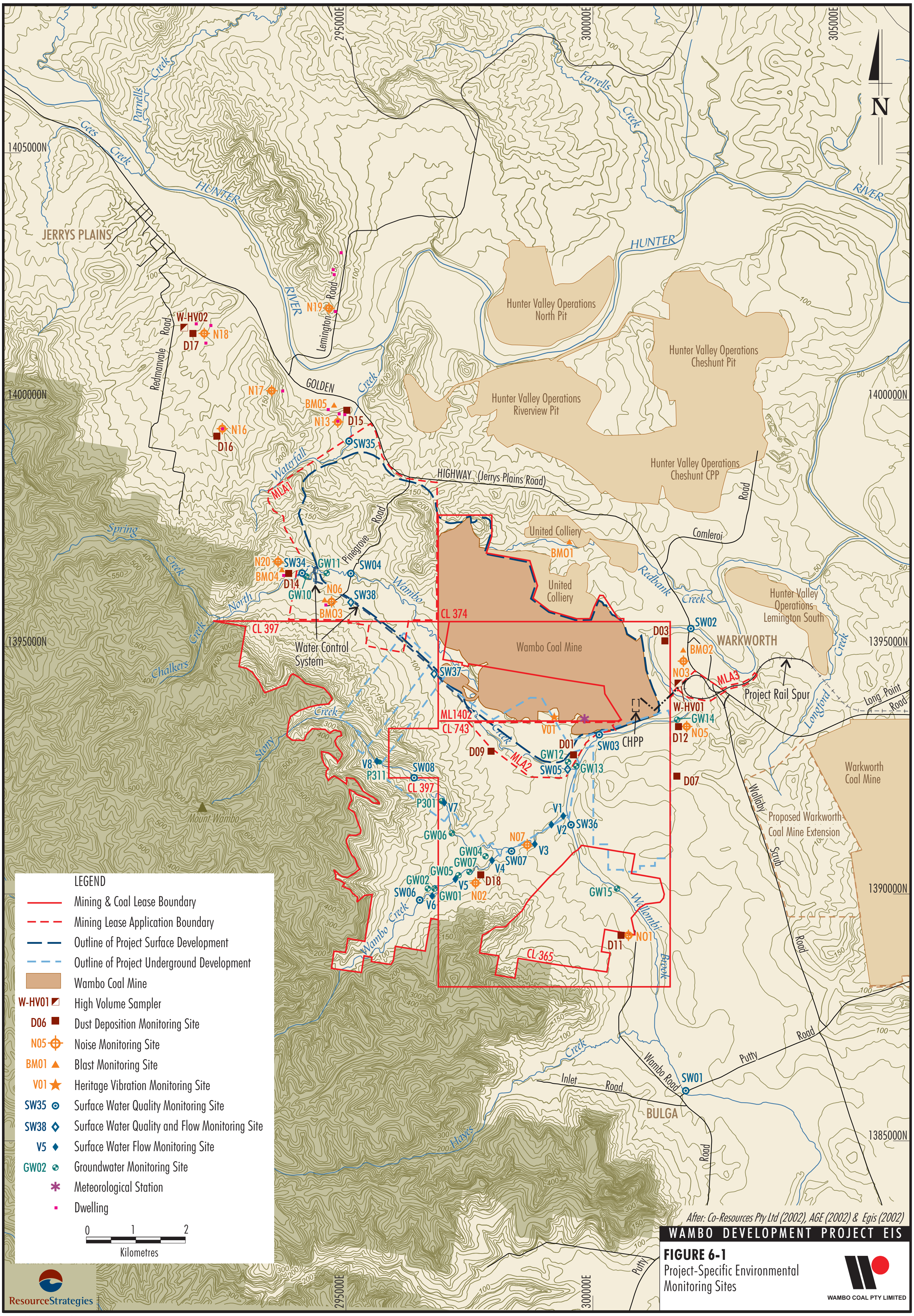

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FIGURE 6-1
Project-Specific Environmental Monitoring Sites

WAM-02-01-Sect 6_001J

The current distribution of dust deposition gauges would adequately monitor dust deposition during the initial development stages of the Project. As the Project open cut progresses to the north-west and further south, additional dust deposition gauges would be installed. Five additional dust deposition gauges are proposed to the north-west (Skinner dwelling – D14, Fisher dwelling – D15, McGowen/Caslick dwelling – D16, Jepolo dwelling – D17) and south (Fenwick dwelling – D18), as shown on Figure 6-1. Based on current mine planning, these gauges would be progressively installed between Years 5 and 9.

An additional high volume sampler would be installed between the Project and Jerrys Plains near Redmanvale Road (W-HV02) (Figure 6-1). It is anticipated that W-HV02 would be required by Year 6, depending on actual mine progression. As part of the Project air quality monitoring programme, both high volume samplers (W-HV01 and W-HV02) would monitor PM_{10} over a six day cycle in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollution in New South Wales* (EPA, 2001).

WCPL would also investigate real time monitoring and dust controls to allow for greater operational flexibility during favourable climatic conditions.

The results of the air quality monitoring programme would be used to optimise dust emission controls, validate predictions made in the EIS and would be reported in the AEMR.

6.3.3 Noise and Blasting

Noise

The Wambo Coal Mine noise monitoring programme comprises quarterly unattended and regular attended monitoring. The following existing noise monitoring sites would be retained for the Project (Figure 6-1):

- Lambkin dwelling (N01);
- Fenwick dwelling (N02);
- Kelly dwelling (N03);
- Hawkes dwelling (N05);
- Long dwelling (N06); and
- Dwelling - WCPL owned land (N07).

The following noise monitoring sites would be added to the programme as the Project progresses to the north-west (Figure 6-1):

- Fisher dwelling (N13);
- McGowen/Caslick dwelling (N16);
- Muller dwelling (N17);
- Jepolo dwelling (N18);
- Lemington Road (N19); and
- Skinner dwelling (N20).

Noise monitoring would be conducted in accordance with AS 1055-1997 *Acoustics – Description and Measurement of Environmental Noise* and the NSW INP (EPA, 2000).

The results of the noise monitoring programme would be used to optimise noise emission controls, validate EIS predictions and would be reported in the AEMR.

WCPL would also investigate real time monitoring and noise controls to allow for greater operational flexibility during favourable climatic conditions.

Blasting

The Wambo Coal Mine vibration and airblast overpressure monitoring sites (BM01 and BM02) would continue to be monitored for the Project (Figure 6-1). Vibration monitoring would also continue to be undertaken on a quarterly basis at the WHC (V01).

Three (3) additional monitoring sites would be added as the Project progresses to the north-west (Figure 6-1) at the Long dwelling (BM03), Skinner dwelling (BM04) and Fisher dwelling (BM05) and as blasting moves away sites would be decommissioned.

Blast monitoring would be conducted for each blast event. Airblast overpressure (dB(Linear) Peak)) and peak particle velocity (mm/s) would be measured in accordance with AS 2187.2-1993 *Explosives – Storage, Transport and Use – Use of Explosives*.

Periodic structural surveys of specific dwellings adjacent to the Project and items of non-Aboriginal heritage would also continue for the Project.

6.3.4 Erosion and Sediment Control

WCPL currently conducts monthly inspections of operational sediment control structures. The structures are assessed for structural stability and effectiveness and appropriate remedial works are implemented as required.

This inspection and monitoring programme would be expanded to include sediment control structures developed for the Project. Inspections of sediment control structures would also be conducted following significant rainfall events.

6.3.5 Subsidence

Monitoring would be conducted to validate Project subsidence predictions and would include the tracking of horizontal and vertical ground movements and strain measurements.

Monitoring would also include routine ground inspections to:

- identify any isolated surface disturbances;
- identify any impacts on surface infrastructure and improvements such as fencing, dams and farm tracks;
- assess the level of disturbance to native vegetation and the condition of the vegetation (e.g. health and vigour of species and communities); and
- assess any changes in drainage lines or watercourses (that may be attributable to subsidence).

The condition of vegetation would be monitored according to predetermined standardised criteria (i.e. plant species diversity and abundance, percentage cover of each stratum) using a number of permanent flora survey quadrats established above Project underground mining areas prior to the commencement of underground mining.

The subsidence monitoring programme would be developed in consultation with the DMR and the Mine Subsidence Board and documented in the Subsidence Management Plan (Section 6.2.5).

6.3.6 Surface Water

Surface water monitoring at Wambo Coal Mine currently involves monthly sampling at a network of surface water quality monitoring sites on Wollombi Brook, North Wambo Creek, Wambo Creek, Stony Creek and mine water storages across the site. Water quality samples are analysed for a range of parameters including pH, electrical conductivity (EC), total dissolved solids and total suspended solids. Significant rainfall events also trigger surface water quality sampling.

The following surface water monitoring sites would be added to the existing program and are shown on Figure 6-1:

- North Wambo Creek upstream of proposed water control structure (SW34);
- Waterfall Creek downstream of the Project disturbance area (SW35);
- Wollombi Brook upstream of Wambo Creek (SW36); and
- North Wambo Creek water control channel (SW37 and SW38).

Surface water flows are currently monitored on a quarterly basis from V-Notch Weirs (V1 to V8). A review would be undertaken to determine the need to continue monitoring each of these weirs. Where appropriate, select weirs would continue to be monitored as part of the Project surface water monitoring programme. Surface water flow would also be monitored at Sites SW05, SW38, SW37 on North Wambo Creek.

In addition, the site water balance would be monitored regularly. This would involve the monitoring of water levels, EC and pH in site storages on a monthly basis and recording transfer volumes between storages. The site water balance would also be reviewed annually to optimise its components and validate predictions. These reviews would also enable corrective actions to be implemented.

The quality of drainage from rehabilitated mine waste rock emplacement areas would also be monitored to assist in assessing rehabilitation performance.

6.3.7 Groundwater

A network of monitoring bores would be used to monitor groundwater quality and level in the alluvial aquifer systems (Figure 6-1). Monitoring of surrounding farm wells would also continue. Groundwater monitoring details and frequencies are outlined in Table 6-2.

Groundwater monitoring, water level measurements and sample collection, storage and transportation would be undertaken in accordance with the procedures outlined in the *Murray Darling Basin Groundwater Quality Sampling Guidelines* (Murray Darling Basin Commission, 1997) and the DLWC *Draft Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region*.

Six additional Project specific groundwater monitoring bores would be installed to monitor the effects of open cut and underground mining on the groundwater system. Bore licences would be obtained from the DLWC prior to the installation of the new monitoring bores. The proposed locations of these bores are as follows (Figure 6-1):

- North Wambo Creek alluvium, upgradient of the water control structure (GW10);
- North Wambo Creek alluvium, downgradient of the water control structure (GW11);
- North Wambo Creek alluvium, downstream of the open cut (GW12);
- Wollombi Brook alluvium, downstream of the open cut (GW13);
- Wollombi Brook alluvium, downstream of the Project (GW14); and
- Wollombi Brook alluvium, upstream of the Project (GW15).

Monitoring of water levels, pH and EC at these bores would occur quarterly. The following suite of groundwater quality parameters would be analysed biannually at all sites listed in Table 6-2 include pH, EC, sodium (Na), magnesium (Mg), calcium (Ca), chloride (Cl), carbonate (HCO_3), sulphate (SO_4) and total iron (Fe).

6.3.8 Flora and Fauna

The flora and fauna monitoring programme would be developed as a component of the FFMP. The programme would focus on revegetation of disturbance areas and the RWEP.

Revegetation Programme

Visual monitoring of revegetation would be conducted on a regular basis to ensure vegetation is establishing and to determine the need for any maintenance and/or contingency measures (such as the requirement for supplementary plantings, erosion control and weed control).

The quality of rehabilitation would be monitored using Ecosystem Function Analysis (EFA) or a similar systems-based approach. An overview of the EFA method is provided below as a general guide to the proposed approach to monitoring.

EFA is a CSIRO developed method used to provide indicators of rehabilitation success and allows the assessment of ecosystem sustainability through the plotting of development trajectories. EFA aims to measure the progression of rehabilitation towards a self-sustaining ecosystem through the assessment of landscape function, vegetation dynamics and habitat complexity.

The Landscape Function Analysis (LFA) component of EFA provides an effective quantitative tool for management and monitoring. Data recorded as part of LFA monitoring is based on landscape processes and focuses on the dynamics of resource mobilisation, transport, deposition, utilisation and loss of soil condition. Parameters assessed as part of LFA monitoring typically include:

- soil cover;
- perennial grass basal cover and canopy cover;
- litter cover, origin and incorporation;
- cryptogam cover;
- crust condition;
- erosion type and severity;
- amount of deposited material;
- microtopography (surface roughness);
- surface resistance to disturbance; and
- soil type (slake and texture tests).

The vegetation dynamics component provides a quantitative assessment of species composition, density and cover. The habitat complexity component provides an index of the development of available habitats for fauna and includes measurements of vegetation cover, ground habitat (litter, logs, rocks) and the availability of water. The monitoring of habitat complexity is based on the assumption that more environmental niches for fauna develop as the diversity of vegetation and ground cover (e.g. litter) increases.

A number of permanent transects would be established within areas of rehabilitation. Corresponding transects would also be established in adjacent undisturbed (analogue) communities. The information obtained would be used to track the rehabilitation progress, predict self-sustainable values and compare the rehabilitation and analogue sites. Remedial management strategies would be implemented where necessary.

Visual assessments would also be incorporated into the revegetation monitoring programme to allow for the rapid application of remedial actions where necessary.

Consideration would also be given to the monitoring of fauna species usage of the rehabilitation areas.

Remnant Woodland Enhancement Programme

Flora and fauna surveys would be conducted to monitor the effectiveness of the RWEP. The key components of the monitoring programme are summarised in Table 6-3.

6.3.9 Weed and Animal Pests

Regular inspections would be conducted of WCPL owned land to detect areas that require the implementation of weed or pest management strategies.

6.3.10 Non-Aboriginal Heritage

Areas of non-Aboriginal heritage would be periodically assessed for evidence of subsidence impacts as part of the subsidence monitoring programme (Section 6.3.5). Periodic surveys would also be undertaken to assess blasting impacts on heritage items as a component of the blast monitoring programme (Section 6.3.3). Subsequent to this monitoring, remedial measures would be undertaken, if required.

Monitoring would be carried out in accordance with the NACHMP.

6.3.11 Aboriginal Heritage

Aboriginal heritage monitoring would comprise pre-clearance monitoring and ongoing observations during operation of the Project. Monitoring of selected construction activities would be undertaken by on-the-ground observers, most suitably members of the local Aboriginal community. Inspections would be periodically carried out in disturbance and subsidence areas to survey for new objects. Aboriginal heritage monitoring would be undertaken in accordance with the ACHMP.

Table 6-3
Remnant Woodland Enhancement Monitoring Programme

Monitoring Component	Monitoring Details
Flora	A number of permanent flora survey quadrats (of varying sizes to survey tree, shrubs and groundcover) would be established in woodland enhancement areas to obtain quantitative data on plant species diversity and abundance.
Habitat Complexity	Habitat complexity would be monitored using a number of permanent transects established within woodland enhancement areas. The monitoring of habitat complexity is based on the assumption that more environmental niches for fauna develop as the diversity of vegetation and ground cover increases. Habitat complexity parameters such as canopy cover, shrub cover, ground vegetation cover, the amount of litter, fallen logs and rocks would be surveyed.
Terrestrial Fauna	Terrestrial fauna surveys would be conducted to monitor the usage of enhancement areas by vertebrate fauna. Survey methodology and objectives would be detailed in the FFMP. Monitoring may include fauna species diversity and abundance or, alternatively, the use of indicator species to measure the effectiveness of enhancement measures.
Specific Enhancement Initiatives	Consideration would be given to the monitoring of specific enhancement initiatives (e.g. the provision of nesting/roosting boxes, weed control or feral animal control).

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Section Seven
References

7 REFERENCES

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WAMBO DEVELOPMENT PROJECT

ENVIRONMENTAL IMPACT STATEMENT

MAIN REPORT

Section Eight
Abbreviations, Acronyms and Glossary

8 ABBREVIATIONS, ACRONYMS AND GLOSSARY

8.1 ABBREVIATIONS AND ACRONYMS

AADT	average annual daily traffic
ABS	Australian Bureau of Statistics
ACN	Australian Company Number
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
ANC	acid neutralising capacity
ANFO	Ammonium Nitrate Fuel Oil
ANZECC	Australian and New Zealand Environment and Conservation Council
AS	Australian Standard
bcm	bank cubic metre
CCC	Community Consultative Committee
CH_4	methane
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
cm	centimetre
CO_2	carbon dioxide
CO_2 – e	carbon dioxide equivalents
DA	Development Application
DIPNR	Department of Infrastructure, Planning and Natural Resources
DLWC	Department of Land and Water Conservation
DMR	Department of Mineral Resources
DSNR	Department of Sustainable Natural Resources
DTRS	Department of Transport and Regional Services
EC	electrical conductivity
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act, 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation, 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999*
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
GRP	gross regional product
H	horizontal
ha	hectare
HCMT	Hunter Catchment Management Trust
HFC	hydrofluorocarbon
Hunter REP	*Hunter Regional Environmental Plan, 1989*
kg/bcm	kilogram per bank cubic metre
km	kilometre
km/hr	kilometres per hour
km^2	square kilometres
kPa	kilopascals
kV	kilovolt
kW	kilowatts
L	litre
LEP	Local Environmental Plan
L/s	litres per second

m	metre
m^2	square metre
m^3/s	cubic metres per second
Mbcm	million bank cubic metres
mg/L	milligrams per litre
ML	million litres
ML 1402	Mining Lease No. 1402
MLA	Mining Lease Application
mm	millimetre
MOP	Mining Operations Plan
MSB	Mine Subsidence Board
MSDS	Material Safety Data Sheets
Mt	million tonnes
MTCL	Mount Thorley Coal Loader
Mtpa	million tonnes per annum
MW	mega watt
N_2O	nitrous oxide
NAG	net acid generation
NAPP	net acid producing potential
ND	not detected
NPWS	National Parks and Wildlife Service
NS	not sampled
NSESD	National Strategy for Ecologically Sustainable Development
NSW	New South Wales
NSW Ag	New South Wales Agriculture
PFC	perfluorocarbon
pH	measure of acid/alkaline condition
PHA	Preliminary Hazard Analysis
REP	Regional Environmental Plan
ROM	run-of-mine
RTA	Roads and Traffic Authority
SCS	Soil Conservation Service
SD	Statistical Division
SEPP	State Environmental Planning Policy
SF_6	sulphur hexafluoride
SLA	Statistical Local Areas
SSC	Singleton Shire Council
t	tonne
TDS	total dissolved solids
tpa	tonnes per annum
tph	tonnes per hour
TSC Act	*Threatened Species Conservation Act, 1995*
TSS	total suspended solids
μS/cm	microsiemens per centimetre
V	vertical
viz.	namely
WCPL	Wambo Coal Pty Limited

8.2 GLOSSARY

A-horizon
: The original top layer of mineral soil divided into A1 and A2 horizons.

Adsorption
: The collection of one substance on the surface of another.

Alluvial
: A general term for clay, silt, sand and gravel transported by water and deposited, on the bed of a flood plain, river or stream.

Alluvium
: Sand, silt and mud deposited by a river or floods.

Ambient noise
: The all-encompassing noise associated with a given environment. It is the cumulative result of sounds from many sources, both near and far.

Amenity
: Useful and enjoyable quality.

Anisotropic
: Denoting a medium in which certain physical properties are different in different directions.

Aquatic
: Living in or on water, or concerning water.

Aquifer
: A sub-surface rock formation containing water in recoverable quantities.

Avifauna
: All species of bird.

Backfilling
: The refilling of cavities created during mining with waste rock or rejects.

Background
: The condition (e.g. noise levels, bird populations) already present in an area before the commencement of a specific activity (e.g. a mining operation).

Base flow
: The discharge of sub-surface water into a stream (i.e. groundwater seepages).

Baseline studies
: Studies conducted over time to collect a body of information to define specific characteristics of an area (e.g. species occurrence or noise levels) prior to an activity (e.g. a mining operation).

Batter
: An engineered slope of soil or rock fill on either side upslope or downslope of a road, embankment or mine waste storage; the sloping banks of cut earth separating different levels in an open-cut pit.

Berm
: A mound formed on a slope either as a low bank, or steep opposite slope, used to improve its structural stability and reduce erosion.

Biological diversity
: The diversity of different species of plants, animals and micro-organisms, including the genes they contain, in the ecosystem of which they are part.

Bituminous rank coal
: Dense black solids with carbon content ranging from 78% to 91% and water content from 1.5% to 7% (Australian Coal Association, 2003).

Boundary Shear Stresses
: Shear stress at the liquid/solid interface caused by the liquid moving past the solid (e.g. forces applied to a channel bank caused by water flow through the channel).

Box cut
An excavation developed to provide access to a lower level of the open cut.

Bund
An earth, rock or concrete wall or mound constructed to restrict the inflow or outflow of liquids or noise.

Catchment
The entire land area from which water (e.g. rainfall) drains to a specific watercourse or water body.

Cation
Positive ion, i.e. an atom or molecule that has lost one or more electrons.

Cherty siltstone
A lithified silt, containing chert and having grains between 4 µm and 62.5 µm in size.

Clarifier
Process equipment used to separate suspended solids from solutions.

Clastic
Formed from fragments of pre-existing rock.

Coal plies
Thin layers of coal present between other rock types.

Coking coal
Coal with more than 15% volatile matter and 80% carbon, which can produce a crush resistant coke.

Conductivity
The measurement of the ability of a substance (either a measure of solid, liquid or gas) to transmit electricity; used to determine the amount of salt in a soil sample.

Confluence
The junction of two streams.

Conglomerate
A coarse grained, clastic sedimentary rock composed of rounded or subrounded fragments larger than 2 mm in size.

Cross-section
A two-dimensional diagram of an object presented as if the object had been cut along its length.

Crusher
That part of a processing plant where the material is mechanically crushed into smaller pieces.

Cyclone
A conical vessel that uses centrifugal action to separate particulate matter from air to water.

dB
Decibel; unit used to express sound intensity.

dBA
Decibels; A-weighted scale; unit used for most measurements of environmental noise; the scale is based upon typical responses of the human ear to sounds of different frequencies.

dBL
Linear decibels; measurable effect of event (e.g. blast) on air pressure including measurement of generated energy which is below the limit of human hearing.

Depreciation
The loss in value of capital goods as a result of wear and tear, obsolescence, etc.

Direct output
The gross value of business turnover of the enterprise.

Drift access
A passage driven through country rock to intersect a vein or seam.

Dyke
: A sheetlike vertical intrusion of igneous rock cutting across the strata of older rocks.

Echolocation
: The location of objects by reflected sound.

Ecologically Sustainable Development (ESD)
: Development that improves the quality of life, in a way that maintains the ecological processes on which life depends.

Ecosystem
: An interacting system of animals, plants, other organisms and non-living parts of the environment.

Ecotone
: Narrow and fairly sharply defined transition zone between two or more different communities.

Edaphic
: Pertaining to ecological formations or effects resulting from or influenced by local conditions of the soil or substrate; also an old term applied to any soil characteristic that affects plant growth.

Electrical conductivity (EC)
: The ability of a substance (either solid, liquid or gas) to transmit electricity.

Embankment
: An embankment is constructed by the placement of a series of progressively higher and narrower earth or rock layers.

Emission
: The discharge of a substance (e.g. dust) into the environment.

Endemic
: Native plant or animal restricted to a specific locality or geographic region.

Evapo-concentration
: The process by which a soluble material being held in suspension becomes more concentrated due to the evaporation of water.

Fault
: Major fracture of the earth's crust caused by the relative movement of the rock masses on either side.

Floristics
: (phytogeography) The study of the geography of plants, particularly their distribution at different taxonomic levels, i.e. family, genus and species. Patterns of distribution are interpreted in terms of climatic and anthropogenic influence, but above all in terms of earlier continental configurations and migration routes.

Gateroads
: An underground roadway (tunnel) that provides access to a working longwall panel for continuous mining.

Glacio-eustatic rise of seal level
: A rise in seal level due to large scale melting of polar and glacial ice.

Greenhouse gases
: Gases with potential to cause climate change (e.g. methane, carbon dioxide and non-methane volatile organic compounds). Usually expressed in terms of global warming potential carbon dioxide equivalent.

Groundwater
: All waters occurring below the land surface; the upper surface of the soils saturated by groundwater in any particular area is called the water table.

Gross operating surplus
: The excess of gross output over the costs incurred in production but before deducting taxes, royalties, dividends, interest, depreciation and land rent payments.

Habitat
: The particular local environment occupied by an organism.

Hardstand areas
: Designated areas which are compacted to withstand the pressure of built structures, equipment storage or deposited materials (e.g. a building pad or a product stockpile).

Headward erosion
: Down-cutting of a streambed resulting in progressive erosion in an upstream direction.

Herpetofauna
: Collective term for reptiles and amphibians.

Hopper
: A container/bin used for holding broken ore.

Hydraulic conductivity
: A measure of the permeability of a porous medium.

Ibid.
: In the same place.

Igneous
: A rock which originated as molten magma from beneath the earth's surface and subsequently came to the surface as an extrusion, or remained below ground as an intrusion.

Income
: The amount of money or its equivalent received during a period of time in exchange for labour or services, from the sale of goods or property, or as profit from financial investments.

Indirect output
: The gross value of business turnover that arises in other enterprises through production-induced linkages (other businesses supplying inputs to production) and consumption-induced linkages (other businesses supplying goods and services demand by employees of the enterprise).

Infrastructure
: The supporting installations and services that supply the needs of the Project.

Input-output analysis
: The analysis of the flows of goods among industries.

In-situ
: A term used to distinguish material (e.g. rocks, minerals, fossils, etc.) found in its original position of formation, deposition, or growth, as opposed to transported material.

Interburden
: Waste rock material in-between layers of *in-situ* coal material that must be removed during mining.

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.

Intra-generational equity
: 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 their own generation.

Isostatic subsidence
: Vertical movement of tectonic plates as a result of increased weight from sediment, water or ice.

L_{Aeq}
The equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period (NSW INP, 2000).

Land capability
A method of land use assessment used to estimate the ability of the land to support a particular land use. Classification is based on an assessment of the land's biophysical characteristics.

Lithology
Characteristics of rock including mineral composition, structure, grain-size and arrangement.

Lithosols
A shallow single layer soil showing minimal profile development and dominated by the presence of weathering rock and rock fragments.

Macroinvertebrate
Larger invertebrates (animals without backbones) which can be studied without using a microscope.

Metamorphic
An aggregate of minerals formed by the recrystallisation of pre-existing rocks in response to a change of pressure, temperature, or volatile content.

Mine waste
By-products of mining operations with no economic value.

Mine water
All water used in mining and processing (for dust suppression, in leach tanks, etc.).

Overburden
Waste rock material overlying *in-situ* coal that must be removed prior to mining of coal.

Permeability
The ability of a rock or soil to allow fluid to pass through it.

Permian age
The youngest geological period of the Palaeozoic era, covering a span between approximately 290-250 million years.

pH
A measure of the degree of acidity or alkalinity of a solution; expressed numerically (logarithmically) on a scale of 1 to 14, on which 1 is most acid, 7 is neutral acid, and 14 is most basic (alkaline).

Podzolic
Soil type found in areas of very high rainfall and low evaporation, developed on siliceous mineral soil.

Portal
The surface entry or exit point of an underground access passage.

Potable water
Water of quality suitable for human consumption.

Quartz
The most abundant and common mineral, consisting of crystalline silica (silicon dioxide, SiO_2), crystallizing in the trigonal system.

Rating Background Level (RBL)
The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period, and is the level used for assessment purposes.

Reagents
Chemicals used as part of an industrial/mining process.

Recharge
: The addition of water to an aquifer, directly from the surface, indirectly from the unsaturated zone, or by discharge from overlying or underlying aquifer systems.

Red podzolics
: Strongly differentiated duplex soils with light to medium textured A1 horizon over a pale or bleached A2 over a reddish, firm to friable B horizon with generally polyhedral structure.

Rehabilitation
: The restoration of a landscape and especially the vegetation following its disturbance.

Relative humidity
: The ratio of actual moisture in the air to the amount the air could hold if saturated, at a given temperature.

Remnant vegetation
: Native vegetation remaining after widespread clearing has taken place.

Reverse faults
: A low-angle, dip-slip fault in which the relative displacement of the hanging wall is upwards.

Riparian
: Pertaining to, or situated on, the bank of a body of water, especially a watercourse such as a river.

Rip-rap
: Crushed rock that is compacted into drain inverts to protect against scour/erosion.

Run-of-mine (ROM)
: Run-of-mine ore, stockpiled and used to feed the crusher.

Runoff
: That portion of precipitation (rain, hail and snow) that flows across the ground surface as water.

Salinity
: The total content of dissolved solids in groundwater, commonly expressed as parts of dissolved solids per million parts of solution, or milligrams of dissolved solids per litre of solution (mg/L); the significance of salinity depends on the nature as well as the amount of the dissolved solids.

Seepage
: Liquid or fluid such as water, seeping or flowing from beneath the ground to the surface.

Silcrete
: A hard soil capping layer cemented with silica.

Siliceous
: Term used to describe sediments, deposits or incrustations that have a large silica component.

Solodic
: Leached, formerly saline soil, associated with semi-arid tropical environments, in which the A soil horizon has become slightly acid, and the B horizon is enriched with sodium-saturated clay.

Soloths
: Acid soils with strong texture contrast between pale topsoil and clay subsoil with coarse blocky or columnar structure.

Spontaneous combustion
: Self heating and ignition of a combustible material such as coal.

State blanket distributions
: A 19th Century government initiative to provide blankets, clothing and other rations to the dwindling Aboriginal population.

Stratigraphic
: Stratigraphy - The branch of geology concerned with the origin, composition, sequence, and correlation of rock strata.

Strip ratio
: Ratio of overburden waste rock material to coal produced from the open cut. The higher the ratio, the more expensive the coal is to extract.

Subsidence zone
: An area in the form of a depression on the land surface above the ore deposit that is affected by underground mining operations.

Subsidies
: Monetary assistance granted by a government to a person or group in support of an enterprise regarded as being in the public interest.

Substrate
: An underlying layer (e.g. of sediment under water).

Supernatant
: The layer of water above settled solids.

Tailings
: Finely ground residue from processing and extraction of product (e.g. coal) from ore.

Tailings slurry
: Material rejected from a mill after the recoverable valuable minerals have been extracted.

Taxa
: Classification system for biological groups (i.e. genus).

Tectonic depression
: The relative lowering of tectonic plates.

Temperature inversion
: An atmosphere phenomenon in which air temperature increases with height over a particular interval.

Terrestrial
: Living or growing on the land.

Thermal coal
: The general term for coal used for energy generation.

Throw
: The amount of vertical displacement produced by a fault.

Thrust fault
: A type of reverse fault - A low-angle (commonly less than 45°) reverse fault, with a significant dip-slip component, in which the hanging wall overhangs the footwall.

Total suspended particulates (TSP)
: Particulate matter suspended in solution of air.

Total suspended solids (TSS)
: A common measure used to determine suspended solids concentrations in a waterbody and expressed in terms of mass per unit of volume (e.g. milligrams per litre).

Tuffaceous claystone
: A claystone made up of predominantly volcanic ash material.

Value added
: The difference between the value of a firm's output and the cost of the inputs of raw materials, components or services brought in to produce that output.

Ventilation shaft
: An opening on the land surface down to the underground workings in which fresh air is introduced.

Waste rock
: Uneconomic rock extracted from the ground during a coal mining operation to gain access to the coal.

Weir

A low dam built across a river to raise the water level, divert the water or control its flow.

Yellow podzolics

Strongly differentiated duplex soils with light to medium textured A1 horizon over a pale A2 horizon over a yellowish, firm to friable B horizon with generally polyhedral structure.

WAMBO DEVELOPMENT PROJECT

ENVIRONMENTAL IMPACT STATEMENT

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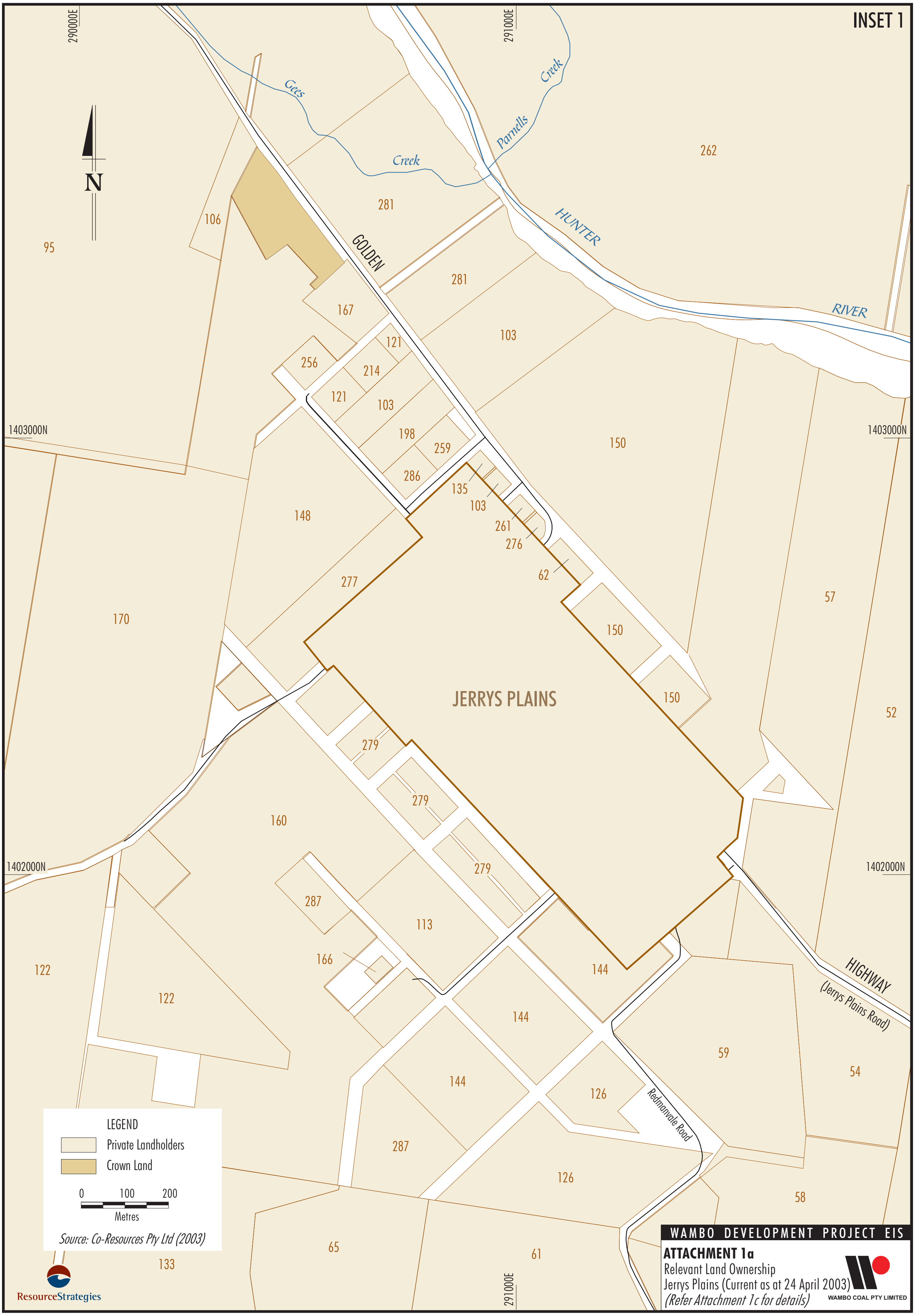
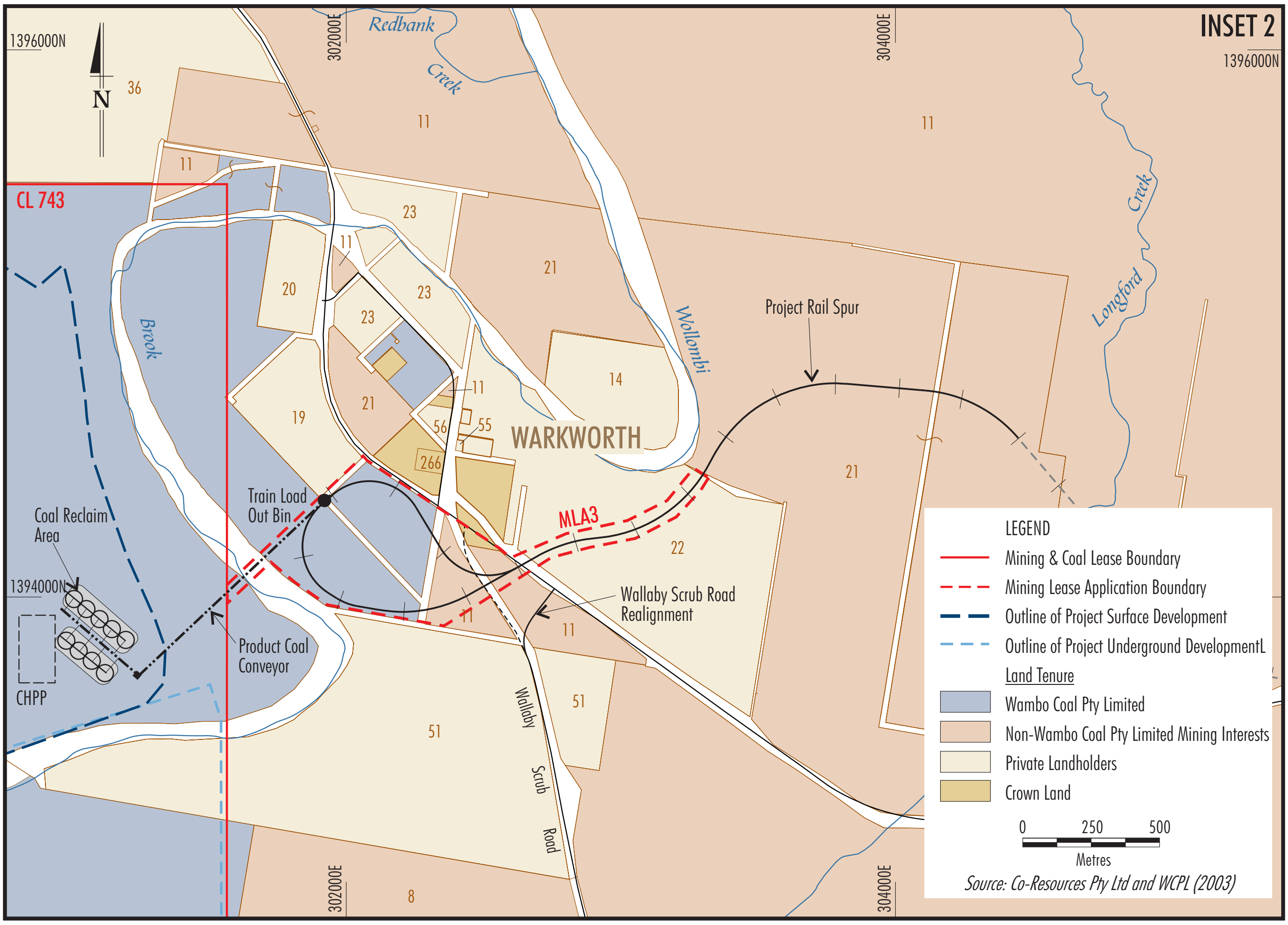
Attachments

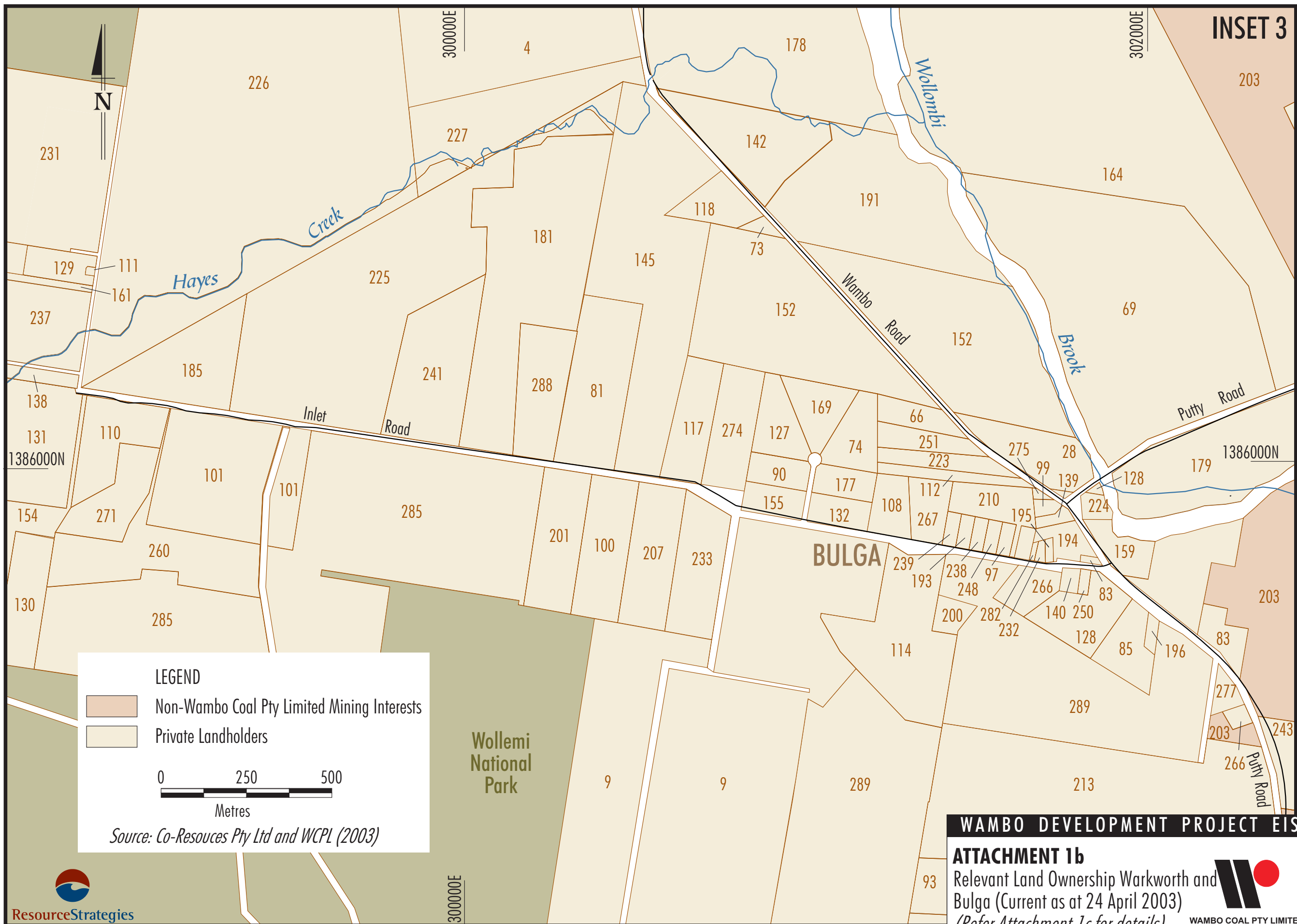
ATTACHMENT 1

LAND OWNERSHIP AND LANDHOLDER KEY



WAM-02-01-Sect1_006M





WAMBO DEVELOPMENT PROJECT EIS

ATTACHMENT 1b

Relevant Land Ownership Warkworth and Bulga (Current as at 24 April 2003)

(Refer Attachment 1c for details)

WAMBO COAL PTY LIMITED

WAM-02-01-Sect1_007S

1 KM & CM Brosi
2 W & D Lambkin
3 HM Birrell
4 IF & MA Circosta
5 DS & DL Strachan
6 HD Merrick
7 DC & EM Maizey
8 Warkworth Mining Limited
9 H Upward
11 Coal & Allied Pty Ltd
13 DR Skinner
14 S & G Keys
15 L McGowen & AJ Caslick
16 MR & CE Cooper
17 J & HJ Carter
18 GJ Denney
19 L Kelly
20 Jerry's Plains Coal Terminal
21 Coal & Allied Pty Ltd
22 O J Henderson
23 HE Kannar
24 AJ Long
25 RW Fenwick & AM Frost (Fenwick)
26 Amarina Systems
27 Birralee Feeds Pty Ltd
28 C & M Garland
29 C Lowe
30 JE & CN Williams
31 CM Fisher
32 CM Moore
33 DJ Thelander & JA O'Niell
35 GJ Brosi
36 Graham, Coates & Maitland
37 IA & JE Lawry
38 JV Clifton
39 K & DL Northcote
40 KM Muller
41 Jepolo Pty Ltd
42 LM Redman
43 ME & CM Carmody
44 MR Skinner
45 R & PK Mansfield
46 RJ & CC Ball
47 RJ Hayes
48 SJL LL Ponder
49 WB TM Oliver
50 WM & RF & TJ & RJ Nowland
51 C.M. Hawkes Pty Ltd
52 KJ Bennett
53 TP & CM Old
54 PW & BN Nichols
55 E & C Burley
56 K & L Haynes
57 TJ & LM Bennett
58 P & MD Cantrill
59 GW & KM Merrick
60 MJ Williams
61 LW Northgate
62 A Mitchell
63 Abrocuff Pty Ltd
64 AE & MJ Dallas
65 AF & HM Holt
66 AJ Gallagher
67 White Mining
68 AL Tarrant
69 AM & NM Renaud
70 Anglican Church
71 ARD & KM Spinks
72 AS Bowman
73 AW & CA Louis
74 B Fogwell
75 BA Barnes
76 Barrington Group of Companies
77 BD Medhurst
78 BE & TA Moxey
79 BE Norton
80 BH & CJ Witchard
81 BJ & MG Anderson
82 BR McTaggart
83 Bulga Community Centre
84 BV Kbodler & ML Swain
85 C & PJ Reid
86 Calogo Bloodstock
87 CG Wallace
88 CI Maskey
89 CJ & MB Cowlard
90 CL & L Price
91 CL Bailey
92 Country Womens Association
93 CS & EA Neville
94 Curlewis Pastoral
95 CW & RM Gee
96 D & D Townsend
97 D & VM Saunders
98 D Macey
99 D Vikas & SJ Mitchell
100 DA Hodge
101 DB Roser
102 DE Leslie
103 DE Morrow
104 Department of Education
105 DG & H Walton
106 DG & JC De Somer
107 DJ & IB Birkett
108 DJ & VA Goldstein
109 DJ Cassidy & AE Conley
110 DK & AG Margery
111 DK Partridge
112 DP & EJ Van Rensburg
113 DR & KG Nichols
114 DV & KN Cameron
115 DW & JA Hadley
116 DW & SP Butler
117 E MacKenzie
118 EA Quilan
119 EE McNaught
120 EI & RC & DE Chapman & PA Salton
121 EJ & DL St John
122 EM Lannigan
123 Energy Australia
124 ES Bowman
125 Estate of the late JE Barry
126 Estate of the late TM Brown
127 F & J Fameli
128 F H Turnbull
129 FJ Carruthers
130 G & JA Lee Wood
131 G & SF O'Brien
132 G & T Carnevale
133 GA & GG Cross
134 GF Morley
135 GJ & BA Wild
136 GJ & JG Ernst
137 GJ & K Woodruff
138 GJ & TM Tlaskal
139 GK & SR Grainger
140 GL Turnbull
141 Glendell Tenements
142 GM Caban
143 GR & JR Mumford
144 GR Duff
145 GW & ME Banks
146 GW Jennison
147 GW McTaggart
148 H & T & H Fotopoulos
149 HJ Kauter
150 IH & RA Moore
151 IK Mitchell
152 IN & AM Batholomew
153 Inchnuek
154 Irene investments
155 IV Farmer
156 IW Killen
157 J & D Vassallo
158 J & G Seiffhart
159 J & V Ferlito
160 J Kladis
161 J Leslie
162 JA Pritchard
163 JA Rodger & CM Williams
164 JC Mullaly & PE McMaugh
165 JE Killin
166 Jerry Plains Cemetery
167 Jerry's Plains Pony Club
168 JF Lannigan
169 JM & M Player
170 JM Woodruff
171 JP & S Evans
172 JR & DC Lamb
173 JR & KA Wulff
174 JT & PJ Walmsley
175 JT Lambkin
176 Justice Dept
177 JW & LM Clements
178 KJ & NL Smith
179 KJ & PD Slade
180 KJ Mitchell
181 KM Hunt
182 KM Merrick
183 KR & JM Dubois

Source: Co-Resources Pty Ltd and WCPL (2003)

WAMBO DEVELOPMENT PROJECT EIS

ATTACHMENT 1c
Landholder Key
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ResourceStrategies

WAMBO COAL PTY LIMITED

WAM-02-01-Sect1_008I

184	KR & MJ Lobb
185	L & M Fletcher
186	L Edwards
187	L Farrugia
188	LA & GI Fuller
189	LC Krey
190	LJ & V Bodiam
191	LM & RB Caban
192	LM Crisp
193	LW & NR McLachlan
194	M & B Dragicevic
195	M & SE Bendall
196	M E Vidler
197	M G White
198	M N Killen
199	Macquarie Generation
200	MC & SJ Mitchell
201	MF & NV Chapman
202	MH & EJ Richards
203	Miller Pohang Coal
204	Minister for Education and Training
205	MJ & JG Bryan
206	MJ Dallas
207	MM & N Roser
208	MS & S Dawson
209	MV & SM Thompson
210	MV Ford
211	MW & P Charlton
212	N & L Holz
213	National Parks & Wildlife
214	ND Chalker & JR Spiller
215	Newcastle Gliding Club
216	Nippon Steel
217	NJ Barry
218	NO & RJ Cole
219	Novacoal Australia
220	NR & GJ Nelson
221	NR Bourke & EL White
222	NR Walters & TJ Barry
223	P Adamthwaite
224	PA & JA Cooke
225	Packtron Packaging
226	Paka Investments
227	PD Culbert
228	Peabody Resources
229	PF & FJ Ritchie
230	PG Gee
231	PJ & ER Hearse
232	PJ & GTL Magin
233	PJ & H Kolatchew
234	PJ Carlyon
235	PJ Keegan
236	PR & CM Burley
237	PT Jessop
238	PW & TA Harris
239	R McLauglin
240	RA & LJ Lannigan
241	RA Corino & PM Rayner
242	Raynest Pty Ltd
243	Recluse Pty Ltd
244	Redbank Project Pty Ltd
245	RG & A Godyn
246	RG & FS Bailey
247	RG & KL Caban
248	RG Nichols & SA Anderson
249	RGW Richardson
250	RI & JM Hedley
251	RJ & JA Evans
252	RJ & JS Wenham
253	RJ & KT Bridge
254	RJ Algie
255	RJ Farley & SJ Oldham
256	RJ Peel
257	RM Spencer
258	Roman Catholic Church
259	RP & L Newman
260	RW & HA Davis
261	RW & MA Cupitt
262	RW Moses
263	Saxonvale Coal Pty Ltd
264	School of Arts
265	SD Edwards & T Howard & JV Clifton
266	Singleton Council
267	SJ & L Pringle
268	SM & TA Gaunt
269	SM Franks & RA Harris
270	SM Gee
271	SPP & SJ Tamplin
272	TA & SA Mills
273	TC & SG Jackson
274	TE & BG Harrison
275	Telstra Corporation
276	TG Gale
277	The State of NSW
278	TJ Bennett
279	TJ BL Holstein
280	TP & S Mitchell
281	TR & SN & ML Cole
282	Transgrid
283	VE Gee
284	W Rienstra
285	W Riley
286	WB Harris & BL Guy
287	WG Barnett
288	WL & P Slaney
289	WT Clark
290	Wyoming Holsteins
291	YC Van Den Berg
292	D & JM Vikas
293	CA Dyson
294	CBS Explosives
295	Ian Headley
296	Singleton Shire Council
297	State Rail Authority
298	D & C Russell
299	C Russell
300	K Isaac
301	Pastures Protection Board
302	DB & P Stuart
303	R Thrift & Co
304	W Bowman, G Elder & A Bowman
305	Canravo Pty Ltd
306	Keith Heuston Pty Ltd
307	B New & A Knodler
308	N & E Riley
309	W & L Barry
310	HD & DR Hobden
311	HD Hobden
312	F & J Ventra
313	W & H Welsh
314	C & L Slade
315	L & R Gatt
316	RW Kannar
317	DM Clemson

Source: Co-Resources Pty Ltd and WCPL (2003)

WAMBO DEVELOPMENT PROJECT EIS

ATTACHMENT 1c
Landholder Key
(Current as at 24 April 2003)
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ResourceStrategies

WAMBO COAL PTY LIMITED

WAM-02-01-Sect1_008I

ATTACHMENT 2

DIRECTOR-GENERAL'S REQUIREMENTS

planningnsw

Henry Deane Building
20 Lee Street Sydney NSW 2000
GPO Box 3927 Sydney NSW 2001
T 02 9762 8000
www.planning.nsw.gov.au

Mr Peter Doyle
Wambo Coal Pty. Ltd.
PO Box H287
Australia Square
SYDNEY NSW 1215

Telephone: 9762 8159
Facsimile: 9762 8707

Dear Mr Doyle

Proposed Expansion – Wambo Mine
Our Reference: S02/02197

I refer to your recent request for the Director-General's requirements for the preparation of an Environmental Impact Statement (EIS) for the above proposal.

Statutory Issues

Attachment No. 1 outlines the statutory matters that must be included in any EIS under Clauses 71 and 72 of the *Environmental Planning and Assessment Regulation 2000* (the Regulation).

Specific Issues

Under Clause 73(1) of the Regulation, the Director-General requires you to address the following specific issues in the EIS:

- **Description of the Proposal**: Describe and justify the proposal, clearly identifying the resource, the proposed site, the proposed works (including any rehabilitation works), the proposed intensity of operations, and the likely inter-relationship between these proposed operations and the existing or approved mining operations at the Wambo Mine.
- **Permissibility:** Demonstrate that the proposal is permissible with consent.
- **Statutory Instruments/Policies**: Assess the proposal against the relevant provisions in *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development, State Environmental Planning Policy No. 44 – Koala Habitat Protection, Hunter Regional Environmental Plan 1989, Hunter Regional Environmental Plan 1989 (Heritage), Singleton Local Environmental Plan 1996,* and any relevant Development Control Plans.
- **Key Issues**: Assess the following potential impacts of the proposal during construction and operation, and describe what measures would be implemented to manage, mitigate, or off-set these potential impacts:
  (a) Subsidence;
  (b) Surface water;
  (c) Groundwater;
  (d) Noise and vibration;
  (e) Air quality/odour;
  (f) Heritage, both Aboriginal and European;
  (g) Fauna and flora, particularly on critical habitats, threatened species, populations, or ecological communities;
  (h) Soil;
  (i) Traffic and transport;
  (j) Hazards;
  (k) Visual;
  (l) Waste management;

(m) Utilities & services; and
(n) Social and economic.

- **Cumulative Impacts:** Assess the potential air, noise, surface & groundwater, fauna & flora, and archaeological cumulative impacts of the proposal, taking into account the proposed expansion of several mines in the surrounding area, particularly the United, Warkworth, Mount Thorley, Hunter Valley Operations, and Bulga mines.
- **Environmental Monitoring & Management:** Describe in detail how the environmental performance of the proposal would be monitored and managed over time.

You should note that if the Development Application (DA) to which these requirements relate is not made within two years of the date of this letter, Clause 73(6) of the Regulation requires you to re-consult with the Director-General before you lodge the DA.

Guidelines

During the preparation of the EIS, you must consider the Department's EIS guideline on *Coal Mines & Associated Infrastructure*.

State Significant Development Requirements

For all State Significant Development proposals, the Director-General requires the Applicant to:

- Nominate a contact person (with telephone number) to answer public enquiries about the proposal;
- Provide the Department with an electronic copy of the Executive Summary of the EIS when you lodge the DA for exhibition on the Department's website; and
- Advise the Department of the relevant newspapers circulating in the area affected by the proposal.

Integrated Development

Under Section 91 of the *Environmental Planning & Assessment Act 1979* (the Act), development is classified as "integrated development" if it requires certain approvals in addition to development consent before it may be carried out.

In your form A, you indicated that the proposal would require additional approvals from the Environment Protection Authority, Department of Land & Water Conservation, NSW Fisheries, NSW Heritage Council, Mine Subsidence Board, National Parks & Wildlife Service, and Singleton Shire Council (with the concurrence of the RTA). These approval bodies have provided the Department with their requirements for your EIS (see Attachment No. 2), and you must address these requirements in your EIS.

If further integrated approvals are identified before you lodge the DA, you must consult with the relevant agencies, and address their requirements in your EIS.

Environmental Monitoring & Management Plans

Given that the Wambo Mine has been operating for many years, and already has an environmental monitoring and management system in place, the Department would like you to consider any necessary changes to this system during the assessment process, rather than deferring this for future consideration.

To address this issue, you should provide specific details about the proposed monitoring program (including location, frequency, methods) and any mitigation measures in the EIS.

The Department would be happy to discuss this with you in more detail before you lodge the DA for the proposal.

Best Management Practice

During the preparation of the EIS, the Department would like you to review and identify current best management practice for the following environmental issues, using any relevant Australian and international literature:

- Air quality (including particulate matter from construction and mining activities, air emissions from off-road vehicles, and odour from ventilation shafts);
- Noise;
- Fauna & flora; and
- Subsidence and the associated surface and groundwater impacts.

Again, the Department would be happy to discuss this with you in more detail before you lodge the DA.

Consultation

During the preparation of the EIS, you should consult with the relevant local, State, and Commonwealth government authorities, service providers and community groups in the area, and address any issues they may raise in the EIS.

In particular, you should consult the surrounding landowners and occupiers that are likely to be affected by the proposal.

Several agencies (see Attachment 3) and community members/groups (see Attachment 4) have provided the Department with their requirements for the EIS, and you should consider these requirements in your EIS.

The EIS must include a report indicating who was consulted, what consultation occurred, and what issues were raised during this consultation.

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will require an additional approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999 (EPBC Act)*. These approvals are in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact Environment Australia in Canberra (6274 1111 or http://www.environment.gov.au).

Administration

You should notify the Department at least 3 weeks before you lodge the DA for the proposal, so that it can make the necessary arrangements to exhibit the DA and EIS.

When you lodge a DA for the proposal, you must include:

- At least 40 hard copies and 20 CD copies of the EIS ;
- A cheque for the DA fee and advertising (see Clauses 246 & 252 of the Regulation), made payable to the Department;
- A cheque for $715, made payable to the Department, for designated development;
- A cheque for $250, made payable to each of the integrated approval bodies; and
- A cheque for $110, made payable to the Department, for integrated development administration.

Enquiries

If you have any enquiries about the above, please contact David Kitto 9762 8162.

Yours sincerely

Nick Agapides
Manager
Mining & Extractive Industries

Attachment No. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 4 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

In accordance with the *Environmental Planning and Assessment Act 1979* (the Act), an environmental impact statement (EIS) must meet the following requirements.

Content of EIS

Pursuant to Schedule 2 and clause 72 of the *Environmental Planning and Assessment Regulation 2000* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including the consequences of not carrying out the development or activity.
4. An analysis of the development or activity, including:
   (a) a full description of the development or activity; and
   (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and
   (c) the likely impact on the environment of the development or activity, and
   (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment, and
   (e) a list of any approvals that must be obtained under any Act or law before the development or activity may be lawfully carried out.
5. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
6. The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:
   (a) 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) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
      (ii) an assessment of the risk-weighted consequences of various options,
   (b) inter-generational equity - namely, 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,
   (c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
   (d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:
      (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
      (ii) 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,
      (iii) 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.

An environmental impact statement referred to in Section 78A(8) of the Act shall be prepared in written form. The prescribed form to accompany the environmental impact statement must comply with the requirements of clause 71 of the Regulation and be signed by the person who has prepared it.

Procedures for public exhibition of the EIS are set down in clauses 77 to 81 of the Regulation.

Attention is also drawn to clause 283 of the Regulation regarding false or misleading statements in EISs.

Note

If the development application to which the EIS relates is not made within 2 years from the date of issue of the Director-General's requirements, under clause 73(6) of the Regulation the proponent is required to reconsult with the Director-General.

Attachment No. 2

Singleton Council

For a better future...

Address all correspondence to the General Manager:
Civic Centre
Queen Street
PO Box 314
SINGLETON
NSW 2330

Ph. (02) 6578 7290
Fax (02) 6572 4197
Email:
ssc@singleton.nsw.gov.au
Website
www.singleton.nsw.gov.au

Enquiries to: **Ken Horner**
02 6578 7331

Our Ref: M 9
Your Ref:

31 DEC 2002

20 December 2002

Mr David Kitto, Senior Planning Officer
PlanningNSW, Mining & Extractive Industries
GPO Box 3927
SYDNEY NSW 2001

Proposed expansion – Wambo Mine

I refer to your letter dated 20 November 2002 requesting Council's requirements for the preparation of the Environmental Impact Statement (EIS) for the above proposal, and apologise for the delay in response.

In addition to those issues normally addressed by the relevant government authorities, Council's requires the EIS to incorporate the following matters:

1. Plain English assessment;
2. Full investigation of alternatives for the State significant Wambo Homestead and justification for the proposed alternative;
3. Impacts on Jerrys Plains, including the establishment of real background noise levels;
4. Details of employment levels throughout the project in consideration of Council's Section 94 Contributions Plan;
5. Full mine exit strategy including both environmental impact assessment and social impact assessment;
6. Impact on natural water drainage systems, with particular reference to North Wambo Creek and the Wollombi Brook;
7. Full traffic impact assessment;
8. Dependency on the proposed rail spur and coal terminal for the project to proceed;
9. Impacts on Warkworth, including the coal terminal and rail loop;
10. Acquisition and decommissioning of the Warkworth service station;
11. Full assessment of visual impacts;
12. Cumulative impacts, with particular reference to environmental health, including the potential for impacts on human health and biophysical impacts; and
13. Demonstration of compliance with past and current approvals.

Should you wish to discuss these matters further please contact me on direct line 6578 7331.

KA Horner

K Horner
Senior Assessment Planner
kh.kh

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"Singleton. A progressive community of excellence and sustainability."

Your Reference
Our Reference : 27071 NEF 10145
Contact : Peter Hughes 4908 6825

NSW EPA
Coastal Regions

Mr N Agapides
PlanningNSW
Development and Infrastructure Assessment
GPO Box 3927
SYDNEY NSW 2001

16 DEC 2002

Dear Mr Agapides,

WAMBO COAL MINE - PROPOSED EXTENSIONS

I refer to your request for the Environment Protection Authority's (EPA) requirements for the preparation of an Environmental Impact Statement (EIS) relating to the above stated development. The information specified in Attachment A must be provided in any Environmental Impact Statement (EIS) submitted in support of the development proposal to enable the EPA to adequately assess the impacts of the development on the environment to the extent that the impacts relate to the EPA's statutory responsibilities.

Based upon information provided at the Planning Focus meeting held on 4 December 2002 the EPA believes that the following issues will be the key considerations requiring detailed assessment and definitive measures to mitigate any impacts:

(a) The likelihood of increased noise impacts due to mining operations;
(b) The potential for dust generation during earthworks and open cut mining operations;
(c) The potential for significant land subsidence above the underground mine and its associated impact on surface and groundwaters;
(d) The mine's water balance and water management systems.

The Wambo Coal Mine holds an Environment Protection Licence under the Protection of the Environment Operations Act 1997. Consequently, if development consent is granted the proposed mining operations will require variations to this licence.

The EPA will require 4 copies of the EIS when the application is submitted. These documents should be lodged at the EPA's Newcastle office located in the Government Office Building at 117 Bull Street Newcastle and marked to the attention of the Regional Manager, Hunter. If you have any inquiries regarding this matter, please contact Peter Hughes 4908 6825.

Yours sincerely

19 DEC 2002

MITCHELL BENNETT
Head, Regional Operations Unit, Hunter

Environment Protection Authority
PO Box 488G Newcastle NSW 2300 Australia Telephone 61 2 4926 9971 Facsimile 61 2 4929 6712 ABN 43 692 285 758
Ground Floor NSW Government Offices 117 Bull Street Newcastle West NSW 2302 www.epa.nsw.gov.au

ATTACHMENT A - ENVIRONMENT PROTECTION AUTHORITY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENT – WAMBO COAL MINE EXTENSIONS

1. EXECUTIVE SUMMARY

1.1 The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

2. THE PROPOSAL

2.1 The objectives of the proposal should be clearly stated and refer to:

- the size and type of the operation;
- the anticipated level of performance in meeting required environmental standards and cleaner production principles;
- the staging and timing of the proposal;
- the proposal's relationship to any other industry or facility.

2.2. A detailed description of the proposed development must be provided which includes but need not be limited to the following:

- An overall description of the proposed development including the rail and conveyor systems and coal storage, handling and loading facilities supported by detailed site layout and locality maps.
- Details of the coal handling arrangements during the initial development headings.
- A description of the operation of the proposed washery rejects emplacement facilities.
- Outline construction works including:
  - actions to address any existing soil contamination;
  - surface works including earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site);
  - construction timetable and staging; hours of construction; proposed construction methods;
  - environment protection measures, including noise mitigation, dust controls and erosion and sediment control measures.

3. AIR

3.1 General

The EIS should demonstrate that the mine will be able to operate within the EPA's air quality objectives which are to control, to the maximum extent practicable, the generation of air pollutants on-site, to contain any pollutants generated within the property, to minimize adverse effects of the operation on the amenity of local residents and sensitive land uses and to limit the effects of pollutants on regional air quality. The EIS should also include:

- A description of existing air quality and meteorology, using existing information and site representative ambient monitoring data. The use of particular meteorological monitoring data sets should be justified. This should include an analysis of site representative data on the following meteorological parameters:
  - temperature and humidity;
  - rainfall and evaporation;
  - wind speed and direction.

- Provide a description of existing air quality, using existing information and site representative ambient monitoring data. This description should include the following parameters:
  - dust deposition;
  - total suspended particulates;
  - PM_{10} particulate matter.

- Identification and location of all fixed and mobile sources of dust/air emissions from the development including rehabilitation. The location of all emission sources should be clearly marked on a plan for key years of mine development. Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source(s) and discharge point(s).

- Details of the project that are essential for predicting and assessing impacts on air quality including:
  - the quantity and physio-chemical characteristics of materials to be handled, stored or transported;
  - an outline of the procedures for coal handling, storage and transport;
  - the management of activities and areas with potential for impacts on air quality.

Note: emissions can be classed as either:
- point (eg emissions from stack or vent) or
- fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).

- A description of the topography and surrounding land uses.

- Details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.

3.2 Impact Assessment

- Detailed dust emission inventory calculations showing the methodology and emission factors used. Suitable emissions factors may be obtained by a review of recent EIS's and reference to the following documents: *'Air Pollution from Surface Coal Mining: Measurement Modeling and Community Perception, National Energy Research and Development Council: Project No 921'*; and *' Section 11.9 Western Surface Coal Mining, Section 11.10 Coal Cleaning and Section 13.2.4 Aggregate Handling and Storage Piles, AP-42, Volume I, Stationary Point and Area Sources, USEPA* (or updated sections as appropriate)'.

- Estimate the resulting ground level concentrations of all pollutants. Use an appropriate dispersion model to predict ambient TSP and PM_{10} dust concentrations and dust deposition levels. Reference should be made to the EPA's *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales.*

- A detailed description of the methodology used to assess the air quality impacts of the development. The use of a particular dispersion model and model parameters used should be justified and discussed. The dispersion model input/output files should be included.

- Air quality impact predictions should include plans showing projected incremental levels of 24-hour average PM_{10} concentrations, annual average dust deposition rates and annual average total suspended particulate concentrations throughout the life of the mine.

- An assessment on the impact of the mine on local and regional air quality. Comparisons should be made with the *'National Environment Protection Measure for Ambient Air'* when assessing regional impacts. Local impacts should be assessed by considering background levels, the predicted project specific impacts and the cumulative impacts by comparison with the following dust deposition criteria:

Table 1: Health and Amenity Based Particulate Matter Standards/Goals/Criteria

Pollutant	Standard/Goal	Source Agency
Total Suspended Particulate (TSP) Matter	90 μg/m³ (annual average)	NHMRC[1]
Dust Deposition	4 g/m²/month (annual average)	SPCC[2]
Particulate Matter Less than 10 microns in Aerodynamic Equivalent Diameter (PM_{10})	50 μg/m³ (24 hour average) 30 μg/m³ (annual average)	NEPC[3] NSW EPA[4]

1 National Health and Medical Research Council.

2 NSW State Pollution Control Commission.

3 National Environment Protection Council. National Environment Protection Measure for Ambient Air Quality standard for reporting regional ambient air quality.

4 NSW EPA long term reporting goal for regional ambient air quality as published in Action for Air.

Table 2: NH&MRC Dust Deposition Criteria (Total Solids)

Existing Dust Level g/m²/month (annual average)	Maximum Acceptable Increase Over Existing Dust Level g/m²/month (annual average)	
	Residential Suburban	Other
2	2	2
3	1	2
4	0	1

- An assessment of cumulative air quality impacts and a description of the methodology used.

- An assessment of the potential impacts on air quality other than by dust, for example nitrogen oxide emissions from diesel equipment.

- Greenhouse gas emissions :

    - using the methodologies published with the National Greenhouse Gas Inventory (1994) estimate the total annual volume of all major greenhouse gases that are likely to be emitted from all aspects of the proposed development.
    - Estimate the net increase or decrease in greenhouse gas emissions from the proposed development and compare it to estimates in the 1990 National Greenhouse Gas Inventory for total Australian emissions and for the energy and transformation industry sector.
    - Specific consideration should be given to measures to minimise the emission of all major greenhouse gases from the proposed development.
    - The use of coal bed methane or renewable energy technologies such as solar and/or wind energy should be considered for on-site power generation.

- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.

- Describe the contribution (if any) that the development will make to regional and global pollution, particularly in sensitive locations.

- An assessment of the impacts on air quality of dust and any other pollutants generated during construction works. In this context, particular attention should be given to:

  - The nature, extent and duration of dust generating activities, e.g. earthmoving equipment, exposed surfaces, material stockpiles, unsealed trafficked areas, spillages etc.
  - Consideration of the location of dust sources, particularly their proximity to sensitive receptors and prior to finalisation of any acquisition or similar processes.

- Details of an investigation of the propensity of coal seams to self heat and the likelihood of spontaneous combustion occurring on site.

- Odour from underground mine ventilation shafts has the potential to cause adverse impacts at the nearest residents. An odour impact assessment should be prepared for the proposed mine.

3.3 Mitigation

- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

- Specific consideration should be given to measures to minimise the emission of all major greenhouse gases from the proposed development.

- Describe consideration of stockpile alignment and optimum stockpile height to minimise wind erosion.

- If spontaneous combustion is likely, details of a management program to minimize spontaneous combustion and to manage any occurrence of spontaneous combustion.

- Include details of an air quality monitoring program to determine effectiveness of mitigation and to verify predictions, including provision for investigations in response to complaints. The air monitoring program should reflect advances in technology for monitoring systems such as real time monitoring systems.

- Control measures to be implemented to minimize dust generation during construction activities.

- Details of contractual arrangements between the applicant and construction contractors aimed at attributing responsibility for controlling the generation and emission of air pollutants.

4. NOISE AND VIBRATION

4.1 General

The EIS must assess the likelihood and implications of intrusive noise and loss of amenity due to noise. The proposal will be assessed in accordance with the EPA's *Industrial Noise Policy* (INP) (2000). The EIS should also include:

- Identify all noise and vibration sources from the development (including both construction and operation phases). Detail all potential noise generating activities and equipment including off-site rail movements and conveyor use.

- Specify the times of operation for the construction and operational phases of the development and for all noise producing activities.

- Provide details of the rail and conveyor corridors and land use (particularly residential) along the proposed routes. Diagrams should be to a scale sufficient to delineate individual residential blocks.

- Specify noise monitoring locations. Particular attention should be given to any areas likely to be affected by the operations.

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals.

- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4.2 Impact Assessment

- Determine existing background noise levels at noise sensitive locations in the area in accordance with the INP.

- Determine the expected noise levels and noise characteristics (eg: tonality, impulsiveness vibration, etc) likely to be generated from noise sources during:
  - site establishment;
  - construction;
  - operational phases;
  - transport including rail and conveyor noise generated by the proposal;
  - other services.

- Determine the noise levels likely to be received at the most sensitive locations under both prevailing and adverse meteorological conditions. (These may also vary during construction and operational phases of the development).

  Note:- *Computer modelling of noise impacts should be undertaken using a recognised computer model.*
  - *Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. This should include the maximum noise levels due to rail traffic, the extent these maximum noise levels exceed ambient noise levels and the number of noise events from rail traffic during the night on an hourly basis for a 'typical' night.*
  - *Noise predictions for individual receptors should be provided with one or more of the L_{Amax}, L_{A1}, L_{A10}, L_{Aeq}, L_{A90} descriptors reported for noise from stationary sources. For*

rail traffic noise, descriptors may include $L_{eq(1hr)}$, $L_{eq(15hr)}$, $L_{eq(9hr)}$ and maximum noise levels depending on the area classification and the types of land use involved.
- *For the assessment of existing and future rail noise, details should be included of assumed rail movements by time of day; and details of the calculation process.*

- Noise contours for both daytime (7am-6pm), evening (6pm – 10pm) and night time (10pm-7am) periods should be provided. Contours should include predicted noise levels under prevailing as well as "worst-case" scenarios during adverse meteorological conditions of wind and temperature inversions.

- Consider the influence of existing meteorological conditions such as winds and temperature inversions in the prediction model so as to provide a true representation of actual noise levels.

- Assess the effect of noise mitigation measures incorporated into the predictive modelling.

- Compare the predicted noise levels with the appropriate noise criteria for the phase of development or activity being considered (determine the appropriate noise criteria for the surrounding area using the INP. (For construction noise criteria refer to the EPA's *Environmental Noise Control Manual* (1994).

- The EIS must demonstrate that ground vibration and overpressure levels recommended by ANZECC will be achieved during blasting.

- The EIS must include a traffic noise assessment covering the expected movement of product off-site for the day, evening and night-time and proposed controls at the source and at affected received locations along the coal transportation routes. Reference should be made to the EPA's *Environmental Criteria for Road Traffic Noise* (1999).

4.3 Mitigation

- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.

- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:
  - locations where the noise level exceeds the criteria and extent of exceedence;
  - numbers of people (or areas) affected;
  - times when criteria will be exceeded;
  - likely impact on activities (speech, sleep, relaxation, listening, etc);
  - change on ambient conditions.

- Determine the most appropriate noise mitigation measures including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, community consultation, complaints handling/monitoring system etc.

- For rail noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects. Appropriate ameliorative measures may include:
  - use of alternative transportation modes and alternative routes;

- control of rail traffic (eg: limiting times of access or speed limitations);
- use of noise barriers or bunds.
- provide details of a noise and blasting (vibration) monitoring program with monitoring to be undertaken at noise sensitive locations subject to the agreement of the owners/occupiers of those properties. The noise and vibration monitoring program should reflect advances in technology for monitoring systems such as integrated blast monitoring. In addition, if noise levels for the premise are to rely on inversion conditions, and inversion monitoring program for noise assessment purposes must also be included in the monitoring program.

5. WATER

5.1 General

- Provide details of the project relevant to any water impacts of the development such as drainage works and associated infrastructure, general earthworks, working capacity of structures, and water resource requirements of the proposal.

- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg effluent ponds) and showing potential areas of modification of contours, drainage, etc.

- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective.

- Describe existing surface water quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

- Provide historic stream flow data for the catchment where available.

- Provide site drainage details and surface runoff yield.

- Describe the condition of the local catchment, eg erosion levels, soils, vegetation cover, etc.

- Outline baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment.

- Accurately map the location of all aquifers likely to affected by the proposal. Where alluvial aquifers exist accurately map the boundaries between them.

5.2 Impact Assessment

- Determine all cumulative changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, hydrologic regimes and groundwater).

- Prepare a groundwater hydrogeological model for the proposal. The EIS should report and justify all assumptions used in the development of this model.

- Identify any potential impacts on quality or quantity of groundwater describing their source and significance.

- Assess the likely water quality and quantity impacts of any bedrock cracking on all surface and groundwater resources. This assessment should include:

  - mapping of the likely location, depth and width at the surface of bedrock cracking due to mining induced subsidence;
  - details of all computer modelling used to predict the extent and occurrence of land subsidence that might result from the proposal and discussion and justification of all assumptions used in the model; and
  - details of the design of the final landform and details of its drainage system and any ponding.

- Detail all likely impacts on the existing habitat values, hydrology and water quality of all watercourses proposed to be impacted by the proposed activities and their downstream receiving waters, such as Wollombi Brook and the Hunter River.

- Estimate the water quality outcomes in all waterbodies on the subject site and their receiving waters, such as Wollombi Brook and the Hunter River.

- Prepare a water and salt balance model to a assist in the development of strategies to negate and/or minimise environmental impacts on existing natural resources.

- Identify potential impacts associated with geomorphologic activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.

- Develop short, medium and long term water management strategies aimed at minimising environmental impacts on existing water resources.

- Detail sewage effluent treatment and disposal arrangements. Effluent should be treated and used on the site. On-site effluent disposal should conform to the EPA's draft "*Environmental Guideline for the Utilisation of Treated Effluent by Irrigation*", 1995.

- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.

  Note:- The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

5.3 Mitigation

A water management plan and site water balance should be prepared which incorporates the following principles:

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.

- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls.

- Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements

- Outline pollution control measures relating to storage of materials, possibility of accidental spills (eg preparation of contingency plans), appropriate disposal methods, and generation of leachates.

- Describe hydrological impact mitigation measures including:
  - site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition);
  - minimising runoff;
  - minimising reductions or modifications to flow regimes;
  - avoiding modifications to groundwater;
  - preventing coal spillage entering waters at stream crossings.

- Describe groundwater impact mitigation measures including:
  - site selection;
  - retention of native vegetation and revegetation;
  - artificial recharge;
  - providing surface storages with impervious linings;
  - monitoring program.

- Describe geomorphologic impact mitigation measures including:
  - site selection;
  - erosion and sediment controls;
  - minimising instream works;
  - treating existing accelerated erosion and deposition;
  - a monitoring program.

- Describe management procedures that will be adopted to prevent pollution of waters by minewater, effluent, stormwater runoff etc. The water management plan should also include a monitoring program to assess the impacts of the operation on the quality and quantity of surface and groundwaters.

- Identify and assess in detail the relative advantages and disadvantages of alternative mine plans that would minimise environmental impacts.

5.4 Hunter River Salinity Trading Scheme (HRSTS)

- If a wastewater discharge is proposed it must be justified and it must be demonstrated that controlled discharges can be managed in compliance with the requirements of the HRSTS.

- If a discharge under the HRSTS is found to be necessary and the discharge would be via a tributary of the Hunter River, the EIS must include a tributary impact assessment that addresses the following:

- Impacts on downstream landholders:

- A contact list of downstream landholder/tenants including a record of permanent or seasonal activities;
- A description and list of all crossings, culverts and other in-stream structures.

- Physical and biological impacts:

- existing flow and stream characteristics, including current bank and bed profiles, potential flow volumes at key points of inflection within the stream course, stability of stream banks and beds and an assessment of soil types.
- Assessment of likely impacts of proposed discharge including impacts on flow characterisics, potential for erosion of banks, bed or damage to riparian vegetation.

- Proposed measures to:

- minimise the impacts of discharge on downstream landholders, including a discharge notification procedure;
- reduce potential erosion hazards at vulnerable points in the stream banks, protect and maintain riparian vegetation and bank stability, and provisions for energy dissipation of discharge waters where necessary.

- In cases where more than one mine discharges to a tributary, each discharger must also address the collective impacts of discharge to that tributary.

6. WASTE AND CHEMICALS

6.1 General

- Provide details of:
  - the quantity and type of all liquid wastes and non-liquid wastes likely to be generated at the premises;
  - the method for storing and disposing of any wastes or recovered materials at the facility.
  - Details of sewage effluent treatment and disposal arrangements. Effluent should be treated and irrigated on site. The EIS should include a description of the effluent treatment and disposal system. On sit effluent disposal should conform to the EPA's draft "*Environmental Guideline for the Utilisation of Treated Effluent by Irrigation*" (1995).

6.2 Impact Assessment

- Identify potential impacts from the handling and storage of any wastes and/or chemicals.

- Measures to avoid or minimise the generation of waste and promote waste re-use and recycling.

- Identification of all wastes which cannot be re-used. Disposal options must also be identified in accordance with EPA *Environmental Guidelines, Assessment, Classification and Management of Liquid and Non-Liquid Wastes.*

6.3 Mitigation

- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.

- Outline measures to support any approved regional or industry waste plans.

7. SOIL CONTAMINATION

7.1 General

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination.

- Identify any stream crossings.

7.2 Impact Assessment

- Identify any likely impacts resulting from the construction or operation of the proposal – this should include the likelihood of:
  - disturbing any existing contaminated soil;
  - contamination of soil by operation of the activity;
  - soil erosion or instability;
  - disturbing acid sulfate or potential acid sulfate soils.

7.3 Mitigation

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
  - erosion and sediment control measures;
  - proposals for the management of any acid sulfate soils.

8. ESD

The basic principles of ESD should be addressed in the EIS.

- *The Precautionary Principle*

  - The proposal should include decision-making processes that are predictable and transparent. This should include:
    * making information available at an early stage so that major issues can emerge and be addressed during the project planning stage;
    * adopting consultative mechanisms between the proponent and the community as a means of minimising disputation at the formal environmental assessment stage;
    * establishing appropriate conflict resolution mechanisms for use during the project approval process.
  - Discussion of Best Practice Environmental Management techniques including the potential use of environmental management plans and environmental audits.
  - Ensuring that best practice monitoring and enforcement procedures are proposed.
  - Identifying the responsibilities of the proponent and government agencies for environmental management and enforcement.

- *Inter and Intra Generational Equity*

  - Overall project management and investment in plant and equipment that minimises pollution and waste and is energy efficient.

- Ensure rehabilitation of land disturbed during construction.

- *Conservation of Biodiversity and Ecological Integrity*

  - The identification and assessment of all environmental characteristics and habitat values that could be affected by the proposal.
  - The identification and assessment of the likely environmental impacts on these characteristics and values.
  - The implementation of measures designed to minimise likely environmental impacts.
  - Consideration given to adopting a whole of life cycle approach through:
    * use of environmentally benign materials, products and processes, eg. fuel-efficient motors, use of recyclable and recycled materials;
    * integrated waste minimisation, reuse and recycling.

- *Valuation and Pricing of Resources*

  - The costs and benefits of all aspects of the proposal should be considered. This should include non-economic environmental resources within a defined area around the subject site using methodologies such as contingency valuation.
  - Consideration could be given to measuring positive environmental initiatives (e.g. energy savings) for possible use as a trade off for other environmental concessions.

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for complying with ESD principles.

9. CONSIDERATION OF ALTERNATIVES AND JUSTIFICATION FOR THE PROPOSAL.

- Consider the environmental consequences of adopting alternatives, including alternative:

  - sites and site layouts;
  - access modes and routes;
  - materials handling and loading processes;
  - waste and water management;
  - impact mitigation measures, particularly air quality and noise measures
  - energy sources.

- Selection of the preferred option should be justified in terms of:

  - ability to satisfy the objectives of the proposal;
  - relative environmental and other costs of each alternative;
  - acceptability of environmental impacts;
  - acceptability of any environmental risks or uncertainties;
  - reliability of proposed environmental impact mitigation measures;
  - efficient use (including minimising re-use) of land, raw materials, energy and other resources.

10. IDENTIFICATION AND PRIORITISATION OF ISSUES (SCOPING OF IMPACT ASSESSMENT)

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
  - relevant NSW government guidelines;
  - industry guidelines;
  - EISs for similar projects;
  - relevant research and reference material;
  - relevant preliminary studies or reports for the proposal;
  - consultation with stakeholders.

- Provide a summary of the outcomes of the process including:
  - all issues identified including local, regional and global impacts (eg increased/ decreased greenhouse emissions);
  - key issues which will require a full analysis (including comprehensive baseline assessment);
  - issues not needing full analysis though they may be addressed in the mitigation strategy;
  - justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

11. CUMULATIVE IMPACTS

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.

- Assess the long-term and short-term cumulative impacts of the proposal against the relevant air, noise and water quality objectives for the area or region.

- Identify infrastructure requirements flowing from the proposal (eg. water and sewerage services, transport infrastructure upgrades).

- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (eg travel demand management strategies).

12. MANAGEMENT AND MITIGATION OF ENVIRONMENTAL IMPACTS

- Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.

- Describe any mitigation measures and management options proposed to minimise identified environmental impacts associated with the proposal including an assessment of their effectiveness and reliability and any residual impacts after these measures are implemented.

- Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include:
  - operational procedures to manage environmental impacts;
  - monitoring procedures;
  - training programs;
  - community consultation;
  - complaint mechanisms including site contacts;

- strategies to use monitoring information to improve performance;
- strategies to achieve acceptable environmental impacts and to respond in event of exceedences.

13. COMPILATION OF MITIGATION MEASURES

- Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under an EPA licence (eg. outline of an environmental management plan).

- The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.

14. EPA LICENSING

- Identify licensing required by the EPA under environment protection legislation including details of all new scheduled development works, scheduled activities, ancillary activities and types of discharges (to air, land, water).

EPA
December 2002

LAND & WATER CONSERVATION

Director - Major Development and Infrastructure
Planning NSW
GPO Box 3927
Sydney NSW 2001

Attention: D Kitto

Our ref. ER 4051

Dear Mr Kitto

SUBJECT: WAMBO COAL PLANNING FOCUS MEETING

Thank you for your letter dated 25 November 2002. The Department of Land and Water Conservation (DLWC) provides the following comments in regard to the development proposal.

DLWC requires that the Environmental Impact Statement (EIS) address the legislative and policy principles and objectives outlined below, both in terms of open cut development through North Wambo Creek, and underground mining under the floodplain to Wollombi Brook. The EIS is to include a summary list referencing where in the document legislation and policy principles and objectives have been addressed.

LEGISLATION/POLICY REQUIREMENTS

1. Water Management Act, 2000
The Department of Land and Water Conservation (DLWC) is responsible for the management of surface and ground water systems, riverine landforms and terrestrial landscapes. DLWC is primarily concerned that the proposal may lead to significant and long term degradation of the physical environment, and consequent long term degradation of surrounding surface and ground waters. DLWC is legally obliged to consider long term degradation to surface and ground water systems in its assessment of any development application for mining operations, as defined under the Water Management Act, 2000.

The principles of the Act require:

Chapter 2 Part 1 Division 1 Section 5(2)

(a) water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored, and where possible, land should not be degraded
(b) habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored;
(c) the water quality of all water sources should be protected and, whenever possible, enhanced; and
(h) the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

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20 DEC 2002

Chapter 2 Part 1 Division 1 Section 5(6)
In relation to floodplain management:
(a) floodplain management must avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land must be rehabilitated, and
(b) the impacts of flood works on other water users should be avoided or minimised, and
(c) the existing and future risk to human life and property arising from occupation of floodplains must be minimised.

A requirement of the *Water Management Act, 2000* (WMA) is a State Water Management Outcomes Plan (SWMOP), which will provide statutory enforcement of protection requirements for groundwater systems. The SWMOP has thirty-one (31) targets to ensure implementation of the principles of the WMA.

The following targets of the SWMOP framework relate to groundwater:

1. T8 The degree of connectivity between aquifers and rivers must be assessed, and zones of high connectivity mapped to enable baseflows to the river to be maintained or improved

2. T9. Groundwater dependent ecosystem protection zones must be mapped for all priority aquifers and water level sensitivity assessed to enable extraction rates to be limited and/or sustainable yields revised to protect these ecosystems.

3. T29. Salt load and electrical conductivity tracking at levels consistent with the salinity targets specified in approved Catchment Management Strategies

4. T30. Significant sources of non-saline water contributing to dilution flows downstream should be prioritised to enable action to be taken to protect these sources.

5. T31. Aquifer water quality vulnerability zones are to be mapped and extraction rates established to reduce the risk of lateral intrusion of poor aquifer water.

DLWC is required under legislation to assess any EIS using these statutory principles. In addition, DLWC is guided in its assessment by the principles of State policy. Policies of relevance to this proposal include:

2. NSW State Rivers and Estuaries Policy
The State Rivers and Estuaries Policy provides a framework for river management throughout New South Wales, and guides DLWC in its assessment of all riverine corridor activities. The Policy objectives state "that rivers and estuaries of New South Wales are to be managed in ways which:

- slow, halt or reverse the overall rate of degradation in the systems,
- ensure the long term sustainability of their essential biophysical functions, and
- maintain the beneficial use of these resources"

Principles of this Policy are:

1. those uses of rivers and estuaries which are non-degrading should be encouraged
2. non-sustainable resource uses which are not essential should be progressively phased out
3. environmentally degrading processes and practices should be replaced with more efficient and less degrading alternatives
4. environmentally degraded areas should be rehabilitated and their biophysical functions restored

5. remnant areas of significant environmental values should be accorded special protection
6. an ethos for the sustainable management of river and estuarine resources should be encouraged in all agencies and individuals who own, manage or use these resources.

3. NSW Groundwater Quantity Management Policy

NSW Groundwater Quantity Management Policy requires the Department of Land and Water Conservation to provide:

1. clear definitions of sustainable yield;
2. options for reducing or maintaining allocations to within sustainable yields;
3. strategies for managing interference effects between groundwater users;
4. strategies for ensuring that groundwater pumping does not have unacceptable impacts on groundwater quality;

4. NSW Groundwater Quality Protection Policy

The State Groundwater Quality Protection Policy has objectives to encourage the ecologically sustainable development and management of the State's groundwater resources so as to:

1. slow and halt, or reverse, any degradation of groundwater resources
2. ensure sustainability of groundwater-dependent ecosystems;
3. maintain the range of beneficial uses of these resources; and
4. maximise economic benefit to the Region, State and nation

5. NSW Groundwater Dependent Ecosystem Policy

The State Groundwater Dependent Ecosystem Policy has the following five principles:

1. Groundwater dependent ecosystems can have important value for scientists, groundwater managers, groundwater users, ecosystem managers and the wider community. These values and how threats to them may be avoided should be identified, and action taken to ensure that the ecosystems are protected.
2. Groundwater extractions should be managed within the sustainable yield of the aquifer system, so that the ecological processes and biodiversity are maintained and/or restored. This may involve establishment of threshold levels that are critical for ecosystem health.
3. Priority should be given to ensuring that sufficient groundwater of suitable quality is available at times when it is needed:
   - For protecting ecosystems which are known to be, or are most likely to be, groundwater dependent, and
   - For ecosystems which have an immediate or high degree of threat.
4. Where scientific knowledge is lacking, the precautionary principle should be applied to protect groundwater dependent ecosystems. The development of adaptive management systems and research to improve understanding of these ecosystems is essential to their management.
5. Planning, approval, and management of developments and land use activities should aim to minimise adverse impacts on groundwater systems by:
   - Maintaining natural patterns of recharge and not disrupting groundwater levels that are critical for ecosystems
   - Not polluting or causing changes in groundwater quality; and
   - Rehabilitating degraded groundwater systems where possible

DLWC GENERAL REQUIREMENTS

The EIS must explain the potential changes in groundwater regime, resulting from the mining development to the post-mining equilibration of groundwater table levels. This must include an assessment of the cone of depression under the open cut mine, any linkage to nearby aquifers, leakage rates and volumes of groundwater intercepted in the open cut pit and longwall panels. Potential leakage into the proposed mine areas, and pre- and post- mining changes in hydraulic properties must be addressed.

The department requires that the following issues be addressed in the EIS.

SURFACE WATER MANAGEMENT

- location and design specifications for all clean water diversions, including channel design, detention basin locations, and basin design and outlet fixtures
- details of internal drainage of the contaminated water circuit, including any bunding, drainage channels, dewatering pits and storages and basins in the dirty water circuit
- details in regard to any dirty water (discharge) storage proposed for the development. This should include design details, including the storm recurrence interval design intervals (which should be significantly above the 1:100 year flood level), construction designs and the outflow/bywash provisions
- discussion of proposed monitoring programs and reporting procedures regarding chemical and biological parameters of water quality
- projected requirements for water supply, identification of sources of water and the requirement for a licence under Part 2 or 5 of the Water Act
- details of any proposed diversion of watercourses which will be either temporary or permanent diversions
- description of the integrated water management system, including an assessment of the water management system under a range of conditions (including 10%, 50% and 90% wet years, and severe storm events).
- discussion of the proposed use of the Hunter River Salinity Trading Scheme, including monitoring requirements and discharge procedures to match high flows and flood flows
- description of all activities to be undertaken within and adjacent to any watercourse.

GROUNDWATER MANAGEMENT

- description of different aquifers systems present in the area including their extent and inter-relationships,
- description of physical and chemical characteristics of aquifers,
- assessment of flow directions and rates of flow, and
- assessment of any connections to the surface water bodies or any dependent ecosystems.

The EIS should include details of any potential changes to the existing groundwater regime as a result of the development including changes associated with:

- implementation of the progressive mine plan
- impacts of dewatering
- emplacements
- waste management
- a ground and surface water monitoring program must be provided by the Applicant. The monitoring program is to provide details on the pre-mining and post-mining phases. The EIS must also include:
  a) detailed descriptions of conceptual models and any other predictive tools used; and
  b) impacts on existing and potential groundwater users including the natural environment.

Under Part V of the Water Act (1912), all proposed groundwater works including bores for the purpose of extraction, dewatering, testing or monitoring must be licensed with DLWC prior to their installation. Therefore the EIS should include information regarding:

- locations and construction details of all proposed bores, including their purpose; and
- expected annual groundwater extractions from individual dewatering bores

Other general information should be provided on:

- details of the proposed monitoring programs, including water levels and quality data;
- the reporting procedures for the monitoring program including mechanism for transfer of information;
- details of the projected effects of any final void on the groundwater regime;
- contingency plans for the rehabilitation of aquifers if there is any adverse impact on the beneficial use of the aquifer system as a result of development. ;
- details of existing and/or potential groundwater users within the area of the development.

Any reports or documents on groundwater studies which are referenced in the EIS should be made available to the DLWC for review.

REHABILITATION

The final landform should be compatible with the surrounding landscape and there should be no adverse environmental effects off-site. The EIS must describe in detail how rehabilitation procedures will be conducted to provide a stable and productive landscape. In the case of streams flowing over emplacement zones or filled pits, the stability of the watercourse must be described in detail, with engineering designs to explain bed controls, bank forms and bed slope designs and control structures, and measures to prevent the connection of surface or rehabilitated alluvial ground waters to mine reject or spoil materials.

CROWN LAND

The EIS should identify the location and status of any Crown Land, and any potential impact on its use, management or amenity.

Crown Roads

Should the proposal include non-public Crown road(s) it is the responsibility of the proponent to obtain all necessary approvals pursuant to the Roads Act, 1993. There is a need to preserve and maintain continuity of access to the Crown road network for use by the public and affected property holders. Alternatively, the proponent should give consideration to making application to close and purchase non-essential Crown roads.

In the case of underground mining activities, subsidence may have some impact on the Crown road(s) system. The proponent should ensure that any impact due to surface subsidence to the road system is restored and safeguarded to the extent that public access is not affected.

Buffer Zones (adjoining Crown lands)

It is preferable that the proponent provide an appropriate vegetative buffer of native species endemic to the area along the common boundary with Crown land(s) and wholly contained within the freehold development site. The buffer is considered necessary to minimise the impacts on the development on the current/future uses(s) and amenity of the adjoining Crown land.

Native Title Implications

The department in consideration of proposals affecting Crown land must take into account whether the proposal will affect any Native Title interest that may exist in the land. The issue of Native Title needs to be addressed in terms of the requirements of the Commonwealth Native Title Act 1993.

At this time, the department has not conducted sufficient searches to determine whether Native Title has been extinguished to any Crown land(s) within the proposed site.

Aboriginal Land Claim
Crown lands may be subject to an Aboriginal Land Claim pursuant to the Aboriginal Land Rights Act, 1983. The department is not in a position to enter into any dealings in respect of that land until any claim has been determined by the Minister.

DLWC SPECIFIC REQUIREMENTS

OPEN CUT PROPOSAL
The EIS must address the following:

1. Existing legislative restrictions on mining through a river, as defined under the Water Management Act, and construction and extraction from a dam upon a river. Current embargoes exist under Sections 22BA and 22BB of the *Water Act*, 1912,
2. The EIS must explain how the relocation or reinstatement of any watercourse will be undertaken, and whether ecological offset provisions will provide adequate protection to any instream or groundwater dependent ecosystems which exist on the site.
3. Interruption of flow in North Wambo Creek must be explained, including the volume of water to be interrupted or accessed for use on site, and consequent impacts on downstream water supply or ecosystems.
4. Consequences to loss of salinity buffering potential from North Wambo Creek to Wollombi Brook, and potential long term salinisation of North Wambo Creek assessed.
5. Detailed salinity budgetting for the North Wambo Creek catchment, including baseline assessment of salinity exports from the catchment to Wollombi Brook and potential mining induced salinity for a range of scenarios.
6. Groundwater modelling processes, assumptions and predictions must be explained, and a justification for model choice
7. The location of the open cut pit must be assessed in terms of its potential to intercept surface or alluvial groundwater. A process must be provided to measure the inflow of waters from Wollombi Brook and alluvial groundwater. A detailed assessment of highwall stability, fracture initiation and propagation between the highwall and the fringe of the alluvial aquifer or Wollombi Brook must be undertaken
8. A monitoring, contingency and remediation program must be described in the EIS for water sources affected by the mining proposal

UNDERGROUND MINE PROPOSAL
The underground (longwall) operations are proposed to undermine the alluvial floodplain of Wollombi Brook. Longwall extraction under the alluvial floodplain may lead to interception of alluvial groundwater into the mine workings. The mine must account for all groundwaters which are intercepted in the mine workings, and develop a process to identify the source, and volume of water.
A detailed monitoring program must be included in the EIS which aims at identifying impacts on alluvial groundwaters overlying the underground workings, and detailing changes in permeability which occurs as each longwall pass occurs under the floodplain. To address these issues, the EIS must address the following in detail:
1. The barrier distance between the underground workings and area of affectation to Wollombi Brook and Wollombi alluvium.
2. Connectivity between coal seams for each longwall pass and potential connectivity from the seams to the weathered zone underlying the alluvial aquifer, and long term issues related to alluvial groundwater condition over the subsided area
3. Drainage from the alluvium either into the mine workings or into fracture zones which develop or an increase in hydraulic conductivity under the alluvium, and replacement or make up of alluvial groundwater which is intercepted by the mine.

Longwall mining is proposed in the South Wambo Creek and Stony Creek catchments. Significant damage has occurred to these watercourses as a result of previous longwall mining operations, with drainage of surface and alluvial groundwaters into the workings, and initiation of bed incision and erosion along the courses of the streams. DLWC is concerned that the proposed longwall mining operations may re-open fracture zones which have been grout sealed to prevent inflows to the subsided goafs overlying longwall panels 9 and 9A. DLWC is also concerned that further mining induced changes in bed level and long gradient slopes will destabilise existing works and initiate new degradation of the watercourses. The EIS must address impacts to the previous stabilisation program which has been undertaken on South Wambo Creek and Stony Creek, and a process of assessment, monitoring and contingency response for each longwall panel as it is extracted.

The Department of Land and Water Conservation recognises that the issues that have been raised in this letter will be of relevance for other State government agencies. Based on the Ashton Coal Project precedent, DLWC requests a formal inter-agency meeting, involving, as a minimum, NSW Planning, NSW Fisheries, Environment Protection Authority, NSW National Parks and Wildlife Service and DLWC to address the key issues in this development proposal. NSW Planning is requested to facilitate this meeting.

If you require clarification of any issue raised in this letter, don't hesitate to contact me (02) 4929 9850.

Yours faithfully

M. Mignanelli

Mark Mignanelli 18.12.02
Resource Access Manager
Hunter Region

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

ABN 30 841 387 271

Mr David Kitto
Senior Planning Officer
Mining and Extractive Industries
Planning NSW
GPO Box 3927
SYDNEY NSW 2001

Our ref: 2000/8 mm
Your ref:

Dear Mr Kitto

Re: Proposed expansion – Wambo Mine

I refer to your letter dated 20 November 2002 requesting the National Parks and Wildlife Service's (NPWS) requirements for the Environmental Impact Statement (EIS) to be prepared for this proposal.

The NPWS has statutory responsibilities for the protection and care of native flora, native fauna and Aboriginal objects and places, and for the management of NPWS lands. Accordingly, the NPWS has an interest in ensuring that potential impacts on these features are appropriately assessed and managed.

The proposal outlined at the Planning Focus Meeting on 4 December 2002 indicated that approval is now being sought for a further 21 years' coal extraction by a combination of longwall and open-cut mining and the latter component would require clearing a considerable remnant of native vegetation. As advised at the Planning Focus meeting, the highly fragmented nature of vegetation on the Hunter Valley Floor, the aerial extent and the location of this remnant relative to the Wollemi National Park to the west and other remnant vegetation to the east, imbue it with considerable conservation significance. The NPWS requests that the EIS contain a comprehensive **assessment of alternatives** for the proposal, and clearly justify the loss of this vegetation as proposed.

On the basis of recent investigations carried out for the neighbouring proposed Warkworth Extension the NPWS considers there is a strong likelihood that this remnant vegetation provides habitat for several **threatened fauna and flora species**. It is therefore crucial that an adequate level of targeted survey is conducted, and survey parameters determined on a species-specific basis. The NPWS has already provided extensive advice to Resource Strategies consultants on this aspect. Regionally significant biodiversity values, particularly flora, should also be comprehensively assessed even if not listed as threatened species, as the level of development and increasing rarity of natural values are likely to result in additional listings in the Hunter Region in the future.

The EIS will also need to comprehensively assess the **impacts of clearing** this vegetation and destroying biodiversity and Aboriginal heritage values, particularly in the context of their conservation status in the region, including the cumulative impact of incremental losses. Development of the proposal should also explore

Conservation Programs
& Planning Division
Central Directorate
Level 6
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6678
Fax: (02) 9585 6442
www.npws.nsw.gov.au

options for avoiding direct and indirect impacts on biodiversity and Aboriginal heritage values wherever possible, but failing avoidance, through appropriate mitigation and amelioration measures. Where extant biodiversity values of the development area cannot be protected, the NPWS requires that early consideration is given to off-site habitat conservation options to compensate for the loss. Such options should be canvassed with regard to other vegetation reserves and/or remnants in the broader landscape.

In this context the NPWS requires that the following issues be comprehensively assessed in the EIS:

- **vegetation communities** on the site, including:
- the areal extent;
- the amount to be cleared;
- the extent and impact of other disturbances such as subsidence;
- the conservation significance of the vegetation communities in both the local and regional context;
- the habitat values of the vegetation, that is, available habitat attributes and which threatened species or species of non-threatened fauna they relate to;
- the extent and nature of revegetation proposed, and how this will be integrated with rehabilitation undertaken on the Wambo mine site to date, and consistency with the Synoptic Plan – Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW (Department of Mineral Resources, 1999).

The description of vegetation communities should wherever possible be correlated with known classifications, such as those used in the Lower Hunter Central Coast Regional Environmental Strategy (REMS) (NPWS 2000), the NPWS Comprehensive Regional Assessment (CRA) or by the Hunter Catchment Management Trust. It is strongly recommended that the latter be contacted in relation to surveys recently undertaken for the Remnant Vegetation Project (Travis Peake: ph. 49 301030).

- **threatened flora** species, and **Endangered Ecological Communities** under the Threatened Species Conservation Act (including preliminary listings and/or determinations);

- threatened flora species listed under the Commonwealth Environment Protection and Biodiversity Conservation Act and their conservation significance;

- threatened flora species listed as ROTAP (Rare or Threatened Australian Plants);

Particular attention should be paid to the Warkworth Sands Woodland preliminarily listed EEC, Hunter Lowland Redgum Forest EEC, the potential for Grassy White Box Woodlands, listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act*, and the White Box-Yellow Box Blakely's Red Gum Woodland EEC listed under the *Threatened Species Conservation Act*.

- **threatened fauna** species under the *Threatened Species Conservation Act* (including preliminary listings and/or determinations) and their conservation significance including:

- those recorded on the site or in the vicinity of the site;
- those with the potential to occur;
- their conservation significance;
- how identified species utilise the habitat on or in the vicinity of the development site.

Threatened species assessment should include:

- woodland birds recently listed on Schedule 2 of the *Threatened Species Conservation Act* (Grey-crowned Babbler, Black-chinned Honeyeater, Brown Treecreeper, Hooded Robin, Speckled Warbler, and the Diamond Firetail);
- threatened mammals such as the Squirrel Glider, Koala, Spotted-tailed Quoll and microchiropteran Bats;
- Green and Golden Bell Frog;
- Pale-headed Snake.

key **threatening processes** in relation to both threatened flora and fauna listed under the Threatened Species Conservation Act including:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
- Clearing of native vegetation;
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (preliminary);
- Invasion of native plant communities by exotic perennial grasses (preliminary); this has relevance for post-mining regeneration.

- **known and potential Aboriginal heritage**

The NPWS IDA Guidelines indicate the standard information required and the following additional guidance.

- Aboriginal community consultation is to be undertaken with all Aboriginal groups in the Hunter region and the reporting for this consultation to be in accordance with the IDA Guidelines.
- Mapping of and description of each of resources within the lease area needs to be provided (raw materials for manufacture of material items, plant and other food resources, other resources, water availability including consideration of springs etc, areas of complex/rich environments, location of suitable campsite locations based on slope gradient etc (using data from previous studies in the region) locations of extensive outlook, location and rating of creek confluences, unusual features, important landscapes, proximity of other significant resources (eg proximity of study area to major watercourses such as the Hunter R., sandstone country immediately to the west, etc. These are essential for developing and supporting models of occupation to be provided for this area. Each layer of information should be mapped separately and at the same scale.
- If test excavations are required as part of the assessment process to identify any possible constraints, these must be undertaken well before the lodgement of the EIS. The applicant must apply for a S87permit, and a processing time of 8 weeks allowed.
- A detailed geomorphic assessment of the area is required to establish a baseline for the interpretation and assessment of the archaeological evidence and identification of possible paleo-landscape features. These need to be mapped to show their location and extent.

- The nature of any subsidence impacts need to be clearly defined for all parts of the landscape (for example using the landform units as a basis). This should include a map showing the nature of and effect of subsidence over the longer term (mapping of subsidence contours) and how this will impact on archaeological evidence across the whole area of underground mining.
- The levels of ground surface disturbance need to be mapped and described to show how and why archaeological evidence is revealed, buried and/or disturbed. It should be noted that not all forms of disturbance compromise the potential to interpret the archaeological evidence, so the disturbance information needs to be directly correlated to the potential impacts on recorded sites and areas of potential.
- The results of the test excavations and the survey results are to be incorporated with the outcomes of the Aboriginal community consultation to produce an integrated management strategy for Aboriginal heritage (to include conservation outcomes, off-sets, further investigations etc).
- The assessment needs to be supported by a clear set of criteria and measurable attributes, derived from the regional overview. The data from the review needs to be presented in the report as part of the context of the overview (refer to NPWS Standards and Guidelines Kit). This is required in the IDA guidelines, but has often been problematic in the past.
- Conservation options of sites or areas of significance need to be clearly identified through the assessment process. A guide to the assessment values is provided as Attachment 1.
- Consideration of off-sets for Aboriginal heritage should be incorporated into the process of reviewing outcomes for compensatory habitat. However, it needs to be considered that the different values may not be co-located.

Should you require any additional information please contact, Meredith Mitton, Conservation Planning Officer on (02) 9585 6953.

Yours sincerely

Lou Ewins 19/12/02

Lou Ewins
Manager
Conservation Planning Unit
Central Directorate

ATTACHMENT 1
Central Aboriginal Heritage Unit (CAHU) – Central Directorate

Hunter Valley – Aboriginal community consultation (NPWS) as at Dec 02

Wonnarua Nations Aboriginal Corporation Lot 2A Pioneer Rd, Singleton PO Box 3066 Singleton Delivery Centre SINGLETON NSW 2330	Attention: Robert Lester Phone: (02) 4936 8106
Upper Hunter Tribal Council 17/174 John St PO Box 184 SINGLETON NSW 2330	Attention: Victor Perry Phone: (02) 6571 4888 Fax:: (02) 6571 4889
Lower Hunter Tribal Council 31 Andrew St MAITLAND NSW 2320	Attention: Barry Anderson Fax: (02) 4934 8107 Mobile: 0417 403 153
Ungooroo Aboriginal Corporation PO Box 3095 SINGLETON NSW 2330	Attention: Graham Ward Phone/Fax: (02) 6571 5111
Wanaruah Local Aboriginal Land Council 17 – 19 Maitland St MUSWELLBROOK NSW 2333 ➢ Singleton LGA/ Muswellbrook LGA	Attention: Noel Downs Phone (02) 6543 1288 Fax: (02) 6542 5377
Combined Council of Hunter Valley Traditional Owners 17 – 19 Maitland St MUSWELLBROOK NSW 2333	Attention: Margaret & John Matthews Phone: (02) 6543 1288 or (02) 6541 1085 Fax: (02) 6542 5377

ATTACHMENT 2

NPWS aims to ensure the long term conservation of Aboriginal heritage. In considering conservation options for sites/ areas/ places a number of issues need to be considered based in an evaluation of the options in terms of the material evidence and/or cultural heritage, context, and long term viability. The issues which need to be addressed are listed below:

- **clear set of criteria** on which the (options) sites/areas and places have been selected as worthy of conservation (rarity and representativeness using a wide range of criteria such as landscape, resources, range /seasonally/reliability etc of resources, complexity of the evidence and its context, time depth of occupation, water availability, ease or difficulty of access/possible movement pathways, areas of cultural importance, cultural interpretations, integrity of the landscape and the potential for the cultural material and archaeological contexts of the material to be and to remain relatively undisturbed, etc). The criteria need to reflect the state of both archaeological and cultural knowledge for the region and the local area within which the site(s)/area(s) and place(s) is/are to be conserved.

- **assessment of the visible/projected extent of physical evidence/features** based on criteria which clearly demonstrate the importance, rarity, representativeness etc of the sites/areas and places within the regional and local contexts.

- **interpretative context** it is important to ensure that a sufficient landscape and /or cultural context of the sites/areas and places, location, feature/s is retained to provide for the interpretation of the sites/areas and places being conserved and/or the cultural context of the area to be conserved

Example : a small area of deposit known to contain evidence of older (than other evidence in the region) occupation is protected/conserved within an open cut mine. It is important that the geomorphic context necessary for the interpretation of site formation processes, the landscape history of this location, the changes through time in occupation behaviour, be retained to provide an adequate context for the site being protected. The relationship between past (old) occupation and the history of occupation at that location from the first evidence to the most recent is essential to an understanding of the changes that are retained in the record.

- **cultural context**: where the area/location/site identified as having cultural significance, the wider context of that location may be of importance to the community in considering conservation.

- **conservation of comparable** : consideration of locations/landscape settings/features sites/areas and places in the immediate and wider contexts which protect such evidence for the long term in adequately managed contexts;

- provision for an adequate **buffer** to ensure the long term survival of the sites/areas and places being conserved and protected;

- the **landscape setting** of archaeological and cultural evidence is an important component for defining long term conservation. The retention of at least part of the landscape setting needs to be considered as an essential .component of the conservation area.

- **viability** of the area being proposed for conservation within the context of a development area. Larger contiguous areas are more viable in the long term than small fragments or thin linear areas.

- the **range of impacts** on the area/s being considered for conservation and any long term effects need to be identified and evaluated in order to ensure that the sites and their context can be protected in the long term. This should include impacts from any immediate developments and future impacts from landuses around the area to be conserved (eg: visitation, erosion, bushland management, rubbish dumping/removal etc).

- **access** for the Aboriginal community and other appropriate stakeholders.

- any **appropriate uses** for the conservation precinct need to be assessed in the light of a clear understanding of the vulnerability of these sites both in the short and long term and identification of the affects of any activities on the area.

- development of a **management plan** in partnership with the Aboriginal community group/s to incorporate the issues above and set out appropriate mitigation procedures to ensure the long term survival of the sites/areas and places being conserved.

NSW NATIONAL PARKS AND WILDLIFE SERVICE

ABORIGINAL CULTURAL HERITAGE AND THE INTEGRATED DEVELOPMENT ASSESSMENT PROCESS

INFORMATION FOR APPLICANTS

20 February 2001

This information is presented to assist you to lodge an integrated development application with your local council. Part 4 of *Environmental Planning and Assessment Act 1979* has recently been amended. The new *Environmental Planning and Assessment Amendment Act 1997* provides a single system for the development, building and subdivisions aspects of a proposal, and involves the linking of some approvals granted by State government agencies under other environmental legislation. Development proposals which require an approval or licence from one or more of these State agencies (refer to section 91 of the *EP&AA Act)* are known as an integrated approval. The basis of the IDA process involves applicants providing up-front the information necessary for agencies or approval bodies to determine if they will give the general terms of approval necessary for granting additional approvals.

The National Parks and Wildlife Service (NPWS) is one of the State government agencies which has been included in the IDA process, in relation to its responsibilities for Aboriginal relics and Aboriginal places under Section 90 of the *National Parks and Wildlife Act 1974*. Under Section 90, it is an offence to knowingly destroy, deface or damage a relic or Aboriginal place without the consent of the Director-General of the National Parks and Wildlife Service.

The NPWS acknowledges that it is Aboriginal people who should determine the cultural significance of Aboriginal heritage, and the NPWS has a strong commitment to working in partnership with Aboriginal people to manage and conserve Aboriginal cultural heritage. The NPWS recognises that Aboriginal cultural heritage includes both traditional and contemporary associations of Aboriginal people with the environment as well as physical sites.

NSW National Parks and Wildlife Service
43 Bridge Street, Hurstville NSW PO Box 1967, Hurstville NSW 2220
Telephone (02) 9585 6444 Facsimile (02) 9585 6555
Internet Email: info@npws.nsw.gov.au

Aboriginal heritage issues should be addressed upfront as part of the planning process undertaken for developments, and prior to lodgement of a development application. The NPWS requires that options for conserving Aboriginal relics within development footprints be fully explored in discussion with the Aboriginal community as part of the development assessment process. Impacts on Aboriginal relics should only be considered where there are no viable alternatives. The NPWS will require a clear demonstration that alternatives to site destruction have been fully explored.

When is the NPWS an approval body in the IDA process ?

The NPWS is an approval body in the IDA process when a development will impact on an Aboriginal relic or Aboriginal place, thereby requiring a consent to destroy from the Director-General of the National Parks and Wildlife Service. Threatened species, populations and/or ecological communities do not trigger the IDA process as the *Environmental Planning & Assessment (EP&A) Act 1979* and *Threatened Species Conservation Act 1995* eliminated the need for separate licensing or approvals in relation to these issues.

The NPWS is an approval body for a development application under the IDA process when:

1) A 'relic' is known to exist on the land to which the DA applies; and/or the land to which the DA applies is an Aboriginal place, immediately before the DA is made (as per s.91 (2)(a-b), *EP&A Amendment Act 1997*); AND

2) The development proposal will destroy, deface or damage an Aboriginal 'relic' or Aboriginal place, and a consent to destroy from the Director-General of the National Parks and Wildlife Service will be required, as per section 90 of the *National Parks and Wildlife (NPW) Act 1974* (note damage to an Aboriginal relic or place may be direct damage or result from indirect impacts).

   Under the *NPW Act*, a '<u>relic</u>' is defined as any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains (as defined within the meaning of the NPW Act). Relics are confined to physical evidence.

   Aboriginal 'relics' are commonly referred to as Aboriginal sites.

   An "<u>Aboriginal place</u>" is a place which has been declared so by the Minister for the Environment because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain physical relics.

It should be noted that *the NPW Act* does not provide protection for spiritual areas or natural mythological areas that have no physical remains of Aboriginal occupation, unless they have been declared an 'Aboriginal place'.

For the purposes of the IDA process, the NPWS considers that an Aboriginal site ('relic') may be considered to be 'known' if:

- It is registered on the NPWS Aboriginal Sites Register; and/or

- It is an Aboriginal site known to the Aboriginal community; and/or
- It is located during surveys (eg: archaeological, anthropological) or test excavations conducted prior to lodgement of the DA.

How do I find out if there is an Aboriginal site on the land ?

To find out whether the land you want to develop contains known Aboriginal site/s or an Aboriginal place, you need to:

- Consult with the Aboriginal community groups to identify the location of Aboriginal sites. They may be aware of sites that have not been registered with NPWS.
- Contact the Aboriginal Sites Registrar at NPWS and request a site search to obtain a listing of registered Aboriginal sites. The Register only includes those Aboriginal sites which have been reported to NPWS. **Attachment 1** provides general information on the Aboriginal Sites Register, and a site search request form.
- Undertake an assessment of the known Aboriginal site/s and/or undertake survey of the subject land to locate Aboriginal sites. Test excavations may be required as part of this investigation to verify the location of Aboriginal sites. Such excavations need to be undertaken before the DA is submitted. A permit is required from NPWS for such investigation and if all information is attached to the application the processing time is 8 weeks.

Once you have this information, you need to assess whether the development proposal will impact upon an Aboriginal site or an Aboriginal place. While the *NPWS Act* provides for the destruction of Aboriginal sites, this should always be considered as a last option, and in-situ conservation is the preferred option.

How to find out whether land contains a gazetted Aboriginal place

An Aboriginal place may be considered known if it has been declared by the Minister, and gazetted. Information on whether a proposed development site contains an Aboriginal place may be obtained by contacting the NPWS Aboriginal Sites Register (refer **Attachment 1**).

What information do I need to include with my development application ?

You need to clearly state in your development application to Council whether your proposal would impact on a known Aboriginal site or an Aboriginal place. The flowchart in **Attachment 2** outlines the process for assessing the Aboriginal heritage values of an area to allow you to determine whether your development application will be an integrated development application for Aboriginal sites. It is essential that the outcomes of the Aboriginal cultural assessment and the technical assessment are integrated. The results of the Aboriginal heritage assessment must be applied to define potential development constraints, and the development concept should these constraints into account. The development application should clearly indicate whether Aboriginal sites will be impacted or not, and if so, what is proposed for each of the impacted sites (this might include salvage excavations, collection of artefacts etc).

If the IDA process is triggered through the presence of known Aboriginal site/s and/or an Aboriginal place that would be impacted by a proposed development, Council will contact the NPWS seeking its general terms of approval. In order to provide general terms of approval the NPWS will need the same level of information required to make the actual decision.

Applicants need to include two types of information in their IDA application:

1. Aboriginal cultural heritage assessment which involves consultation with Aboriginal community groups. The NPWS is committed to working in partnership with Aboriginal community groups in the management of sites and requires community assessment of any Aboriginal sites.
2. Archaeological assessment which involves the assessment of Aboriginal sites and their management based on archaeological heritage criteria.

This information from each of these must be integrated to provide the basis for the final assessment of Aboriginal heritage values and recommendations for management options.

The following advice sets out the NPWS information requirements in more detail. Not all applications will attract the same information requirements. As some of this information is of a technical nature, the NPWS suggests that you consider engaging a reputable archaeologist to assist in the preparation of an IDA.

The NPWS advises that it does not require that a Section 90 consent application be submitted with the Integrated Development Application. The proponent will however be required to apply to the NPWS for a Section 90 consent within three years of the granting of development consent. This is explained in more detail below.

2.1 Aboriginal Cultural Heritage Assessment

Aboriginal sites can be the physical remains of Aboriginal occupation of an area or alternatively, an area that has particular meaning for Aboriginal people, for example, spiritual areas or natural mythological areas. It is important to consider that Aboriginal heritage is not only valuable to Aboriginal people but also to those people who are interested in learning from the early inhabitants of Australia. Proposed developments that alter landscapes can impact on these various types of Aboriginal sites.

Assessment of the cultural values of Aboriginal sites and places to the Aboriginal community is an important part of the assessment process, and the Aboriginal Cultural Heritage Assessment report (discussed below) is required by the NPWS in order for it to consider whether to issue general terms of approval.

2.1.1 Aboriginal Community Group/s Consultation

Applicants should contact (as early as possible) local Aboriginal community groups, including Local Aboriginal Land Councils, any known Tribal Elders Corporations and Native Title Claimants to ensure that proper consultation processes are carried out. Local Aboriginal community groups will require time to consider a proposal and to discuss any issues with its members, and sufficient time must be allowed for this to occur.

The purpose of Aboriginal participation in the assessment process is:

- To notify the local Aboriginal people in sufficient detail and in a timely manner about activities or developments which may impact on Aboriginal heritage, so that their concerns and possible options for action can be identified on a fully informed basis;
- To ensure that Aboriginal people who hold cultural knowledge, including native title holders or applications, are able to contribute to the assessment process in ways that are culturally acceptable to them;
- To identify locations and cultural values of Aboriginal sites and places of significance to the Aboriginal community that may be affected by the proposal so that potential impacts can be avoided wherever possible; and
- To identify whether there are culturally acceptable mitigative measures when impacts are considered to be unavoidable by the applicant.

It is essential that applicants provide NPWS with documentation from the Aboriginal community groups regarding their views and recommendations for actions.

The Environmental Planning and Assessment Regulation 2000 (cl. 111) allows 46 days (from the date of DA lodgement with the consent authority) for the Director-General of the National Parks and Wildlife to undertake any further Aboriginal community consultation, if the Director-General of the NPW considers that such consultation is required before the Director-General can make a decision concerning the general terms of approval, and consultation commences within 25 days after the date on which the DA is forwarded to the Director-General.

2.1.2 Aboriginal Cultural Heritage Assessment Report

The report should contain:

1. Information on the nature, timing and location of consultation, including the identification of individuals and/or groups consulted and copies of any correspondence from those individuals and/or groups;
2. A statement of the Aboriginal community group/s understanding of the values of the known Aboriginal site/s and/or Aboriginal place located on the development site. This may include social, spiritual, historic, and archaeological values.
3. A statement of the Aboriginal community groups response to the development and their recommendations (if any) for mitigation of impacts and/or conservation of known Aboriginal sites and/or Aboriginal place/s.

The results of this assessment must be integrated with the technical (archaeological) assessment and provide the basis for the final assessment of Aboriginal heritage values and recommendations for management options. The NPWS will also require a clear demonstration in the development application of how the proponent proposes to address any issues which have been raised as part of the Aboriginal cultural assessment, and whether this is acceptable to the Aboriginal community.

To obtain a list of Land Councils and Native Title claimants contact:

NSW State Aboriginal Land Council.
PO Box W125
PARRAMATTA NSW 2150
Ph: (02) 9689 4444

Department of Aboriginal Affairs
Level 5, 83 Clarence Street
SYDNEY NSW 2000
Ph: (02) 9290 8700

2.2 Archaeological Assessment

The NPWS requires the information summarised below to evaluate reports on the assessment of Aboriginal sites. Further detail on this is located in the NPWS' *"Aboriginal Cultural Heritage Standards and Guidelines Kit" 1997*, which sets out NPWS requirements for reporting on Aboriginal sites and assessments (refer **Attachment 3** for information on this kit). The assessment of individual Aboriginal sites and the development of management strategies may not require that all of the categories under the following list of information requirements are addressed, however, their relevance needs to be considered for each proposal.

The assessment of Aboriginal sites should be directed towards their conservation and protection. While the *NPW Act* provides for the destruction of sites, this option should always be considered as a last option and must be well supported.

2.2.1 Locational Context:

- description of location of study
- legislative context
- cadastral context (eg: Lot, DP)
- identification of any associated Aboriginal cultural heritage studies undertaken in the study area

2.2.2 Description of Development Impact

- type of development
- extent of direct impacts
- extent of potential indirect impacts (eg: run-off, increased visitation)
- flexibility of project design
- staging and how this might effect present or future management decisions

2.2.3 Assessment Context

- the brief for the work being undertaken for this particular project
- objectives of the assessment

2.2.4 Archaeological Context

- targeted review of known archaeology of region and previous work in the study area to identify range of expected archaeological evidence relative to the project and landscape
- type/s of Aboriginal sites
- **synthesis** and **evaluation** of this information to identify archaeological issues. This will provide the basis for defining the archaeological assessment and management context

relevant to this study, and the development of appropriate management options, with protection/conservation being the primary consideration. It should be noted that a summary of previous work is not adequate.

2.2.5 Landscape Context

- description of landscape classification and land units being used for the study (at the different levels of landscape, landscape unit, landform, topographic unit)
- identification of any paleo-features
- assessment of how the landscape context and previous land surface change is relevant to the study
- assessment of how the landscape relates to models of site location and archaeology (as per synthesis above), and development of a framework for assessing the sites and landscapes within the study area
- identification of areas of archaeological sensitivity

The landscape analysis may need to include a geomorphic study to ensure that significant features are identified and considered in the overall assessment (e.g.: paleofeatures with the potential to include older sites).

2.2.6 Condition of Landsurface

- identify previous land surface impacts across the study area, with the view to assessing whether sites may be buried such as campsites, burials, and the integrity of the landsurface in those locations
- description of ground surface conditions and supporting tabulated data (for surveys)
- assessment of how the landsurface conditions have revealed, concealed, destroyed, impacted on or preserved archaeological evidence and how this relates to archaeological potential, the condition of Aboriginal sites and the geomorphology in these contexts

2.2.7 Methodology for Investigation

- description of input from the Aboriginal community to the method proposed for undertaking the study
- the proposed field methodology, such as type of sampling strategies and survey coverage (this should be targeted to the objectives of the study)
- description of the scope and method of recording and analysis by which the objectives of the study will be achieved
- the method whereby a clear and supportable significance assessment will be undertaken a supportable rationale for any proposed test excavations
- the program of work
- rationale for any variation in the methods adopted
- test excavation methodology, if relevant

2.2.8 Survey Coverage Data

- description of survey coverage and the effectiveness of that coverage for detecting potentially buried Aboriginal sites (this needs to be fully described and evaluated within the context of the objectives and the study plan. Specific methods are detailed in the NPWS Standards & Guidelines Kit)

2.2.9 Analysis and Reporting

- detailed Aboriginal site description/s including tabulated data summarising site content and any analysis, as per the NPWS Guidelines
- comprehensive evaluation of the study results (for potentially buried archaeological deposits this includes incorporating the information on archaeological potential and the reliability of survey coverage)
- results of test excavations, if relevant

Diagrams and photos are considered to be an essential component of archaeological reporting.

2.2.10 Archaeological Significance Assessment
- the significance criteria and attributes used for the assessment need to be fully supported by the information presented on the archaeological and landscape context of the site/s (e.g.: representativeness, items and landscape elements considered to be rare, information potential, social/historical values). The criteria for assessment need to be measurable.

2.2.11 Conclusions of the Study
- evaluation of potential impacts on known Aboriginal sites and areas of
- archaeological sensitivity and potential (if relevant)
- establish clear relationship between significance assessment and impacts
- consideration of cumulative impact of development on comparable sites and landscapes at both a local and regional level
- consideration of various management options, **specifically identification of conservation options**, including on-site conservation and compensatory areas (for larger scale projects)
- description of mitigation works required for specific sites to be impact on

2.2.12 Management Options
- recommendations for conservation and other management options based on the results of the archaeological report and discussions with the land owner / manager and the Aboriginal community group/s
- incorporation of management options from Aboriginal community group/s where these relate to the management options being proposed for sites or places

The following maps are required as a minimum (more detailed specifications are set out in the NPWS Guidelines). Mapping should be at the same scale throughout the report.
- location of study area (1:25,000 map series where available, more detailed maps are useful additions)
- development layout if known, flexible components of design if applicable
- locations of previous survey undertaken and sites recorded (referred to in text)
- (for surveys) survey coverage data showing location and extent of different methods used
- land units and topographic information used
- land surface history highlighting the location and boundaries of the disturbed and intact deposits
- Aboriginal site locations

A comprehensive glossary of terms used should also be provided.

Subsequent to the grant of development consent.

Please note that while you may have been granted a development consent, you are still required to apply to the NPWS for a Section 90 consent to destroy an Aboriginal site and/or Aboriginal place. You have up to three (3) years to apply to the NPWS for a consent to destroy an Aboriginal site or an Aboriginal place. This will involve the submission of an application to the NPWS and the payment of a fee to have the application assessed. For more information about how to applying for a consent to destroy, contact the relevant NPWS office (see below).

What happens if an Aboriginal site is found on the land after a development application is lodged or a development consent is granted ?

It is possible that an 'unknown' Aboriginal site could be identified on the land over which a development application has been lodged or development consent has been granted. The NPWS strongly advises that an adequate assessment of Aboriginal heritage values of the land is carried out prior to lodgement of the DA, so that this situation does not arise. However, in the event that this does occur, all works on or adjacent to the Aboriginal site must cease, and you must identify a conservation option to project the Aboriginal site or seek a consent to destroy the Aboriginal site from the Director-General of NPWS. A development consent granted under the *EP&A Act* does not equate to a Section 90 consent issued under the NPW Act. A consent to destroy an Aboriginal site must be granted pursuant to the *NPW Act* before an Aboriginal site or Aboriginal place can be destroyed. Failure to obtain this consent may result in prosecution.

Fees

The NPWS will charge a fee of $250 to process the development application for an integrated approval. This fee should be paid by cheque and attached to the integrated development application. The cheque should be made out the National Parks and Wildlife Service.

This fee is only for the processing of an integrated development application. You may be required to pay separate fees to the NPWS to obtain a site search from the NPWS Aboriginal Sites Register, and/or a fee if you apply to the NPWS for an application for consent to destroy an Aboriginal site.

Contacts

The National Parks and Wildlife Service has a Cultural Heritage Division which manages Aboriginal heritage. The Division includes 4 geographic units which deal with on- and off-park conservation planning and assessment issues. These boundaries are shown on **Attachment 4.**

For further information on these requirements, please contact the Aboriginal heritage unit in your area:

Manager, Central Aboriginal Heritage Unit

Manager, Northern Aboriginal Heritage Unit

Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 1967
HURSTVILLE NSW 2040

Ph: (02) 9585 6674
Fax: (02) 9595 6442

Cultural Heritage Division
NSW National Parks and Wildlife Service
Locked Bag 914
COFFS HARBOUR NSW 2450

Ph: (02) 6659 8245
Fax: (02) 6651 6187

Manager, Southern Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 2115
QUEANBEYAN NSW 2620

Ph: (02) 6298 9736
Fax: (02) 6298 4281

Manager, Western Aboriginal Heritage Unit
Cultural Heritage Division
NSW National Parks and Wildlife Service
PO Box 1007
DUBBO NSW 2830

Ph: (02) 6883 5345
Fax: (02) 6884 9382

ATTACHMENT 1

THE ABORIGINAL SITES REGISTER OF NSW
GENERAL INFORMATION

The National Parks and Wildlife Service maintains the Aboriginal Sites Register of NSW. The Register includes a computer database and site recording cards for all recorded Aboriginal sites in NSW, in addition to a database index of archaeological reports and a library of these reports. Information from the Register may be made available for a variety of uses.

What information is available?

Information relating to recorded Aboriginal sites in a particular area may be made available upon request. The information is generally available in the form of a standard report from the Register database. This report lists all recorded sites within and/or surrounding the area of interest, with each record including the site identifying number, site type, site location and Australian Map Grid co-ordinates, date of recording and the name of the recorder of the site.

If the area of interest is particularly large (e.g.. a river catchment), a Data Licence Agreement may be required. This agreement is a legal contract document between the Director-General of the National Parks and Wildlife Service and a named client, and is designed to ensure that any data supplied under the agreement is used appropriately.

In some cases, written support from the relevant Local Aboriginal Land Council may be required before information can be provided from the Register.

How is the data provided?

Site information will generally be provided as a standard computer print out, however, digital computer formats on disk may be available for specific purposes.

Is there a charge for data?

The cost for supply of a standard report is $30 per search area. An urgent database search may be conducted for $60. More complex reports may incur an additional charge.

In particular circumstances there may be no charge for a report (e.g.. for Aboriginal Land Councils, research purposes etc.). The waiving of any charge requires discussion with the Aboriginal Sites Registrar.

There is no charge imposed for a Data Licence Agreement, however, any data supplied under a Licence Agreement will generally be charged at the current "cost of transfer".

Are there any limitations in the data?

It is essential to note that a report from the Register does not represent a comprehensive list of all Aboriginal sites in a specified area. A report lists recorded sites only. In any given area there may be a number of undiscovered and/or unrecorded sites. As a result of this limitation, and the fact that all Aboriginal sites are protected under NSW legislation, the NPWS may recommend that a survey for Aboriginal sites is conducted where development is proposed.

Locational details are recorded as grid references. It is important to note that there *may* be errors in these recordings. If accurate site locations are required it may be necessary to confirm the locations on the ground.

If the information provided is to be used for ongoing purposes, it is recommended that regular updates are obtained as new records are continually being added to the database.

How to obtain Aboriginal sites data

To obtain information about recorded Aboriginal sites, a written request should be forwarded to the Aboriginal Sites Registrar (a request form is available if required). All requests must include;

- Company/organisation name (if applicable)
- Contact name, phone number and address details
- Purpose for which the information is required
- Copy of a topographic map with the area of interest clearly marked
- A cheque for $30 per search area, made out to the NPWS (unless other arrangements have been made with the Registrar)

Applications should be forwarded to:

The Aboriginal Sites Registrar
NPWS
PO Box 1967
Hurstville, NSW 2220. **or fax (02) 9585 6466**

Further information

For further information about the Aboriginal Sites Register, please contact the Aboriginal Sites Registrar (02 9585 6471, fax 02 9585 6466) or the Database Co-ordinator (02 9585 6843, fax 02 9585 6466

ATTACHMENT 2

PROCESS

1. Development proposal
2. Investigative studies and assessments. This could include: Aboriginal heritage, flora and fauna, hydrology, air, noise, social / economic etc
3. Get Aboriginal heritage information as required above
4. Information sources *NB. Test excavations may be required. This requires a permit from NPWS, allow weeks for processing*
5. Undertake assessment
6. Prepare report and recommend management options
7. Apply findings and information from other assessments to development concept and finalise development proposal. Avoiding impact on sites is the preferred strategy
8. Lodgement of DA with consent authority
9. DA is an IDA if development will impact on Aboriginal sites

[redacted]

Aboriginal cultural values

- Consult with the Aboriginal community to identify sites / places of cultural significance
- Assessment of cultural values

Archaeological / scientific values

- Field survey to locate and record sites
- Check NPWS Aboriginal Sites Register
- Test excavations
- Assessment of archaeological values

- Write report which integrates the cultural and technical assessments
- Develop management options. Consider conservation, compensatory areas.

- Apply information to development concept.
- If sites will be impacted by the proposal, and no alternative options (eg: conservation) are available, ensure that the DA contains site-specific recommendations

Lodge DA with consent authority.

No impact on Aboriginal sites

Not an integrated development application for NPWS.

Impact on Aboriginal sites

Integrated development application for NPWS

Referral to NPWS for its general terms of approval.

ATTACHMENT 3

Aboriginal Cultural Heritage Standards and Guidelines Kit

comprising

Guidelines for Aboriginal Consultants

These *Guidelines* aim to clarify for Aboriginal consultants the type of reporting required for heritage assessments. The *Guidelines* reflect the Service's commitment to partnership with Aboriginal stakeholders in protecting and managing Aboriginal cultural heritage.

•

Standards Manual for Archaeological Practice in Aboriginal Heritage Management

The *Standards Manual* sets out current best practices in this diverse and developing field. The *Manual* encourages archaeological methodology to be relevant to the management context. It has been developed in partnership with the professional community and will be supplemented by regular updates.

•

Guidelines for Archaeological Survey Reporting

These *Guidelines* set out in detail the requirements of NPWS for survey reports submitted by archaeologists. The object is to enhance the comparability of survey reports as well as to promote transparency and predictability in the industry by making clear the needs and expectations of NPWS as the reviewing agency.

•

Guidelines for Aboriginal Heritage Impact Assessment in the Exploration & Mining Industries

These *Guidelines* provide industry-specific advice to applicants of exploration and mining ventures. They were prepared by NPWS in co-operation with the NSW Minerals Council and the NSW Department of Mineral resources.

To obtain a copy of this valuable kit please send a cheque for $70 made out to NPWS to:
Cultural Heritage Services Division, NPWS, PO Box 1967, Hurstville NSW 2220
Enquires to
Denis Byrne (02)9585 6571 *denis.byrne@npws.nsw.gov.au*
Anthony English (02)9585 6464 *anthony.english@npws.nsw.gov.au*
Daphne Siu (02) 9586 6642

NSW Heritage Office

3 Marist Place
Parramatta NSW 2150
Locked Bag 5020
Parramatta NSW 2124
DX 8225 PARRAMATTA

Telephone: 61 2 9873 8500
Facsimile: 61 2 9873 8599
heritageoffice@heritage.nsw.gov.au
www.heritage.nsw.gov.au

Contact: Gary Pringle
Telephone: 02-98738564
pringlg@heritage.nsw.gov.au
File:S90/07120/002
Our Ref: HRL19943

The Director
Major Development Assessment
Planning NSW
GPO Box 3927
SYDNEY 2001

RE: PROPOSED ENVIRONMENTAL IMPACT STATEMENT – WAMBO MINE PROPOSED EXPANSION
Attention: David Kitto

I refer to your letter of 20 November 2002 requesting comments on heritage requirements for the preparation of the above Environmental Impact Statement (EIS). The following comments are provided to assist in the process of preparing the EIS.

- The heritage significance of the site and any impacts the development may have upon this significance should be assessed by the EIS. The assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site including the Wollemi National Park.
- The Heritage Council maintains the State Heritage Register (SHR) which lists items protected under the Heritage Act 1977. The register can be accessed through the Heritage Office home page on the internet (http:/www.heritage.nsw.gov.au), or can be searched by Heritage Office staff on request. It is noted that the Wambo Homestead Group is listed on the SHR (No.200) which is affected by the proposed development. A copy of the listing report is enclosed for your information. The application will therefore be integrated development due to the requirement for the approval of the development under the Heritage Act.
- Particular attention of the applicant should be drawn to section 63 of the Heritage Act regarding the demolition of items listed on the SHR. The Heritage Council has also adopted Guidelines for the Demolition of Items listed on the SHR a copy of which is enclosed. Proposals to demolish or relocate an item listed on the SHR and impact on the setting of the place will require the preparation of a heritage impact statement in accordance with Heritage Office Guidelines. The consequences of retention of the Homestead Group and alternatives to demolition or relocation must also be canvassed by the EIS. The feasibility of alternative means of extraction of the coal resource other than open cut mining is also required.
- The applicant's attention should also be drawn to the requirements of the Heritage Act regarding the minimum standards of maintenance and repair of items listed on the SHR. It appears that the standard of maintenance and repair of the buildings comprising the Wambo Homestead Group is in contravention of the provisions of

2 3 DEC 2002

the Act. A survey of the condition of the buildings and landscape elements should be submitted with the EIS together with a strategy for their conservation.

- The applicant should consult lists maintained by the NSW National Parks and Wildlife Service, the National Trust, the Australian Heritage Commission and Singleton Council in order to identify any other items of heritage significance in the area affected by the proposal. However, these lists are constantly evolving and items with potential heritage significance may not yet be listed.
- Non-Aboriginal heritage items within the area affected by the proposal should be identified by a field survey. This should include any buildings, works, relics, trees or places of non-aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment must be undertaken by a qualified consultant with historic sites experience. The Heritage Office can provide a list of suitable consultants.
- The relics provisions in the Heritage Act require an excavation permit to be obtained from the Heritage Council prior to commencement of works if disturbance to a site with known or potential archaeological relics is proposed. If any unexpected archaeological relics are uncovered during the course of work, excavation should cease and an excavation permit obtained.
- The proposal should have regard to any impacts on places, item or relics of significance to Aboriginal people. Where it is likely that the project will impact on Aboriginal heritage, adequate community consultation should take place regarding the assessment of significance, likely impacts and management/mitigation measures. For guidelines regarding the assessment of Aboriginal sites, please contact the NSW National parks and Wildlife Service on (02) 9858 6444. It is also suggested that consultation take place with the Aboriginal Heritage Committee of the NSW Heritage Council.

The Heritage Office would be happy to review any further documentation that may address any likely heritage impacts. If you have any further inquiries regarding this matter, please contact Gary Pringle on 98738564.

Yours sincerely

Alice Brandjes 19/12/02

ALICE BRANDJES
Acting Principal Heritage Officer
NSW Heritage Office

Heritage Office Database

NSW State Heritage Inventory

HO Number 5045018

SHR/IHO 00200

Item Name: Wambo & outbuildings

Location: Warkworth

Addresses:

Street:	Suburb / Nearest Town:	Local Government Area:
	Warkworth NSW 2330	Singleton

Parcels:

LotCode	Number	Section	PlanCode	PlanNumber	Current	Date Entered
LOT	82		DP	548749	☑	22/04/1999

Property Ident (old):

Boundary / Curtilage:

Item Type: Area/Complex/Group **Group:** Farming and Grazing **Category:** Homestead Complex

Owners:

Organisation:	Owner Category
Wambo Mining Corporation Pty Ltd	Private

Current Use:

Former Uses:

Area/Group/Complex: **Group ID:**

Other/Former Names:

Assessed Significance: State **Endorsed Significance:** State

Statement of Significance: Wombo Homestead is highly significant in the context of Australian pastoral activities and horse breeding in New South Wales. The use of Wombo 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.

Historical Notes or Provenance:

Themes:

Designer:

Maker / Builder:

Year Started: 1830 **Year Completed:** **Circa:** Yes

Physical Description: The Homestead is presently comprised of eight buildings, the earliest being the kitchen wing. Originally this was a single storey sandstone building with a cellar, to which a brick upper floor was added. A large brick laundry has also been added.

Other buildings include the Stud Master's Cottage of three rooms and the brick servants wing of three rooms also. All are 'Old Colonial Georgian', the earliest European architectural style used in Australia.

Around 1844, the 'Victorian Regency' New House was built. Its architectural style based on the Georgian vernacular. The New House was constructed of brick and render with a stone

Item Name: Wambo & outbuildings

Location: Warkworth

base. It contains four rooms off a central corridor under the main roof with four additional rooms under the main roof.

Other buildings which make up the Homestead are the Slab Carriage House with Stables, the timber slab / rammed earth Butcher's Hut and the Slab Horse Boxes. Other remote structures exist on the property including a large hay barn, silos and fences.

Physical Condition: As a group of buildings, Wambo Homestead is rare in New South Wales in that many outbuildings still remain substantially intact allowing easy understanding of the development of a homestead complex.

Modification Dates: 1830's - Single brick Stud Master's Cottage and Servants Wing constructed possibly while the brick upper floor to the kitchen wing was added.
1837 - Homestead was situated on 4480 acres and included a large brick structure with cellars.
1844 (circa) - The New House was constructed. The construction of the Carriage House and Stables would have been contemporary with the building of the New House.

Recommended Management:

Management:

Further Comments:

SHR criteria a): Wambo Homestead shows the development of pastoral activities in the Hunter Valley after J.T Bigge's reports on the state of the colony and its administration to the British Government. It specifically shows the pattern of selection by residents of Windsor via John Howe's newly established Bulga Road. Wambo provides evidence of the rise to wealth of James Hale, a former convict and important resident of Windsor. Wambo Homestead is a rare example which demonstrates the economic development of the Hunter Valley Region from an agricultural base through sheep, cattle and horse breeding to dairying and presently coal mining. The process involved in gaining the best economic opportunities from the property can be clearly seen.

SHR criteria b): As the creation of the convicted thief, James Hale, Wambo Estate demonstrates the enormous opportunities open to the pioneers of New South Wales. Within two decades a farm boy serving a seven year prison term had become wealthy and influential in two districts, the Hawkesbury and the Hunter Valley. In the Durham period, the property continued to yield affluence to its owners, allowing the children of convicts to control the circumstances of their lives and to live with some style.

SHR criteria c): Wombo Homestead remains substantially intact and largely unaltered. The buildings follow the architectural vocabulary of vernacular Georgian England and are elementary in design, symmetrical and consist of the simplest combination of rooms. Interior finishes and furnishings reflect conditions on the frontier where isolation and poor roads necessitated local manufacture.

SHR criteria d): Wambo Homestead demonstrates the opportunities available to energetic people who were transported to NSW in the early decades of the 19th century. Wambo Homestead is significant in terms of its distance from Hales place of residence, Windsor, and because of

Item Name: Wambo & outbuildings

Location: Warkworth

its position in the broadening agricultural enterprises of pioneer settlers. The group of buildings express the way farms were operated, with an emphasis on manual labour, and the use of the horse for work and transport.

As the residence of William and Sophia Durham the homestead has associative social significance in the Hunter Valley. This is evident in the substantial development of the Homestead in the early years and the descriptions of lifestyle afforded by visiting commentators of the period. Further, the development of the Horse Stud Infrastructure by the Allen and McDonald partnership provides physical evidence of the social and sporting aspirations of elite residents of Sydney at the turn of the 20th century.

SHR criteria e): As an archaeological resource the buildings and surrounding grounds provided an opportunity to contribute to the knowledge regarding the expansion of the colony of New South Wales, its agricultural diversification and every day life on homestead properties from the 1820's till the 1890's.

SHR criteria f):

SHR criteria g): As a group of buildings, Wambo Homestead is rare in New South Wales in that many outbuildings still remain substantially intact allowing easy understanding of the development of a homestead complex.

Integrity / Intactness:

References:

Author:	Title:	Year:
Bernard Collins	Wambo Homestead Near Wakworth NSW: A Conservation Management Plan	1994
Bernard Collins	Wambo Homestead Near Warkworth, New South Wales, A conservation Study	1994

Studies:

Listings:

Name:	Title:	Number:	Date:
Heritage Act - State Heritage Register		00200	2/04/1999
Heritage Act - Permanent Conservation Order - former		00200	3/09/1982
Local Environmental Plan		1996	5/07/1996

Custom Field One:

Custom Field Two:

Custom Field Three:

Custom Field Four:

Custom Field Five:

Custom Field Six:

Data Entry: Date First Entered: 06/06/1997 Date Updated: 05/07/2002 Status: Partial

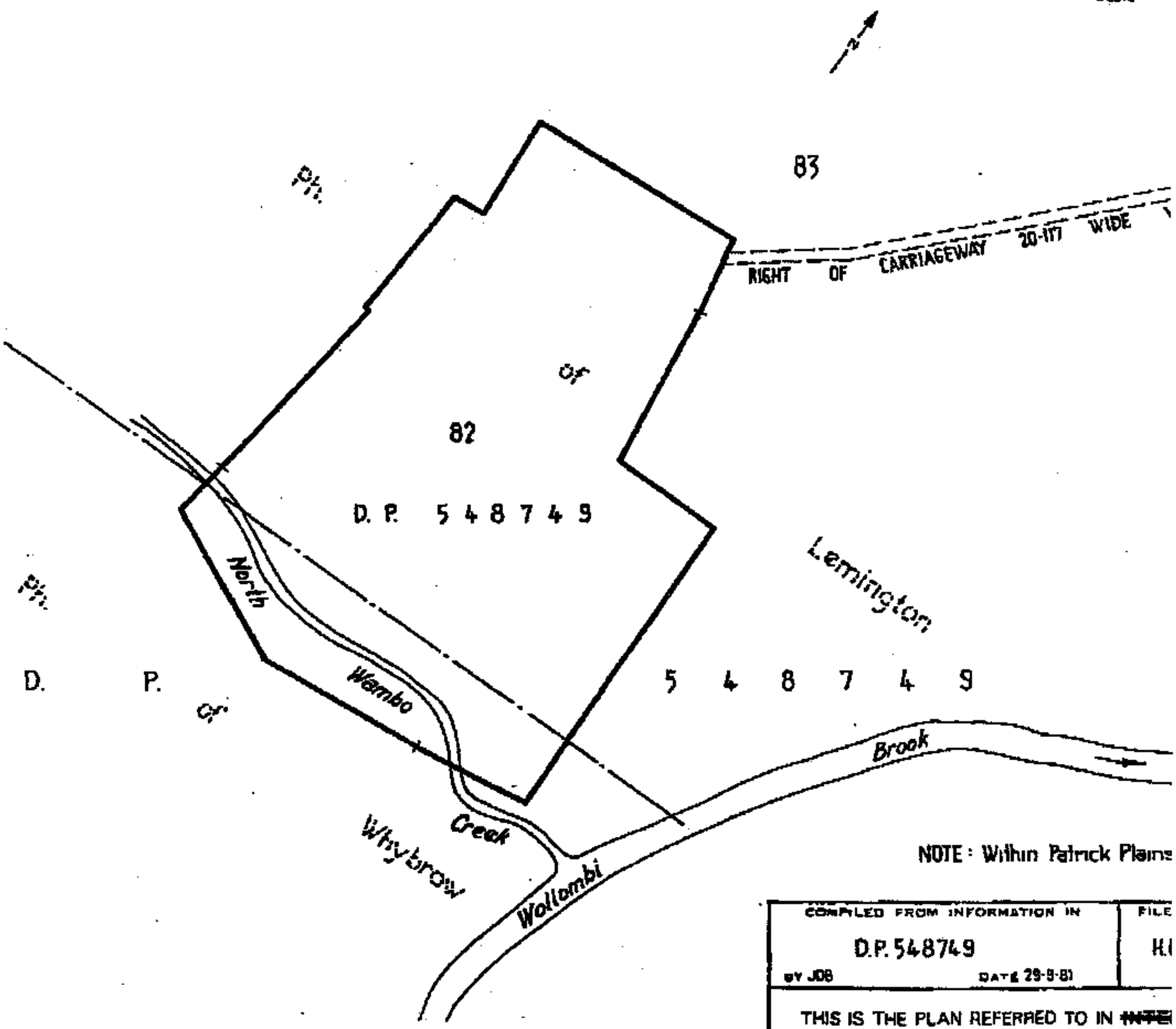
Heritage Council

Under the

Description LOT 82 D.P.54

~~Mun~~/Shire/~~City~~ SINGLETON
Parish of LEMINGTON AND WHY

Scale



COMPILED FROM INFORMATION IN	FILE
D.P. 548749	H.I
BY JDB DATE 29-9-81	

THIS IS THE PLAN REFERRED TO IN ~~INTE~~

N. S. W. GOVERNMENT GAZETTE No. 116

SUBJECT LAND SHOWN THUS:

FORM H3

GUIDELINES FOR THE DEMOLITION OF ITEMS LISTED ON THE STATE HERITAGE REGISTER OR TO WHICH AN INTERIM HERITAGE ORDER APPLIES

Background

The 1998 amendments to the Heritage Act allowed the establishment of the State Heritage Register which records items of heritage significance to the State of NSW. Monitoring of the effect of the amendments and the listing process has revealed that insufficient flexibility in the approval process discouraged the listing of some places and precincts.

Accordingly, the Heritage Act was further amended in December 2001 to alter the circumstances under which an approval body may approve the demolition of the whole of a building or work.

The amendments to the Act allow, under certain circumstances, the demolition of a building or work within a place or precinct of State heritage significance if it is not itself of State significance and its demolition will not have a materially detrimental effect on the heritage significance of the place or precinct.

As an example, a heritage precinct which contains a number of structures, some of which may not contribute to the heritage significance of the place, may now be listed on the Register or made subject to an interim heritage order. Structures within the precinct which do not contribute to the significance of the place or may even detract from its significance may now be approved for demolition.

Most importantly, the circumstances under which items may be demolished remains very limited and does not affect the over-riding objective that items of State significance are to be retained and conserved.

Circumstances Where Demolition may be Approved

An approval body may only approve the demolition of the whole of a building or work if one or more of the following circumstances applies:

(a) the approval body agrees that the building or work is a danger to its users or occupiers, the public or a section of the public (s.63(3)(a);

(b) a condition of the approval requires that the building or work be relocated to other land (s.63(3)(b); or

(c) the building or work is within a place or precinct of State heritage significance but is not itself of State significance and the approval body agrees that its demolition will not have a materially detrimental effect on the heritage significance of the place or precinct (s.63(3)(c).

How to Make an Application

An application must be made to the approval body (The Heritage Council or the relevant local Council where that Council made the Order) and be accompanied by a Heritage Impact Statement, three copies of the plans of the proposal and the appropriate fee.

A **Heritage Impact Statement** is a document consisting of a statement of the heritage significance of the item, an assessment of the impact of the proposed development on its heritage significance and measures to minimise that impact. Reference should be made to the NSW Heritage Manual ("Statements of Heritage Impact" and "Assessing Heritage Significance" 2001) published by the NSW Heritage Office for further information about heritage impact statements and assessing significance. Most importantly, the Heritage Impact Statement supporting a proposal to demolish the whole of a building or work must satisfy the approval body that the proposed demolition is able to be approved under section 63(3) of the Heritage Act.

The evidence required to be provided by a heritage impact statement for each of the circumstances where demolition may be approved includes:

CIRCUMSTANCES OF DEMOLITION	DOCUMENTATION REQUIRED
(a) The building or work is a danger to its users or occupiers, the public or a section of the public.	Report of structural soundness or survey of hazardous materials by a suitably qualified and experienced heritage specialist and a person such as a Structural Engineer with previous experience in heritage matters or a Land Contamination Auditor which assesses the extent of the danger and options for its mitigation or treatment other than complete demolition.
(b) The building or work is to be relocated to other land.	Details of the proposed relocation of the building or work and an assessment by a suitably qualified and experienced heritage specialist of its effect on the heritage significance of the building or work, the place or precinct from which it is to be removed and to where it is to be relocated.
(c) The building or work: (i) is not an item of State heritage significance; and (ii) its demolition will not have a materially detrimental affect on the heritage significance of the place or precinct.	An assessment by a suitably qualified and experienced heritage specialist that the proposed demolition satisfies the 2-part test of section 63(3)(c) of the Heritage Act which is described in column 1. The assessment must also consider: • whether the building or work can be retained and new development sited elsewhere on the site; • whether all options for retention and adaptive reuse have been explored; • whether demolition can be postponed which may provide an opportunity for future circumstances to enhance the prospects of its conservation.

"State Heritage Significance"

The concept of "State heritage significance" is defined in the Heritage Act (s.4A) in the following terms:

> *"State heritage significance, in relation to a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item."*

For further guidance on the meaning of the expression "State heritage significance", applicants are referred to the NSW Heritage Manual "Assessing Heritage Significance" 2001 and to the State Historical Themes adopted by the Heritage Council on 4 October 2001 and published on the Heritage Office web site.

"Materially Detrimental Affect"

The demolition of any building or work obviously has an impact on the physical fabric of the place or precinct. However, demolition only **"materially affects"** the significance of the place or precinct in which it is located if it changes that significance to more than a minor extent. In terms of the grades of significance described in "Assessing Heritage Significance" (NSW Heritage Office 2001), the demolition of a building or work graded as having "little" significance or being "intrusive" to the significance of the place or precinct will not materially affect its significance. A **"detrimental effect"** on heritage significance is one which reduces or obscures the level of significance. Additional guidance on the meaning of "material affectation" is contained in the "Local Government Heritage Guidelines" 2002.

Cumulative Impact

The Heritage Impact Statement must also document previous demolition activity which has occurred within the place or precinct and the possible demolition of other buildings or works which do not materially contribute to the heritage significance of the place or precinct. It is important to consider the cumulative impact on heritage significance of a number of minor proposals for demolition as collectively they may change the character of the place in an adverse way. Such cumulative effects may be materially detrimental to the heritage significance of the place or precinct and therefore unable to be approved.

Measures to be Taken for Demolition

In addition to the above, details of the measures to be taken in the interests of public safety and convenience with respect to the demolition must be submitted with the application.

Notification

If the approval body is the Heritage Council applications for the demolition for the whole of a building or work will be given public notification, unless public notice has already been given for integrated development under the Environmental Planning And Assessment Act. Such notification is to be published in a daily newspaper circulating throughout the State and to provide a period of 21 days during which submissions may be lodged with the approval body. A copy of the application is also to be sent to the relevant local Council. If the approval body is a local Council, the procedure for public notification of the application is to be in accordance with the Council's notification policy or as otherwise determined by the Council. Submissions received are to be considered by the approval body prior to the determination of the application.

Archival Recording

The approval body may impose conditions on its approval of applications for the demolition of buildings or works requiring the completion of an archival record prior to the commencement of demolition. Reference should be made to "How to Prepare Archival Records of Heritage Items" 1998, published by the NSW Heritage Office.

In reply please send to: Singleton

Our reference: 00/00762S GM:SA

Your reference: ENQ: 02/1909

Contact: Garry Moore

PlanningNSW
Mining & Extractive Industries
GPO Box 3927
SYDNEY 2001

10th December 2002

ATTENTION: DAVID KITTO

Dear Sir

WAMBO DEVELOPMENT PROJECT
PLANNING FOCUS MEETING

Thankyou for your email of 13th November, 2002 seeking the Mine Subsidence Board's input to the preparation of an Environmental Impact Statement (EIS) for the above development. The Board has attended a Planning Focus Meeting on the proposed project.

The site is located within the Patrick Plains Mine Subsidence District. It is therefore a requirement of Section 15 of the Mine Subsidence Compensation Act that all surface improvements and relocation of surface improvements are approved by the Mine Subsidence Board.

The information provided at the Planning Focus Meeting indicated that the development will include both open cut and eventually underground mining operations. The Board would request that the EIS address the impact of mine subsidence on existing structures as covered under the Mine Subsidence Compensation Act. Some of the issues which may need to be addressed are attached. If there is to be no impact from mine subsidence, then this should be clearly outlined in the EIS.

.../2

HEAD OFFICE:
PO Box 488G
Newcastle 2300
Telephone: (02) 4908 4395
Facsimile: (02) 4929 1032

NEWCASTLE:
NSW Government Offices
117 Bull Street
Newcastle West 2302
PO Box 488G
Newcastle 2300
Telephone: (02) 4908 4300
Facsimile: (02) 4929 1032
DX 4322 Newcastle West

SPEERS POINT:
143 Main Road
Speers Point 2284
PO Box 9 Boolaroo 2284
Telephone: (02) 4950 8088
Facsimile: (02) 4950 8101
DX 7820 Newcastle

WYONG:
Suite 3 Feldwin Court
30 Hely Street
Wyong 2259
PO Box 157 Wyong 2259
Telephone: (02) 4352 1646
Facsimile: (02) 4352 1757
DX 7317 Wyong

SINGLETON:
Joint Coal Board Building
1 Civic Avenue
Singleton 2330
PO Box 524 Singleton 2330
Telephone: (02) 6572 4344
Facsimile: (02) 6572 4504

PICTON:
100 Argyle Street
Picton 2571
PO Box 40 Picton 2571
Telephone: (02) 4677 1967
Facsimile: (02) 4677 2040
DX 25814 Camden

EMAIL:
mail@minesub.nsw.gov.au

WEBSITE:
www.minesub.nsw.gov.au

Some of the issues, which you may consider addressing, are:

1. Prediction of maximum subsidence, strains, tilts and curvatures.

2. Assessment of likely impacts of coal extraction.

3. Type of surface structures and likely damage.

4. Measures which might be employed to mitigate the effects of mine subsidence.

5. Details regarding the angle of draw.

6. Vibration monitoring and likelihood of extraction related vibrations.

7. Effect of subsidence on farm dams, ground water systems and survey marks.

8. Subsidence monitoring.

9. Pre-mining inspections.

10. Mine Subsidence Board requirements.

11. Preparation of a Subsidence Management Plan.

12. Identification of coal resource potential under and around proposed infrastructure.

Yours faithfully

Garry Moore
District Supervisor

NSW Fisheries

Our ref: 02-403-sc
Your ref:

22 November 2002

David Kitto
Senior Planning Officer
Mining and Extractive Industries
Planning NSW
GPO Box 3927
SYDNEY NSW 2001

Dear David

Re: Proposed Expansion – Wambo Mine

Thank you for your letter requesting EIS requirements from NSW Fisheries for the proposal cited above. The information listed below may be of some assistance in the preparation of the EIS for this proposal.

NSW Fisheries has concerns relating to the proposal due to the proposed consumption of North Wambo Creek by open cut and waste dumping, the potential risks of subsidence for Wambo and Stoney Creeks and the proposed regulation of North Wambo Creek. The all have implications for the aquatic species that inhabit these streams.

Consequently a survey of aquatic habitats and fauna must be carried out. The EIS must also identify all works on the site that will create a barrier to the passage of fish. This includes road crossings causeways and regulator weirs on natural waterways.

Definitions

The definitions given below are relevant to these requirements:

Fish means any part of marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead). Fish include oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes.

Marine vegetation means any species of plant that at any time in its life must inhabit water (other than fresh water, whether living or dead. Marine vegetation can be protected on any land adjacent to public water land, or adjacent to an area that is the subject of an aquaculture lease, that is below the highest astronomical tide level of the waters by which the land or area is submerged.

PORT STEPHENS FISHERIES CENTRE
Taylors Beach Road, Taylors Beach 2316 - Private Bag 1 Nelson Bay 2315
Telephone: 4982 1232 Facsimile: 4982 1107
Website: www.fisheries.nsw.gov.au
ABN 56 287 047 871

Water land means land submerged by water whether permanently or intermittently, or whether forming an artificial or natural body of water, and includes wetlands and any other land prescribed by the regulations as water land.

Wetlands includes marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.

Dredging work means any work that involves excavating water land, or any work that involves the removal of material from water land that is prescribed by the regulations. Exceptions include dredging work or reclamation work carried out in respect of an artificial body of water, unless the body of water is permanently or intermittently connected to a natural body of water or unless the regulations otherwise provide, any dredging work or reclamation work carried out in respect of a farm dam, unless the regulations otherwise provide, ;

Farm dam means the backed up waters of any dam, or impoundment, located on land that is not public water land.

Reclamation work means any work that involves using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or draining water from water land for the purpose of its reclamation.

Fish Passage: It is an offence to place any material, or construct or alter a dam, floodgate, causeway or weir, or otherwise create an obstruction, across or within a bay, inlet, river or creek, so that the free passage of fish will or could be obstructed.

Useful Information
To help you in the preparation of an EIS, the publication "*Guidelines for the Assessment of Aquatic Ecology in EIA*" (Draft 1998) produced by the Department for Urban Affairs and Planning may prove useful in outlining appropriate procedures and methodologies for conducting aquatic surveys.

Should you require any further information on these requirements please contact the Office of Conservation at Port Stephens on 4916 3929.

Yours sincerely

Scott Carter
Senior Conservation Manager - Central

Matters to be Addressed

1. **General Requirements**

The EIS must include the information outlined below:
A topographic map of the locality at a scale of 1:25 000 should be provided. This map should detail the location of all component parts of the proposal, any areas locally significant for threatened species (such as aquatic reserves), and areas of high human activity (such as townships, regional centres and major roads).

A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided, if possible. This aerial photograph should clearly show the subject site and indicate the scale of the photograph.

GENERAL REQUIREMENTS

- Area which may be affected either directly or indirectly by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs).
- All waterbodies and waterways within the proposed area of development are to be identified.
- For each freshwater body identified on the plan, the plan should include, either by annotation or by an accompanying table, hydrological and stream morphology information such as: flow characteristics, including any seasonal variations, bed substrate, and bed width
- Description of aquatic vegetation, snags, gravel beds and any other protected, threatened or dominant habitats should be presented.
- Area, density and species composition should be included and mapped.
- An assessment of aquatic species in the waterbodies on site, upstream and downstream. Existing data must be less than 5 years old, otherwise a sampling program must be undertaken.
- Details of the location of all component parts of the proposal, including any auxiliary infrastructure, timetable for construction of the proposal with details of various phases of construction
- Size of the area affected
- Aspects of the management of the proposal, both during construction and after completion, which relate to impact minimisation eg Environment Management Plans

DREDGING AND RECLAMATION ACTIVITIES

- Purpose of works
- Method of dredging to be used
- Duration, Time and Dimension of dredging works
- Nature of sediment to be dredged, including Acid Sulphate Soil
- Method of marking area subject to works
- Environmental safeguards to be used during and after works
- Measures for minimising harm to fish habitat under the proposal
- Spoil type and source location for reclamation activities
- Method of disposal of dredge material
- Location and duration of spoil stockpiling, if planned
- Volume of material to be extracted or placed as fill

ACTIVITIES THAT BLOCK FISH PASSAGE

- Type of activity eg works in a stream that change flow or morphological characteristics
- Length of time fish passage is to be restricted
- Timing of proposed restriction

- Remediation works

THREATENED SPECIES

- Threatened aquatic species assessment (Part 5C, EP&A Act 1979)
- Eight Part Test

2. Initial assessment

A list of threatened species, endangered populations and endangered ecological communities must be provided. In determining these species, consideration must be given to the habitat types present within the study area, recent records of threatened species in the locality and the known distributions of these species.

In describing the locality in the vicinity of the proposal, discussion must be provided in regard to the previous land and water uses and the effect of these on the proposed site. Relevant historical events may include land clearing, agricultural activities, water abstraction/diversion, dredging, de-snagging, reclamation, siltation, commercial and recreational activities.

A description of habitat including such components as stream morphology, in-stream and riparian vegetation, water quality and flow characteristics, bed morphology, vegetation (both aquatic and adjacent terrestrial), water quality and tide/flow characteristics must be given. The condition of the habitat within the area must be described and discussed, including the presence and prevalence of introduced species. A description of the habitat requirements of threatened species likely to occur in the study area must be provided.

In defining the proposal area, discussion must be provided in regard to possible indirect effects of the proposal on species/habitats in the area surrounding the subject site: for example, through altered hydrological regimes, soil erosion or pollution. The study area must extend downstream and/or upstream as far as is necessary to take all potential impacts into account.

Please Note: Persons undertaking aquatic surveys may be required to hold or obtain appropriate permits or licences under relevant legislation. For example:

Fisheries Management Act 1994

- Permit to take fish or marine vegetation for research or other authorised purposes (Section 37)
- Licence to harm threatened (aquatic) species, and/or damage the habitat of a threatened species (Section 220ZW).

Animal Research Act 1985:

- Animal Research Authority to undertake fauna surveys.

It is recommend that, prior to any field survey activities taking place, those persons proposing to undertake those activities give consideration to their obligation to obtain appropriate permits or licences which may be required in the specific context of the proposed survey activities.

3. Assessment of likely impacts

The EIS must:

- describe and discuss significant habitat areas within the study area;
- outline the habitat requirements of threatened species likely to occur in the study area;
- indicate the location, nature and extent of habitat removal or modification which may result from the proposed action;
- discuss the potential impact of the modification or removal of habitat;
- identify and discuss any potential for the proposal to introduce barriers to the movement of fish species; and
- describe and discuss any other potential impacts of the proposal on fish species or their habitat.

For all species likely to have their lifecycle patterns disrupted by the proposal to the extent that individuals will cease to occupy any location within the subject site, the EIS must describe and discuss other locally occurring populations of such species. The relative significance of this location for these species in the general locality must be discussed in terms of the extent, security and viability of remaining habitat in the locality.

4. Ameliorative measures

The EIS must consider how the proposal has been or may be modified and managed to conserve fisheries habitat on the subject site and in the study area.

In discussing alternatives to the proposal, and the measures proposed to mitigate any effects of the proposal, consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for fish species. This may include proposals to restore or improve habitat.

Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency.

In the event of a request for concurrence or consultation of the Director of NSW Fisheries, one (1) copy of the EIS should be provided to NSW Fisheries in order for the request to be processed.

It should be noted that NSW Fisheries has no regulatory or statutory role to review draft EISs unless they are accompanied by or are requested as part of a licence application under Part 7A of the FM Act. However, NSW Fisheries is available to provide advice to consent and determining authorities regarding Fisheries' opinion as to whether the requirements have been met if requested, pending the availability of resources and other statutory priorities.

Attachment No. 3

File: 325.5395/01/36
Contact: Greg Gola
Telephone: (02) 4924 0337
Facsimile: (02) 4924 0342
Email: Greg_Gola@rta.nsw.gov.au

RTA

www.rta.nsw.gov.au
Roads and Traffic Authority
ABN 64 480 155 255

Hunter Region

59 Darby Street
Newcastle NSW 2300
Telephone (02) 4924 0240
Locked Bag 30
Newcastle NSW 2300
DX 7813 Newcastle

The Director-General
Department of Urban Affairs and Planning
Development & Infrastructure Assessment
GPO Box 3927
SYDNEY NSW 2001

Attention: Mr David Kitto

Proposed Wambo Coal Mine extension, Warkworth

Dear Mr Kitto

I refer to your request for RTA comment regarding preparation of an Environmental Impact Statement (EIS) for the above-mentioned proposal.

The RTA is accountable for ensuring that NSW roads are safe for everyone to use while at the same time ensuring efficient movement of people and goods in a socially and environmentally responsible manner.

The following comments are provided to assist the preparation of an EIS:

Classified Road Network

RTA administered classified road in the vicinity of proposed development site:

- Golden Highway-Jerrys Plains Road (State Highway 27)
- The Putty Road, south of Golden Hwy (Main Road 503)

Singleton Shire Council administered classified roads in the vicinity of the proposed development site:

- The Putty Road, north of Golden Hwy (Main Road 128)
- Broke Road (Main Road 188)

In accordance with the Roads Act 1993 the RTA has consent powers in relation to construction, modification or removal of road work, traffic control facilities and other works and structures on the classified road network.

Assessment of Road Network Impacts

The proposed development is a Schedule 1 development under State Environmental Planning Policy No. 11 – Traffic Generating Developments. A development application for this proposal will be referred to the RTA for comment.

Impacts of the development upon the traffic operation of the surrounding road network are to be assessed for each stage of development covered by the development application.

Assessment is to be provided in the form of a traffic impact study (TIS) and should be prepared in accordance with the RTA's *Guide to Traffic Generating Developments*.

Blasting

Blasting and the control of flyrock and debris are to be addressed by the applicant. During operation of the quarry, blasting is to be undertaking in a safe manner that ensures the safe operation of the classified road network at all times.

Consultation with Local Government and other Roads Authorities

The applicant is directed to seek the requirement of Singleton Shire Council with respect to council administered roads.

Should you wish to discuss this matter further, please contact Greg Gola, A/Network Development Planner on 4924 0337.

Yours faithfully

C W Nunn
Development Manager
Hunter Client Services

20/12/02

Our ref:

Your ref:

1 6 DEC 2002

HUNTER CATCHMENT MANAGEMENT TRUST
Care for the land

Private Bag 2010
PATERSON 2421
816 Tocal Road, Paterson
Phone: (02) 4930 1030
Facsimile: (02) 4930 1013
ABN 35 554 004 710

Email: hunter.trust@hcmt.org.au
Web site: www.hcmt.org.au

Mr David Kitto
Senior Environmental Planner
Planning NSW
GPO Box 3927
SYDNEY NSW 2001

Dear David

Re: Wambo Development Project Planning Focus Document

Thank you for the invitation for the Hunter Trust to comment on the Wambo Planning Focus Document. Below are comments on several key sections of the PFD. Due to the time available to comments, this response is focussed on vegetation management issues, and does not attempt to comment on all issues in the Planning Focus Document.

Ecological Issues

The Hunter Trust is currently completing a study of the remnant vegetation of the central Hunter Valley, which includes the Wambo study area. The Hunter Trust urges the project proponent to make use of data from that project in the preparation of its EIS.

In preparing the EIS, the Hunter Trust suggests that the following issues are addressed in addition to those mentioned in the Planning Focus Document.

Regional habitats and corridors:

The impacts of the proposed development at the regional level should be adequately assessed by the EIS. This includes the reduction of important habitat for threatened species, regionally significant species and migratory species. As the vegetation in the Wambo area forms part of a broad regional corridor across the centre of the Hunter Valley, the impacts on the ecosystems in the area are likely to be significant. In principle, the Hunter Trust is supportive of proposals that would minimise the amount of clearing and provide for long-term protection of a large proportion of regional habitats and corridors in the area. This principle is in line with those espoused in the Integrated Catchment Plan for the Hunter Catchment.

Vegetation communities:

The Hunter Trust suggests that the EIS map and adequately address the impacts of the proposed mine on the following listed Endangered Ecological Communities:

- Grassy white box woodland;
- Hunter Lowland Redgum Forest; and
- Warkworth Sands Woodland.

In addition, the following vegetation types are considered by the Hunter Trust to be of regional significance, and may meet the criteria for listing on the *NSW Threatened Species Conservation Act* 1995, should they be nominated:

- semi-evergreen vine thicket;
- river red gum (*Eucalyptus camaldulensis*) woodland; and
- paperbark woodland (dominated by *Melaleuca sieberi* or *M. decora*).

The likely impacts of the proposed development on these regionally significant vegetation types and rehabilitation or compensatory actions should be adequately addressed by the EIS.

The Hunter Trust suggests that the project proponents also contact the Hunter Rare Plants Committee of the Hunter Regional Botanic Gardens to liaise with them regarding the listing of regionally significant flora species, populations and communities. When identified, regionally significant flora is likely be subject to management actions under the Integrated Catchment Plan for the Hunter Catchment, and are likely to be subject to provisions under the Hunter Regional Vegetation management Plan when it is completed.

Survey Timing:

It is suggested that, as far as is practicable, ecological surveys be timed to maximise the likely detection of threatened or regionally significant flora and fauna. Many flora and fauna species are very difficult to detect during certain seasons. Examples include microchiropteran bats, some amphibians, terrestrial orchids, grasses and many herbs. Review of a recent nearby EIS highlighted the fact that while it was possible that a threatened orchid species (*Pterostylis gibbosa*) occurred on the subject property, the survey timing all but ensured that this species could not be detected during the EIS surveys. It is suggested that field surveys be timed to take this into account. This approach will help to ensure that an adequate ecological survey is undertaken during the EIS preparation.

Impacts of Subsidence on Vegetation:

It is suggested that a comprehensive analysis of the likely impacts of mine subsidence on vegetation communities be undertaken by the proponent. This would specifically include the likely impacts of subsidence on the Warkworth Sands Woodland east of Wollombi Brook, and the impact of subsidence on riparian vegetation communities. If the impacts of subsidence are likely to be significant then it is suggested that the project is modified to ensure that no significant impacts result.

Rehabilitation Plan:

A comprehensive rehabilitation plan would be welcomed by the Hunter Trust. Such a plan should aim to restore vegetation communities directly affected by the proposed development either *in-situ* or off site, depending on final landforms. Soil should be stockpiled for short time periods and re-spread and seeded as soon as possible. A comprehensive seed collection program should be undertaken prior to clearing and mining, with the intent of re-establishing as much of the floristic diversity as possible. The rehabilitation plan should aim to restore viable ecological communities, rather than species-poor plantations. Exotic species (such as Rhodes grass, *Chloris gayana*) should preferably not be used in rehabilitation efforts. Rehabilitation, however, should be seen as a second-best option to protection of existing vegetation in the first place. Rehabilitation should augment protection of vegetation in offset areas, as well as rehabilitation of degraded vegetation *ex-situ*.

Revegetation and vegetation protection activities should be undertaken in a complementary way, to ensure that largely connected areas of vegetation result from the proposal. Ensuring such vegetation linkages, should the proposal go ahead, would be in standing with the *Synoptic Plan – Integrated*

Landscapes for Coal Mine Rehabilitation – Hunter Valley, NSW, and would also contribute towards the protection and management of vegetation in priority landscapes as identified in the Integrated Catchment Plan for the Hunter Catchment.

Cumulative Impacts:

The Hunter Trust urges the proponent to adequately consider the cumulative impacts of this and other development on the regional habitat of the central Hunter Valley in the EIS. Other nearby projects, such as the proposed Warkworth open cut extension, Warkworth sand mine, and a proposed rail line and loop, together with the proposed Wambo extension, are likely to have significant impacts on the ecology of the central Hunter Valley, especially on regional habitats and corridors, as well as Endangered Ecological Communities and regionally significant communities. The EIS should also identify opportunities to ameliorate the cumulative impacts on regional habitats and corridors.

Ameliorative Measures:

The EIS should propose ameliorative measures where significant impacts on any of the above vegetation types are considered likely. Such measures may include purchase and protection of similar vegetation types, rehabilitation of those vegetation types and modification of the mine plan. Specifically, the formalised protection of the *Warkworth Sands Woodland* vegetation community on the eastern side of Wollombi Brook is considered to be a desirable outcome by the Hunter Trust. The Hunter Trust supports the principle of offsets whereby land of significant ecological value is protected as an offset for development in other areas. Protection could be through the form of re-zoning, voluntary conservation agreement or other long-term measures.

Water Management Issues

The Hunter Trust has endorsed draft guidelines prepared by the Department of Land and Water relating to the management of mining impacts adjacent to watercourses. It is suggested that the proponent obtain a copy of the guidelines and take them into account in preparing the EIS.

It is understood that the Department of Land and Water Conservation will consider the water management issues relating to this proposal than are provided here.

Yours faithfully

Travis Peake for
Glenn Evans
Chief Executive Officer

9 December 2002

MINERAL RESOURCES NEW SOUTH WALES

NSW DEPARTMENT OF MINERAL RESOURCES
Level 1, 1 Civic Avenue (PO Box 51)
Singleton NSW 2330 Australia
INSPECTORATE: Phone (02) 6572 1899 Fax (02) 6572 1201
GEOLOGY: Phone (02) 6572 4200 Fax (02) 6572 1201
MINING TITLES: Phone (02) 6572 4200 Fax (02) 6572 1201
www.minerals.nsw.gov.au
DX 7071
ABN: 68 040 288 347

Mr David Kitto
Senior Environment Planner
Mining & Extractive Industries
Planningnsw
GPO Box 3927
Sydney NSW 2001

11 DEC 2002

Our Ref: C91/0257

Dear Mr Kitto,

Proposed Wambo Development Project
Planning Focus Meeting

I refer to the Planning Focus Meeting held on site at Wambo Mine on the 4 December 2002. As far as the DMR's principal areas of responsibility are concerned, from a conceptual point of view, this proposal represents responsible development. Resource recovery is optimised, proposed mining methods are sound and the area could be satisfactorily rehabilitated. The DMR would however like to draw the proponent's attention to the following issues, some of which will need to addressed in detail in the EIS:

- A summary resource reserve statement, which outlines how coal recovery will be optimised.
- The area beyond existing mining lease will require a new mining lease. Mining leases have as a standard condition the requirement to lodge a Mining Operations Plan (MOP) and this will be used to assess details of the actual mining and rehabilitation. The mining lease also requires the lodgement of an Annual Environmental Management Report (AEMR), which essentially covers detailed reporting on rehabilitation and environmental management.
- Details of subsidence impacts and their derivation will be required in order for the DMR to assess potential impacts in relation to future subsidence management plans and second working approvals.
- The proponent should be aware that if there be any areas of Crown Land on which Native Title has not been extinguished, the provisions of the Commonwealth Native Title Act will need to be complied with before a new mining lease can be granted.

Should you have any further queries, please contact me.

Yours sincerely,

6/12/02

David Agnew
Manager Coal & Petroleum Titles

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C.B. Alexander
Agricultural College,
Tocal

NSW Agriculture

ABN 86 308 026 989

Tocal, PATERSON, NSW. 2421
Phone (02) 4939 8942, PATERSON, NSW 2421
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http://www.agric.nsw.gov.au

PlanningNSW
GPO Box 3927
Sydney NSW 2001

Attention David Kitto

Re Proposed Expansion, Wambo Mine
Planning Focus Meeting 4 December 2002.
EIS Requirements.

The proposed significant expansion of the Wambo mine as outlined at the planning focus meeting on the 4 December 2002 and in the 'Planning Focus Document' will potentially involve open cut mining on Prime Agricultural land Classes 2 & 3, which may contain alluvial soils and occur on aquifer intake areas. The development also proposes the possible damming and/or diversion of North Wambo Creek across potentially subsided land. This creek has a large external catchment of over 20 square Kilometers and is an important tributary to Wollombi Brook.

It is with these concerns in mind that we request that the EIS clearly addresses these issues and any likely impact on the environment and cumulative effects of run off on the land and down stream users and irrigators.

The EIS should clearly identify all potential impacts on current agricultural enterprises in the locality and how the land is to be restored including:

- Actual agricultural land suitability and improvements within all areas to be disturbed including the significance of such resources.
- The nature of existing agricultural operations, including properties surrounding the mine.
- Potential impacts on agricultural activities that may result from mining or associated activities. This should include all Wollombi Brook alluvial's and tributaries in the study area; changes to surface and ground water flows, volume, and quality; impact on the aquifer along the creeks; salinity; noise; dust; blasting and changes to infrastructure including potential road closures. Includes Wollombi Brook, Waterfall Creek, North Wambo Creek, Stony Creek, and Wambo Creek areas.
- Predicted cumulative environmental and socio-economic impacts on current agricultural activities and the future agriculture potential.
- Effects of subsidence on agriculture and the environment. This should include scientific modelling of the multi seam mining subsidence impact and comparisons of the pre and (predicted) post mining surface contours on a worst case scenario, including impact of subsidence on the creeks and the proposed possible diversion of the creeks across subsided land.
- Mitigation measures proposed.

NSW Agriculture advises that in addition to routine coverage of rehabilitation and environmental protection measures, the EIS should also document: -

Head Office: 161 Kite Street, Locked Bag 21, ORANGE NSW 2800. Telephone (02) 6391 3100. Facsimile (02) 6391 3336

- Changes to the existing rehabilitation program and a revised land use management plan as a result, of this proposal
- Additional rehabilitation measures required as a result of this expansion and the intrusion on class2 & 3 lands
- Objectives for rehabilitation and land use, including proposed post mining land use patterns.
- Proposed rehabilitation measures including strategies to effectively re-establish and maintain pastures, timbered areas, water storages and biodiversity.
- Proposals to integrate land forms, vegetation and water management with adjoining mines including potential regional / local conservation corridors and sustainable post mining use.
- Possible opportunities for agricultural production on land under the control of the mining company during and post mining.
- How the proposed rehabilitation practices, land form, vegetation patterns and water storages would contribute to the realisation of rehabilitation and land use goals.
- Final Void rehabilitation, management and water/ salinity balance
- Rehabilitation and land management performance indicators for the restitution of land to the pre mining land suitability and capability.

Yours faithfully

Peter Gillespie
Acting Agricultural Environment Officer, Hunter Region.
5/12/02.

Attachment No. 4

David Kitto - wambo open cut

From: "yvonne & ian" <killenberg@bigpond.com>
To: <david.kitto@planning.nsw.gov.au>
Date: 31/01/2003 12:02 PM
Subject: wambo open cut
CC: "wambo" <david.kitto@planning.nsw.gov.au>

TO DAVID KITTO

I'M WRITTING TO YOU IN REGARD TO THE PROPOSED NEW MINING LEASE EXTENSION OF WAMBO COAL OPEN CUT.
I WAS BORN IN 1974 THE SAME YEAR THAT WAMBO OPEN CUT MINE WAS STARTED. MY FAMILY HAS A PROPERTY AT THE TOP OF NORTH WAMBO CREEK THAT HAS BEEN IN OUR FAMILY FOR ABOUT 100 YEARS [THREE GENERATIONS] THE PROPERTY HAS BEEN USED MAINLY FOR CATTLE AND AGRICULTURAL PURPOSES. IT HAS SIGNIFICANT HERITAGE VALUE NOT IN THE SIGN OF THE DOLLAR BUT IN THE HEART, AS MY GREAT,GREAT AUNT IS BURIED AT THE BACK OF THE PROPERTY AND THE BUILDINGS ARE ONES THAT MY GRANDFATHER CONSTRUCTED.
OUR FAMILY HAS ALWAYS ENJOYED A NORMAL COUNTRY LIFESTYLE AND UPBRINGING AND THE PROPERTY PINEGROVE HAS BEEN A BIG PART OF THAT , BEING THE SAME AGE AS WAMBO OPEN CUT I HAVE SEEN CONSIDERABLE CHANGES FROM THE THE EAST OF PINEGROVE NOT ONLY ONES YOU CAN SEE BUT THE ONES YOU CAN HEAR AND SMELL.
IN THE LAST FEW YEARS WAMBO HAS COME CLOSER AND CLOSER TO OUR BOUNDRY AND AS OF TODAY THEY ARE APPROXIMATLY 3KMS AWAY AND THE NOISE LEVELS HAVE BECOME UNBELEVABLE TO THE EXTENT I CAN HEAR THE TRUCKS BEING LOADED AND UNLOADED [OVER THE TOP OF THE TV AND RADIO] ALL HOURS OF THE DAY AND NIGHT AS WELL AS A VERY BRIGHT SET OF LIGHTS SHINING STRAIGHT TOWARDS THE BUILDINGS ON OUR PROPERTY.THE PILES OF OVERBURDEN HAVE BECOME A HUGE EYE SORE FROM WHAT WAS ONCE A PEACEFUL PROPERTY AS WELL AS THE DUST AND HAZE THAT GETS SWEPT OVER US. THEY MAY OR MAY NOT BE WITHIN GOVERNMENT STANDARDS BUT THEY ARE DEFINITELY BEYONED NORMAL DECENT HUMAN STANDEDS.
THERE IS ALSO A SIGNIFICANT INCREASE IN FERAL ANIMALS NUMBERS FOR WHICH NATIVE AND DOMESTIC ANIMALS HAVE TO COMPETE WITH FOR SURVIVAL. IN THE LAST SIX MONTHS WAMBO MINE HAS APROCHED OUR FAMILY ASKING IF WE WOULD BE INTERSESTED IN SELLING PINEGROVE TOTHE COMPANY SO THEY CAN CONTINUE THERE MINING PROCESS , AS I HAVE EXPLAINED THE PROPERTY FOR US GOES ABOVE AND BEYOND THE EXTENT OF THE DOLLAR SIGN BECAUSE WE WOULD LIKE TO KEEP IT FOR FUTURE GENERATIONS TO LOVE AND RESPECT FAMILY VALUES. WHAT IS OF GREAT CONCERN TO US IS WHETHER THOSE YOUNG GENERATIONS WILL BE ABLE TO HAVE THE SAME LIFESTYLE AS THERE FORE FATHERS ENJOYED. AND IF YOUR DEPARTMENT APROVES THE NEW MINING LEASE IT WILL BRING WAMBO MINE WITH IN 1 KM OF THE BUILDING AND RIGHT TO THE BOUNDRY OF OUR FAMILY PROPERTY WHICH WILL MAKE THIS EXTREMLY DIFFICULT. ANOTHER CONCERN FOR US IS THAT WE HAVE AND WILL ALWAYS RELY ON UNDERGROUND STREAMS(WELLS) AND RAINWATER TANKS AND AS A RESULT OF DUST OUR TANKS ARE ALREADY SUBJECT TO INCREASED AMOUNTS OF DIRT, AND AS THE MINE COMES CLOSER THE LEVEL HAS AND WILL BECOME MORE AND MORE
STRAINED OR EVENTUALY DRY UP COMPLETLY THEREFORE GIVING US NO OPTION BUT TO TRUCK WATER INTO THE PROPERTY WHICH WOULD BE A FIRST IN THE HISTORY OF PINEGROVE AND A GREAT INCONVENIICE. ALSO WE WOULD LIKE TO KNOW IF PLANNING NSW WILL HOLD WAMBO MINE ACCOUNTABLE FOR DROP IN THE LEVEL OF THE WELLS ,WAMBO HAVE TOLD US THAT THEY PLAN TO DAM AND DIVERT NORTH WAMBO CREEK TO MY KNOWLAGE IT IS ILLEGAL LET ALONE IMORAL TO ALTER A NATURAL WATER COURSE, IF WE WERE TO DO THIS I,M SURE WE WOULD FACE A FINE OR WORSE GO TO GAOL.
ANOTHER FACTOR IS THE ACCESS ROAD TO PINE GROVE WOULD BE SEVERLY ALTERED IN THE DIRECTION AND LENGTH THAT IT WILL TAKE TO TRAVEL TO THE PROPERTY SO IN THIS OFTEN HARSH ENVIROMENT AND EVER RISING LIVING COSTS ITS GETTING HARDER FOR THE FAMILY ON THE LAND TO SURIVE LET ALONE HAVING THE THREAT OF A MULTI MILLION DOLLER COMPANY WANTING TO DIG AROUND THE FAMILY PROPERTY AND CHANGE YOUR WAY OF LIFE. IT MAY NOT MEAN ANYTHING TO RICH COMPANYS ,INVESTORS OR THE PERSON IN THE CITY,BUT IT SURE AS HELL DOES TO SOME FAMILYS IN THE COUNTRY, IN CLOSING THIS LETTER YOU WOULD UNDERSTAND THAT MY FAMILY IS VERY MUCH IN OPERSITION TO THE PROPOSED MINING LEASE EXSTENION OF WAMBO OPEN CUT MINE. I UNDERSTAND THAT ONE FAMILYS CONCERNS MAY NOT

MEAN MUCH TO THE GOVERNMENT ECONOMY AND PLANNING - BUT ALWAYS REMEMBER THAT A WATER FALL STARTS WITH ONE DROP OF RAIN. SO I HOPE WHEN YOU MAKE YOUR DISICION YOU HAVE A GOOD HARD THINK ON THE MORALS OF HUMAN DECENTCY AND QUIET COUNTRY LIVING AND HERITAGE.

DALLAS SKINNER

Robert & Lynette Mac Bain

51 William St., Singleton. NSW.2330
Australia.
Phone/Fax 61 0265722235
Email macbain13@bigpond.com

David Kitto
Snr Environmental Planner
Planning NSW.

Dear David

Re: Proposed Expansion of Wambo Mine.

Issues we believe must be addressed in the Environmental Impact Statement for the Wambo Mine extension. Many should be addressed in every EIS.

When the burden of mining development hits, local landholders and residents are told they have rights and choices. Yes, they can stay and put up with it or they can move if they do not like what is happening, in some instances the mine will acquire their land ect., ect.,. Some choice, the reality is in most cases, people are forced to move because their environment and amenity is changed to the detriment of their lifestyles. Many in our community have long-term family connections with their land, village and community; their love of 'place' is no less significant than our indigenous members of the community and must be address in equal light. Our personal connection to this area is a family one, since the early 1830's ours have been born, lived, married, died and were buried in the area and hopefully will continue to be able do so.

Some of the other issues are as follows, alphabetically not in order of greatest importance.

Addressing the Issues. We believe this proposal cannot be seen in isolation. It must be addressed in the light of cumulative effects, the proposed rail loop, the expansion of other mines in both close proximity and others in the Singleton Shire. Further, there is an opportunity for this proposal as well as future proposals to start to address the regional impacts as well as their local impact, something that is long overdue.

Amenity of the area must be addressed.
Why should residents in communities such as the Singleton Shire constantly have their rural landscape changed? The amenity of our shire is fast becoming something that replicates a lunar landscape.

Assessment of the EIS must be addressed. Our experience of the EIS process leaves us cold. Without exception, the EIS' we have addressed have had overwhelming amounts of "possibilities', probables', maybes, could dos, might's, will consider, if we do this, if we do that, the effects will be insignificant [to who], in our opinion the risk or effect is minimal," ect. ect., ect.,. The writers of EIS' are touch by the blarney stone. The community can have no confidence in addressing any EIS, which does not address the issues with definitive answers. Waffle is elusive, time consuming and an insult to an intelligent community who has over twenty years of experience in dealing with EIS'.

<u>Time allowance for assessment</u> is usually insufficient for a community who has to do their own research while coping with other commitments, and no financial assistance for technical or legal advice.

The community is often denied the input of other government departments due their conflicting interest.

<u>Access to copies of EIS'</u> is another right denied to the community. Copies should be made available by the proponent to anyone who wishes to assess them free of charge. In the Singleton Shire, assessing an EIS may require you to stand at the Council counter for hours and hours to access the volumes of data in some EIS'. Copies can be exhibited in our library but if you are a shift worker, which a major proportion of the community are, then you cannot get to the Council or Library in business hours, therefore you are denied the opportunity. Given the amount of EIS' which are placed before this community, it is unfair to expect the community to buy all copies, many cannot afford them therefore their rights are denied by lack of proper opportunity.

'Best Practice' must be addressed. Over and over again, the issue of best practice falls by the wayside to economics. The community deserves best practice on all issues and methods. The community should be able to be confident that the issues addressed in any EIS are answered with Best Practice methods but this is certainly not our experience.

Community and Social Impact must be addressed. The decimation of our villages one after another must cease, before the beautiful village of Jerry's Plains goes the way of the villages of Warkworth, Campbellwell, Ravensworth, Liddell, Rix's Creek to name a few who have already heard the death knell.

Cumulative Impact on the Environment must be addressed. There are 26 mines in the Singleton Shire and most with the potential to expand. Warkworth, and United mining companies whose boundary's are in close proximity to Wambo are also expanding, the cumulative impact on not only the local environment but also the Hunter region will be increased and must be addressed.

Farmland reduction and degradation must be addressed.
Depletion of farming land is already an issue in this shire and is of National importance. Inability to return the land to previous use reduces our already depleted farming land base. Food for the future is an issue.

Health must be addressed.
World health authorities have recognised the health impacts of coal dust and other pollutants from coal mine operations. A Health Study of the Upper Hunter is due to commence sometime 2003. The Hunter Valley leads Australia in Asthma; this proposal will add further impacts, what measures will be put in place to negate any impact?

The History of Singleton Shire's, The Hunter's, The State's and Australia's must be addressed.
The history of our community has been subjected to genocide of sorts. Historic properties bought by mining companies are left to decay with little or no maintenance, despite obligations and undertakings to protect them. Most are fenced and left, and oh, gosh they are become beyond restoration especially if there is coal underneath despite in some cases receiving Heritage Grants for maintenance. The Wambo Homestead, a State Significant property represents the pastoral advances of Australian rural life since the 1820's, it is our belief that a case could be proved for it to be registered as a Nationally Significant, that is if we were able to access the property. The significance is largely diminished if the homestead, out buildings and implements were to be removed, imagine if it was suggested that Elizabeth Farm be moved, Wambo Homestead is no less significant to our history.
What will be;
The long term effects of both intermittent and continuous vibration, on blasting, on fallout and increase pollution on;
The State Significant Wambo House and the homestead area.
The Historic Cemeteries of Jerry's Plains.
The Historic properties within the area.
The impact of the proposed rail loop on St. Phillip's Church and Cemetery.

Jobs must be addressed. How many jobs will really be created? Our experience tells us that in most cases Job Creation is grossly overstated. New work practices and many company policies allow personnel to be moved around this is not real job creation.

Long-term land occupancy must be addressed. A sense of place, environment, land or community is not only experienced by the indigenous members of our community and we believe it is about time that this issue is seen in equal light. It is not about race, culture or religion; it is about that sense of belonging, which is truly a human attribute.

Noise Impact must be addressed.
With Warkworth, and United also expanding, another mine extension will further increase noise on a community subjected to the noise from light and heavy traffic, mines, industry, army camp, fighter planes and agriculture, in most cases operating 24 hours a day, 7 days a week.

Penalties must be addressed
Over and over again, our experience has shown that Proponents and their Consultants can mislead, misrepresent and outright lie in an EIS without penalty. It is about time that if a case is proven then the severest penalty should be imposed, such as the proposal should be withdrawn from consideration and a monetary penalty imposed, it would not take long before EIS' became genuine documents instead of a public relations exercise of hoodwinking.

Pollution must be addressed.
The local and regional cumulative problems of dust and other pollution such as fuel emissions, escaping gases, spontaneous combustion gases will affect an already heavily impacted community. What best practice measures will be used to combat the ever-increasing problems?

Rehabilitation must be addressed. The issue of rehabilitation has become much of a joke in the Shire as many put the minimum effort and minimum funds into rehabilitation.

Subsidence must be addressed.
Already homes in the area have suffered damage and some have extensive damage due to subsidence leaving the owners in considerable distress.

Sustainability must be addressed. Continuous expansion of leases cannot be justified. Leave something for the coming generations. With the new technology available, previous leases can return profits.

Tailings disposal methods must be addressed. Experience shows the disposal of tailings to be a long-term environmental problem, what will be the methods and will they be best practice or just the cheapest avenue?

Traffic must be addressed. Traffic assessment on the amount of and dangers in previous EIS' have always appeared to be understated in our experience.

Vibration must be addressed. The long-term effects of both intermittent and continuous vibration on properties and in particular the Glennies Creek Dam, taking into account impacts of mining history already experienced.

Water must be addressed. This precious resource is fast becoming scarcer and scarcer. Who will be going without, if this mine, gains consent. How will and how much water be used? What will be the effects on the Hunter River and its environs? How much will this proposal add to the salinity problem, pollution problem and water table issues?

Weather Conditions and Temperature Inversions must be addressed.
Singleton as well as the Hunter Valley is subject to unique weather conditions, this has the potential to further affect the mine therefore impacting and affecting health.

We look forward to seeing a new direction for Environmental Impact Statements; many issues can be overcome with honest appraisal, which will ensure that best practices are put in place if a development proceeds. The community is no longer prepared to just accept what they are told by proponents and consultants, whose use of language in an EIS is at best creative and in some cases outright lies. Many in the community find the time to scrutinise, research and seek alternatives to proposals in an attempt protect their health and lifestyles of not only themselves but of future generations. The community has no confidence in a system that puts them on the bottom of the ladder, perhaps 'Plan First' will be a step in the right direction but it will only work if the community is given fair opportunity and penalties are in place to ensure honesty.

Yours Truly,

Robert Mac Bain

Lynette MacBain

Singleton Historical Society
SINGLETON, N.S.W., 2330

P.O. Box 120.
Singleton 2330.
24.1.03.

Mr. D. Kitto
Senior Environmental Planner
Major Development Assessment
Planning N.S.W.
Henry Dean Building
20 Lee Street
Sydney. 2000.

4 FEB 2003

Dear Sir,

On behalf of the members of the Singleton Historical Society I am writing in support of the enclosed copy of a letter from the parishioners of St Philips Anglican church at Warkworth.

Our members support all their concerns for the area, the community & their buildings. Our particular concern is for the church building & the homestead "Wambo", both of great historical value to our area.

We would like to think that some consideration could be given to preserving & protecting these buildings.

Yours faithfully.
Kaye Stacy. (Mrs)
(President)

'WAMBO' B. listing National Trust 1844.
CHURCH D " " . 1840.

SAINT PHILIP'S - WARKWORTH

Errol Long
8 Gas Street. Singleton 2330.
Phone 6572 2047

20th January, 2003.

David Kitto
Senior Environmental Planner
Major Development Assessment
Planning NSW
Henry Dean Building
20 Lee Street
SYDNEY NSW 2000

Dear David

Re: Proposed Expansion of Wambo Mine, Hunter Valley NSW

We are writing as concerned members of St Philip's Anglican Church, Warkworth as we are strongly opposed to the position of the proposed Wambo Rail Spur and Balloon Loop.

From information received from Mr Peter Doyle, Project Manager, Wambo Coal Pty Limited the proposed rail spur will be 290 metres on the south-western side and 350 metres on the south-eastern side from the Church buildings and Cemeteries.

Concerns for the Church Building & Headstones

1. **Their Historical Significance:** The building and surrounding cemeteries have a Heritage listing, the building being commenced in 1845 and some gravesites dating back to the 1830's.
2. **The Visual Impact:** For over 150 years St Philip's Church has enjoyed the beautiful rural setting which is still appreciated today by the regular worshippers along with those visiting our Church.
3. **Vibration:** With the close proximity of the rail proposal we are very concerned that the stress generated by the constant vibration of rail carriages will cause the structure of the Church and headstones to wear and crumble.
4. **Dust:** An increase in dust would occur if this proposal goes ahead and this would have a detrimental effect on the buildings and headstones.

The Wardens and Vestry Members of St Philip's Church are committed to the already difficult task of restoring and maintaining the Church & Cemeteries. Work has commenced and is continuing with help coming from the present members as well as those who have ancestors buried in the cemeteries. Within our congregation we have members who are themselves third and fourth generation worshippers at St Philip's. Interest in the preservation of our Church extends to the local community and beyond.

Concerns for Quality of Worship

1. **Noise:** The noise generated from the proposed rail spur and balloon loop would severely effect our quality of Worship.
   (a) Sunday Services: These are usually held from 9.30am to 10.30am, sometimes being changed to afternoon or evening for special occasions throughout the year. During these services many in our congregation including young mums, children and older folk take part in praying, reading the bible and leading the service. This participation is a vital part of our worship as we praise God together. Music and singing is also an important part of our services and our singing group practices in the Church.
   (b) Friday Evening Meditation Service: This service is one which everyone looks forward to as a time when we can come away from our busy week, bring our pillows, relax with only candle-light in the Church, listening to quiet music and allowing God to speak to us.
   (c) Kid's Church – This is held during Sunday Services, the children are taken outside and we have songs, prayers bible stories and craft.

To worship together as the body of Christ is a vitally important part of our Christian faith and growth, not to be able to hear each other during worship services would destroy the whole reason for our meeting together. Loud noise during the Meditation Services would destroy the quite atmosphere, which is necessary in this type of service. All the children love going out under the huge tree at the front of the Church for Kid's Church. It would be extremely hard for the teachers and helpers to teach and relate to the children if we had to keep stopping every time a train went by.
Looking at the plan of the proposal, the noise would go for a long duration of time considering that it would be heard from several different directions.

Health Concerns:

1. Several of our members live in the Warkworth area within close proximity to the proposed rail spur and balloon loop.
2. Both noise and dust increases would have a detrimental effect on those who live locally and those attending our services.

We are concerned for all residents of the Warkworth area who will suffer greatly from the effects of increased noise and dust. Within our congregation we have young children and elderly people along with those who suffer asthma and allergies, any increase in dust would affect them greatly. Increased noise is also a concern for the general well-being of our members.

In a world struggling to find peace, our Wardens and Vestry feel the need to maintain the Spiritual integrity of this beautiful place as a peaceful Centre of Worship in our Community.

Wambo Homestead & Outbuildings

The Homestead being close to Warkworth has strong historical connections to St Philip's Church. Previous residents of the Homestead and workers attended St Philip's Church and some are buried in the surrounding cemeteries.

It is for these reasons that we strongly object to the demolition of the Homestead and it's surrounding outbuildings. Demolition was mentioned as an option by representatives of Wambo Coal Pty Limited at a public meeting held at Jerry's Plains recently because of the amount of coal under the homestead site.

Another option mentioned was the relocation of the Homestead and outbuildings. A proposal for this option has been submitted by Mr John Willis of "Glen Nevis" 399 Westbrook Road, Westbrook NSW (Phone 6577 5612) to at least two Singleton Councillors for consideration. Mr Willis has successfully relocated an historical building to his property and believes that relocation would be the best option to preserve these historic buildings.

We believe that as the Wambo Homestead and Outbuildings has a heritage listing that under the original development application for mining in that area, the mine owners had to maintain the homestead and buildings. Very little restoration and maintenance work has been done at the site and many interested people fear that parts of the buildings if left any longer will deteriorate beyond repair.

Surely on purchasing the Wambo mine property Excel Mining the more recent owners have to admit responsibility for these heritage listed buildings, especially buildings of such extreme significance both locally and nationally.
Our concern is that if this new development application goes ahead that the clause of the previous development application relevant to preservation and maintenance of the homestead will become redundant and any hope of preservation be lost.

There are other communities such as Bulga who have historical connections with Wambo Homestead and we believe that there would be wider local, state and national interest if such a site was to be demolished purely so that coal reserves under it could be mined.

The members of St Philip's Church would like to urge you to ensure that any development application approved which would affect in any way Wambo Homestead & Outbuildings include conditions which require the owners to maintain these buildings. We believe that there needs to be urgent discussion with Excel Mining, Wambo Coal, Singleton Council and the community for the preservation of these and other historic buildings, cemeteries etc affected by mining.

St Philip's Church is very close to our hearts, for it's history which has such close connections to many of our present members and for a place where we can grow in our faith in God and bring others to enjoy loving fellowship in such peaceful surroundings. We therefore, do not agree with the positioning of the proposed Wambo Rail Spur and Balloon Loop and trust that you will take our concerns into consideration.

Yours faithfully,

E. Long
....
Errol Long
Rector's Warden
On behalf of the Wardens, Vestry and Friends
of St Philip's Warkworth.

Alwyn & Helen Holt
"Henley Lawn"
Piribil Street
Jerrys Plains
NSW 2330
28 January 2003

D[illegible]vid Kitto
M[illegible]jor Development Assessment
P[illegible]ningNSW
([illegible]O Box 3927
S[illegible]dney
N[illegible]W 2001

D[illegible]ar Mr Kitto,
I[illegible] relation to Wambo Development Project, Alwyn, Rebecca and myself have the following concerns and o[illegible]servations that we would like addressed.

1 **Increased road haulage and dangers associated with heavy truck movements** – tail gating by truck drivers; impeding the flow of traffic going up Watts Hill from Warkworth; travelling in convoy especially in wet weather when the wash from their vehicles hit oncoming vehicles with tremendous force causing diminished vision especially at night; the health and alertness of truck drivers particularly at the end of their long shifts; the wear and tear on the road between the mines and Mount Thorley; coal falling off the haulage vehicles and landing on vehicles travelling near them, causing considerable damage at times and the rigmarole one has to go through when lodging a complaint with the haulage company!

2 **The Intersection of Wallaby Scrub Road and the Golden Highway.** The intersection is extremely narrow. To allow a smooth flow of traffic travelling east towards Mount Thorley behind traffic turning right into Wallaby Scrub Road, results in the through traffic passing the turning traffic on the shoulder of the roads intersection or queuing behind the turning traffic and subsequently holding up the flow of traffic.

3 **The proposed Rail Loading Facility** – will this eventuate? We still have not received any response to our opposition to the EIS and Statement of Environmental Effects, December 1999 - JPCT & Rail Line - nor has there been any publicity re proposed rail loading facility. Will this rail link be additional to the existing EIS that Wambo proposed in the late 1990's or a new development on a new area of the mine site?

4 **Dust.** Our residence is situated west/north-west of Wambo Mine and subsequently in the direction of the prevailing winds particularly in summer. We are concerned about the dust emanating from the mine and settling on our property and water supplies and polluting the air.

5 Is there a precedence with regards to visual effect? Given our residence is situated on one of the highest points in Jerrys Plains, we have a 360 degree view of the valley. Accordingly we will be able to see and hear the mines' workings at all hours of the day and night. What strategies, policies and procedures will be put in place to counteract the discomfort and interference to our quality of life?

6 **Noise** - How is this going to be monitored and where? The residences nearest to the proposed mining site are not necessarily going to be the worst affected residences given the geography of the area. With experience gained from living adjacent to Wambo and Warkworth Mines, we know how sound travels; the impact it has on quality of life especially at night -- particularly the constant drone of the dragline, the 'dakadak' noise of the track vehicles eg bulldozers and the sound of the reversing horns on vehicles; the effects blasting can have on buildings, assets, animals – whether it be noise, ground vibration, the impact of air movement hitting buildings and subsequent bang or 'whomp'! Will noise monitoring occur whilst the mine is fully operational or on a low or non-working day? This has happened before!

(2)

7. **Heritage protection.** Will steps be taken to preserve the heritage of Wambo Homestead and any associated buildings, gardens, monuments, etc? If so, what will they be?

8. Are strategies in place to protect the Warkworth Sands? Would there be ramifications from mining under the brook that may adversely affect the pristine environmental value of the Sands?

9. **Cultural impacts on the local area.** Jerrys Plains is a pretty village nestled between picturesque hills and mountains - from whichever direction one enters the village you have to travel over one of these hills. It is truly a beautiful sight! The village itself offers numerous services to the community and passing traffic – are these services going to be interfered with in any way because of mining infringing on the community? Will there be compensation for losses incurred? If so, how will this compensation be assessed and by whom?

10. Will we have access to information about Wambo Mine and its operations after it has received approval for its DA?

11. We would like more time to read the EIS when they eventually become available to the public. Would it be possible for more copies of the EIS to be available for reading as we feel there will be immense interest in the proposal from the residents of Jerrys Plains and local area?

We are concerned for the safety of ourselves, our children and family members whilst living and commuting in the community of Jerrys Plains and the Shire of Singleton. We strongly urge you to address the issues and arguments we have assembled in the hope of attaining a solution suitable and acceptable to all. We look forward to further correspondence.

Yours faithfully

...wyn Holt	Helen Holt	Rebecca Holt
[signature]	[signature]	pp per Rebecca Holt.

31/1/03

Planning NSW
Attention: David Kitto.
Fax 97628707

RE: Expansion Wambo Mining Co

Please find below a list of issues that we feel should be addressed with in the EIS put forward by Wambo Mining

1/ Visual impact
2/ Air Quality impacts
3/ Noise impacts
4/ Rail transport impacts including Visual
5/ Road transport impacts including intersections
6/ Social impacts
7/ Economic impacts
eg - loss of agricultural jobs & farms
- Reduction of cattle numbers with in the area
8/ future expansion plans eg 25 yrs
9/ The adoption of Real Time monitoring
10/ Light impacts
11/ future of Wambo Homestead
12/ Impact from Rail loop on Workworth Ch
13/ Viability of adjacent property Viticulture Horticulture
14/ Height of Batters

1/2

[illegible]
0411 700499

For & on behalf of the Residents of Jerrys Plains.

15/ Impact on Tourism

16/ The Cumulative impact the expansion will have on Jerrys Plains & near by residents

17/ The effects the expansion will have on futher Land development with in the area causing a down turn in growth of Jerrys Plains.

18/ Mine exit stratagy

19/ Decrease in Land Values

We also look forward to all of these issues being addressed with current & up to date base line information Particular to those imediatly impacted on adjacent to Jerrys Plains.

Regards

Paul [signature]

344 Redmanvale Rd
Jerrys Plains
65 764029
0411 700499

For & on behalf of the Residents of Jerrys Plains

FAX TO: 9762 8707
PAGE 1/1

John & Annie Schipper
PO Box 121 BROKE NSW 2330

101 Milbrodale Road Milbrodale NSW 2330
Phone: 02 6574 5114 Fax: 02 6574 5356
Email: schipper@coscom.net
30th January, 2003.

David Kitto
Senior Environmental Planner
Major Development Assessment
Planning NSW
Henry Dean Building
20 Lee Street
SYDNEY NSW 2000

Dear David

Re: Proposed Expansion of Wambo Mine, Hunter Valley NSW

On submitting our first objection we like many others in our community felt that it is a foregone conclusion that the expansion to Wambo Mine will go ahead, but on thinking further and talking to others it seems that we should register a further protest as follows:-

We would prefer that no expansion be allowed to the Wambo Mine, our beautiful area has enough mines and the new proposal would destroy the whole feeling of one of our favourite drives along the Golden Highway to Jerry's Plains which we make often. There is at least one section where the mine would be very close to the road and due to the enormity of the operation we are sure it would be visible right along that area. What we can see from the road, the natural bush on one side and the Hunter river plains on the other is just stunning and then there is the little cemeteries and the historic homesteads.

But then the places we have enjoyed even more are up behind where the proposal is, from Stony Creek through to Pinegrove we have had picnics, hiked, camped and driven through these amazing areas. There are the most beautiful rock formations, views and even rain forests up in those hills and we just love going up there. The quietness and beauty would be destroyed by the noise and dust, it would never be the same.

Thank you for the opportunity to express our objections.

Kindest Regards

per Annie Schipper
John & Annie Schipper

John & Annie Schipper
PO Box 121 BROKE NSW 2330

101 Milbrodale Road Milbrodale NSW 2330
Phone: 02 6574 5114 Fax: 02 6574 5356
Email: schipper@coscom.net
20th January, 2003.

David Kitto
Senior Environmental Planner, Major Development Assessment
Planning NSW
Henry Dean Building 20 Lee Street SYDNEY NSW 2000

23 JAN 2003

Dear David

Re: Proposed Expansion of Wambo Mine, Hunter Valley NSW

We are writing as concerned members of St Philip's Anglican Church, Warkworth as we are strongly opposed to the position of the proposed Wambo Rail Spur and Balloon Loop.

Our concerns are based on the close proximity and the direction the rail spur and balloon loop, considering the position of St Philip's Church and Cemeteries.

Our concerns are detailed in the letter from the Wardens, Vestry and Friends of St Philip's which highlight the following reasons:-

Concerns for the Church Building & Headstones: Their Historical Significance, The Visual Impact, Vibration and Dust.
For many years we have had a personal interest in Australian History, Buildings, Cemeteries, Farming Equipment, Furniture etc. and are avid collectors of items used in early Australia. We realize the cost of maintaining our Australian heritage, but if we do not, what will we have to pass on to our children and grandchildren?

Concerns for Quality of Worship: Having moved to the Hunter Valley from Sydney we cherish worshipping God in this beautiful little historic Church, we love the rural atmosphere and we enjoy such loving fellowship and a close feeling of family from the rest of the congregation. We see each other often during the week, the friendships developed will be lifetime ones. We are really concerned that the NOISE from the Rail proposal will severely effect our quality of Worship and personally my teaching of the Children out in the grounds during Sunday Services.

Health Concerns: Both of us suffer from asthma and allergies which are effected by dust, we are concerned not only for our own health, but for the health of the elderly and children, especially those with asthma. Not being able to come to a quiet place to Meditate and Worship will also have a detrimental effect on our health.

Wambo Homestead & Outbuildings:
We also share the concerns expressed in the submission regarding Wambo Homestead and would urge you to consider this very seriously in any decisions made so that demolition is not allowed to be an option for this historical site.

In summary we join with the members of St Philip's Church in opposing the positioning of the Rail and any development which would cause damage or demolition to historical buildings and cemeteries. Yours faithfully

John & Annie Schipper

Annie Schipper

Your Name...H DALLIMORE...........
Your Address:..241 WALLABY SCRUB RD..........
...WARKWORTH.................Date:...20-1-2005.

....
Your Phone, Fax, email details: (optional)

David Kitto
Senior Environmental Planner
Major Development Assessment
Planning NSW
Henry Dean Building
20 Lee Street
SYDNEY NSW 2000

Email: david.kitto@planning.nsw.gov.au
Phone: 02 9762 8162 Fax: 02 9762 8707

Dear David

Re: Proposed Expansion of Wambo Mine

I/we write to you as (1) a member or as members of St Philip's Church, Warkworth
(2) an interested or interested member/s of the Community

I/we are strongly opposed to the proposed Wambo Rail Spur and Balloon Loop which is part of the above proposal. I/we are concerned about the close proximity,(some 290 metres on the south western side and 350 metres on the south eastern side) to St Philips Church, Warkworth for the following reasons:-

1. HISTORICAL SIGNIFICANCE OF ST PHILIP'S CHURCH AND CEMETERIES. Records show that building commenced on St Philip's Church in 1845 and there are gravesites in the cemeteries dating back to the 1830's.
2. VISUAL IMPACT Any proposed rail activity would have a severe visual impact on the rural setting in which the Church and Cemetery was placed more than 150 years ago. This quiet rural setting is something both regular worshippers and visitors to our Church comment on and really enjoy.
3. VIBRATION: There is major concern due to the age of the Church Building and Cemetery headstones. Due to the close proximity of the proposal our concern is that the stress generated due to constant vibrations will, over an extended period of time, cause the structure of the Church & headstones to wear and crumble. The members of the Vestry of St Philip's Church are committed to maintaining both the building and headstones. The already difficult task of restoration has commenced and is continuing.
4. DUST: An increase in dust would occur if this proposal goes ahead. Again the damage which would be caused to the building and headstones is of major concern to those already trying to preserve such a significant part of our local history. There is also concern for the health of the residents of Warkworth, many of whom are members of St Philip's Church and for the health of those attending services including young children.

5. NOISE: The noise from the proposed rail spur and balloon loop would severely effect the quality of our Worship Services. St Philip's Church holds services during the week for prayer, meditation, singing group practice, other special services as well as services on Sundays. The Sunday services are usually held in the morning, but throughout the year there are services held on Sunday afternoon and evening. Kid's Church is held during the Sunday morning services out in the Church grounds. If this proposal goes ahead, the noise would make it impossible for those within the building to worship peacefully and for those teaching the children outside.

For over 150 years the congregations of St Philip's Church have enjoyed coming away from their busy lifestyles to a quiet rural setting to worship God. There are some in the congregation who have descendants going back four and five generations, some of these descendants are buried in the surrounding cemeteries. There has been an increase in enquires from descendants wanting to trace family ancestors and wanting to see the Church and Gravesites preserved. The Church and Cemeteries are Heritage listed and so the interest in their preservation extends to members of the local community and beyond.

Our Wardens and Vestry feel the need to maintain the Spiritual Integrity of this beautiful place as a Centre of Worship in our Community.

It is for all of the above reasons that I/we do not agree with the positioning of the Wambo Rail Spur and Balloon Loop and trust that you will take our concerns into consideration.

Yours faithfully,

Signed.. C.A Dallimore

Name: Howard Dallimore Christine Dallimore

Your Name..Janene Henderson........
Your Address:...P.O. Box 274..............
..Singleton 2330......Date: 24.1.03...
...6265 744 555...............................
Your Phone, Fax, email details: (optional)

David Kitto
Senior Environmental Planner
Major Development Assessment
Planning NSW
Henry Dean Building
20 Lee Street
SYDNEY NSW 2000

30 JAN 2003

Email: david.kitto@planning.nsw.gov.au
Phone: 02 9762 8162 Fax: 02 9762 8707

Dear David

Re: Proposed Expansion of Wambo Mine

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Yours faithfully,

Signed.........J Henderson..............

Name:.........Janene Henderson....

Your Name... ERROL LONG ...
Your Address:... 5 CNG ST ...
... SINGLETON ... Date: 23.1.03 ...
...
Your Phone, Fax, email details: (optional)

David Kitto
Senior Environmental Planner
Major Development Assessment
Planning NSW
Henry Dean Building
20 Lee Street
SYDNEY NSW 2000

30 JAN 2003

Email: david.kitto@planning.nsw.gov.au
Phone: 02 9762 8162 Fax: 02 9762 8707

Dear David

Re: Proposed Expansion of Wambo Mine

I/we write to you as (1) a member or as members of St Philip's Church, Warkworth
(2) an interested or interested member/s of the Community

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Signed...

Name: Errol Long

Your Name....D J STUART....
Your Address:..90 GOULDSVILLE RD..
....SINGLETON.......Date:21-1-03.
....65746133....
Your Phone, Fax, email details: (optional)

David Kitto
Senior Environmental Planner
Major Development Assessment
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Yours faithfully,

Signed... D. J. Stuart ....

Name: DUDLEY ... JAMES ... STUART

Your Name: Bruce Merrick
Your Address: 8 Gas Street
Singleton Date: 22-1-03
NSW 2330 Ph 657220
Your Phone, Fax, email details: (optional)

David Kitto
Senior Environmental Planner
Major Development Assessment
Planning NSW
Henry Dean Building
20 Lee Street
SYDNEY NSW 2000

1 FEB 2003

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Yours faithfully,

Signed: B Merrick

Name: Bruce Merrick

Your Name...KEN & LORRAINE HAYNES...
Your Address:...50 HIGH RD WARKWORTH
..............NSW 2330.......Date: 24-1-03
....0265744510...................................
Your Phone, Fax, email details: (optional)

David Kitto
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Yours faithfully,

Signed: Haynes L. Haynes

Name: KEN & LORRAINE HAYNES

As we reside in the same street as the church we have the same concerns for our own residence regarding noise, dust & vibration. We already experience an excess of all these things due to the heavy mining presence in the area.