WILPINJONG COAL MINE




Mining Rate Modification

ENVIRONMENTAL ASSESSMENT

Peabody

Wilpinjong Coal Pty Limited

Peabody

WILPINJONG COAL MINE

17 May 2010

Department of Planning
GPO Box 39
SYDNEY NSW 2001

Attention: David Kitto

Dear David

RE: WILPINJONG COAL MINE – MINING RATE MODIFICATION ENVIRONMENTAL ASSESSMENT

The enclosed Environmental Assessment for the Wilpinjong Coal Mine Mining Rate Modification (the Modification) has been prepared on our behalf by Resource Strategies Pty Ltd.

Wilpinjong Coal Pty Ltd (WCPL) believes the Environmental Assessment represents an accurate statement of WCPL's development intentions and commitments in regard to environmental management and monitoring for the Modification.

Yours faithfully
WILPINJONG COAL PTY LTD

KEITH DOWNHAM
General Manager
Wilpinjong Coal Mine

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ES1 EXECUTIVE SUMMARY

ES1.1 BACKGROUND

The Wilpinjong Coal Mine is an existing open-cut coal mining operation situated approximately 40 kilometres north-east of Mudgee, within the Mid-Western Regional Council Local Government Area in central New South Wales (Figure ES-1).

The Wilpinjong Coal Mine has been operating since 2006, and is approved to produce up to 13 million tonnes per annum of run-of-mine coal. Thermal coal products from the Wilpinjong Coal Mine are transported by rail to domestic customers for use in electricity generation and to port for export. An aerial photograph of the Wilpinjong Coal Mine, illustrating the approved extent of the open pits and contained infrastructure area is provided on Figure ES-2.

The Wilpinjong Coal Mine is owned and operated by Wilpinjong Coal Pty Limited, a wholly owned subsidiary of Peabody Energy Australia Pty Limited. This Environmental Assessment has been prepared by Wilpinjong Coal Pty Limited to support an application to modify the Wilpinjong Coal Mine Project Approval (the Mining Rate Modification).

ES1.2 DESCRIPTION OF THE MODIFICATION

The Mining Rate Modification would increase the run-of-mine coal production rate from the approved 13 million tonnes per annum to approximately 15 million tonnes per annum.

To facilitate the increased rate of run-of-mine coal production and improve efficiency, the existing coal handling and preparation plant would be extended and general coal handling and stockpiling systems at the Wilpinjong Coal Mine would be upgraded (Figure ES-3). It is anticipated that construction of these upgrades would take approximately 9 months.

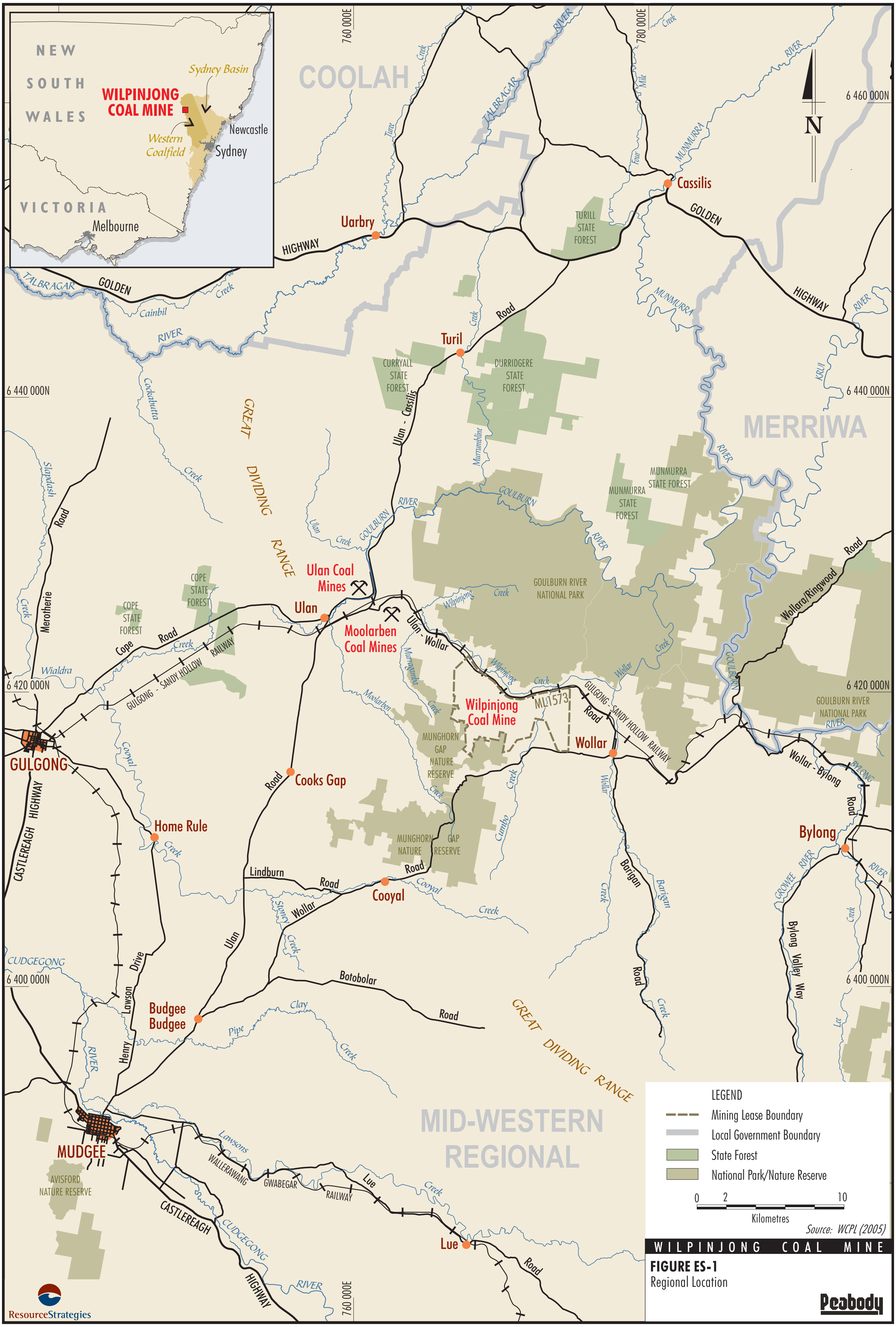
An increase in the operational mobile fleet (e.g. number of haul trucks) and a marginal increase in the maximum annual waste rock production rate would also be required.

The Mining Rate Modification would not alter the approved extent of mining at the Wilpinjong Coal Mine, the duration of the approved mine life, the approved open cut blasting frequency or the maximum number of trains per day that are required to transport product coal off-site.

ES1.3 ENVIRONMENTAL REVIEW

As the approved life of the Wilpinjong Coal Mine and the spatial extent and depth of mining would be unchanged by the Modification, there would be no material alteration to the approved impacts of the mine on the following environmental aspects:

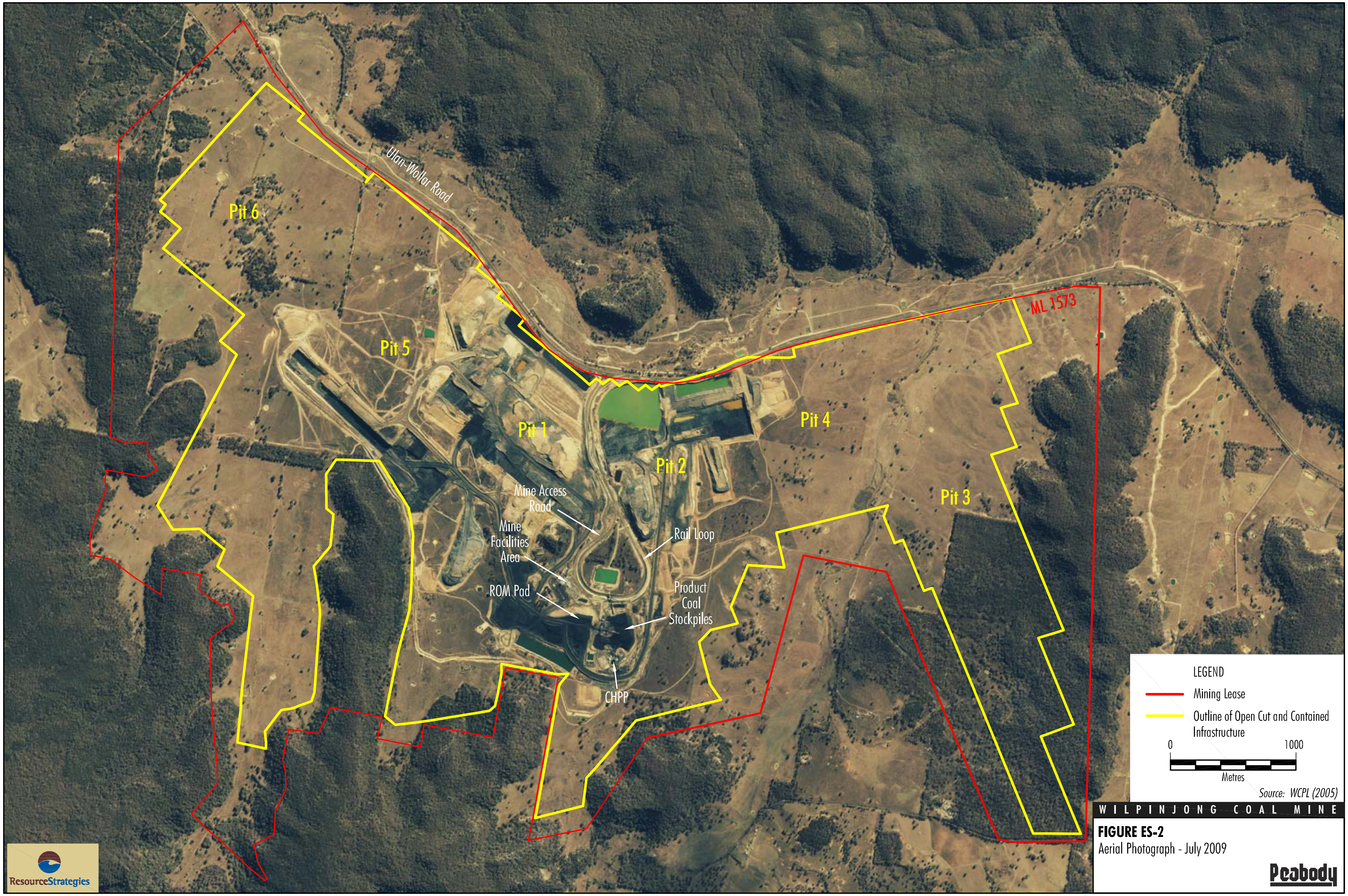
- land resources, rehabilitation and final landforms;
- waste rock management and geochemistry;
- flora and fauna;
- non-Aboriginal heritage;
- Aboriginal heritage;
- groundwater resources; and
- surface water resources (i.e. disturbance to natural catchment areas).



WILPINJONG COAL MINE

FIGURE ES-1
Regional Location

WIL-09-07 ES_001A



WILPINJONG COAL MINE

FIGURE ES-2
Aerial Photograph - July 2009

Peabody

WIL-09-07 ES_102A

Source: WCPL (2010)

WILPINJONG COAL MINE

FIGURE ES-3

Conceptual Arrangement of the CHPP and Materials Handling Upgrades

WIL-09-07 ES_003B

Potential environmental impacts of the Modification are therefore largely restricted to the following key potential issues:

- off-site noise emissions;
- off-site air quality emissions;
- road transport impacts (peak traffic during the 2011 construction period); and
- socio-economic effects.

In order to assess the potential environmental impacts of the proposed Mining Rate Modification, environmental reviews were completed for the above key issues. For the Wilpinjong Coal Mine incorporating the Mining Rate Modification, the environmental reviews have concluded that:

- With the adoption of noise controls (e.g. noise attenuated haul trucks) the Noise Impact Assessment indicates that potential exceedances of project specific noise criteria would occur at some 15 privately owned dwellings. The majority of these nearby private dwellings are already listed in the Project Approval for noise exceedances associated with the approved Wilpinjong Coal Mine. For comparison, the Wilpinjong Coal Mine Project EIS indicated that some 18 private dwellings would experience potential exceedances of the Project specific noise criteria.
- No exceedances of the applicable annual dust deposition and suspended particulate air quality assessment criteria are predicted at the nearest private dwellings. Three nearby private dwellings are predicted to experience potential exceedances of the applicable short term (24 hour) criteria for particulate matter less than 10 micrometres in diameter.
- No significant impacts on the performance and safety of the road network are expected as a result of the Mining Rate Modification.
- Economic analysis of the Mining Rate Modification indicates that it would have a net benefit to society of approximately $47 million.
- WCPL would continue to implement existing environmental management and monitoring measures to minimise the potential impacts of the Wilpinjong Coal Mine on existing environmental values and the nearest private dwellings.

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1 INTRODUCTION

This document is an Environmental Assessment (EA) for a modification to the Wilpinjong Coal Mine which operates in accordance with Project Approval 05-0021, granted by the Minister for Planning in February 2006. The Mine is owned and operated by Wilpinjong Coal Pty Limited (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Limited.

A copy of Project Approval 05-0021 is provided as Attachment 1.

1.1 OVERVIEW - WILPINJONG COAL MINE

The Wilpinjong Coal Mine is an existing open-cut coal mining operation situated approximately 40 kilometres (km) north-east of Mudgee, near the village of Wollar, within the Mid-Western Regional Council (MWRC) Local Government Area (LGA), in central New South Wales (NSW) (Figures 1 and 2).

Construction of the Wilpinjong Coal Mine commenced in February 2006, and the mine is approved to produce up to 13 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Thermal coal products from the Wilpinjong Coal Mine are transported by rail to domestic customers for use in electricity generation and to port for export. In 2009, the Wilpinjong Coal Mine produced approximately 8.4 million tonnes (Mt) of ROM coal.

An aerial photograph of the Wilpinjong Coal Mine, illustrating the approved extent of the open pits and contained infrastructure area is provided on Figure 3.

Since the approval of the Wilpinjong Coal Mine, WCPL has acquired a number of former private properties that are located adjacent to the mine. Current company landholdings in the vicinity of the mine are shown on Figures 4A and 4B. Moolarben Coal Mines and Ulan Coal Mines have also acquired all privately-owned land previously located to the west between Wilpinjong and the Ulan Coal Mines.

1.2 OVERVIEW - MINING RATE MODIFICATION

Following a review of current mine planning and domestic and export coal demand, WCPL has determined that the maximum ROM coal production rate of the Wilpinjong Coal Mine could be extended from the currently approved 13 Mtpa to approximately 15 Mtpa (i.e. an increase of approximately 15 percent [%]). This proposed change in production is referred to as the mining rate modification (the Modification).

Additional mobile plant is required on-site to achieve the currently approved 13 Mtpa and to achieve the proposed incremental increase in the production rate to 15 Mtpa ROM.

To facilitate increased coal production and improve the efficiency of ROM coal handling and preparation on-site and the separation of washed and unwashed coal products, the existing coal handling and preparation plant (CHPP) would be extended and general coal handling and stockpiling systems would be upgraded. These upgrades are partly required in support of the existing approved production rate and partly to achieve the incremental increase in production associated with the proposed Modification.

Table 1 provides a comparative summary of the currently approved and proposed modified Wilpinjong Coal Mine.

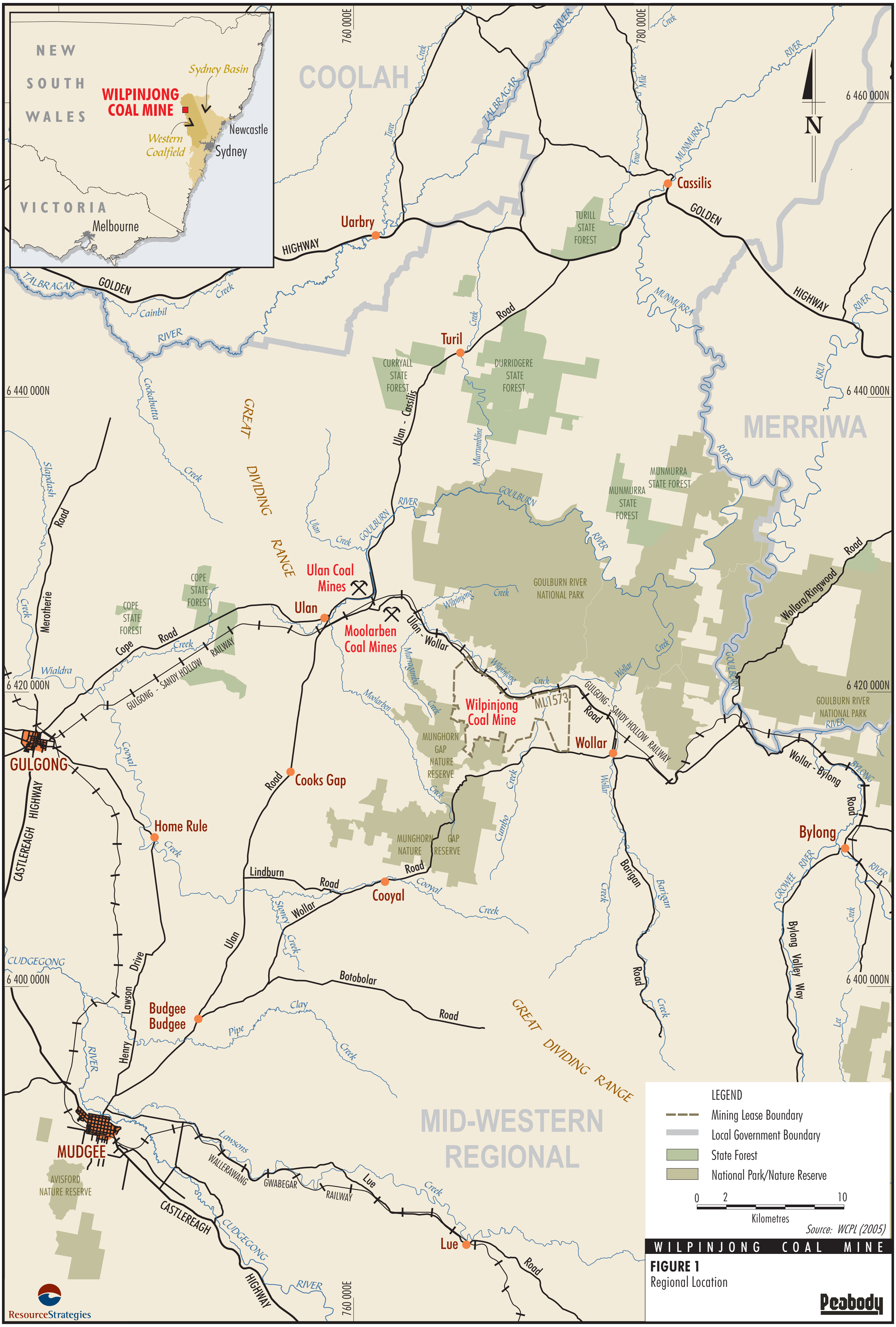


FIGURE 1
Regional Location

WIL-09-07_001A

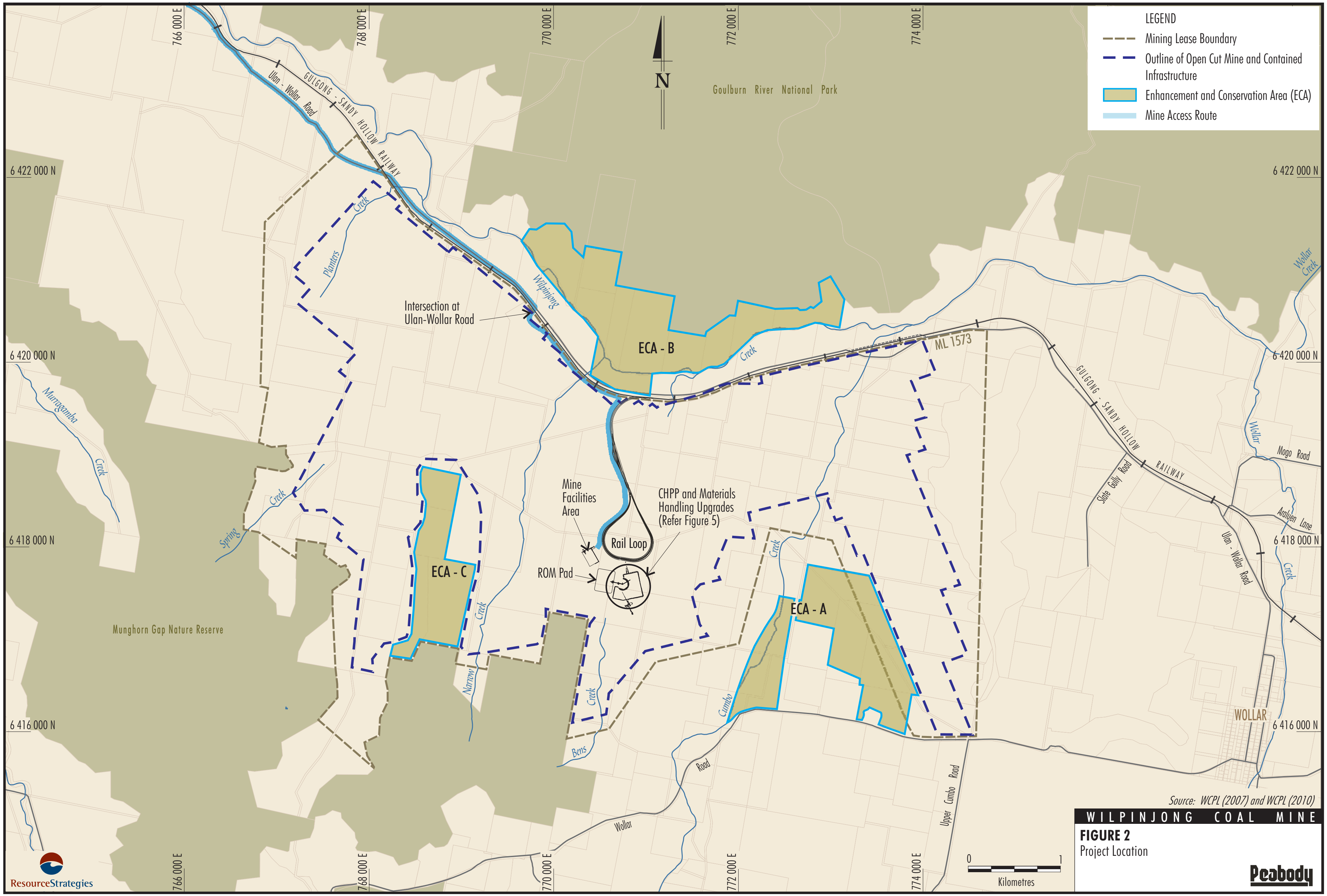
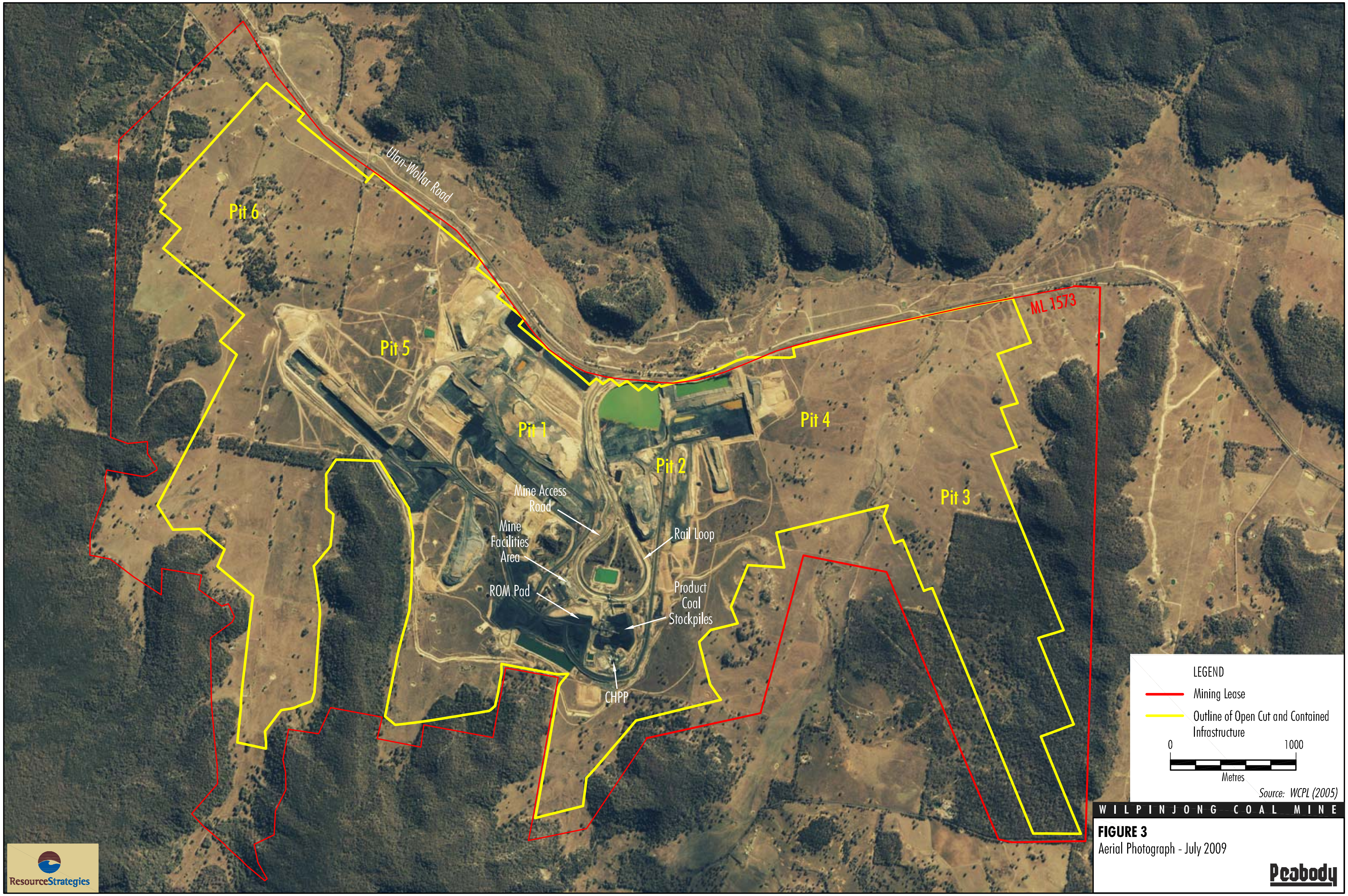


FIGURE 2
Project Location

WIL-09-07_002B

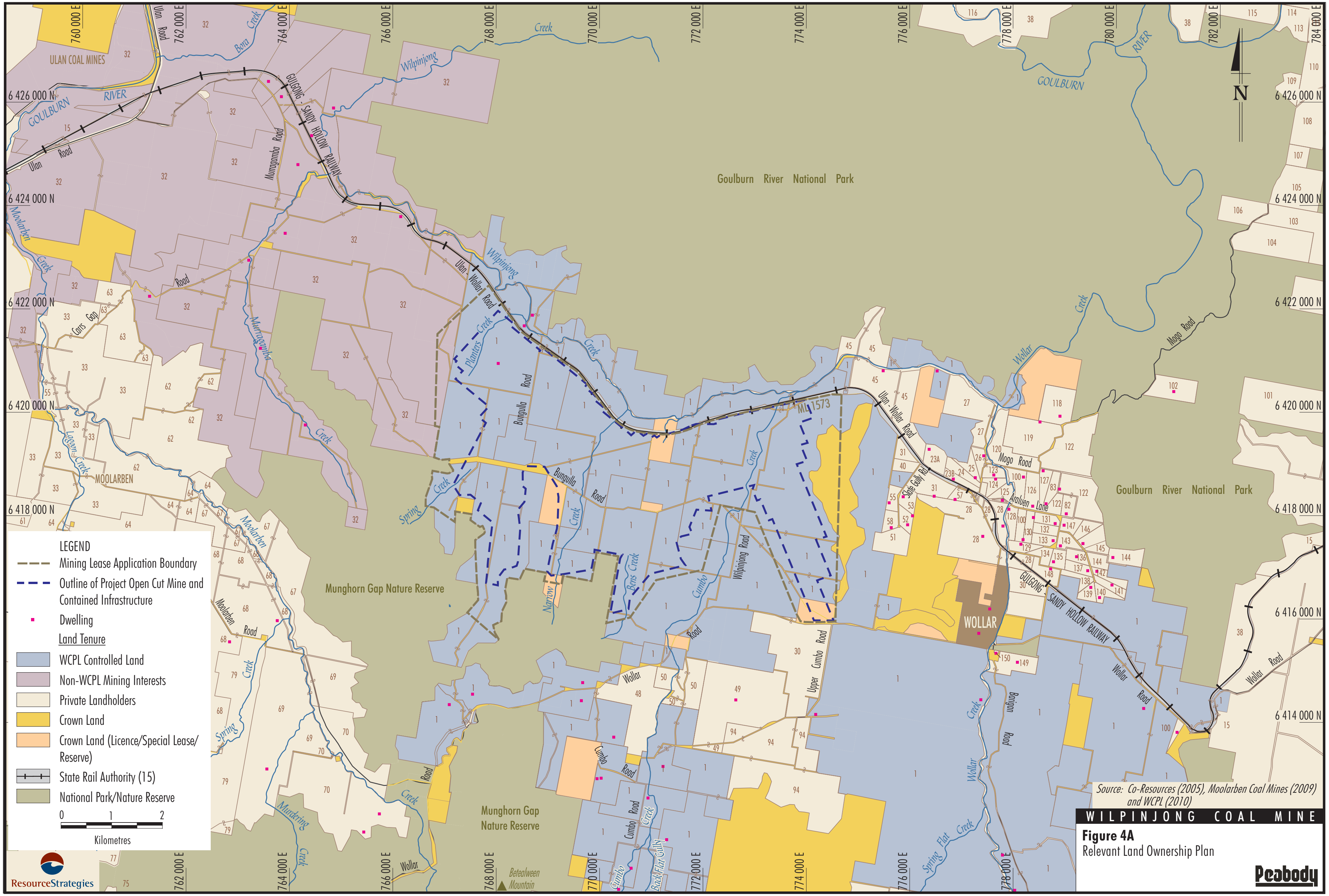


WILPINJONG COAL MINE

FIGURE 3
Aerial Photograph - July 2009

Peabody

WIL-09-07_103C



WIL-09-07_006C

1	Wilpinjong Coal Controlled Land	105	ELM Toombs
15	State Rail Authority	106	JA Sales
23A	ID Bloomfield	107	RJ Lee
23B	B Bishop	108	R Campbell
24	JA & TS Peach	109	MO Vaisey
25	SE & JE Pettit	110	GS & JR Smiles
26	K & VC Christiansen	113	AJ Brett & S & D Hilt
27	BC McDermott	114	BJ Hughes & CA Beinssen & K Aslett
28	BP & FV & MJ & JM Power	115	E & T Schoenfelder
30	WF Gaffney	116	PD & JE Griffiths
31	DE & AM Conradt	118	DS & D Ponton
32	Ulan Coal Mines/Moolarben Coal Mine Owned/Controlled Land	119	TJ & JA Peach
33	MJ & PM Swords	120	JT & JW & D Fitzpatrick
38	State Of N.S.W.	122	PN Hardiman
40	G & J Maher	123	A & M Zivkovic
45	JAW Smith	124	A Zivkovic
48	JR & BM Evans	125	E & K Roberts
49	RSM & LD Harkin	126	A & P Davies
50	LD Thompson & RJ Hopper	127	A & D Wentzel
51	P Bailey	128	WG Pongratz
52	CR Long	129	R & K Roser
53	RW & JL Reynolds	130	L Batty & D Hirons
55	SC & M Fox	131	MR Field
57	F Nagy	132	SL Cook
58	FN Maher	133	P & J Harty
61	J Szymkarczuk	134	CL Ammann
62	MJ Swords	135	R & K Roser
63	MJ & H Swords	136	M & R Bryson
64	DJ & Y Rayner	137	A & C Chetcuti
67	K & RE Mayberry	138	B Covel
68	EC Mayberry	139	P & M Woolford
69	DJ & JG Stokes	140	W Stafford & M McCullough
70	JW & JG O'Sullivan	141	C Hull
79	C Mayberry	142	D & S Williams
80	RB Cox	143	R Bale & K Lawes
82	RJ Jackson	144	J Hibberd
83	G & DJ Hayes	145	C Bremner & M O'Neill
94	GM & KL McKenzie	146	D & B Spearpoint
100	TJ & VE Rheinberger	147	D Currington
101	NAB Pierce	148	O Lee
102	W Filipczyk	149	JD Zagarella
103	MR Molloy	150	E Tindale & A McDonald & W Wilson
104	WB & PA Deane	151	T & V Rheinberger

Source: Co-Resources (2005), Moolarben Coal Mines (2009) and WCPL (2010)

WILPINJONG COAL MINE

FIGURE 4B
Relevant Land Ownership List
(Refer Figure 4A for
Land Ownership Plan)

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ResourceStrategies

WIL-09-07_007D

Table 1
Comparative Summary of the Approved and Modified Projects

Component	Approved Wilpinjong Coal Mine	Modified Wilpinjong Coal Mine
Mining Method	• Open cut mining operation extracting ROM coal from the Ulan Seam. • Six open cut pits and associated contained infrastructure area.	• Unchanged.
ROM Coal Production Rate	• Up to 13 Mtpa of ROM coal.	• Up to 15 Mtpa of ROM coal.
Total ROM Coal Mined	• 250.6 Mt.	• 223.7 Mt.
Waste Rock Management	• Waste rock deposited predominantly within mined-out voids.	• Unchanged.
Waste Rock Production	• Maximum annual waste rock production 26.5 Mbcm.	• Maximum annual waste rock production 28 Mbcm.
Total Waste Rock	• 329.9 Mbcm.	• 366.6 Mbcm.*
Coal Washing	• Construction and operation of a CHPP capable of washing up to approximately 8.5 Mtpa of ROM coal.	• Unchanged. • Upgrades to material handling.
Product Coal	• Production of up to 10 Mtpa of product coal.	• Production of up to 12 Mtpa of product coal.
Coal Rejects (tailings and coarse rejects)	• Coal rejects placed predominantly within mined-out voids.	• Unchanged.
Water Supply	• Make-up water demand to be met from runoff recovered from mine operational areas, recovery from tailings disposal areas, open cut dewatering, advanced dewatering of pit areas and supply from a borefield.	• Unchanged.
Project Life	• 21 years (from the date of grant of a mining lease).	• Unchanged.
Product Coal Transport	• Product coal loaded onto trains and transported via the Gulgong-Sandy Hollow railway.	• Unchanged.

After: WCPL (2005).
Mbcm = million bank cubic metres.
* Includes rehandling of temporary waste rock emplacements.

1.3 CONSULTATION FOR THE MODIFICATION

State Government Agencies

WCPL initiated consultation regarding the Modification with the NSW Department of Planning (DoP) in October 2009 when an overview of the proposed changes was provided to the DoP and key assessment requirements and the proposed timing for EA lodgement were discussed.

During the preparation of this EA, DoP was provided with updates on key draft assessment findings and WCPL's proposed timing for lodgement of the EA. In April 2010 WCPL met with representatives of the DoP and NSW Department of Environment, Climate Change and Water (DECCW) Noise Branch at a joint meeting to provide an overview of Modification, the Noise Impact Assessment methodology and draft assessment findings.

DECCW Noise Branch and Regional representatives also attended the Wilpinjong Coal Mine site in April 2010 to discuss potential variations to the Environment Protection Licence (EPL) and the proposed Modification. At this site visit WCPL also provided DECCW representatives with an overview of the site noise monitoring and management system (Section 4.2).

Local Government

The Wilpinjong Coal Mine is wholly located within the MWRC LGA. WCPL provided a briefing on the Modification to the MWRC executive and key planning staff in January 2010. MWRC provided feedback on key assessment issues (e.g. transport) and provided an update on the status of local transport planning and road upgrade works.

Local Community

A Wilpinjong Coal Mine Community Consultative Committee (CCC) is in place and provides a mechanism for ongoing communication between WCPL and the local community. In March 2010 WCPL provided an overview of the proposed Modification to the CCC.

At this meeting members of the CCC requested that a public meeting be held in Wollar to inform the wider community regarding the proposed Modification, and in particular to provide an overview of the operational noise implications of the proposal. WCPL will hold a public meeting in Wollar regarding the Modification in the second or third Quarter of 2010.

It is anticipated that consultation between WCPL, regulatory agencies and the local community will continue during the public exhibition of this EA and the assessment of the proposal by the NSW Government.

1.4 STRUCTURE OF THIS DOCUMENT

Section 1	Provides an overview of the Wilpinjong Coal Mine, the Modification and the consultation undertaken in relation to the Modification.
Section 2	Provides a description of the existing Wilpinjong Coal Mine.
Section 3	Provides a description of the Modification.
Section 4	Provides an environmental assessment of the Modification and describes how the existing WCPL environmental management systems and measures are available to manage and monitor any potential impacts.
Section 5	Describes the general statutory context of the proposed Modification and identifies any Project Approval conditions or site management documents that would require revision in support of the Modification.
Section 6	References.

Attachment 1 and Appendices A to E provide supporting information as follows:

Attachment 1	Wilpinjong Coal Mine Consolidated Project Approval.
Appendix A	Noise Impact Assessment.
Appendix B	Air Quality Impact Assessment.
Appendix C	Road Transport Assessment.
Appendix D	Water Balance Review.
Appendix E	Socio-Economic Assessment.

2 EXISTING WILPINJONG COAL MINE

2.1 APPROVALS HISTORY

The *Wilpinjong Coal Project Environmental Impact Statement* (the Project EIS) (WCPL, 2005) was originally prepared by WCPL in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act), however, it was accepted by the Director-General of the DoP under Clause 8J(2) of the NSW *Environmental Planning and Assessment Regulation, 2000* (EP&A Regulation) as an EA for the purpose of Part 3A of the EP&A Act.

The Wilpinjong Coal Mine was approved under Part 3A of the EP&A Act by the NSW Minister for Planning in February 2006 (Project Approval 05-0021 – Attachment 1).

In April 2007, WCPL submitted an application to modify Project Approval 05-0021 under Section 75W of the EP&A Act to address the following minor modifications to the approved Wilpinjong Coal Mine:

- *Increasing the permitted frequency of blasting to a maximum of two blasts per day (and five blasts per week on average over any 12 month period).*
- *Changing the primary mine access route to be along Ulan Road and Ulan-Wollar Road, rather than Ulan Road and Wollar Road…*

The modification was approved by the NSW Minister for Planning in November 2007. The consolidated Project Approval, incorporating these modifications, is provided in Attachment 1.

Upgrade of Ulan-Wollar Road in accordance with WCPL's Statement of Commitments and the modified Project Approval have been undertaken progressively over 2008 and 2009 by MWRC (Section 4.4).

2.2 CONSTRUCTION

The majority of the existing Wilpinjong Coal Mine facilities were constructed in 2006/2007, including:

- office administration complex;
- workshop and plant wash down facility;
- fuel facility;
- sewerage treatment plant;
- site access and on-site roads;
- product coal stockpile pad;
- CHPP;
- ROM pad;
- water storages;
- tailings emplacements;
- site water management measures;
- rail spur, rail loop and rail loading infrastructure; and
- relocation of existing electricity transmission lines.

A workforce of up to approximately 250 people was employed on-site during the main construction period.

2.3 OPEN CUT MINING

Mining at the Wilpinjong Coal Mine commenced in September 2006. The following description of the existing mining operation is largely sourced from the *Wilpinjong Coal Mine Mining Operations Plan* (MOP) (WCPL, 2008) and the *Wilpinjong Coal Mine Annual Environmental Management Report* (AEMR) (WCPL, 2010a).

The mining operation uses bulk push dozers and hydraulic excavators to mine coal and waste rock in a strip mining configuration. Steady state mining consists of a combination of truck and excavator mining and dozer bulk pushing of blasted overburden into the previous strip void, followed by the removal of coal and interburden. Mining strips are typically 70 metres (m) wide and are oriented east-west.

Coal and interburden is mined in a similar manner to the overburden material and dozers are used to rip and push the coal/interburden, followed by truck loading using excavators. Some interburden blasting is also required, depending on the thickness and hardness of the material. Overburden and interburden that is not bulk pushed with dozers is hauled into the previous strip void using off-road Cat 785 haul trucks.

ROM coal is transported by Cat 785 haul trucks along internal haul roads to the ROM pad where it is directly dumped into the ROM hopper or is temporarily stockpiled and then rehandled to the hopper.

2.4 COAL HANDLING AND PREPARATION

The Wilpinjong Coal Mine produces both washed and unwashed coal products. The coal handling and processing infrastructure has been designed to accommodate the processing of raw coal and the handling of raw and washed product coal.

Stockpiles located near the infrastructure area are used to stockpile ROM coal. ROM coal is crushed to produce either raw product coal or raw feed to the CHPP. Three product stockpiles with a combined capacity of approximately 390,000 tonnes (t) are used to stockpile washed and unwashed coal products prior to reclaim and loading to trains for transport off-site.

The CHPP operates up to 24 hours per day, seven days per week and the Project Approval (Attachment 1) allows for the beneficiation of up to 8.5 Mt of ROM coal in the CHPP per year.

2.5 PRODUCT COAL TRANSPORT

A train loading facility capable of loading coal at a rate of 4,000 tonnes per hour (tph) is located at the head of the rail loop within the mine infrastructure area. Coal is reclaimed from a product feed conveyor that runs the length of the product coal stockpile. Product coal is loaded onto trains 24 hours per day, seven days per week.

An average of four trains are loaded each day, with a maximum of six trains per day being loaded during peak coal transport periods.

2.6 WASTE ROCK MANAGEMENT

With the exception of initial box-cut development, overburden and interburden or partings material is progressively placed back in-pit once the coal has been mined.

A combination of temporary and permanent out-of-pit waste rock emplacements are located adjacent to the open cut mining operations. Mine waste rock emplacements behind the advancing open cut are constructed to approximate the pre-mining topography. Some of the overburden is also used to construct internal walls for the tailings emplacements, as described in Section 2.7.

Overburden material has also been placed along selected boundary areas of each open pit to act as a safety bund (i.e. to prevent accidental access). The bunds assist in reducing direct views of the open cut workings to the public, as well as assisting in flood mitigation.

2.7 COAL REJECT MANAGEMENT

The tailings produced from the CHPP consist of fine rejects and slimes from the thickener. CHPP tailings are pumped as a slurry and deposited in purpose-built tailings dams constructed within mined out voids. Internal walls of tailings emplacements are constructed of a combination of *in situ* and dumped overburden material.

Once tailings disposal areas are near-filled, they are progressively capped with overburden material to a minimum depth of cover of 2 m prior to final profiling and rehabilitation.

CHPP coarse coal reject material is hauled back to the mining operation and deposited below the natural surface in the mined-out voids. Coarse reject material is dispersed throughout the overburden within the mine waste rock emplacements to manage its geochemical characteristics (i.e. acid generation potential). Where practicable, coarse rejects are placed 5 m below the final landform surface so there is sufficient coverage by non-acid forming overburden to reduce oxygen movement through the rehabilitated profile.

2.8 WATER SUPPLY

Water is required to operate the CHPP, for washdown of mobile equipment, dust suppression on haul roads and for dust emission control sprays in the ROM and product coal stockpile areas. The supply of this water is prioritised as follows:

1. Recycling of water from the tailings thickener overflow. Capture of incident rainfall and runoff across the mining operational areas (i.e. CHPP, mine facilities area, ROM and product coal stockpile areas).
2. Recovery of supernatant waters and seepage collected from tailings disposal areas. Dewatering of active open cut mining areas including groundwater inflows, incident rainfall and infiltration/runoff from adjacent mine waste rock emplacements.
3. Dewatering of inactive open cut mining areas including groundwater inflows, incident rainfall and infiltration/runoff from adjacent mine waste rock emplacements.
4. Licensed groundwater extractions from the approved water supply borefield to the north of open cut mining operations (borefield extractions have not been required over the last two years).

Process water used to wash coal is recycled from the current tailings emplacement/water storage via the recycled water dam with any necessary make-up water obtained from the raw water dam located within the rail loop.

The majority of the Wilpinjong Coal Mine make-up water supply requirements are met by dewatering of the open cut mining areas.

2.9 GENERAL INFRASTRUCTURE

2.9.1 Site Access

The primary route from Mudgee to the site is via Ulan Road and Ulan-Wollar Road (Figure 1). Access to the site from Ulan-Wollar Road is via an internal sealed mine access road connecting the mine facilities area to the Ulan-Wollar Road at an intersection located approximately 1.5 km north-west of the rail spur (Figure 2).

Recent upgrades to the local roads in support of the Wilpinjong Coal Mine include:

- an upgrade of the intersection connecting Ulan-Wollar Road and the internal mine access road;
- sealing, line-marking and signage on Ulan-Wollar Road between the Wilpinjong Coal Mine access and Ulan Road (completed by MWRC with funding provided by WCPL); and
- an upgrade of the intersection between Ulan Road and Ulan-Wollar Road (completed by Moolarben Coal Mines).

WCPL has also contributed funding towards works conducted by MWRC such as:

- ongoing upgrades of Ulan Road and Ulan-Wollar Road; and
- the ongoing development of school bus lay-by areas along Ulan Road.

2.9.2 Mine Facilities Area

The mine facilities area is constructed on a hardstand located within an area that does not contain recoverable coal to the south-west of the rail loop (Figure 2). The mine facilities area contains a workshop, storage building, office buildings (including a crib shed, bath house and first aid room), muster area and a range of service facilities (i.e. potable water, sewerage, electricity, fire services and hydrocarbon management).

Car parking areas in the mine facilities area are sealed.

2.9.3 Dangerous Goods/Wastes

Hydrocarbon Storages

Hydrocarbons used on-site include fuels (i.e. diesel and petrol), oils, greases, degreaser and kerosene.

Two bunded 88,000 litre (L) diesel storage tanks are located in the fuel dispensing facility. Oil is stored in two 28,000 L self-bunded double-skinned oil storage tanks, located in the oil storage facility. Two shipping containers are used for the storage of oil and grease pods. Flammable paints are stored on a containment pallet in a fenced compound, as well as in a locked cabinet inside the workshop.

Hydrocarbon storage facilities are constructed and operated in accordance with Australian Standard (AS) 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids* and the *Operational Health and Safety Act, 2000*. Hydrocarbon storage also includes the use of relocatable self-bunded double-skinned storage tanks.

The workshop infrastructure includes waste oil extraction equipment. An oil/water separator is located downslope of the workshop area, and a manually operated oil/water separator is located at the vehicle washdown bay area. All waste hydrocarbons collected in the separators are disposed of by a licensed contractor on a monthly basis.

Explosives Storages

Explosives required for the Wilpinjong Coal Mine include initiating products and detonators, ammonium nitrate fuel oil and emulsion equipment. The explosives are used in accordance with AS 2187.2:2006 *Explosives – Storage, Transport and Use – Use of Explosives*. AS 2187.2:2006 details the requirements for the safe storage, handling and land transport of explosives, safe storage distances from other activities and bunding requirements.

The explosives magazine is located in the west of the open cut area. As mining progresses the explosives magazine will be relocated.

Liquid and Non-Liquid Wastes

All solid and hazardous waste generated by the mine is removed from the site and disposed of by a licensed contractor.

Sewage is treated in an on-site sewage treatment plant which is serviced by a licensed contractor on a monthly basis. The treated effluent is used for irrigation within the rail loop and/or the CHPP area.

Waste materials are collected and sorted for recycling of paper, cardboard, metals, glass, air filters and oil filters.

2.9.4 Haul Roads

All coal is hauled on internal roads, and product coal is transported by rail. Internal haul roads are progressively constructed between the open cut operations, mine waste rock emplacements and ROM coal stockpiles as required.

As mining advances, the coal haul road is re-established in the highwall to optimise the haul distance from the open cut operation to the ROM coal stockpile. Haul roads are regularly watered to minimise dust generation.

2.9.5 Electricity Supply and Distribution

The 2008/2009 electricity use of the mine was 15,867,630 kilowatt hours, purchased from the grid. The Wilpinjong Coal Mine receives electricity from a 66 kilovolt (kV) supply system. Power is distributed by overhead cable or underground cable where necessary.

2.9.6 Potable Water

Potable water is provided by a 35,000 L storage tank located in the mine facilities area. Potable water is delivered by truck to the storage tank. The potable water supply reticulation system services the appropriate areas around the site (e.g. office buildings, crib rooms and maintenance areas).

2.10 REHABILITATION

The disturbed land on the mine site is primarily a result of open cut operations, out-of-pit waste rock emplacements and tailings emplacements. Rehabilitation occurs progressively as areas/landforms become available to minimise the area of disturbance at any one time.

Completed tailings disposal areas will be decommissioned through a capping process to create a landform that is stable which can be rehabilitated and revegetated.

The final landform levels and topography are to approximate the pre-mining topography. Final landform areas are designed with an allowance for the long-term settlement of mine waste rock and tailings. Drainage is designed to integrate with the surrounding catchment and include some permanent creek features similar to the pre-mining topography.

The revegetation strategy recognises the alternative land uses that exist in the region, with the aim of establishing the potential for both sustainable agriculture and areas of woodland vegetation. Approximately 31 ha of rehabilitation has been undertaken to date at Wilpinjong Coal Mine (primarily in the northern end of Pit 1) and is progressing well (WCPL, 2010a).

2.11 ENHANCEMENT AND CONSERVATION AREAS

Three Enhancement and Conservation Areas (ECAs) have been established (namely, ECA-A, ECA-B and ECA-C) (Figure 2). These ECAs are situated on WCPL-owned land which contain remnant vegetation and proximal grazing land, as well as known and potential Aboriginal cultural heritage sites.

Surveys have shown the ECAs to be habitats for threatened fauna species, and sites where Endangered Ecological Communities (EEC) such as the White Box, Yellow Box, Blakely’s Red Gum Woodland EEC are found. These areas have been fenced to exclude stock. WCPL vehicle access to these areas is limited and the ECAs have been the focus of noxious weed and feral animal control measures.

2.12 ENVIRONMENTAL MANAGEMENT AND MONITORING

Monitoring plans and control strategies have been developed in consultation with relevant agencies as part of the Wilpinjong Coal Mine’s Environmental Management Strategy. These monitoring programmes and control strategies are briefly described below:

- An Air Quality Monitoring Programme (WCPL, 2010b) summarises relevant air quality criteria, identifies potential sources of dust, provides air quality monitoring locations and presents the protocols for air quality monitoring.
- An Erosion and Sediment Control Plan (WCPL, 2006a) details controls and monitoring of erosion in disturbed areas.
- A Surface Water Management and Monitoring Plan (WCPL, 2006b) details the surface water control structures, works and procedures to manage potential surface water impacts and describes the implemented monitoring programme.
- A Groundwater Monitoring Programme (WCPL, 2006c) details monitoring and management of groundwater levels and quality across a network of monitoring bores.

- A Rehabilitation Management Plan (WCPL, 2006d) describes management strategies including:
  - land management practices to minimise mine related impacts on land resources;
  - flora and fauna management strategies across the site, covering specific areas such as:
    - Vegetation Clearance Protocol;
    - Threatened Species Management Protocol;
    - Remnant Woodland Enhancement Programme;
    - Rehabilitation Programme;
    - Flora and Fauna Monitoring Programme (FFMP); and
    - FFMP review, monitoring and implementation processes.
  - weed and feral animal management strategies; and
  - bushfire management strategies.
- A Blast Management Plan and Blast Monitoring Programme (WCPL, 2010c) that provides a monitoring programme to measure ground vibration and airblast overpressure.
- A Noise Monitoring Programme (WCPL, 2009) that details real-time noise monitoring and quarterly attended and unattended noise monitoring and operational noise performance and corrective action mechanisms.
- An Aboriginal Cultural Heritage Management Plan and North Eastern Wiradjuri Cultural Heritage Management Plan (WCPL, 2010d) to assist in the investigation, salvage and management of Aboriginal heritage sites.
- A Spontaneous Combustion Management Plan (WCPL, 2006e) which describes the management measures to minimise spontaneous combustion through the monitoring of potential causes.

Details of the monitoring undertaken and monitoring results are included in the AEMR and the Annual Environmental Protection Licence Return and provided at regular intervals on the Wilpinjong Coal Mine website in accordance with Project Approval Condition 13 of Schedule 5 (Attachment 1).

2.13 WORKFORCE

Combined Thiess and WCPL staff currently comprise approximately 180 personnel. Average on-site maintenance and supporting contractors add a further 120 (full time equivalent) staff. The total workforce of the site is therefore approximately 300 people.

2.13.1 Shift Times

Mining operations work three shifts per day, and the CHPP and workshop operations work two shifts per day. Nominal shift start and finish times are provided in Table 2.

Table 2
Nominal Shift Times

Thiess and WCPL Personnel	Nominal Shift Start	Nominal Shift Finish
Day Shift Crews (production)	7.00 am	7.00 pm
Swing Shift Crews (production)	5.00 am	7.00 am
Night Shift Crews (production)	7:00 pm	5.00 am
CHPP and Workshop	6:30 am	6:30 pm
	6:30 pm	6:30 am
Office Staff	7.00 am	5.00 pm

Maintenance contractors and other on-site contractors work their own shift times as required.

2.14 COMMUNITY CONTRIBUTIONS

WCPL makes financial and in-kind contributions to a number of non-government and community organisations in the region.

WCPL financial contributions to the MWRC in accordance with the Wilpinjong Coal Mine Planning Agreement and the Project Approval (Attachment 1) have included:

- an initial payment of $450,000 prior to the first shipment of coal from the site;
- an annual payment of $70,000 per year for community infrastructure and road maintenance contributions; and
- $20,000 per year for the period 2007 to 2009 to assist with the development of school bus lay-by areas along Ulan Road.

WCPL financial contributions (in the form of sponsorships, donations and in kind support) to various education, community development, health, environmental, arts and culture, and youth services causes in the region in financial year 2009-2010 will total more than $60,000.

2.15 COMPLAINTS

In accordance with the requirements of the Environmental Management Strategy and Project Approval (Attachment 1) WCPL records and responds to all complaints and provides a complaints register summary in the AEMR each year.

In 2009, a total of 134 complaints were received from 23 complainants, with approximately 70% of all complaints received from four complainants (WCPL, 2010a). The majority of complaints received were related to noise, with a smaller number of complaints also received regarding dust, spontaneous combustion and blasting.

Complaints were received primarily from areas to the east and south-east of the mine, including Araluen, Wollar and Cumbo Valley. Complaints from the Cumbo Valley area decreased in 2009 with the completion of a number of property acquisitions by WCPL.

Mine-related complaints are managed in accordance with the Complaints Response Procedure as outlined in the Environmental Management Strategy.

3 MINING RATE MODIFICATION

The Mining Rate Modification would not require significant alteration to the existing approved Wilpinjong Coal Mine operations and general supporting infrastructure. However, the facilities for the processing and handling of coal would be upgraded.

3.1 CONSTRUCTION/DEVELOPMENT ACTIVITIES

Construction activities would be limited to the CHPP and associated materials handling area adjacent to the rail loop (Figure 5).

3.1.1 CHPP and Materials Handling

To improve the efficiency of coal washing and coal handling systems and the separation of washed and unwashed coal products, some upgrades to the existing systems are required to meet the approved 13 Mtpa ROM production rate. Further upgrades are also required in support of the proposed increase in production rates for the Modification.

Key components of the proposed upgrades include:

- a 7 m extension to the CHPP building and an increase in the throughput capacity of the CHPP to approximately 1,200 tph;
- an additional ROM hopper and associated sizing station and raw coal conveyor and stacker;
- an additional product coal stockpile and associated stacking conveyor and reclaim conveyor; and
- associated minor earthworks, conveyors, transfer stations and relocation of site roads.

A conceptual layout for the proposed upgrades is provided on Figure 5. The final design of the upgrades would be subject to a detailed feasibility study and further engineering design.

Table 3 provides a summary comparison between the Project EIS and proposed modified CHPP and materials handling rates.

Table 3
Major Fixed Plant Capacities

Description	Project EIS (tph)	Modification (tph)
CHPP	1,100	1,200
Coal Handling Systems Feed Rate	1,200	2,800
Coal Reclaim and Rail Load-out	4,000	4,000

Subject to approval, construction of the CHPP/coal handling upgrades is expected to commence in January 2011 and would be completed over a period of approximately 9 months.

Construction works would be 24 hours, 7 days, however, construction heavy vehicle movements would be restricted to daytime hours. Construction activities would be restricted to the contained infrastructure area (i.e. near the centre of the Wilpinjong Coal Mine site).

WILPINJONG COAL MINE

FIGURE 5
Conceptual Arrangement of the CHPP and Materials Handling Upgrades

WIL-09-07_009B

3.1.2 Electricity Distribution Upgrades

Some on-site upgrades to electricity infrastructure would be required to support the proposed Modification, including the installation of a new 22 kV/415 volt transformer to augment the existing ring main unit.

3.1.3 Construction Workforce

On average, over the nine month construction period it is anticipated that approximately 150 construction workers would be required. At peak, up to 280 construction workers may be required for short periods. It is anticipated that 75% of this workforce would work dayshifts and some limited night works would be required.

3.1.4 Construction Mobile Equipment

An indicative maximum construction fleet for the proposed upgrades to the CHPP and materials handling is provided in Table 4. It is anticipated that only 50 to 75% of this construction fleet would be operating on-site at any one time during the 9 month construction period.

Table 4
Indicative Maximum CHPP and Materials Handling Construction Fleet

Fleet Item	Number
200 t Crawler Crane	1
75 t Crawler Crane	1
16 t Franna Crane	2
12 t Franna Crane	1
5CX Backhoe	4
20 t Excavator	2
30 t Truck and Dog Tipper	3
Concrete Delivery Truck	2*
Semi-Trailer Low Loader	2
D7/D8 Dozer	2
Bobcat	3
Elevated Work Platform/Cherry Picker	3
Light Vehicles	35
Lighting Plant	As required

* 60 to 80 cycles required.

3.2 OPERATIONS

3.2.1 Open Cut Extent

The Modification does not include any alteration to the approved extent of open cut mining.

3.2.2 Life of Mine

The Modification does not include any alteration to the approved 21 year mine life.

3.2.3 Blasting Parameters and Frequency

No change is proposed to the current blasting parameters or the blasting frequency limits described in the Project Approval (Attachment 1).

3.2.4 Mine Schedule

The Modified mine schedule and comparison to the projected production rates from the Project EIS are provided in Table 5.

Table 5
Modified Mine Schedule 2010 to 2026

Year		Waste Rock (Mbcm)		ROM Coal (Mt)		Product Coal (Mt)	
		Project EIS	**Modification**	**Project EIS**	**Modification**	**Project EIS**	**Modification**
2010	5	11.2	17.5	13.0	10.6	9.6	8.5
2011	6	9.3	25.0	13.0	13.5	9.5	10.8
2012	7	13.8	27.0	13.0	13.5	9.7	10.8
2013	8	12.9	27.0	13.0	15.0	9.7	12.0
2014	9	19.5	28.0	13.0	15.0	9.4	12.0
2015	10	14.3	27.0	13.0	14.2	9.4	11.4
2016	11	19.1	24.0	13.0	13.0	9.5	10.4
2017	12	18.5	22.0	13.0	13.0	9	10.4
2018	13	17.1	21.0	13.0	13.0	9	10.4
2019	14	15.6	18.0	13.0	13.0	8.9	10.4
2020	15	19.2	15.0	13.0	12.0	9.3	9.6
2021	16	22.7	15.0	13.0	10.5	9.4	8.4
2022	17	26.5	15.0	13.0	10.1	9.3	8.1
2023	18	23.8	15.0	13.0	9.5	9	7.6
2024	19	25.0	15.0	13.0	9.4	8.8	7.5
2025	20	26.4	12.0	13.0	9.4	9	7.5
2026	21	9.8	10.0	5.6	6.2	3.8	5.0
Total		**304.7**	**333.5***	**213.6**	**200.9**	**152.3**	**160.8**

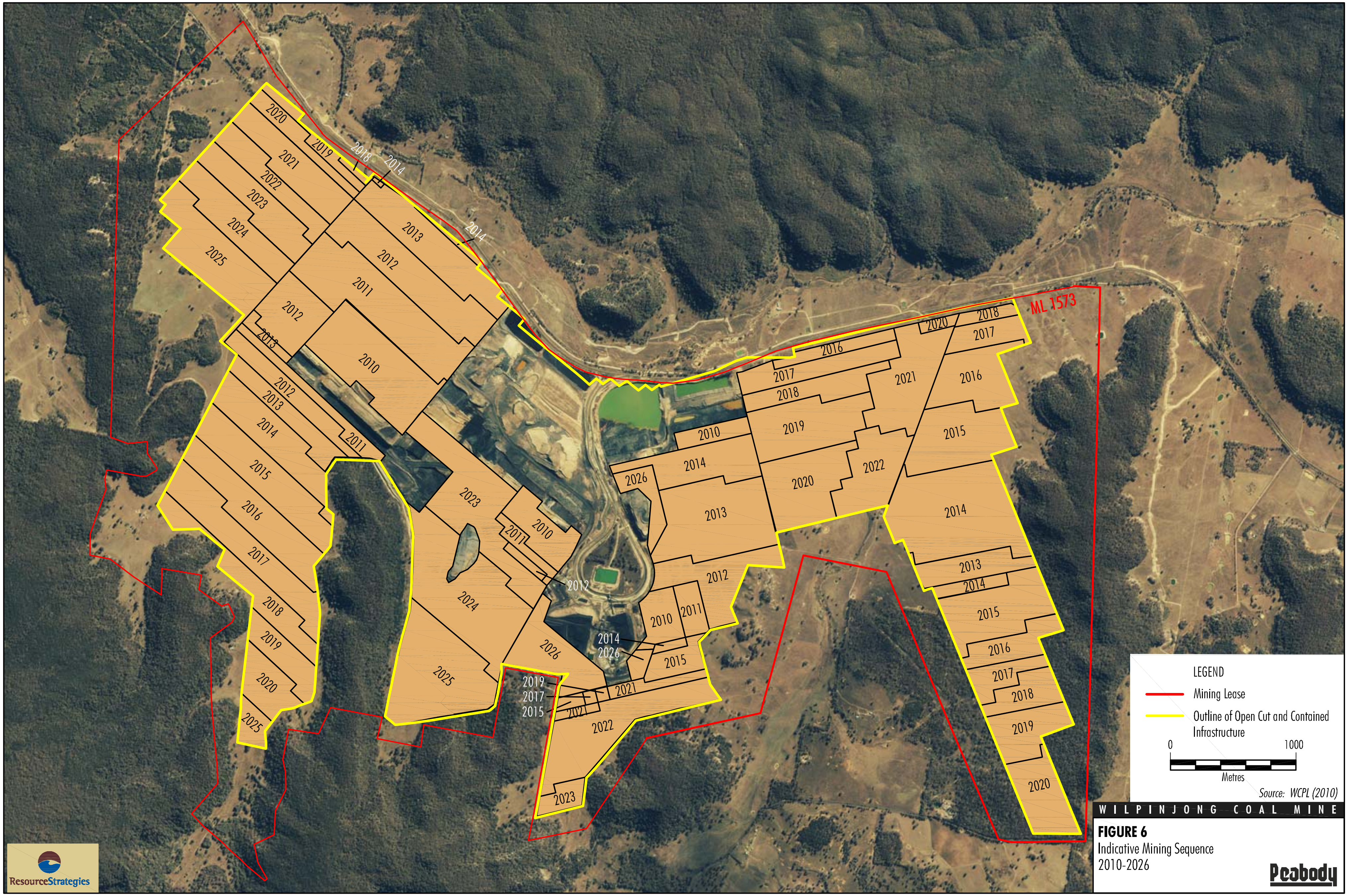
* From Year 5 onwards and includes rehandling of temporary waste rock emplacements.

An indicative sequence of mining for the remainder of the mine life is provided on Figure 6.

The mining sequence and rate of mining would continue to be subject to review on the basis of market conditions and customer demand. Relevant changes to the mining sequence and mining activities would be approved by the NSW Department of Industry and Investment via revision of the MOP as required.

3.2.5 Mobile Fleet

WCPL operating experience indicates that to meet the existing approved 13 Mtpa ROM coal production rate, some increases in the mobile fleet would be required. Further mobile equipment would also be required to meet the proposed incremental increase in production to 15 Mtpa of ROM coal.



WILPINJONG COAL MINE

FIGURE 6
Indicative Mining Sequence
2010-2026

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Table 6 provides a summary of the nominal mobile fleet required to achieve production of 15 Mtpa of ROM coal at Wilpinjong.

Table 6
Major Mobile Fleet

Description	Project EIS	Modification
Excavator	4 x 186 t	1 x Ex 1900
		3 x Ex 2500
Haul Truck	1 x 91 t	-
Haul Truck	9 x 136 t	18 x Cat 785
D8 Dozer	2	-
D10 Dozer	2	1
D11 Dozer	5	8*
Front End Loader	2	2
Grader	1	3
Water Truck	2	3
Drill	1	2

* Includes allowance for 2 x D11s at the CHPP.

3.2.6 Product Coal Transport

With the proposed Modification the average number of train movements per day would increase from four to five, however, the peak number of trains would remain unchanged at six trains per day (Table 7).

Table 7
Key Product Coal Train Parameters

Description	Project EIS	Modification
Nominal Train Capacity	8,500 t	8,500 t (91 x 120 t wagons) (Pacific National) 6,700 t (70 x 100 t wagons) (Queensland Rail)
Average Daily Project-Related Train Movements	Four events per day	Five events per day
Peak Daily Project-Related Train Movements	Six events per day	Six events per day

Note: Arrival and Departure = 1 event.

3.2.7 Water Supply and Water Management

A review of the water balance of the Wilpinjong Coal Mine incorporating the modified production rates and upgraded CHPP was conducted by Gilbert and Associates (2010) (Appendix D). The water balance model simulates future changes in stored volumes of water on-site in response to inflows (rainfall-runoff, groundwater, tailings water and water supply bore extraction), outflows (e.g. evaporation, CHPP make-up, dust suppression usage) and pumped transfers. Modelling includes simulation of water stored in water storages, tailings storages and each of the open cut pits (Appendix D). The catchments of each of the water storages and open cuts are annually adjusted based on projected mine development.

The modelling was completed over a large number of different daily climate "realisations" compiled from the 121 year available rainfall record and includes historical climatic events in the water balance model, including high, low and median rainfall periods. The water balance review indicates that incorporating the proposed Modification the average volumetric mean water supply reliability of the site over the remaining mine life would be approximately 83.6% (Appendix D).

Gilbert and Associates concluded (Appendix D):

> *There is a very low predicted risk of CHPP water supply shortfall prior to 2012 – mainly due to the significant volume of water stored on site currently. There is a higher risk of supply shortfall in years after 2012. As stored water volume falls below 1,000 ML, WCPL will need to implement sourcing of water from water supply bores to maintain a storage "reserve" and supply reliability in line with the above predictions. Ongoing reviews of the mine water balance will provide updated information on future supply reliability, which is inherently highly influenced by site rainfall. Depending on the results of these reviews, WCPL could initiate sourcing additional water supply under agreement with the nearby Ulan Coal Mine …*

WCPL has a "Heads of Agreement" with Ulan Coal Mines Limited for the potential transfer of excess mine water from the Ulan Coal Mines via a pipeline for use as a supplementary source of make-up water to the Wilpinjong Coal Mine.

Should future review of the site water balance indicate that a supplementary supply via the pipeline is required to meet WCPL reliability targets, environmental approvals for the pipeline and any associated modifications to the existing Project Approval for the Wilpinjong Coal Mine (Attachment 1) and the Development Consents/Project Approval for the Ulan Coal Mines would be subject to a separate assessment and approval process.

WCPL will continue to undertake regular reviews of the site water balance.

3.2.8 Operational Workforce

It is anticipated that the existing Wilpinjong Coal Mine workforce of approximately 300 people would be extended to approximately 350 people during peak production in years 2014 to 2015. Later in the mine life the workforce would be expected to fall back to similar levels as the existing operation, as the ROM coal production rate would be lower in the later years of mine life (Table 5).

4 ENVIRONMENTAL ASSESSMENT

4.1 IDENTIFICATION OF KEY ISSUES

As the approved life of the mine and the spatial extent and depth of mining at the Wilpinjong Coal Mine would be unchanged by the Modification (Section 3), there would be no material alteration to the approved impacts of the Wilpinjong Coal Mine on the following environmental aspects:

- land resources, rehabilitation and final landforms;
- waste rock management and geochemistry;
- flora and fauna;
- non-Aboriginal heritage;
- Aboriginal heritage;
- groundwater resources; and
- surface water resources (i.e. disturbance to natural catchment areas).

No change to the currently approved frequency of blasting (Attachment 1) or the nature of blasting is proposed (Section 3.2.3).

In addition, the peak daily product coal train movements (six trains per day) from the site would remain unchanged (Section 3.2.6).

The Modification comprises the following proposed changes to the approved Wilpinjong Coal Mine that may have some material effect on the approved environmental impacts of the mine:

- increases in the:
  - number mobile fleet items (e.g. haul trucks) utilised on-site;
  - maximum annual ROM coal production rate; and
  - maximum annual waste rock production rate;
- upgrade of the CHPP and materials handling systems and operation of these systems at higher rates of production;
- increased road transport movements associated with construction activities in 2011; and
- some limited additional operational workforce movements and consumable deliveries.

On the basis of the above, it can be concluded that potential environmental impacts of the Modification are restricted to the following key potential issues:

- off-site noise emissions associated with the operation of more mobile fleet and modified CHPP and material handling infrastructure;
- off-site air quality emissions associated with the increased rates of coal and waste rock production;
- road transport impacts and associated transport noise effects at residences located in close proximity to key roads; and
- economic effects, employment generation and associated population and community infrastructure demand primarily associated with the 9 month construction period.

The above key issues were discussed with the DoP in December 2009 and are addressed in supporting Appendices A, B, C and E and the results summarised below.

Potential alteration of the operational water balance and site water demand is described in Section 3.2.7 and Appendix D.

For completeness, in Section 4.6 consideration is also given to the potential visual impacts of the CHPP and materials handling improvements on the local visual environment.

4.2 NOISE

4.2.1 Background

Richard Heggie Associates assessed the potential noise and vibration impacts of the Wilpinjong Coal Project in 2005 (Richard Heggie Associates, 2005). The study assessed construction and operation noise, blasting noise and vibration, off-site road and rail transport noise and cumulative mine noise effects at potentially affected receptors against applicable assessment criteria.

The original study identified some 18 privately-owned dwellings and nine vacant private landholdings where the predicted Wilpinjong Coal Mine noise levels exceeded the Project-specific noise assessment criteria. This included some 16 private dwellings within the noise management zone (1 to 5 decibels [dBA] above applicable project specific noise criteria) and two dwellings within the noise affectation zone (>5 dBA above applicable project specific noise criteria). WCPL subsequently purchased a number of these properties.

Heggies Pty Ltd conducted a Blast Emissions Impact Assessment and Traffic Noise Impact Assessment (Heggies, 2007a; 2007b) in support of the mine access route and blasting frequency modification that was approved in November 2007 (Section 2.1).

Noise Monitoring Programme

A Noise Monitoring Programme (WCPL, 2009) was established in 2006 prior to the commencement of mining and has been revised a number of times in response to community feedback, technical issues, operational experience and the recommendations of an independent noise audit.

In addition to attended monitoring, real-time noise monitoring is used as a noise management tool at Wilpinjong Coal Mine and involves the use of noise investigation triggers to assist in the implementation of pre-emptive management actions to avoid potential operational noise non-compliances.

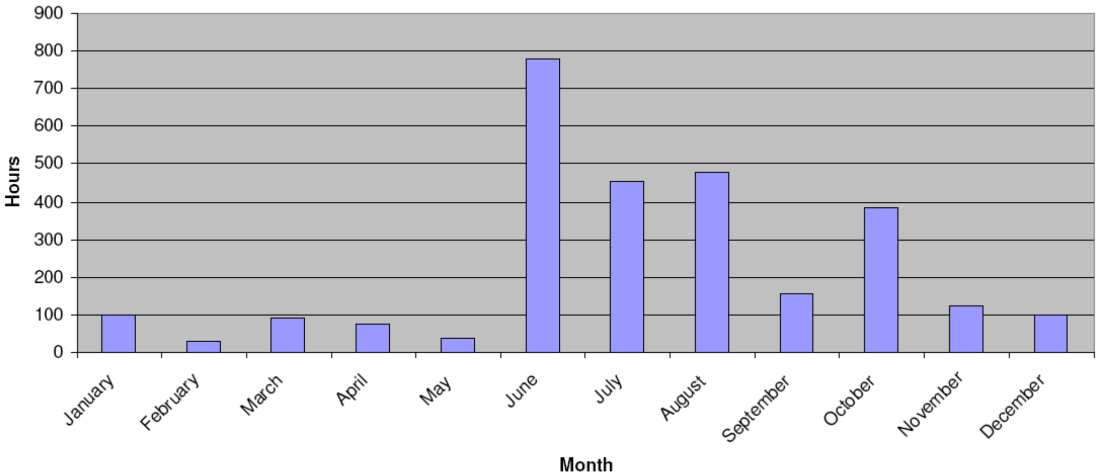
Real-time monitors are located adjacent to the mine at points indicative of local rural residential areas and are periodically relocated.

The real-time noise monitor system records 15 minute statistical noise data, continuous audio (MP3) files, meteorological data and produces daily noise reports. A graphical summary of the previous 24 hours of noise is sent to mine staff via email on a daily basis. The continuous audio recording can also be downloaded, so that a listener can consider whether the noise being recorded is mine related.

WCPL real-time noise investigation triggers are set at 2 dBA below the relevant Project Approval criterion at the monitoring locality and the triggers are used between 8.00 pm and 8.00 am. A SMS message is sent to the mobile phone of the Open Cut Examiner if a noise trigger is activated. The protocol for responding to noise investigation triggers is described in the Noise Monitoring Programme and includes review of the real-time audio to determine whether the noise is mine related and the implementation of suitable management measures, including the temporary stoppage of components of mobile plant, if required.

During 2009, the use of the real-time monitoring, investigation trigger and response system at Wilpinjong Coal Mine resulted in 2,806 machine hours lost (WCPL, 2010a) with the majority of the lost machinery hours occurring in winter (Chart 1).

Chart 1
2009 Machinery Hours Lost Due to Noise Control Measures



Source: WCPL (1010a)

Operator attended noise monitoring in accordance with the Noise Monitoring Programme has been undertaken since commencement of mining operations in 2006. Attended compliance monitoring results have indicated compliance with applicable noise compliance criteria at the nearest private receptors (Appendix A).

Figure 7 illustrates current continuous noise monitoring and attended compliance noise monitoring locations.

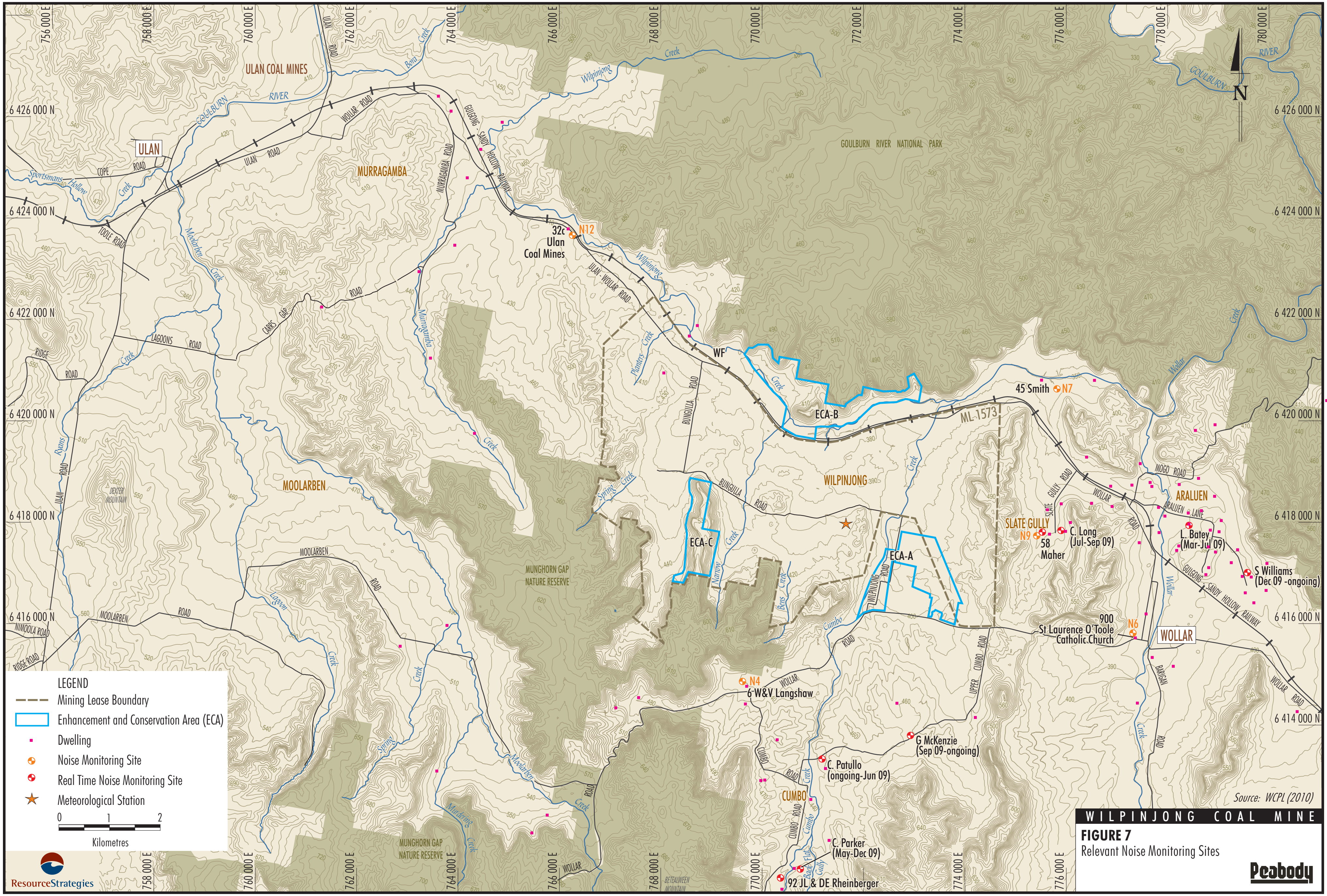


FIGURE 7
Relevant Noise Monitoring Sites

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4.2.2 Environmental Review

Construction and Operational Noise

Potential Impacts

Heggies (2010) have completed a review of the potential noise impacts of the Modification (Appendix A). As a component of the study Heggies completed a review of the sound power levels of the as-built major fixed plant and major mobile fleet items to update and calibrate the existing noise model for the Wilpinjong Coal Mine. Heggies also conducted a review of on-site weather monitoring data and review of private receptor locations (Appendix A).

Additional noise sources associated with the Modification were incorporated in the noise model (e.g. additional CHPP capacity and coal handling upgrades) and the following three key scenarios were modelled to assess the potential noise emissions of the modified Wilpinjong Coal Mine:

- **2011** - CHPP and coal handling upgrade construction, with the focus of mining operations in Pit 5;
- **2014** - peak mine production and peak mobile fleet operating, with the focus of mining operations moving to central Pit 3 (i.e. the eastern most pit and closest to private receivers), upgraded CHPP and coal handling systems; and
- **2017/2020** - combined scenario to review the potential effect of mining operations in the southern and northern extents of Pit 3 with less topographic shielding to the Wollar and Araulen localities, upgraded CHPP and coal handling systems.

The noise modelling involved iterative review of a range of potential noise mitigation measures to determine the effectiveness of various combinations of noise controls. As a result of this review WCPL adopted the following at source noise controls that would be progressively implemented as required from 2012 to meet applicable Project Approval criteria at the nearest private receivers (Appendix A):

- up to 18 factory noise attenuated haul trucks (e.g. XQ Cat 785);
- up to two factory noise attenuated dozers (e.g. XQ Cat D11); and
- a noise attenuated excavator (e.g. attenuated Hitachi EX 2500) when mining in Pit 3 south.

With the adoption of the above noise mitigation measures the Noise Impact Assessment (Appendix A) indicates that exceedances of the Project specific noise criteria would occur at a total of 15 privately owned dwellings and nine vacant land properties under adverse weather conditions.

This includes some 13 private dwellings within the predicted noise management zone and two private dwellings within the predicted noise affectation zone (Table 8). For comparison, the Project EIS indicated that 16 private dwellings would be in the noise management zone and two private dwellings would be in the noise affectation zone (Section 4.2.1).

Table 8
Private Dwellings in Predicted Noise Management and Noise Affectation Zones

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**
31 Conradt* 57 Nagy 100 Rheinberger 124 Zivkovik 125 Roberts	23A Bloomfield* 23B Bishop (ex Bloomfield)* 25 Pettit 52A Long* 52B Long* 53 Reynolds* 55 Fox* 58 Maher*	45 Smith* 49 Harkin*

Source: Appendix A

* Listed in the existing Wilpinjong Coal Mine Project Approval due to predicted noise exceedances.

The majority of the private dwellings listed in Table 8 are already listed in the Wilpinjong Coal Mine Project Approval (Attachment 1) due to predicted noise exceedances for the existing approved mine.

Indicative contour diagrams of the predicted noise emissions of the modified Wilpinjong Coal Mine in 2011, 2014 and 2017/20 under adverse evening westerly wind conditions are presented on Figures 8, 9 and 10 respectively. Additional noise contour diagrams under night-time temperature inversion conditions are provided in Appendix A.

Mitigation and Management Measures

In addition to the factory noise attenuated mobile fleet items to be progressively implemented from 2012 (see above) WCPL would continue to implement attended monitoring and real-time monitoring and response protocols under the Noise Monitoring Programme (WCPL, 2009).

In consultation with DoP and DECCW, WCPL would also develop a suitable method for temperature inversion monitoring during attended monitoring for compliance purposes (this may include the use of temporary tethered meteorological balloons and suspended temperature sensors, or an alternative DoP agreed methodology). Once agreed, the inversion monitoring methodology would be included in future revisions of the Noise Monitoring Programme.

Road Noise

The majority of Wilpinjong Coal Mine traffic is related to employee movements travelling to and from the mine along Ulan Road and Ulan-Wollar Road (Figures 1 and 2).

The operational employee traffic and traffic associated with deliveries would be only modestly increased by the Modification. However, a short-term peak in additional traffic is expected in 2011 during construction of the Modification and potential traffic noise levels on Ulan-Wollar Road (west of Wilpinjong) and Ulan Road (north of Cooks Gap) for 2011 were reviewed.

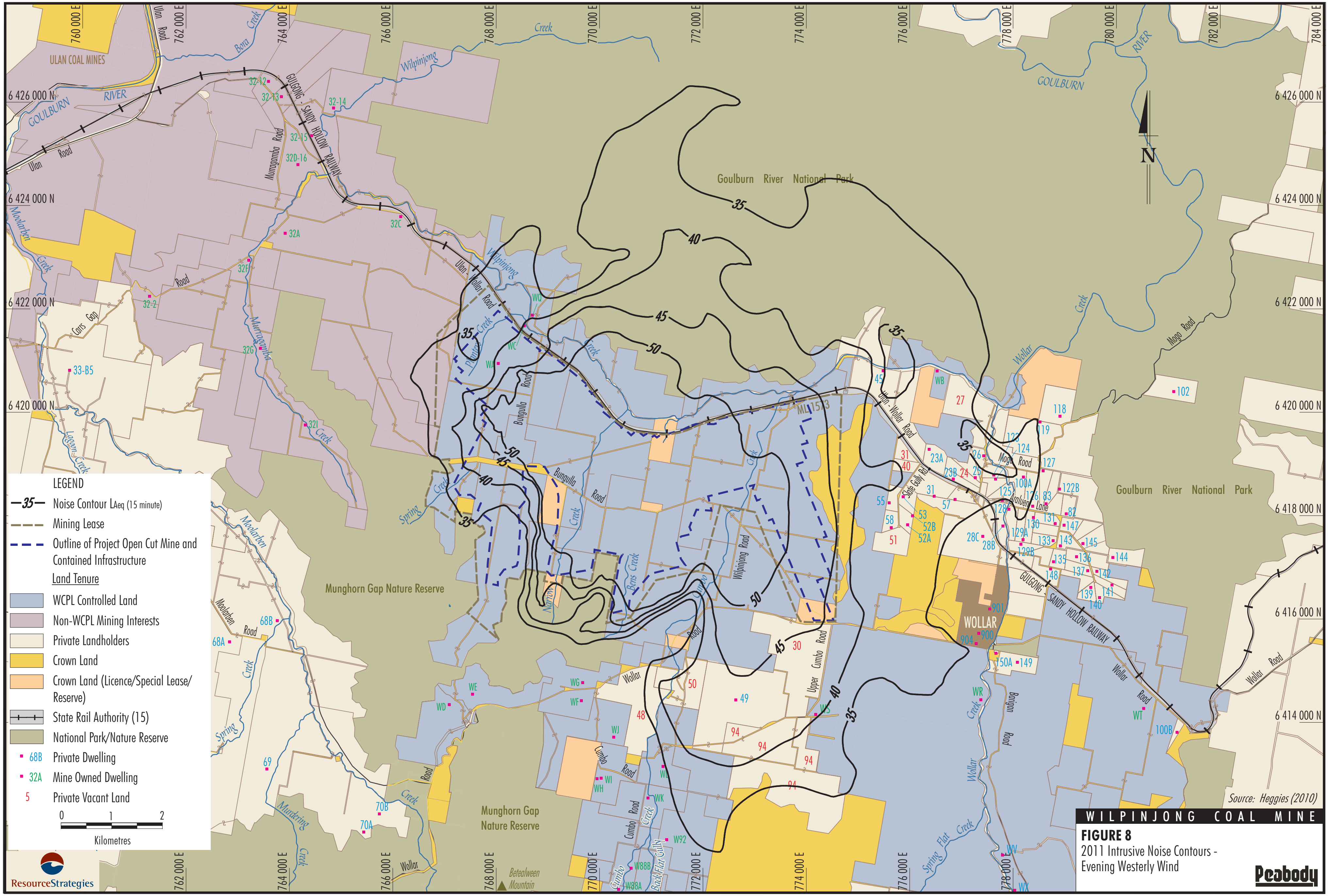


FIGURE 8
2011 Intrusive Noise Contours - Evening Westerly Wind

WIL-09-07_016B

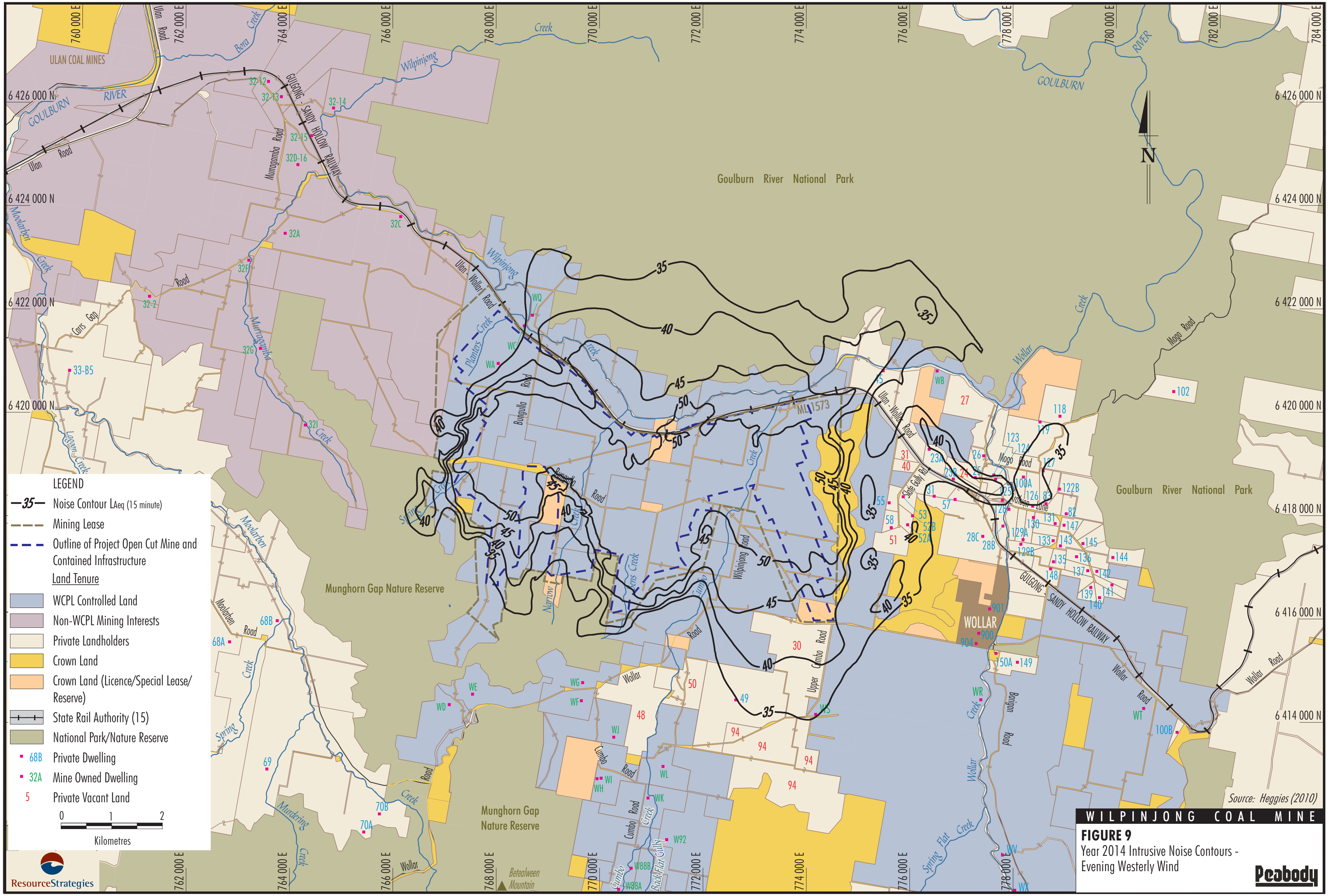
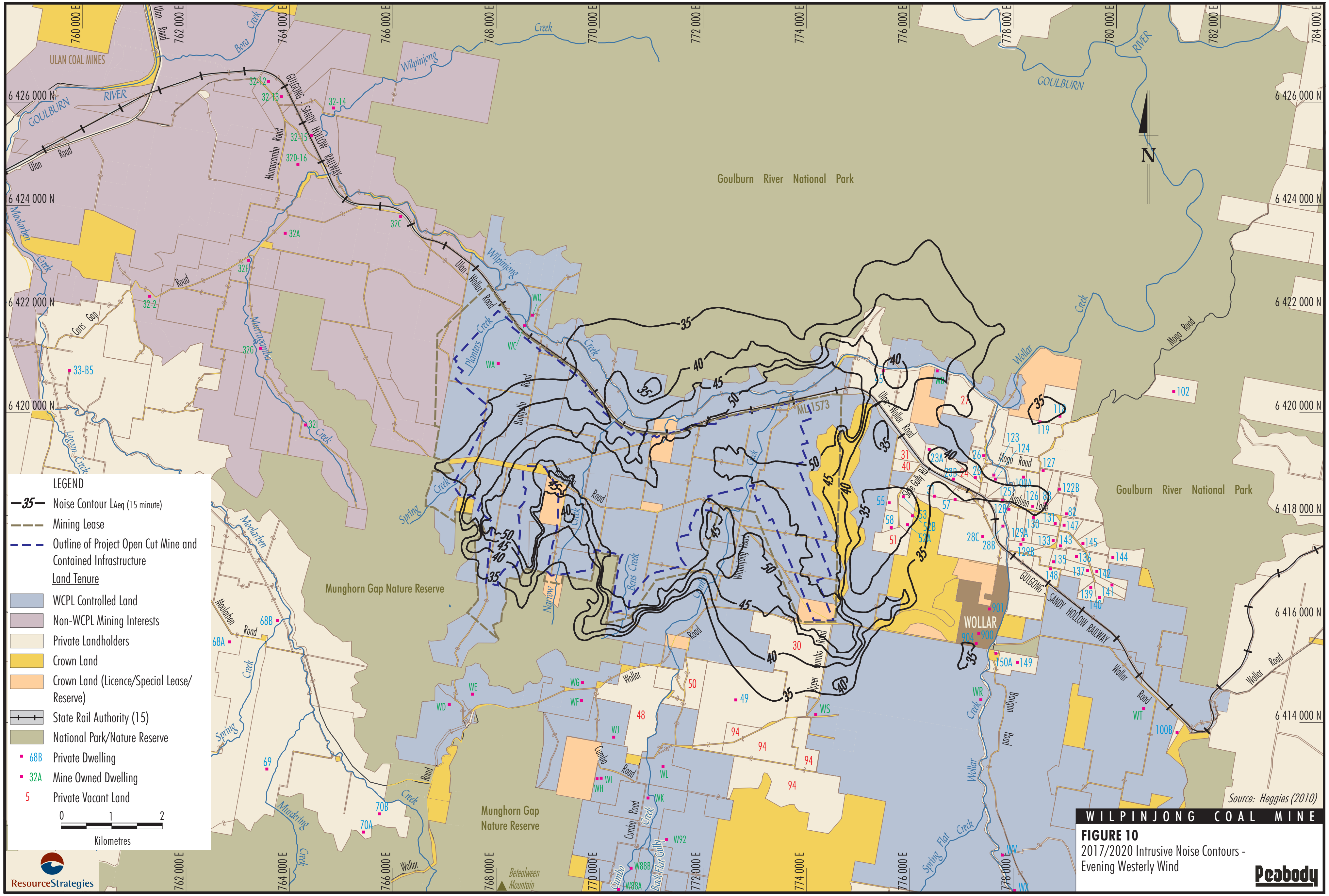


FIGURE 9
Year 2014 Intrusive Noise Contours - Evening Westerly Wind

WIL-09-07 App Noise_017B



Goulburn River National Park
Munghorn Gap Nature Reserve
Munghorn Gap Nature Reserve
Goulburn River National Park
ULAN COAL MINES
WOLLAR
ML 1573
GULGONG - SANDY HOLLOW RAILWAY
LEGEND
35 Noise Contour LAeq (15 minute)
Mining Lease
Outline of Project Open Cut Mine and Contained Infrastructure
Land Tenure
WCPL Controlled Land
Non-WCPL Mining Interests
Private Landholders
Crown Land
Crown Land (Licence/Special Lease/Reserve)
State Rail Authority (15)
National Park/Nature Reserve
68B Private Dwelling
32A Mine Owned Dwelling
5 Private Vacant Land
0 1 2
Kilometres
Source: Heggies (2010)
WILPINJONG COAL MINE
FIGURE 10
2017/2020 Intrusive Noise Contours - Evening Westerly Wind
Peabody
ResourceStrategies
WIL-09-07_018B

Heggies review of the traffic noise implications of this short term 2011 construction traffic increase indicates (Appendix A):

- Ulan Road traffic noise levels would increase by less than 2 dBA and hence are likely to be acceptable; and
- Ulan-Wollar Road traffic noise levels would increase by up to approximately 5 dBA during peak hour periods, however, there are no longer any private receivers located on Ulan-Wollar Road to the west of Wilpinjong.

Rail Noise

Peak Wilpinjong Coal Mine daily product train movements would be unchanged by the Modification (Section 3.2.6) and peak rail traffic noise levels would therefore also remain unchanged (Appendix A).

The rail noise assessment found that there would be a negligible increase in average daytime/evening, night time and 24 hour rail traffic noise levels as a result of the Modification (Appendix A).

4.3 AIR QUALITY

4.3.1 Background

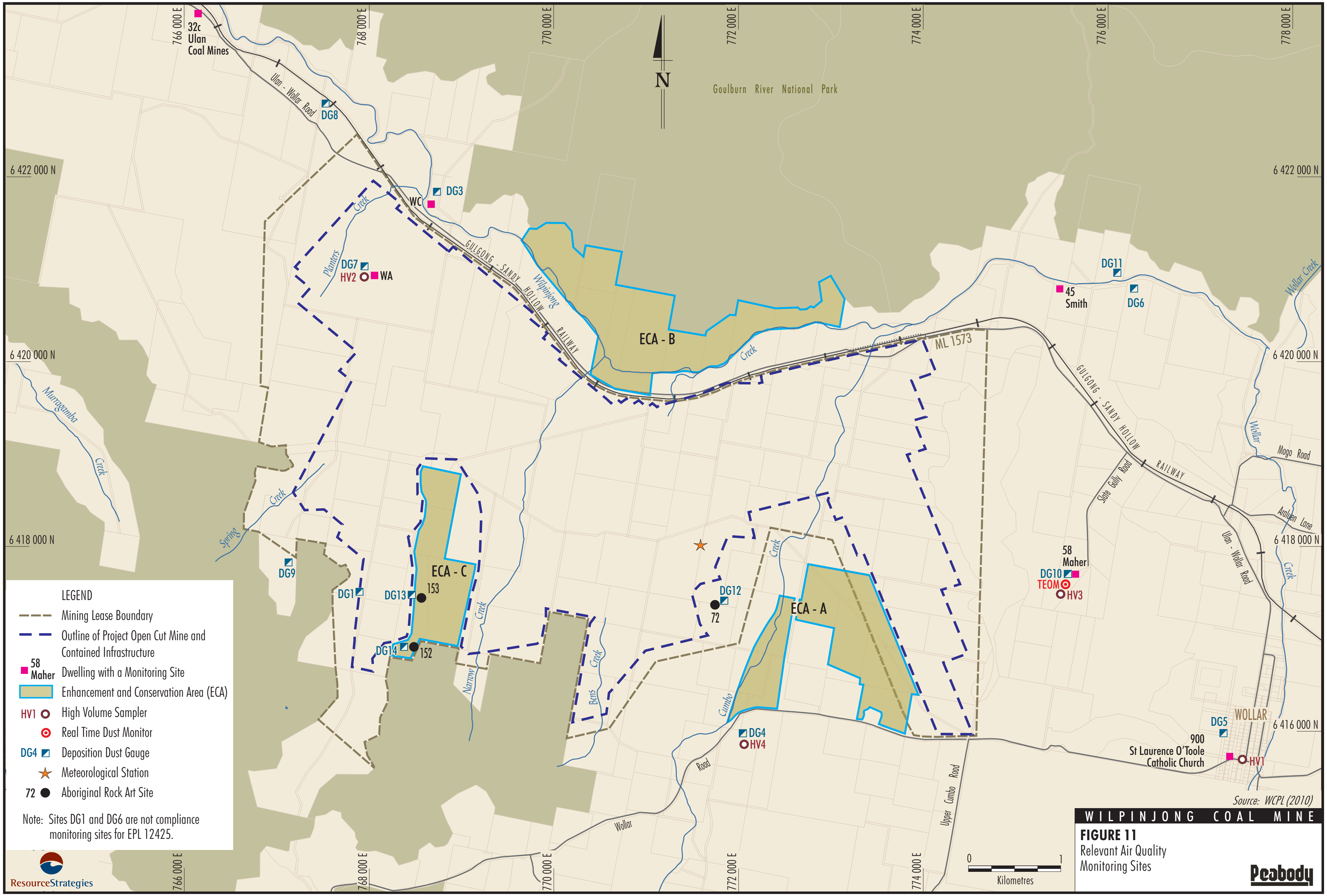
The potential air quality impacts of the Wilpinjong Coal Project were assessed in the Project EIS by Holmes Air Sciences in 2005 (Holmes Air Sciences, 2005). The assessment predicted compliance with relevant air quality criteria at all nearby private dwellings except the nearest private residence to the north of Pit 6 (now mine-owned).

An air quality monitoring program commenced in 2004 prior to the commencement of mining which includes the measurement of dust deposition and dust concentration (as particulate matter less than 10 micrometres diameter [PM_{10}] and total suspended particles [TSP] as micrograms per cubic metre [$\mu g/m^3$]). The locations of current air quality monitoring sites are shown on Figure 11.

Monitoring of dust deposition indicates there have been some exceedance of the 4 grams per square metre per month (g/m^2/month) (averaged over a 12 month period) DECCW assessment criteria during certain months, however these were largely attributed to regional meteorological events, or non-mine causes adjacent to the monitoring gauges (Appendix B). The average dust deposition during the monitoring history across all sites is 2.3 g/m^2/month (Appendix B).

Annual average PM_{10} and TSP concentration monitoring from four High Volume Air Samplers (HVAS) over the life of the Wilpinjong Coal Mine and one Tapered Element Oscillating Microbalance (TEOM) in 2009 have indicated that there has been compliance with the DECCW's annual average PM_{10} criteria of 30 $\mu g/m^3$ and annual average TSP concentration criteria of 90 $\mu g/m^3$ across all sites.

A summary of the PM_{10} and the TSP concentration monitoring data is provided in Tables 9 and 10 respectively.



WILPINJONG COAL MINE

FIGURE 11
Relevant Air Quality Monitoring Sites

WIL-09-07_013B

Table 9
Monitored Annual Average PM_{10} Concentrations

HVAS Site	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)	2009 (µg/m^3)	Average (µg/m^3)
HV1 – HVAS Wollar Village	15.1	14.2	11.8	14.4	13.9
HV2 – HVAS West (Note: this site is within the Mining Lease)	21.9	16.0	12.0	16.8	16.7
HV3[1] – HVAS East	16.8	-	-	-	16.8
HV4 – HVAS South	18.5	13.1	10.7	12.9	13.8
TEOM	-	-	-	18.5	18.5
Average of All Data					15.9

Source: Appendix B.

[1] HV3 used for TSP measurement from January 2007 onwards.

Table 10
Monitored Annual Average TSP Concentrations

HVAS Site	2007 (µg/m^3)	2008 (µg/m^3)	2009 (µg/m^3)	Average (µg/m^3)
HV3 – HVAS East	19.8	19.6	23.8	21.1

Source: Appendix B.

Monitoring results have indicated that the DECCW PM_{10} 24-hour assessment criteria of 50 µg/m^3 have been exceeded when regional weather events such as bush fires and dust storms have contributed to the high dust concentrations (Appendix B).

4.3.2 Environmental Review

Potential Impacts

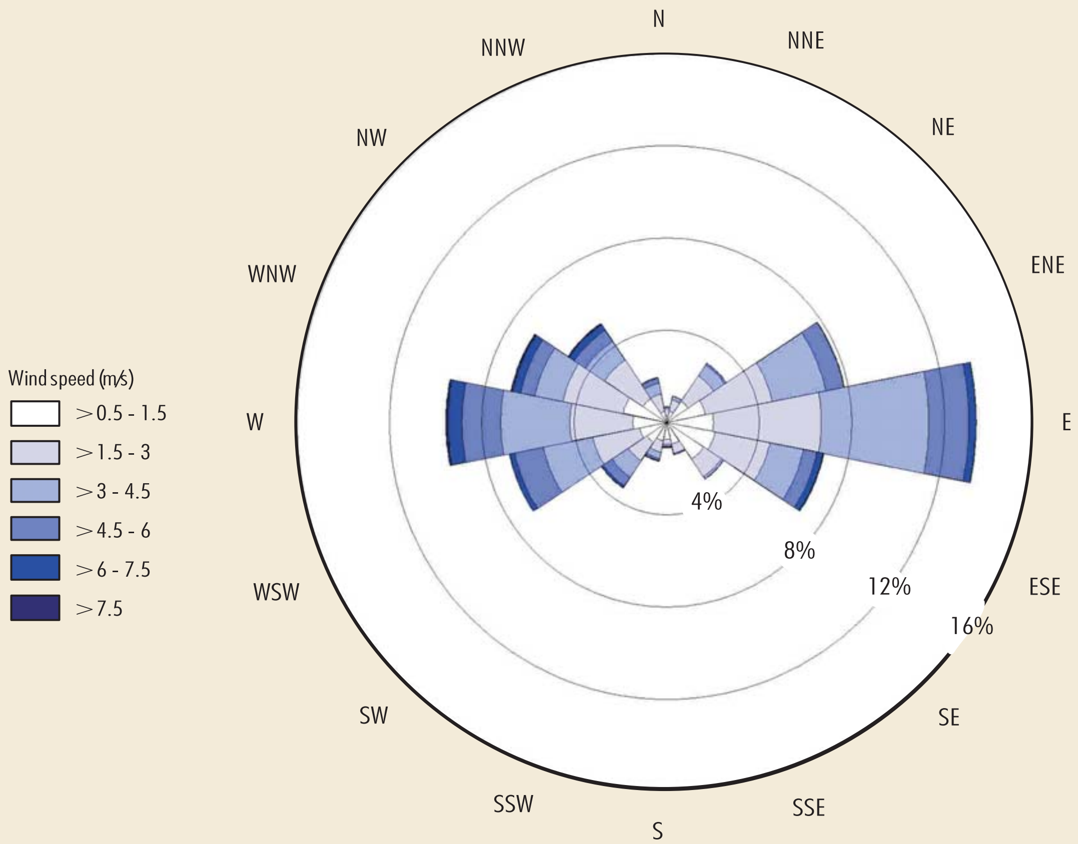
PAEHolmes (2010) have completed a review of the potential air quality impacts of the Modification (Appendix B). Dust concentrations and deposition rates have been modelled for two key periods of the modified mining operations (i.e. 2011 and 2014).

2011 would be the year when mining operations would be most highly concentrated in one area of the mine (i.e. central Pit 5) and 2014 would be both the peak production year and when mining would be located closest to the nearest private receivers in Slate Gully. Slate Gully receivers are aligned with the majority of the mining operations under common westerly wind conditions (Figure 12).

The potential impacts for the Wilpinjong Coal Mine alone and the potential cumulative impacts of Wilpinjong Coal Mine with emissions from other sources (including background emissions and proposed extensions to the Ulan Coal Mines and the Moolarben Coal Mines) were considered.

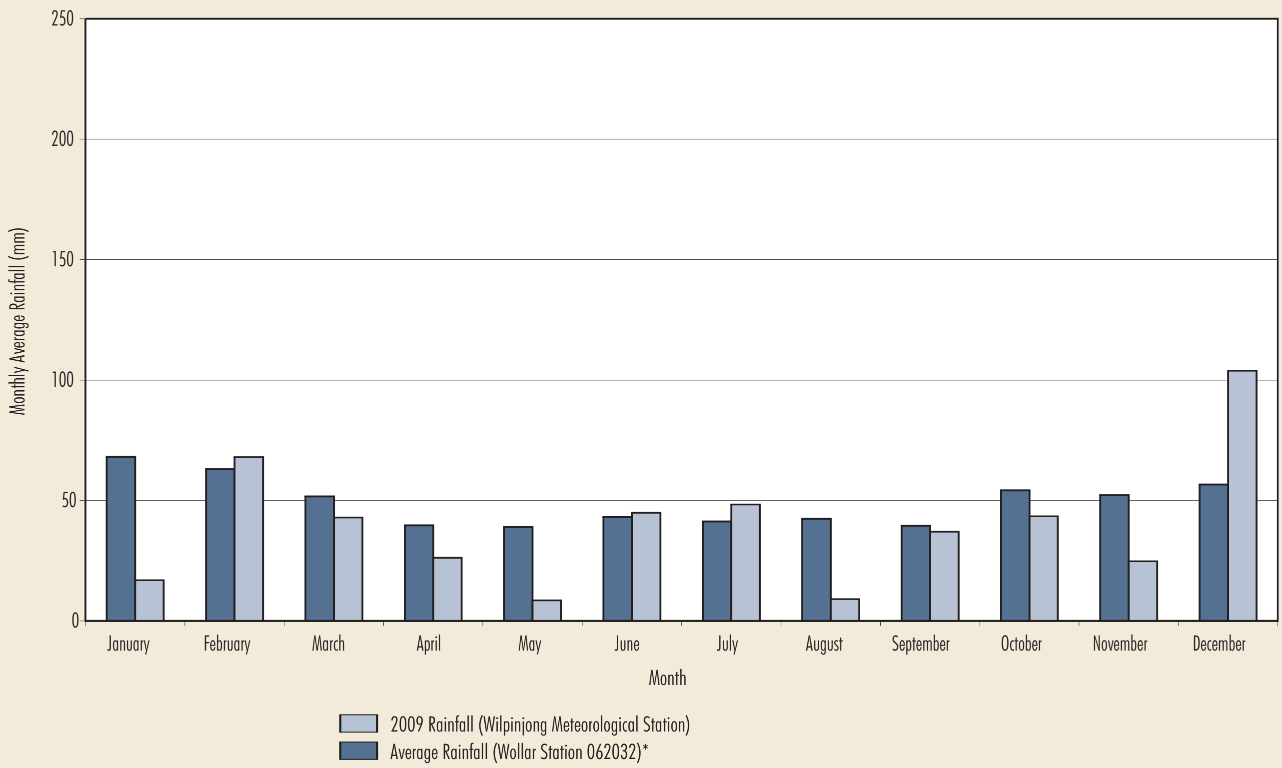
Air quality modelling results for the Wilpinjong Coal Mine incorporating the Modification indicate (Appendix B):

- The annual average dust deposition assessment criteria of 2 g/m^2/month (project-only) and the 4 g/m^2/month (cumulative) would not be exceeded at any private dwellings in either 2011 or 2014.
- The annual average PM_{10} assessment criteria of 30 µg/m^3 would not be exceeded at any private dwellings in either 2011 or 2014.



2009 Annual Windrose - Wilpinjong Meteorological Station

Rainfall Summary



Source: WCPL (2010)

WILPINJONG COAL MINE

FIGURE 12
Wilpinjong 2009 Annual Windrose and Rainfall Record

Peabody

ResourceStrategies

* Based on 104 Years of Data

WIL-09-07_010B

- The annual average TSP assessment criteria of 90 μg/m^3 would not be exceeded at any private dwellings in either 2011 or 2014.
- Compliance with the project-only 24-hour average PM_{10} criteria of 50 μg/m^3 at private dwellings in 2011.

The Air Quality Impact Assessment indicates potential non-compliances with the project-only PM_{10} 24-hour assessment criteria (50 μg/m^3) at three private dwellings in Slate Gully to the east of the Wilpinjong Coal Mine in 2014, namely 31 (Conradt), 53 (Reynolds) and 55 (Fox) (Appendix B).

Additional review of the modelling results, predicted concentrations and the predicted number of exceedances of the PM_{10} 24-hour assessment criteria in Appendix B indicates that only one private dwelling 55 (Fox) would be expected to experience more than five exceedances of the 24-hour PM_{10} criteria in 2014. PAE Holmes concluded there is a low risk of high 24-hour PM_{10} concentrations due to mining operations at these private receptors (Appendix B).

Figures 13 and 14 show predicted maximum 24-hour average PM_{10} concentrations generated by the mine for 2011 and 2014, respectively.

Management and Mitigation Measures

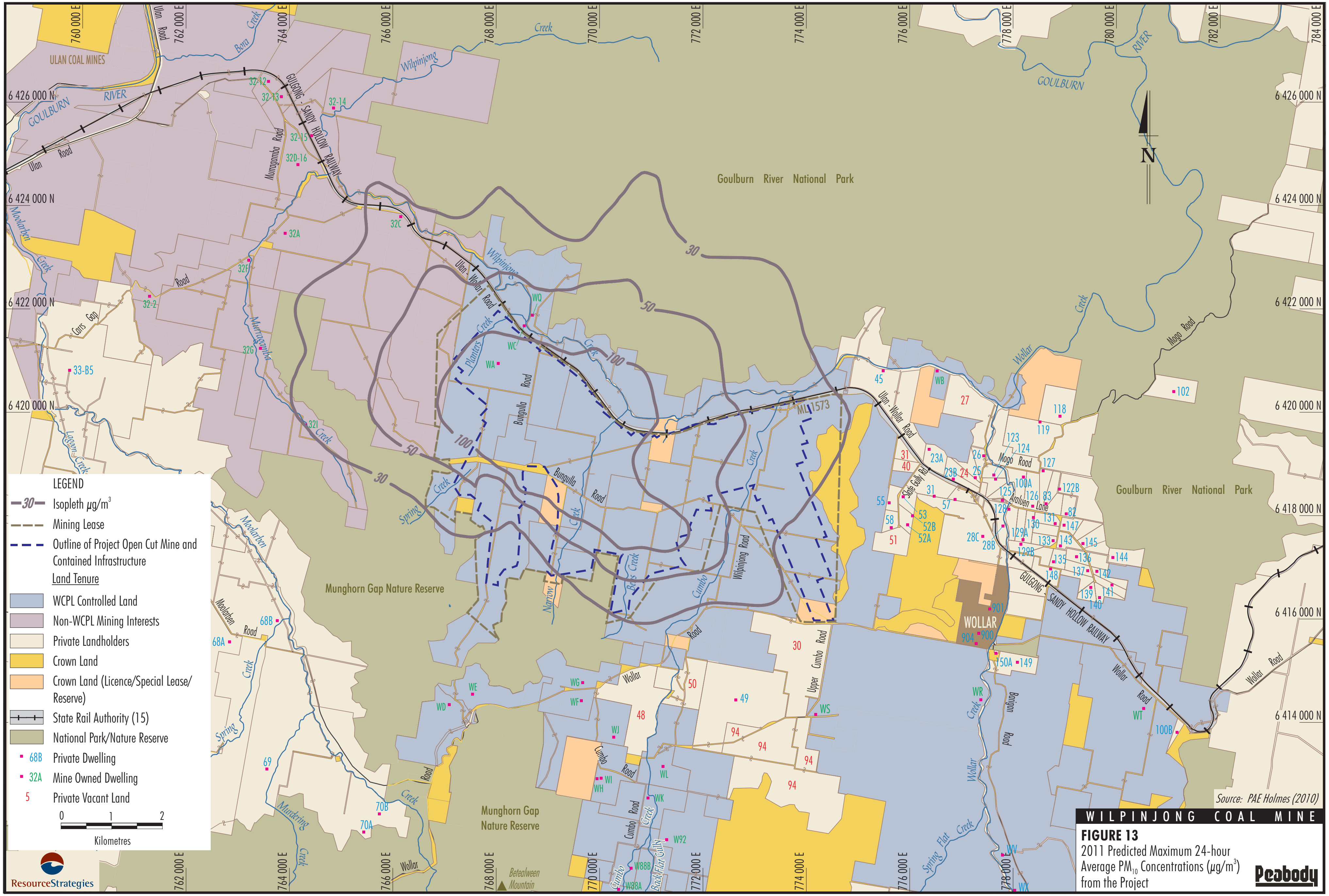
A range of management and mitigation measures will continue to be implemented by WCPL to minimise air quality impacts associated with wind blown dust from exposed areas and dust generated by mining activities in accordance with the existing Air Quality Monitoring Programme (WCPL, 2010b).

WCPL is currently trialling a TEOM real-time trigger and response system for the management of PM_{10} emissions at the nearest private receivers. Once finalised, this real-time dust control system would be incorporated into a future revision of the Air Quality Monitoring Programme. WCPL would then utilise the real-time monitoring system to relocate, modify and/or stop mining operations if required to maintain compliance with relevant air quality criteria on privately owned land in accordance with Condition 22, Schedule 3 of the Project Approval (Attachment 1).

Greenhouse Gas Emissions

As the Modification does not involve any expansion of the approved extent of mining or the extraction of additional coal at the Wilpinjong Coal Mine, there would be no material change to the total greenhouse gas emissions of the Wilpinjong Coal Mine. The only change to emissions would be in regard to the timing of emissions (i.e. greenhouse gas emission rates are expected to rise or fall with changes in the annual production rates of ROM coal and waste rock).

Notwithstanding the above, an assessment has been undertaken to examine the greenhouse gas emissions that may be expected from the remaining life of the Wilpinjong Coal Mine incorporating the proposed Modification and this assessment is detailed in Appendix B.



WILPINJONG COAL MINE

FIGURE 13

2011 Predicted Maximum 24-hour Average PM_{10} Concentrations ($\mu g/m^3$) from the Project

WIL-09-07_019B

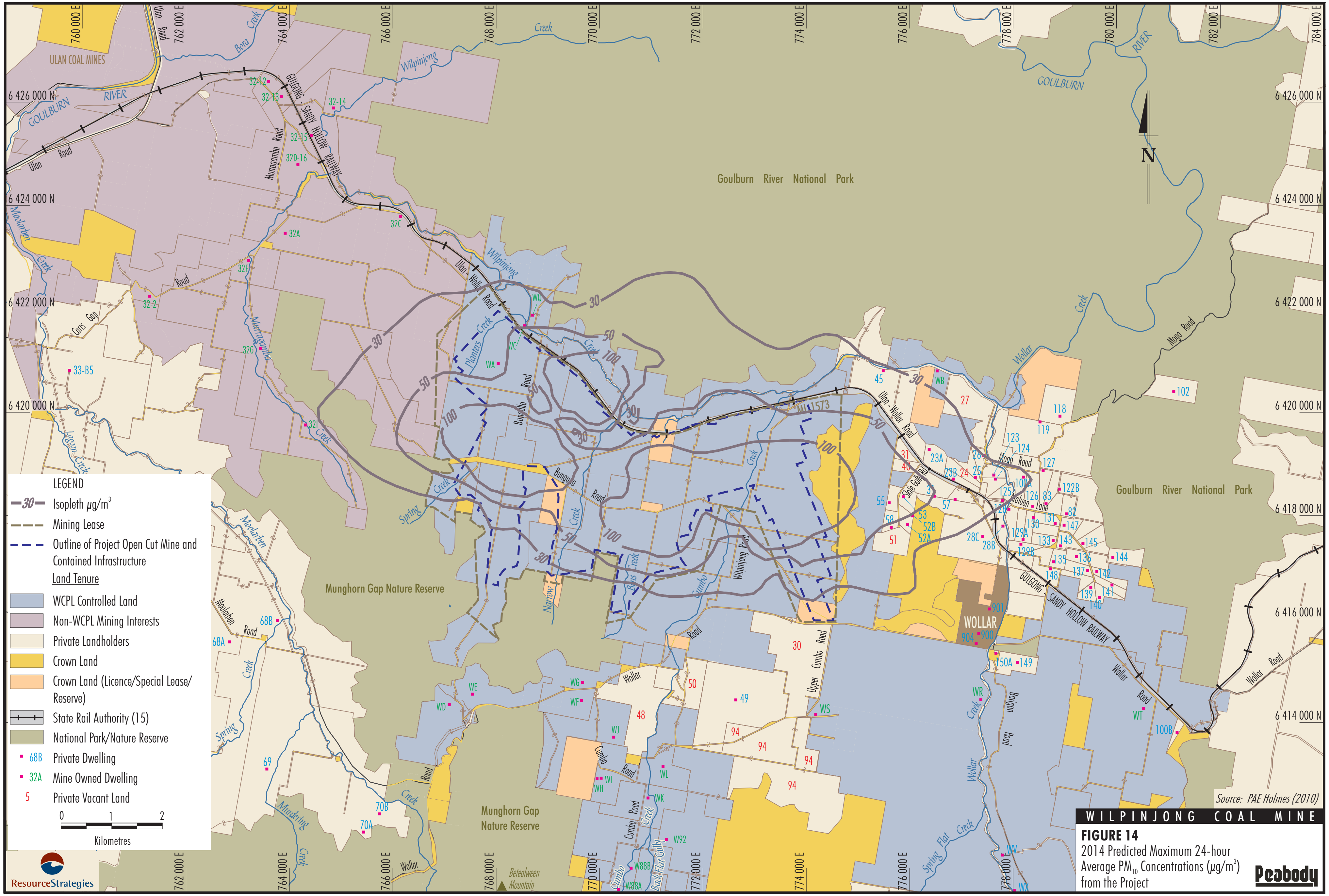


FIGURE 14
2014 Predicted Maximum 24-hour Average PM_{10} Concentrations (µg/m³) from the Project

WIL-09-07_020B

4.4 ROAD TRANSPORT

4.4.1 Background

A Road Transport Assessment for the Wilpinjong Coal Project was completed by Traffix in 2005 (Traffix, 2005). Originally, the primary access was to be from the south, via an unsealed two-lane mine access road connecting to Wollar Road. However, in accordance with Condition 4, Appendix 2 of the Project Approval (Attachment 1), a Route Assessment Study (incorporating a Road Safety Audit and a Road Conditions Audit) was conducted by J. Wyndham Prince Pty Ltd (JWP) in 2006. The objective of the Route Assessment Study was to identify the most appropriate traffic route for both construction traffic (including oversize-overmass vehicles) and operational traffic to and from the mine and included review of the condition and suitability of Ulan Road, Wollar Road and Ulan-Wollar Road (JWP, 2006).

Based on the investigations undertaken, the Route Assessment Study concluded …*Ulan Road (MR214) and the Ulan-Wollar Road have been identified as the preferred construction and operational traffic route to the Project* (JWP, 2006). Subsequently, a modification to the mine access route was approved by the DoP (Section 2.1) to allow site access from Ulan-Wollar Road and the use of Ulan-Wollar Road and Ulan Road as the primary access route to the site from Mudgee and Gulgong (Figure 2). The site access off Ulan-Wollar Road is used for all employee, contractor and delivery access to the mine.

In accordance with Project Approval Condition 52A (Attachment 1), WCPL has funded the upgrade of Ulan-Wollar Road by the MWRC between Ulan Road and the Wilpinjong Mine access road.

The intersection of Ulan-Wollar Road and Ulan Road was also recently upgraded by Moolarben Coal Mines.

School bus services operate along several routes in the area including along Ulan Road and Ulan-Wollar Road. School buses generally travel on the above routes between 7.30 am and 9.00 am, and between 3.00 pm and 5.00 pm. Both of these periods are outside the peak hours for general Wilpinjong Coal Mine workforce traffic movements.

WCPL has made financial contributions to the establishment of school bus lay-by areas on Ulan Road and makes ongoing financial contributions to local road maintenance by MWRC (Section 2.14).

4.4.2 Environmental Review

Halcrow (2010) (Appendix C) completed a review of recent available traffic volume data and assessed the potential impacts of the Modification.

In February 2010, traffic volume counts were conducted at eight sites on local roads used by Wilpinjong Coal Mine traffic to determine current traffic flows (Figure 15). A summary of the existing daily traffic flows is presented in Table 11. The existing traffic flows and performance of the intersection of Ulan-Wollar Road and Ulan Road was also analysed during morning and evening peak hours. Halcrow's analysis indicates that the existing roads of relevance to the Wilpinjong Coal Mine and the Ulan-Wollar Road/Ulan Road intersection operate at acceptable levels of service with the current traffic flows.

Heavy vehicle deliveries account for approximately 5% of existing Wilpinjong Coal Mine vehicle movements (Appendix C), significantly less than the existing proportion of heavy vehicles on the local road network (Table 11).

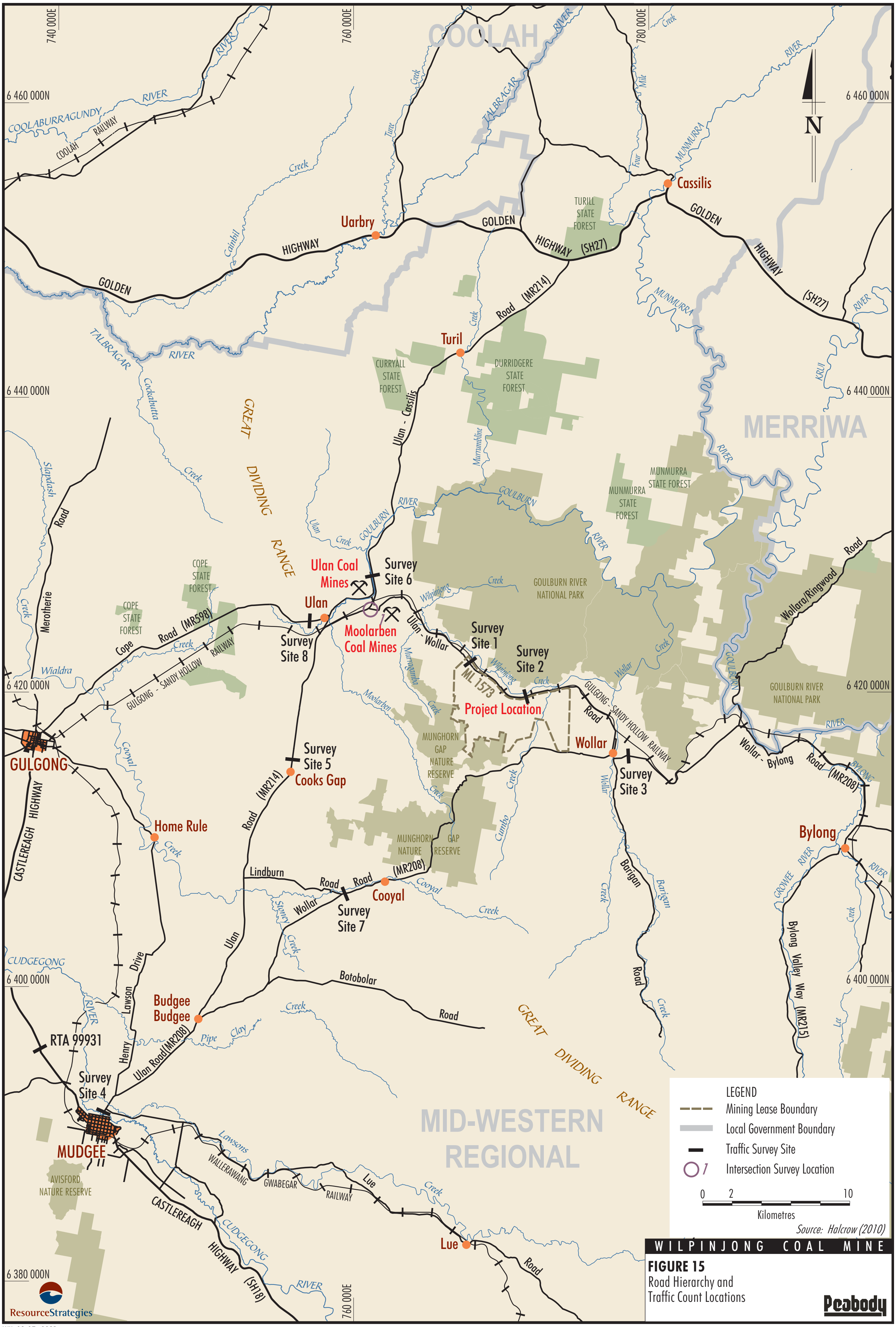


FIGURE 15
Road Hierarchy and Traffic Count Locations

WIL-09-07_008B

Table 11
Existing Average Weekday Traffic Volumes (February 2010)

Road	Location	Survey Site[1]	Volume (vehicles/day)	Heavy Vehicles (%)
Cope Road	West of Ulan Road	8	1,043	15.7
Ulan-Cassilis Road	North of Ulan-Wollar Road	6	2,241	13.2
Ulan-Wollar Road	West of Wilpinjong Coal Mine	1	415	15.9
	East of Wilpinjong Coal Mine	2	119	17.4
Wollar Road	East of Wollar	3	161	26.1
	North of Lindburn Road	7	455	7.3
Ulan Road	North of Cooks Gap	5	1,841	14.3
	South of Henry Lawson Drive	4	6,624	9.1

Source: Appendix C

1 Refer to Figure 15.

Halcrow identified that 2011 would be the peak period of traffic generation for the Modification, as minor operational traffic increases could combine with traffic generated during the nine month construction period. The potential contribution of the Modification to total traffic on the road network would decline significantly after 2011 (Appendix C).

A conservative assessment of the potential additional traffic movements associated with the Modification in 2011, including contributions of peak construction and additional operational employee traffic and deliveries was assessed (Table 12).

Table 12
Peak 2011 Traffic Generation due to the Modification (vehicles/day)

Road	Location	Additional Operational		Construction Peak		Total Increase 2011
		Workforce (light)	Deliveries (50% heavy)	Workforce (light)	Deliveries (100% heavy)	
Mine Access Road	South of Ulan-Wollar Road	50	16	476	20	562
Cope Road	West of Ulan	8	0	76	0	84
Ulan-Cassilis Road	North of Ulan	2	2	15	2	21
Ulan-Wollar Road	West of Wilpinjong Coal Mine	45	16	430	20	511
	East of Wilpinjong Coal Mine	5	0	46	0	51
Wollar Road	East of Wollar	2	0	15	0	17
	North of Lindburn Road	1	0	5	0	6
Ulan Road	North of Cooks Gap	36	14	339	18	407
	South of Henry Lawson Drive	34	14	323	18	389

Source: Appendix C.

A cumulative 2011 traffic impact assessment was then undertaken including consideration of baseline traffic growth, traffic generated by the Modification as well as cumulative traffic associated with the proposed Moolarben Coal Project Stage 2 and the Ulan Coal Mines - Continued Operations Project (Table 13).

Table 13
Existing and Future Weekday Traffic on the Local Road System (vehicles/day)

Road	Location	Existing (2010)	Additional Traffic in 2011				Total 2011
			Baseline Growth	Wilpinjong Modification	Ulan Coal Mines[1]	Moolarben Coal Mines[2]	
Mine Access Road	South of Ullan-Wollar Road	426	0	562	0	0	988
Cope Road	West of Ulan	1,043	17	84	148	48	1,340
Ulan-Cassilis Road	North of Ulan	2,241	39	21	17	0	2,319
Ulan-Wollar Road	West of Wilpinjong Coal Mine	415	1	511	0	0	926
	East of Wilpinjong Coal Mine	119	1	51	0	0	172
Wollar Road	East of Wollar	161	3	17	0	0	181
	North of Lindburn Road	455	8	6	0	0	469
Ulan Road	North of Cooks Gap	1,841	27	407	393	196	2,864
	South of Henry Lawson Drive	6,624	112	389	393	196	7,714

Source: Appendix C.

Note: Totals may include some minor discrepancies due to rounding.

1 Ulan Coal – Continued Operations Project.

2 Moolarben Coal Project Stage 2.

The worst case scenario of cumulative impacts described above was used to assess the level of service on the key roads for traffic generated by the Wilpinjong Coal Mine. Results of the assessment indicate that all roads will continue to operate at acceptable levels with the cumulative traffic volumes in 2011 (Appendix C).

The operation of the intersection of Ulan Road and Ulan-Wollar Road was also assessed with future cumulative traffic generation assumptions. The results indicate the intersection would also continue to operate at a good level of service during peak hours (Appendix C).

Halcrow concluded that (Appendix C):

> *No significant impacts on the performance and safety of the road network are expected to arise as a result of the Modification, even with the cumulative effects of the proposed changes to the Ulan Coal Mines and Moolarben Coal Mines and no specific management or mitigation measures are considered to be warranted.*

To minimise the potential impacts of Modification generated traffic, WCPL will continue to encourage car pooling by employees to minimise traffic movements.

4.5 SOCIO-ECONOMICS

Background

Gillespie Economics completed a benefit cost analysis and regional economic impact assessment in the *Wilpinjong Coal Project Economic Assessment* (Gillespie Economics, 2005). A Community Infrastructure Assessment was also prepared by Martin and Associates Pty Ltd (2005) that considered the potential impacts of the construction and operation of the Wilpinjong Coal Mine on population and community infrastructure demand.

WCPL and the mining contractor (Thiess) employ in the order of 180 staff (Section 2.13). With supporting contractors the on-site workforce is approximately 300 people. The majority of the workforce resides in Mudgee and Gulgong, with a lesser proportion spread throughout rural areas and other towns in the MWRC LGA and the wider region.

Review

Gillespie Economics (2010) has completed a Socio-Economic Assessment of the Modification (Appendix E) that includes the following analyses:

- a benefit cost analysis of the Modification;
- a regional economic impact assessment of the Modification; and
- an employment, population and community infrastructure assessment.

Gillespie Economics have estimated that on average the Modification would generate 202 direct and indirect jobs during the nine month construction of the CHPP and materials handling upgrades.

During the peak increase in ROM coal production (i.e. years 2013 and 2014) the following economic benefits for the MWRC LGA are estimated as a result of the Modification (i.e. the incremental increase in economic benefits when compared to the approved Wilpinjong Coal Mine) (Appendix E):

- $179 million (M) in annual direct and indirect regional output or business turnover;
- $106M in annual direct and indirect regional value added;
- $13M in annual direct and indirect household income; and
- 137 direct and indirect jobs.

Appendix E concluded that the additional construction workforce for the proposed upgrades is likely place some temporary upward pressure on the rental housing market, but is likely to create minimal demand for other community infrastructure such as schools or health facilities.

The estimated population change during peak operation of the Modification (2013 to 2014) is also likely to place some temporary upward pressure on the rental market, however, the effect on community infrastructure is likely to be minimal given the projected small change in the regional population (Appendix E).

The benefit cost analysis for the Modification indicates that it would have a net production benefit in the order of $47M and hence is desirable and justified from an economic efficiency perspective (Appendix E).

4.6 OTHER ENVIRONMENTAL ASPECTS

Visual Amenity

A visual impact assessment was conducted for the Wilpinjong Coal Project in 2005 by EDAW Gillespies for the Project EIS (EDAW Gillespies, 2005). The assessment identified two private residences (now WCPL-owned) that were predicted to experience a low to moderate visual impact and one private residence (now WCPL-owned) that was predicted to experience a high visual impact as a result of the development of the Wilpinjong Coal Mine. Potential visual impacts were also expected for locations on Ulan-Wollar Road and the Gulgong-Sandy Hollow Railway, however, the visual sensitivity of these transport routes was assessed as low.

The Modification would not involve any alteration to the approved extent of mining or the life of the approved Wilpinjong Coal Mine (Section 3.2.2). Potential visual impacts are therefore limited to the proposed upgrades to the CHPP and materials handling that are located in the centre of the mine area to the south of the rail loop (Figures 2 and 5). These upgrades would include the construction and operation of additional coal conveyors, transfer bins, coal stockpiles and a 7 m extension to the existing CHPP (Figure 5). The new product coal stacking conveyor is likely to be the highest of these new structures.

Additional lighting would also be installed on the new infrastructure as required to comply with operational and safety requirements.

Given the mass and scale of the existing Wilpinjong Coal Mine landforms and infrastructure and the limited private ownership in the Wilpinjong valley (Figure 4A), the Modification would not significantly alter the visual impacts of the approved Wilpinjong Coal Mine.

It is anticipated that the higher components of the new infrastructure would be visible from portions of Ulan-Wollar Road and the Gulgong-Sandy Hollow Railway, however the views would be intermittent and from a distance of approximately 2 km or more. The additional operational and safety lighting would be similar in nature and location to the existing night-lighting of the approved Wilpinjong Coal Mine.

Hazard and Risk

A preliminary hazard analysis (PHA) was conducted for the Project EIS in accordance with State Environmental Planning Policy (SEPP) 33 to evaluate the potential hazards associated with the Wilpinjong Coal Project. The PHA identified the storage and handling of explosives, diesel, petrol and hydrocarbons as the primary source of potential risks.

WCPL has prepared and implemented a number of management plans and control strategies as part of the Environmental Management Strategy (Section 2.12) to address the potential hazards and risks associated with the construction and operation of the Wilpinjong Coal Mine.

The proposed Modification does not significantly alter the consequences or likelihood of a hazardous event occurring at the Wilpinjong Coal Mine, as the operational activities on-site would be generally unchanged. Notwithstanding, environmental management plans and procedures would be updated to include the proposed Modification, where relevant (Section 5.2).

4.7 CONSIDERATION OF CUMULATIVE IMPACTS WITH OTHER NEARBY MINING OPERATIONS

4.7.1 Moolarben Coal Mines

The Moolarben Coal Mines are located approximately 5 km west of the Wilpinjong Coal Mine (Figure 1). Stage 1 of the Moolarben Coal Project was approved on the 6 September 2007 and involves mining of three open cut mines and one underground mine. Stage 1 is approved to mine at a rate of up to 12 Mtpa until 2028 (Moolarben Coal Mine, 2009).

The Moolarben Coal Mines currently has a proposal before the DoP (Moolarben Coal Project Stage 2) that includes one open cut mine proposed to be mined at a maximum rate of 12 Mtpa, as well as two underground mines with a combined maximum mining rate of 4 Mtpa. Additional coal handling facilities are proposed to be constructed to transfer the ROM coal to the existing Stage 1 CHPP. An application to modify the Stage 1 infrastructure is also before the DoP to increase the capacity of approved Stage 1 processing facilities to process Stage 2 ROM coal.

The Moolarben Coal Project Stage 2 is not yet approved by the NSW Minister for Planning and assessment of the proposal is currently being undertaken by the DoP. Notwithstanding, as the proposal may be determined in the near future, potential cumulative traffic impacts with the Moolarben Coal Project Stage 2 have been considered in the Noise Impact Assessment (Appendix A), Air Quality Impact Assessment (Appendix B) and Road Transport Assessment (Appendix C) and no significant adverse cumulative impacts have been identified.

In addition, the Groundwater Assessment for the Moolarben Coal Project Stage 2 (Aquaterra, 2008) indicates:

> *Limited dewatering will be required in OC's 1 to 4, as the Ulan Seam and overlying sediments are only partially saturated through most of the area. The Ulan Seam is also already partly dewatered in areas of the north-west of OC1 and OC4, due to the regional effects of dewatering operations at Ulan coal mine.*

The western-most pit at Wilpinjong (i.e. Pit 6) is currently scheduled to be mined in the period 2018 to 2025 (Figure 6), whereas the eastern arms of the Moolarben Stage 2 Open Cut 4 that is proposed to the west of Wilpinjong are not scheduled to be mined until the period 2026-2032. On this basis it can be concluded that the potential impacts of the Moolarben Coal Mines on Wilpinjong Coal Mine groundwater inflows and the site water balance would be expected to be minor, should Moolarben Stage 2 be approved.

4.7.2 Ulan Coal Mines

Mining in the Ulan area has been undertaken since the 1920s, with mining operations at Ulan Coal Mines Limited expanding significantly in the 1980s when an exploration program found extensive coal reserves (Ulan Coal Mines Limited, 2009). The Ulan Coal Mines are located approximately 11 km to the north-west of the Wilpinjong Coal Mine (Figure 1) and potential cumulative impacts are therefore more limited in comparison to the Moolarben Coal Mines.

The Ulan Coal Mines currently has a proposal before the DoP (the Ulan Coal – Continued Operations Project) to recommence and extend open cut mining operations while concurrently mining approved underground resources. A combined open cut and underground mining rate of 20 Mtpa is proposed for the 21 year mine plan. Some upgrades to existing surface facilities are proposed, as well as construction of additional infrastructure.

The Ulan Coal – Continued Operations Project is not yet approved by the NSW Minister for Planning, however, assessment of the proposal is currently being undertaken by the DoP. As the proposal may be determined in the near future, potential cumulative impacts have been considered in the Air Quality Impact Assessment (Appendix B) and Road Transport Assessment (Appendix C) and no significant adverse cumulative impacts have been identified.

5 STATUTORY CONTEXT

The Project was approved under Part 3A of the EP&A Act by the Minister for Planning in February 2006 (Project Approval 05-0021 – Attachment 1).

As outlined in Section 1.3, WCPL consulted with the DoP in 2009 with regard to seeking the necessary approvals for the Modification and based on this consultation, this EA has been prepared under Section 75W of the EP&A Act.

Section 75W of the EP&A Act states:

> **75W Modification of Minister's approval**
>
> *(1) In this section:*
>
> ***Minister's approval*** *means an approval to carry out a project under this Part, and includes an approval of a concept plan.*
>
> ***modification of approval*** *means changing the terms of a Minister's approval, including:*
>
> *(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and*
>
> *(b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.*
>
> *(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.*
>
> *(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.*
>
> *(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.*
>
> *….*

5.1 GENERAL STATUTORY REQUIREMENTS

Mid-Western Regional Interim Local Environmental Plan, 2008

The Wilpinjong Coal Mine is wholly within the *Mid-Western Regional Interim Local Environmental Plan, 2008* (MWRI LEP) area.

The MWRI LEP refers throughout to "Council" in its capacity as consent authority. The Wilpinjong Coal Mine has a Project Approval under Part 3A of the EP&A Act, for which the consent authority is the NSW Minister for Planning. References to "Council" in the MWRI LEP should therefore be interpreted as references to the Minister for Planning for this Project.

Clause 12(2) of the MWRI LEP relevantly provides:

> *The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.*

The Project Application area of the approved Wilpinjong Coal Mine is largely zoned "Agriculture Zone". A portion of ECA C is also zoned "Conservation" under the LEP, however, no change to the management of the approved ECA areas is proposed for the Modification.

Under the MWRI LEP the objectives of the Agriculture Zone are:

- *To protect and maintain land for agriculture and other rural purposes.*
- *To avoid the fragmentation of agricultural land and conflict between land uses, and to restrict unnecessary dwellings and incompatible development.*
- *To provide for other rural land uses, such as mining, extractive industries, forestry and energy generation.*
- *To provide for the protection, enhancement and conservation of areas of significance for nature conservation, of habitat of threatened species, populations and ecological communities and of other areas of native vegetation.*
- *To maintain the scenic amenity and landscape quality of the area.*
- *To promote the sustainable management, use and development of certain land for agriculture, mining and other primary industries.*
- *To promote the conservation of productive agricultural land for agricultural purposes, particularly cropping and grazing.*
- *To preserve the area's open rural landscapes and environmental and cultural heritage values by the maintenance of large holdings accommodating both intensive and extensive forms of agriculture.*
- *To avoid development that would conflict with or unreasonably impact upon the efficient use of land for rural or other primary industries, such as small lot rural residential subdivision and hobby farms.*
- *To protect the residential and visual amenity of existing and future residents of rural areas by applying appropriate building siting and design controls.*
- *To ensure that development does not significantly detract from the existing rural character or create unreasonable or uneconomic demands for provision or extension of public amenities and services.*
- *To permit some non-agricultural land uses and agricultural support facilities, such as rural industries and tourist facilities, which are in keeping with the other zone objectives and which will not adversely affect agricultural capability or capability of the land the subject of the development (or adjoining land).*
- *To encourage high quality advertising signs in association with approved uses that provide business identification, that are appropriately integrated into the site development, and that contribute positively to the visual amenity of the surrounding area.*

Under Clause of the MWRI LEP "Mines" are permissible on lands zoned Agriculture with development consent as mining use is not listed as being a prohibited use in the zoning table in Part 2.

State Environmental Planning Policy (Major Projects) 2005

As outlined above, the Wilpinjong Coal Mine was approved under Part 3A of the EP&A Act by the NSW Minister for Planning in February 2006 (Project Approval 05-0021 – Attachment 1).

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries)* (Mining SEPP), which commenced on 16 February 2007, regularises the various environmental planning instruments that previously controlled mining activities.

Clause 5(3) of the Mining SEPP gives it primacy where there is an inconsistency between the provisions of the Mining SEPP and the provisions of any other environmental planning instrument (except the *State Environmental Planning Policy (Major Projects) 2005* [Major Projects SEPP], *State Environmental Planning Policy No. 14 [Coastal Wetlands]* and *State Environmental Planning Policy No. 26 [Littoral Rainforest]*).

- ***Clause 2***

Clause 2 sets out the aims of the Mining SEPP as follows:

> *(a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and*
>
> *(b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and*
>
> *(c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.*

- ***Clause 7***

Clause 7 (1) of the Mining SEPP states that development for any of the following purposes may be carried out only with development consent:

> *(b) mining carried out:*
>
> *…*
>
> *(ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999.*

The modified Wilpinjong Coal Mine comprises mining within Mining Lease (ML) 1573.

- ***Clause 8***

Clause 8 of the Mining SEPP provides:

> *8 Determination of permissibility under local environmental plans*
>
> *(1) If a local environmental plan provides that development for the purposes of mining, petroleum production or extractive industry may be carried out on land with development consent if provisions of the plan are satisfied:*
>
> *(a) development for that purpose may be carried out on that land with development consent without those provisions having to be satisfied, and*
>
> *(b) those provisions have no effect in determining whether or not development for that purpose may be carried out on that land or on the determination of a development application for consent to carry out development for that purpose on that land.*
>
> *(2) Without limiting subclause (1), if a local environmental plan provides that development for the purposes of mining, petroleum production or extractive industry may be carried out on land with development consent if the consent authority is satisfied as to certain matters specified in the plan, development for that purpose may be carried out on that land with development consent without the consent authority having to be satisfied as to those specified matters.*

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

Clause 13 of SEPP 33 requires the consent authority, in considering a Development Application for a potentially hazardous or a potentially offensive industry, to take into account:

(c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and

(d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application)…

A PHA was conducted for the Project EIS in accordance with SEPP 33 to evaluate the potential hazards associated with the Wilpinjong Coal Project (Section 4.6). The proposed Modification does not significantly alter the consequences or likelihood of a hazardous event occurring at the Wilpinjong Coal Mine, as the operational activities on-site would be generally unchanged (Section 4.6).

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

SEPP 44 requires the consent authority for any Development Application in certain LGAs (including the former Mudgee LGA) 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 was conducted in the Project EIS. The assessment concluded that the land subject to the Wilpinjong Coal Project was not core Koala habitat and does not have a resident population of Koalas (Mount King Ecological Surveys, 2005). Therefore the provisions of SEPP 44 are not considered applicable to the proposed Modification.

State Environmental Planning Policy No. 55 (Remediation of Land)

SEPP 55 aims to provide a State-wide planning approach to the remediation of contaminated land. Under SEPP 55, planning authorities are required to consider the potential for contamination to adversely affect the suitability of the site for its proposed use.

A consent authority must consider the following under clause 7(1):

(a) whether the land is contaminated, and

(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and

(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

Further, under clause 7(2), before determining an application for consent to carry out development that would involve a change of use of land, the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned, carried out in accordance with the contaminated land planning guidelines.

Because the proposed Modification is within the existing ML 1573 and the approved extent of mining and contained infrastructure area, no change of use is proposed and no preliminary land contamination investigation is required.

Water Management Act, 2000

Under the NSW *Water Management Act, 2000,* the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009* (Water Sharing Plan) commenced on 1 August 2009. Wollar Creek and its tributaries fall within Goulburn Extraction Management Unit of the Water Sharing Plan.

Clause 4 of the Water Sharing Plan provides that the plan applies to the following waters:

> *(3) Subject to subclause (4), these water sources include:*
>
> > *(a) all water occurring naturally on or below the surface of the ground shown on the registered plan for these water sources, and*
> >
> > *(b) all water in rivers, lakes and wetlands in these water sources, and*
> >
> > *(c) all water contained within all alluvial sediments below the surface of the land shown on the registered plan for these water sources (hereafter the alluvial sediments in these water sources)…*
>
> *…*
>
> *(4) These water sources do not include:*
>
> *…*
>
> > *(c) any water contained in fractured rock aquifers and basement rocks in these water sources,*
>
> *…*

As clause 4 of the Water Sharing Plan excludes fractured rock and basement rock aquifers and because no separate water sharing plan applicable to those aquifers has commenced, the *Water Act, 1912* remains the relevant Act for the licensed groundwater extractions from non-alluvial aquifers in the Wilpinjong Coal Mine open pits and production borefield.

Environment Protection and Biodiversity Conservation Act, 1999

The objective of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) is to provide for the protection of those aspects of the environment that are of *national environmental significance.* Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a *controlled action* under the EPBC Act. Proposals that are, or may be, a controlled action are required to be referred to the Commonwealth Minister for the Environment to determine whether or not the action is a controlled action.

The Modification does not involve any alteration of the approved extent of mining at the Wilpinjong Coal Mine and is not likely to have a significant impact on any protected matters listed under the EPBC Act. It has therefore not been referred to the Commonwealth Minister for the Environment for consideration under the EPBC Act, as no "controlled action" is proposed.

5.2 PLANS, LICENCES AND AGREEMENTS THAT REQUIRE REVISION

5.2.1 Project Approval Conditions

Condition 6, Schedule 2 of the Project Approval (Attachment 1) stipulates limits of approval as follows:

> *The Proponent shall not extract more than 13 million tonnes of ROM coal a year from the site.*

Condition 6, Schedule 2 of the Project Approval would require revision as a result of the Modification as follows:

> *The Proponent shall not extract more than **15** million tonnes of ROM coal a year from the site.*

Tables 1 and 2, Schedule 3 of the Project Approval (Attachment 1) provide land acquisition and noise impact assessment criteria. These tables would require revision to reflect recent changes in land ownership and amended noise impact criteria.

5.2.2 Environment Protection Licence Conditions

Condition L6 of the EPL provides noise limits for the operation.

This condition would require revision as a result of the Modification to match the revised conditions of the Project Approval.

5.2.3 Wilpinjong Coal Project Planning Agreement

It is anticipated that the DoP, MWRC and WCPL would review the Wilpinjong Coal Project Planning Agreement as a result of the Modification. No significant changes to the existing agreement are anticipated.

5.2.4 Management/Monitoring Plans

Some management plans (e.g. the Noise Monitoring Programme and Air Quality Monitoring Programme) may require revision to reflect updated environmental management measures or changes to Project Approval conditions resulting from the Modification.

5.2.5 Mining Operations Plan

The current MOP (WCPL, 2008) would require revision to reflect the revised annual ROM coal, product coal and waste rock production rates as a result of the Modification.

6 REFERENCES

Aquaterra (2008) *Moolarben Stage 2 Groundwater Assessment.* Appendix 5 in Moolarben Coal Mines Pty Ltd (2009) *Moolarben Coal Project Stage 2 Environmental Assessment.*

EDAW Gillespies (2005) *Wilpinjong Coal Project Visual Impact Assessment*. Appendix N in Wilpinjong Coal Pty Ltd (2005) *Wilpinjong Coal Project Environmental Impact Statement.*

Gilbert and Associates (2010) *Wilpinjong Coal Project Site Water Balance*.

Gillespie Economics (2005) *Wilpinjong Coal Project Economic Assessment.* Appendix I in Wilpinjong Coal Pty Ltd (2005) *Wilpinjong Coal Project Environmental Impact Statement.*

Gillespie Economics (2010) *Wilpinjong 75W Modification Socio-Economic Assessment.*

Halcrow (2010) *Wilpinjong Coal Mine - Mining Rate Modification Road Transport Assessment.*

Heggies (2007a) *Wilpinjong Coal Project Blasting Frequency Modification Blast Emission Impact Assessment.* Report prepared for Wilpinjong Coal Pty Limited.

Heggies (2007b) *Wilpinjong Coal Project Operational Phase Access Route Modification Traffic Noise Impact Assessment.* Report prepared for Wilpinjong Coal Pty Limited.

Heggies (2010) *Wilpinjong Coal Mine - 75W Modification Noise Impact Assessment.*

Holmes Air Sciences (2005) *Air Quality Impact Assessment: Wilpinjong Coal Project.* Appendix E in Wilpinjong Coal Pty Limited (2005) *Wilpinjong Coal Project Environmental Impact Statement.*

J. Wyndham Prince Pty Ltd (JWP) (2006) *Route Assessment Report - Wilpinjong Coal Project.* Report prepared for Wilpinjong Coal Pty Limited.

Martin and Associates Pty Ltd (2005) *Wilpinjong Coal Project Community Infrastructure Assessment.* Appendix J in Wilpinjong Coal Pty Limited (2005) *Wilpinjong Coal Project Environmental Impact Statement.*

Moolarben Coal Mines Pty Ltd (2009) *Moolarben Coal Project Stage 2 Environmental Assessment.*

Mount King Ecological Surveys (2005) *Wilpinjong Coal Project Terrestrial Fauna Assessment*. Appendix HB in Wilpinjong Coal Project Environmental Impact Assessment.

PAEHolmes (2010) *Air Quality Impact Assessment Wilpinjong Coal Mine Modification.*

Richard Heggie Associates (2005) *Wilpinjong Coal Project Construction, Operation and Transportation Noise and Blasting Impact Assessment.* Appendix D in Wilpinjong Coal Pty Limited (2005) *Wilpinjong Coal Project Environmental Impact Statement.*

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Ulan Coal Mines Limited (2009) *Ulan Coal - Continued Operations Environmental Assessment.*

Wilpinjong Coal Pty Limited (2005) *Wilpinjong Coal Project Environmental Impact Statement.*

Wilpinjong Coal Pty Limited (2006a) *Wilpinjong Coal Project Erosion and Sediment Control Plan.*

Wilpinjong Coal Pty Limited (2006b) *Wilpinjong Coal Project Surface Water Management and Monitoring Plan.*

Wilpinjong Coal Pty Limited (2006c) *Wilpinjong Coal Project Groundwater Monitoring Programme.*

Wilpinjong Coal Pty Limited (2006d) *Wilpinjong Coal Project Rehabilitation Management Plan.*

Wilpinjong Coal Pty Limited (2006e) *Wilpinjong Coal Project Spontaneous Combustion Management Plan.*

Wilpinjong Coal Pty Limited (2008) *Wilpinjong Coal Mine Mining Operations Plan (ML 1573).*

Wilpinjong Coal Pty Limited (2009) *Wilpinjong Coal Mine Noise Monitoring Programme.*

Wilpinjong Coal Pty Limited (2010a) *Wilpinjong Coal Mine Annual Environmental Management Report*.

Wilpinjong Coal Pty Limited (2010b) *Wilpinjong Coal Mine Air Quality Monitoring Programme.*

Wilpinjong Coal Pty Limited (2010c) *Wilpinjong Coal Mine Blast Management Plan and Blast Monitoring Programme.*

Wilpinjong Coal Pty Limited (2010d) *Wilpinjong Coal Mine Aboriginal and Cultural Heritage Management Plan and North Eastern Wiradjuri Cultural Heritage Management Plan.*

Attachment 1




Wilpinjong Coal Mine
Consolidated Project Approval

Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

I, the Minister for Planning, approve the project referred to in schedule 1, subject to the conditions in schedules 2 to 5.

These conditions are required to:
- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

SIGNED

Frank Sartor MP
Minister for Planning

Sydney 1 FEBRUARY 2006 File No: S04/00699

Red type represents November 2007 modification.

SCHEDULE 1

Application No:	05-0021.
Proponent:	Wilpinjong Coal Pty Limited.
Approval Authority:	Minister for Planning.
Land:	See Appendix 1.
Project:	Wilpinjong Coal Project.
Major Project:	The proposal is classified as a Major Project under section 75B(1)(a) of the *Environmental Planning and Assessment Act 1979*, because it is a development of a kind described in clause 5 of schedule 1 to *State Environmental Planning Policy (Major Projects) 2005*.

TABLE OF CONTENTS

DEFINITIONS

AEMR	Annual Environmental Management Report
ARTC	Australian Rail Track Corporation Ltd
Proponent	Wilpinjong Coal Pty Limited, or its successors
BCA	Building Code of Australia
CCC	Community Consultative Committee
Council	Mid-Western Regional Council
Day	Day is defined as the period from 7am to 6pm on Monday to Saturday, and 8am to 6pm on Sundays and Public Holidays
DECC	Department of Environment and Climate Change
Department	Department of Planning
Director-General	Director-General of Department of Planning, or delegate
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EEC	Endangered Ecological Community as defined under the NSW *Threatened Species Conservation Act 1995*
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
Evening	Evening is defined as the period from 6pm to 10pm
Land	Land means the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Mine Water	Water that accumulates within active mining areas, coal rejects emplacement areas, tailings dams and infrastructure areas
Minister	Minister for Planning, or delegate
Night	Night is defined as the period from 10pm to 7am on Monday to Saturday, and 10pm to 8am on Sundays and Public Holidays
Offset Strategy	The enhancement and regeneration program described in the EIS for the Wilpinjong Coal Project, dated May 2005
Privately owned land	Land that is not owned by a public agency, or a mining company or its subsidiary
ROM	Run of Mine
RTA	Roads and Traffic Authority
Site	Land to which the Project Application applies

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
   (a) Project Application 05-0021;
   (b) EIS titled *Wilpinjong Coal Project EIS*, volumes 1-5, dated May 2005, and prepared by Resource Strategies Pty Ltd; and
   (c) Modification Application 05_0021-1 and EA titled *Wilpinjong Coal Project Operational Phase Mine Access Route and Blasting Frequency Modification*, dated April 2007, and prepared by Resource Strategies Pty Ltd;
   (d) the proponent's Statement of Commitments for this modification, dated 10 August 2007 (see Appendix 8); and
   (e) conditions of this approval.

3. If there is any inconsistency between the above documents, the latter document shall prevail over the former to the extent of the inconsistency. However, the conditions of this approval shall prevail over all other documents to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
   (a) any reports, plans or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans or correspondence.

Limits on Approval

5. Apart from the conditions relating to the Rehabilitation and Landscape Management Plan, this approval expires 21 years after the grant of a mining lease for the project.

   Note: Under this approval, the Proponent is required to implement the Rehabilitation and Landscape Management Plan for the life of the impact (as determined by the Director-General in consultation with the DPI). This approval will continue to operate during this period.

6. The Proponent shall not extract more than 13 million tonnes of ROM coal a year from the site.

7. The Proponent shall not beneficiate more than 8.5 million tonnes of ROM coal a year at the Coal Handling and Preparation Plant.

8. The Proponent shall only transport coal from the site by rail.

Management Plans/Monitoring Programs

9. With the approval of the Director-General, the Proponent may prepare and submit any management plan or monitoring program required by this approval on a progressive basis. Where a management plan and monitoring program is required before carrying out any development, or stage of development, the plans/programs may be prepared and submitted in relation to either discrete components of the project or for a specified time period.

Structural Adequacy

10. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

    Notes:
    - *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for the proposed building works.*
    - *Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.*

Demolition

11. The Proponent shall ensure that all demolition work is carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures*, or its latest version.

Operation of Plant and Equipment

12. The Proponent shall ensure that all plant and equipment used at the site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

Planning Agreement

13. Within 3 months of this approval, the Proponent shall enter into a planning agreement with Council, in accordance with Division 6 of Part 4 of the EP&A Act, and the terms of the offer made to the Council on 15 December 2005 by the Proponent which must include the matters set out in Appendix 2.

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Proponent shall acquire the land in accordance with the procedures in conditions 10-12 of schedule 4.

Table 1: Land subject to acquisition upon request

30 – Gaffney	45 – Smith
5 - Power	

Note: For more information on the numbering and identification of properties used in this approval, see Figures 1-5 and 1-6 in Volume 1 of the Wilpinjong Coal Project EIS, dated May 2005.

NOISE

Noise Impact Assessment Criteria

2. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in Table 2.

Table 2: Noise impact assessment criteria dB(A)

Day	Evening	Night		Land Number
$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$	
35	35	40	45	4 - Robinson
35	38	39	45	60A - Reid
35	37	39	45	49 - Harkin
35	35	37	45	29 - Kattau
				59 – Langshaw
35	35	36	45	90 – Pattullo
35	39	39	45	58 – Maher
				52A – Long
				52B – Long
				53 – Reynolds
				55 – Fox
				56 – Rogers
35	38	38	45	23A - Bloomfield
35	37	37	45	23B - Bloomfield
				31A - Conradt
35	36	36	45	31B - Conradt
36	35	35	45	Wollar - Residential
35	35	35	45	All other privately owned land, excluding the land listed in Table 1
35	35	35	-	901 – Wollar School
40	40	40	-	150A – St Luke's Anglican Church
				900 – St Laurence O'Toole Catholic Church
50	50	50	-	Goulburn River National Park/Munghorn Gap Nature Reserve

However, if the Proponent has a written negotiated noise agreement with any landowner of the land listed in Table 2, and a copy of this agreement has been forwarded to the Department and the DECC, then the Proponent may exceed the noise limits in Table 2 in accordance with the negotiated noise agreement.

Notes:

a) Noise from the project is to be measured at the most affected point or within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary, to determine compliance with the $L_{Aeq(15\ minute)}$ noise limits in the above table. Where it can be demonstrated that direct measurement of noise from the project is impractical, the DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.

b) Noise from the project is to be measured at 1 metre from the dwelling façade to determine compliance with the $L_{A1(1\ minute)}$ noise limits in the above table. Where it can be demonstrated that direct measurement of noise from the project is impractical, the DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).

c) For the Goulburn River National Park/Munghorn Nature Reserve noise levels are to be assessed at the most affected point within 50 metres of the Goulburn River National Park/Munghorn Nature Reserve. The limit applies when the area is in use.

d) The noise emission limits identified in the above table apply under meteorological conditions of:

- *wind speeds of up to 3 m/s at 10 metres above ground level; or*
- *temperature inversion conditions of up to 3ºC/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.*

Land Acquisition Criteria

3. If the noise generated by the project exceeds the criteria in Table 3, the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 10-12 of schedule 4.

Table 3: Land acquisition criteria dB(A)

Day/Evening/Night $L_{Aeq(15\ minute)}$	***Land***
40	*All privately owned land, excluding the land listed in Table 1*

Note: Noise generated by the project is to be measured in accordance with the notes presented below Table 2.

Cumulative Noise Criteria

4. The Proponent shall take all reasonable and feasible measures to ensure that the noise generated by the project combined with the noise generated by other mines does not exceed the following amenity criteria on any privately owned land, excluding the land listed in Table 1, to the satisfaction of the Director-General:
   - $L_{Aeq(11\ hour)}$ *50 dB(A) – Day;*
   - $L_{Aeq(4\ hour)}$ *45 dB(A) – Evening; and*
   - $L_{Aeq(9\ hour)}$ *40 dB(A) – Night.*

5. If the cumulative noise generated by the project combined with the noise generated by other mines exceeds the following amenity criteria on any privately owned land, excluding the land listed in Table 1, then upon receiving a written request from the landowner, the Proponent shall take all reasonable and feasible measures to acquire the land on as equitable basis as possible with the relevant mines, in accordance with the procedures in conditions 10-12 of schedule 4, to the satisfaction of the Director-General:
   - $L_{Aeq(11\ hour)}$ *53 dB(A) – Day;*
   - $L_{Aeq(4\ hour)}$ *48 dB(A) – Evening; and*
   - $L_{Aeq(9\ hour)}$ *43 dB(A) – Night.*

Additional Noise Mitigation Measures

6. Upon receiving a written request from:
   - a landowner of the land listed in Table 1 (unless the landowner has requested acquisition); or
   - the owner of any residence where subsequent noise monitoring shows the noise generated by the project is greater than, or equal to, $L_{Aeq(15\ minute)}$ 38 dB(A) (except where a negotiated noise agreement is in place),

   the Proponent shall implement additional noise mitigation measures such as double glazing, insulation, and/or air conditioning at any residence on the land in consultation with the landowner. These additional mitigation measures must be reasonable and feasible. If within 3 months of receiving this request from the landowner, the Proponent and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Director-General for resolution.

Continuous Improvement

7. The Proponent shall:
    (a) implement all reasonable and feasible best practice noise mitigation measures;
    (b) investigate ways to reduce the noise generated by the project, including off-site road and rail noise and maximum noise levels which may result in sleep disturbance; and
    (c) report on these investigations and the implementation and effectiveness of these measures in the AEMR,

    to the satisfaction of the Director-General.

Monitoring

8. Prior to carrying out any development, the Proponent shall prepare (and following approval implement) a Noise Monitoring Program for the project, to the satisfaction of the Director-General. The Noise Monitoring Program must include a combination of real-time and supplementary attended monitoring measures, and a noise monitoring protocol for evaluating compliance with the noise impact assessment and land acquisition criteria in this approval.

BLASTING AND VIBRATION

Airblast Overpressure Criteria

9. The Proponent shall ensure that the airblast overpressure level from blasting at the project does not exceed the criteria in Table 4 at any residence on privately owned land.

Table 4: Airblast overpressure impact assessment criteria

Airblast overpressure level (dB(Lin Peak))	Allowable exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

Ground Vibration Impact Assessment Criteria

10. The Proponent shall ensure that the ground vibration level from blasting at the project does not exceed the criteria in Table 5 at any residence on privately owned land.

Table 5: Ground vibration impact assessment criteria

Peak particle velocity (mm/s)	Allowable exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

Blasting Hours

11. The Proponent shall only carry out blasting at the project between 9am and 5pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the DECC.

Blasting Frequency

12. The Proponent shall comply with the following blasting restrictions on site:
    (a) a maximum of 2 blasts per day;
    (b) a maximum of 5 blasts per week, averaged over any 12 month period;
    (c) a maximum of 2 blasts per week where the maximum instantaneous charge (MIC) is greater than 400kg; and
    (d) a maximum of 1 blast per week where the MIC is greater than 400kg, when averaged over any 12 month period.

    However the Director-General may approve minor variations to these restrictions for short periods of time.

Operating Conditions

13. During mining operations, the Proponent shall:
    (a) implement best blasting practice to:
        - protect the safety of people and livestock in the area surrounding blasting operations;
        - protect public or private infrastructure/property in the area surrounding blasting operations from blasting damage; and
        - minimise the dust and fume emissions from blasting at the project;
    (b) limit temporary blasting related road closures to 1 per day; and
    (c) co-ordinate timing of blasting on site with the timing of blasting at the adjoining Moolarben coal mine to minimise the potential cumulative blasting impacts of the two mines,

    to the satisfaction of the Director-General.

14. Prior to carrying out any blasting within 500 metres of a public road or railway, the Proponent must obtain approval from Council (in respect of public roads) and ARTC (in respect of the Gulgong-Sandy Hollow railway).

Public Notice

15. During the life of the project, the Proponent shall:
    (a) notify the landowner/occupier of any residence within 2 km of the project who registers an interest in being notified about the blasting schedule at the mine;
    (b) operate a Blasting Hotline, or alternate system agreed to by the Director-General, to enable the public to get up-to-date information on the blasting schedule at the project; and
    (c) advertise the blasting hotline number in a local newspaper at least 4 times each year,

    to the satisfaction of the Director-General.

Property Inspections

16. Within 3 months of this approval, the Proponent shall advise all landowners within 2 km of the project that they are entitled to a structural property inspection.

17. If the Proponent receives a written request for a structural property inspection from any landowner within 2 km of the project, the Proponent shall within 3 months of receiving this request:
    (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to inspect the condition of any building or structure on the land, and recommend measures to mitigate any potential blasting impacts; and
    (b) give the landowner a copy of the property inspection report.

Property Investigations

18. If any landowner within 2 km of the site claims that buildings and/or structures on his/her land have been damaged as a result of blasting at the project, the Proponent shall within 3 months of receiving this request:
    (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to investigate the claim; and
    (b) give the landowner a copy of the property investigation report.

    If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damages to the satisfaction of the Director-General.

    If the Proponent or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Director-General for resolution.

    If the matter cannot be resolved within 21 days, the Director-General shall refer the matter to an Independent Dispute Resolution Process (see Appendix 7).

Blast Monitoring Program

19. Prior to carrying out any blasting at the site, the Proponent shall prepare (and following approval implement) a detailed Blast Monitoring Program, to the satisfaction of the Director-General. The Blast Monitoring Program must include a protocol for evaluating blasting impacts on privately owned residences and public infrastructure (including the Gulgong-Sandy Hollow railway), and demonstrating compliance with the blasting criteria in this approval.

AIR QUALITY

Impact Assessment Criteria

20. The Proponent shall ensure that the dust emissions generated by the project do not cause additional exceedances of the air quality impact assessment criteria listed in Tables 6, 7, and 8 at any residence on, or on more than 25 percent of, any privately owned land (excluding property 5 – Power).

Table 6: Long term impact assessment criteria for particulate matter

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 $\mu g/m^3$
Particulate matter < 10 µm (PM_{10})	Annual	30 $\mu g/m^3$

Table 7: Short term impact assessment criterion for particulate matter

Pollutant	Averaging period	Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	50 $\mu g/m^3$

Table 8: Long term impact assessment criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS 3580.10.1-1991: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

Land Acquisition Criteria

21. If the dust emissions generated by the project exceed the criteria in Tables 9, 10, and 11 at any residence on, or on more than 25 percent of, any privately owned land, the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 10-12 of schedule 4.

Table 9: Long term land acquisition criteria for particulate matter

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 $\mu g/m^3$
Particulate matter < 10 µm (PM_{10})	Annual	30 $\mu g/m^3$

Table 10: Short term land acquisition criteria for particulate matter

Pollutant	Averaging period	Criterion	Percentile[1]	Basis
Particulate matter < 10 µm (PM_{10})	24 hour	150 µg/m^3	99[2]	Total[3]
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3	98.6	Increment[4]

[1]Based on the number of block 24 hour averages in an annual period.
[2]Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Director-General in consultation with the DECC.
[3]Background PM_{10} concentrations due to all other sources plus the incremental increase in PM_{10} concentrations due to the mine alone.
[4]Incremental increase in PM_{10} concentrations due to the mine alone.

Table 11: Long term land acquisition criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS 3580.10.1-1991: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

Operating Conditions

22. The Proponent shall:
    (a) ensure any visible air pollution generated by the project is assessed regularly, and that mining operations are relocated, modified, and/or stopped as required to minimise air quality impacts on privately owned land;
    (b) ensure real-time air quality monitoring for 24-hour average PM_{10} and the meteorological monitoring data are assessed regularly, and that mining operations are relocated, modified and/or stopped as required to ensure compliance with the relevant air quality criteria; and
    (c) implement all practicable measures to minimise the off-site odour and fume emissions generated by any spontaneous combustion at the project,

    to the satisfaction of the Director-General.

Monitoring

23. Prior to carrying out any development, the Proponent shall prepare (and following approval implement) a detailed Air Quality Monitoring Program to the satisfaction of the Director-General. The Air Quality Monitoring Program shall include a combination of real-time monitors, high volume samplers and dust deposition gauges to monitor the dust emissions of the project; and an air quality monitoring protocol for evaluating compliance with the air quality impact assessment and land acquisition criteria in this approval.

METEOROLOGICAL MONITORING

24. Prior to carrying out any development, the Proponent shall ensure that there is a suitable meteorological station operating in the vicinity of the project in accordance with the requirements in *Approved Methods for Sampling of Air Pollutants in New South Wales*, and to the satisfaction of the DECC and the Director-General.

SURFACE AND GROUND WATER

Discharge Limits

25. Except as may be expressly provided by a DECC Environment Protection Licence, the Proponent shall not discharge any Mine Water from the site.

Cumbo Creek Relocation

26. The Proponent shall design, construct, maintain, and rehabilitate the proposed relocation of Cumbo Creek, to the satisfaction of the Director-General.

27. Within one month of completing the construction of the Cumbo Creek relocation, the Proponent shall submit an as-executed report, certified by a practising registered engineer, to the Director-General.

28. Prior to destroying the original creek line, the Proponent shall demonstrate that the Cumbo Creek Relocation is operating successfully, in consultation with DWE, and to the satisfaction of the Director-General.

Site Water Management Plan

29. Prior to carrying out any development, the Proponent shall prepare (and following approval implement) a Site Water Management Plan for the mine, in consultation with the DWE, and to the satisfaction of the Director-General. This plan must be prepared by suitably qualified expert/s whose appointment/s have been approved by the Director-General, and must include:
   (a) a Cumbo Creek Relocation Plan;
   (b) a Site Water Balance;
   (c) an Erosion and Sediment Control Plan;
   (d) a Surface Water Management and Monitoring Plan;
   (e) a Ground Water Monitoring Program; and
   (f) a Surface and Ground Water Response Plan.

   Note: The Department accepts that the initial Site Water Management Plan may not include the detailed plans for the proposed relocation of Cumbo Creek. However, if this occurs, the Proponent will be required to seek approval from the Director-General for an alternative timetable for completion and approval of the Cumbo Creek Relocation Plan.

Cumbo Creek Relocation Plan

30. The Cumbo Creek Relocation Plan must include:
   (a) a vision statement for the creek relocation;
   (b) an assessment of the water quality, ecological, hydrological and geomorphic baseline conditions in Cumbo Creek;
   (c) the detailed design and specifications for the creek relocation;
   (d) a construction program for the creek relocation, describing how the work would be staged, and integrated with mining operations;
   (e) a revegetation program for the relocated creek using a range of suitable native species;
   (f) water quality, ecological, hydrological and geomorphic performance and completion criteria for the creek relocation based on the assessment of baseline conditions; and
   (g) a program to monitor and maintain the water quality, ecological, hydrological and geomorphic integrity of the creek relocation.

Site Water Balance

31. The Site Water Balance must:
   (a) include details of:
      - sources of water;
      - reliability of water supply;
      - water use on site;
      - water management on site;
      - off-site water transfers;
      - reporting procedures; and
   (b) describe measures to minimise water use by the project.

Erosion and Sediment Control

32. The Erosion and Sediment Control Plan must:
   (a) be consistent with the requirements of the Department of Housing's Managing Urban Stormwater: Soils and Construction manual;
   (b) identify activities that could cause soil erosion and generate sediment;
   (c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;
   (d) describe the location, function, and capacity of erosion and sediment control structures; and
   (e) describe what measures would be implemented to maintain the structures over time.

Surface Water Management and Monitoring

33. The Surface Water Management and Monitoring Plan must include:
   (a) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the project;
   (b) surface water and stream health assessment criteria;
   (c) a program to monitor surface water flows, quality and impacts on water users (upstream and downstream of the project in Wilpinjong and Cumbo Creeks);
   (d) a program to assess stream health conditions in Wilpinjong and Cumbo Creeks;
   (e) a program to monitor channel stability in Wilpinjong and Cumbo Creeks;
   (f) reporting procedures; and
   (g) a protocol for the investigation, notification, and mitigation of identified exceedances of the surface water and stream health assessment criteria.

Groundwater Monitoring

34. The Groundwater Monitoring Program must include:
   (a) detailed baseline data, based on sound statistical analysis, to benchmark the pre-mining natural variation in groundwater levels, yield and quality (including privately owned groundwater bores within the predicted drawdown impact zone identified in the EIS);
   (b) groundwater impact assessment criteria (including for monitoring bores and privately owned bores);
   (c) a program for accurately delineating the boundary of the Wilpinjong Creek alluvial aquifer in any areas intersected by mining;
   (d) a program to monitor:
      - impacts on the groundwater supply of potentially affected landowners;
      - impacts of the water supply borefield;
      - impacts on the Wilpinjong Creek alluvial aquifer;
      - connectivity and groundwater leakage to/from Cumbo Creek following relocation;
      - impacts on groundwater dependent ecosystems and riparian vegetation;
      - the volume of ground water seeping into the open cut mine workings;
      - regional ground water levels and quality in the alluvial, coal seam, and interburden aquifers; and
      - the groundwater pressure response in the surrounding coal measures.
   (e) procedures for the verification of the groundwater model; and
   (f) reporting procedures for the results of the monitoring program and model verification.

Surface and Ground Water Response Plan

35. The Surface and Ground Water Response Plan must include:
   (a) a protocol for the investigation, notification and mitigation of any exceedances of the surface water, stream health and groundwater impact assessment criteria;
   (b) measures to mitigate and/or compensate potentially affected landowners with privately owned groundwater bores within the predicted drawdown impact zone identified in the EIS, including provision of alternative long term supply of water to the affected landowner that is equivalent to the loss attributed to the project;
   (c) measures to mitigate and/or compensate potentially affected landowners for the loss of surface water flows in Wilpinjong Creek downstream of the open cut;
   (d) measures to minimise, prevent or offset groundwater leakage from the Wilpinjong Creek alluvial aquifer if the rate of leakage exceeds EIS predictions;
   (e) measures to mitigate any direct hydraulic connection between the backfilled open cut and the Wilpinjong Creek and Cumbo Creek alluvium if the potential for adverse impacts is detected; and
   (f) the procedures that would be followed if any unforeseen impacts are detected during the project.

36. Within 6 months of the Independent Environmental Audit (see condition 7 in schedule 5), the Proponent shall update the Site Water Management Plan to the satisfaction of the Director-General.

REHABILITATION AND LANDSCAPE MANAGEMENT

37. The Proponent shall:
   (a) implement the Offset Strategy described in the EIS and summarised in Table 12 (shown conceptually in Appendix 3) ; and
   (b) progressively rehabilitate the site in a manner that is generally consistent with the final landform in the EIS (shown conceptually in Appendix 4),

   to the satisfaction of the Director-General.

Table 12: Offset Strategy

Area	Size
Enhancement and Conservation Areas	480 ha
Regeneration Areas	350 ha

38. Within 3 years of this approval, the Proponent shall make suitable arrangements to provide appropriate long term security for the Enhancement and Conservation Areas, to the satisfaction of the Director-General.

39. Within 12 months of this approval, in consultation with DECC:
    (a) secure ownership of land beyond the boundary of the site which contains sufficient areas of Yellow Box White Box Blakely's Red Gum Woodland EEC to satisfactorily offset the impacts of the project on the EEC; and
    (b) make suitable arrangements to secure the long term protection of this land,

    to the satisfaction of the Director-General.

Rehabilitation and Landscape Management Plan

40. Within 6 months of this approval, the Proponent must prepare (and following approval implement) a detailed Rehabilitation and Landscape Management Plan for the project, in consultation with DWE, DECC, DPI, and to the satisfaction of the Director-General. This plan must be prepared by suitably qualified expert/s whose appointment/s have been approved by the Director-General, and must include a:
    (a) Rehabilitation Management Plan;
    (b) Final Void Management Plan; and
    (c) Mine Closure Plan.

    Note: The Department accepts that the initial Rehabilitation and Landscape Management Plan may not include the detailed Final Void Management Plan and Mine Closure Plan. However, if this occurs, the Proponent will be required to seek approval from the Director-General for an alternative timetable for completion and approval of the Final Void Management Plan and Mine Closure Plan.

Rehabilitation Management Plan

41. The Rehabilitation Management Plan must include:
    (a) the rehabilitation objectives for the site;
    (b) a description of the short, medium, and long term measures that would be implemented to:
        - rehabilitate the site;
        - implement the Offset Strategy; and
        - manage the remnant vegetation and habitat on the site;
    (c) detailed assessment and completion criteria for the rehabilitation of the site;
    (d) a detailed description of how the performance of the rehabilitation of the mine would be monitored over time to achieve the stated objectives;
    (e) a detailed description of what measures would be implemented over the next 3 years to rehabilitate and manage the landscape of the site including the procedures to be implemented for:
        - progressively rehabilitating areas disturbed by mining;
        - implementing revegetation and regeneration within the Offset Strategy;
        - protecting areas outside the disturbance areas;
        - rehabilitating creeks on the site (including Wilpinjong Creek);
        - undertaking pre-clearance surveys;
        - managing impacts on fauna;
        - landscaping the site to minimise visual impacts;
        - conserving and reusing topsoil;
        - collecting and propagating seed for rehabilitation works;
        - salvaging and reusing material from the site for habitat enhancement;
        - controlling weeds and feral pests;
        - controlling access;
        - bushfire management;
        - managing any potential conflicts between the rehabilitation of the mine and Aboriginal cultural heritage; and
    (f) details of who is responsible for monitoring, reviewing, and implementing the plan.

Note: Reference to "rehabilitation" in this approval includes all works associated with the rehabilitation and restoration of the site as described in the EIS, and applies to all areas within the Mining Lease, Offset Strategy, and the areas proposed to be rehabilitated along Wilpinjong Creek.

Final Void Management

42. The Final Void Management Plan must:
    (a) justify the planned final location and future use of the final void/s;
    (b) incorporate design criteria and specifications for the final void/s based on verified groundwater modelling predictions and a re-assessment of post-mining groundwater equilibration;
    (c) assess the potential interactions between creeks on the site and the final void/s; and
    (d) describe what actions and measures would be implemented to:
        - minimise any potential adverse impacts associated with the final void; and
        - manage and monitor the potential impacts of the final void until the Mining Lease for the project is relinquished.

Mine Closure Plan

43. The Mine Closure Plan must:
    (a) define the objectives and criteria for mine closure;
    (b) investigate options for the future use of the site, including any final void/s;
    (c) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
    (d) describe how the performance of these measures would be monitored over time.

44. Within 6 months of the Independent Environmental Audit (see condition 7 in schedule 5), the Proponent shall update the Rehabilitation and Landscape Management Plan to the satisfaction of the Director-General.

Conservation Bond

45. Following the Independent Environmental Audit (see condition 7 in schedule 5) at the end of year 12 of the project, the Proponent shall lodge a conservation bond with the Department to ensure that there are sufficient resources available to fully implement the Offset Strategy. The size of the bond will be set by the Director-General, in consultation with the Proponent, at that time, of fully implementing the Offset Strategy in accordance with the completion criteria set out in the approved Rehabilitation and Landscape Management Plan. The bond will be adjusted by the Director-General, in consultation with the Proponent, after each subsequent Independent Environmental Audit.

    Notes:
    - *If the Offset Strategy is completed to the satisfaction of the Director-General, the Director-General will release the conservation bond.*
    - *If the Offset Strategy is not completed to the satisfaction of the Director-General, the Director-General will call in all or part of the conservation bond, and arrange for the satisfactory completion of the relevant works.*
    - *If amendments to the Mining Act 1992 allow the Minister for Mineral Resources to require rehabilitation securities under a Mining Lease which apply to the implementation of rehabilitation works outside the boundary of a Mining Lease, the Proponent may transfer the conservation bond required under this approval to the Minister of Mineral Resources provided the Director-General and the DPI agree to the transfer.*

ABORIGINAL CULTURAL HERITAGE

Archaeological Salvage Program

46. Prior to carrying out any development, the Proponent shall prepare and implement a salvage program for the project, in consultation with the DECC and the Aboriginal communities, and to the satisfaction of the Director-General.

47. Before the commencement of salvage operations, the Proponent shall ensure that a keeping place is established to temporarily house objects recovered from the salvage program.

48. The Proponent shall temporarily house the objects recovered during the salvage program in the keeping place established for the purpose, and in consultation with the DECC and the Aboriginal communities, replace the objects within the rehabilitated landscape.

Aboriginal Cultural Heritage Management Plan

49. Prior to carrying out any development, the Proponent shall prepare (and following approval implement) an Aboriginal Cultural Heritage Management Plan, in consultation with DECC and the Aboriginal communities, and to the satisfaction of the Director-General. The plan must include:
    (a) a detailed description of the measures that would be implemented to protect Aboriginal sites outside the project disturbance area;
    (b) a detailed monitoring program for Aboriginal sites 72, 152 and 153 (as shown in Appendix 5);
    (c) a description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the project; and
    (d) a protocol for the ongoing consultation and involvement of the Aboriginal communities in the conservation and management of Aboriginal cultural heritage on the site.

HERITAGE

50. The Proponent shall prepare an archival record of the remaining heritage sites listed in Table 3-20 of the EIS (shown in Appendix 6), prior to any activity associated with the project that may disturb these sites, in accordance with the requirements of the NSW Heritage Office, and to the satisfaction of the Director-General.

TRAFFIC AND TRANSPORT

Monitoring of Coal Transport

51. The Proponent shall:
    (a) keep records of the:
        - amount of coal transported from the site each year; and
        - number of coal haulage train movements generated by the project (on a daily basis); and
    (b) include these records in the AEMR.

Traffic Management

52. The Proponent shall design and construct:
    (a) the intersection of the internal mine access road with the Ulan-Wollar Road to the satisfaction of Council;
    (b) the realignment of the Ulan-Wollar Road to the satisfaction of the Council; and
    (c) the road-rail crossings of the Gulgong - Sandy Hollow railway to the satisfaction of the ARTC and Council.

Upgrade of Ulan-Wollar Road

52A By 31 March 2009, the Proponent shall, at its own expense, upgrade the Ulan-Wollar Road between the Ulan Road and the mine access road (including sealing and installation of appropriate line-marking and signage) to the satisfaction of Council.

Upgrade of Intersection between Ulan Road (MR 208/214) and Ulan-Wollar Road

52B By 30 June 2008, or prior to the Moolarben coal mine commencing construction, whichever is the sooner, the Proponent shall design and upgrade the existing intersection between the Ulan Road and the Ulan-Wollar Road, in conjunction with the owner of the Moolarben coal mine, to the satisfaction of the RTA.

Upgrade of Ulan Road (MR 208/214)

52C The Proponent shall, in consultation with Council, ensure that any money that would have been spent on the upgrading of the Wollar Road (arising from its planning agreement with Council, as specified in condition 2 of schedule 2) is reallocated to the upgrading of the Ulan Road and the Ulan-Wollar Road.

The Proponent shall pay Council an additional $20,000 each year for 3 years (with the payments due on 31 December in each of 2007, 2008 and 2009) to assist with the development of school bus lay-by areas along Ulan Road.

Program for the Implementation of Road Works

52D The Proponent shall:
    (a) prepare a detailed program for the staged upgrade of the Ulan Road and Ulan-Wollar Road in consultation with the RTA, Council, and the owner of the Moolarben coal mine to the satisfaction of the Director-General. This program must:

- be prepared by a suitably qualified expert/s whose appointment has been approved by the Director-General;
- include a detailed program to progressively implement these works;
- allocate the available funding in any relevant VPA or statement of commitments to these works; and

(b) following the approval of this program, implement the program in consultation with the RTA, Council and the owner of the Moolarben coal mine,

to the satisfaction of the Director-General.

Traffic Management

53 The Proponent shall co-ordinate the timing of shift changes on site with the timing of shift changes at the adjoining Ulan and Moolarben coal mines to minimise the potential cumulative traffic impacts of the shift changes at the three mines to the satisfaction of the Director-General.

VISUAL IMPACT

Visual Amenity

53. The Proponent shall minimise the visual impacts of the project to the satisfaction of the Director-General.

Lighting Emissions

54. The Proponent shall:

(a) take all practicable measures to mitigate off-site lighting impacts from the project; and

(b) ensure that all external lighting associated with the project complies with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*,

to the satisfaction of the Director-General.

GREENHOUSE GAS

55. The Proponent shall:

(a) monitor the greenhouse gas emissions generated by the project;

(b) investigate ways to reduce greenhouse gas emissions generated by the project; and

(c) report on greenhouse gas monitoring and abatement measures in the AEMR,

to the satisfaction of the Director-General.

WASTE MINIMISATION

56. The Proponent shall:

(a) monitor the amount of waste generated by the project;

(b) investigate ways to minimise waste generated by the project;

(c) implement reasonable and feasible measures to minimise waste generated by the project;

(d) ensure irrigation of treated wastewater is undertaken in accordance with DECC's *Environmental Guideline for the Utilisation of Treated Effluent*; and

(e) report on waste management and minimisation in the AEMR,

to the satisfaction of the Director-General.

SCHEDULE 4
ADDITIONAL PROCEDURES FOR AIR QUALITY AND NOISE MANAGEMENT

Notification of Landowners

1. The Proponent shall notify the landowners of the land listed in Table 1 in writing that they have the right to require the Proponent to acquire their land at any stage during the project.

2. If the results of the air quality and/or noise monitoring required in schedule 3 identify that the air pollution and/or noise generated by the project is greater than any of the air quality and/or noise criteria in schedule 3, except where this is predicted in the EIS and except where a negotiated air quality or noise agreement has been entered into, then the Proponent shall notify the Director-General and the affected landowners and/or existing or future tenants (including tenants of mine owned properties) accordingly, and provide quarterly monitoring results to each of these parties until the results show that the project is complying with the air quality and/or noise criteria in schedule 3.

3. Within 6 months of this approval, the Proponent shall develop a brochure to advise landowners and/or existing or future tenants (including tenants of mine owned properties) of the possible health and amenity impacts associated with exposure to particulate matter, in consultation with NSW Health, and to the satisfaction of the Director-General.

   The Proponent shall review relevant human health studies and update this brochure every 3 years, to the satisfaction of the Director-General.

   The Proponent shall provide this brochure (and associated updates) to:
   (a) all landowners and/or existing or future tenants (including tenants of mine owned properties) in areas where the air dispersion model predictions in the EIS identify that the dust emissions generated by the project are likely to be greater than the air quality land acquisition criteria in condition 22 of schedule 3; and
   (b) all landowners and/or existing or future tenants (including tenants of mine owned properties) of properties where the monitoring results identify that the mine is exceeding the air quality land acquisition criteria in condition 22 of schedule 3.

Independent Review

4. If a landowner considers the project to be exceeding the air quality and/or noise criteria in schedule 3, except where this is predicted in the EIS, then he/she may ask the Director-General in writing for an independent review of the air pollution and/or noise impacts of the project on his/her land.

   If the Director-General is satisfied that an independent review is warranted, the Proponent shall within 3 months of the Director-General advising that an independent review is warranted:
   (a) consult with the landowner to determine his/her concerns;
   (b) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to conduct air quality and/or noise monitoring on the land, to determine whether the project is complying with the relevant air quality and/or noise criteria in schedule 3, and identify the source(s) and scale of any air quality and/or noise impact on the land, and the project's contribution to this impact;
   (c) give the Director-General and landowner a copy of the independent review.

5. If the independent review determines that the project is complying with the relevant air quality and/or noise criteria in schedule 3, then the Proponent may discontinue the independent review with the approval of the Director-General.

6. If the independent review determines that the project is not complying with the relevant air quality and/or noise criteria in schedule 3, and that the project is primarily responsible for this non-compliance, then the Proponent shall:
   (a) take all reasonable and feasible measures, in consultation with the landowner, to ensure that the project complies with the relevant air quality and/or noise criteria; and
   (b) conduct further air quality and/or noise monitoring to determine whether these measures ensure compliance; or
   (c) secure a written agreement with the landowner to allow exceedances of the air quality and/or noise criteria in schedule 3,

   to the satisfaction of the Director-General.

   If the additional monitoring referred to above subsequently determines that the project is complying with the relevant air quality and/or noise criteria in schedule 3, then the Proponent may discontinue the independent review with the approval of the Director-General.

If the measures referred to in (a) do not achieve compliance with the air quality and/or noise land acquisition criteria in schedule 3, and the Proponent cannot secure a written agreement with the landowner to allow these exceedances within 3 months, then the Proponent shall, upon receiving a written request from the landowner, acquire the landowner's land in accordance with the procedures in conditions 10-12 below.

7. If the independent review determines that the relevant air quality and/or noise criteria in schedule 3 are being exceeded, but that more than one mine is responsible for this non-compliance, then the Proponent shall:
   (a) take all reasonable and feasible measures with the relevant mine/s, in consultation with the landowner, to ensure that the relevant air quality and/or noise criteria are complied with; and
   (b) conduct further air quality and/or noise monitoring to determine whether these measures ensure compliance; or
   (c) secure a written agreement with the landowner and other relevant mines to allow exceedances of the air quality and/or noise criteria in schedule 3,

   to the satisfaction of the Director-General.

8. If the independent review determines that the relevant air quality and/or noise land acquisition criteria in schedule 3 are being exceeded at the residence and/or on the landowner's land, and that more than one mine is responsible for this non-compliance, and the Proponent cannot secure a written agreement with the landowner to allow these exceedances within 3 months, then upon receiving a written request from the landowner, the Proponent shall acquire all or part of the landowner's land on as equitable a basis as possible with the relevant mine/s in accordance with the procedures in conditions 10-12 below.

   If the Proponent is unable to finalise an agreement with the landowner and/or other mine/s, then the Proponent or landowner may refer the matter to the Director-General for resolution.

   If the matter cannot be resolved within 21 days, the Director-General shall refer the matter to an Independent Dispute Resolution Process.

   If, following the Independent Dispute Resolution Process, the Director-General decides that the Proponent shall acquire all or part of the landowner's land, then the Proponent shall acquire this land in accordance with the procedures in conditions 10-12 below.

9. If the landowner disputes the results of the independent review, either the Proponent or the landowner may refer the matter to the Director-General for resolution.

   If the matter cannot be resolved within 21 days, the Director-General shall refer the matter to an Independent Dispute Resolution Process.

Land Acquisition

10. Within 3 months of receiving a written request from a landowner with acquisition rights, the Proponent shall make a binding written offer to the landowner based on:
    (a) the current market value of the landowner's interest in the property at the date of this written request, as if the property was unaffected by the project the subject of the project application, having regard to the:
        - existing and permissible use of the land, in accordance with the applicable planning instruments at the date of the written request; and
        - presence of improvements on the property and/or any approved building or structure which has been physically commenced at the date of the landowner's written request, and is due to be completed subsequent to that date, but excluding any improvements that have resulted from the implementation of condition 6 of schedule 3;
    (b) the reasonable costs associated with:
        - relocating within the Mid-Western Regional local government area, or to any other local government area determined by the Director-General;
        - obtaining legal advice and expert advice for determining the acquisition price of the land, and the terms upon which it is required; and
    (c) reasonable compensation for any disturbance caused by the land acquisition process.

    However, if at the end of this period, the Proponent and landowner cannot agree on the acquisition price of the land, and/or the terms upon which the land is to be acquired, then either party may refer the matter to the Director-General for resolution.

    Upon receiving such a request, the Director-General shall request the President of the NSW Division of the Australian Property Institute to appoint a qualified independent valuer or Fellow of the Institute, to consider submissions from both parties, and determine a fair and reasonable acquisition price for the land, and/or terms upon which the land is to be acquired.

Within 14 days of receiving the independent valuer's determination, the Proponent shall make a written offer to purchase the land at a price not less than the independent valuer's determination.

If the landowner refuses to accept this offer within 6 months of the date of the Proponent's offer, the Proponent's obligations to acquire the land shall cease, unless otherwise agreed by the Director-General.

11. The Proponent shall bear the costs of any valuation or survey assessment requested by the independent valuer, or the Director-General and the costs of determination referred above.

12. If the Proponent and landowner agree that only part of the land shall be acquired, then the Proponent shall pay all reasonable costs associated with obtaining Council approval for any plan of subdivision, and registration of the plan at the Office of the Registrar-General.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, MONITORING, AUDITING AND REPORTING

ENVIRONMENTAL MANAGEMENT STRATEGY

1. Prior to carrying out any development, the Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Director-General. This strategy must:
   (a) provide the strategic context for environmental management of the project;
   (b) identify the statutory requirements that apply to the project;
   (c) describe in general how the environmental performance of the project would be monitored and managed during the project;
   (d) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the project;
      - respond to any non-compliance;
      - manage cumulative impacts; and
      - respond to emergencies;
   (e) describe the role, responsibility, authority, and accountability of all the key personnel involved in environmental management of the project; and
   (f) be updated following each Independent Environmental Audit required by condition 7 below.

2. Within 6 months of the completion of the Independent Environmental Audit (see condition 7 below), the Proponent shall review, and if necessary revise, the Environmental Management Strategy to the satisfaction of the Director-General.

2A. Within 3 months of any modification to this approval, the Proponent shall review and if necessary revise all strategies/plans/programs required under this approval which are relevant to the modification to the satisfaction of the Director-General.

ENVIRONMENTAL MONITORING PROGRAM

3. Within 6 months of this approval, the Proponent shall prepare an Environmental Monitoring Program for the project in consultation with relevant agencies, and to the satisfaction of the Director-General. This program must consolidate the various monitoring requirements in schedule 3 of this approval into a single document.

4. Within 6 months of the completion of the Independent Environmental Audit (see condition 6 below), the Proponent shall review, and if necessary revise, the Environmental Monitoring Program to the satisfaction of the Director-General.

INCIDENT REPORTING

5. Within 7 days of detecting an exceedance of the limits/performance criteria in this approval or an incident causing (or threatening to cause) material harm to the environment; the Proponent shall report the exceedance/incident to the Department (and any relevant agency). The report must:
   (a) describe the date, time, and nature of the exceedance/incident;
   (b) identify the cause (or likely cause) of the exceedance/incident;
   (c) describe what action has been taken to date; and
   (d) describe the proposed measures to address the exceedance/incident.

ANNUAL REPORTING

6. Within 12 months of this approval, and annually thereafter, the Proponent shall submit an Annual Environmental Management Report (AEMR) to the Director-General and the relevant agencies. This report must:
   (a) identify the standards and performance measures that apply to the project;
   (b) describe the works carried out in the last 12 months;
   (c) describe the works that will be carried out in the next 12 months;
   (d) include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;
   (e) include a summary of the monitoring results for the project during the past year;
   (f) include an analysis of these monitoring results against the relevant:
      - impact assessment criteria/limits;
      - monitoring results from previous years; and
      - predictions in the EIS;
   (g) identify any trends in the monitoring results over the life of the project;

(h) identify any non-compliance during the previous year; and
(i) describe what actions were, or are being, taken to ensure compliance.

INDEPENDENT ENVIRONMENTAL AUDIT

7. At the end of year 2 of the project, and every 3 years thereafter, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
   (a) be conducted by a suitably qualified, experienced, and independent team of experts whose appointment has been endorsed by the Director-General;
   (b) include consultation with the relevant agencies;
   (c) assess, in respect of the requirements of this approval and any relevant mining lease or environment protection licence, the environmental performance of the project and its effects on the surrounding environment;
   (d) assess whether the project is complying with relevant standards and performance measures specified in these approvals (including under any strategy, plan or program required under these approvals) and with other statutory requirements;
   (e) review the adequacy of strategies, plans or programs required under these approvals; and, if necessary,
   (f) recommend measures or actions to improve the environmental performance of the project, and/or any strategy, plan or program required under these approvals.

   Note: This audit team must be led by a suitably qualified auditor and include experts in the fields of water management, noise management and mine rehabilitation.

8. Within 6 weeks of completing this audit, or as otherwise agreed by the Director-General, the Proponent shall submit a copy of the audit report to the Director-General with a response to any recommendations contained in the audit report.

8A. Within 3 months of submitting the audit report to the Director-General, the Proponent shall review and if necessary revise the strategies/plans/programs required under this approval, to the satisfaction of the Director-General.

ENVIRONMENTAL MANAGER

9. Prior to carrying out any development, the Proponent shall employ a suitably qualified and experienced Environmental Manager, whose appointment has been endorsed by the Director-General, for the duration of the project to oversee the environmental performance of the project and compliance with the conditions of this approval.

COMMUNITY CONSULTATIVE COMMITTEE

10. Within 3 months of this approval, the Proponent shall establish a Community Consultative Committee (CCC) to oversee the environmental performance of the project. The CCC shall:
   (a) be comprised of:
      - 2 representatives from the Proponent, including the person responsible for environmental management at the mine;
      - at least 1 representative from Council (if available); and
      - at least 2 representatives from the local community,

      whose appointment has been approved by the Director-General in consultation with the Council. The local community representative positions will be re-appointed every two years unless otherwise agreed by the Director-General;
   (b) be chaired by an independent chairperson, whose appointment has been approved by the Director-General;
   (c) meet at least twice a year;
   (d) review the Proponent's performance with respect to environmental management and community relations;
   (e) undertake regular inspections of the mine operations;
   (f) review community concerns or complaints about the mine operations, and the Proponent's complaints handling procedures; and
   (g) provide advice to:
      - the Proponent on improved environmental management and community relations, including the provision of information to the community and the identification of community initiatives to which the Proponent could contribute;
      - the Department regarding the conditions of this approval; and
      - the general community on the performance of the mine with respect to environmental management and community relations; and

(h) be operated generally in accordance with any guidelines the Department may publish in regard to the operation of Community Consultative Committees for mining projects.

Note: The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Proponent complies with this approval.

11. The Proponent shall, at its own expense:
    (a) ensure that 2 of its representatives attend CCC meetings;
    (b) provide the CCC with regular information on the environmental performance and management of the project;
    (c) provide meeting facilities for the CCC;
    (d) arrange site inspections for the CCC, if necessary;
    (e) take minutes of the CCC meetings;
    (f) make these minutes available to the public;
    (g) respond to any advice or recommendations the CCC may have in relation to the environmental management or community relations; and
    (h) forward a copy of the minutes of each CCC meeting, including a response to any recommendations from the CCC, to the Director-General within a month of the CCC meeting.

ACCESS TO INFORMATION

12. Within 3 months of the approval of any plan/strategy/program required under this approval (or any subsequent revision of these plans/strategies/programs), the completion of the Independent Environmental Audits required under this approval, or the completion of the AEMR, the Proponent shall:
    (a) provide a copy of the relevant document/s to the Council, relevant agencies and the CCC;
    (b) ensure that a copy of the relevant document/s is made publicly available at the mine; and;
    (c) put a copy of the relevant document/s on the Proponent's website;

    to the satisfaction of the Director-General.

13. During the life of the project, the Proponent shall:
    (a) make a summary of monitoring results required under this approval publicly available at the mine and on its website; and
    (b) update these results on a regular basis (at least every 2 months),

    to the satisfaction of the Director-General.

APPENDIX 1
SCHEDULE OF LAND

Freehold Land

Property	Owner	Property	Owner
Lot 10 DP 703223	Cumbo Coal Pty. Ltd.	Lot 1 DP 727117	Cumbo Land Pty. Ltd.
Lot 123 DP 755425	Cumbo Coal Pty. Ltd.	Lot 100 DP 755454	Cumbo Land Pty. Ltd.
Lot 124 DP 755425	Cumbo Coal Pty. Ltd.	Lot 109 DP 755454	Cumbo Land Pty. Ltd.
Lot 2 DP 720305	Cumbo Coal Pty. Ltd.	Lot 110 DP 755454	Cumbo Land Pty. Ltd.
Lot 3 DP 583254	Cumbo Coal Pty. Ltd.	Lot 116 DP 755425	Cumbo Land Pty. Ltd.
Lot 3 DP 755425	Cumbo Coal Pty. Ltd.	Lot 12 DP 755425	Cumbo Land Pty. Ltd.
Lot 5 DP 703225	Cumbo Coal Pty. Ltd.	Lot 128 DP 755425	Cumbo Land Pty. Ltd.
Lot 90 DP 755425	Cumbo Coal Pty. Ltd.	Lot 13 DP 755425	Cumbo Land Pty. Ltd.
Lot 93 DP 755425	Cumbo Coal Pty. Ltd.	Lot 14 DP 755425	Cumbo Land Pty. Ltd.
Pt. Lot 237 DP 724588	Cumbo Coal Pty. Ltd.	Lot 142 DP 755425	Cumbo Land Pty. Ltd.
Lot 1 DP 724617	Cumbo Creek Pastoral	Lot 143 DP 755425	Cumbo Land Pty. Ltd.
Lot 1 DP 728756	Cumbo Creek Pastoral	Lot 144 DP 755425	Cumbo Land Pty. Ltd.
Lot 105 DP 755425	Cumbo Creek Pastoral	Lot 145 DP 755425	Cumbo Land Pty. Ltd.
Lot 11 DP 703223	Cumbo Creek Pastoral	Lot 146 DP 755425	Cumbo Land Pty. Ltd.
Lot 122 DP 755425	Cumbo Creek Pastoral	Lot 148 DP 755425	Cumbo Land Pty. Ltd.
Lot 125 DP 755425	Cumbo Creek Pastoral	Lot 149 DP 755425	Cumbo Land Pty. Ltd.
Lot 133 DP 755425	Cumbo Creek Pastoral	Lot 150 DP 755425	Cumbo Land Pty. Ltd.
Lot 134 DP 755425	Cumbo Creek Pastoral	Lot 151 DP 755425	Cumbo Land Pty. Ltd.
Lot 135 DP 755425	Cumbo Creek Pastoral	Lot 152 DP 755425	Cumbo Land Pty. Ltd.
Lot 136 DP 755425	Cumbo Creek Pastoral	Lot 153 DP 755425	Cumbo Land Pty. Ltd.
Lot 137 DP 755425	Cumbo Creek Pastoral	Lot 156 DP 755425	Cumbo Land Pty. Ltd.
Lot 138 DP 755425	Cumbo Creek Pastoral	Lot 157 DP 755425	Cumbo Land Pty. Ltd.
Lot 139 DP 755425	Cumbo Creek Pastoral	Lot 158 DP 755425	Cumbo Land Pty. Ltd.
Lot 140 DP 755425	Cumbo Creek Pastoral	Lot 160 DP 755425	Cumbo Land Pty. Ltd.
Lot 141 DP 755425	Cumbo Creek Pastoral	Lot 183 DP 755425	Cumbo Land Pty. Ltd.
Lot 161 DP 755425	Cumbo Creek Pastoral	Lot 184 DP 755425	Cumbo Land Pty. Ltd.
Lot 18 DP 755425	Cumbo Creek Pastoral	Lot 186 DP 755425	Cumbo Land Pty. Ltd.
Lot 25 DP 755425	Cumbo Creek Pastoral	Lot 187 DP 755425	Cumbo Land Pty. Ltd.
Lot 27 DP 755425	Cumbo Creek Pastoral	Lot 188 DP 755425	Cumbo Land Pty. Ltd.
Lot 35 DP 755425	Cumbo Creek Pastoral	Lot 194 DP 755425	Cumbo Land Pty. Ltd.
Lot 40 DP 755425	Cumbo Creek Pastoral	Lot 195 DP 755425	Cumbo Land Pty. Ltd.
Lot 50 DP 755425	Cumbo Creek Pastoral	Lot 196 DP 755425	Cumbo Land Pty. Ltd.
Lot 53 DP 755425	Cumbo Creek Pastoral	Lot 26 DP 755425	Cumbo Land Pty. Ltd.
Lot 54 DP 755425	Cumbo Creek Pastoral	Lot 31 DP 755454	Cumbo Land Pty. Ltd.
Lot 66 DP 654143	Cumbo Creek Pastoral	Lot 34 DP 755425	Cumbo Land Pty. Ltd.
Lot 71 DP 755425	Cumbo Creek Pastoral	Lot 35 DP 755454	Cumbo Land Pty. Ltd.
Lot 75 DP 755425	Cumbo Creek Pastoral	Lot 37 DP 755425	Cumbo Land Pty. Ltd.
Lot 76 DP 755425	Cumbo Creek Pastoral	Lot 41 DP 583255	Cumbo Land Pty. Ltd.
Lot 79 DP 755425	Cumbo Creek Pastoral	Lot 42 DP 583255	Cumbo Land Pty. Ltd.
Lot 9 DP 755425	Cumbo Creek Pastoral	Lot 43 DP 583255	Cumbo Land Pty. Ltd.
Lot 94 DP 755425	Cumbo Creek Pastoral	Lot 44 DP 583255	Cumbo Land Pty. Ltd.
Lot 95 DP 755425	Cumbo Creek Pastoral	Lot 44 DP 755425	Cumbo Land Pty. Ltd.
Pt. Lot 132 DP 755425	Cumbo Creek Pastoral	Lot 45 DP 755425	Cumbo Land Pty. Ltd.
Lot 1 DP 112124	Cumbo Land Pty. Ltd.	Lot 45 DP 755454	Cumbo Land Pty. Ltd.
Lot 1 DP 583254	Cumbo Land Pty. Ltd.	Lot 46 DP 755454	Cumbo Land Pty. Ltd.
Lot 49 DP 755425	Cumbo Land Pty. Ltd.	Lot 48 DP 755454	Cumbo Land Pty. Ltd.

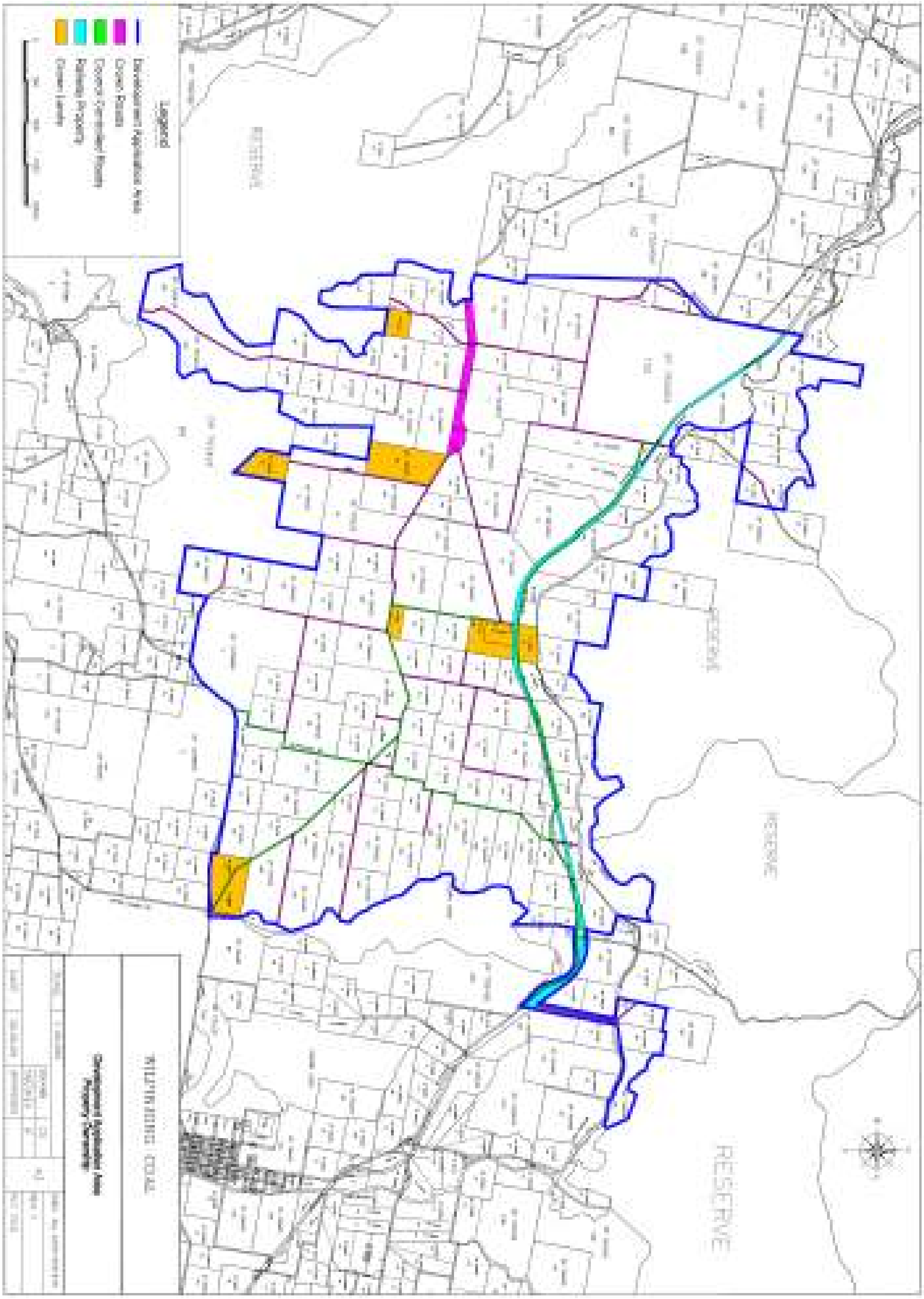
Property	Owner	Property	Owner
Lot 49 DP 755454	Cumbo Land Pty. Ltd.	Lot 14 DP 755454	Cumbo Land Pty. Ltd.
Lot 55 DP 755425	Cumbo Land Pty. Ltd.	Lot 15 DP 755454	Cumbo Land Pty. Ltd.
Lot 56 DP 755425	Cumbo Land Pty. Ltd.	Lot 17 DP 755454	Cumbo Land Pty. Ltd.
Lot 57 DP 755425	Cumbo Land Pty. Ltd.	Lot 18 DP 755454	Cumbo Land Pty. Ltd.
Lot 57 DP 755455	Cumbo Land Pty. Ltd.	Lot 182 DP 755425	Cumbo Land Pty. Ltd.
Lot 59 DP 755425	Cumbo Land Pty. Ltd.	Lot 19 DP 755454	Cumbo Land Pty. Ltd.
Lot 70 DP 755425	Cumbo Land Pty. Ltd.	Lot 22 DP 755454	Cumbo Land Pty. Ltd.
Lot 72 DP 755454	Cumbo Land Pty. Ltd.	Lot 23 DP 755454	Cumbo Land Pty. Ltd.
Lot 83 DP 755425	Cumbo Land Pty. Ltd.	Lot 24 DP 755454	Cumbo Land Pty. Ltd.
Lot 95 DP 755455	Cumbo Land Pty. Ltd.	Lot 3 DP 755454	Cumbo Land Pty. Ltd.
Lot 96 DP 755455	Cumbo Land Pty. Ltd.	Lot 46 DP 755425	Cumbo Land Pty. Ltd.
Pt. Lot 1 DP 1078866	Cumbo Land Pty. Ltd.	Lot 47 DP 755454	Cumbo Land Pty. Ltd.
Pt. Lot 131 DP 755425	Cumbo Land Pty. Ltd.	Lot 5 DP 755454	Cumbo Land Pty. Ltd.
Pt. Lot 69 DP 755455	Cumbo Land Pty. Ltd.	Lot 52 DP 755425	Cumbo Land Pty. Ltd.
Pt. Lot 89 DP 755455	Cumbo Land Pty. Ltd.	Lot 58 DP 755425	Cumbo Land Pty. Ltd.
Pt. Lot 92 DP 755425	Cumbo Land Pty. Ltd.	Lot 6 DP 703225	Cumbo Land Pty. Ltd.
Lot 1 DP 703224	Cumbo Land Pty. Ltd.	Lot 6 DP 755454	Cumbo Land Pty. Ltd.
Lot 10 DP 755454	Cumbo Land Pty. Ltd.	Lot 78 DP 755425	Cumbo Land Pty. Ltd.
Lot 104 DP 755454	Cumbo Land Pty. Ltd.	Lot 80 DP 755425	Cumbo Land Pty. Ltd.
Lot 106 DP 755425	Cumbo Land Pty. Ltd.	Lot 87 DP 755425	Cumbo Land Pty. Ltd.
Lot 11 DP 755454	Cumbo Land Pty. Ltd.	Lot 88 DP 755425	Cumbo Land Pty. Ltd.
Lot 114 DP 42127	Cumbo Land Pty. Ltd.	Lot 9 DP 755454	Cumbo Land Pty. Ltd.
Lot 12 DP 703223	Cumbo Land Pty. Ltd.	Lot 1 DP 653565	M Bloom & R Beheit
Lot 12 DP 755454	Cumbo Land Pty. Ltd.	Pt. Lot 1 DP 755455	RWB & NJ & DB Reid
Lot 13 DP 703223	Cumbo Land Pty. Ltd.	Pt. Lot 52 DP 755454	Ulan Coal Mines Limited
Lot 13 DP 755454	Cumbo Land Pty. Ltd.	Pt. Lot 68 DP 755454	Ulan Coal Mines Limited

Crown Lands

Property	Owner
Lot 115 DP 42127	Crown Land
Lot 147 DP 755425	Crown Land
Lot 233 DP 723412	Crown Land
Lot 234 DP 723412	Crown Land
Lot 235 DP 723412	Crown Land
Lot 77 DP 755425	Crown Land
Lot 84 DP 755425	Crown Land
Lot 91 DP 755425	Crown Land
Lot 97 DP 755425	Crown Land

Other Lands

Crown Roads, Council Roads and property under the control of the State Rail Authority have been identified and are shown on the attached plan (00567A).


Legend
Development Application Area
Crown Roads
Council Controlled Roads
Railway Property
Crown Lands
RESERVE
RESERVE
RESERVE
RESERVE
WILPINJONG COAL
Development Application Area
Property Ownership

APPENDIX 2
GENERAL TERMS FOR THE PLANNING AGREEMENT

Lump Sum Payment

1. The Proponent must pay Council $450,000.00 prior to the first shipment of coal from the site.

Community Infrastructure Contribution

2. The Proponent must pay Council a Community Infrastructure Contribution of $40,000 each year commencing on the first anniversary of the first shipment of coal from the site for a period of 20 years.

   Note: The Community Infrastructure Contribution must be reviewed and adjusted to take into account any increase in the CPI over time, in accordance with the Planning Agreement between the Proponent and Council required under this approval.

Road Maintenance Contribution

3. The Proponent must pay Council a Road Maintenance Contribution of $30,000 each year commencing on the first anniversary of the first shipment of coal from the site for each year until the Proponent ceases mining coal on the site.

   Note: The Road Maintenance Contribution must be reviewed and adjusted to take into account any increase in the CPI over time, in accordance with the Planning Agreement between the Proponent and Council required under this approval.

Route Assessment Study

4. The Proponent must carry out a Route Assessment Study (incorporating a Road Safety Audit and a Road Conditions Audit) which identifies:

   (a) the standard of compliance of the Roads with the applicable [AUSROAD Standard];

   (b) traffic flows at the date of the Route Assessment Study which are not attributable to the Project;

   (c) predicted traffic flows over the life of the Project excluding traffic flows attributable to the Project;

   (d) predicted traffic flows and timing of traffic flows attributable to the Project;

   (e) whether the traffic flows identified in clause 4(b) or 4 (c) require the upgrade of any part of the Roads to comply with the relevant [AUSROAD Standard]; and

   (f) whether the predicted traffic flows attributable to the Project require the upgrade of any part of the Roads in order to comply with the relevant [AUSROAD Standard] where that upgrade would not be required, either at that time or at all, having regard to the traffic flows in clauses 4(b) and 4(c) only.

   Note: "Roads" means:
   - *Ulan Road between Mudgee and the intersection with the Ulan-Wollar Road;*
   - *Ulan-Wollar Road between the Project and the intersection with the Ulan Road; and*
   - *Wollar Road between the Project and the intersection with Ulan Road.*

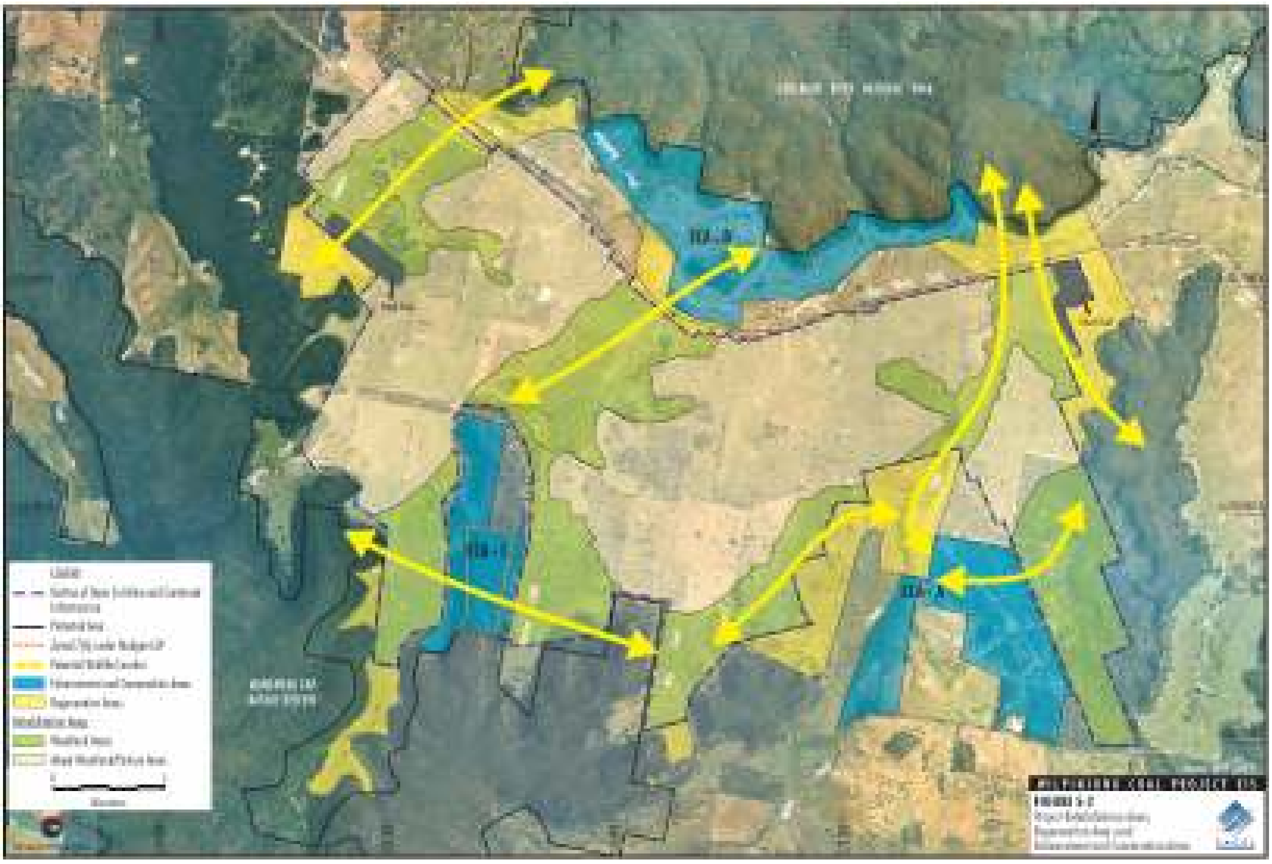
Contribution to Road Upgrades

5. The Proponent must, at its option, either carry out or pay the costs of each upgrade to the Roads identified as required in the Route Assessment Study if:

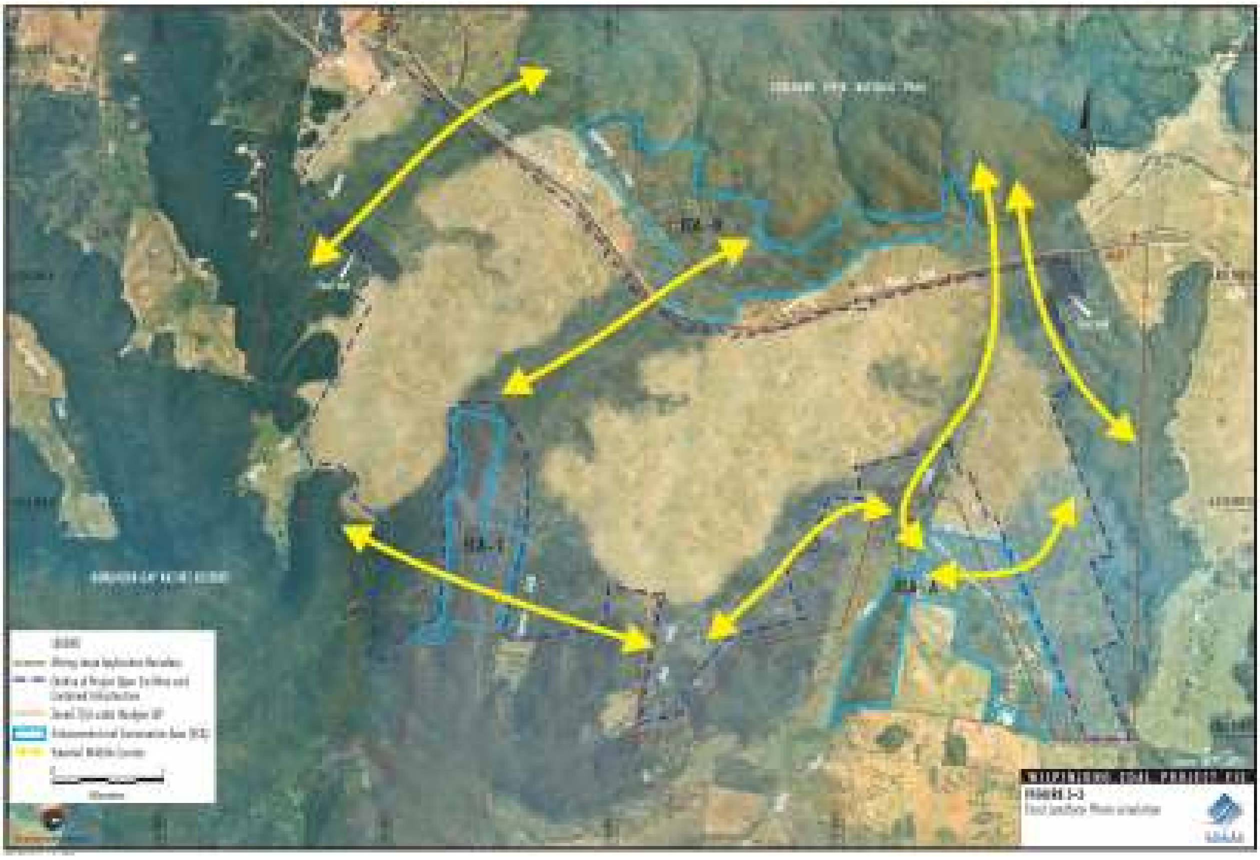
   (a) the incremental increase in traffic flow attributable to the Project require that upgrade of any part of the Roads in order to comply with the relevant [AUSROAD Standard]; and

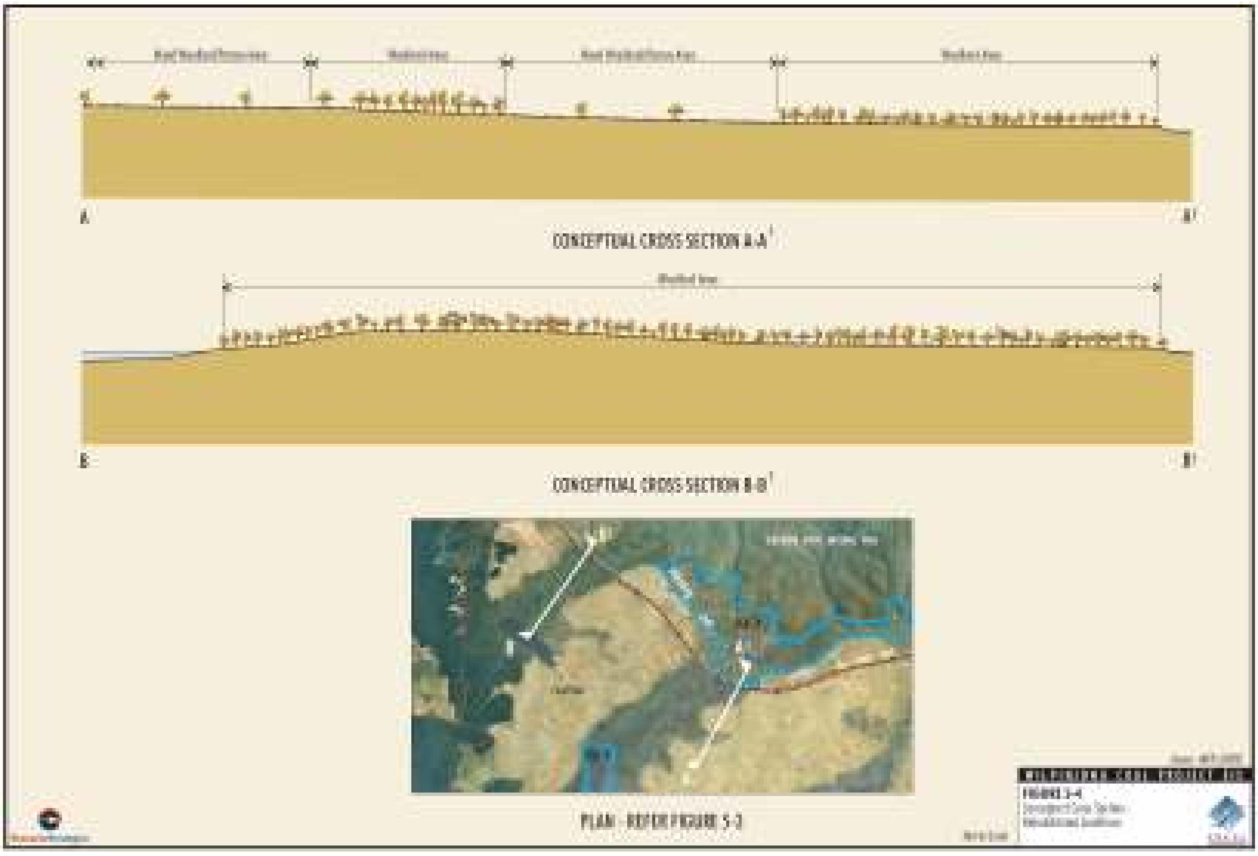
   (b) that upgrade would not be required at that time by the current or predicted traffic flows which are not attributable to the Project.

APPENDIX 3
OFFSET STRATEGY

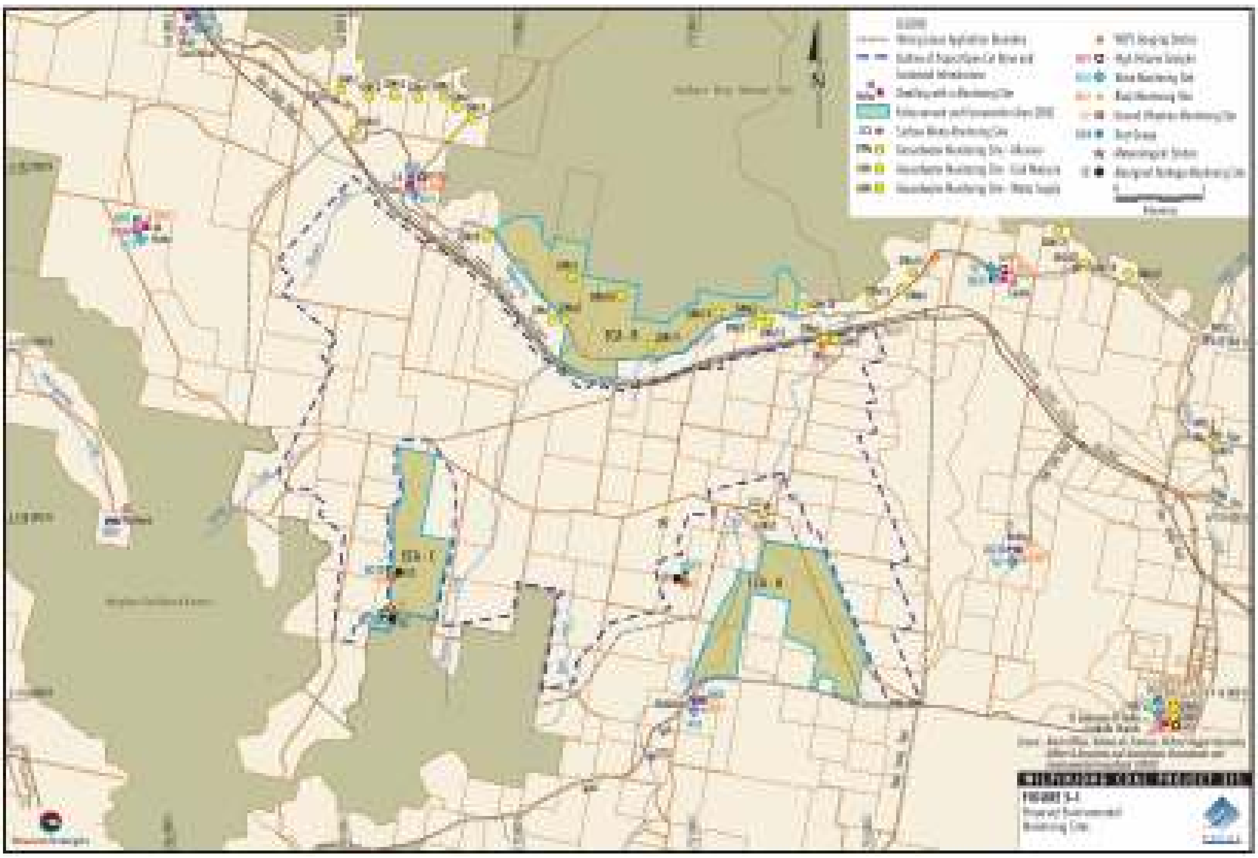


APPENDIX 4
CONCEPTUAL REHABILITATION PLAN





APPENDIX 5
ABORIGINAL SITES



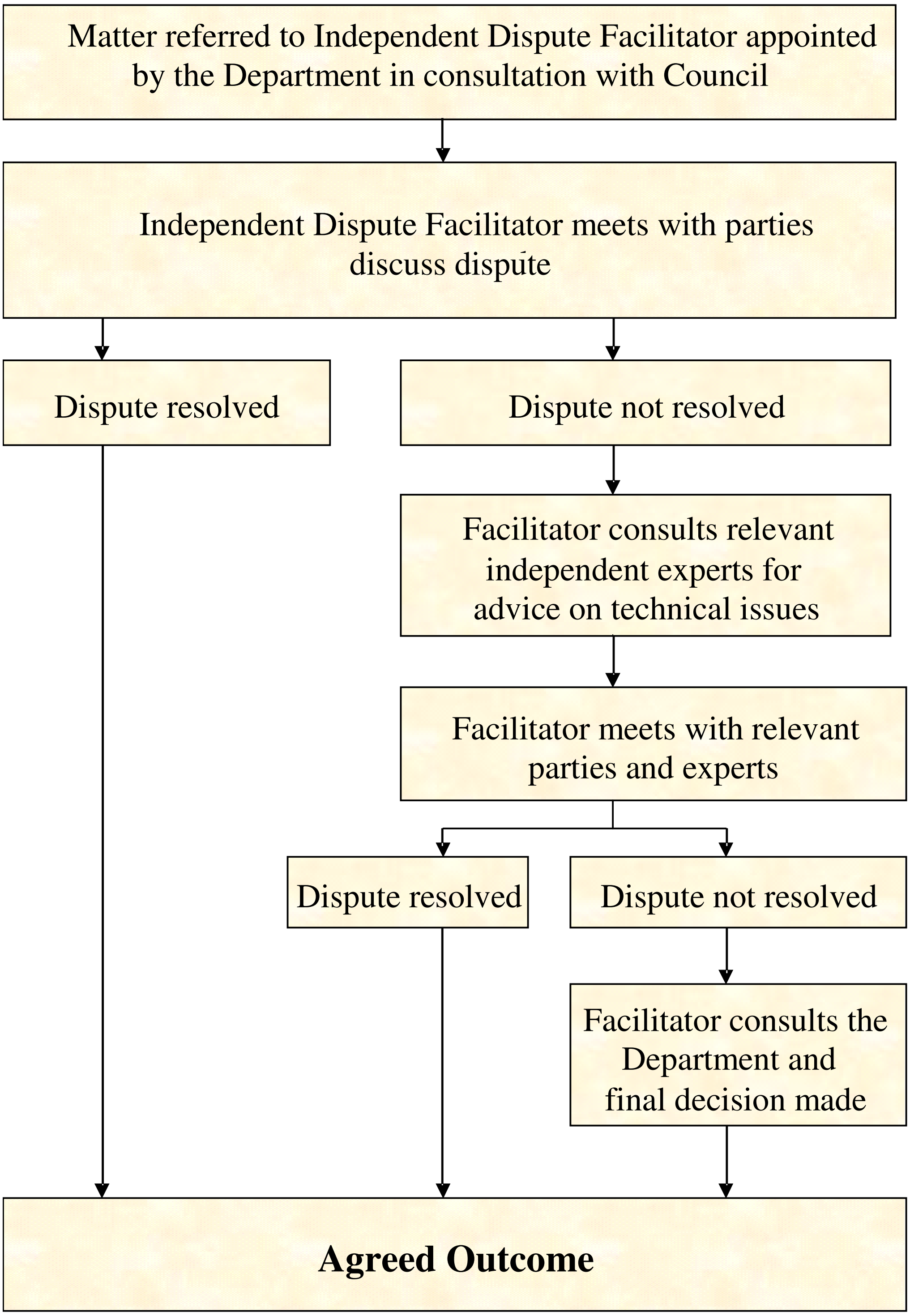
APPENDIX 6
HERITAGE SITES

Table 3-20
Sites of Local Heritage Significance Identified in the Project Survey

Site No.	Place Name	History and Description
1.	*Cumbo Creek*	Built 1912, stone cottage with later additions, now in poor condition.
2.	*Hillside*	First building possibly built 1866, and added to over time. Key early slab buildings intact, but in poor condition.
3.	*Keylah*	Slab building built 1896, stone section 1922. Intact and in good condition.
4.	*Warrawong*	Slab cottage, originally built near the junction of Wilpinjong and Cumbo Creek, moved to present site 1912.
5.	Atcheson's cottage, Wyangle Portion 19 Wilpinjong	Concrete structure, probably built 1930s now in poor condition.
6.	Loy's cottage	Slab cottage, built circa 1894, and possibly used for a time as a school room. Now in ruin.
7.	*Pine Park* woolshed	Slab woolshed built in 1930s. In good condition.
8.	Post and rail fence, Portion 108 Cumbo	Long section of post and rail fence, unknown date and in poor condition.
9.	Wilpinjong Road stone embankment, Portion 26 Cumbo	43 m long stone road embankment, possibly from 19th century. Intact.

APPENDIX 7
INDEPENDENT DISPUTE RESOLUTION PROCESS

Independent Dispute Resolution Process (Indicative only)



APPENDIX 8
STATEMENT OF COMMITMENTS FOR OPERATIONAL ROAD ACCESS AND BLASTING FREQUENCY MODIFICATION, 05_0021-1

Peabody

WILPINJONG COAL

Wilpinjong

10 August 2007

The Director-General
c/- David Kitto
Department of Planning
Level 4
23-33 Bridge Street
SYDNEY NSW 2000

Dear Sir

RE: WILPINJONG COAL PROJECT OPERATIONAL PHASE MINE ACCESS ROUTE AND BLASTING FREQUENCY MODIFICATION – CONSOLIDATED STATEMENT OF COMMITMENTS

As requested, please find below a consolidated statement of commitments[1] incorporating the commitments made by Wilpinjong Coal Pty Limited (WCPL) in the:

- *Operational Phase Mine Access Route and Blasting Frequency Modification – Environmental Assessment* (WCPL, April 2007); and
- *Operational Phase Mine Access Route and Blasting Frequency Modification – Responses to Submissions* (WCPL, July 2007).

Blasting, Vibration and Public Safety

WCPL will:

- Undertake all additional blasting activities in accordance with the Blast Management Plan and Monitoring Programme, including:
  - Operating a free-call Blasting Hotline that provides information on the daily and proposed weekly blasting schedule. Advertisement of the contact number in local newspapers at least quarterly, via the Wilpinjong Community Newsletter.
  - Maintenance of road closure notification boards on Ulan-Wollar Road. Provision of at least three days warning of impending road closures subject to blasting demands.
  - Traffic control signs set up in accordance with the Roads and Traffic Authority (RTA)/Mid-Western Regional Council (MWRC) guidelines for all temporary road closures.
  - Modification of blast design to meet vibration and airblast limits and avoid damage to life or property from flyrock, including consideration of wind speed, direction and other meteorological factors prior to blasting to minimise impacts on neighbours.
  - Assessment of wind speed and direction immediately prior to each blast to minimise the potential for dust emissions from blasting to adversely impact on neighbouring private residencies.
  - Monitoring of blasts to determine whether airblast and ground vibration limits are met. Review of monitoring results and management practices to evaluate performance and identify responsive action, if required.

[1] This document is not provided as a Preferred Project Report.

Wilpinjong Coal Pty Ltd
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Brisbane Qld 4000

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Mudgee NSW 2850

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Fax: +61 2 8080 8170

- Establishment of a meteorological assessment protocol so that blasts are postponed during adverse weather conditions.
- Restriction of blasting activities to Monday to Saturday inclusive between 9.00 am and 5.00 pm EST, with no blasting on Sundays, public holidays, or at any other time without the written approval of the Department of Environment and Climate Change (DECC).
- Notification of private landholders within 2 km of the Project who have registered an interest in being informed of the blasting frequency via telephone, e-mail or as otherwise agreed.
- Repairing of any damage to buildings and/or structures on private residences confirmed to have been incurred as a result of blasting activities at the Project (via structural assessment process).
- Gaining approval from the MWRC (in respect of public roads) and Australian Rail Track Corporation (ARTC) (in respect of the Gulgong-Sandy Hollow railway) prior to blasting within 500 m of a public road or railway.
- Operating the complaints line and register and managing all blast related complaints in accordance with the existing complaints protocol.

- Limit the maximum instantaneous charge of additional blasts for coal and interburden to a maximum of 400 kg.
- Update the Blast Management Plan and Monitoring Programme and the Aboriginal Cultural Heritage Management Plan to include notification of the Department of Planning and DECC (within 24 hours) following the identification of an exceedance of ground vibration levels (specified in the Blast Management Plan and Monitoring Programme i.e. 80 mm/s) at Aboriginal Rock Art Sites 72, 152 or 153 or identification of actual damage.
- Consult with Moolarben Coal Mines Pty Limited regarding management of potential cumulative blasting amenity impacts associated with road closures (should the Moolarben Coal Project be approved).
- Continue to consult with the MWRC and the ARTC (in accordance with the current legal agreement between WCPL and the ARTC) in regard to managing blasting amenity impacts.

Traffic and Public Safety

WCPL will:

- Contribute an additional $20,000 per annum to the MWRC over the next three years for the development of school bus lay-by areas along Ulan Road.
- Finance the sealing of the un-sealed section of Ulan-Wollar Road between Ulan Road and the internal mine access road.
- Continue to water the unsealed section of Ulan-Wollar Road until the section of Ulan-Wollar Road between Ulan Road and the internal mine access road is sealed.
- Finance the installation appropriate line-marking and signage along the section of Ulan-Wollar Road between Ulan Road and the internal mine access road.

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- Contribute (in consultation with the MWRC and Moolarben Coal Mines Pty Limited) to the upgrading of the Ulan Road/Ulan-Wollar Road intersection and the Ulan-Wollar Road/internal mine access road intersection.
- Continue to minimise the number of light and heavy vehicles using the local road network by promoting car pooling and/or utilising employee bus services and by limiting the number of heavy vehicle deliveries to site, where practicable.
- Assist MWRC to direct existing financial contributions made by WCPL to MWRC (in accordance with the Wilpinjong Coal Project Planning Agreement and Project Approval 05_0021) towards the following recommended improvements:
  - Upgrading of the Ulan-Wollar Road/internal mine access road intersection to include:
    - geometry and linemarking as per RTA type 'AUR' Right Turn Treatment for vehicles traveling west on Ulan-Wollar Road and turning right into the Project access road; and
    - appropriate lighting at the intersection in accordance with AS 1158:2005 *Lighting for Roads and Public Spaces* (AS 1158) to Country Energy and RTA requirements.
  - Upgrading of the Ulan Road/Ulan-Wollar Road intersection to include:
    - geometry and linemarking as per RTA type 'AUR' Right Turn Treatment for vehicles traveling north on the Ulan Road and turning right into Ulan-Wollar Road;
    - a separate left turn deceleration lane (for vehicles traveling southbound on Ulan Road) to improve safety and capacity for left turn traffic from Ulan Road; and
    - appropriate lighting at the intersection in accordance with AS 1158 to Country Energy and RTA requirements.
- Continue to provide MWRC with annual payments for community infrastructure and road maintenance via the Wilpinjong Coal Project Planning Agreement and Project Approval 05-0021.

A Traffic Management Plan would be prepared for any works required on Ulan-Wollar Road and works associated with the Ulan Road/Ulan-Wollar Road intersection in accordance with AS 1742.3: 2002 *Manual of Uniform Traffic Control Devices – Traffic Control Devices for Works on Roads* (AS 1742.3) and the RTA publication *Traffic Control at Work Sites*.

Road Safety and Road Surface Performance Strategy

WCPL will:

- Implement a Road Performance Strategy during the Project life to maintain an appropriate level of road safety and road surface performance on Ulan-Wollar Road and Ulan Road. The Road Performance Strategy would: be implemented in consultation with the MWRC, RTA and other local mining operators; and include the following key measures:
  - Encourage the MWRC to allocate a proportion of WCPL's (and other local mine operator's) annual financial contributions towards the cost of annual traffic count surveys to determine the relative contribution of each local mining operation to total traffic flows on the road network and for road dilapidation/safety surveys to identify any required works to maintain road safety and the road pavement surface on Ulan Road and Ulan-Wollar Road.

- Encourage employee traffic minimisation throughout the life of the Project by advocating car pooling through site inductions and regular tool box meetings and/or utilising employee bus services.
- Continue to actively promote safe driving on public roads.
- Consult with other local mining operators to identify whether the staggering of shift times could be undertaken to reduce cumulative peak hour traffic on Ulan Road and Ulan-Wollar Road if peak hour movements are identified as being excessive.
- Consult with the MWRC and other local mining operators to encourage the focussing of annual financial contributions from mining operations on road safety, road pavement improvements and general maintenance on Ulan Road and Ulan-Wollar Road.

Traffic Noise

WCPL will continue to minimise the number of light and heavy vehicles using the local road network by promoting car pooling and/or utilising employee bus services and by limiting the number of heavy vehicle deliveries to site, where practicable.

Please do not hesitate to contact me on (02) 6370 2500 should you have any queries.

Yours faithfully
Wilpinjong Coal Pty Ltd

KEITH DOWNHAM
Wilpinjong General Manager

Wilpinjong Coal Pty Ltd ACN 104 594 694
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Fax: +61 2 8080 8170

Appendix A




Noise Impact Assessment

HEGGIES

REPORT 30-1313-R2

Revision 0

Wilpinjong Coal Mine - 75W Modification

Noise Impact Assessment

PREPARED FOR

Wilpinjong Coal Pty Ltd
C/- Resource Strategies Pty Ltd
Level Two, 11 Lang Parade
MILTON QLD 4064

17 MAY 2010

HEGGIES PTY LTD
ABN 29 001 584 612

Wilpinjong Coal Mine - 75W Modification

Noise Impact Assessment

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1 INTRODUCTION

1.1 Assessment Requirements

Wilpinjong Coal Pty Ltd (WCPL), a subsidiary of Peabody Energy Australia Ltd, owns and operates the Wilpinjong Coal Mine (WCM). The New South Wales (NSW) Minister for Planning granted approval to WCPL to operate the WCM in accordance with the Department of Planning (DoP) Project Approval 05-0021 dated 1 February 2006. Coal production commenced at the WCM in late 2006 using open cut mining methods. In 2009 the WCM produced some 8.4 million tonnes (Mt) of run-of-mine (ROM) coal.

The WCM is approved to produce up to 13 million tonnes per annum (Mtpa) of ROM coal. All product coal from the WCM is transported by rail to domestic electricity generation customers and to the Port of Newcastle for export. The WCM is situated approximately 40 kilometres (km) northeast of Mudgee, near the village of Wollar, within the Mid-Western Regional Local Government Area (LGA), in central NSW.

WCPL seeks approval to increase the approved maximum ROM coal mining rate from 13 Mtpa to 15 Mtpa and a small increase in the maximum annual rate of overburden mined (the Modification). Additional mobile fleet would be required on-site to achieve the currently approved 13 Mtpa and the proposed incremental increase in production under the Modification.

To facilitate increased coal production and improve the efficiency of coal handling and preparation on-site, the existing Coal Handling and Preparation Plant (CHPP) and general coal handling/stockpiling systems would be upgraded.

Heggies Pty Ltd (Heggies) has been engaged by WCPL to evaluate and assess the potential noise impacts associated with the WCM Modification.

The assessment has been prepared in accordance with the NSW Department of Planning's (DoP's) and the NSW Department of Environment, Climate Change and Water's (DECCW's) policies. In accordance with these policies, the major sources of noise emissions may be grouped as follows:

On-site Intrusive Construction Noise

The WCM Modification construction works including construction of the CHPP/coal handling upgrades is expected to commence in January 2011 and would be completed over a period of approximately 9 months. Construction works would be 24 hours per day, 7 days per week, however, construction related heavy vehicle movements would be restricted to daytime hours.

In accordance with the DECCW's *Interim Construction Noise Guideline* (ICNG) mine construction activities are generally considered to be integral to mining operations. Therefore the construction works associated with the WCM Modification have been modelled as a component of operational activities in Year 2011.

On-site Intrusive Noise Assessment

Three WCM Modification operational scenarios were selected for modelling of potential noise emissions.

- Year 2011 operations were assessed when operations would be heavily concentrated in central Pit 5 - and coinciding with the construction of the CHPP/coal handling upgrades.
- Year 2014 operations were assessed to coincide with the peak on-site mobile equipment fleet and mining activities located in central Pit 3 and closest to Slate Gully locality private receptors.

- Year 2017/2020 (combined scenario) operations were assessed for activities in the northernmost and southernmost portions of Pit 3, to examine the potential worst case emissions to the Araluen, Wollar and Cumbo localities (ie when less topographic shielding would be located between the mining sources and private receivers).

In all cases, train movements at the WCM rail loop were included in the assessment of on-site operating noise.

The assessment of (construction and) mine operating noise impacts has been undertaken in accordance the NSW Industrial Noise Policy (INP) (NSW Environment Protection Authority [EPA, 2000]) (and the associated INP Application Notes) (EPA, 2008) which provides non-mandatory procedures for setting acceptable $L_{Aeq(15minute)}$ intrusive (and $L_{Aeq(period)}$) amenity noise levels for various receiver areas and guidelines for assessing noise impacts from on-site (stationary) noise sources.

Cumulative Industrial Noise Amenity

The INP (EPA, 2000) also provides non mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ amenity levels for all industrial (ie non-transport related) noise in a receiver area. Note, the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources in a receiver area, but rather seeks to control cumulative noise via its amenity criteria (EPA, 2000).

The most stringent acceptable cumulative L_{Aeq} noise amenity level is 40 dBA at the receivers surrounding the WCM. The corresponding WCM project specific L_{Aeq} noise amenity criterion is 32 dBA.

The Moolarben Coal Mines and the Ulan Coal Mines are located to the west and northwest of the WCM. There are no other significant industrial developments located in close proximity to the WCM. Both of these mining operations currently have major expansion proposals before the DoP (ie the Moolarben Coal Project - Stage 2 and the Ulan Coal - Continued Operations Project).

All receivers located to the west of the WCM, between WCM and Ulan Coal Mines, are mine owned properties (either related to the Moolarben Coal Mines, Ulan Coal Mines or WCM), accordingly, the potential for cumulative industrial noise impacts to privately owned residences to the west is negligible and does not warrant any further consideration in this assessment.

The nearest private residences which could potentially receive cumulative noise emissions from the WCM and the Moolarben Coal Mines are on the far side of the Munghorn Gap Nature Reserve and are located approximately 4 to 5 km to the southwest of the WCM (ie Residences 68A, 68B, 69, 70A and 70B).

The WCM noise amenity emission level at these residences is less than 32 dBA, which complies with the most stringent WCM project specific noise amenity criterion of 32 dBA.

There are no other identified nearby non-mine owned receivers which may potentially be exposed to material cumulative noise emissions from WCM and any other mining operation. Therefore, the potential for cumulative noise impacts from the WCM Modification and Moolarben Coal Mines or Ulan Coal at private receivers is negligible, and will not be considered any further in this assessment.

On-site Open Pit Blasting

The DECCW's Assessing Vibration: A Technical Guideline dated February 2006 does not address blast-induced effects, rather it focuses on vibration from other sources (eg construction piling activities). However, Australian Standard AS 2187.2-2006 *Explosives - Storage and use Part 2: Use of Explosives - Appendix J* does provide guidance on relevant procedures for assessing the blast-induced noise and vibration effects on buildings and their occupants.

The DECCW currently adopts the Australia and New Zealand Environment Council Committee (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* dated September 1990 for assessing potential annoyance from blast emissions during daytime hours.

WCM blast design parameters and management practices remain generally unchanged by the WCM Modification. The WCM Modification would not increase the blast frequency that is currently permitted in the Project Approval 05-0021 and there is no change in the extent of mining. Therefore, no further blasting assessment is required.

Off-site Road Transport Noise

The NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999) provides non mandatory procedures for setting acceptable L_{Aeq} noise levels on arterial, collector and local roads and guidelines for assessing noise impacts from off site road traffic.

The existing access road off Ulan-Wollar Road would remain the WCM primary site access. The vast majority of WCM traffic utilises Ulan-Wollar Road and Ulan Road to access the site. To the west of WCM all residences located along Ulan-Wollar Road are now mine owned.

WCM daily operational workforce traffic and traffic associated with deliveries along public roads would be only modestly increased by the WCM Modification. However, a short-term peak in additional traffic is expected during 2011 when the average workforce would be 150 people over the nine month construction period (at peak the construction workforce would be up to 280 people).

In 2011, traffic flows on Ulan Road are therefore expected to increase during peak hour periods, however, at the cessation of the nine month construction period WCM traffic contributions would fall back considerably.

Off-Site Rail Transport Noise

The Australian Rail Track Corporation Ltd (ARTC) controls and operates the Gulgong-Sandy Hollow Railway and Main Northern Railway. Noise emissions from the railway are regulated via ARTC's Environmental Protection Licence (EPL No 3142). A review of EPL 3142 requirements is presented together with an assessment of potential rail traffic noise impacts on communities neighbouring the Gulgong-Sandy Hollow Railway and Main Northern Railway.

The DECCW has released the *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (IGANRIP, 2007) which applies specifically to rail infrastructure projects, where a new rail line is developed or an existing rail line is redeveloped, and accordingly, does not apply to the WCM.

In addition, the DECCW has recently (3 March 2010) revised their "*Environmental Assessment Requirements for Rail Traffic-Generating Developments"* which are similar (but not the same) to the ARTC's EPL noise goals.

An average of four trains per day is required to transport the product coal from the approved WCM to market. The WCM Modification would require the number trains departing the WCM to increase to an average of five trains per day. The maximum number of trains departing the site per day (6) would not increase as a result of the WCM Modification.

2 EXISTING WILPINJONG COAL MINE

2.1 Overview of the existing WCM

Coal production commenced at the WCM in 2006 with mining of run-of-mine (ROM) coal using conventional open cut mining methods.

The WCM operations are supported by on-site facilities including a main infrastructure area, CHPP, water management infrastructure/storages and rail infrastructure.

2.2 Existing WCM Approvals

With respect to noise and blasting emissions, WCPL has approval to operate in accordance with the following approval requirements:

- Project Approval (05-0021) dated 1 February 2006 (as amended) (the Project Approval and Notice of Modification dated 30 November 2007 are attached as **Appendix A1** and **Appendix A2**, respectively).
- Environment Protection Licence (EPL) No 12425.

In addition, NSW Work Cover Dangerous Goods Licences describe noise specifications for individual equipment, for health and safety purposes.

2.3 WCM Noise Management Measures

WCM Noise Monitoring Programme

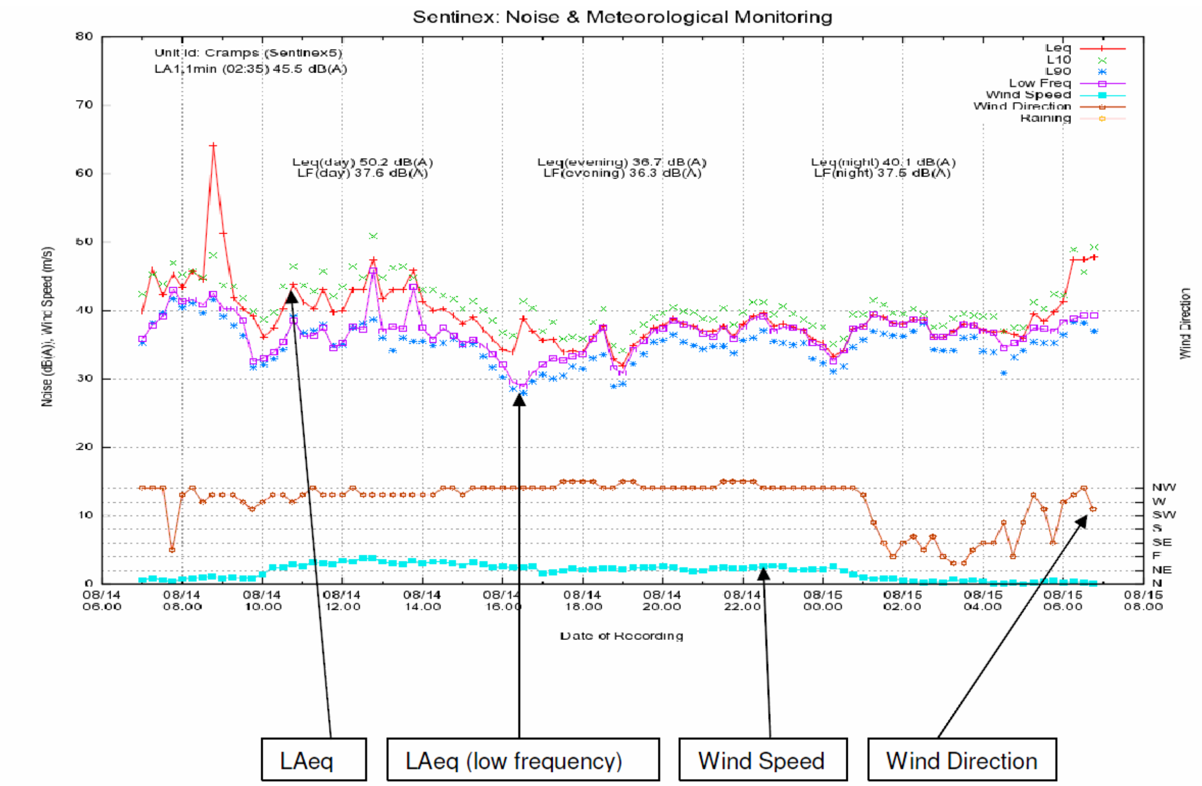
The original Noise Monitoring Programme (NMP, approved by the DoP in February 2006) has been revised a number of times in response to community feedback, technical issues, operational experience and the recommendations of an independent noise audit commissioned by the DoP in order to provide a more refined approach to noise management. The latest revision of the WCM NMP is dated 3 July 2009 and it describes the current noise monitoring and management activities at the WCM. Real-time noise management monitoring is undertaken at two locations and is used as a management tool to assist WCPL to take pre-emptive management actions to avoid potential non-compliances, while operator-attended noise monitoring is undertaken on a quarterly basis at approximately 7 locations for the purposes of demonstrating compliance with the noise criteria. The current noise monitoring locations are shown on the Relevant Noise Monitoring Sites plan in **Appendix B1**.

The NMP includes a number of proactive mitigation measures including:

- Developing an awareness and understanding of noise issues through site inductions for all staff and contractors at the WCM.
- Real-time noise management monitoring used as a noise management tool (not for compliance purposes), including the use of "noise investigation triggers" for ongoing performance assessment and to assist in the implementation of pre-emptive management actions to avoid potential non-compliances. A graphical summary of the previous 24 hours of noise sent via email to key WCM staff at 0700 hours each morning for review and follow-up investigation, if required (a sample graph if shown in **Figure 1**).

- Monitoring weather conditions and where adverse conditions are experienced or predicted operational changes are made to avoid or reduce noise impacts.
- Avoiding the simultaneous use of significant noise generating equipment wherever possible.
- The noisiest activities being scheduled where practicable to the least sensitive times of the day.
- Maintaining all machinery and plant used on site to minimise noise generation.

Figure 1 Sample of 24 Hour Real-time Noise Monitoring Graph



Noise Investigation Triggers

In order to give a margin of head room, the noise investigation triggers are set at a level 2 dBA below the approved noise limit and are only used between the hours of 2000 hours and 0800 hours to minimise false triggers. Further, the sample period is conservatively set at 5 minutes, which allows the operations to be modified in time to achieve compliance with the 15 minute approved noise limits, if required.

In the event of a noise investigation trigger, an SMS message is sent to the Open Cut Examiner (OCE), who would then implement the following response protocol:

1. Download audio file from relevant noise monitor to determine noise source.
2. If found to be extraneous noise then no further action is taken.
3. If found to be mine noise then monitor noise levels.
4. If mine noise levels equal Project Approval/EPL noise criteria begin to shut down machinery.
5. Continue to shut down machinery until mine noise reduces to at least 2 dBA below Project Approval/EPL noise criteria.

6. Continue to monitor situation and repeat steps 1 to 5 if an alarm is re-triggered.
7. Record details of the investigation, type of response and real-time noise monitor's response.
8. Review of data and response by Environmental Manager (or delegate).

Noise Control Strategies

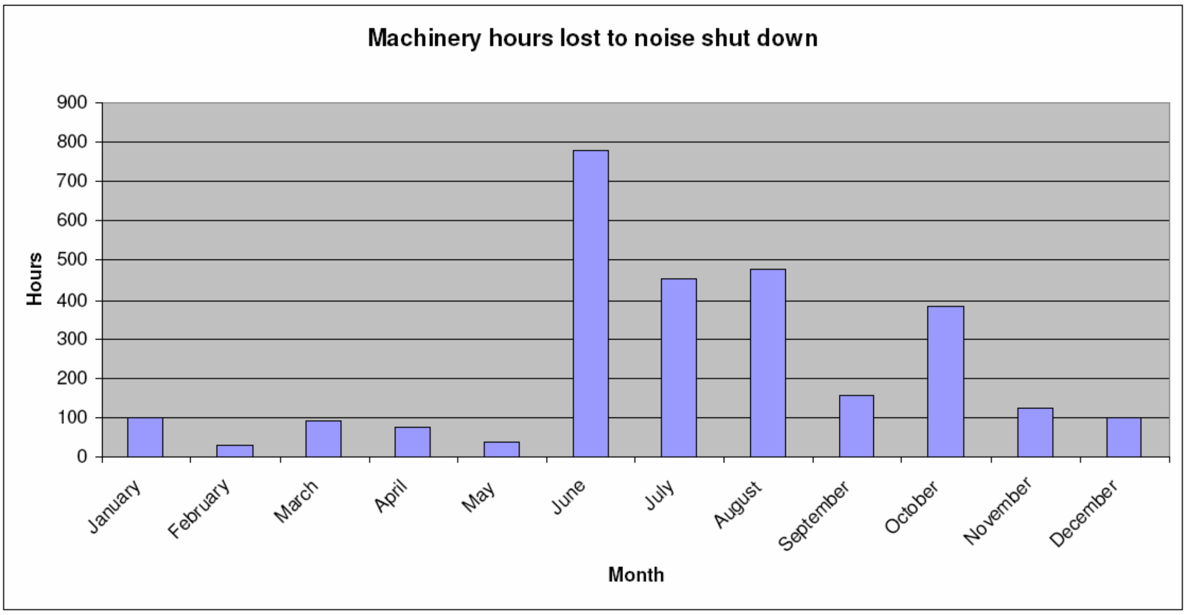
Noise management and mitigation measures are undertaken in accordance with the NMP. As outlined in the NMP, the Standard Protocol (summarised above) is implemented to facilitate the day-to-day management of noise emissions from the WCM activities.

As detailed in the 2009 *Wilpinjong Coal Mine Annual Environmental Management Report* (AEMR) (WCPL, February 2010, noise control strategies were implemented in accordance with the NMP during the 2009 reporting period to minimise noise emissions from the WCM.

During the 2009 reporting period a total of 2806 machine hours were lost as a result of noise management activities on site as a direct response to noise investigation triggers. **Figure 2** presents the number of machine hours lost due to noise investigation trigger shut downs.

The effectiveness of the control strategies implemented during the reporting period is demonstrated by the environmental performance discussed below.

Figure 2 Machine Hours Lost due to Noise Investigation Trigger Shut Down - 2009



Source: 2009 *Wilpinjong Coal Mine Annual Environmental Management Report,* WCPL (February, 2010).

WCM Noise Management Performance

In addition to the daily review of the real-time noise monitoring summary and response undertaken by WCM staff, in accordance with the WCM NMP, independent acoustic consultants undertake a quarterly review of the real-time noise monitoring data in order to assess the noise management performance of the WCM.

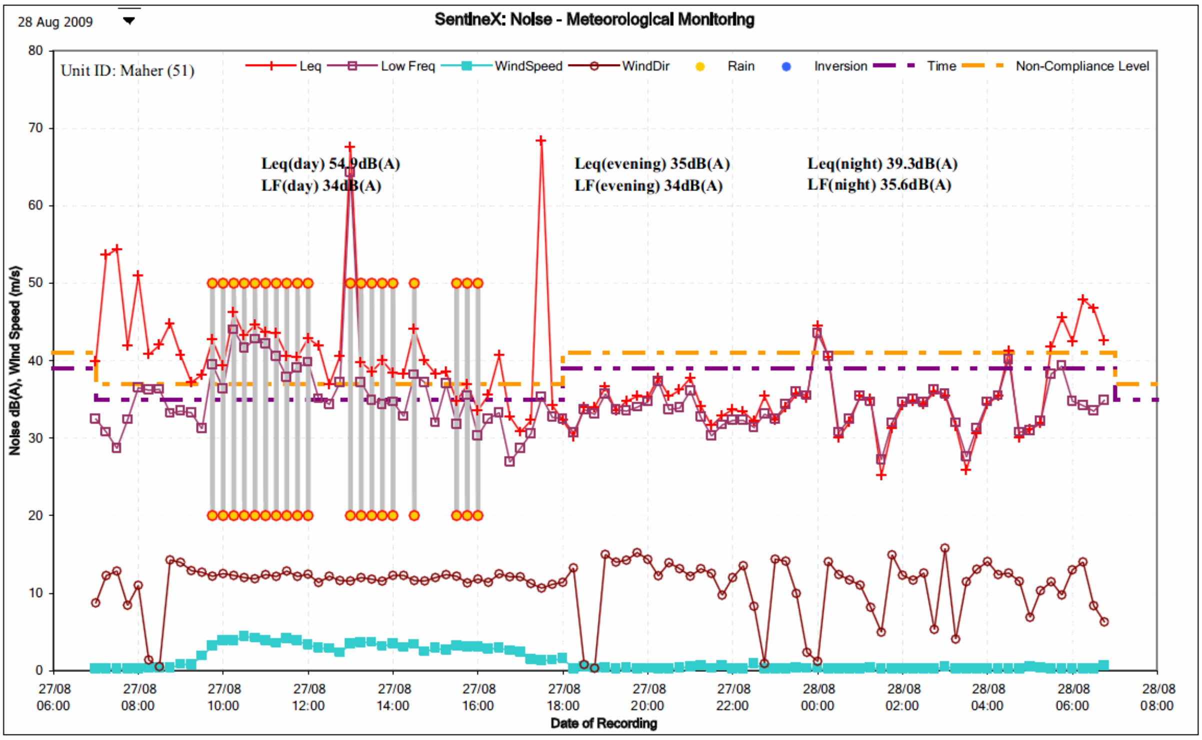
Review of the real-time unattended noise management monitoring has been undertaken by independent acoustic consultants since 2006. A summary of the findings of the reviews undertaken since 2008 indicates that the real time noise monitoring and response procedures have been an effective noise management tool.

WCM Noise Management Example

Figure 3 presents a sample period from August 2009 which demonstrates the effectiveness of the WCM noise management strategy in maintaining WCM noise emissions below the applicable Project Approval criteria. The approximate sequence of events can be summarised as follows:

1. Around midnight the noise investigation trigger was triggered and a consequent SMS message sent to the OCE notifying of the exceedance.
2. Having listened the real-time audio recording, the OCE confirmed that the trigger was due to WCM activities.
3. The OCE shut down mobile equipment operating in Pit 2, including one excavator, three haul trucks and one dozer, plus one dozer operating on a waste emplacement area.
4. The next noise level update indicates that the ambient noise level has reduced to just below the noise limit (of 39 dBA), but is still above the trigger level (of 37 dBA). Subjectively, the real-time audio stream indicates that the ambient noise level is controlled by WCM activities.
5. The OCE proceeds to shut down all mobile equipment.
6. The next noise level update indicates that the ambient noise level has reduced to 30 dBA and only the WCM washery mine hum is discernible on the real-time audio.
7. The OCE gradually brings equipment back on-line starting with equipment operating in Pit 5 and ROM area, followed by Pit 2 and dozer fleets.
8. Both the real-time audio and ambient noise levels are monitored by the OCE for the remainder of the night-time period, with equipment turned-off and on (primarily equipment in Pit 2 and dozers on waste in Pit 5), as required, throughout the period based on both subjective and objective observations by the OCE.

Figure 3 Real-time Noise Management Example and Recorded Noise Emission Levels



The above example demonstrates how the WCM noise emission levels are actively managed to maintain mine noise emissions below an acceptable level, including when weather conditions are outside those nominated in the WCM Project Approval/EPL.

The WCM noise management strategy will continue to be implemented for the WCM Modification.

2.4 WCM Noise Compliance Summary

Noise monitoring is conducted at the WCM in accordance with the WCM NMP. Operator-attended noise monitoring is used to assess for compliance against the approved and licensed noise limits.

WCM Operator-Attended Noise Monitoring

Operator-attended noise monitoring undertaken by independent acoustic consultants since 2006 (commencement of WCM mining operations) has demonstrated ongoing compliance with the noise criteria. A summary of the findings of the operator-attended noise compliance monitoring undertaken since 2008 is provided in **Table 1**.

Table 1 Summary of Operated-Attended Noise Compliance Monitoring

Year	Quarter	Noise Compliance Statement	Notes
2008	1st	Compliant	-
	2nd	Compliant	-
	3rd	Compliant	-
	4th	Compliant	An exceedance would have been noted at N10 (Robinson) on 9 December 2008 had criteria been applicable. During this measurement, WCM was audible as an engine continuum and frequently as dozer track noise (500 - 630 Hz) and individual haul truck noise (80 Hz, 160 - 200 Hz). Meteorological conditions at the time of this measurement were outside the range for which criteria apply and so there was no exceedance of WCM's evening and night criteria.
2009	1st	Compliant	-
	2nd	Compliant	-
	3rd	Compliant	-
	4th	Compliant	A 1 dB exceedance of WCM's $L_{A1(1\ minute)}$ Criteria would have been noted at N7 (Ulan, Wollar Road East) on the 9 September 2009 had the criteria been applicable. However, this exceedance is not considered significant as per Chapter 11 of the DECCW's INP which deems a development to be in non-compliance only when *"the monitored noise level is more than 2 dB above the statutory noise limit specified in the consent or licence condition."*

Independent Noise Assessment

Two independent noise audit reports were conducted by Wilkinson Murray Pty Ltd for the Department of Planning.

- Residence 90 (Pattullo) - *Wilpinjong Coal Mine Independent Operational Noise Monitoring at The Fairvale Property* dated August 2008, Report Number 08132 Version A

- Residence 59 (Langshaw) - *Wilpinjong Coal Mine Independent Operational Noise Monitoring at The Koringa Property* dated August 2008, Report Number 08132 Version A

The monitoring at the Fairvale Property included 8 weeks of real-time directional noise monitoring and 2 days of operator-attended noise monitoring. The monitoring at the Koringa Property included 4 weeks of real-time directional noise monitoring and 2 days of operator-attended noise monitoring.

The reports conclude that:

> *"A detailed analysis of the noise monitoring data was conducted and it is concluded that there is no sustained non-compliance of the noise criteria at the Fairvale [or Koringa] property and as such it is considered that Wilpinjong Coal Mine is not in breach of its noise conditions in the Project Approval."*

And that:

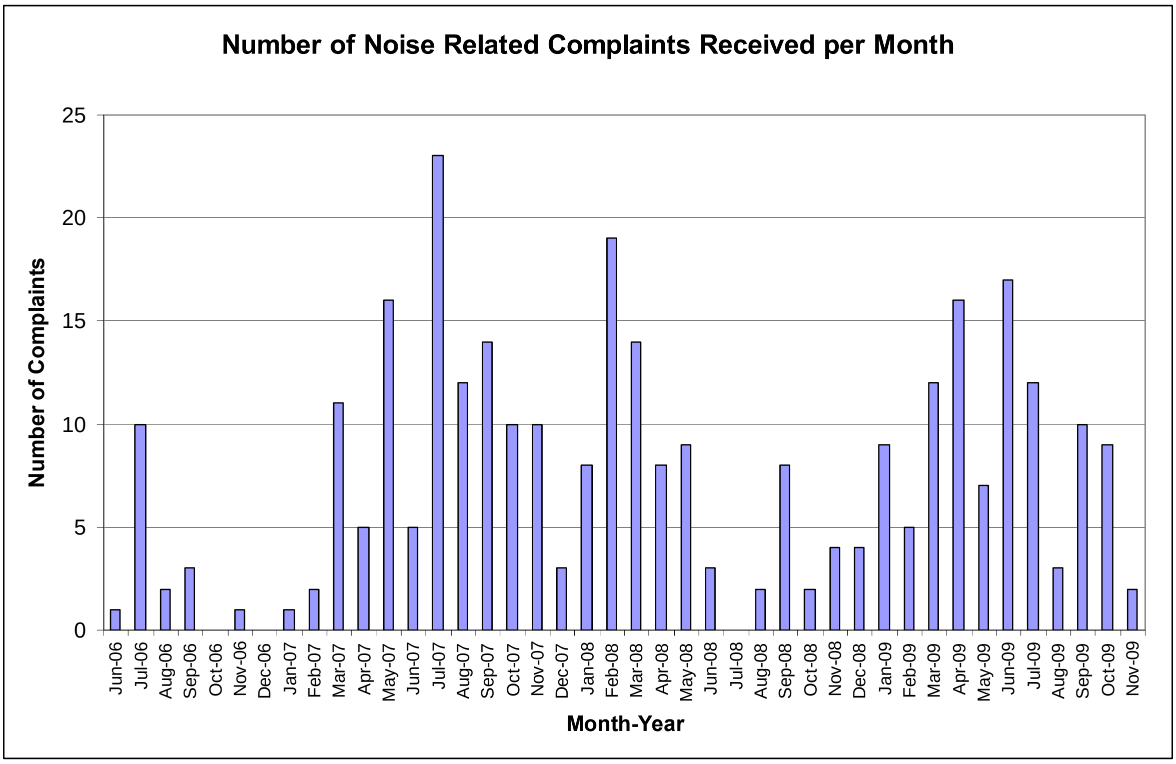
> *"Wilpinjong Coal Mine has a real time noise monitoring system in place that compared well with the BarnOwl directional noise monitoring system that could be used to reactively manage noise levels from the mine."*

2.5 WCM Noise Complaints Summary

WCPL maintains a complaints register in accordance with the WCM NMP. WCM noise complaints generally relate to on site mobile plant noise (eg haul truck and dozer noise). A summary of the number of noise complaints for the period June 2006 to November 2009 is provided in **Figure 4**.

Complaints regarding noise received during the 2009 AEMR reporting period were responded to in accordance with the Mine Complaint Response Protocol (detailed in the WCM NMP). Following each complaint the source and noise level were determined/verified and in all cases where noise emissions were attributed to the WCM activities, the noise levels were found to be below the noise management levels (and in turn the noise criteria), consequently, there were no reportable environmental incidents (WCPL, 2010).

Figure 4 Summary of Noise Complaints Received at the WCM



Source: WCPL (2006-2009).

The following comments can be made with regard to the noise complaints:

- Generally there are a greater number of complaints during the winter period when temperature inversions prevail together with lower ambient background levels.
- Completion of the Cumbo Valley acquisition strategy has resulted in a reduction in the number of complaints from this area.
- Generally there is an increase in the number of complaints when operations commence in a new pit or mining area.
- Most complaints relate to the mine being discernible or audible (eg low frequency noise) however, in all instances further investigation found the WCM to be below the respective noise limits.
- With a night-time background noise level in the order of 20 dBA and 25 dBA (externally) at most of the complainants' residences, the WCM would be clearly discernible if the noise criterion of 35 dBA is reached (eg the low frequency component of the mine noise is audible at greater distance than the higher frequency noise).

Reportable Incidents

No environmental incidents were reported relating to noise at the WCM during the 2009 AEMR reporting period (WCPL, 2010). Complaints regarding noise received during the reporting period were responded to in accordance with the Mine Complaint Response Protocol.

3 WCM MODIFICATION

3.1 Existing and Proposed Hours of Operation

The current WCM and proposed WCM Modification operating hours are summarised in **Table 2**, together with the operating hours proposed in WCM Environmental Impact Statement (EIS).

Table 2 Existing WCM and Proposed WCM Modification Hours of Operation

On-Site Operation	WCM EIS	Current WCM (Approved)[1]	WCM Modification
Periodic daytime civil construction works	Generally daytime (0700 hrs to 1800 hrs, 7 days per week)	Unchanged	24 hrs [2] 7 days per week
Mine maintenance, operation, coal handling	24 hrs 7 days per week	Unchanged	Unchanged
Blasting Operations	0900 to 1700 hrs A maximum of 1 blast per day and 1 blast per week on average over any 12 month period	0900 to 1700 hrs A maximum of 2 blasts per day and 5 blasts per week on average over any 12 month period	Unchanged
Off-Site Operation			
Train Traffic	24 hrs 7 days per week	Unchanged	Unchanged
Road Traffic	WCM main access road via Wollar Road 24 hrs 7 days per week	WCM main access road via Ulan-Wollar Road	Unchanged

Note 1: Since receiving approval in February 2006, WCPL has been granted some modifications to the WCM Approval (and corresponding variations to the WCM Licence).

Note 2: For CHPP and coal handling upgrade only.

3.2 Description of the Modification

WCPL seeks approval to increase the approved WCM maximum ROM coal mining rate from 13 Mtpa to 15 Mtpa and a small increase in the maximum annual rate of overburden mined (the WCM Modification). Additional mobile fleet would be required on-site to achieve the currently approved 13 Mtpa and the proposed incremental increase in production under the WCM Modification.

To facilitate increased coal production and improve the efficiency of coal handling and preparation on-site, the existing Coal Handling and Preparation Plant (CHPP) and general coal handling/stockpiling systems would be upgraded.

The WCM Modification would involve some additional extension to the existing coal handling and processing infrastructure at the WCM as shown on **Appendix B2**. An indicative sequence of mining for the years 2010 to 2026 is shown on **Appendix B3**. This mining sequence is based on planned maximum production and mine progression. The main activities associated with the WCM Modification would include:

- Continued development of open cut mining operations at the WCM to facilitate a total ROM coal production rate of up to approximately 15 Mtpa, including:
    - Introduction of additional mobile plant; and
    - Upgrade and expansion of CHPP and general coal handling/stockpiling systems.
- Increased road transport movements associated with the construction period in 2011 and additional operational workforce movements and deliveries.

- Increased average daily coal rail transport movements on the Gulgong-Sandy Hollow Railway and Main Northern Railway (maximum daily train movements would be unchanged).

3.3 On-site Blasting

The method of hard rock overburden material removal at the WCM is by drill and blasting techniques. A mixture of ammonium nitrate and fuel oil (ANFO) (dry holes) and emulsion blends (wet holes) are used. Blast sizes would generally remain unchanged by the WCM Modification.

The WCM Modification would not increase the blast frequency above that currently approved. The number of blasts in any week would be dependent on mine production. Blasting would only occur between the hours of 0900 hours and 1700 hours, 7 days per week (excluding public holidays or Sundays).

3.4 Off-site Rail Transport

In order to facilitate the increase in coal production it is expected that the number of train movements would increase from approximately four movements per day to approximately five movements per day when averaged over an annual period. Daily maximum train movements would remain unchanged at six trains per day.

Train loading would continue to be conducted 24 hours per day, 7 days per week.

3.5 Off-site Road Transport

The existing access road off Ulan-Wollar Road would remain the primary site access. The WCM has an existing workforce of approximately 300 people (including Peabody/WCPL and Thiess staff and on-site sub-contractors' personnel). At full development, the WCM Modification operational workforce would be in the order of 350 people, including a mixture of direct Peabody/WCPL employees and contractors.

A short-term peak in additional traffic is expected during 2011 when the average construction workforce would be 150 people over the nine month construction period (at peak the construction workforce would be up to 280 people).

The current shift arrangements at the WCM would generally be retained. During the life of the WCM Modification, alternative shift configurations may be required to meet operational requirements.

3.6 Land Ownership

The WCM site and surrounding area are shown on the Land Ownership Plan attached as **Appendix C1**. A summary of the nearest potentially affected non-mine owned receivers, mine owned receivers and non-mine owned vacant land are presented in **Table 3**, **Table 4** and **Table 5**, respectively.

Table 3 Nearest Potentially Affected Receivers (Non-Mine Owned)

Locality	ID No	Landholder	ENM Receiver Coordinates[1]		
			East (m)	North (m)	Elevation (m)
Wilpinjong	45[2]	JAW Smith	17489	10800	353
Araluen	26	K & VC Christiansen	19436	9146	353
Araluen	82	RJ Jackson	21042	8021	372
Araluen	83	G & DJ Hayes	20625	8247	361
Araluen	100	TJ & VE Rheinberger	20199	8762	361
Araluen	102	W Filipczyk	23087	10412	440
Araluen	118	DS & D Ponton	20904	9943	450
Araluen	119	TJ & JA Peach	20509	9848	419
Araluen	123	A & M Zivkovic	19621	8800	350
Araluen	124	A Zivkovik	19660	8716	355
Araluen	125	E & K Roberts	19800	8290	356
Araluen	126	A & P Davies	20377	8201	360
Araluen	127	A & D Wentzel	20565	8879	368
Araluen	128	WG Pongratz	19924	8120	351
Araluen	130	L Batty & D Hirons	20392	7978	360
Araluen	131	MR Field	20786	7861	375
Araluen	133	P & J Harty	20780	7503	398
Araluen	135	R & K Roser	20787	7102	390
Araluen	144	J Hibberd	21910	7207	386
Araluen	137	A & C Chetcuti	21450	6925	375
Araluen	139	P & M Woolford	21444	6563	377
Araluen	140	W Stafford & M McCullough	21663	6431	378
Araluen	141	C Hull	21899	6679	379
Araluen	142	D & S Williams	21623	6915	373
Araluen	143	R Bale & K Lawes	20924	7412	390
Araluen	147	D Currington	20993	7812	375
Araluen	148	O Lee	20710	6975	390
Araluen	122B	PN Hardiman	20897	8516	360
Araluen	129A	K & R Roser	20179	7553	372
Araluen	129B	K & R Roser	20142	7459	374
Araluen	145	C Bremner & M O'Neill	21337	7479	370
Araluen	136	M & R Bryson	21216	7223	375
Araluen	23A	ID Bloomfield	18376	9282	388
Araluen	23B[3]	B Bishop	18912	8719	365
Araluen	25	SE & JE Pettit	19277	8726	375
Araluen	28B	BP & FV & MJ & JM Power	19822	7795	360
Araluen	28C	BP & FV & MJ & JM Power	19402	7618	377
Combo	49[3]	RSM & LD Harkin	14646	4434	455
Moolarben	68A	EC Mayberry	4851	5580	528
Moolarben	68B	EC Mayberry	5771	5958	499

Locality	ID No	Landholder	ENM Receiver Coordinates[1]		
			East (m)	North (m)	Elevation (m)
Moolarben	69	DJ & JG Stokes	5567	3126	545
Moolarben	70A	JW & JG O'Sullivan	7439	1909	572
Moolarben	70B	JW & JG O'Sullivan	7751	2259	556
Murragumba	33B-5	M & P Swords	1764	10796	451
Slate Gully	53[3]	RW Reynolds	17883	8356	395
Slate Gully	55[3]	SC & M Fox	17576	8269	392
Slate Gully	58[3]	FN Maher	17624	7748	400
Slate Gully	31[3]	DE & AM Conradt	18471	8374	389
Slate Gully	57	F Nagy	18866	8337	380
Slate Gully	52A[3]	CR Long	17957	7823	410
Slate Gully	52B[3]	CR Long	18053	7994	421
Wollar	149	JD Zagarella	20077	5186	372
Wollar	900	St Laurence O'Toole Catholic Church	19333	5738	369
Wollar	901	School	19555	6223	365
Wollar	904	Wollar Village	19297	5569	369

Note 1: To convert to MGA coordinates add 758 000 mE and add 6 410 000 mN.

Note 2: Properties identified in the WCM Project Approval as being in the Noise Affectation Zone (Acquisition Zone).

Note 3: Properties identified in the WCM Project Approval as being in the Noise Management Zone.

Table 4 Nearest Potentially Affected Receivers (Mine Owned)

Locality	ID No	Landholder	ENM Receiver Coordinates[1]		
			East (m)	North (m)	Elevation (m)
Murragumba	32-12	Ulan Coal Mines/Moolarben Coal Mines controlled lands	5608	16397	441
Murragumba	32-13		5860	16113	439
Murragumba	32-14		6864	15885	420
Murragumba	32-2		3321	12257	499
Murragumba	32A		5929	13469	435
Murragumba	32C		8154	13779	412
Murragumba	32D-16		6166	14816	425
Murragumba	32F		5224	12940	435
Murragumba	32G		5442	11238	455
Murragumba	32I		6310	9751	479
Murragumba	32L-15		6438	15349	420

Note 1: To convert to MGA coordinates add 758 000 mE and add 6 410 000 mN.

Table 5 Nearest Potentially Affected Vacant Land (Non-Mine Owned)

Locality	ID No	Landholder	Approximate ENM Property Coordinates[1, 2]		
			East (m)	North (m)	Elevation (m)
Araluen	24	JA & TS Peach	19010	8850	365
Araluen	27	McDermott	19190	10130	400
Cumbo	30	WF Gaffney	16000	5240	420
Cumbo	48	JR & BM Evans	12850	4540	430
Cumbo	50	LD Thompson & RJ Hopper	13720	4810	420
Cumbo	94	GM & KL McKenzie	15570	3250	460
Slate Gully	31	DE & AM Condradt	17860	9230	373
Slate Gully	40	G & J Maher	17910	8980	377
Slate Gully	51	P Bailey	17600	7500	400

Note 1: To convert to MGA coordinates add 758 000 mE and add 6 410 000 mN.
Note 2: Coordinates are an approximation of the centre of the land holding.

The receiver locations used in the noise modelling are shown on the figure presented in **Appendix C2**.

4 EXISTING METEOROLOGICAL AND NOISE ENVIRONMENT

4.1 Meteorological Environment

Section 5.3 of the NSW INP (EPA, 2000) provides the following regarding wind effects:

> *"Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season."*

An assessment of prevailing wind conditions was derived from the meteorological data recorded by WCM Automatic Weather Station (AWS). The wind roses and dominant seasonal wind speeds and directions over a composite 5-year period (2005 to 2009) are presented in **Appendix D1** and **Appendix D2**, respectively, for daytime (0700 hours to 1800 hours), evening (1800 hours to 2200 hours) and night-time (2200 hours to 0700 hours) in accordance with a methodology consistent with the requirements of the INP.

The prevailing winds less than (or equal to) 3 metres per second (m/s) with a frequency of occurrence greater than (or equal to) 30% and considered to be relevant to the WCM in accordance with the INP are presented in **Table 6**.

Table 6 Prevailing Wind Conditions in accordance with the INP

Season	Winds ±45° ≤ 3m/s with Frequency of Occurrence ≥ 30%		
	Daytime	Evening	Night-Time
Annual	Nil	Nil	Nil
Summer	Nil	E (31.2 %) ESE (31.3 %)	ENE (32.7 %) E (42.3 %) ESE (43.9 %) SE (36.3 %)
Autumn	Nil	E (32.9 %) ESE (36.7 %) SE (32.3 %)	Nil
Winter	Nil	Nil	Nil
Spring	Nil	Nil	Nil

Section 5.2 of the INP provides the following regarding temperature inversions:

> *"Assessment of impacts is confined to the night noise assessment period (10.00 pm to 7.00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible."*
>
> *"Where inversion conditions are predicted for at least 30% (or approximately two nights per week) of total night-time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment".*

An assessment of atmospheric stability conditions has also been prepared from the meteorological data recorded by the WCM AWS. The frequency of occurrence of atmospheric stability classes are presented in **Table 7**, together with estimated Environmental Lapse Rates (ELR).

Table 7 Atmospheric Stability Frequency of Occurrence

Stability Class	Frequency of Occurrence					Estimated ELR °C/100 m	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0.0%	0.0%	0.0%	0.0%	0.0%	<-1.9	Lapse
B	0.0%	0.0%	0.0%	0.0%	0.0%	-1.9 to -1.7	Lapse
C	0.0%	0.0%	0.0%	0.0%	0.0%	-1.7 to -1.5	Lapse
D	32.6%	42.9%	25.8%	27.6%	32.5%	-1.5 to -0.5	Neutral
E	16.1%	18.7%	16.2%	13.6%	16.0%	-0.5 to 1.5	Weak inversion
F	49.3%	36.4%	56.8%	56.4%	49.5%	1.5 to 4	Moderate inversion
G	1.9%	2.0%	1.1%	2.4%	1.9%	>4.0	Strong inversion

Note: ELR (Environmental Lapse Rate).

In accordance with the INP, the frequency of occurrence of moderate (ie 1.5 to 4.0°C/100m) winter temperature inversions is greater than 30% during the combined evening and night-time period and therefore requires assessment.

In addition, the INP Section 5.2 *Temperature Inversions* also states:

> *"The drainage-flow wind default value should generally be applied where a development is at a higher altitude than a residential receiver, with no intervening higher ground (for example, hills). In these cases, both the specified wind and temperature inversion default values should be used in the noise assessment for receivers at the lower altitude."*

In this case all general localities, with the exception of Residence 45 to the immediate north-east of the WCM area (see **Table 3**), are positioned at higher elevation relative to the Project site and/or there is intervening topography between the site and noise sensitive receiver. As the WCM is at a higher altitude than the Residence 45 to the immediate north-east of the WCM area (and with no intervening higher topography), this locality is assessed under drainage conditions.

Noise Model Meteorological Parameters

The noise modelling meteorological parameters presented in **Table 8** are based on the analysis of the available WCM meteorological data set presented above. In this case, the observed meteorological conditions at the WCM site are generally consistent with the default parameters presented in the Section 5 of the INP.

The site weather conditions are characterised by prevailing east-southeast winds throughout the year. Moderate temperature inversions are also a feature of the area coinciding with the "down valley" west-southwest drainage flow particularly during the cooler seasons.

Table 8 Calm (neutral) and Noise Enhancing Meteorological Modelling Parameters

Period	Meteorological Parameter	Air Temperature	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	18°C	57%	0 m/s	0°C/100 m
Evening	Calm	16°C	64%	0 m/s	0°C/100 m
	Wind only	16°C	64%	E 3 m/s, ESE 3 m/s, SE 3 m/s W 3 m/s (EIS wind)[2]	0°C/100 m
Night-time	Calm	6°C	85%	0 m/s	0°C/100 m
	Wind only	6°C	85%	E 3 m/s, ESE 3 m/s, SE 3 m/s	0°C/100 m
	Temperature Inversion only	6°C	85%	0 m/s	3°C/100 m
	Inversion plus Drainage flow[1]	6°C	85%	WSW 2 m/s	3°C/100 m

Note 1: West-southwest down valley drainage flow applicable to receivers with no intervening higher topography.

Note 2: Based on the analysis of the available WCM meteorological data set presented in **Table 6**, the frequency of occurrence of noise enhancing westerly winds is less than 30% and therefore not considered to be relevant to the WCM in accordance with the INP, however, westerly winds have been included in this assessment for consistency and comparison with the original WCM EIS assessment.

4.2 Noise Environment

Given the existing operation of the WCM, it is appropriate to review the pre-mine background noise data (from 2004) to determine the relevant Rating Background Levels (RBLs) and noise amenity levels ($L_{Aeq(period)}$) in accordance with the INP procedures.

Background Noise August - September 2004

Comprehensive background noise surveys to characterise and quantify the pre-mine noise environment in the area surrounding the WCM were conducted in August and September 2004. The measurement methodology and analysis procedures are described in the WCM EIS. The unattended background noise logger data from each monitoring location, together with the on-site weather conditions are presented graphically on a daily basis in Heggies Report 30-1313R1 *"Wilpinjong Coal Project, Construction, Operation and Transportation Noise and Blasting Impact Assessment"* dated 18 May 2005. The ambient noise data were then processed in accordance with the requirements of the INP to derive the ambient noise levels presented in **Table 9**.

The pre-mine background noise levels are summarised in **Table 9** where daytime, evening and night-time are defined as 0700 hours to 1800 hours, 1800 hours to 2200 hours and 2200 hours to 0700 hours respectively.

Table 9 Unattended Noise Monitoring Results 2004 (dBA re 20 µPa)

Locality	Reference/ Landowner	Rating Background Level[1,2,3] All Noise Sources			LAeq(period)[3] All Noise Sources		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Cumbo	6 Langshaw (dwelling)	27	22	22	51	41	41
	6 Langshaw (25 metres [m] from road)	27	23	23	51	44	41
Wollar	900 St Laurence O'Toole Catholic Church (boundary)	31	26	27	64	42	50
Araluen	139 Woolford (dwelling)	25	24	24	43	39	41
Slate Gully	WG Cumbo P/L (potential dwelling site)	25	22	22	50	44	40
Wilpinjong (north-east of the Project area)	WB Cumbo P/L (dwelling)	27	28	23	52	41	39
Wilpinjong	WF Cumbo P/L (75 m from Railway)	28	34[4]	27	53	51	51
Murragamba	42 Little/Salter (dwelling)	26	24	24	54	38	42
	34 Birt/Hayes (dwelling)	28	43[4]	23	46	49	30

Note 1: Measured noise levels less than 31 dBA may have a signal to noise ratio less than 5 dBA.
Note 2: In accordance with the NSW INP (2000), if the RBL is below 30 dBA, then 30 dBA shall be the assumed RBL.
Note 3: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 4: Affected by insect noise or diesel generator in the evening period.

In accordance with the NSW INP where the background level was found to be less than 30 dBA, the background level was set to 30 dBA.

Background Noise and Amenity Levels for INP Assessment Purposes

The Rating Background Levels (RBLs) adopted for assessment purposes are representative of the background noise environment, with all RBLs at 30 dBA, except for Wollar which has a daytime RBL of 31 dBA. Furthermore, industrial noise amenity levels (ie non-transport related noise) from other mines in the locality are minimal at non-mine owned residences. The RBLs are typical for a rural environment where there is minimal industrial noise and relatively low use transport corridors.

In view of the foregoing, the RBLs and noise amenity levels ($L_{Aeq(period)}$) are presented in **Table 10**, which form the basis of establishing the Project-specific noise assessment criteria (**Section 5.3**).

Table 10 Background Noise and Amenity Levels for Assessment Purposes

Receiver Type	Locality	Estimated RBL[1] All Noise Sources			Estimated LAeq(period)[1, 2] Industrial Noise Only		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Privately Owned	Wollar residential receivers	31	30	30	<44	<39	<34
Privately Owned	All other residential receivers	30	30	30	<44	<39	<34

Note 1: Estimated RBLs and noise amenity levels in the absence of WCM operation.

Note 2: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

5 NOISE ASSESSMENT METHODOLOGY

5.1 Construction Noise

WCM Modification construction works would be limited in extent, but would include infrastructure upgrades in line with the increased ROM coal production, including upgrades to the existing Coal Handling and Preparation Plant (CHPP) and general coal handling/stockpiling systems.

In accordance with the NSW Department of Environment and Climate Change and Water (DECCW) interim policy “Interim Construction Noise Guideline” (ICNG) mine construction activities are generally considered integral with the general mining operations. Therefore the construction works associated with the upgrade works have been included in modelled daytime 2011 mine operations.

5.2 Sleep Disturbance Assessment Criteria

The INP does not specifically address sleep disturbance however the DECCW’s Application Notes (**Appendix E1**) provides some guidance in relation to this complex matter.

The DECCW uses the ECRTN (Appendix B Section B5) sleep disturbance criterion of the $L_{A1(1minute)}$ not exceeding the $L_{A90(15minute)}$ (prevailing at the time) by more than 15 dBA as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required. The $L_{A1(1minute)}$ descriptor is meant to represent a maximum noise level measured under “fast” time response. The DECCW will accept analysis based on either $L_{A1(1minute)}$ or L_{Amax}.

A review of noise events from the approved WCM night-time operations indicates that the maximum (L_{Amax}) levels are typically less than 10 dBA above the $L_{Aeq(15minute)}$ intrusive level when measured at a receiver. Hence, if the $L_{Aeq(15minute)}$ criteria (ie background plus 5 dBA) are achieved then the DECCW's sleep disturbance criteria would also be met. This relationship enables the noise assessment process to focus on the setting and assessment of INP based intrusive noise and amenity levels which aim to minimise annoyance at noise sensitive receiver locations.

Furthermore, the ECRTN's review of sleep disturbance research concludes that (i) the maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions and (ii) one or two noise events per night, with maximum internal noise level of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly. As approvals conditions generally include external noise levels, an internal noise level can be conservatively transposed to an external noise level by adding 10 dBA (or 12.5 dBA when measured 1m from the dwelling facade).

It follows, that an external $L_{A1(60second)}$ noise criteria of 50 dBA to 55 dBA would appear conservatively lower than the ECRTN's conclusions in relation to this matter.

Therefore, it is considered that the INP-based intrusive criteria would be the controlling factor in determining compliance for the WCM Modification.

5.3 Intrusive Noise and Amenity Levels Assessment Criteria

The DECCW has regulatory responsibility for the control of noise from "scheduled premises" (the WCM is a scheduled premises) under the Protection of the Environment Operations Act, 1997. The procedure for assessing the potential impacts of the industrial noise sources is set out in the INP.

The INP assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short-term.
- Maintaining noise level amenity for particular land uses over the medium to long-term.

The INP prescribes detailed calculation routines for establishing "Project-specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (ie non-transport related) criteria for a development at potentially affected noise sensitive and various other receiver areas. Ideally, the intrusive noise level should generally not exceed the background level by more than 5 dBA.

In addition, the DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. For assessment purposes in this report vacant land is defined as a lot which may be permitted to have (but does not yet have) a dwelling and is therefore a potentially sensitive receiver in accordance with the INP. In the absence of a specific dwelling (or a known approved building Development Application) noise impacts are determined where exceedances are predicted over 25% of the vacant land area.

In accordance with the INP's Chapter 2 Industrial Noise Criteria in conjunction with the INP's Application Notes, the Project-specific intrusive and amenity assessment criteria for residential and vacant land receiver areas are presented in **Table 11**. These criteria are nominated for the purposes of assessing potential noise impacts from the Project.

Table 11 Project-specific Noise Assessment Criteria (dBA re 20 µPa)

Receiver Type	Land Use Amenity Area	Intrusive LAeq(15minute)[1]			Amenity LAeq(period)[1]		
		Day	Evening	Night	Day	Evening	Night
Existing Dwellings	Wollar Residential[2]	36	35	35	55	45	40
Existing Dwellings	Rural Residential[2]	35	35	35	50	45	40
Potential Dwellings	Rural Vacant Land[3]						
Place of Worship	Laurence O'Toole Catholic Church (internal) St Luke's Anglican Church (internal)	INP Place of Worship[4]			40	40	Not in use[5]
School Classroom	Wollar School (internal)	INP School Classroom[4]			35	35	
National Parks	Goulburn River National Park Munghorn Gap Nature Reserve	INP School National Park[4]			50	50	50

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

Note 2: At the most-affected point within 30 m of the residential area.

Note 3: Where exceedances are predicted over 25% of the vacant land area.

Note 4: Intrusive criteria apply to residential receptors only.

Note 5: It is understood that churches and schools are generally not utilised at night-time (ie after 2200 hours).

The intrusiveness criterion is met if the $L_{Aeq(15minute)}$ is less than or equal to the RBL plus 5 dBA, where the RBL is determined from monitoring data following the INP procedures discussed in **Section 4.2**. Thus, the most stringent Project-specific criterion for the WCM Modification would be the intrusiveness criterion (ie 35 dBA $L_{Aeq(15minute)}$) for daytime, evening and night-time periods.

The INP states that these criteria have been selected to preserve the amenity of at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, then most people would consider the resultant noise levels acceptable.

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

- Negligible noise level increase <1 dBA (Not noticeable by all people).
- Marginal noise level increase 1 dBA to 2 dBA (Not noticeable by most people).
- Moderate noise level increase 3 dBA to 5 dBA (Not noticeable by some people but may be noticeable by others).
- Appreciable noise level increase >5 dBA (Noticeable by most people).

5.4 Operational Noise Impact Assessment Methodology

In view of the foregoing, **Table 12** presents the methodology for assessing operational noise against the INP Project-specific noise assessment criteria.

Table 12 Project-specific Noise Assessment Methodology (dBA re 20 µPa)

Assessment Criteria	Project-specific Criteria	Noise Management Zone		Noise Affectation Zone
		Marginal	Moderate	
Intrusive $L_{Aeq(15minute)}$	RBL plus 5 dBA	1 to 2 dBA above Project-specific criteria	3 to 5 dBA above Project-specific criteria	> 5 dBA above Project-specific criteria

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

For the purposes of assessing the potential noise impacts, the management and affectation criteria are further defined as follows:

Noise Management Zone

Depending on the degree of predicted exceedance of the Project-specific criteria (1 dBA to 5 dBA) potential noise impacts in the noise management zone could range from negligible to moderate (in terms of the perceived noise level increase). In addition to the noise mitigation measures included in the predictive modelling (Section C6.2), 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 operating procedures where practicable.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine are 3 dBA to 5 dBA above Project specific noise criteria.

Noise Affectation Zone

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

- Discussions with relevant land owners to assess concerns and define responses.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine which are >5 dBA above Project specific noise criteria.
- Negotiated agreements with land owners where required.

6 NOISE MODELLING METHODOLOGY AND MITIGATION MEASURES

6.1 Noise Modelling Procedure

The WCM noise model was prepared using Roads and Traffic Authority, NSW (RTA) Software's Environmental Noise Model (ENM for Windows, Version 3.06), a commercial software system developed in conjunction with the (then) NSW EPA (now DECCW). The acoustical algorithms utilised by this software have been endorsed by the Australian and New Zealand Environment Council and all State Environmental Authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available.

Heggies has an existing ENM model for the WCM that has been used for a number of reviews since mining commenced in 2006. The existing WCM noise model was modified to incorporate the significant noise sources associated with the proposed WCM Modification. The surrounding terrain and nearby potentially affected receivers (**Table 3**, **Table 4** and **Appendix C2**) were also updated.

Noise Model Validation

Heggies conducted two noise investigation surveys (November 2009 and January 2010) in order to gather sufficient data to validate the WCM noise model and reflect as-built noise emissions. The WCM noise model validation process can be summarised as follows:

- The Sound Power Levels (SWLs) of all significant noise generating plant and equipment were determined from nearfield sound pressure measurements of representative items operating under typical operational conditions. Survey items included haul trucks, dozers (supporting excavator, pushing waste and on coal stockpile), excavators, loaders, conveyors, ROM bin, sizer, washery (directional contributions for each side plus the roof), reject bin, rail loadout and trains.
- 56 additional noise sources were added into the WCM model to more accurately reflect the number of as-built noise emitting sources located at the CHPP and materials handling area.
- Mid-field and far-field operator-attended noise surveys (10 validation locations in total) were conducted to determine the WCM noise level contribution at each location.
- For each survey the ambient weather conditions, number and location of operating plant and equipment and current ground topography were recorded and used to modify the existing WCM noise model to create the base WCM “validation” noise model.
- The measured SWLs of existing plant and equipment were included into the base WCM “validation” noise model and the noise levels predicted to the 10 validation locations.
- The outcome of the validation exercise has resulted in a 1.8 dBA calibration factor for the WCM noise model which has been included in the WCM Modification assessment presented in this report.

Noise Modelling Scenarios

The WCM Modification description was reviewed to determine representative scenarios to assess potential WCM noise impacts. For the purposes of assessing noise impacts in accordance with INP requirements, the following scenarios were considered:

Year 2011 Operations and CHPP Construction (Refer to Mining Sequence shown in Appendix B3):

Representative of approximately 13.5 Mtpa ROM coal production rate coinciding with mining in two areas of central Pit 5, together with operations of waste rock mining and emplacement in Pit 1. Construction of the CHPP and materials handling upgrades.

Key equipment in this scenario includes:

- Six CAT 785 haul trucks working with a Hitachi EX1900 excavator and CAT D11 support dozer handling coal from a northern strip in Pit 5.
- Two Cat D11 dozers and one drill working on overburden in the northern strip in Pit 5.
- Six CAT 785 haul trucks working with a Hitachi EX2500 excavator and CAT D11 support dozer handling coal from a southern strip in Pit 5.
- One Cat D11 dozers working on overburden in the southern strip in Pit 5.
- Two CAT 785 haul trucks together with a Hitachi EX1900 excavator and a CAT D11 dozer removing and emplacing waste rock in Pit 1.
- One Cat D10 and one drill working in Pit 2 on overburden.
- One Cat 785 haul truck hauling coal rejects from the CHPP.
- Support fleet including two graders and two water trucks working on active haul roads.
- As built CHPP and materials handling systems and 2 x CAT D11 stockpile dozers.
- CHPP and materials handling upgrade construction fleet (daytime).

Year 2014 Operations (Refer to Mining Sequence shown in Appendix B3):

Representative of the maximum mine fleet, maximum waste rock production and ROM coal production rate at 15.0 Mtpa coinciding with mining in Pit 2, central Pit 3 and southern portion of Pit 5, together with waste rock mining and emplacement in central Pit 3.

Key equipment in this scenario includes:

- Five CAT 785 haul trucks with a Hitachi EX2500 excavator and CAT D11 support dozer handling coal from Pit 2.
- One drill working on overburden in Pit 2.
- Five CAT 785 haul trucks and a Hitachi EX2500 excavator and CAT D11 support dozer handling coal from a northern strip in Pit 3.
- One CAT D11 dozer working on overburden in the northern strip in Pit 3.
- Five CAT 785 haul trucks with a Hitachi EX1900 excavator and CAT D11 support dozer handling coal from a southern strip in Pit 5.
- Three CAT 785 trucks with a Hitachi EX2500 excavator and two CAT D11 dozers removing and emplacing waste rock in the southern strip in Pit 3.
- One Cat D10 and one drill working in Pit 5 on overburden.
- Support fleet including three graders and three water trucks working on active haul roads.

- Upgraded CHPP and materials handling systems and 2 x CAT D11 stockpile dozers.

Year 2017 and Year 2020 combined Operations (Refer to Mining Sequence shown in Appendix B3):

Representative of lesser mobile fleet after the peak in production, but potentially reduced topographic shielding from Pit mining operations for private receivers to the east of the WCM area (eg Wollar).

Key equipment in this combined scenario includes:

- Five CAT 785 haul trucks with a Hitachi EX2500 excavator and CAT D11 support dozer handling the coal in the southernmost extent of Pit 3 (2020).
- One CAT D11 working on overburden in the southernmost extent of Pit 3 (2020).
- Four CAT 785 haul trucks with a Hitachi EX2500 excavator and CAT D11 support dozer handling coal from Pit 4 (2017).
- One drill on overburden in Pit 4 (2017).
- Waste rock removal and emplacement in northern Pit 3 with two CAT 785 trucks, a Hitachi EX2500 excavator and two CAT D11 dozers (2017).
- Five CAT 785 haul trucks and a Hitachi EX1900 excavator and CAT D11 support dozer handling coal from the southern portion of Pit 5 (2017).
- One Cat D10 and one drill working in Pit 2 on overburden (2017).
- Support fleet including two graders and two water trucks working on active haul roads.
- Upgraded CHPP and materials handling systems and 2 x CAT D11 stockpile dozers.

The three operational noise modelling scenarios include all existing and proposed plant items operating concurrently to simulate the overall maximum energy equivalent (ie $L_{Aeq(15minute)}$) intrusive noise level. A large proportion of the mobile equipment is operated in repeatable routines and a relatively smaller proportion of the emissions emanate from continuous fixed plant items.

The L_{Aeq} SWLs given for each item of mobile equipment do not include noise emissions which emanate from alarms or communication “horns”. In the event that alarm noise is considered to be a source of disturbance, the alarm noise level should be checked against the appropriate Australian Standard and/or requirements and the necessary mitigating action taken to achieve an acceptable noise reduction without compromising safety standards. It is noted that WCPL have installed broad-band “quacker” reversing alarms on the majority of the WCM mobile equipment fleet. Further, positive radio communication is used in place of horns.

6.2 Reasonable and Feasible Noise Mitigation

The predictive modelling involved the investigation of feasible and reasonable noise mitigation measures, particularly in relation to evening and night-time operations. These mitigation measures are assumed to be implemented for the purposes of the predictive modelling. A number of iterative steps were taken to develop noise mitigation measures for the Modification, including:

- Preliminary noise modelling of scenarios representative of the maximum noise emissions from the WCM Modification, using the measured SWLs of plant currently operating on the site (and used in the validation modelling), to identify areas of potential noise exceedances.
- Evaluation of various combinations of noise management and noise mitigation measures to assess their relative effectiveness.

- Adoption by WCPL of a range of noise management and mitigation measures (including low noise equipment and operational controls) to appreciably reduce noise emissions, including:
  - Selected additional mobile equipment post 2012 to be current technology and low noise emission standard, including implementation of up to 18 CAT 785XQ haul trucks, up to 2 CAT D11XQ dozers and a 3 dBA noise control kit fitted to one Hitachi EX2500 excavator when required.
  - Continuation of the current real-time noise monitoring and active response mechanisms under the NMP leading to mobile plant shut-downs when trigger levels are exceeded.

The above at source noise controls (eg low noise fleet items) would be implemented progressively as required from 2012 to meet applicable noise criteria at nearby private receivers.

The resulting noise mitigated daytime, evening and night-time WCM modified operations can be generally described as follows:

- Daytime, evening and night-time mining operations include coal and overburden mining and haulage, coal processing/washing, handling and stockpiling, rail loading and on-site train movement. The mitigated operational fleet typically comprises:
  - Up to 18 x low noise CAT 789XQ trucks
  - Up to 2 x low noise CAT D11XQ dozers
  - 6 x standard CAT D11 dozers
  - 1 x standard CAT D10 dozer
  - 1 x noise attenuated Hitachi EX2500 excavator (when required in Pit 3 south in 2020)
  - 2 x standard Hitachi EX2500 excavators
  - 1 x standard Hitachi EX1900 excavator
  - Associated support and ancillary fleets operating in open cut areas

6.3 Sound Power Levels

The potential for machinery to emit noise is quantified as the sound power level (SWL) expressed in A-weighted decibels (dBA) re 1 pW. At the receptor, the received noise is quantified as the sound pressure level (SPL) expressed in dBA re 20 µPa. The INP's energy equivalent (L_{eq}) assessment parameters has introduced greater mathematical rigour to the prediction of received noise levels as it enables the use of L_{eq} SWL as noise model inputs. In general terms, any variation in mine site L_{eq} SWL will produce a similar variation in the $L_{eq(15minute)}$ sound pressure level at the receiver.

Comparative equipment fleets are presented in **Table 13** together with the overall mine site L_{eq} SWLs from the WCM as predicted in the WCM EIS, the current as built WCM, and the proposed WCM Modification.

Table 13 WCM EIS, Current as built WCM, and Proposed WCM Modification Equipment Fleets

Equipment Description	WCM EIS Years 1-5		WCM EIS >Years 5		Existing as Built (January 2010)		WCM Modification Year 2011		WCM Modification Year 2014		WCM Modification Year 2017 & Year 2020 (Combined)	
	No of Items	Total	No of Items	Total	No of Items	Total	No of Items	Total	No of Items	Total	No of Items	Total
Excavator (EX2500)	0	-	0	-	1	117 dBA	1	117 dBA	3	122 dBA	3[3]	121 dBA
Excavator (EX1900)	4	120 dBA	4	118 dBA	2	121 dBA	2	121 dBA	1	118 dBA	1	118 dBA
Haul Truck (CAT 785)	9	128 dBA	9	123 dBA	13	139 dBA	15	140 dBA	18[1]	128 dBA	16[1]	127 dBA
Haul Truck (CAT 777)	1	116 dBA	1	113 dBA	0	-	0	-	0	-	0	-
Dozer (CAT D8/D9)	2	120 dBA	2	118 dBA	1	120 dBA	0	-	0	-	0	-
Dozer (CAT D10)	2	123 dBA	2	121 dBA	2	126 dBA	1	123 dBA	1	123 dBA	1	123 dBA
Dozer (CAT D11- In-pit)	4	128 dBA	4	126 dBA	3	131 dBA	6	134 dBA	6[2]	132 dBA	6[2]	132 dBA
Dozer (CAT D11 - Stockpile)	1	122 dBA	1	120 dBA	2	120 dBA	2	120 dBA	2	120 dBA	2	120 dBA
Front End Loader	2	117 dBA	2	115 dBA	2	118 dBA	2	118 dBA	2	118 dBA	2	118 dBA
Grader	1	115 dBA	1	112 dBA	1	115 dBA	3	120 dBA	3	120 dBA	2	118 dBA
Water Truck	2	117 dBA	2	115 dBA	1	116 dBA	3	121 dBA	3	121 dBA	2	119 dBA
Drills	1	115 dBA	1	113 dBA	1	120 dBA	2	122 dBA	2	122 dBA	2	122 dBA
Coal Preparation Plant	1	122 dBA	1	122 dBA	1	118 dBA	1	118 dBA	1	120 dBA	1	120 dBA
ROM Bin & Feeder	0	-	0	-	1	106 dBA	1	106 dBA	2	109 dBA	2	109 dBA
Reject Bin	0	-	0	-	1	109 dBA	1	109 dBA	1	109 dBA	1	109 dBA
Sizer and Crushers	3	117 dBA	3	117 dBA	1	116 dBA	1	116 dBA	2	119 dBA	2	119 dBA
Stockpile Discharge	1	103 dBA	1	103 dBA	2	103 dBA	2	103 dBA	4	106 dBA	4	106 dBA
Transfer Station	0	-	0	-	0	-	3	105 dBA	4	106 dBA	4	106 dBA
Train Loadout Bin	1	114 dBA	1	114 dBA	1	113 dBA	1	113 dBA	1	113 dBA	1	113 dBA
Locos	4	114 dBA	4	114 dBA	3	105 dBA	3	105 dBA	3	105 dBA	3	105 dBA
Raw Coal Conveyors	1	103 dBA	1	103 dBA	3	106 dBA	3	106 dBA	5	109 dBA	5	109 dBA
Reject Conveyor	1	101 dBA	1	101 dBA	1	97 dBA	1	97 dBA	1	99 dBA	1	99 dBA
Product Conveyors	1	104 dBA	1	104 dBA	2	100 dBA	2	100 dBA	4	108 dBA	4	108 dBA
Reclaim Conveyor	1	102 dBA	1	102 dBA	0	-	0	-	1	106 dBA	1	106 dBA
Train Loadout Conveyor	1	102 dBA	1	102 dBA	1	108 dBA	1	108 dBA	1	108 dBA	1	108 dBA
Total SWL		**133 dBA**		**131 dBA**		**140 dBA**		**141 dBA**		**135 dBA**		**135 dBA**

Note 1: Fleet includes up to 18 low noise CAT 785XQ haul trucks.

Note 2: Fleet includes up to two low noise CAT D11XQ dozers.

Note 3: Fleet includes up to one noise attenuated excavator.

As shown above, the overall maximum sound power levels of the WCM Modification in 2011 (141 dBA) introduces a minor (approximately 1 dBA) increase in comparison to the existing site sound power. However, the introduction of low noise standard fleet items would result in a moderate (approximately 5 dBA) site sound power reduction by comparison with the existing WCM operations.

7 MINE NOISE IMPACT ASSESSMENT

The sub-sections below present the results of noise modelling for the WCM Modification.

7.1 Year 2011 Construction and Operations Noise Assessment

The predicted Year 2011 operations $L_{Aeq(15minute)}$ intrusive noise emissions at the nearest receivers are presented in **Table 14**.

The Year 2011 night-time $L_{Aeq(15minute)}$ intrusive noise contours during inversion conditions are presented in **Appendix F1**. The Year 2011 evening $L_{Aeq(15minute)}$ intrusive noise contours during westerly wind conditions are presented in **Appendix F2**. Note, the calculation of the noise contours involves numerical interpolation of a noise level array. This means that in some cases the presented contour locations differ from the values presented in **Table 14** particularly where topographic effects are prominent.

Table 14 Year 2011 Construction and Operation $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA) - Private Receivers

ID No	Landholder	Daytime	Evening			Night-time		
		Calm	Calm	INP Wind 3 m/s (E/ESE/SE)	EIS Wind 3 m/s (West)	Calm	INP Wind 3 m/s	Inversion 3°C/100m + Drainage where applicable
45	JAW Smith	22	22	27	**36**[2]	31	29	**36**[2]
26	K & VC Christiansen	13	13	10	19	14	11	16
82	RJ Jackson	17	17	13	34	17	14	32
83	G & DJ Hayes	17	17	13	34	17	14	33
100	TJ & VE Rheinberger	18	18	14	**36**[2]	18	15	34
102	W Filipczyk	20	20	17	31	20	18	31
118	DS & D Ponton	23	23	20	34	23	20	34
119	TJ & JA Peach	8	9	19	35	22	19	26
123	A & M Zivkovic	7	7	16	35	19	17	27
124	A Zivkovik	18	18	15	**36**[2]	18	15	35
125	E & K Roberts	17	17	14	35	18	15	34
126	A & P Davies	17	17	14	35	18	14	33
127	A & D Wentzel	18	18	14	35	18	15	34
128	WG Pongratz	3	4	12	34	17	13	26
130	L Batty & D Hirons	16	17	13	34	17	13	33
131	MR Field	17	17	13	34	17	13	32
133	P & J Harty	18	18	14	34	18	14	32
135	R & K Roser	17	17	13	34	17	13	32
144	J Hibberd	16	16	12	33	17	13	31
137	A & C Chetcuti	16	16	12	33	16	12	31
139	P & M Woolford	16	16	11	33	16	12	31
140	W Stafford & M McCullough	15	15	11	33	16	11	31
141	C Hull	15	16	11	33	16	12	31

ID No	Landholder	Daytime	Evening			Night-time		
		Calm	Calm	INP Wind 3 m/s (E/ESE/ SE)	EIS Wind 3 m/s (West)	Calm	INP Wind 3 m/s	Inversion 3°C/100m + Drainage where applicable
142	D & S Williams	16	16	11	33	16	12	31
143	R Bale & K Lawes	17	17	13	34	17	13	32
147	D Currington	17	17	13	34	17	13	32
148	O Lee	16	17	12	34	17	13	32
122B	PN Hardiman	17	17	14	34	18	14	33
129A	K & R Roser	16	16	12	34	16	12	32
129B	K & R Roser	16	16	12	34	16	12	33
145	C Bremner & M O'Neill	16	16	12	33	16	13	32
136	M & R Bryson	17	17	14	32	17	15	31
23A	ID Bloomfield	21	21	17	**39**[3]	21	17	29
23B	B Bishop	18	18	15	**38**[3]	19	15	**36**[2]
25	SE & JE Pettit	19	19	15	**37**[2]	19	16	**36**[2]
28B	BP & FV & MJ & JM Power	15	15	11	34	16	12	32
28C	BP & FV & MJ & JM Power	15	15	11	34	15	12	26
49	RSM & LD Harkin	16	16	22	**42**[4]	26	23	**38**[3]
68A	EC Mayberry	16	16	34	12	17	35	30
68B	EC Mayberry	4	5	26	11	16	27	11
69	DJ & JG Stokes	14	14	33	11	15	34	28
70A	JW & JG O'Sullivan	15	15	32	12	16	34	29
70B	JW & JG O'Sullivan	15	15	31	12	16	33	26
33B-5	M & P Swords	12	12	32	6	12	33	24
53	RW & JL Reynolds	8	8	16	**39**[3]	20	17	32
55	SC & M Fox	8	8	16	**39**[3]	20	17	31
58	FN Maher	8	8	16	**38**[3]	20	16	31
31	DE & AM Conradt	8	8	16	**36**[2]	20	17	26
57	F Nagy	7	8	16	**36**[2]	20	17	27
52A	CR Long	9	9	17	**39**[3]	21	17	31
52B	CR Long	10	10	18	**39**[3]	22	19	31
149	JD Zagarella	15	15	11	34	16	11	32
900	St Laurence O'Toole Catholic Church	0	0	7	32	12	8	19
901	School	0	0	8	34	13	9	26
904	Wollar Village	16	16	11	33	16	12	32

Note 1: Properties identified in the Project Approval as being in the Noise Affectation Zone.

Note 2: Marginal Noise Management Zone 1 dBA to 2 dBA above Project Specific Noise Level (PSNL) (applies to privately-owner receivers only).

Note 3: Moderate Noise Management Zone 3 dBA to 5 dBA above PSNL (applies to privately-owner receivers only).

Note 4: Noise Affectation Zone >5 dBA above PSNL (applies to privately-owner receivers only).

7.2 Year 2014 Operations Noise Assessment

The predicted Year 2014 operations $L_{Aeq(15minute)}$ intrusive noise emissions at the nearest receivers are presented in **Table 15**.

The Year 2014 night-time $L_{Aeq(15minute)}$ intrusive noise contours during inversion conditions are presented in **Appendix F3**. The Year 2014 evening $L_{Aeq(15minute)}$ intrusive noise contours during westerly wind conditions are presented in **Appendix F4**. Note, the calculation of the noise contours involves numerical interpolation of a noise level array. This means that in some cases the presented contour locations differ from the values presented in **Table 15** particularly where topographic effects are prominent.

Table 15 Year 2014 Operation $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA) - Private Receivers

ID No	Landholder	Daytime	Evening			Night-time		
		Calm	Calm	INP Wind 3 m/s (E/ESE/SE)	EIS Wind 3 m/s (West)	Calm	INP Wind 3 m/s	Inversion 3°C/100m + Drainage where applicable
45	JAW Smith	19	19	23	**40**[3]	25	25	**43**[4]
26	K & VC Christiansen	11	11	9	17	13	11	16
82	RJ Jackson	11	11	7	34	12	8	28
83	G & DJ Hayes	11	11	8	35	12	9	28
100	TJ & VE Rheinberger	12	12	9	**37**[2]	13	10	30
102	W Filipczyk	13	13	10	28	14	11	28
118	DS & D Ponton	16	16	13	34	17	14	33
119	TJ & JA Peach	7	7	12	34	16	13	26
123	A & M Zivkovic	7	8	11	30	15	13	22
124	A Zivkovik	13	13	10	**37**[2]	14	12	30
125	E & K Roberts	12	13	9	**37**[2]	14	11	29
126	A & P Davies	11	12	8	35	13	9	29
127	A & D Wentzel	12	12	9	35	13	10	30
128	WG Pongratz	5	6	9	30	13	10	24
130	L Batty & D Hirons	11	11	8	33	12	9	28
131	MR Field	11	11	8	32	12	9	27
133	P & J Harty	12	12	8	30	13	9	27
135	R & K Roser	11	11	7	30	12	8	28
144	J Hibberd	10	10	6	30	11	7	26
137	A & C Chetcuti	10	10	6	29	11	7	27
139	P & M Woolford	9	9	5	29	10	6	27
140	W Stafford & M McCullough	9	9	5	29	10	6	26
141	C Hull	9	9	5	29	10	6	26
142	D & S Williams	9	10	5	29	10	6	26
143	R Bale & K Lawes	11	11	7	30	12	8	27
147	D Currington	11	11	7	32	12	8	27
148	O Lee	11	11	7	30	12	8	28
122B	PN Hardiman	11	11	8	34	12	9	28
129A	K & R Roser	11	11	7	30	12	9	28
129B	K & R Roser	11	11	7	30	12	9	28
145	C Bremner & M O'Neill	10	10	7	30	11	8	26

ID No	Landholder	Daytime	Evening			Night-time		
		Calm	Calm	INP Wind 3 m/s (E/ESE/ SE)	EIS Wind 3 m/s (West)	Calm	INP Wind 3 m/s	Inversion 3°C/100m + Drainage where applicable
136	M & R Bryson	11	11	8	27	12	9	25
23A	ID Bloomfield	17	17	15	**39**[3]	18	16	32
23B	B Bishop	15	15	12	**39**[3]	16	13	32
25	SE & JE Pettit	14	14	11	**39**[3]	16	13	31
28B	BP & FV & MJ & JM Power	11	12	8	30	13	10	25
28C	BP & FV & MJ & JM Power	12	12	9	30	14	10	22
49	RSM & LD Harkin	24	25	34	35	31	**36**[2]	**36**[2]
68A	EC Mayberry	9	10	31	5	10	33	26
68B	EC Mayberry	1	1	22	5	10	24	8
69	DJ & JG Stokes	7	8	28	4	8	30	28
70A	JW & JG O'Sullivan	8	9	24	6	9	26	23
70B	JW & JG O'Sullivan	9	9	23	6	10	25	23
33B-5	M & P Swords	5	5	25	0	6	27	19
53	RW & JL Reynolds	14	15	16	**36**[2]	20	17	30
55	SC & M Fox	16	16	17	**36**[2]	21	18	27
58	FN Maher	15	15	16	**37**[2]	20	17	27
31	DE & AM Conradt	11	12	14	31	18	16	21
57	F Nagy	9	9	13	32	16	14	22
52A	CR Long	14	14	15	**38**[3]	20	17	31
52B	CR Long	13	14	15	**37**[2]	20	17	30
149	JD Zagarella	10	10	5	29	11	7	27
900	St Laurence O'Toole Catholic Church	4	4	6	26	12	8	14
901	School	3	3	5	30	11	8	22
904	Wollar Village	10	11	7	28	12	8	25

Note 1: Properties identified in the Project Approval as being in the Noise Affectation Zone.
Note 2: Marginal Noise Management Zone 1 dBA to 2 dBA above PSNL (applies to privately-owner receivers only).
Note 3: Moderate Noise Management Zone 3 dBA to 5 dBA above PSNL (applies to privately-owner receivers only).
Note 4: Noise Affectation Zone >5 dBA above PSNL (applies to privately-owner receivers only).

7.3 Year 2017/2020 Operations Noise Assessment

The predicted Year 2017/2020 operations $L_{Aeq(15minute)}$ intrusive noise emissions at the nearest receivers are presented in **Table 16**.

The Year 2017/2020 night-time $L_{Aeq(15minute)}$ intrusive noise contours during inversion conditions are presented in **Appendix F5**. The Year 2017/2020 evening $L_{Aeq(15minute)}$ intrusive noise contours during westerly wind conditions are presented in **Appendix F6**. Note, the calculation of the noise contours involves numerical interpolation of a noise level array. This means that in some cases the presented contour locations differ from the values presented in **Table 16** particularly where topographic effects are prominent.

Table 16 Year 2017/2020 Operation $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA) - Private Receivers

ID No	Landholder	Daytime	Evening			Night-time		
		Calm	Calm	INP Wind 3 m/s (E/ESE/ SE)	EIS Wind 3 m/s (West)	Calm	INP Wind 3 m/s	Inversion 3°C/100m + Drainage where applicable
45	JAW Smith	27	28	26	**40**[3]	30	28	**44**[4]
26	K & VC Christiansen	12	13	10	18	14	12	17
82	RJ Jackson	11	11	8	33	12	9	31
83	G & DJ Hayes	12	12	8	35	13	9	31
100	TJ & VE Rheinberger	14	14	10	31	15	12	29
102	W Filipczyk	13	13	10	29	14	11	28
118	DS & D Ponton	16	16	13	35	17	14	33
119	TJ & JA Peach	8	8	6	33	11	8	30
123	A & M Zivkovic	10	11	8	26	13	11	22
124	A Zivkovik	17	17	14	31	19	16	30
125	E & K Roberts	13	13	12	**36**[2]	14	14	30
126	A & P Davies	12	12	8	35	13	10	31
127	A & D Wentzel	13	13	10	32	14	11	28
128	WG Pongratz	6	7	4	32	9	6	25
130	L Batty & D Hirons	12	12	8	35	13	10	30
131	MR Field	11	12	8	34	13	9	31
133	P & J Harty	12	12	8	33	13	9	31
135	R & K Roser	11	11	7	33	12	9	30
144	J Hibberd	10	10	6	31	11	7	29
137	A & C Chetcuti	11	11	7	29	13	9	26
139	P & M Woolford	10	10	6	30	11	8	28
140	W Stafford & M McCullough	9	9	5	30	10	6	29
141	C Hull	9	10	5	31	10	6	29
142	D & S Williams	11	12	7	29	13	9	27
143	R Bale & K Lawes	11	11	8	33	12	9	30
147	D Currington	11	11	8	33	12	9	31
148	O Lee	11	11	7	32	12	8	28
122B	PN Hardiman	13	13	9	31	14	10	28
129A	K & R Roser	12	12	9	33	14	10	30
129B	K & R Roser	12	12	8	32	13	10	28
145	C Bremner & M O'Neill	10	11	8	32	12	9	30
136	M & R Bryson	12	12	9	29	14	11	25
23A	ID Bloomfield	18	18	16	**39**[3]	20	17	32
23B	B Bishop	15	15	12	**38**[3]	17	14	31
25	SE & JE Pettit	15	15	12	**38**[3]	16	13	31
28B	BP & FV & MJ & JM Power	12	13	9	31	14	11	26

ID No	Landholder	Daytime	Evening			Night-time		
		Calm	Calm	INP Wind 3 m/s (E/ESE/ SE)	EIS Wind 3 m/s (West)	Calm	INP Wind 3 m/s	Inversion 3°C/100m + Drainage where applicable
28C	BP & FV & MJ & JM Power	12	12	9	30	13	11	21
49	RSM & LD Harkin	26	26	34	31	28	**36**[2]	35
68A	EC Mayberry	8	8	26	4	9	28	22
68B	EC Mayberry	1	2	12	0	4	16	7
69	DJ & JG Stokes	7	7	24	3	8	26	22
70A	JW & JG O'Sullivan	9	9	23	6	10	24	21
70B	JW & JG O'Sullivan	9	9	22	6	10	24	21
33B-5	M & P Swords	3	4	23	0	4	24	16
53	RW & JL Reynolds	13	14	11	34	16	13	29
55	SC & M Fox	15	15	13	33	17	14	28
58	FN Maher	13	14	12	32	16	13	25
31	DE & AM Conradt	11	11	9	30	13	11	22
57	F Nagy	9	10	7	34	12	9	25
52A	CR Long	12	13	10	33	15	12	29
52B	CR Long	13	13	10	33	15	12	29
149	JD Zagarella	12	12	7	31	13	9	26
900	St Laurence O'Toole Catholic Church	5	5	2	19	8	5	13
901	School	4	4	1	22	7	4	20
904	Wollar Village	12	13	9	34	14	11	25

Note 1: Properties identified in the Project Approval as being in the Noise Affectation Zone.
Note 2: Marginal Noise Management Zone 1 dBA to 2 dBA above PSNL (applies to privately-owner receivers only).
Note 3: Moderate Noise Management Zone 3 dBA to 5 dBA above PSNL (applies to privately-owner receivers only).
Note 4: Noise Affectation Zone >5 dBA above PSNL (applies to privately-owner receivers only).

7.4 Summary of Operational Noise Results

In summary, the predicted noise levels show that:

- Compliance is generally determined by evening and night-time noise levels, due to the noise enhancing meteorological conditions experienced during the evening and night-time period.
- A total of fifteen privately owned receivers exceed the project specific criteria, including thirteen receivers within the Noise Management Zone, and two receivers in the noise affectation zone. The majority of these receivers are already with WCM noise management or noise affectation zones.
- During the daytime, no privately owned receivers are within the Noise Management Zone or Noise Affectation Zone.
- During the evening, up to 14 privately owned receivers are within the Noise Management Zone and one receiver in the noise affectation zone.
- During the night-time, up to three privately owned receivers are within the Noise Management Zone and one receiver in the noise affectation zone.

- Review of predicted intrusive noise levels indicates WCM noise levels would be well within compliance with relevant amenity $L_{Aeq(period)}$ criteria at churches and the school in Wollar.

Table 17 presents a summary of privately-owned receivers with predicted noise levels in exceedance of project specific criteria.

Table 17 Privately Owned Rural Receivers with Predicted Noise Level Exceedances

Period	Noise Management Zone		Noise Affection Zone
	1 dBA to 2 dBA above PSNL	**3 dBA to 5 dBA above PSNL**	**> 5 dBA above PSNL**
Daytime	-	-	-
Evening	100 Rheinberger 124 Zivkovic 125 Roberts 31[1] Conradt 57 Nagy	23A[1] Bloomfield 23B[1] Bishop 25 Pettit 53[1] Reynolds 55[1] Fox 58[1] Maher 52A[1] Long 52B[1] Long 45[2] Smith	49[1] Harkin
Night-time	25 Pettit 23B Bishop	49[1] Harkin	45[2] Smith

Note 1: Properties identified in the existing WCM Project Approval (05-0021) as being in the Noise Management Zone.

Note 2: Properties identified in the existing WCM Project Approval (05-0021) as being in the Noise Affectation (Acquisition) Zone.

7.5 Vacant Land Noise Assessment

As discussed in **Section 5.3**, the DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. **Table 18** identifies those properties for all scenarios where exceedances of the $L_{Aeq(15\ minute)}$ intrusive noise level is predicted for more than 25% of vacant land.

Table 18 Vacant Land with Predicted Project Specific Noise Level Exceedances

Assessment Period	36 dBA to 37 dBA	38 dBA to 40 dBA	Above 40 dBA
Day, Evening or Night-time	24 Peach	27 McDermott 31 Conradt 40 Maher 51 Bailey	30[1] Gaffney 48 Evans 50 Thompson & Hopper 94 McKenzie

Note 1: Properties identified in the Project Approval as being in the Noise Affectation Zone.

7.6 Nature Reserve Noise Assessment

A review of the noise contours presented in **Appendices F1** to **F4** indicates that the L_{Aeq} 50 dBA noise criterion is exceeded at both the Goulburn River National Park and Munghorn Gap Nature Reserve in the vicinity at which the WCM adjoins the parks. However, the WCM noise emission levels to the parks are comparable to those presented in the WCM EIS.

8 OFF-SITE ROAD TRANSPORT NOISE

8.1 Traffic Noise Criteria

In accordance with the Condition 52 and the Statement of Commitments (Appendix 8) of the Project Approval (see **Appendix A1** and **Appendix A2**), a number of improvements to the road network were commenced and/or completed including the upgrade and use of Ulan-Wollar Road as the main access road to WCM as opposed to Wollar Road considered in the EIS.

The two roads likely to be impacted by the WCM Modification are Ulan Road (MR 214) and Ulan-Wollar Road. Ulan Road (MR 214) and Ulan-Wollar Road are classified as collector and principal haulage / collector roads, respectively, in accordance with the DECCW's ECRTN as presented in **Table 19**. Ulan-Wollar no longer has any private landholders located adjacent to the road to the west of Wilpinjong.

Table 19 NSW Environmental Criteria for Road Traffic Noise (dBA re 20 µPa)

Road	Policy	Descriptor[1]	Noise Criterion
Ulan Road (MR 214)	Land use developments with the potential to create additional traffic on collector road	Daytime $L_{Aeq(1hour)}$	60
		Night-time $L_{Aeq(1hour)}$	55
Ulan-Wollar Road	Land use developments with the potential to create additional traffic on principal haulage / collector road	Daytime $L_{Aeq(1hour)}$	60
		Night-time $L_{Aeq(1hour)}$	55

Note 1: Daytime 0700 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

Note that in all cases where the nominated criteria are already exceeded, traffic associated with a new development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA. This can be achieved when the project related percentage increase in existing light and heavy vehicle movements is generally no greater than 60%.

8.2 Traffic Movements

The existing and additional traffic movements on Ulan Road are presented in **Table 20** and **Table 21** on an average daily and peak hourly basis respectively. These traffic movements incorporate predicted 2011 traffic growth associated with the proposed Ulan and Moolarben coal mine extensions that are currently being assessed by the NSW government.

Traffic noise impacts are assessed further below.

8.3 Traffic Noise Impact Assessment

Traffic noise predictions are based on the methodology endorsed by the United States (US) Environmental Protection Agency Report 550/9-74-004 dated March 1974, but including modifications based on equations in Appendix A-13 and certain amendments recommended in the United Kingdom (UK) Calculation of Road Traffic Noise (CORTN). The prediction methodology is generally conservative and takes into account vehicle volume, speed, type, passby duration and facade reflection and assumes no intervening barriers or topography with all receivers having a full angle of view to the road.

According to the ECRTN (EPA, 1999) described in **Section 8.1**, traffic associated with the development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA. This is achieved when the project related percentage increase in light and heavy vehicles movements is no greater than 60%.

Predicted noise levels on the Ulan Road, South of Henry Lawson Drive have not been calculated given that the average daily percentage increase in light and heavy vehicles movements on these roads is predicted to be only 5%, and therefore not of a magnitude which would change the ambient road traffic noise levels discernibly (ie the change would be less than 1 dBA).

The calculated peak hourly daytime (afternoon 1630 to 1730 hours), daytime (afternoon 1800 to 1900 hours) and night-time traffic noise levels for Ulan Road (between Cooks Gap and Ulan-Wollar Road, North of Cooks Gap) and Ulan-Wollar Road (West of WCM) are presented in **Table 22**.

Table 20 Mine Access Routes - Estimate Daily Traffic Movements[1]

Road	Location	Existing Traffic (2010)[2]	Peak WCM Modification (2011)			Additional Traffic (2011)			Total Cumulative Traffic (2011)	% Contribution of WCM Modification Traffic
			Workforce/ Visitors	Deliveries/ trucks	Total traffic	Ulan Coal Mines	Moolarben Coal Mines	Background Growth		
Ulan Road	North of Cooks Gap	1,841	375	32	407	393	196	27	2,864	14
	South of Budgee Budgee	6,624	357	32	389	393	196	112	7,714	5
Ulan-Wollar Road	West of WCM	415	475	36	511	0	0	1	926	55

Note 1: Source WCPL.

Note 2: Existing traffic incorporates WCM existing traffic flows.

Table 21 Mine Access Routes - Estimated Peak Hourly Traffic Movements

Peak Period	Existing Traffic (2010)[2]			Background + Ulan + Moolarben Contributions (2011)			Modification (2011)			Cumulative total (2011)			Modification Traffic % Contribution of Cumulative Total (2011)		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
Ulan Road between Cooks Gap and Ulan-Wollar Road 100 km/hr[1,3]															
Night-time 0600 - 0700 hours	314	52	366	500	84	584	224	5	229	724	89	813	31	6	28
Daytime (Afternoon) 1630 - 1730 hours	269	29	298	368	62	430	8	3	11	376	65	441	2	5	3
Daytime (Afternoon) 1800 - 1900 hours	119	16	135	225	38	263	218	5	223	443	43	486	50	12	46
Ulan-Wollar Road West of WCM 80 km/hr[1,4]															
Night-time 0600 - 0700 hours	149	28	177	190	35	225	258	6	264	448	41	489	58	15	54
Daytime (Afternoon) 1630 - 1730 hours	119	22	141	149	28	177	9	3	12	158	31	189	6	10	6
Daytime (Afternoon) 1800 - 1900 hours	58	11	69	69	13	82	251	6	257	320	19	339	78	32	76

Note 1: Conservatively assumes that the proportion of heavy vehicles on the roads in 2011 is the same as the current (2010) proportion.

Note 2: Proportioned from daily traffic and peak hour percentage measured at Ulan-Wollar/Ulan Road Intersection.

Note 3: Speed limit sourced form Traffic & Urban Planning report *"Traffic and Transport Impact Assessment for Ulan Coal continued Operations Project at Ulan"* dated 19 August 2009.

Note 4: Speed limit based on WCPL speed limit for all WCM personnel.

Table 22 Estimated Existing and Cumulative Peak Hourly Traffic Noise Levels

Distance from Road	Criteria (Night-time /Daytime)	LAeq(1hour) (dBA) - Existing Traffic (2010)			LAeq(1hour) (dBA) - Predicted Traffic (2011)[1] - Traffic from WCM Modification not Included			LAeq(1hour) (dBA) - Predicted Cumulative Traffic (2011)[1] - Traffic from WCM Modification Included		
		Night -time	Daytime (afternoon 1630 to 1730)	Daytime (afternoon 1800 to 1900)	Night -time	Daytime (afternoon 1630 to 1730)	Daytime (afternoon 1800 to 1900)	Night -time	Daytime (afternoon 1630 to 1730)	Daytime (afternoon 1800 to 1900)
Ulan Road between Cooks Gap and Ulan-Wollar Road, North of Cooks Gap										
20 m	55/60 dBA	66	65	62	68	67	65	69	67	67
30 m	55/60 dBA	64	62	59	66	64	62	67	65	64
40 m	55/60 dBA	62	60	57	64	62	60	65	63	62
50 m	55/60 dBA	60	59	56	62	61	59	63	61	61
80 m	55/60 dBA	57	56	53	59	58	56	60	58	58
100 m	55/60 dBA	56	54	51	58	56	54	59	57	56
140 m	55/60 dBA	54	52	49	56	54	52	56	54	54
160 m	55/60 dBA	53	51	48	55	53	51	56	54	53
Ulan-Wollar Road West of WCM										
10 m	55/60 dBA	66	65	62	67	66	63	70	66	67
20 m	55/60 dBA	62	61	58	63	62	58	65	62	63
25 m	55/60 dBA	60	59	56	61	60	57	64	60	61
30 m	55/60 dBA	59	58	55	60	59	56	62	59	60
50 m	55/60 dBA	56	55	51	57	56	52	59	56	57
60 m	55/60 dBA	54	53	50	55	54	51	58	55	56
80 m	55/60 dBA	52	51	48	53	52	49	56	53	54
85 m	55/60 dBA	52	51	48	53	52	49	55	52	53

Note 1: Predicted traffic (2011) includes traffic generated by Ulan and Moolarben Coal Mines and background growth.

Ulan Road between Cooks Gap and Ulan-Wollar Road, North of Cooks Gap

- Excluding traffic generated by the WCM Modification, the night-time criterion is met at 104 m (and greater) for the existing traffic 2010 and is met at 142 m (and greater) for the predicted future traffic 2011.

  Peak hour night-time predicted future traffic 2011 noise levels increase by 1.0 dBA with the traffic generated by the WCM Modification. Including traffic generated by the WCM Modification, the night-time criterion is met at 163 m (and greater) for the predicted future traffic 2011.

- Excluding traffic generated by the WCM Modification, the daytime criterion is met at 39 m (and greater) for the existing traffic 2010 and is met at 55 m (and greater) for the predicted future traffic 2011 in the peak hour daytime afternoon (1630 to 1730 hours).

  Peak hour daytime afternoon (1630 to 1730 hours) predicted future 2011 traffic noise levels increase by 0.1 dBA with the traffic generated by the WCM Modification. Including traffic generated by the WCM Modification, the daytime criterion is met at 80 m (and greater) for the predicted future traffic 2011.

- Excluding traffic generated by the WCM Modification, the daytime criterion is met at 24 m (and greater) for the existing traffic 2010 and is met at 40 m (and greater) for the predicted future traffic 2011 in the peak hour daytime afternoon (1800 to 1900 hours).

Peak hour daytime afternoon (1800 to 1900 hours) predicted future traffic noise levels increase by 1.8 dBA with the traffic generated by the WCM Modification. Including traffic generated by the WCM Modification, the daytime criterion is met at 52 m (and greater) for the predicted future traffic 2011.

Ulan-Wollar Road West of WCM

- Excluding traffic generated by the WCM Modification, the night-time criterion is met at 51 m (and greater) for the existing traffic 2010 and is met at 59 m (and greater) for the predicted future traffic 2011.

  Peak hour night-time predicted future traffic 2011 noise levels increase by 2.4 dBA with the traffic generated by the WCM Modification. Including traffic generated by the WCM Modification, the night-time criterion is met at 85 m (and greater) for the predicted future traffic 2011.

- Excluding traffic generated by the WCM Modification, the daytime criterion is met at 21 m (and greater) for the existing traffic 2010 and is met at 24 m (and greater) for the predicted future traffic 2011 in the peak hour daytime afternoon (1630 to 1730 hours).

  Peak hour daytime afternoon (1630 to 1730 hours) predicted future 2011 traffic noise levels increase by 0.4 dBA with the traffic generated by the WCM Modification. Including traffic generated by the WCM Modification, the daytime criterion is met at 25 m (and greater) for the predicted future traffic 2011.

- Excluding traffic generated by the WCM Modification, the daytime criterion is met at 13 m (and greater) for the existing traffic 2010 and is met at 15 m (and greater) for the predicted future traffic 2011 for the peak hour daytime afternoon (1800 to 1900 hours).

  Peak hour daytime afternoon (1800 to 1900 hours) predicted future traffic noise levels increase by 4.7 dBA with the traffic generated by the WCM Modification. Including traffic generated by the WCM Modification, the daytime criterion is met at 29 m (and greater) for the predicted future traffic 2011.

It is noted that WCM Modification traffic contributions to the local road network would be significantly reduced after the 2011 construction period. In addition, there are no longer any privately owned residences located along Ulan-Wollar Road to the west of Wilpinjong (**Appendix C1**).

9 OFF-SITE RAIL TRANSPORT NOISE

9.1 Railway Noise Criteria

ARTC Licence

The ARTC operates the Gulgong - Sandy Hollow and Main Northern railways. Noise emissions from the railways are regulated via ARTC's EPL 3142.

EPL 3142 Section L6 nominates general airborne noise limits at residential receivers as follows:

> *L6.1.1 General Noise Limits*
>
> *It is an objective of this Licence to progressively reduce noise levels of to the goals of 65 dB(A) Leq, (daytime from 7.00 am - 10.00 pm), 60 dB(A) Leq, (night-time from 10.00 pm - 7.00 am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Program.*

The goals do not represent unobtrusive noise levels. Rather, the objectives recognise that railway operations are inherently noisy and represent a compromise between what may be desirable from a community point of view (ie maintaining amenity) and what is necessary to enable trains to continue to operate.

Based on the foregoing, the general noise goals for the Gulgong - Sandy Hollow and Main Northern railways are presented in **Table 23** and form the basis of guideline noise assessment criteria.

Table 23 ARTC's Guideline Noise Assessment Goals

Railway	Licence Holder	Descriptor	Rail Traffic Goal
Gulgong - Sandy Hollow Railway Main Northern Railway	ARTC EPL 3142	Daytime/evening $L_{Aeq(15hour)}$	65 dBA
		Night-time $L_{Aeq(9hour)}$	60 dBA
		Maximum Passby L_{Amax}	85 dBA

DECCW Requirements

The DECCW has recently (October 2009) released *"Environmental Assessment Requirements for Rail Traffic-Generating Developments",* which are attached as **Appendix E2**.

Rail noise assessment trigger levels are provided in the DECCW requirements and are reproduced in **Table 24** below.

Table 24 DECCW Rail Noise Assessment Trigger Levels for Rail Traffic Generating Developments

Descriptor	Rail Traffic Goal
$L_{Aeq(24hour)}$	60 dBA
Maximum Passby L_{Amax} (95th percentile)	85 dBA

Note: 95th percentile equates to the 5% exceedance value.

The DECCW rail noise assessment trigger levels are similar to the ARTC's EPL noise goals, however the DECCW trigger levels have an averaging period of 24 hours, rather than day (15 hours) and night-time (9 hours) for the ARTC's goals. The potential rail noise contribution from the WCM Modification has been assessed against both sets of criteria (ie ARTC's EPL and the DECCW requirements).

The DECCW states that where the cumulative noise level exceeds the noise assessment trigger levels and where the L_{Aeq} noise level increases are more than 2 dBA, strong justification should be provided why it is not reasonable and feasible to reduce noise.

9.2 Rail Traffic Movements

9.2.1 Gulgong - Sandy Hollow Railway

The existing, additional and cumulative daytime/evening, night-time and 24 hour train movements are presented in **Table 25** together with the estimated operating conditions whilst travelling on the Gulgong - Sandy Hollow railway in the vicinity of the WCM site.

Table 25 Existing, Additional and Cumulative Train Movements - Gulgong - Sandy Hollow Railway

Status	Train Type	Train Pass-bys						Train Length (m)	Train Speed (kph)
		Daytime/Evening		Night-time		24 Hours			
		Average pass-bys	Peak pass-bys	Average pass-bys	Peak pass-bys	Average pass-bys	Peak pass-bys		
Existing/Approved/ Proposed	Ulan Coal [2,3]	6	6	2	2	8	8	1500	60
	Ulan Coal Stage 2 [2,3]	2	2	2	2	4	4	650	60
	Ulan Coal Continued Operations [2]	5	7	3	3	8	10	1500	60
	Moolarben [1]	6	8	4	5	10	13	1500	60
	FCorp Ore [2]	2	2	0	0	2	2	850	60
	FCorp Ore [2]	1	1	1	1	2	2	418	60
	Wilpinjong Coal Project [2]	6	8	2	4	8	12	1500	60
Additional Proposed	WCM Modification [4]	1	0	1	0	2	0	1500	60
Cumulative Approved		**28**	**34**	**14**	**17**	**42**	**51**		
Cumulative Approved and Additional Proposed		**29**	**34**	**15**	**17**	**44**	**51**		

Note 1: Source from Spectrum Acoustics report "Moolarben Coal Project - Stage 2, Ulan, NSW, Noise and Vibration Impact Assessment" dated December 2008.

Note 2: Source from Richard Heggie & Associates 2005 report "Wilpinjong Coal Project Construction, Operation and Transportation Noise" dated 18 May 2005.

Note 3: Source from Wilkinson Murray report "Ulan Coal Mine, Ulan Coal - Continued Operations, Noise and Vibration Assessment" dated September 2009.

Note 4: Source WCPL.

9.2.2 Main Northern Railway

The existing, additional and cumulative daytime/evening, night-time and 24 hour train movements are presented in **Table 26** together with the estimated operating conditions whilst travelling on the Main Northern Railway on route to the Bayswater/Liddell rail unloader. As the majority of WCM coal would be unloaded at Bayswater/Liddell, it is considered that maximum cumulative impacts on the Main Northern Railway would occur between Muswellbrook and the Bayswater/Liddell rail spur turnout. Hence, this section of the Main Northern Railway has been assessed. Both domestic and export coal would be transported along this section of the Main Northern Railway.

Table 26 Existing, Additional and Cumulative Train Movements

Status	Train Type	Train Pass-bys						Train Length (m)	Train Speed (kph)
		Daytime/Evening		Night-time		24 Hours			
		Average Passbys	Peak Passbys	Average Passbys	Peak Passbys	Average Passbys	Peak Passbys		
Existing	Passenger[2]	2	2	2	2	4	4	375	60
	Freight[2]	9	9	5	5	14	14	750	60
Existing/ Approved	Ulan Coal[2,3]	6	6	2	2	8	8	1500	60
	Ulan Coal Stage 2 [2,3]	2	2	2	2	4	4	650	60
	Ulan Coal continued operations[3]	5	7	3	3	8	10	1500	60
	Moolarben[1]	6	8	4	5	10	13	1500	60
	Mangoola Project[3]	5	6	2	2	7	8	1500	60
	Other Coal[3]	6	6	4	4	10	10	1500	60
	Wilpinjong Coal Project[2]	6	8	2	4	8	12	1500	60
Additional Proposed	WCM Modification[4]	1	0	1	0	2	0	1500	60
Cumulative Existing/Approved		**47**	**54**	**26**	**29**	**73**	**83**		
Cumulative Existing/Approved and Additional Proposed		**48**	**54**	**27**	**29**	**75**	**83**		

Note 1: Source from Spectrum Acoustics report “Moolarben Coal Project - Stage 2, Ulan, NSW, Noise and Vibration Impact Assessment” dated December 2008.

Note 2: Source from Richard Heggie & Associates 2005 report “Wilpinjong Coal Project Construction, Operation and Transportation Noise” dated 18 May 2005.

Note 3: Source from Wilkinson Murray report “Ulan Coal Mine, Ulan Coal - Continued Operations, Noise and Vibration Assessment” dated September 2009.

Note 4: Source WCPL.

9.2.3 Noise Modelling Methodology

The calculation of the daytime/evening and night-time equivalent continuous noise levels and the maximum pass-by levels have been conducted using a computer prediction model developed by Heggies. This model has previously been accepted by the DoP and DECCW.

The prediction model uses characteristic noise levels for the various sources (locomotive engine and exhaust noise as a function of throttle notch, wheel/rail noise as a function of train speed, and wagon type, etc.) at a fixed reference distance. The model then makes adjustments for the train length and distance from the track (assuming no barriers) and facade reflection.

Parameters including the $L_{Aeq(24hour)}$ and maximum pass-by levels can then be determined by summing the effects of the individual noise sources and by incorporating the number of train events as appropriate.

9.3 Rail Traffic Noise Assessment - Gulgong Sandy Hollow Railway

9.3.1 Rail Traffic Noise Assessment - Daytime/Evening

The daytime/evening $L_{Aeq(15hour)}$ and maximum (5% exceedance) passby noise levels for the existing and approved rail traffic are presented in **Table 27** together with the cumulative existing, approved and proposed WCM Modification rail traffic trains. Train movements are considered on an average and peak basis.

Table 27 Daytime/Evening Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver	Existing and Approved Trains			Cumulative Trains (Existing and Approved Trains plus WCM Modification Trains)		
	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$	Passby Maximum	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$	Passby Maximum
30 m	67	67	85	67	67	85
60 m	64	65	81	64	65	81
90 m	62	63	78	62	63	78
120 m	61	62	77	61	62	77
150 m	60	61	75	60	61	75
180 m	59	60	74	59	60	74
210 m	59	59	73	59	59	73
240 m	58	59	72	58	59	72

The following assessments are derived from the predicted rail traffic noise levels:

- A comparison of the existing/approved average $L_{Aeq(15hour)}$ rail traffic noise levels with the cumulative levels indicates that the daytime/evening rail noise levels would increase by up to 0.2 dBA. The existing/approved average $L_{Aeq(15hour)}$ rail traffic noise meets the 65 dBA criterion at a distance of 41 m (and greater). The cumulative average $L_{Aeq(15hour)}$ rail traffic noise level meets the 65 dBA criterion at a distance of 42 m (and greater).
- Peak $L_{Aeq(15hour)}$ rail traffic noise levels would remain unchanged due to the WCM Modification and the cumulative peak $L_{Aeq(15hour)}$ rail traffic noise levels would continue to meet the 65 dBA criterion at a distance of 48 m (and greater).
- The existing/approved maximum pass-by noise level would remain unchanged due to the WCM Modification and would continue to meet the criterion of 85 dBA at a distance of 29 m (and greater).

9.3.2 Rail Traffic Noise Assessment - Night-time

The night-time $L_{Aeq(9hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table 28** together with the cumulative existing, approved and proposed WCM Modification rail traffic trains. Train movements are considered on an average and peak basis.

Table 28 Night-time Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver	Existing and Approved Trains			Cumulative Trains (Existing and Approved Trains plus WCM Modification Trains)		
	Average $L_{Aeq(9hour)}$	Peak $L_{Aeq(9hour)}$	Passby Maximum	Average $L_{Aeq(9hour)}$	Peak $L_{Aeq(9hour)}$	Passby Maximum
30 m	66	67	85	66	67	85
60 m	63	64	81	63	64	81
90 m	61	62	78	61	62	78
120 m	60	61	77	60	61	77
150 m	59	60	75	59	60	75
180 m	58	59	74	59	59	74
210 m	58	58	73	58	58	73
240 m	57	58	72	57	58	72

The following assessments are derived from the predicted rail traffic noise levels:

- A comparison of the existing/approved average $L_{Aeq(9hour)}$ rail traffic noise with the cumulative level indicates that the night-time rail noise levels would increase by up to 0.3 dBA. The existing/approved average $L_{Aeq(9hour)}$ rail traffic noise level meets the 60 dBA criterion at a distance of 108 m (and greater). The cumulative average $L_{Aeq(9hour)}$ rail traffic noise level would meet the 60 dBA criterion at a distance of 114 m (and greater).
- Peak $L_{Aeq(9hour)}$ rail traffic noise levels would remain unchanged due to the WCM Modification and the cumulative peak $L_{Aeq(9hour)}$ rail traffic noise levels would continue to meet the 60 dBA criterion at a distance of 126 m (and greater).
- The existing/approved maximum pass-by noise level would remain unchanged due to the WCM Modification and would continue to meet the criterion of 85 dBA at a distance of 29 m (and greater).

9.3.3 Rail Traffic Noise Assessment - DECCW Criteria

The $L_{Aeq(24hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table 29** together with the cumulative existing, approved and proposed WCM Modification rail traffic trains. Train movements are considered on an average and peak basis.

Table 29 Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver	Existing and Approved Trains			Cumulative Trains		
	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	Pass-by Maximum	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	Pass-by Maximum
30 m	66	67	85	67	67	85
60 m	63	64	81	64	64	81
90 m	62	62	78	62	62	78
120 m	61	61	77	61	61	77
150 m	60	60	75	60	60	75
180 m	59	60	74	59	60	74
210 m	58	59	73	59	59	73
240 m	58	59	72	58	59	72

The following assessments are derived from the predicted rail traffic levels:

- A comparison of the existing/approved average $L_{Aeq(24hour)}$ rail traffic noise levels with the cumulative noise level indicates that the 24 hour rail noise levels would increase by up to 0.2 dBA. The existing/approved average $L_{Aeq(24hour)}$ rail traffic noise level meets the 60 dBA criterion at a distance of 124 m (and greater). The cumulative average $L_{Aeq(24hour)}$ rail traffic noise levels would meet the 60 dBA criterion at a distance of 129 m (and greater).
- Peak $L_{Aeq(24hour)}$ rail traffic noise levels would remain unchanged due to the WCM Modification and cumulative peak $L_{Aeq(24hour)}$ rail traffic noise levels would continue to meet the 60 dBA criterion at a distance of 147 m (and greater).
- The existing/approved maximum pass-by noise level would remain unchanged due to the WCM Modification and would meet the criterion of 85 dBA at a distance of 29 m (and greater).

9.4 Rail Traffic Noise Assessment - Main Northern Railway

9.4.1 Rail Traffic Noise Assessment - Daytime/Evening

The daytime/evening $L_{Aeq(15hour)}$ and maximum (5% exceedance) passby noise levels for the existing and approved rail traffic are presented in **Table 30** together with the cumulative existing, approved and proposed WCM Modification rail traffic trains. Train movements are considered on an average and peak basis.

Table 30 Daytime/Evening Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver	Existing and Approved Trains			Cumulative Trains (Existing and Approved Trains plus WCM Modification Trains)		
	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$	Passby Maximum	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$	Passby Maximum
30 m	68	69	88	69	69	88
60 m	66	66	85	66	66	85
90 m	64	64	82	64	64	82
120 m	63	63	81	63	63	81
150 m	62	62	80	62	62	80
180 m	61	62	78	61	62	78
210 m	61	61	77	61	61	77
240 m	60	61	77	60	61	77

The following assessments are derived from the predicted rail traffic noise levels:

- A comparison of the existing/approved average $L_{Aeq(15hour)}$ rail traffic noise levels with the cumulative noise levels indicates that the daytime/evening rail noise levels would increase by 0.1 dBA. The existing/approved average $L_{Aeq(15hour)}$ rail traffic noise level meets the 65 dBA criterion at a distance of 61 m (and greater). The cumulative average $L_{Aeq(15hour)}$ rail traffic noise level meets the 65 dBA criterion at a distance of 62 m (and greater).
- Peak $L_{Aeq(15hour)}$ rail traffic noise levels would remain unchanged with the Modification and cumulative peak $L_{Aeq(15hour)}$ rail traffic noise levels would continue to meet the 65 dBA criterion at a distance of 70 m (and greater).
- The existing/approved maximum pass-by noise level would remain unchanged with the Modification and would continue to meet the criterion of 85 dBA at a distance of 50 m (and greater).

9.4.2 Rail Traffic Noise Assessment - Night-time

The night-time $L_{Aeq(9hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table 31** together with the cumulative existing, approved and proposed WCM Modification rail traffic trains. Train movements are considered on an average and peak basis.

Table 31 Night-time Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver	Existing and Approved Trains			Cumulative Trains (Existing and Approved Trains plus WCM Modification Trains)		
	Average $L_{Aeq(9hour)}$	Peak $L_{Aeq(9hour)}$	Pass-by Maximum	Peak $L_{Aeq(9hour)}$	Average $L_{Aeq(9hour)}$	Pass-by Maximum
30 m	68	68	88	68	68	88
60 m	65	65	85	65	65	85
90 m	63	63	82	63	63	82
120 m	62	62	81	62	62	81
150 m	61	61	80	61	61	80
180 m	60	61	78	60	61	78
210 m	60	60	77	60	60	77
240 m	59	60	77	59	60	77

The following assessments are derived from the predicted rail traffic noise levels:

- A comparison of the existing/approved average $L_{Aeq(9hour)}$ rail traffic noise levels with the cumulative noise levels indicates that the night-time rail noise levels would increase by up to 0.2 dBA. The existing/approved average $L_{Aeq(9hour)}$ rail traffic noise level meets the 60 dBA criterion at a distance of 171 m (and greater). The cumulative average $L_{Aeq(9hour)}$ rail traffic noise level would meet the 60 dBA criterion at a distance of 177 m (and greater).
- Peak $L_{Aeq(15hour)}$ rail traffic noise levels would remain unchanged due to the WCM Modification and cumulative peak $L_{Aeq(9hour)}$ rail traffic noise levels would continue to meet the 60 dBA criterion at a distance of 191 m (and greater).
- The existing/approved maximum pass-by noise level would remain unchanged due to the WCM Modification and would continue to meet the criterion of 85 dBA at a distance of 50 m (and greater).

9.4.3 Rail Traffic Noise Assessment - DECCW Criteria

The $L_{Aeq(24hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and approved rail traffic are presented in **Table 32** together with the cumulative existing, approved and proposed WCM Modification rail traffic trains. Train movements are considered on an average and peak basis.

Table 32 Predicted Train Noise Emissions (dBA re 20 µPa)

Distance to Receiver	Existing and Approved Trains			Cumulative Trains		
	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	Pass-by Maximum	Average $L_{Aeq(24hour)}$	Peak $L_{Aeq(24hour)}$	Pass-by Maximum
30 m	68	69	88	68	69	88
60 m	65	66	85	65	66	85
90 m	64	64	82	64	64	82
120 m	62	63	81	63	63	81
150 m	62	62	80	62	62	80
180 m	61	61	78	61	61	78
210 m	60	61	77	60	61	77
240 m	60	60	77	60	60	77

The following assessments are derived from the predicted rail traffic levels:

- A comparison of the existing/approved average $L_{Aeq(24hour)}$ rail traffic noise levels with the cumulative noise levels indicates that the 24 hour rail noise levels would increase by 0.1 dBA. The existing/approved average $L_{Aeq(24hour)}$ rail traffic noise level meets the 60 dBA criterion at a distance of 196 m (and greater). The cumulative average $L_{Aeq(24hour)}$ rail traffic noise level would meet the 60 dBA criterion at a distance of 202 m (and greater).
- Peak $L_{Aeq(24hour)}$ rail traffic noise levels would remain unchanged due the WCM Modification and cumulative peak $L_{Aeq(24hour)}$ rail traffic noise levels would continue to meet the 60 dBA criterion at a distance of 225 m (and greater).
- The existing/approved maximum pass-by noise level would remain unchanged due the WCM Modification and would continue to meet the criterion of 85 dBA at a distance of 50 m (and greater).

10 SUMMARY OF FINDINGS

10.1 Operating Noise Criteria

The INP prescribes detailed calculation routines for establishing "Project-specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (ie non-transport related) criteria for a development at potentially affected noise sensitive and various other receiver areas. Ideally, the intrusive noise level should generally not exceed the background level by more than 5 dBA.

In addition, the DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. In the absence of a specific dwelling (or a known approved building Development Application) noise impacts are determined where exceedances are predicted over 25% of the vacant land area.

In accordance with the INP's Chapter 2 Industrial Noise Criteria in conjunction with the INP's Application Notes, the Project-specific intrusive and amenity assessment criteria for residential and vacant land receiver areas are presented in **Table 33**. These criteria are nominated for the purposes of assessing potential noise impacts from the WCM.

Table 33 Project-specific Noise Assessment Criteria (dBA re 20 μPa)

Receiver Type	Land Use Amenity Area	Intrusive LAeq(15minute)[1]			Amenity LAeq(period)[1]		
		Day	Evening	Night	Day	Evening	Night
Existing Dwellings	Wollar Residential[2]	36	35	35	55	45	40
Existing Dwellings	Rural Residential[2]	35	35	35	50	45	40
Potential Dwellings	Rural Vacant Land[3]						
Place of Worship	Laurence O'Toole Catholic Church (internal)	INP Place of Worship[4]			40	40	Not in use[5]
Scholl Classroom	Wollar School (internal)	INP School Classroom[4]			35	35	

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 2: At the most-affected point within 30 m of the residential area.
Note 3: Where exceedances are predicted over 25% of the vacant land area.
Note 4: Intrusive criteria apply to residential receptors only.
Note 5: It is understood that churches and schools are generally not utilised at night-time (ie after 2200 hours).

The intrusiveness criterion is met if the $L_{Aeq(15minute)}$ is less than or equal to the RBL plus 5 dBA, where the RBL is determined from monitoring data following the INP procedures discussed in **Section 4.2**. Thus, the most stringent Project-specific criterion for the Modification would be the intrusiveness criterion (ie 35 dBA $L_{Aeq(15minute)}$).

The INP states that these criteria have been selected to preserve the amenity of at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, then most people would consider the resultant noise levels acceptable.

In those cases where the INP Project-specific assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. Exceedances of 5 dBA or more are generally required before the impact becomes clearly noticeable and appreciable.

10.2 Operating Noise Modelling and Mitigation

The existing WCM noise model was modified to incorporate the noise sources associated with the WCM Modification. The surrounding terrain and nearby potentially affected receivers (**Table 3**, **Table 4** and **Appendix C2**) were also included in the model.

A noise model validation study was undertaken, incorporating SWL surveys of mobile equipment and fixed plant, including a detailed survey of the washery, the addition of 56 fixed plant noise sources, a total of ten mid-field and far-field validation survey locations, resulting in a 1.8 dBA calibration factor for the validated WCM noise model.

For the purposes of assessing noise impacts in accordance with INP requirements, the following mine operating scenarios were considered:

Year 2011 Operations and CHPP Construction: Representative of approximately 13.5 Mtpa ROM coal production rate coinciding with mining in two areas of central Pit 5, together with operations of waste rock mining and emplacement in Pit 1. Construction of the CHPP and materials handling upgrades.

Year 2014 Peak Operations: Representative of the maximum mine fleet, maximum waste rock production and ROM coal production rate at 15.0 Mtpa coinciding with mining in Pit 2, central Pit 3 and southern portion of Pit 5, together with waste rock mining and emplacement in central Pit 3.

Year 2017 and Year 2020 Combined Operations: Representative of lesser fleet after the peak in production, but potentially reduced topographic shielding from Pit 3 north and south for private receivers located to the east of the WCM area.

The predictive modelling involved the investigation of feasible and reasonable noise mitigation measures, particularly in relation to evening and night-time operations. These mitigation measures are assumed to be implemented for the purposes of the predictive modelling. A number of iterative steps were taken to develop noise mitigation measures for the WCM, including:

- Preliminary noise modelling of scenarios representative of the maximum noise emissions from the WCM Modification, using the measured SWLs of plant currently operating on the site (and used in the validation modelling), to identify areas of potential noise exceedances.
- Evaluation of various combinations of noise management and noise mitigation measures to assess their relative effectiveness.

- Adoption by WCPL of a range of noise management and mitigation measures (including low noise equipment and operational controls) to appreciably reduce noise emissions, including:
  - Selected additional mobile equipment post 2012 to be current technology and low noise emission standard, including implementation of up to 18 CAT 785XQ haul trucks, up to 2 CAT D11XQ dozers and a 3 dBA noise control kit fitted to one Hitachi EX2500 excavator when required.
  - Continuation of the current real-time noise monitoring and active response plan leading to plant shut-downs when trigger levels are exceeded.

The above at source noise controls (eg low noise fleet items) would be implemented progressively as required from 2012 to meet applicable noise criteria at nearby private receivers.

10.3 Operating Noise Impact Summary

Based on the predicted daytime, evening and night-time $L_{Aeq(15minute)}$ intrusive noise emissions, the privately owned receivers where the Project-specific noise level is anticipated to be exceeded are summarised in **Table 34**.

Table 34 Privately Owned Rural Receivers with Noise Level Exceedances

Period	Noise Management Zone		Noise Affection Zone
	1 dBA to 2 dBA above PSNL	3 dBA to 5 dBA above PSNL	> 5 dBA above PSNL
Daytime	-	-	-
Evening	100 Rheinberger 124 Zivkovic 125 Roberts 31[1] Conradt 57 Nagy	23A[1] Bloomfield 23B[1] Bishop 25 Pettit 53[1] Reynolds 55[1] Fox 58[1] Maher 52A[1] Long 52B[1] Long 45[2] Smith	49[1] Harkin
Night-time	25 Pettit 23B Bishop	49[1] Harkin	45[2] Smith

Note 1: Properties identified in the existing WCM Project Approval (05-0021) as being in the Noise Management Zone.

Note 2: Properties identified in the existing WCM Project Approval (05-0021) as being in the Noise Affectation (Acquisition) Zone.

The DoP has previously advised that the noise impacts on vacant land are assessed on a "case by case" basis. **Table 35** identifies those properties for all scenarios where exceedances of the $L_{Aeq(15 minute)}$ intrusive noise level is predicted for more than 25% of vacant land.

Table 35 Vacant Land with Project Specific Noise Level Exceedances

36 to 37 dBA	38 to 40 dBA	above 40 dBA
24 Peach	31 Conradt 40 Maher 27 McDermott 51 Bailey	30[1] Gaffney 48 Evans 50 Thompson & Hopper 94 McKenzie

Note 1: Properties identified in the Project Approval as being in the Noise Affectation Zone.

10.4 Noise Management

WCPL will continue to implement the current WCM noise monitoring programme which includes real-time noise monitoring and a validated active response plan leading to mobile plant shut-downs when trigger levels are exceeded.

10.5 Road Traffic Noise Impact Summary

The existing access road off Ulan-Wollar Road would remain the WCM primary site access. The vast majority of WCM traffic utilises Ulan-Wollar Road and Ulan Road to access the site. To the west of WCM all residences located along Ulan-Wollar Road are now mine owned.

WCM daily operational workforce traffic and traffic associated with deliveries along public roads would be only modestly increased by the WCM Modification. However, a short-term peak in additional traffic is expected during the 2011 construction period and was therefore assessed in accordance with the DECCW's requirements.

A short-term peak in traffic is anticipated during the 9 month construction period (2011) which would increase vehicle movements on Ulan Road and Ulan-Wollar Road. Ulan Road traffic noise increases in 2011 are predicted to be less than 2 dBA in magnitude and hence are likely to be acceptable. Traffic noise increases on Ulan-Wollar Road to the west of WCM would increase by up to approximately 5 dBA during peak hour periods in 2011, however there are no longer any private receivers located on this section of road.

10.6 Rail Traffic Noise Impact Summary

The ARTC controls and operates the Gulgong-Sandy Hollow Railway and Main Northern Railway in NSW. Noise emissions from the railway are regulated via the ARTC's Environmental Protection Licence (EPL No 3142). A review of the ARTC's EPL requirements has been conducted together with a general assessment of rail traffic noise impacts.

EPL Section L6 Noise Limits provides railway operating noise goals of 65 dBA L_{Aeq} (daytime/evening), 60 dBA L_{Aeq} (night-time) and 85 dBA maximum passby noise, at one metre from the facade of the nearest affected residential property.

The DECCW has also released rail noise assessment trigger levels for rail-traffic generating developments. The DECCW nominates trigger levels of 60 dBA L_{Aeq} (24 hours) and 85dBA maximum passby noise, at one metre from the facade of the nearest affected residential property. Where the cumulative noise level exceeds the noise assessment trigger levels, the L_{Aeq} noise level should not increases by more than 2 dBA.

The average and peak existing, additional and cumulative train movements and associated rail noise levels have been determined for communities neighbouring the Gulgong-Sandy Hollow Railway and Main Northern Railway.

The assessment found that there would be a negligible (less than 1 dBA) increase in average $L_{Aeq(daytime/evening)}$, $L_{Aeq(night\text{-}time)}$ and $L_{Aeq(24hour)}$ rail traffic noise levels.

Peak $L_{Aeq(daytime/evening)}$, $L_{Aeq(night\text{-}time)}$ and $L_{Aeq(24hour)}$ rail traffic noise levels and maximum passby (L_{Amax}) rail noise levels would remain unchanged due to the WCM Modification.

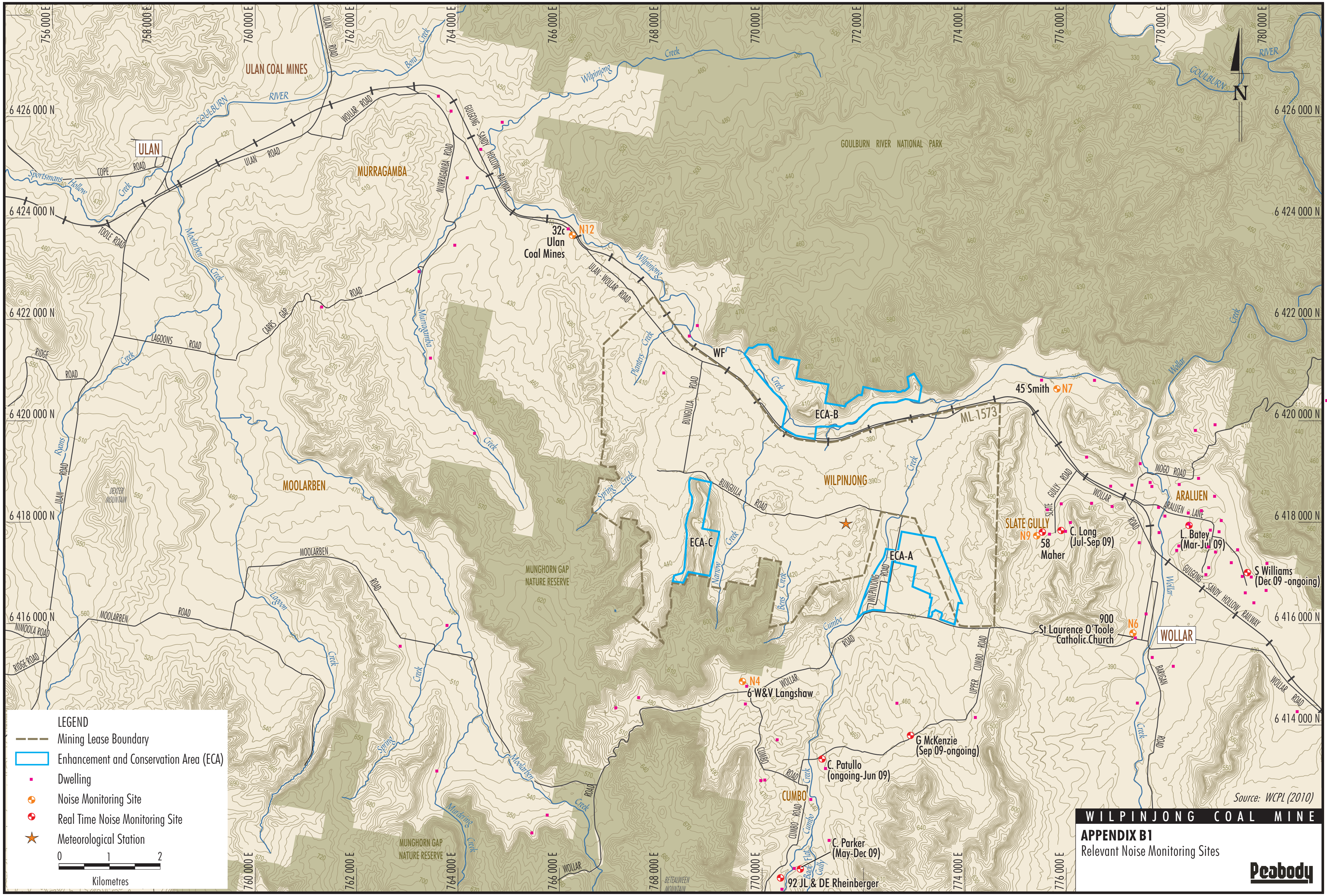
Project Approval (05-0021) dated 1 February 2006

(Not included in this copy - refer to Attachment 1 to the EA Main Report)

Notice of Modification (05-0021) dated 30 November 2007

(Not included in this copy - refer to Attachment 1 to the EA Main Report)

Relevant Noise Monitoring Sites



WIL-09-07 App Noise_001B

Indicative Arrangement of the CHPP and Materials Handling Upgrades

Source: WCPL (2010)

WILPINJONG COAL MINE

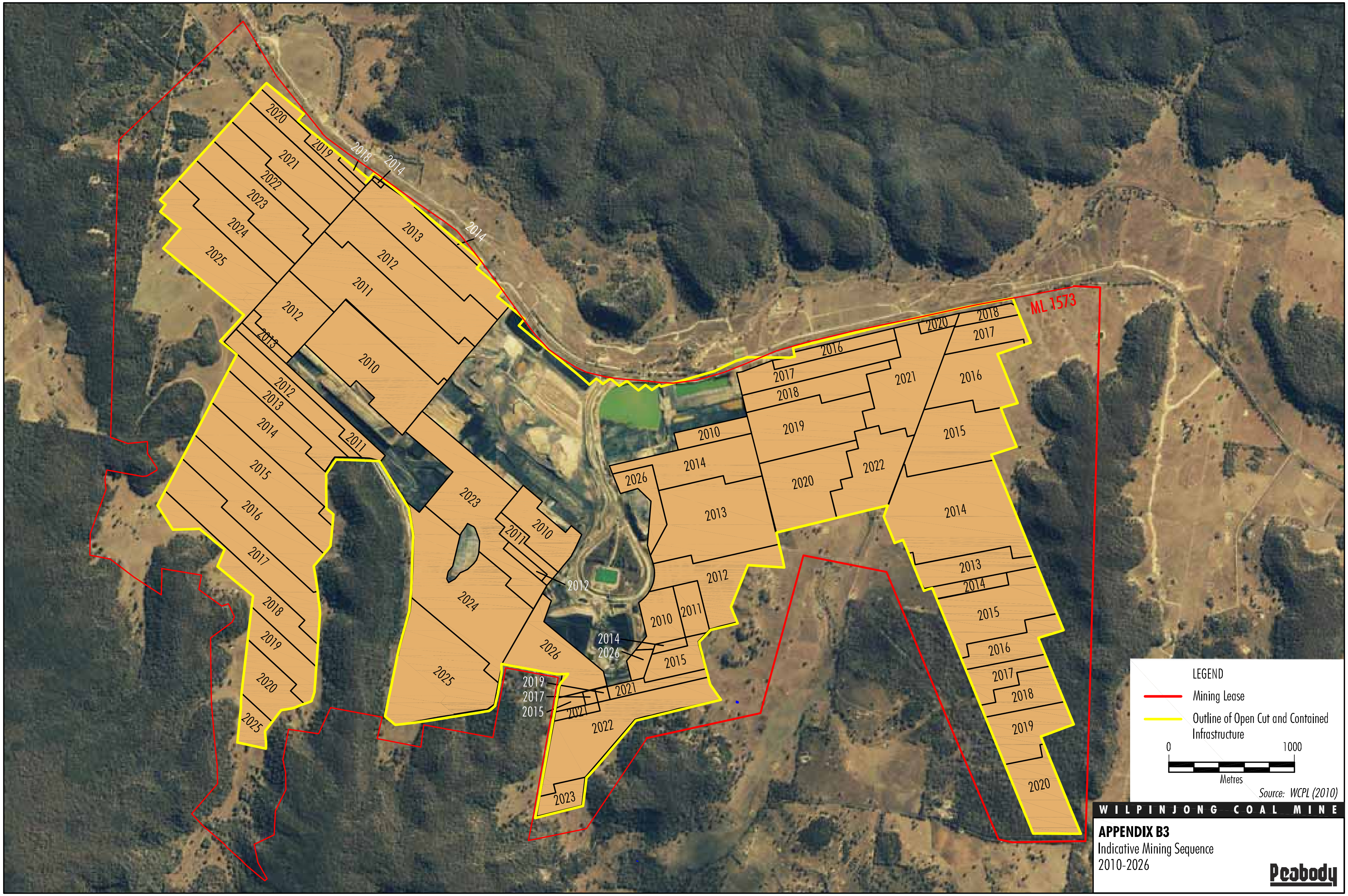
APPENDIX B2

Conceptual Arrangement of the CHPP and Materials Handling Upgrades

Peabody

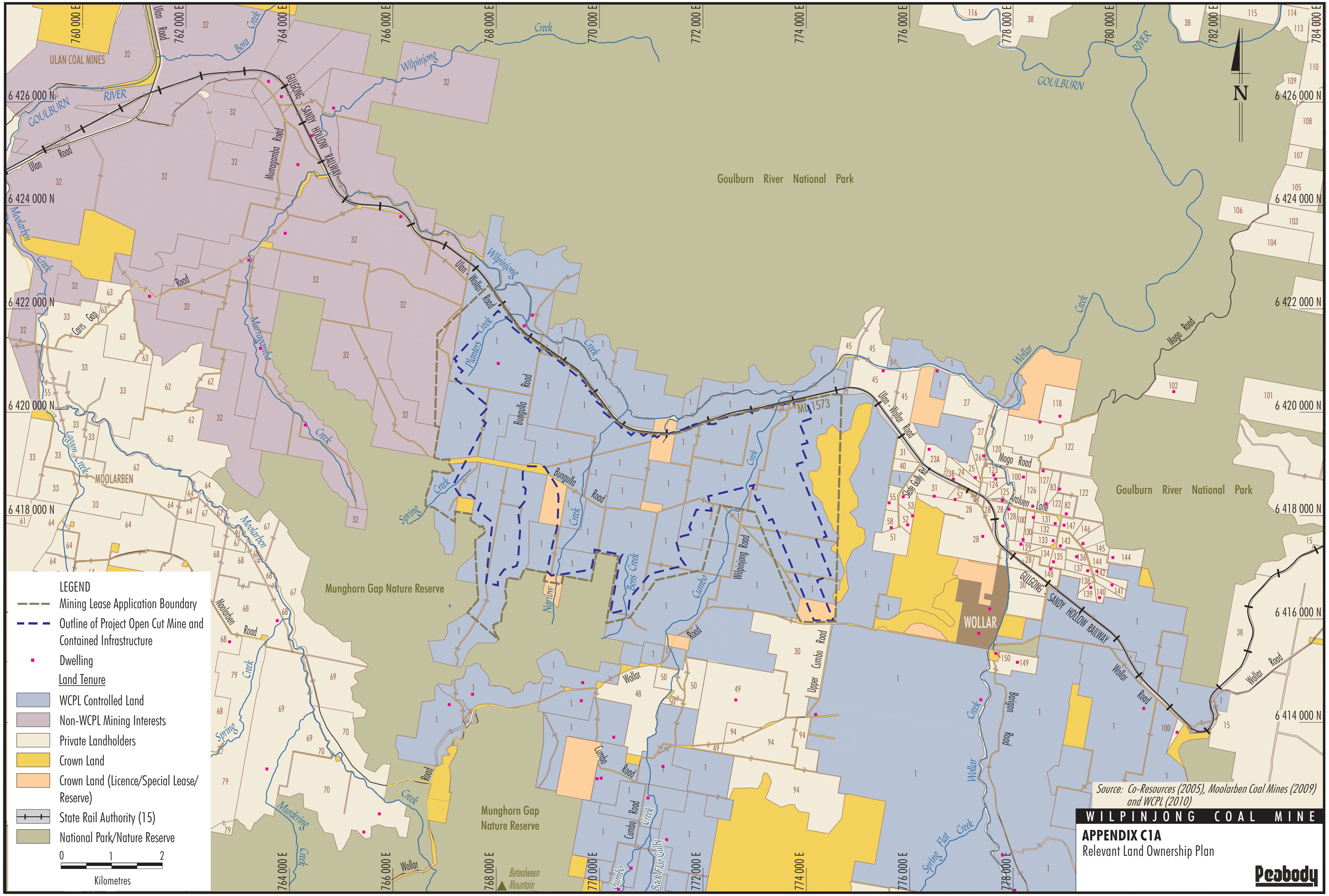
WIL-09-07 App Noise_002B

Indicative Mining Sequence - 2010 to 2026



WIL-09-07 App Noise_103B

Relevant Land Ownership Plan



WIL-09-07 App Noise_004B

Relevant Land Ownership List

1	Wilpinjong Coal Controlled Land
15	State Rail Authority
23A	ID Bloomfield
23B	B Bishop
24	JA & TS Peach
25	SE & JE Pettit
26	K & VC Christiansen
27	BC McDermott
28	BP & FV & MJ & JM Power
30	WF Gaffney
31	DE & AM Conradt
32	Ulan Coal Mines/Moolarben Coal Mine Owned/Controlled Land
33	MJ & PM Swords
38	State Of N.S.W.
40	G & J Maher
45	JAW Smith
48	JR & BM Evans
49	RSM & LD Harkin
50	LD Thompson & RJ Hopper
51	P Bailey
52	CR Long
53	RW & JL Reynolds
55	SC & M Fox
57	F Nagy
58	FN Maher
61	J Szymkarczuk
62	MJ Swords
63	MJ & H Swords
64	DJ & Y Rayner
67	K & RE Mayberry
68	EC Mayberry
69	DJ & JG Stokes
70	JW & JG O'Sullivan
79	C Mayberry
80	RB Cox
82	RJ Jackson
83	G & DJ Hayes
94	GM & KL McKenzie
100	TJ & VE Rheinberger
101	NAB Pierce
102	W Filipczyk
103	MR Molloy
104	WB & PA Deane
105	ELM Toombs
106	JA Sales
107	RJ Lee
108	R Campbell
109	MO Vaisey
110	GS & JR Smiles
113	AJ Brett & S & D Hilt
114	BJ Hughes & CA Beinssen & K Aslett
115	E & T Schoenfelder
116	PD & JE Griffiths
118	DS & D Ponton
119	TJ & JA Peach
120	JT & JW & D Fitzpatrick
122	PN Hardiman
123	A & M Zivkovic
124	A Zivkovic
125	E & K Roberts
126	A & P Davies
127	A & D Wentzel
128	WG Pongratz
129	R & K Roser
130	L Batty & D Hirons
131	MR Field
132	SL Cook
133	P & J Harty
134	CL Ammann
135	R & K Roser
136	M & R Bryson
137	A & C Chetcuti
138	B Covel
139	P & M Woolford
140	W Stafford & M McCullough
141	C Hull
142	D & S Williams
143	R Bale & K Lawes
144	J Hibberd
145	C Bremner & M O'Neill
146	D & B Spearpoint
147	D Currington
148	O Lee
149	JD Zagarella
150	E Tindale & A McDonald & W Wilson
151	T & V Rheinberger

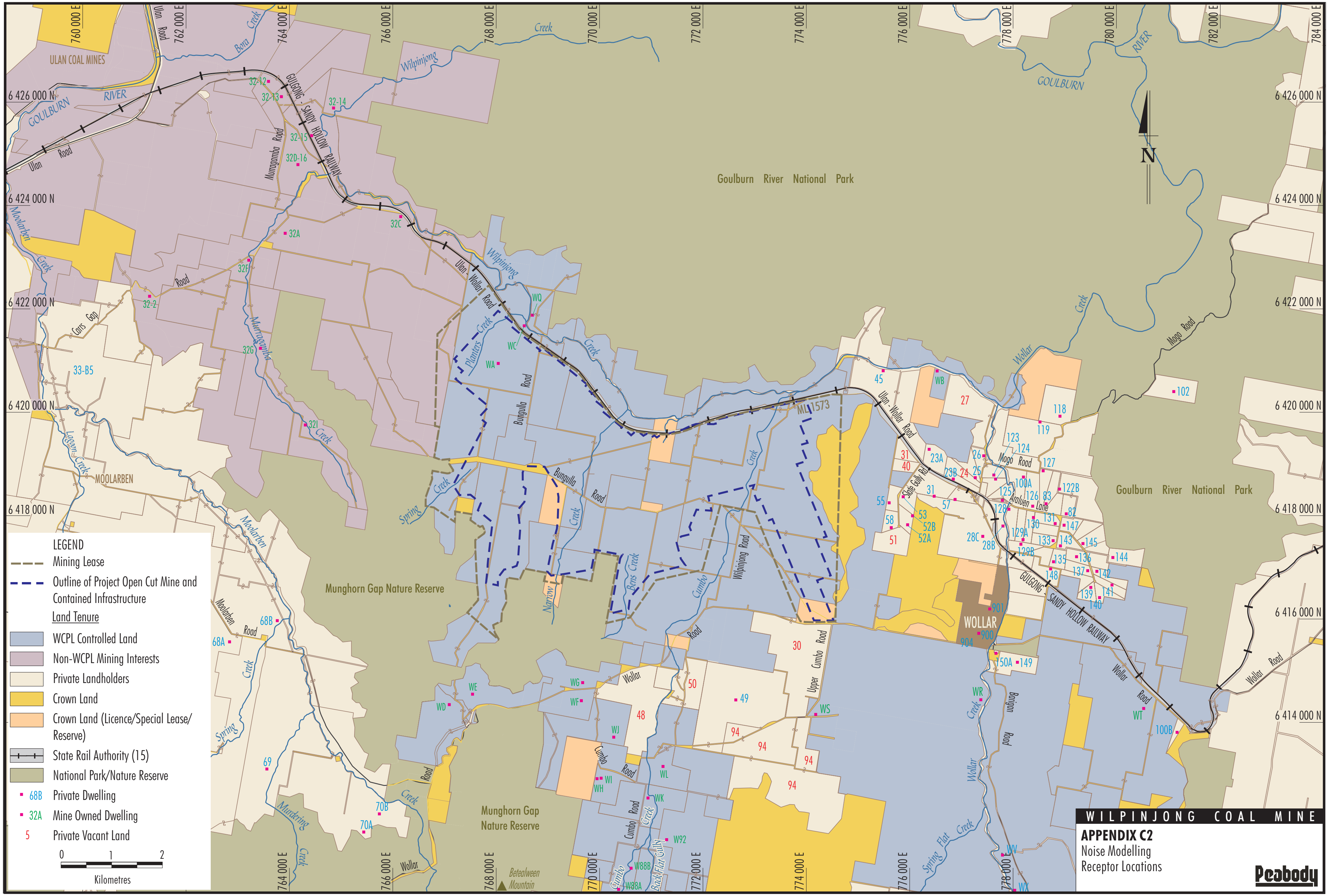
Source: Co-Resources (2005), Moolarben Coal Mines (2009) and WCPL (2010)

W I L P I N J O N G   C O A L   M I N E

APPENDIX C1B
Relevant Land Ownership List

Peabody

Noise Modelling Receptor Locations



WILPINJONG COAL MINE

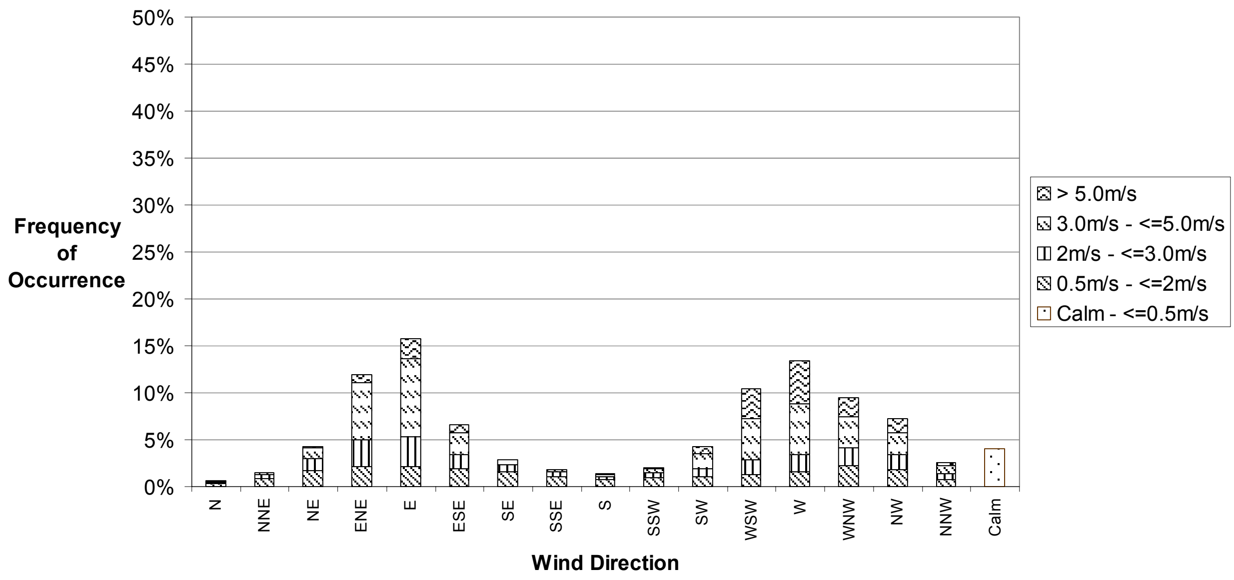
APPENDIX C2
Noise Modelling
Receptor Locations

Peabody

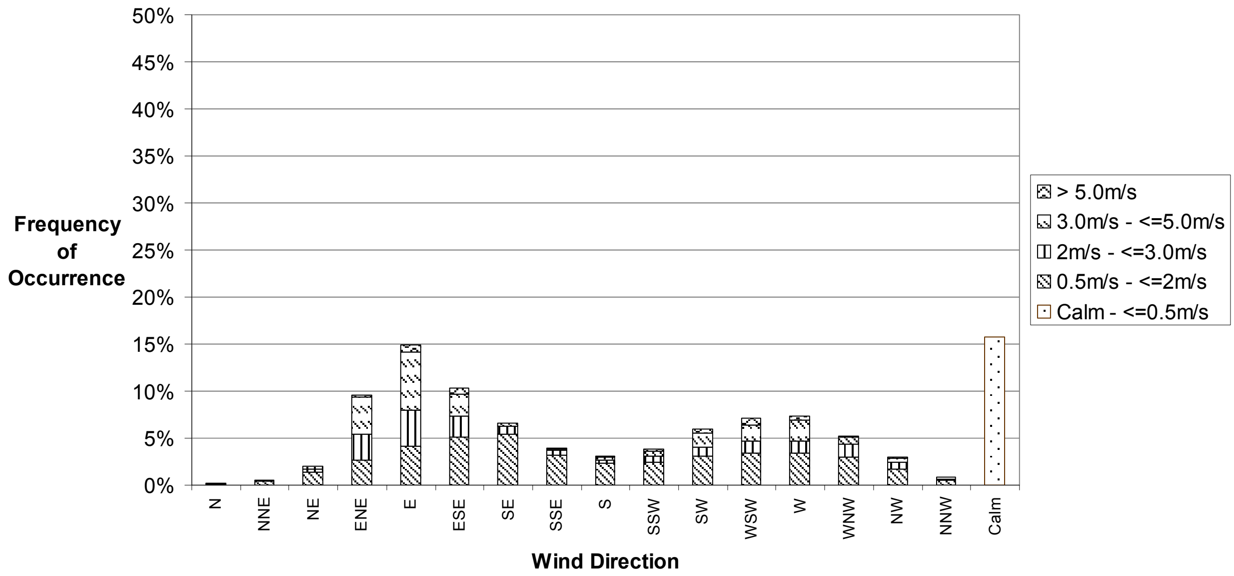
WIL-09-07 App Noise_006C

Wind Roses - 2005 to 2009

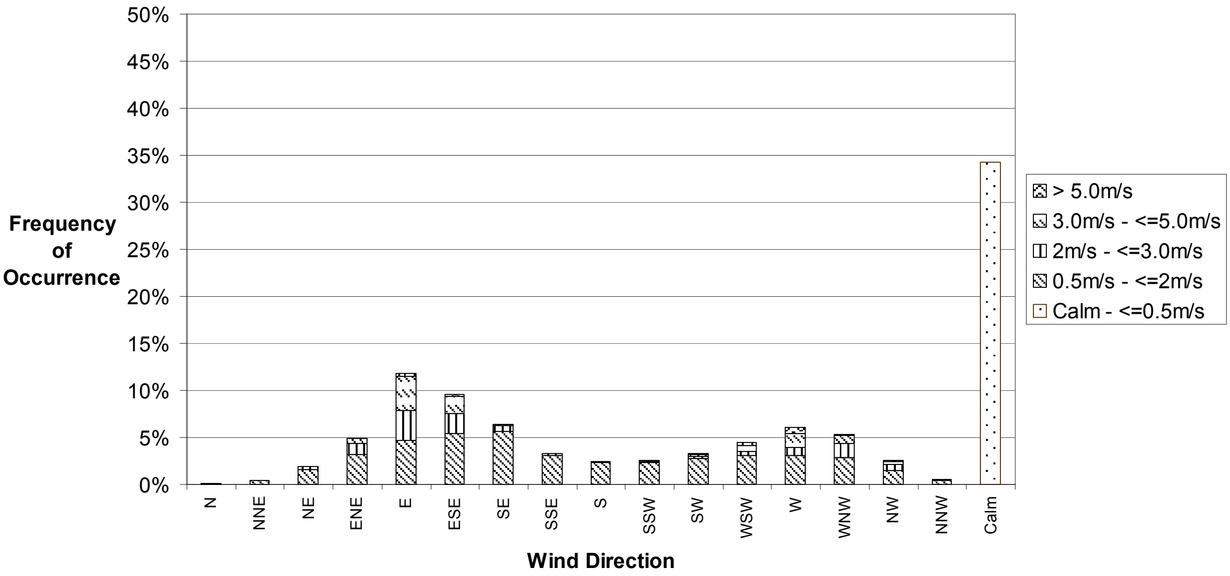
Annual Day Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



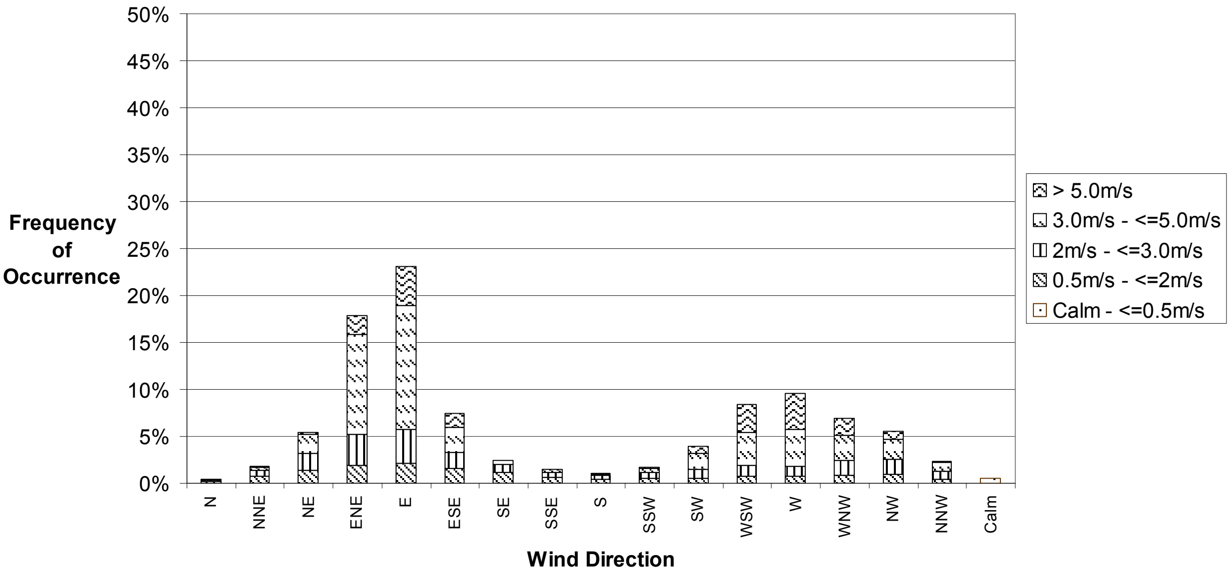
Annual Evening Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



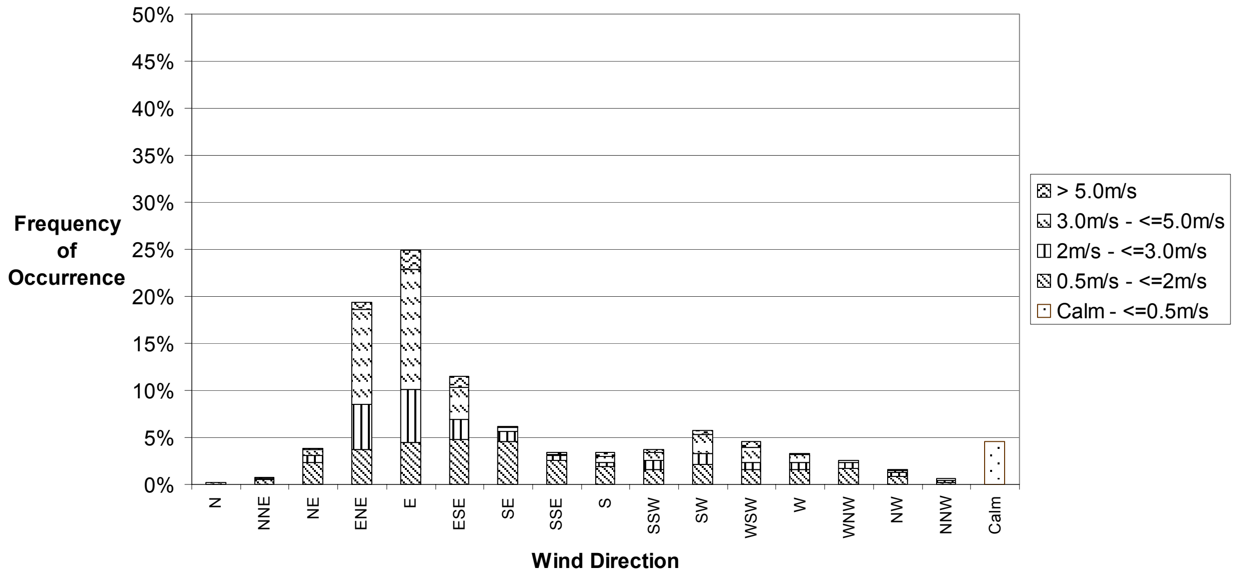
Annual Night Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



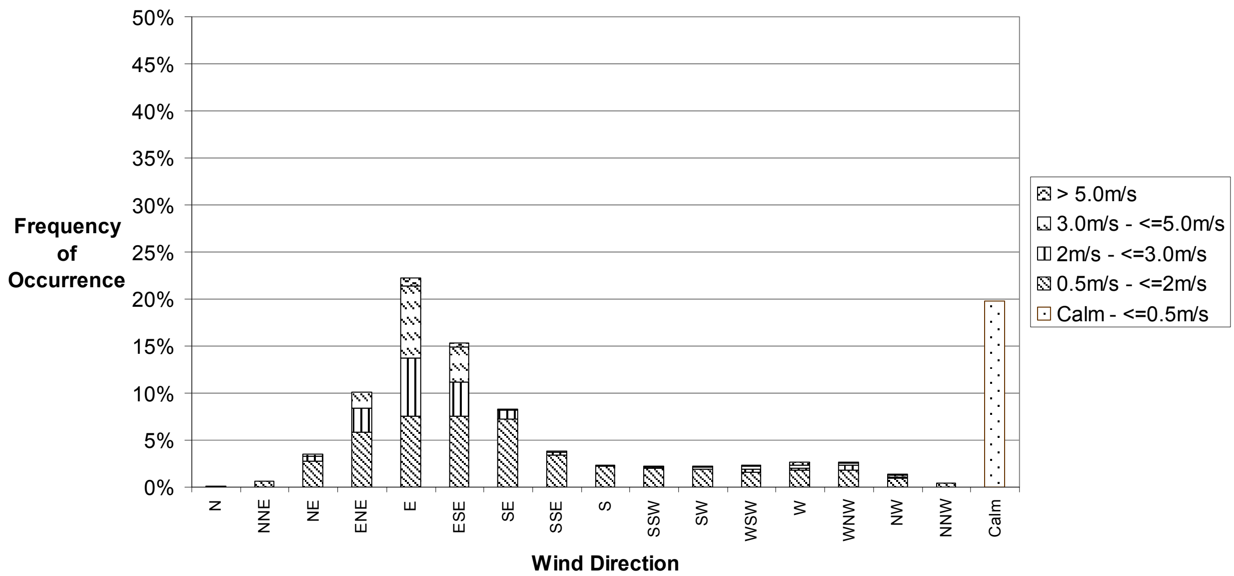
Summer Day Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009

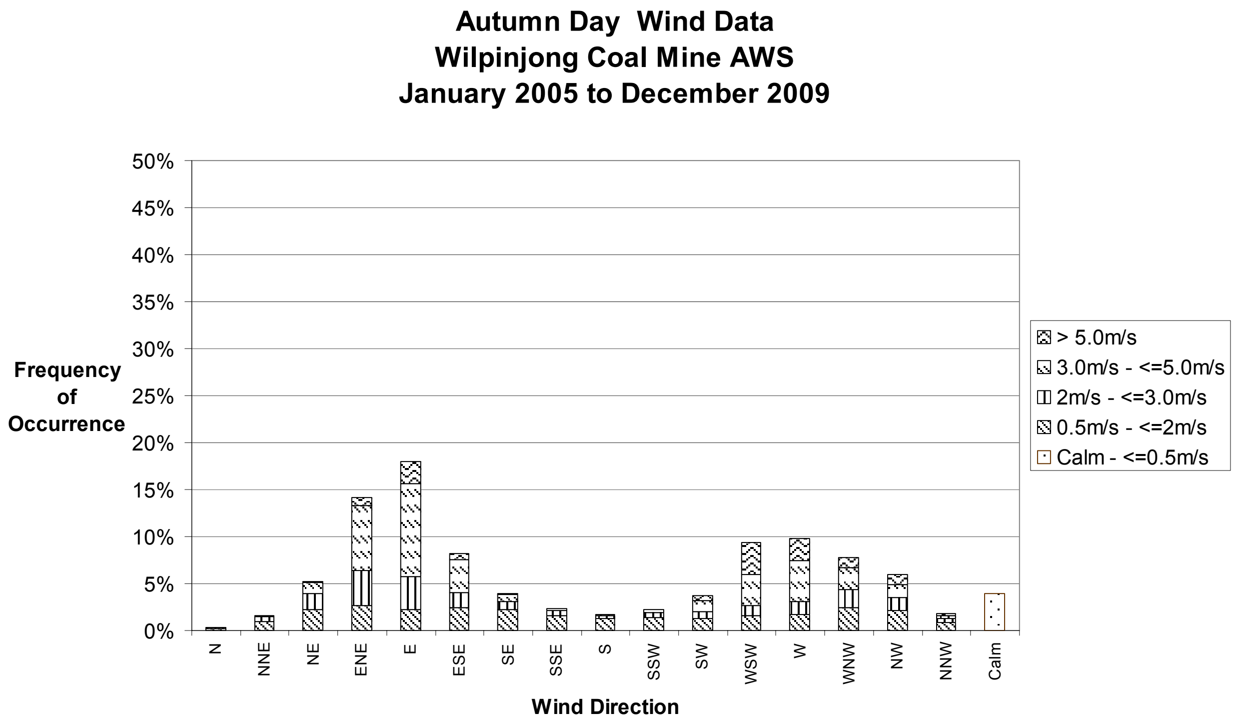


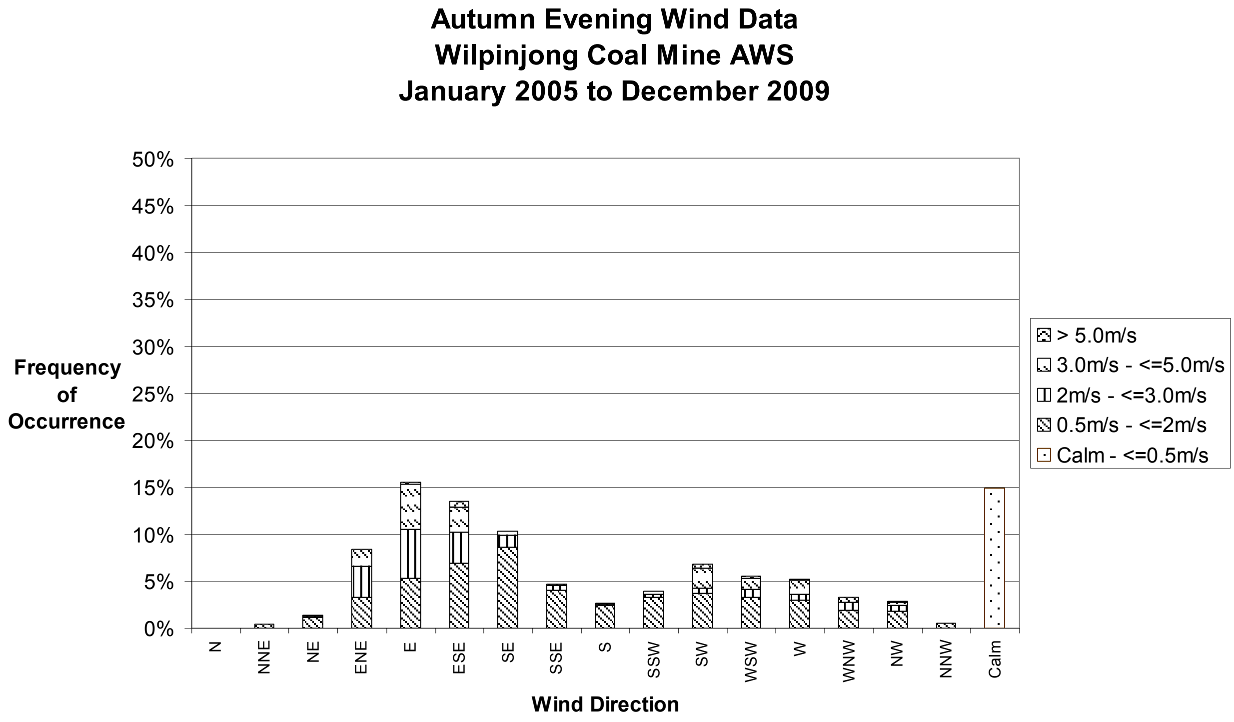
Summmer Evening Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



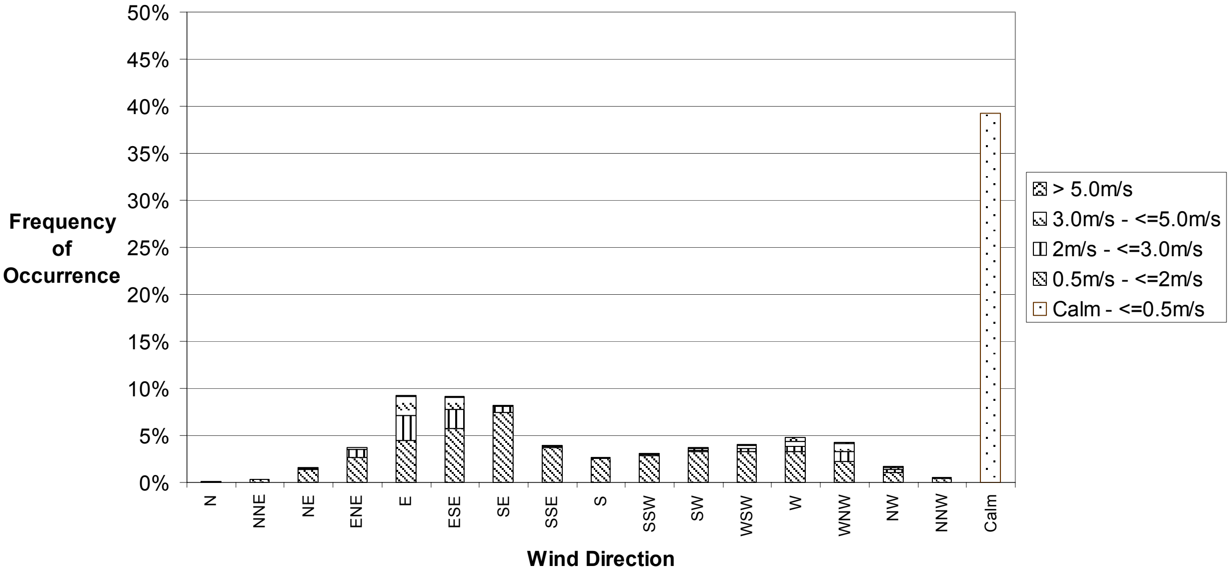
Summer Night Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



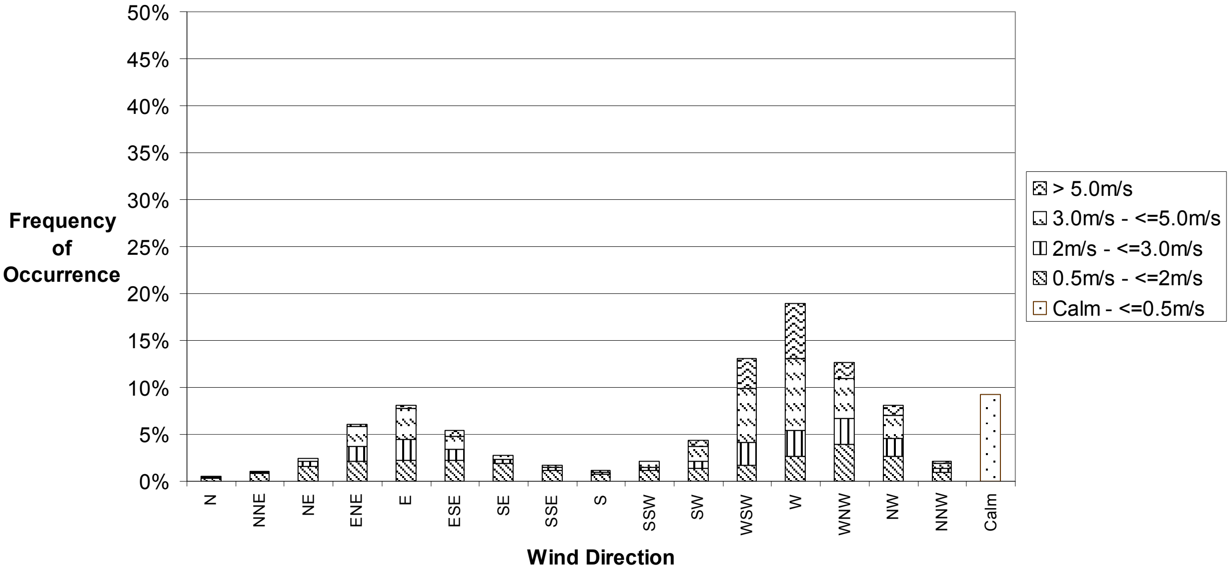

Autumn Day Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Frequency of Occurrence
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
Calm
Wind Direction
> 5.0m/s
3.0m/s - <=5.0m/s
2m/s - <=3.0m/s
0.5m/s - <=2m/s
Calm - <=0.5m/s


Autumn Evening Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Frequency of Occurrence
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
Calm
Wind Direction
> 5.0m/s
3.0m/s - <=5.0m/s
2m/s - <=3.0m/s
0.5m/s - <=2m/s
Calm - <=0.5m/s

Autumn Night Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



Winter Day Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



Winter Evening Wind Data
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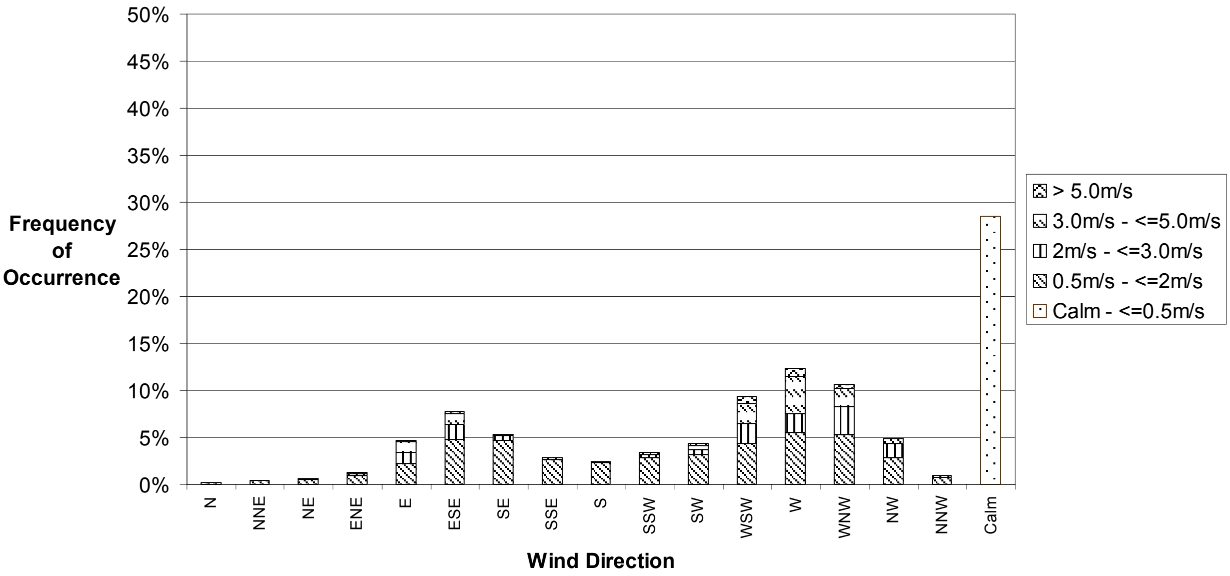
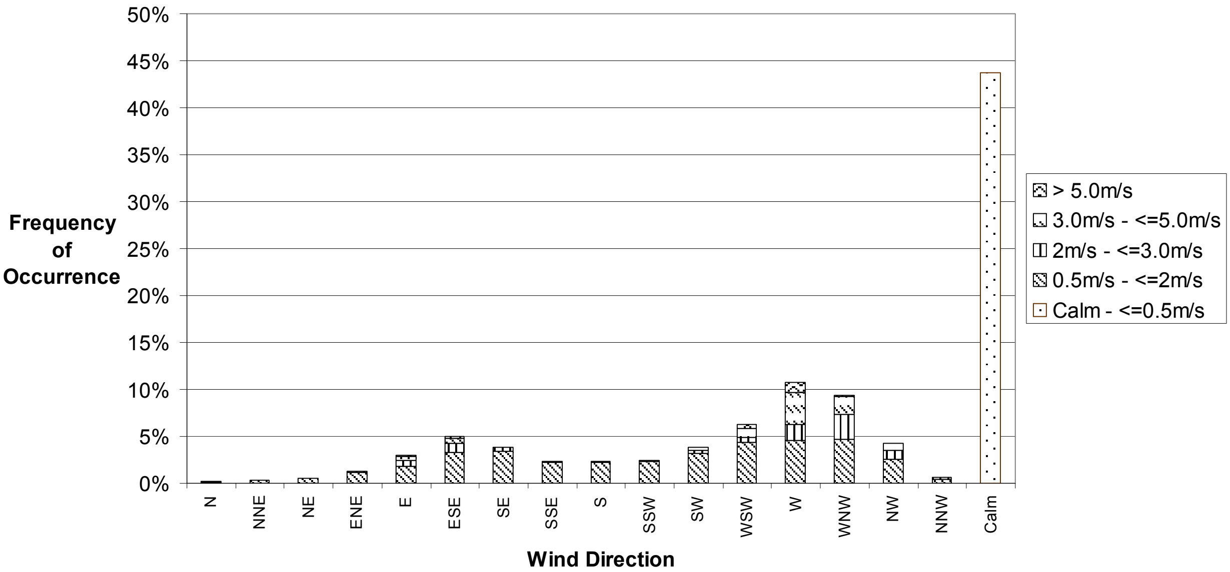
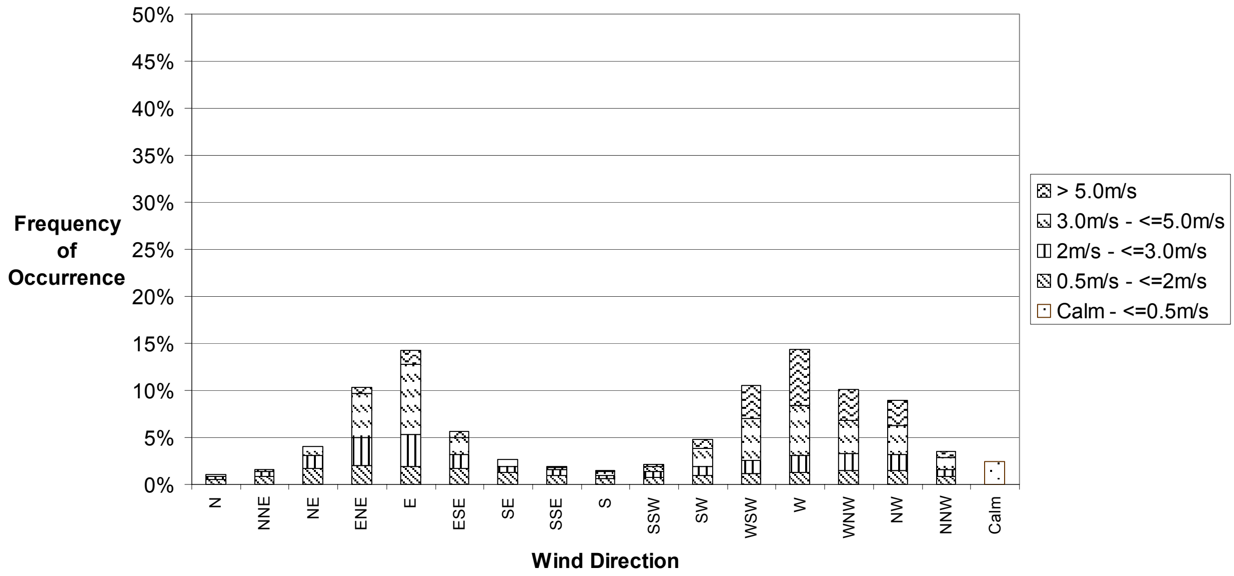
January 2005 to December 2009



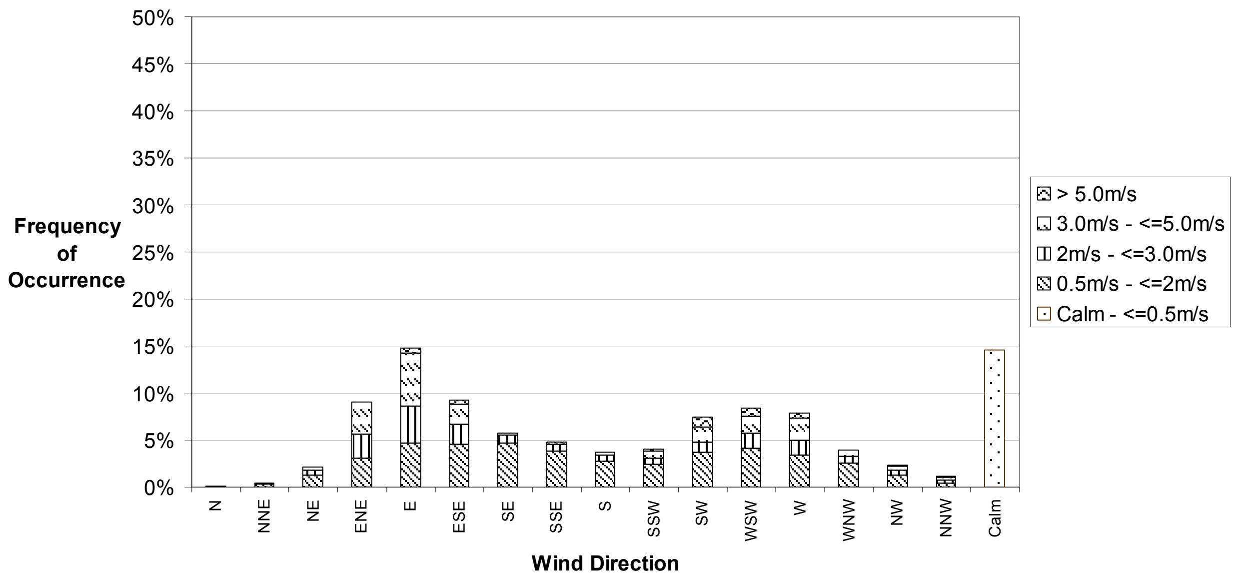
Winter Night Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009

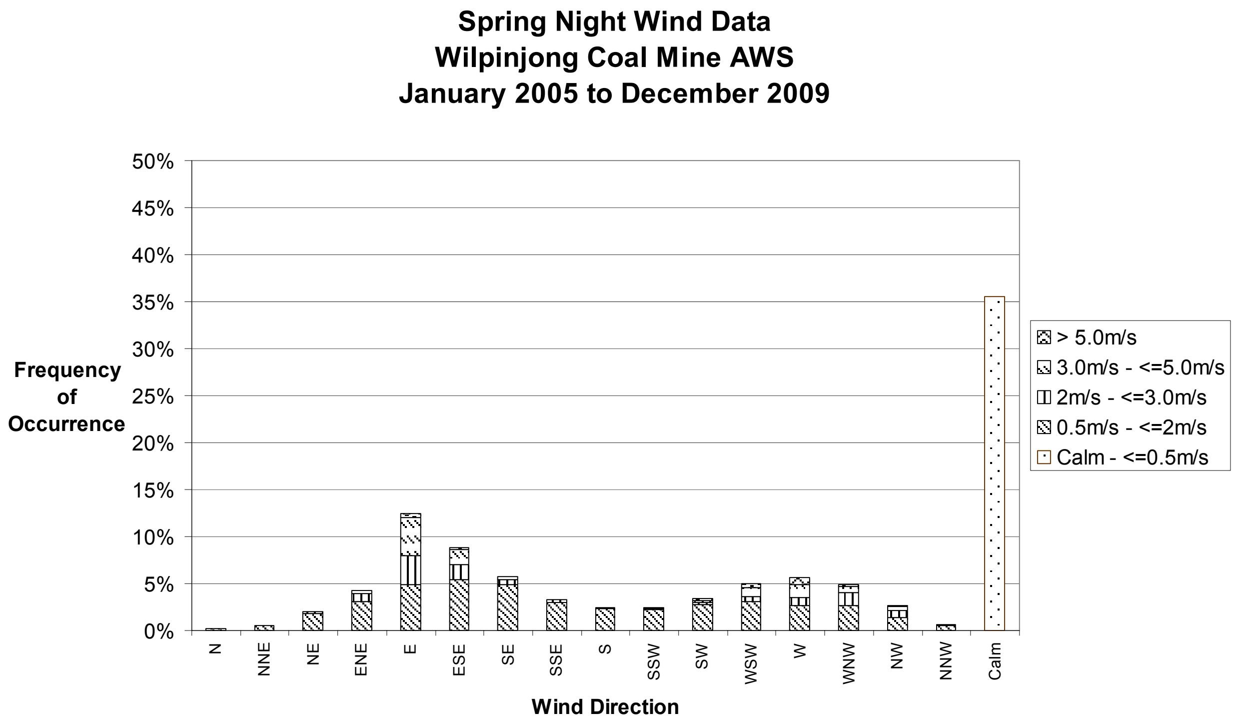


Spring Day Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009



Spring Evening Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009




Spring Night Wind Data
Wilpinjong Coal Mine AWS
January 2005 to December 2009
Frequency of Occurrence
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
> 5.0m/s
3.0m/s - <=5.0m/s
2m/s - <=3.0m/s
0.5m/s - <=2m/s
Calm - <=0.5m/s
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
Calm
Wind Direction

Dominant Seasonal Wind Data - 2005 to 2009

Seasonal Frequency of Occurrence Wind Speed Intervals - Daytime

Period	Calm (<0.5 m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	4.1%	E	7.8%	8.6%	16.4%
Summer	0.6%	E	6.9%	10.0%	16.9%
Autumn	4.0%	E	9.5%	10.2%	19.7%
Winter	9.3%	W	10.3%	9.4%	19.7%
Spring	2.5%	E	7.1%	8.9%	16.0%

Seasonal Frequency of Occurrence Wind Speed Intervals - Evening

Period	Calm (<0.5 m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	15.7%	ESE	17.6%	8.6%	26.2%
Summer	4.6%	E	16.4%	13.5%	29.9%
Autumn	14.9%	ESE	24.4%	11.9%	36.3%
Winter	28.5%	W	18.2%	8.2%	26.4%
Spring	14.6%	ESE	17.4%	8.5%	25.9%

Seasonal Frequency of Occurrence Wind Speed Intervals – Night-Time

Period	Calm (<0.5 m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	34.3%	ESE	18.9%	6.5%	25.4%
Summer	19.7%	ESE	27.0%	12.1%	39.2%
Autumn	39.3%	ESE	20.8%	5.8%	26.7%
Winter	43.7%	W	16.5%	5.5%	22.0%
Spring	35.5%	ESE	18.2%	5.9%	24.1%

DECCW Industrial Noise Policy - Application Notes

Application notes - NSW industrial noise policy

The application notes, When to apply the urban/industrial interface amenity category, Identifying the appropriate receiver amenity category and When the RBL for evening or night is higher than the RBL for daytime were updated in July 2006.

These application notes are provided to assist industry and acoustical consultants develop noise impact assessments and apply the provisions of the NSW Industrial Noise Policy (INP), with the aim of reducing processing time.

DEC requires noise impact assessments to apply the provisions of the INP, alternative approaches are not acceptable. The process for identifying project-specific noise levels in Section 2 of the INP must be followed.

The level of mitigation that can be applied to a project is based on what is feasible and reasonable within the circumstances of that project. Valid factors include costs, aesthetics, community preferences, noise reduction achieved, etc.

Noise level requirements in a licence are based on what the project can achieve using feasible and reasonable mitigation.

For more information on feasible and reasonable levels of mitigation see:

- Environmental criteria for road traffic noise
- Sections 1.4.5 and 7 of the NSW Industrial Noise Policy
- RTA's Environmental Noise Management Manual

Identifying the existing level of noise from industry

(see INP Section 2.2 and 3.2)
Table 2.1 Amenity Criteria (INP p. 16) sets out recommended cumulative noise levels for industry. In assessment of the amenity effects of noise from a new development it is essential that the level of noise already present be determined.

Where the ambient noise levels are below the Acceptable Noise Level (ANL), then ideally the measurement of the existing level of noise should include only noise from industrial sources. In these situations, however, it may be acceptable to include noise from other sources (for example, roads, neighbourhood). The reasons for this are that:

- including noise from other sources typically results in assessing the worst case for impacts on amenity
- strictly excluding noise from sources other than industry can be difficult and costly and may not be necessary if the development meets the criteria.

However, where ambient noise levels are above the ANL then noise from other sources should be excluded in establishing existing levels of industrial noise. Where the level of road traffic noise is high enough to make noise from an industrial source inaudible for the majority of the time or difficult to measure directly, it may be necessary to consider applying the assessment for areas of high traffic noise. (Application Note Amenity criteria in high traffic noise areas provides further guidance on this.)

Assessing noise at industrial/commercial receivers

(see INP Section 2.2)
The INP does not require that intrusive noise be assessed at industrial or commercial premises. For industrial/commercial receivers, only the amenity criteria apply. Amenity noise levels should be assessed at the most affected point on or within the property boundary. This approach also applies to other non-residential receivers, such as educational facilities, hospitals and places of worship.

When to apply the urban/industrial interface amenity category

(see INP Section 2.2.1)
The urban/industrial interface category in the INP recognises that the availability of noise mitigation measures might be limited for existing premises where residences are close to existing industries.

The urban/industrial interface amenity category applies only for existing situations (that is, an existing receiver near an existing industry) and only for those receivers in the immediate area surrounding the existing industry, that is, the region that extends from the boundary of the existing industry to the point where the noise level of the existing industry (measured at its boundary) has fallen by 5 decibels.

Beyond the interface region (that is, beyond the point where noise has fallen by 5 decibels) the receiver category that most describes the area (rural, suburban or urban) would apply. (Note: the wording on pages 18 and 67 of the INP does not fully clarify this and the word 'urban' should be deleted and replaced with the word 'applicable' on page 18 at line 6 of the 'Urban/industrial interface' category and on page 67 at line 9 of the first paragraph.)

For new developments of a limited nature (such as an extension to existing process or plant or when replacing part of an existing process or plant with new technology) on existing sites (where the urban/industrial amenity category applies) then the urban/industrial amenity category is the appropriate amenity category for the new development. However, where a new development on an existing site is of a substantial nature (such as demolition of the existing plant and replacement with current technology or different type of plant) and where replacement of the existing plant has a realistic potential to significantly reduce receiver noise levels through using feasible and reasonable noise mitigation (ie: where the existing plant is the dominant or a significant contributor to receiver noise levels) then the applicable noise criteria for the new development is the appropriate (rural, suburban or urban) amenity criteria for the location.

In most cases the situation will be apparent but in some cases careful judgement will be required to determine whether the new development is of sufficient magnitude to effectively replace the existing plant. In situations where no clear conclusion on the magnitude of change created by the new development is possible then the urban/industrial amenity category should apply.

Identifying the appropriate receiver amenity category

(see INP Section 2.2.2)
Amenity criteria in Table 2.1 of the INP vary depending on the type of receiver. INP Section 2.2.2 provides guidance on identifying the appropriate receiver type. Where there is doubt or debate over which receiver category is appropriate, the proponent needs to seek the views of the relevant land use manager (for example, Council or Department of Planning). Once the land use manager has identified the land use (eg: zone, allowable density of development and land use patterns), the appropriate amenity criteria can be assigned.

Amenity criteria in high traffic noise areas

(see INP Section 2.2.3)
In areas where traffic flow is continuous and noise from industrial sources is inaudible or difficult to measure due to a high level of road traffic noise, and where the $L_{Aeq, (period), traffic}$ noise level is more than 10 dB above the ANL presented in Table 2.1, the ANL is replaced by $L_{Aeq, (period), traffic}$ minus 10 dB. This becomes the new ANL for the receiver area.

Once the new ANL is determined, the project-specific amenity criterion can be determined by following the modification process given in Table 2.2.

Example. An industrial development is proposed adjacent to several existing industrial facilities. The measured ambient night-time L_{Aeq} noise level is 60 dB(A) at a receiver potentially affected by noise from the proposed industrial development. The residential receiving area of the assessment location has been identified as 'urban'. A nearby road dominates the night-time acoustic environment at the receiver and there are no other environmental or extraneous local noise sources. In these circumstances, the measured ambient LAeq noise level of 60 dB(A) can be taken to represent the $L_{Aeq, (period), traffic}$. The night-time noise contribution from existing industry is estimated to be 46 dB(A). What is the project-specific amenity (night-time) noise criterion for the proposed industrial development?

Solution. The $L_{Aeq, (period), traffic}$ minus 10 dB is greater than the night time ANL of 45 dB(A) as determined from Table 2.1 for urban areas not significantly affected by traffic noise. Therefore, the approach described in Section 2.2.3 of the INP can be applied and the new ANL becomes LAeq, (period), traffic minus 10 dB. As the $L_{Aeq, (period), traffic}$ is 60 dB(A), then the new ANL becomes 50 dB(A). This is the amenity noise criterion for the total industry L_{Aeq} noise in the area. The project-specific amenity (night-time) noise criterion for the proposed industrial development is then determined by comparing the existing industry L_{Aeq} of 46 dB(A) to the new ANL of 50 dB(A) with respect to the modification process given in Table 2.2. This gives the project-specific amenity (night-time) noise criterion of 48 dB(A), that is, new ANL minus 2 dB(A).

Dealing with cumulative noise from multiple developments

(see INP Section 2.2.4)
The intrusive and amenity criteria outlined in Section 2 of the INP were established primarily to deal with individual development applications for industrial sites in the vicinity of existing sensitive receivers with stable background noise levels. In Section 2.2.4 the INP recognises that for multiple developments, such as a new industrial area, a strategic approach can be implemented to ensure the amenity objectives are not compromised and an equitable share of the remaining available allocation of amenity-related noise for each industrial development is achieved.

Identifying which of the amenity or intrusive criteria apply

(see INP Section 2.4)
The INP notes that the Project-Specific Noise Levels (PSNL) are the more stringent of either the amenity or intrusive criteria. This is not necessarily just a matter of comparing the magnitude of the amenity criteria to the intrusive criteria because different time periods apply (intrusive criteria uses 15 minutes while the amenity criteria are over the day, evening or night period).

For example, where the same number applies to both the amenity and intrusive criteria, the intrusive criteria would typically be more stringent because it is determined over a much shorter period.

Where the predicted amenity noise level is lower than the intrusive level for the proposed development, the proponent needs to ensure that both levels will be satisfied. In this situation, noise limits specified in the licence conditions will include both the intrusive and amenity noise levels predicted to be achieved by the proposal to ensure that the community is protected from intrusive noise impacts at all times.

Assessing background noise levels

(see INP Section 3.1)
To determine the Rating Background Level (RBL) and existing industry-contributed LAeq, the measurement of ambient noise levels should be undertaken in the absence of noise from the development under consideration.

When the RBL for evening or night is higher than the RBL for daytime

(see INP Section 3.1)
The results of long term unattended background noise monitoring can sometimes determine that the calculated Rating Background Level (RBL) for the evening or night period is higher than the RBL for the daytime period. These situations can often arise due to increased noise from for example insects or frogs during the evening and night in the warmer months or due to temperature inversion conditions during winter. The objective of carrying out long-term background noise monitoring is to determine existing background noise levels at a location that are indicative of the entire year.

In determining project-specific noise levels from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific noise levels for a particular development, it is generally recommended that the intrusive noise level for evening be set at no greater than the intrusive noise level for daytime. The intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening. Alternative approaches to these recommendations may be adopted if appropriately justified.

Maximum noise levels during shoulder periods

(see INP Section 3.3)
Noise levels in limit conditions for sleep disturbance would typically be set as a maximum noise level. The approach noted in the INP for developing intrusive criteria for the shoulder period is not appropriate for determining maximum noise levels for the shoulder period. That is, assigning a background noise level based on averaging daytime and night-time RBLs may be appropriate for determining intrusive criteria but it is not appropriate for assigning maximum noise levels. The reason for this is that the day or night RBL is based around the 90th percentile of LA90s, which is quite different to an RBL based on an average. (Additionally, setting maximum noise levels for the shoulder period based on the lowest LA90 during the period is not practical as it can result in the maximum noise limit being set lower than the intrusive noise limit.)

In order to generate a statistically valid data set to derive the 90th percentile of LA90s for the shoulder period, a much larger sampling time (than the one week typically applied) would be required, with associated cost and practicality implications. Therefore, a statistical approach to calculating the RBL for shoulder periods is not required by the INP.

It is the intention of the INP that appropriate noise targets for the shoulder period be negotiated with the regulatory/consent authority on a case-by-case basis. The focus of the INP is on avoiding or minimising noise of a high level and/or with intrusive characteristics, during the shoulder period, through the use of best practice.

Options available to the proponent for managing maximum noise levels during the shoulder period are to:

- avoid noise events during the shoulder period (or at least during the first half and then to meet RBL(shoulder period) +15 dB(A) during the second half of the shoulder period)
- collect sufficient data to calculate a statistically robust 90th percentile-based RBL for the shoulder period and use this to determine RBL+15 dB(A) as the maximum noise level limit
- conduct a detailed analysis of the number and noise level of noise events, and the exceedence of the background noise level, then, present a case comparing the results of the analysis and the research results contained in the ECRTN, Appendix B.

Tonality - sliding scale test

(see INP Section 4.2)
The sliding scale test for tonality outlined in Section 4 of the INP uses a linear (z-weighted) spectrum (that is, no frequency weighting on each of the octave or third octave bands).

Duration correction

(see INP Section 4.2)
Section 4 of the INP provides guidance on the use of modifying factors to account for certain characteristics of a noise source. The duration factors in Table 4.2 are intended to increase the criterion that is acceptable, whereas the modifying factor corrections in Table 4.1 are intended to increase the measured or predicted level.

How calm is defined

(see INP Section 5.1)
In the assessment of wind effects, the INP requires the assessment of wind speeds of up to 3 metres per second where these speeds are a feature of the area (they occur for 30 percent of the time or more) but does not specify the minimum wind speed that needs to be assessed. The calm condition is typically represented by wind speeds less than or equal to 0.5 metres per second as this is likely to be the lower limit of measurement.

Presenting predicted noise impacts

(see INP Section 6.3)
In carrying out noise impact predictions for a particular development, predicted noise levels for calm conditions as well as any significant adverse weather conditions should generally be provided. It is particularly useful to provide predicted noise impacts for calm weather conditions where predicted noise impacts under adverse weather conditions exceed the project-specific noise levels. This allows for a better understanding of potential noise impacts from the development.

Prosecution guidelines

(see INP Section 11.1)
DEC's approach to prosecuting offences is described in EPA prosecution guidelines, 2001, particularly Sections 3.2-3.6 under 'Discretion' which states that "not every breach of the criminal law is automatically prosecuted", "The EPA has a discretion as to how to proceed in relation to environmental breaches" and "Each case will be assessed to determine whether prosecution is the appropriate strategic response". Sections 3.7-3.8 under 'Factors to be considered' in the Guidelines describe factors that are considered when determining whether prosecution is required, such as "whether the breach is a continuing or second offence", "the availability and efficacy of any alternatives to prosecution" and "the prevalence of the alleged offence and the need for deterrence, both specific and general".

Using Appendix D

Appendix D of the INP provides a rough guide for predicting the increase in noise due to inversion effects. The data provided is based on simple calculations performed using the Environmental Noise Model (ENM), assuming flat ground and no barriers.

The use of this Appendix may underestimate the effects of temperature inversions where a barrier or intervening topography is present. For detailed noise impact assessments, a more thorough analysis of noise impacts under temperature inversions is expected. Where a noise model such as SoundPlan or ENM is used to determine noise impacts from a development under calm conditions or during wind conditions, the model should also be used to determine potential noise impacts under inversion conditions, rather than using Appendix D.

How to account for operations that only occur for part of the day, evening or night

If a plant operates throughout the day and evening but only part of the night, the assessment and applicable criteria are based on the period that the plant operates. For example, if the night operation occurs between 10 pm and 3 am the assessment of background noise and existing noise from industry would cover only those 5 hours and the applicable criteria would be derived from this period. The same applies for part operation during the day or evening.

The basic inputs needed to establish the amenity criteria are the existing industrial noise and the ANLs for different types of receivers. The amenity criterion is then obtained by a process that seeks to limit continuing increases in noise levels from industrial sources. The amenity criterion is equally applicable to a development that operates only for a portion of the relevant assessment period.

During the impact prediction phase, determining whether an industrial activity meets the amenity criteria entails assessing the noise level emissions from the activity over the period it takes place. Typically this would correspond to the times during which the industrial operation has approval to operate as specified in a licence or consent.

For example, where an industrial operation commences at 5am, the period during which to assess night-time amenity would be from 5am to 7am. A noise impact assessment should not include the period during which the industrial operation does not operate (the night-time hours of 10pm to 5am).

The basic premise of assessing noise over the period that an activity occurs has and continues to be the standard approach.

The existing industrial noise should be used in conjunction with the appropriate ANL to establish the amenity criteria applicable. The criteria are applicable to the hours the development operates.

If there were a disparity between the approved operating hours and the actual period over which industrial activities take place then the appropriate period to apply to assessing amenity would need to be assigned with the aim of assessing noise over the time in which industrial activities take place. In practice, it is expected that this is unlikely to be a significant issue as most industrial operations conduct industrial activities during their approved operating hours.

In situations where high levels of ambient noise occur the INP provides a mechanism to adjust the applicable noise criteria so as not to impose overly stringent criteria. For example, if an industry operates from 5am to 7am and the receiver premises experience high levels of existing traffic noise at this time, the ANL used to derive the amenity criteria can be adjusted on the basis of the high existing traffic noise. If the existing industrial noise is low, then the traffic-modified ANL becomes the amenity criterion.

Sleep disturbance

Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.

DEC reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, DEC recognised that current sleep disturbance criterion of an LA1, (1 minute) not exceeding the LA90, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DEC will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or LA1, (1 minute), that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur
- time of day (normally between 10pm and 7am)
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. DEC will accept analysis based on either LA1, (1 minute) or LA, (Max).

Addressing privately owned haul roads

Noise from privately owned haul roads is to be assessed as an industrial noise source according to the INP. The practice of treating access roads as part of the industrial premises with which they are associated is a long established part of noise management in NSW, which the INP has not changed. The basis for treating vehicles on private access roads as part of an industrial noise source lies in the relationship between the enterprise and the noise, and the community's response to noise from vehicles operating on private roads.

The character of the noise is different to general road traffic noise
Traffic on access roads is solely related to the operation of the site served by the access road and is usually composed almost entirely of heavy vehicles, producing noise of a different character to the typical public roadway where smaller vehicles typically predominate.

Factors that influence community response are different compared to public roads
The distribution of benefits from the operation of a private access road is typically perceived as different than from a public road. Affected members of the public have been reported as questioning the equity of truck noise degrading their amenity for the benefit of others.

The degree of control possible for traffic on a private access road is typically perceived as greater than for a public road. The result is a higher level of expectations that more can and should be done to reduce noise from the private road (than from a public one).

Determining noise limits for licence conditions

Where the proponent predicts that noise levels from the industrial development would be below the project-specific noise levels, then the noise limits specified in the licence/consent conditions should reflect the noise levels that the proponent states would be achieved (that is, the predicted noise levels, however a minimum intrusive criterion of 35 dB(A) still applies). This is for a number of reasons:

- to ensure that the best-management practices and best available technology described in the noise impact assessment report are actually adopted by the proponent
- to ensure that the level of achievable performance presented by the proponent to the public, though public documentation such as Environmental Impact Statements, is achieved
- to optimise the opportunity for further industrial development in the area without an unacceptable degradation of the acoustic amenity of the area
- to fulfil a general aim of the environmental assessment process to minimise environmental impacts.

It should be noted that noise limits would apply to the contributed noise levels from only the premises or site of concern. In setting noise limits, judgement needs to be made as to whether the predicted noise levels warrant noise limits on the licence/consent. Where the predicted noise levels from the premises of concern are well below the project-specific noise levels, there may be no need for noise limit conditions.

Any tolerances to the predicted noise levels should be addressed in the proponent's assessment of impacts so that the predicted noise levels can be applied in conditions.

Other application notes

Application notes for the following subjects are in development:

- Noise impact assessment for the upgrade of existing facilities.
- Analysis of temperature inversions
- Weather conditions applied in consents
- Amended method for direct measurement of temperature inversions
- Process for working out the frequency of wind speeds affecting a receiver
- What weather conditions should be used in predicting noise?
- Tonality correction

Page last updated: 21 February 2008

Appendix E2

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Page 1 of 2

DECCW Environmental Assessment Requirements for Rail Traffic - Generating Developments dated 3 March 2010

Rail noise

The NSW Government is developing a comprehensive approach to managing the environmental impacts of noise and vibration from the NSW rail system. Effective management of rail noise will require the combined efforts of rail infrastructure owners and developers, rail operators, train manufacturers, regulatory and planning authorities, and the community. The key parts of this approach include:

- release of Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects
- preparation of a noise management manual on best practices to mitigate rail noise and vibration
- implementation of a rail noise abatement program, which aims to mitigate noise for those acutely affected by it by taking into account the results of a current trial by the rail agencies
- release of environmental planning guidelines for new residential developments along rail lines (pdf format, 4.42MB)
- development of rolling stock noise-emission standards.

The Department of Environment, Climate Change and Water is participating in the development of all of these components.

Environmental assessment requirements for rail traffic-generating developments

Land-use developments that are likely to generate additional rail traffic were previously assessed with reference to the *Environmental Noise Control Manual*. This manual is no longer in print and does not represent current government policy.

When reviewing the Environmental Assessments, Environmental Impact Statements, Statements of Environmental Effects, or Reviews of Environmental Factors for land-use developments, DECCW will assess these developments against the following requirements:

- The typical offset distance/s of sensitive receivers from the rail line/s that are likely to be affected by increased rail movements should be identified.
- The existing level of rail noise at the offset distance/s identified in point one above should be quantified using the noise descriptors LAeq,24hr and LAmax (95th percentile) dB(A).
- The cumulative rail noise level (i.e. from existing, plus proposed, rail movements) should be predicted using a calibrated noise model (based on predicted increased rail movements) at the offset distances identified above.
- The cumulative noise level should be compared with the rail noise assessment trigger levels: LAeq,24hr 60dB(A) and LAmax (95th percentile) 85dB(A).
- Where the cumulative noise level exceeds the noise assessment trigger levels, and project-related noise increases are predicted, all feasible and reasonable noise mitigation measures should be implemented. As a general principle, where the reduction of existing noise levels can be achieved through feasible and reasonable measures, a reduction in noise levels to meet the noise assessment trigger levels is the primary objective. In all cases where the LAeq noise level increases are more than 2dB(A), strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.

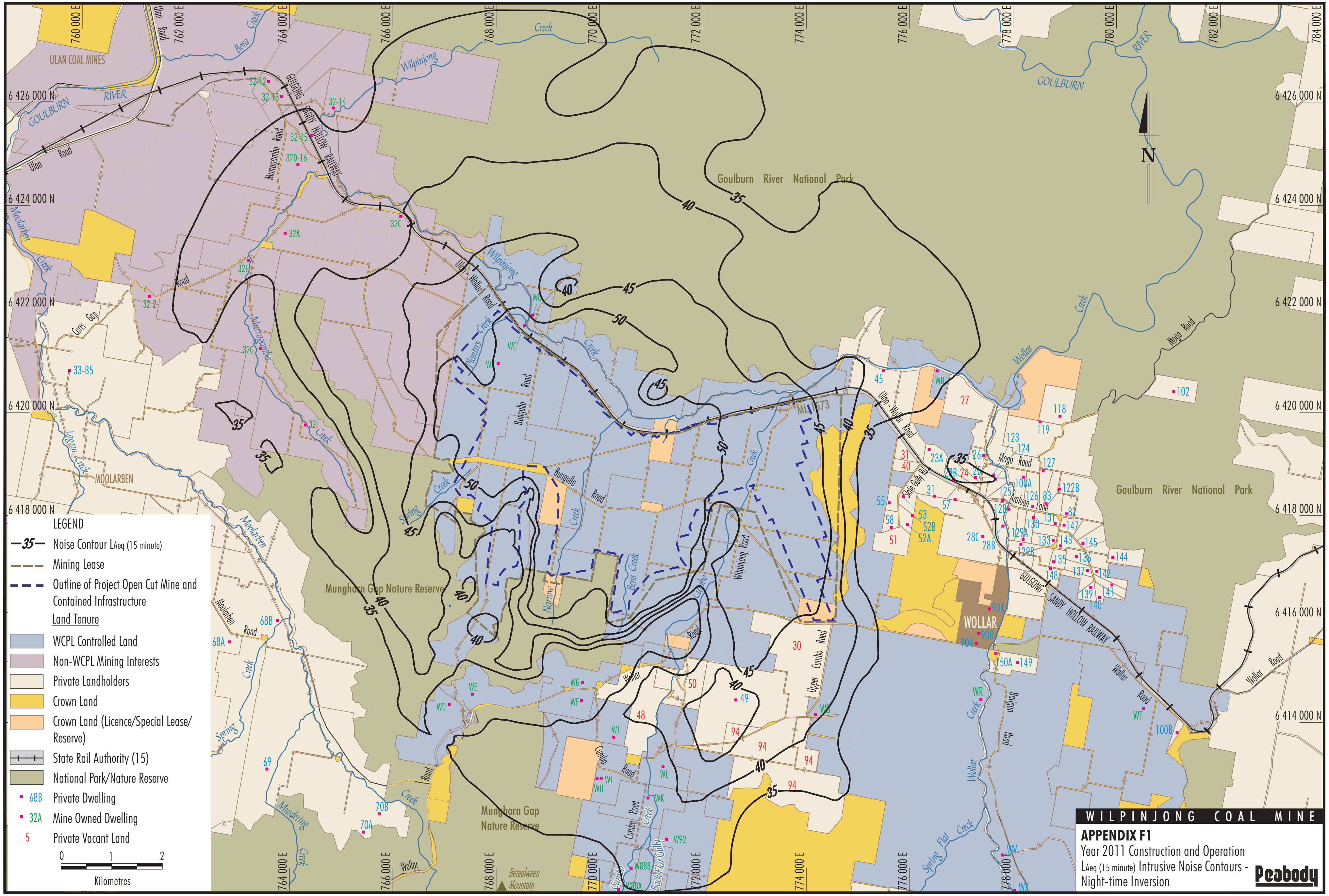
Notes:

1. A project-related noise increase is an increase of more than 0.5dB.
2. Ideally, the geographical extent of the rail noise assessment should be to where project-related rail noise increases are less than 0.5dB. This roughly equates to where project-related rail traffic represents less than 10% of total line/corridor rail traffic.
3. General guidance on the concept of 'feasible and reasonable' can be obtained from DECCW's Interim Construction Noise Guideline. However, in the context of rail noise, consideration of feasible and reasonable noise mitigation measures should extend, but not necessarily be limited, to:

   - the use of best practice rolling stock, including only locomotives that have received an 'approval to operate on the NSW rail network' in accordance with the noise limits L6.1 to L6.4 in RailCorp (L12208.pdf, 309KB) and Australian Rail Track Corporation Ltd (L3142.pdf, 259KB) Environment Protection Licences or a Pollution Control Approval issued pursuant to the former *Pollution Control Act 1970*
   - scheduling - limit movements during more sensitive times, to the extent practicable
   - using noise barriers and acoustic treatments.

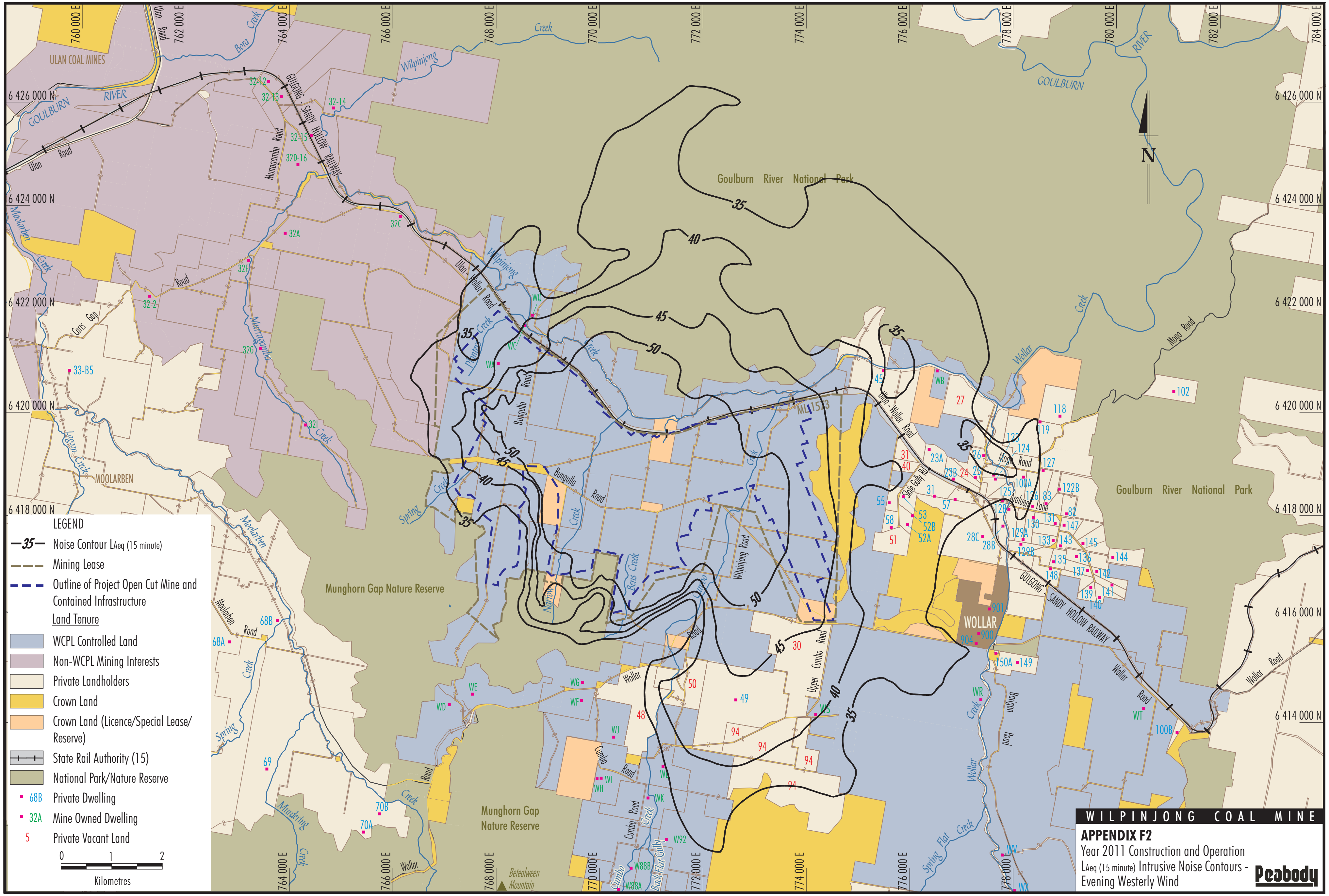
Page last updated: 03 March 2010

Year 2011 Construction and Operation $L_{Aeq(15minute)}$ Intrusive Noise Contours - Night-Time Inversion



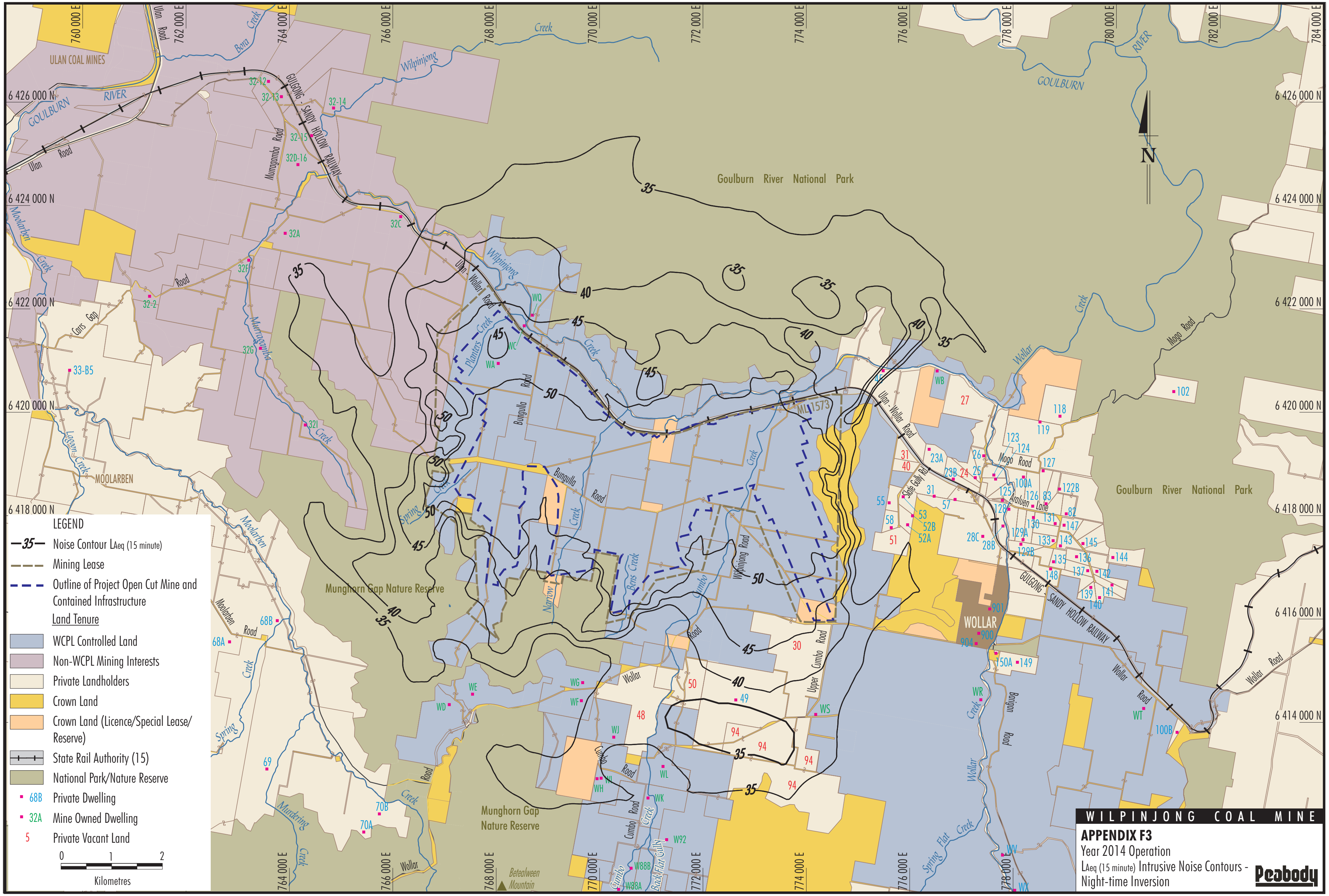
WIL-09-07 App Noise_007D

Year 2011 Construction and Operation $L_{Aeq(15minute)}$ Intrusive Noise Contours - Evening Westerly Wind



WIL-09-07 App Noise_008B

Year 2014 Operation $L_{Aeq(15minute)}$ Intrusive Noise Contours
- Night-Time Inversion



WIL-09-07 App Noise_009C

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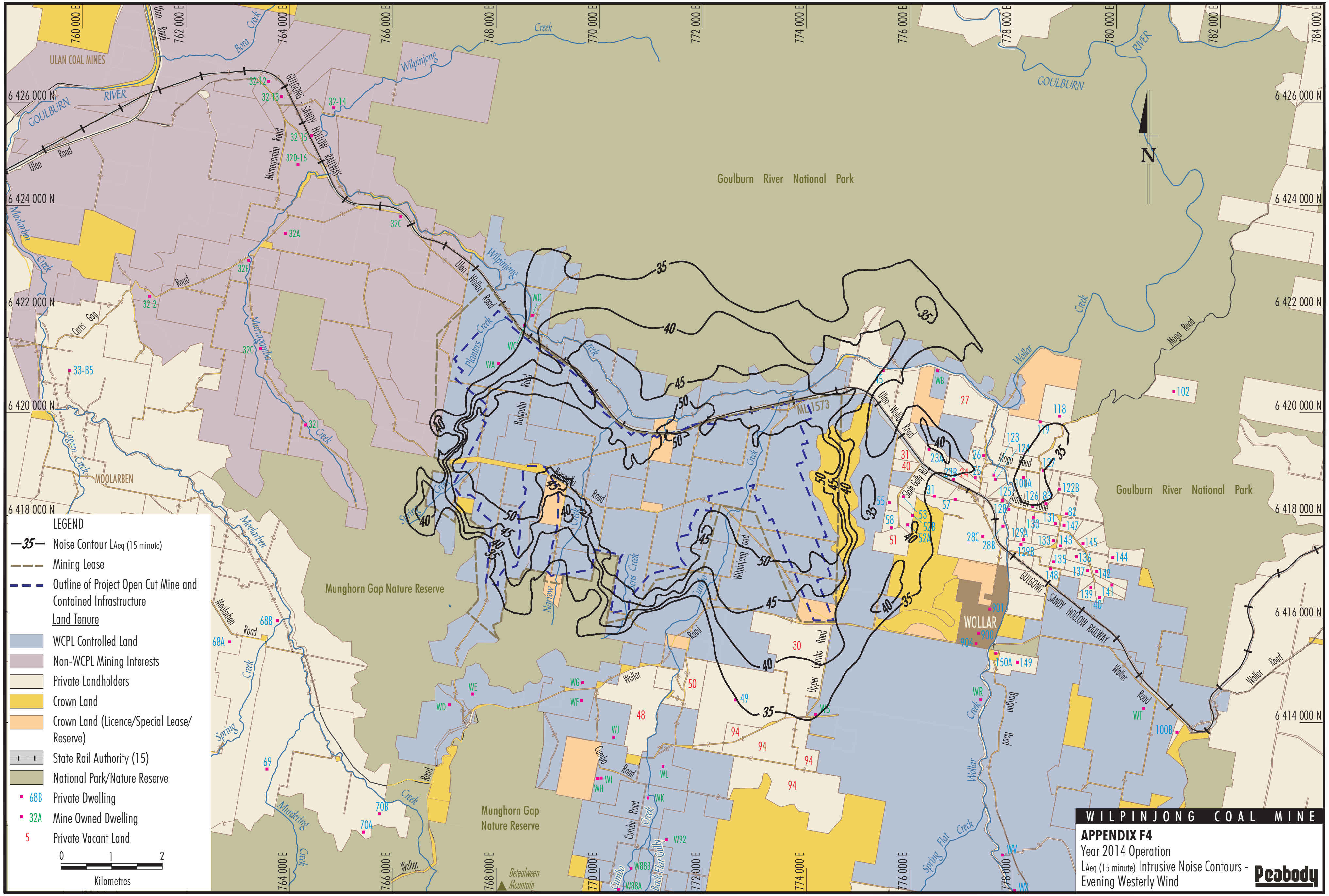

WIL-09-07 App Noise_011B

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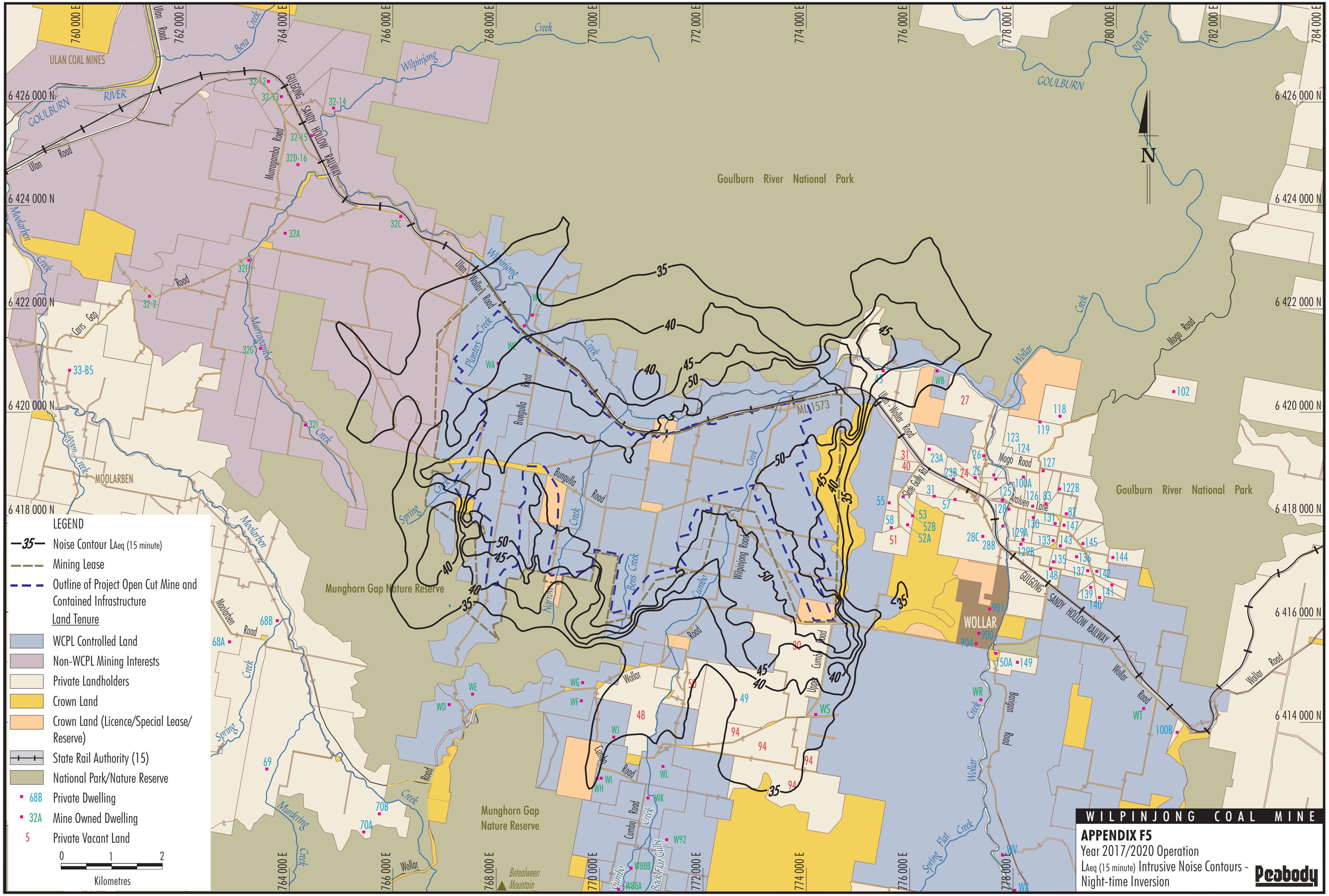
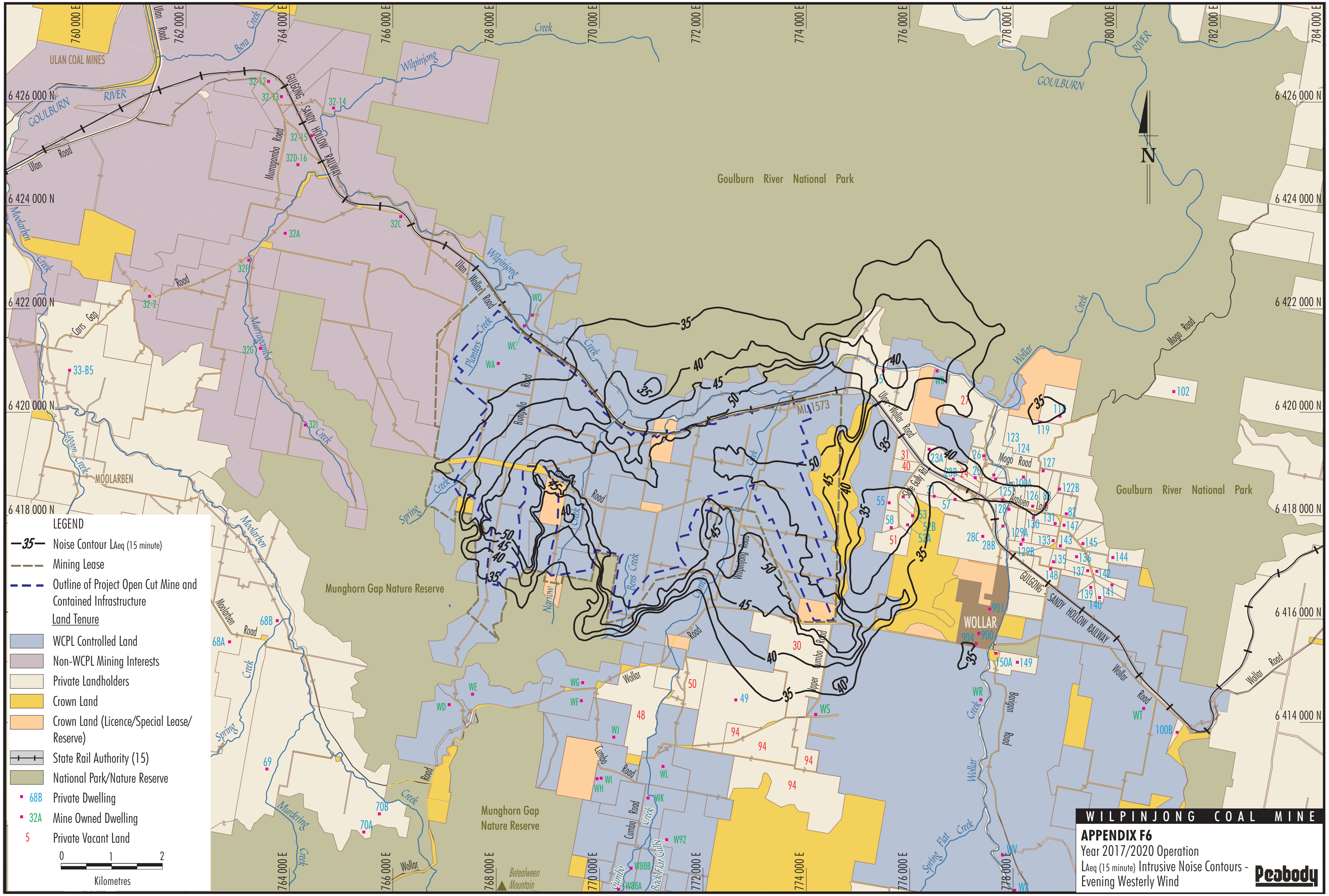
- Night-Time Inversion



WIL-09-07 App Noise_010C

Year 2017/2020 Operation $L_{Aeq(15minute)}$ Intrusive Noise Contours
- Evening Westerly Wind



WIL-09-07 App Noise_012B

Appendix B




Air Quality Impact Assessment

AIR QUALITY IMPACT ASSESSMENT

WILPINJONG COAL MINE MODIFICATION

Wilpinjong Coal Pty Ltd

Job No: 3717

17 May 2010

A PEL Company

PROJECT TITLE:	**WILPINJONG COAL MINE MODIFICATION**
JOB NUMBER:	**3717**
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	WILPINJONG COAL PTY LTD
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1 INTRODUCTION

This report has been prepared by PAEHolmes for Wilpinjong Coal Pty Ltd (WPCL). The report assesses the likely air quality impacts of a proposed Modification of the approved Wilpinjong Coal Mine (hereafter referred to as the Project) located in central New South Wales (NSW).

The Project is an open cut coal mine that is approved to operate over a period of approximately 21 years and includes open cut mining, processing facilities, rail loading and coal stockpiling areas, waste rock emplacement areas and associated infrastructure.

The potential impacts of the approved Project were assessed by Holmes Air Sciences (**2005**) as a component of the original Environmental Impact Statement (**WCPL, 2005**). The 2005 Holmes Air Sciences assessment predicted compliance with relevant air quality criteria at all nearby private receptors except the nearest private residence to the north of Pit 6 (now mine owned).

The Modification of the Project would involve an incremental increase in the approved maximum ROM coal mining rate from 13 million tonnes per annum (Mtpa) to 15 Mtpa and a small increase in the maximum annual rate of overburden mined. No change is proposed to the approved life of the Project or the approved extent of open cut mining.

While the location of the approved mining operation would not be altered and the proposed incremental changes to production rates associated with the Modification would not significantly alter the overall emissions of the approved Project, the mining sequence and the location of mining operations in the peak year of mining operations would be further to the east than anticipated in the original proposal. Re-modelling of the potential air quality emissions was therefore considered prudent for the maximum production year (2014 or Year 9).

The assessment is based on the use of a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the mine. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality criteria.

The assessment follows the procedures outlined by the NSW Department of Environment and Climate Change and Water (DECCW) in their document titled "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (**NSW DEC, 2005**) (hereafter referred to as the "Approved Methods"). The Approved Methods specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data, emissions data and relevant air quality criteria.

In summary, the report provides information on the following:

- the way in which mining is to be undertaken with a focus on describing those aspects that will affect air quality;
- air quality criteria that need to be met to protect the air quality environment;
- meteorological and climatic conditions in the area;
- a discussion as to the likely existing air quality conditions in the area;
- the methods used to estimate dust emissions and the way in which dust emissions from the proposal would disperse and fallout;

- the expected dispersion and dust fallout patterns due to emissions from the Project incorporating the proposed Modification and a comparison between the predicted dust concentration and fallout levels and the relevant air quality criteria;
- control methods which can be used to reduce dust impacts; and
- the estimated emissions of greenhouse gases from the Project (incorporating the incremental changes associated with the proposed Modification).

2 LOCAL SETTING AND PROJECT DESCRIPTION

The Project is located approximately 40 kilometres (km) to the northeast of Mudgee and approximately 11 km to the south-east of Ulan in central NSW.

Figure 2.1 shows the Project location including the mining lease (ML 1573) boundary, mine facilities and the nearest sensitive receptors. Air quality impacts have been assessed at these locations and will be discussed in subsequent sections.

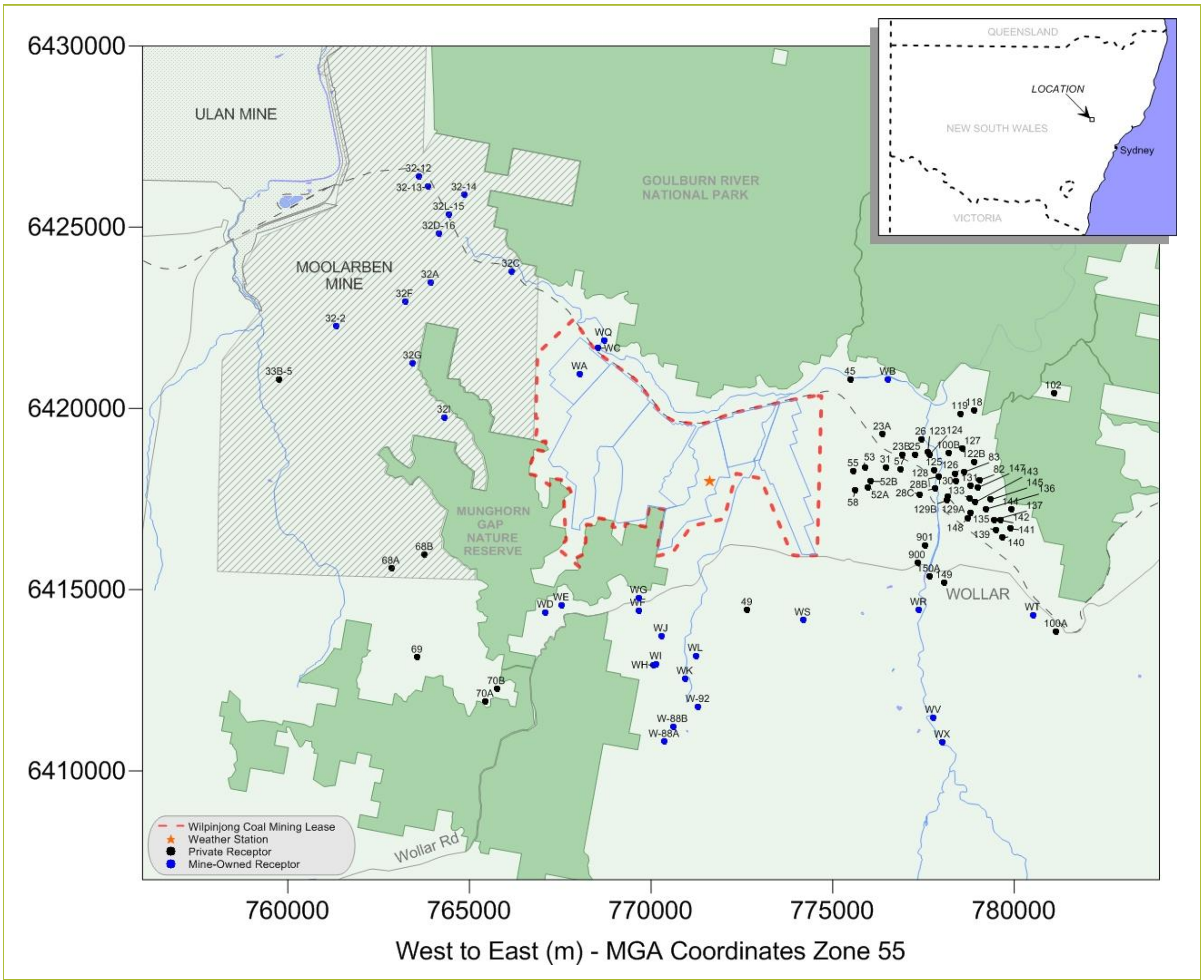


Figure 2.1: Location of Study Area

Figure 2.2 shows the topography of the area. It can be seen from **Figure 2.2** that the Project is located within a valley running generally west to east. A ridge of high ground, running north-south crosses the valley at the edge of the eastern-most approved open cut (Pit 3). Landforms are characterised by the narrow flood plains associated with the tributaries of the Goulburn River, undulating foothills, ridges and escarpments of the Great Dividing Range and the dissected landforms of the Goulburn River National Park.

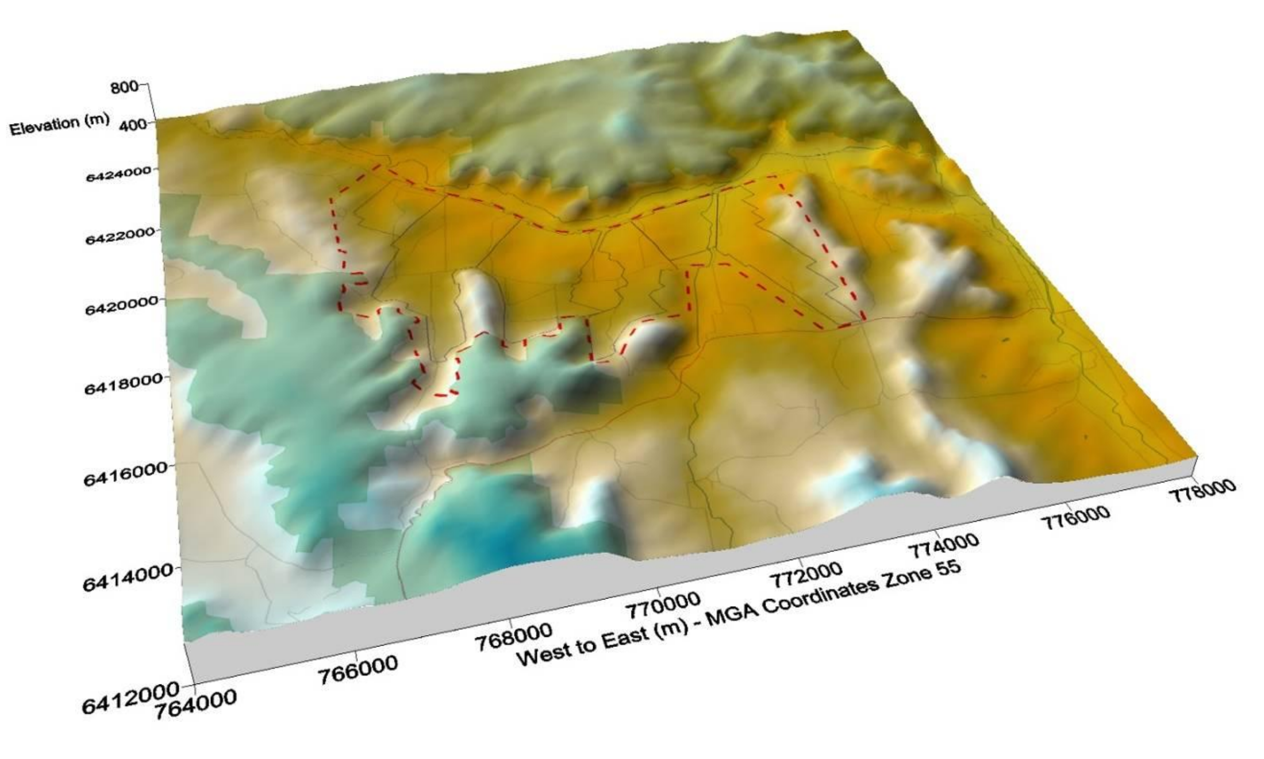


Figure 2.2: Pseudo 3-Dimensional Topographical Representation of the Study Area

Land use in the vicinity of the Project consists of a combination of coal mining operations, agricultural land uses (primarily grazing), national park/nature reserve (Goulburn River National Park and Munghorn Gap Nature Reserve) and the rural residential developments of Wollar and Ulan. The Project is situated in the vicinity of the Ulan Coal Mines and Moolarben Coal Mines that are located to the west and north-west of the Project. These operations are considered in the modelling of cumulative sources. Since the original assessment of the Project in 2005, the Moolarben and Ulan Coal Mines have purchased all of the private properties previously located in the west and north-west between Wilpinjong and the Ulan Coal Mines.

3 AIR QUALITY CRITERIA

The Project incorporating the proposed Modification will result in emissions of dust and particulate matter from the surface mining activities and associated coal handing and processing.

Emissions of carbon monoxide (CO), nitrogen dioxide (NO_2), and sulphur dioxide (SO_2) will occur from diesel-powered equipment used on-site; however these emissions are typically minor and too widely dispersed to give rise to significant off-site concentrations.

3.1 Particulate matter

Emissions of particulate matter are considered in three separate size fractions. These are described as total suspended particulate matter (TSP), particulate matter with an equivalent aerodynamic diameter of 10 μm or less (PM_{10}) and particles with an equivalent aerodynamic diameter of 2.5 μm and less ($PM_{2.5}$).

Particulate matter has the capacity to affect health and to cause nuisance effects. The extent to which health or nuisance effects occur, relates to the size and/or chemical composition of the particulate matter.

This section provides information on the air quality criteria used to assess the impact of emissions. The assessment criteria provide benchmarks, which if met, are intended to protect the community against the adverse effects of air pollutants. These criteria are generally considered to reflect current Australian community standards for the protection of health and protection against nuisance effects. To assist in interpreting the significance of predicted concentration and deposition levels some background discussion on the potential harmful effects is provided below.

The human respiratory system has in-built defensive systems that prevent particles larger than approximately 10 μm from reaching the more sensitive parts of the respiratory system. Particles with aerodynamic diameters less than 10 μm are referred to as PM_{10}. Particles larger than 10 μm, while not able to affect health, can soil materials and generally degrade aesthetic elements of the environment. For this reason air quality goals make reference to measures of the total mass of all particles suspended in the air. This is referred to as TSP. In practice, particles larger than 30 to 50 μm settle out of the atmosphere too quickly to be regarded as air pollutants. The upper size range for TSP is usually taken to be 30 μm and includes PM_{10} as a subset.

The health-based assessment criteria used by DECCW have, to a large extent, been developed by reference to epidemiological studies undertaken in urban areas with large populations where the primary pollutants are the products of combustion. This means that, in contrast to dust of crustal[1] origin, the particulate matter would be composed of smaller particles and would generally contain acidic and carcinogenic substances that are associated with combustion.

Table 3.1 summarises the air quality criteria that are relevant to this study. The air quality criteria relate to the total dust burden in the air and not just the dust from the project.

Table 3.1: Air quality standards/criteria for particulate matter concentrations

Pollutant	Standard	Averaging Period	Source
TSP	90 $\mu g/m^3$	Annual mean	NHMRC
PM_{10}	50 $\mu g/m^3$	24-hour maximum	DEC (**2005**) (assessment criteria)
	30 $\mu g/m^3$	Annual mean	DEC (**2005**) (assessment criteria)
	50 $\mu g/m^3$	24-hour average	NEPM (allows five exceedances per year for bushfires and dust storms)

[1] The term crustal dust is used to refer to dust generated from materials that constitute the earth's crust.

3.2 Dust deposition

In addition to health impacts, airborne dust also has the potential to cause nuisance effects by depositing on surfaces. **Table 3.2** shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust fallout levels are set to protect against nuisance impacts (**NSW DEC, 2005**).

Table 3.2: DECCW criteria for dust (insoluble solids) fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month*	4 g/m^2/month

* grams per square metre per month

4 EXISTING ENVIRONMENT

This section describes the dispersion meteorology, local climatic conditions and existing air quality in the area. The existing air quality conditions will be influenced to some degree by the existing operations of the Project.

4.1 Dispersion Meteorology

The Gaussian dispersion model used for this assessment requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class[2] and mixing height[3].

The DECCW have listed requirements for meteorological data that are used for air dispersion modelling in the Approved Methods. The requirements are as follows:

- Data must span at least one year;
- Data must be at least 90% complete; and
- Data must be representative of the area in which emissions are modelled.

A meteorological station was installed on the Project site in May 2004 and continues to collect meteorological data.

Figure 2.1 shows the location of this site. The weather station collects hourly and 15-minute records of temperature, wind speed, wind direction and sigma-theta (a measure of the fluctuation of the horizontal wind direction). The data have been processed into a form suitable for the use in the ISCMOD dispersion model.

[2] In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

[3] The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

Data between June 2004 and December 2009 were available for this assessment. **Figure 4.1** and **Figure 4.2** present the annual and seasonal windroses created from the available meteorological data for 2005 to 2009. All years show the same general patterns of winds. On an annual basis winds are predominantly from the eastern and western directions. This pattern of winds is evident in most seasons to various degrees, however westerlies are less apparent in summer and autumn and easterlies are less apparent in winter. Spring shows very similar wind patterns to those in the annual windrose. Between 2005 and 2008 the annual percentage of calms (that is, winds less than or equal to 0.5 metres per second [m/s]) is similar and ranges from 10.7 to 15.5 percent (%) annually. However, the calms in the 2009 data differ substantially to those in previous years with the annual percentage of calms being 25.7% (it is understood that there was a fault with the station in 2009 that required the replacement of the anemometer).

The dataset collected during 2009 is less than 90% complete and therefore does not satisfy the DECCW's requirement of 90% data recovery in the year. Meteorological data from 2008 was selected for use in this assessment as it was determined to be the most recent and representative year of data.

The 2008 data contains 35,137 15-minute records which satisfy the DECCW's requirement of 90% data recovery in the year. Calm periods occur 11.7% of the time and the mean wind speed for 2008 data is 2.5 m/s.

To assess dispersion, it is necessary to have data available on atmospheric stability. Stability class was calculated for each hour of the meteorological data using sigma-theta according to the method recommended by the United States Environmental Protection Agency (US EPA) (**US EPA, 1985**).

Table 4.1 shows the frequency of occurrence of the stability categories expected in the area.

Table 4.1: Frequency of occurrence of stability classes in the study area

Stability Class	Wilpinjong meteorological station data 2008
A	10.8
B	5.9
C	13.8
D	34.1
E	11.1
F	24.4
Total	100.1*

* N.B: Minor discrepancy in the total due to rounding

The most common stability class in the area was determined to be neutral D class stability with 34.1% which would suggest that the dispersion conditions would be such that dust emissions would disperse rapidly for a significant proportion of the time.

Joint wind speed, wind direction and stability class frequency tables for the repeater weather station data are provided in **Appendix A**.

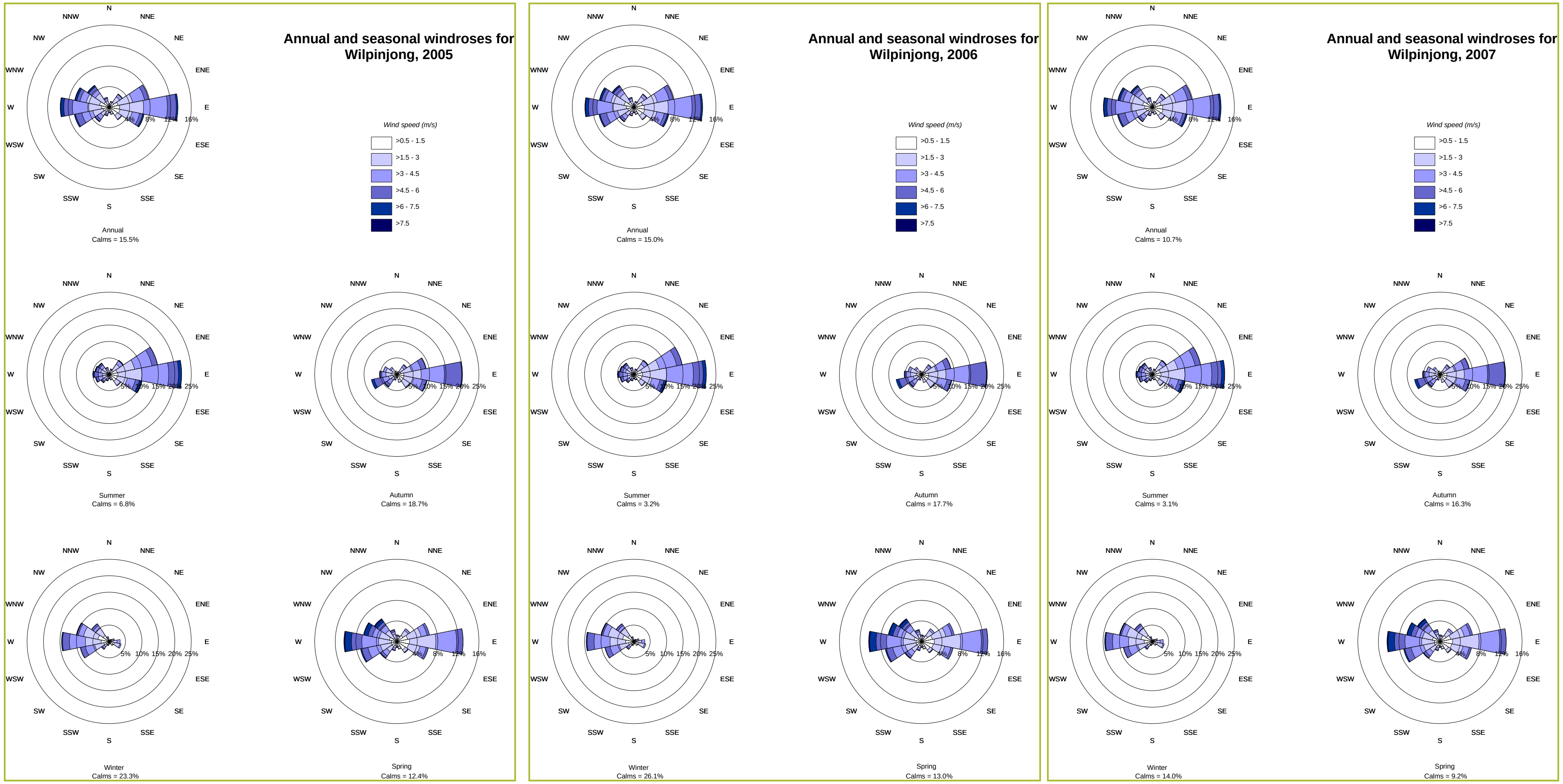


Figure 4.1: Annual and Seasonal Windroses for Wilpinjong (2005-2007)

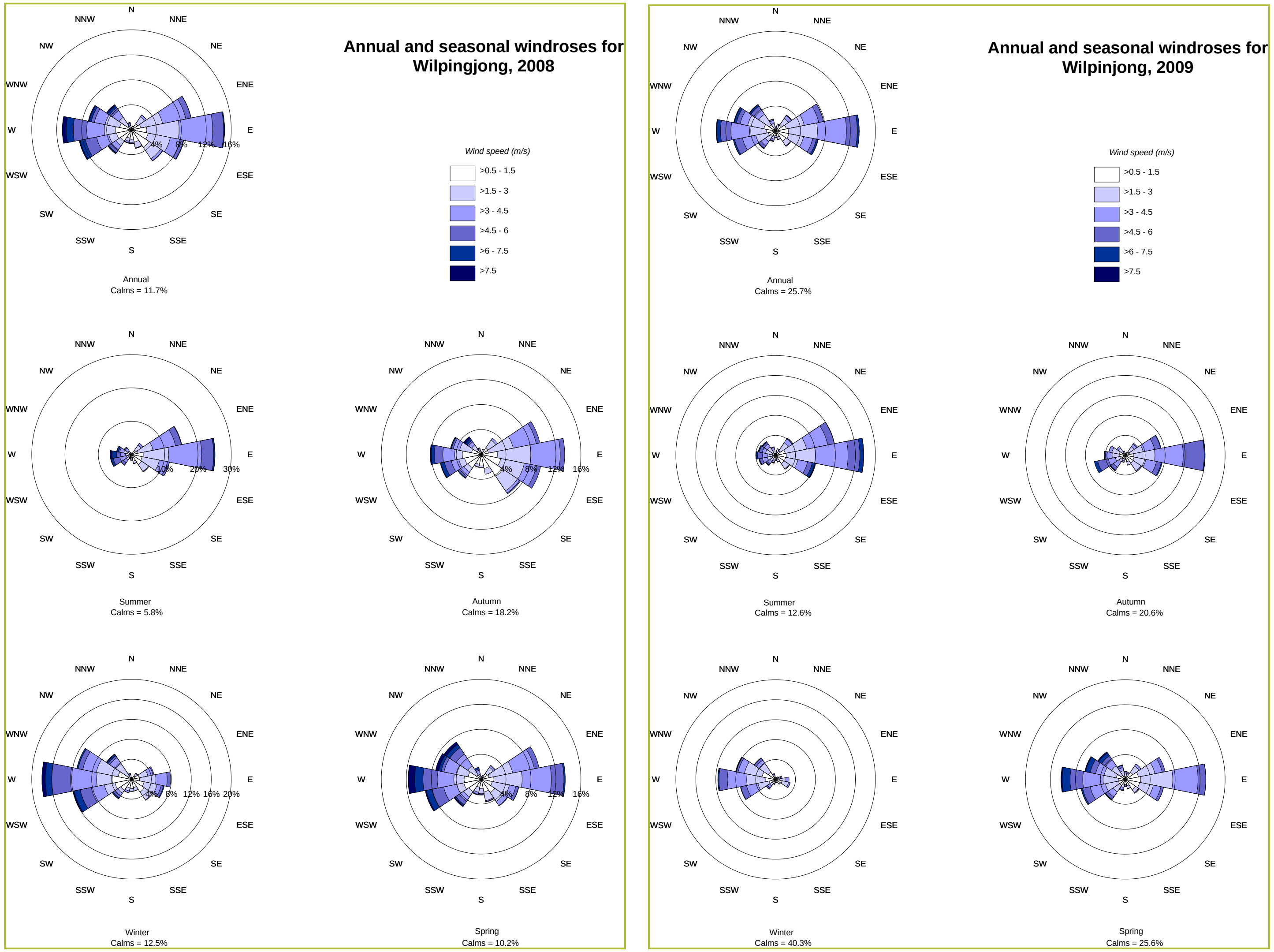


Figure 4.2: Annual and Seasonal Windroses for Wilpinjong (2008 and 2009)

4.2 Local Climatic Conditions

The Bureau of Meteorology (BOM) collects climatic information in the vicinity of the study area. A range of climatic information collected from Gulgong Post Office (located approximately 30 km from the Project) are presented in **Table 4.2** (**BOM, 2010**). Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

The annual average maximum and minimum temperatures experienced at Gulgong are 23°C and 9.6°C respectively. On average January is the hottest month with an average maximum temperature of 31°C. July is the coldest month, with average minimum temperature of 2.6°C.

The annual average relative humidity reading collected at 9 am from the Gulgong site is 71% and at 3 pm the annual average is 44%. The months with the highest relative humidity on average are June and July with 9 am averages of 84%. The month with the lowest relative humidity is December with a 3 pm average of 36%.

Table 4.2: **Climate Information for Gulgong Post Office**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9 am Mean Dry-bulb and Wet-bulb Temperatures (ºC)[1] and Relative Humidity (%)													
Dry-bulb	21.7	20.6	18.9	15.8	11.3	7.7	6.7	8.5	12.6	16.5	18.3	20.7	14.9
Humidity	64	70	71	70	79	84	84	76	69	61	63	62	71
3 pm Mean Dry-bulb and Wet-bulb Temperatures (ºC)[1] and Relative Humidity (%)													
Dry-bulb	29.4	28.4	26.2	22.3	18.0	14.3	13.5	15.4	18.5	22.1	25.1	28.1	21.8
Humidity	37	41	41	42	49	57	54	46	44	40	39	36	44
Mean Maximum Temperature (ºC)[1]													
Mean	31.0	29.8	27.4	23.4	19.1	15.4	14.7	16.4	19.6	23.5	26.6	29.7	23.0
Mean Minimum Temperature (ºC)[1]													
Mean	16.6	16.3	13.6	9.8	6.4	3.6	2.6	3.4	6.1	9.3	12.2	14.9	9.6
Rainfall (mm)[2]													
Mean	70.2	61.7	54.1	44.4	45.1	51.1	49.0	46.3	46.1	56.4	59.1	65.2	648.4
Raindays (Number)													
Mean	5.1	4.7	4.5	3.9	4.8	6.0	6.1	5.7	5.3	5.6	5.4	5.4	62.5

Source: ***BOM (2010)***

[1] ºC = degrees Celcius

[2] mm = millimetres

Climate averages for Station: 062013; Commenced: 1881, Last record: 2009; Latitude (deg S): -32.3634; Longitude (deg E): 149.5329.

Rainfall data collected at Gulgong shows that January is the wettest month with an average rainfall of 70.2 mm over 5 days. The average annual rainfall is 648.6 mm with an average of 62.5 raindays.

4.3 Existing Air Quality

4.3.1 Introduction

Air quality standards and criteria refer to pollutant levels that include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals (see **Section 3**) it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the Project is likely to contribute to these levels. It is important to note that the existing air quality conditions (that is, background conditions) will be influenced by the existing mining operations.

A monitoring program has been established in the area as part of the Project which includes the measurement of dust deposition and dust concentration (as PM_{10} and TSP). Monitoring commenced in 2004. The locations of the current monitoring sites are shown on **Figure 4.3**.

There are four high volume air samplers (HVAS) measuring PM_{10} and TSP. There is also one Tapered Element Oscillating Microbalance (TEOM) measuring PM_{10} and thirteen dust deposition gauges (DDG).

The following sections provide an analysis and summary of the dust monitoring data. Complete data is also shown in **Appendix B**.

4.3.2 PM_{10} Concentrations

Figure 4.3 shows the locations of the four HVAS used to monitor PM_{10} concentrations. All HVAS are located within approximately 3 km of the mining site with the closest being HV2 located within the mining lease boundary. Measurements of PM_{10} concentrations commenced in the area in 2005. The Project area is predominantly grassland although the surrounding hills are well vegetated. Non-mining sources of particulate matter in the area would include traffic on unsealed roads, local building and construction activities, animal grazing activity and to a lesser extent traffic from the other local roads.

The HVAS record 24-hour average concentrations and these results are presented on **Figure 4.4**. The results show an exceedance of the PM_{10} 24-hour criterion at HV2 in December 2006 with a value of 59.2 micrograms per cubic metre (µg/m^3). As the other HVAS monitors also recorded high PM_{10} values around this time, these values may be the result of a regional weather event such as the bushfires in Queensland or Victoria at the time. There were another four exceedances of the PM_{10} 24-hour criteria in November and December 2009. HV2 recorded another exceedance of the criteria in November 2009 but as the other HVAS monitors also recorded high PM_{10} values on this day, it is likely that these values are again the result of a regional dust event. HV1, 2 and 4 also recorded exceedances of the criteria on the same day in December 2009 which also suggests a regional event occurring on this day.

A summary of the HVAS PM_{10} data are also shown below in **Table 4.3**. The results show that all sites recorded an annual PM_{10} level below the DECCW criterion of 30 µg/m^3. The average PM_{10} concentration across all HVAS monitoring sites is 14.9 µg/m^3.

Table 4.3: Annual average PM_{10} concentration at each HVAS monitoring site (µg/m^3)

HVAS Site	2006	2007	2008	2009	Average
HV1 – HVAS Wollar Village	15.1	14.2	11.8	14.4	13.9
HV2[1] – HVAS West	21.9	16.0	12.0	16.8	16.7
HV3[2] – HVAS East	16.8	-	-	-	16.8
HV4 – HVAS South	18.5	13.1	10.7	12.9	13.8
Average of all data					**14.9**

[1] This site is within the Project Mining Lease
[2] HV3 used for TSP measurement from January 2007 onwards.

24-hour PM_{10} concentrations are also measured using a TEOM located approximately 1.5 km east of the Project (see **Figure 2.1**). Data from this station are available between November 2008 and December 2009.

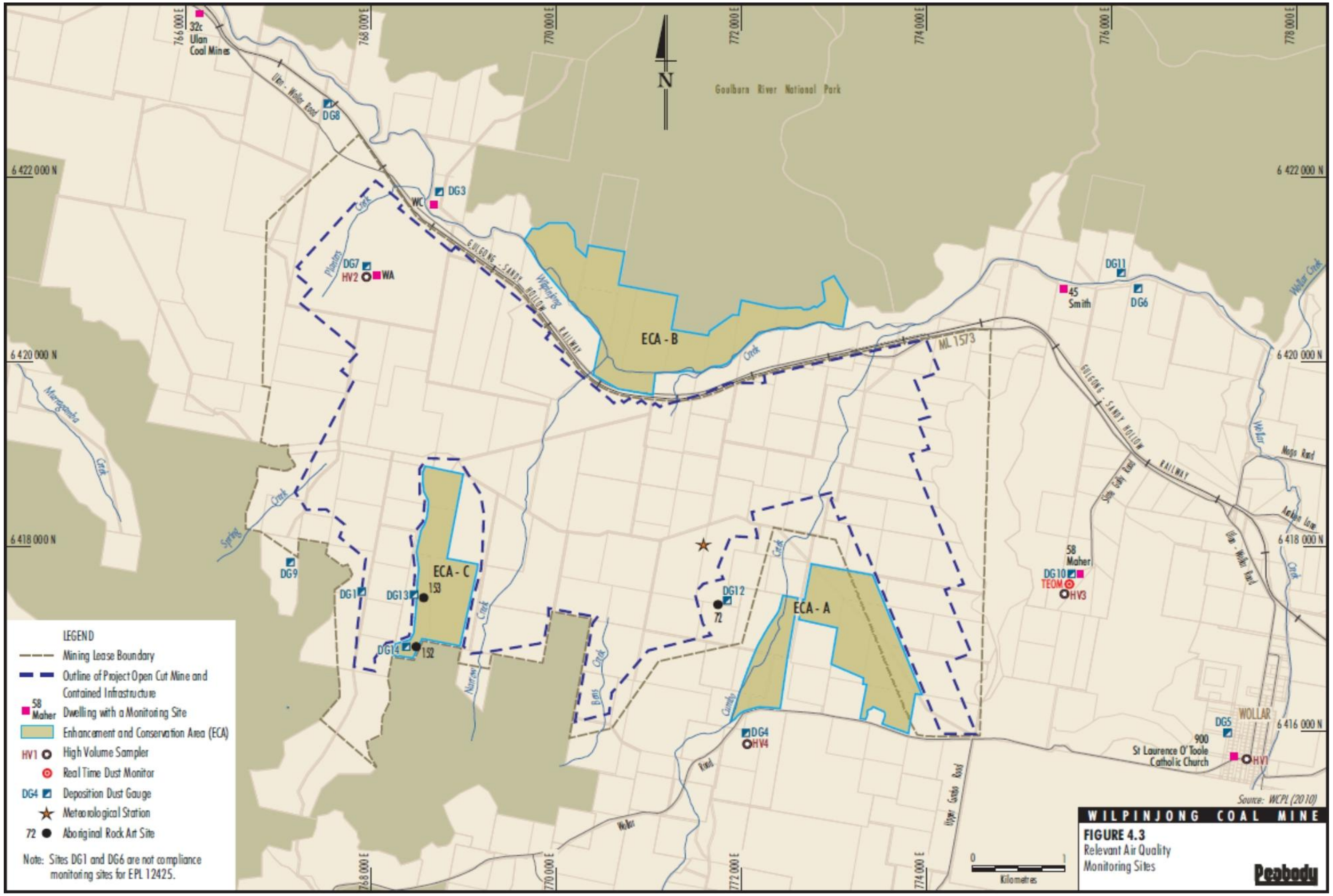


Figure 4.3: Monitoring Locations

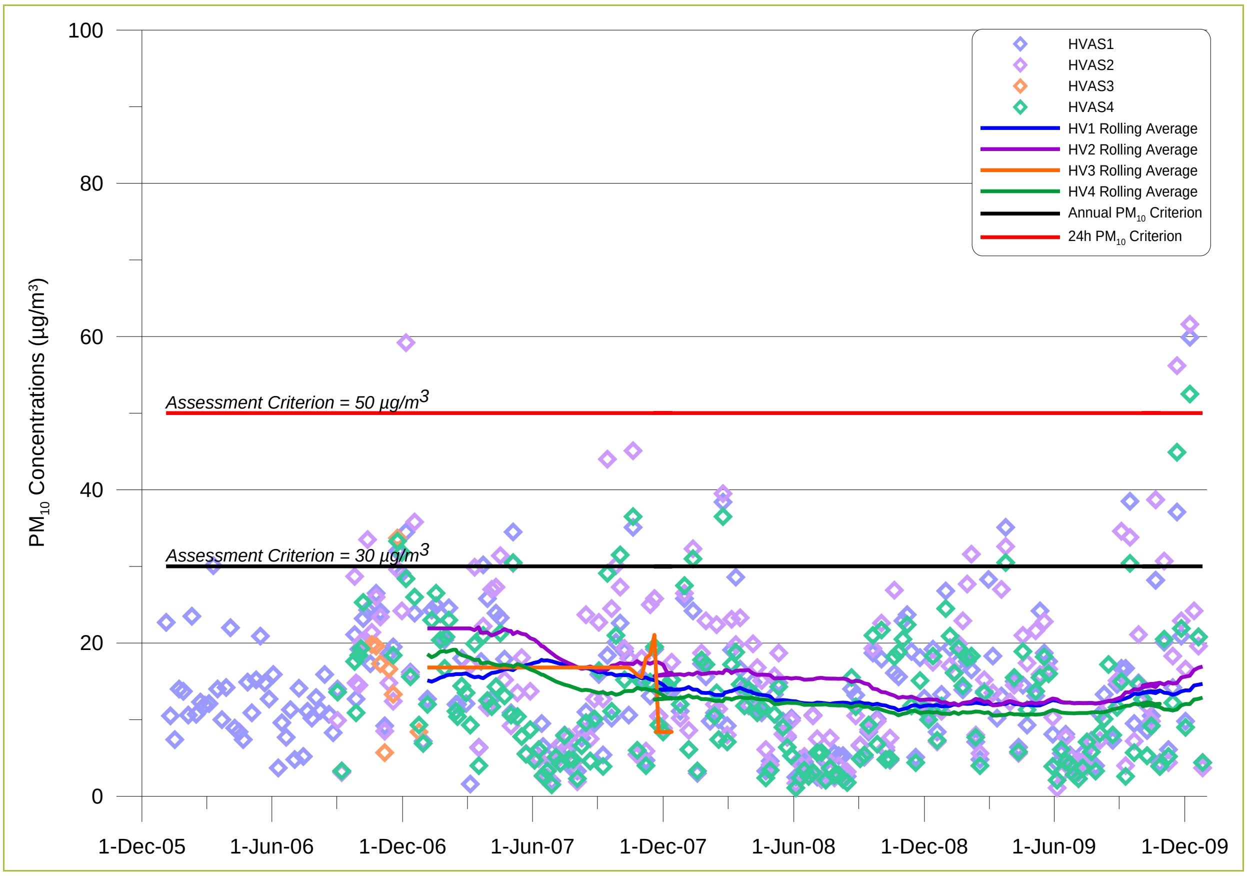


Figure 4.4: HVAS PM_{10} Concentrations

Figure 4.5 presents the 24-hour average PM_{10} concentrations from the TEOM monitoring site for this period. The results show that the majority of the data are below the DECCW 24-hour PM_{10} criterion of 50 µg/m^3. There are however some exceedances of the criterion. These exceedances are most likely caused by regional weather events such as bushfires and dust storms. In particular, the unusually high values recorded on the 23rd and 24th of September 2009 were caused by the widespread dust storms in NSW at this time.

The annual average PM_{10} concentration at the TEOM site is 15.1 µg/m^3 which is below the DECCW's assessment criterion of 30 µg/m^3 and correlates well with the HVAS averages.

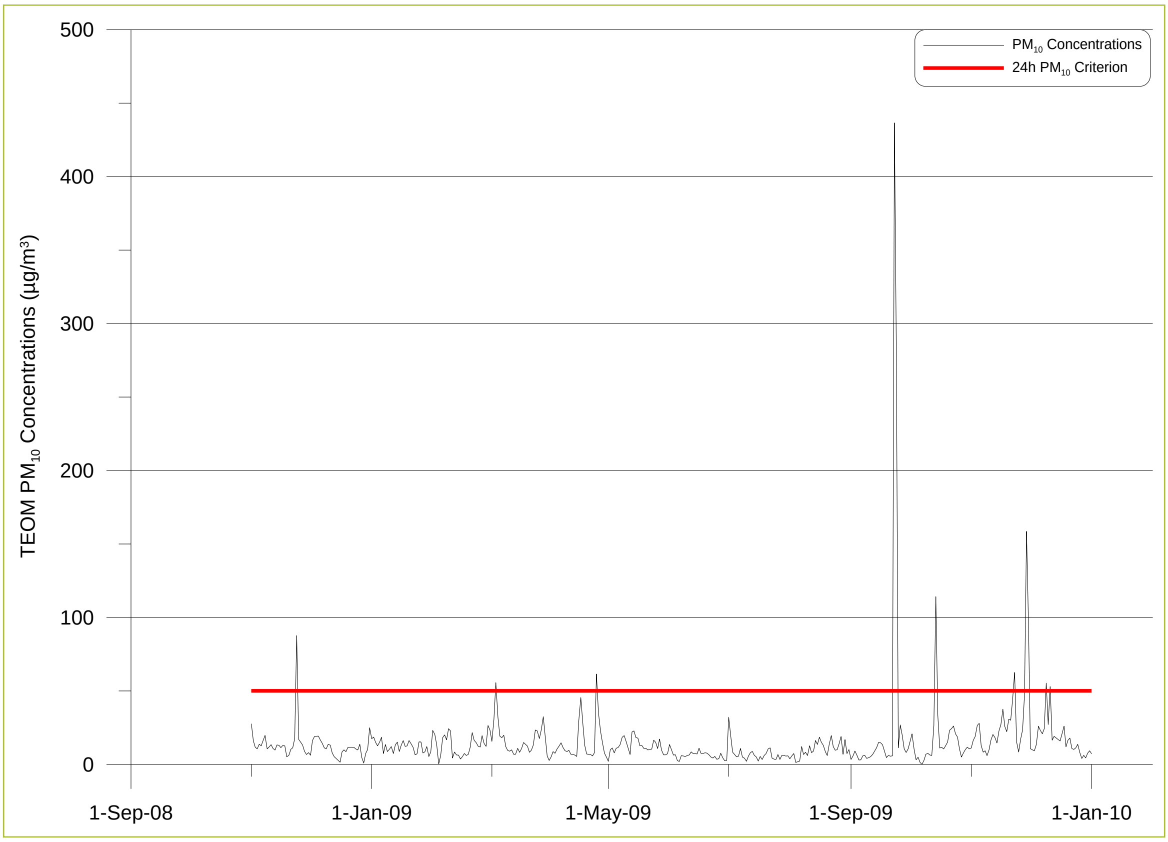


Figure 4.5: TEOM PM_{10} Concentrations

4.3.3 TSP Concentrations

TSP data is available from HV3 between January 2007 and November 2009 (see **Figure 4.3**).

Figure 4.6 presents the TSP concentrations measured at HV3. Results show that all TSP concentrations are well below the DECCW criterion of 90 µg/m^3.

Table 4.4 presents a summary of the TSP concentrations measured at HV3. As shown on **Figure 4.6** all TSP concentrations are well below the assessment criteria. The average of the data over all years is 21.1 µg/m^3.

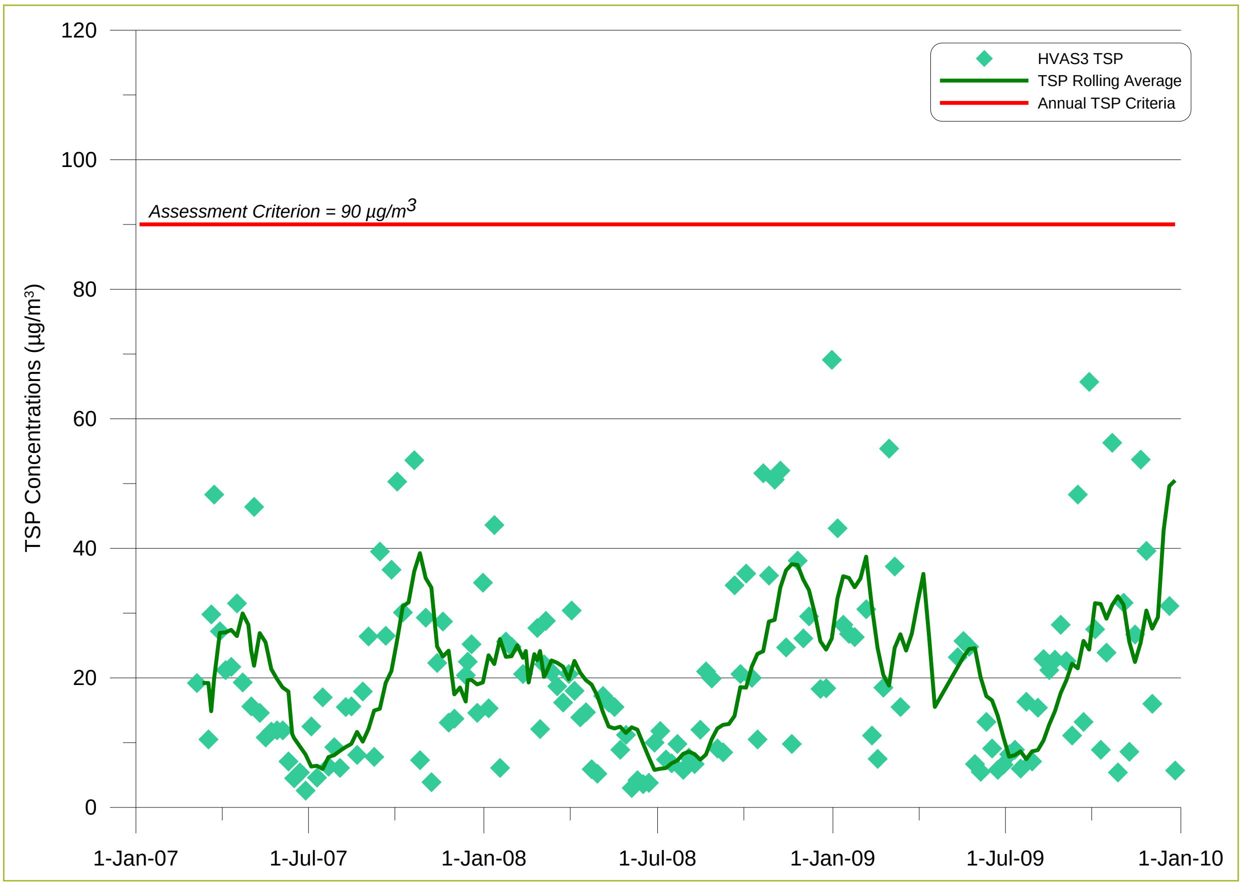


Figure 4.6: HV3 TSP Concentrations

Table 4.4: Annual average TSP concentration at HV3 (µg/m^3)

HVAS Site	2007	2008	2009	Average
HV3	19.8	19.6	23.8	**21.1**

4.3.4 Dust Deposition

Figure 4.3 shows the locations of the 13 dust deposition gauges analysed in this assessment. A number of these gauges are located within the Project mining lease, or on adjoining WCPL owned land. The monthly data are presented in **Appendix B**, and the annual averages summarised in **Table 4.5**. Data shown in **bold red** indicate levels above of the DECCW criteria of 4 µg/m^3.

Table 4.5: Dust deposition data (insoluble solids) – 2006 to 2009 ($g/m^2/month$)

Dust Deposition Gauge	2004[1*]	2005[*]	2006	2007	2008	2009	Average
DG1[2]-Wyangle	1.2	1.0	1.4	1.1	1.9	2.3	1.7
DG2/7-Mittaville Sth	1.6	1.2	1.0	1.1	2.0	1.8	1.5
DG3-Mittaville Nth	2.0	1.8	3.1	1.9	2.3	**4.7**	3.0
DG4-Castle View	0.6	0.9	1.1	1.1	2.8	2.3	1.8
DG5-Wollar	0.8	1.3	1.7	1.3	1.3	2.8	1.8
DG6[2]-Retreat	2.0	1.4	1.3	2.7	**4.3**	**6.7**	3.7
DG8-'Ulan Coal Mines-owned' dwelling	-	-	-	1.0	1.3	2.2	1.5
DG9-'Power' dwelling	-	-	1.9[3]	3.0	2.7	**4.5**	3.0
DG10-'Maher' dwelling	-	-	0.9[3]	1.0	3.6	2.9	2.1
DG11-'Smith' dwelling	-	-	1.1[3]	1.6	**9.2**	2.3	3.6
DG12-Aboriginal rock art site 72	-	-	1.7[3]	1.7	2.2	4.0	2.4
DG13-Aboriginal rock art site 153	-	-	0.9[3]	1.1	1.2	**4.7**	2.0
DG14-Aboriginal rock art site 152	-	-	1.2[3]	1.0	0.9	3.1	1.5
Average of all data							**2.3**

[*] These data were recorded before the operation of the mine and are therefore not included in the overall average.
[1] 2004 data available from June to December only.
[2] Not compliance monitoring sites for the Environmental Protection Licence 12425
[3] Less than 6 months of valid data available.

It is clear from the monitoring results presented in **Table 4.5** that there are some sites which exceed the 4 $g/m^2/month$ DECCW criterion.

DG3 recorded a value of 5.2 $g/m^2/month$ in 2009. This elevated level was predominantly due to unusually high levels of dust recorded in April, May and June 2009. April 2009 recorded a dust deposition level of 22.7 $g/m^2/month$. It is important to note that measurements at dust deposition gauges can be heavily influenced by regional weather events such as bushfires and dust storms as well as local dust producing activities. For example, on the 15th and 16th of April 2009 NSW experienced strong winds and raised dust over southern inland areas as well as the east coast in Sydney, Newcastle and the Hunter Valley (**BOM, 2010**). It is likely that these events produced elevated levels of dust during this month. Road construction works on Ulan-Wollar Road which was upgraded from an unsealed to a sealed road may also have contributed to elevated dust levels at this site in 2009. If the value of 22.7 $g/m^2/month$ value were to be removed from the analysis for 2009, the annual average dust deposition level would be 3.1 $g/m^2/month$ and would not exceed the assessment criteria.

Table 4.5 shows that DG6 exceeded the annual average dust deposition criteria in 2008 and 2009 with annual average dust levels of 4.3 $g/m^2/month$ and 6.7 $g/m^2/month$ respectively. DG6 is not a compliance monitoring site to be monitored as part of the WCPL Environmental Protection Licence (EPL 12425). **Figure 4.3** shows that DG6 is located to the northeast of the Project and in the general west south-west wind alignment. High levels of dust at this monitor in 2008 and 2009 may be due to mining operations occurring in the west south-west wind alignment predominantly in Pit 2 however, DG11 is located closer to the mine and in the same prevailing wind direction (see **Figure 4.3**). During 2009 DG11 recorded levels of 2.3 $g/m^2/month$ likely indicating that a localised source at DG6 was impacting at this location. Elevated levels of dust recorded in October and December 2008 and April and October 2009 may also be the result of dust storms in various parts of NSW (**BOM, 2010**).

DG9 recorded an annual average dust level of 4.5 g/m^2/month in 2009. The high annual average is due to high dust concentrations recorded in March (7.1 g/m^2/month), April (7.3 g/m^2/month) and May (8.0 g/m^2/month). The WCPL AEMR (**2010**) reported that it is likely that these high levels were associated with cattle grazing in the paddock the dust gauge is located in. The report stated that when the cattle were moved, the dust concentrations returned to levels below 4 g/m^2/month Dust storms in NSW in April and September are also likely to have caused elevated levels during 2009.

Table 4.5 shows that DG11 recorded an unusually high dust deposition value of 9.2 g/m^2/month in 2008. This was predominantly due to exceptionally high dust deposition levels in May, September and October 2008 with readings of 30.3, 19.3 and 15.4 g/m^2/month respectively. An investigation as part of the 2008 Annual Environmental Monitoring Report (AEMR) concluded that these high levels were likely to be a result of unusually high truck movements along unsealed sections of the Ulan-Wollar road during construction of a high voltage power line. The high September and October 2008 results are also likely to be the result of localised dust activity but may also be partially due to severe dust storms around NSW particularly in September. With these three high levels of dust removed from the analysis the annual average dust deposition level for DG11 in 2008 would be 3.9 g/m^2/month which would be within the assessment criteria.

DG13 is within the mining lease and recorded an average dust deposition concentration of 4.7 g/m2/month in 2009. It is likely that the high level is associated with regional dust storms during September, October, November and December. Prior to these regional meteorological events annual dust concentrations were around 2 g/m^2/month.

The data in **Table 4.5** shows that the averages for each site across all years are under the dust deposition assessment criteria of 4 g/m^2/month. The average across all sites is 2.3 g/m^2/month.

4.4 Complaints

The Project has been operating since 2006 and has maintained a complaints register since then. A summary of the complaints data, relating to air quality issues, is provided on **Figure 4.7** which shows the number of complaints relating to dust declining since 2006. During 2006, six of the seven complaints related to dust from unsealed sections of Ulan–Wollar Road. Since this time, the road has been upgraded to a sealed road to the west of the mine, including some road re-alignment. Based on the significant reductions in complaints received, these actions appear to have been effective. Complaints received in other years are infrequent (1-2 per annum) and non-specific.

Odour complaints have also been infrequent and limited to one to two per annum since operation of the site. Odour complaints seem to be related to either burning type odours or sulphur based odours and typically occur early in the morning. Possible causes include spontaneous combustion events and blasting, although based on complaints occurring in the early morning, blasting is unlikely to be the cause. Spontaneous combustion events are managed at the site as outlined in the Spontaneous Combustion Management Plan.

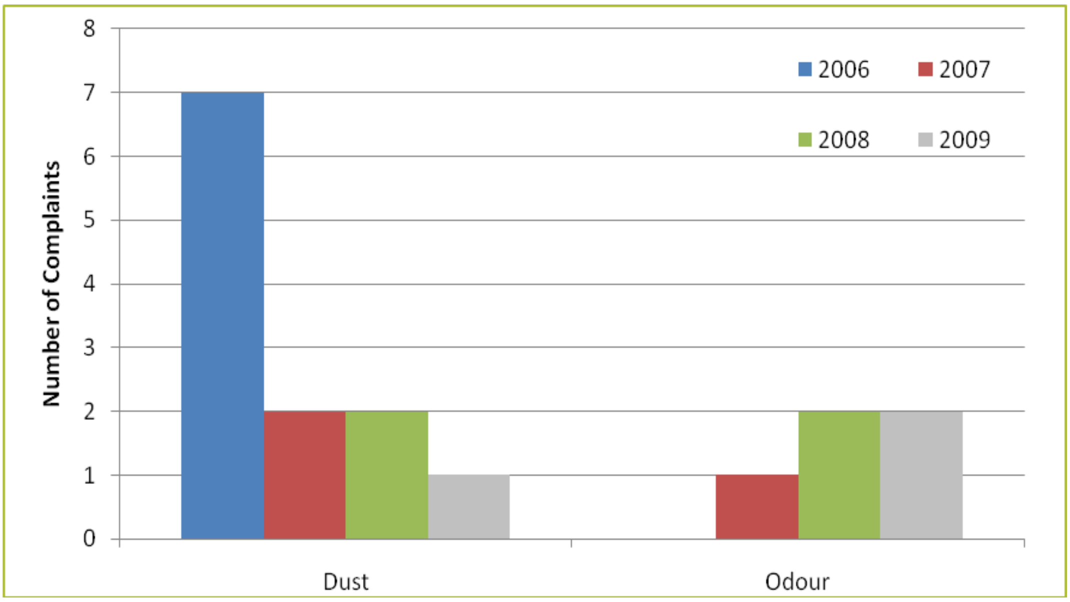


Figure 4.7: Summary of complaints – Air Quality

5 APPROACH TO ASSESSMENT

In August 2005, the (now) DECCW published the "Approved Methods" for the assessment of air pollution sources using dispersion models (**NSW DEC, 2005**). The Approved Methods specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data to be used in dispersion models, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal.

This section is provided so that technical reviewers can appreciate how the modelling of different particle size categories was carried out.

The model used was a modified version of the US EPA ISCST3 model (ISCMOD). ISCST3 is fully described in the user manual and the accompanying technical description (**US EPA, 1995**).

The ISCST3 model has a tendency to overestimate short-term (24-hour) PM_{10} concentrations. To overcome this difficulty it has been modified to create ISCMOD. ISCMOD is identical to ISC except that the horizontal plume spreading dispersion curves have been modified to adopt the recommendations of the American Meteorological Society's (AMS) expert panel on dispersion curves (**Hanna, 1977**) and the suggestions made by **Arya (1999)**. The suggested changes were recommended because, as the AMS panel notes, the original horizontal dispersion curves relate to an averaging time of three minutes and they recommend that these be adjusted to the one hour curves required by ISC. The change involves increasing the horizontal plume widths by a factor of 1.82 (60 minutes/3 minutes)$^{0.2}$. The modifications improve the performance of the model in predicting 24-hour concentrations and make almost no difference to the annual average predictions.

A similar adjustment has been applied to account for the local surface roughness being different at the sites compared with the site where the original curves were developed. The sites have been taken to have a surface roughness of 0.3 metres (m) compared with 0.03 m for the original curves. The adjustment leads to an increase in the horizontal and vertical curves by a factor of 1.6 (0.3 m/0.03 m)$^{0.2}$.

The modelling has been based on the use of three particle-size categories (0 to 2.5 micrometres (μm) - referred to as fine particle (FP), 2.5 to 10μm - referred to as coarse matter (CM) and 10 to 30μm - referred to as the Rest). Emission rates of TSP have been calculated using emission factors developed both within NSW and by the US EPA (see **Appendix C**).

The distribution of particles has been derived from measurements published by the NSW State Pollution Control Commission (SPCC) (**SPCC, 1986**). While these measurements were taken around coal mines in the Hunter Valley, NSW, in the absence of any other information, these values have been deemed appropriate. The distribution of particles in each particle size range is:

- $PM_{2.5}$ (FP) is 4.7% of the TSP;
- $PM_{2.5-10}$ (CM) is 34.4% of TSP; and
- PM_{10-30} (Rest) is 60.9% of TSP.

Modelling was done using three ISC source groups with each group corresponding to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have an aerodynamic diameter equal to 1 μm. The predicted concentration in the three plot output files for each group were then combined according to the weightings in the dot points above to determine the concentration of PM_{10} and TSP.

The ISC model also has the capacity to take into account dust emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions on mining operations where wind speed is an important factor in determining the rate at which dust is generated.

Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of activity and the wind speed. It is important to do this in the ISC model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds at a mine site would correspond with periods of low dust generation because wind erosion and other wind dependent emissions rates will be low. Light winds also correspond with periods of poor dispersion. If these measures are not taken into account, the model has the potential to significantly overstate impacts.

Operations were represented by a series of volume sources located according to the location of activities for the modelled scenarios (**Section 6.2**). These correspond to operations as they are envisaged to occur in Years 2011, and 2014.

Dust concentrations and deposition rates have been predicted in the vicinity of the Project for two key periods of the proposed modified mining operations (i.e. Year 6 or 2011 and Year 9 or 2014).

These periods were modelled specifically as 2011 would be the year when mining operations would be most highly concentrated in one area of the mine (i.e. Pit 5) and 2014 (Year 9) would be both the peak year of mining activities and when mining would be in Pit 3 and most proximal to the nearest private receivers in Slate Gully (to the east of the mine) that are aligned with the prevailing east-west wind directions (see **Figure 4.2**). The local terrain has been taken into consideration for the modelling.

The modelling has been performed using the meteorological data discussed in **Section 4.1** and the dust emission estimates from **Section 6**. As an example, an ISCMOD input file is provided in **Appendix D**.

All relevant activities have been modelled for 24 hours per day. **Appendix C** provides details of dust emissions and allocation of sources for each activity.

6 ESTIMATES OF EMISSIONS OF PARTICULATE MATTER

6.1 Introduction

This section discusses the calculation of the particulate emissions applied in the assessment. Emissions have been calculated for the following:

- the open-cut operations from the Project; and
- approved and key proposed operations at other mines in the area (including the Ulan and Moolarben Coal Project Stage 2).

6.2 Emissions from open cut mining operations for the Project

The operation of the mine has been analysed and estimates of dust emissions for the key dust generating activities have been made. Emission factors developed both locally and by the US EPA, have been applied to estimate the amount of dust produced by each activity. The emission factors applied are considered to be the most reliable or up-to-date methods for determining dust generation rates. The mining plans for the Project have been analysed and detailed emissions inventories have been prepared for two key scenarios.

- Year 6 (2011) when mining activities would be highly concentrated in Pit 5; and
- Year 9 (2014) the peak mining year and when mining activities would be in close proximity to Slate Gully private receptors who are aligned with the mining operations and the prevailing winds;

The detailed calculations are provided in **Appendix C**.

Appendix C provides information on the equations used, the basic assumptions about material properties (e.g. moisture content, silt content etc), information on the way in which equipment would be used to undertake different mining operations and the quantities of materials that would be handled in each operation.

Figure 6.1 and **Figure 6.2** show the general progression of mining and associated activities over the life of the Project together with numbered locations that represent dust sources assumed in the modelling. The activities that are associated with each of the numbered locations are identified in **Appendix C**.

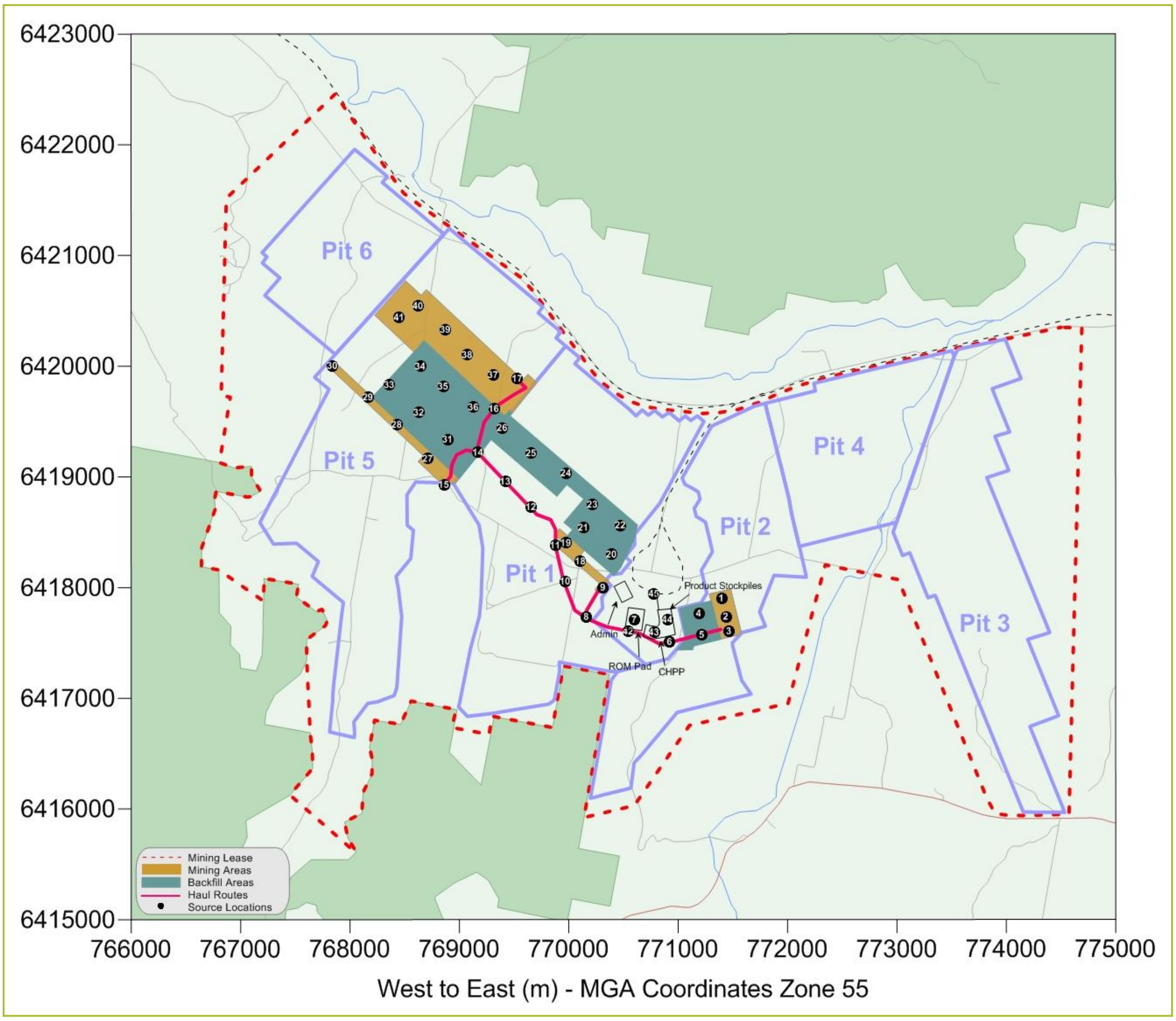


Figure 6.1: Modelling source locations - 2011

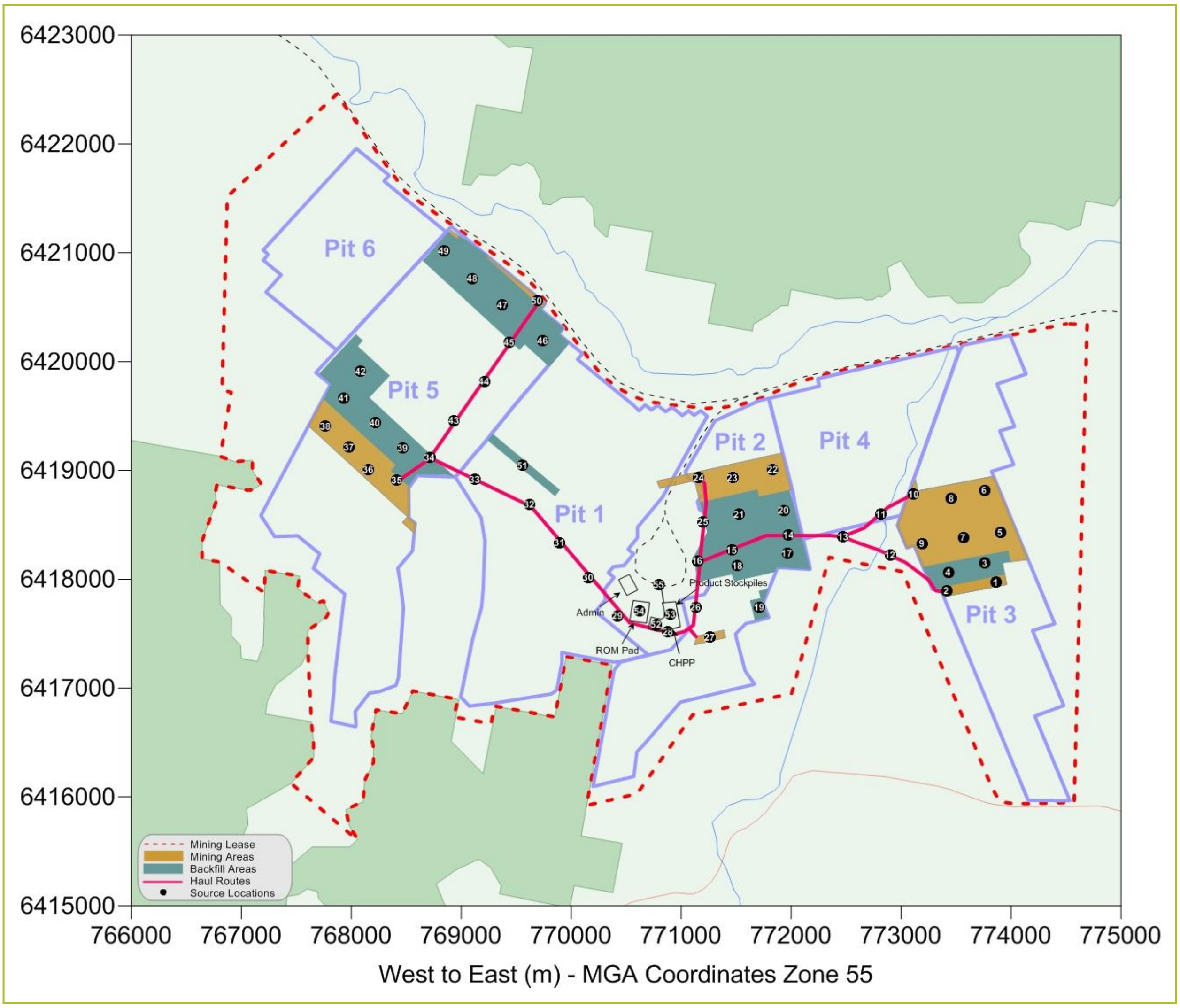


Figure 6.2: Modelling sources locations – 2014

Table 6.1 presents the emission estimates for each year modelled.

Table 6.1: Summary of estimated TSP emissions from the Project (kg/y)[1]

ACTIVITY	Year 6 (2011)	Year 9 (2014)
Topsoil Removal (Pit 1) - Scrapers ripping topsoil	210	-
Topsoil Removal (Pit 2) - Scrapers ripping topsoil	210	1,417
Topsoil Removal (Pit 3) - Scrapers ripping topsoil	-	6,612
Topsoil Removal (Pit 5) - Scrapers ripping topsoil	10,076	7,715
Topsoil Removal (Pit 1) - Dozer on topsoil	134	-
Topsoil Removal (Pit 2) - Dozer on topsoil	134	904
Topsoil Removal (Pit 3) - Dozer on topsoil	-	4,217
Topsoil Removal (Pit 5) - Dozer on topsoil	6,426	4,920
Topsoil Removal (Pit 1) - Grader on topsoil	20	-
Topsoil Removal (Pit 2) - Grader on topsoil	20	133
Topsoil Removal (Pit 3) - Grader on topsoil	-	620
Topsoil Removal (Pit 5) - Grader on topsoil	945	724
OB - Drilling (Pit 1)	422	-
OB - Drilling (Pit 2)	422	1,898
OB - Drilling (Pit 3)	-	8,859
OB - Drilling (Pit 5)	20,249	10,335
OB - Blasting (Pit 1)	1,763	-
OB - Blasting (Pit 2)	1,763	7,932
OB - Blasting (Pit 3)	-	37,015
OB - Blasting (Pit 5)	84,607	43,185
OB - Excavator loading OB to haul truck in Pit 1	1,179	-
OB - Excavator loading OB to haul truck in Pit 2	1,179	5,944
OB - Excavator loading OB to haul truck in Pit 3	-	27,738
OB - Excavator loading OB to haul truck in Pit 5	56,608	32,361
OB - Hauling to emplacement area from Pit 1	2,638	-
OB - Hauling to emplacement area from Pit 2	4,129	-
OB - Hauling to emplacement area from Pit 2 North	-	24,715
OB - Hauling to emplacement area from Pit 2 South	-	1,012
OB - Hauling to emplacement area from Pit 3 North	-	109,264
OB - Hauling to emplacement area from Pit 3 South	-	2,698
OB - Hauling to emplacement area from Pit 5 North	272,541	56,656
OB - Hauling to emplacement area from Pit 5 South	22,024	7,869
OB- Emplacing at dumps in Pit 1	1,179	-
OB- Emplacing at dumps in Pit 2	1,179	5,944
OB- Emplacing at dumps in Pit 3	-	27,738
OB- Emplacing at dumps in Pit 5	56,608	32,361
OB - Dozers on OB in Pit 1	5,848	-
OB - Dozers on OB in Pit 2	5,848	26,316
OB - Dozers on OB in Pit 3	-	122,808
OB - Dozers on OB in Pit 5	280,704	143,276
CL - Drilling (Pit 1)	2,531	-
CL - Drilling (Pit 2)	4,219	9,281
CL - Drilling (Pit 3)	-	37,967
CL - Drilling (Pit 5)	77,620	37,123
CL - Blasting (Pit 1)	10,576	-
CL - Blasting (Pit 2)	17,626	38,778
CL - Blasting (Pit 3)	-	158,638
CL - Blasting (Pit 5)	324,326	155,112
CL - Dozers on Pit 1	8,232	-
CL - Dozers on Pit 2	13,721	30,186
CL - Dozers on Pit 3	-	123,487
CL - Dozers on Pit 5	252,463	120,743
CL - Loading ROM to trucks in Pit 1	27,359	-
CL - Loading ROM to trucks in Pit 2	45,598	111,463
CL - Loading ROM to trucks in Pit 3	-	455,985
CL - Loading ROM to trucks in Pit 5	839,012	445,852
CL - Hauling ROM coal to dump hopper from Pit 1	5,658	-
CL - Hauling ROM coal to dump hopper from Pit 2	6,452	-
CL - Hauling ROM coal to dump hopper from Pit 2 North	-	23,051
CL - Hauling ROM coal to dump hopper from Pit 2 South	-	382
CL - Hauling ROM coal to dump hopper from Pit 3 North	-	147,408
CL - Hauling ROM coal to dump hopper from Pit 3 South	-	17,868

ACTIVITY	Year 6 (2011)	Year 9 (2014)
CL - Hauling ROM coal to dump hopper from Pit 5 North	271,231	187,809
CL - Hauling ROM coal to dump hopper from Pit 5 South	25,571	13,588
CL - Unloading ROM to pile/hopper (all pits)	1,315	45,000
CL - Rehandle coal to hopper	1,315	45,000
CL - Screening	14,850	16,500
CL - Crushing	8,100	9,000
CL - Sized Coal Unloading to Existing Product/Raw Stockpiles	1,096	37,500
CL - Loading from Raw to CHPP	1,096	1,113
CL - Loading from Existing Product Stockpiles to trains	3,507	1,113
CL - Unloading from CHPP to Product Stockpile	658	22,500
CL - Loading from Product Coal stockpile No.2 to trains	-	2,436
CL - Dozers on ROM Coal stockpiles	39,979	39,979
CL - Dozers on Existing Product/Raw stockpiles	79,958	39,979
CL - Dozers on New Product Coal Stockpile	-	39,979
CL - Hauling rejects to Pit 1	626	-
CL - Hauling rejects to Pit 2	461	5,784
CL - Hauling rejects to Pit 3	-	44,985
CL - Hauling rejects to Pit 5	87,004	47,456
WE - Backfill Pit 1	115,632	11,563
WE - Backfill Pit 2	23,757	143,594
WE - Backfill Pit 3	-	30,064
WE - Backfill Pit 5	154,947	234,207
WE - Pit 1	15,453	-
WE - Pit 2	20,604	73,584
WE - Pit 3	-	180,036
WE - Pit 5	176,847	84,131
WE - ROM coal stockpiles	36,792	36,792
WE - Existing product/raw stockpiles	4,030	4,030
WE - New Product stockpile	-	1,927
Grading roads	77,637	77,637
Total	**3,636,924**	**4,153,793**

[1] kg/y = kilograms per year

6.3 Emissions from neighbouring mines

The dust inventories used in the modelling include estimates of emissions from other approved operations at nearby mines. The locations of the nearby mines are shown on **Figure 2.1**.

The estimated emissions for the neighbouring mines have been taken from the relevant Environmental Assessment documents for following mines:

- Moolarben Stage 2 (**PAEHolmes, 2009a**)
- Ulan Continued Operations Project (**PAEHolmes, 2009b**)

It is noted that neither of these proposals are yet approved. However, as the mine capacity and production rates are substantially higher in these proposals than the currently approved operations of the Ulan Coal Mines and Moolarben Coal Mines, it was therefore deemed to be 'worst-case'. This is a conservative approach.

Where data were not available for the precise years of the Project, data were interpolated or extrapolated from the available previously calculated emissions data. **Table 6.2** presents a summary of the estimated emissions apportioned to other mines.

Table 6.2: Summary of estimated TSP dust emissions from other mines (kg/y)

Mine	TSP Emissions	
	Year 6	Year 9
Moolarben Stage 2 - WI	3,195,128	3,265,401
Moolarben Stage 2 - WS	612,764	626,241
Moolarben Stage 2 - WE	568,995	581,510
Ulan – WI	2,479,724	2,769,874
Ulan – WS	457,326	510,837
Ulan – WE	450,551	503,269

Notes:
WI = Wind insensitive emissions;
WS = Wind sensitive emissions;
WE = Wind erosion emissions

In the cumulative modelling work, each neighbouring mine has been treated as a small number of volume sources. These have been located at the apparent points of major emissions as estimated from the known locations of the pits and/or major dust sources on the mine or facility.

Sources have been considered in three classes covering all dust emission sources for which there are emission factor equations for open cut mines:

1. Wind erosion sources where emissions vary with the hourly average wind speed according to the cube of the wind speed.
2. Loading and dumping operations where emissions vary as wind speed is raised to the power of 1.3.
3. All other sources where emissions are assumed to be independent of wind speed.

For neighbouring mines, the proportion of emissions in each of these categories has been assumed to be:

- 0.732 for emissions independent of wind speed;
- 0.135 for emissions that depend on wind speed (such as loading and dumping); and
- 0.133 for wind erosion sources.

These factors are based on a detailed analysis of mine dust inventories undertaken as part of the Mount Arthur North EIS (**URS, 2000**), and have subsequently been accepted as appropriate and routinely applied to subsequent air quality impact assessments for mining operations.

6.4 Estimated emissions from distant mines and other sources

Other sources, in addition to the Project and other mines identified in **Section 6.3**, will contribute to dust in the area. Estimating the background allowance for distant mines and the dust from other closer non-mining sources is complicated and depends on local land use and the associated emission sources, as well as climate, soil type, farming practice etc.

For annual average TSP, PM_{10} and dust deposition the following constant values have been used in the modelling predictions:

- 28 $\mu g/m^3$ for annual average TSP;
- 11 $\mu g/m^3$ for annual average PM_{10}; and
- 1.5 g/m^2/month for annual average dust deposition.

The above background levels were consistent with those used in the Wilpinjong Coal Project 2005 EIS dispersion modelling (**Holmes Air Sciences, 2005**). The background values were derived from 24-hour PM_{10} and dust deposition monitoring between June 2004 and February 2005 prior to the commencement of Project mining operations. These background levels were also obtained prior to commencement of operations at Moolarben Coal Mine however, Ulan Coal Mine was operating during this period.

7 ASSESSMENT OF IMPACTS

7.1 Assessment Criteria

The air quality criteria used for identifying which properties are likely to experience air quality impacts are those specified in the Approved Methods. These have been applied in the assessment process following the practices used in contemporary approvals for mining projects in NSW.

The criteria are:

- 50 $\mu g/m^3$ for 24-hour average PM_{10} for the Project considered alone;
- 30 $\mu g/m^3$ for annual average PM_{10} due to the Project and other sources;
- 90 $\mu g/m^3$ for annual average TSP concentrations due to the Project alone and other sources;
- 2 g/m^2/month for annual average deposition (insoluble solids) due to the Project considered alone; and
- 4 g/m^2/month for annual average predicted cumulative deposition (insoluble solids) due to the Project and other sources.

Predictions for 24-hour and annual average $PM_{2.5}$ concentrations for the Project are provided in **Appendix E**.

Following practice established in recent Conditions of Consent, with the exception of the 2 g/m^2/month goal and the 24-hour PM_{10}, the assessment criteria are interpreted to be cumulative assessment criteria.

The following sections provide a summary of the affected private receptors and at what stage the effects are predicted to occur.

7.2 Assessment Approach

Dust concentrations due to mining operations have been presented as isopleth diagrams showing the following:

1. Predicted maximum 24-hour average PM_{10} concentration.
2. Predicted annual average PM_{10} concentration.
3. Predicted annual average TSP concentration.
4. Predicted annual average dust deposition.

It is important to note that the isopleth figures are presented to provide a visual representation of the predicted impacts. To produce the isopleths it is necessary to make interpolations, and as a result the isopleths will not always match exactly with predicted impacts at any specific location.

The actual predicted impacts at the private receptors are presented in tabular form (see **Section 7.3**).

It is important to the note that it is not possible to accurately predict the cumulative PM_{10} 24-hour average into the future as daily fluctuations are highly influenced by other sources in the area and events such as bushfires, dust storms, etc. Therefore cumulative PM_{10} 24-hour average predictions have not been included in the assessment.

All modelling results for mine-owned receptors are shown in **Appendix F**.

7.3 Model Predictions

7.3.1 Annual average PM_{10}, TSP and dust deposition predictions

7.3.1.1 Year 6

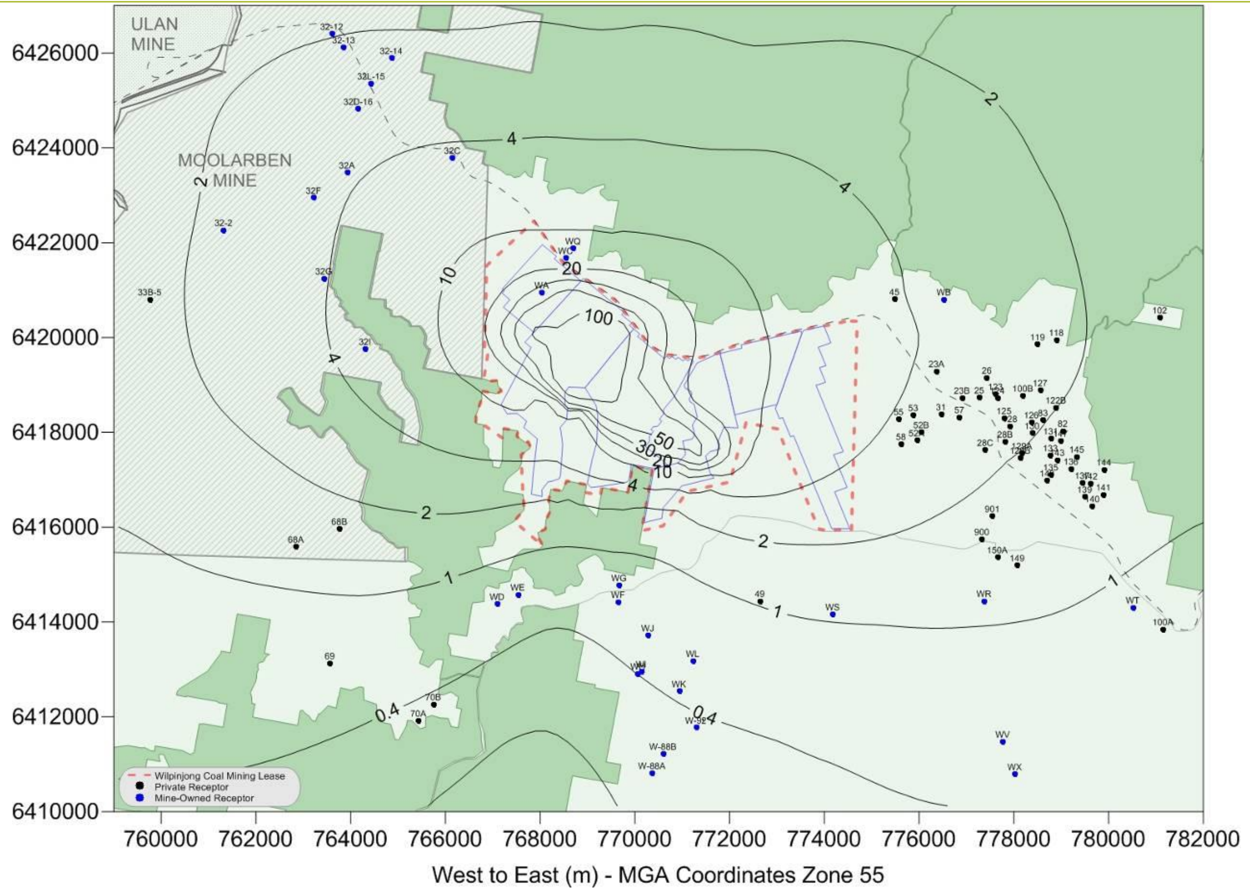
Table 7.1 presents a summary of the Year 6 predicted concentrations at each of the nearby private receptors, due to the operations of the Project alone and the Project and other sources.

Figure 7.1 to **Figure 7.6** show the predicted annual average PM_{10}, TSP concentrations and dust deposition levels in Year 6 due to the operations of the Project alone and the Project and other sources.

Modelling results for Year 6 show no exceedances of the annual average PM_{10}, TSP and dust deposition DECCW criteria for the Project alone and the Project and other sources at any of the private receptors.

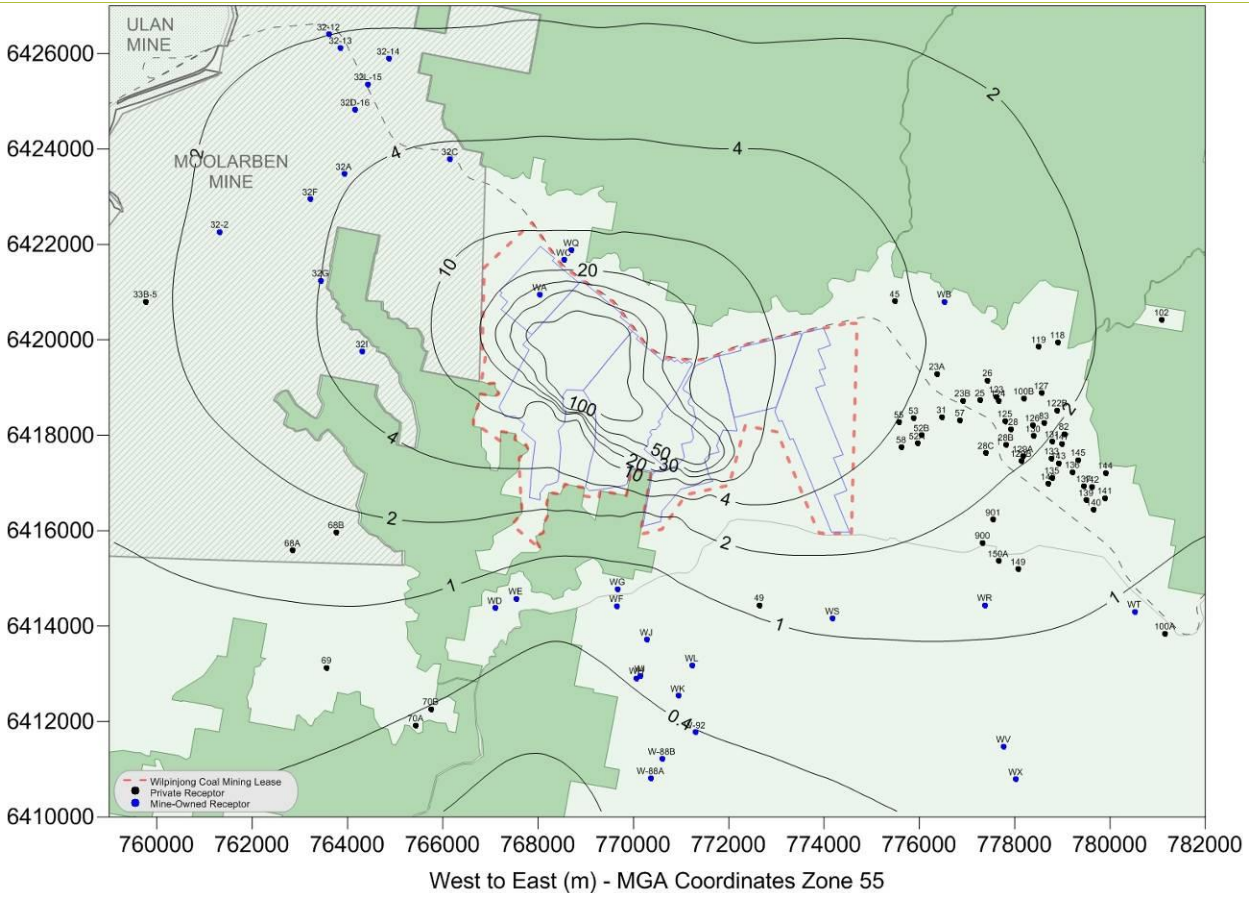
Table 7.1: Year 6 – predicted PM_{10} and TSP concentrations and dust deposition levels due to the Project alone and the Project and other sources

ID	Year 6 – Project alone			Year 6 - Project and other sources		
	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust deposition (g/m^2/month)	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust deposition (g/m^2/month)
	Assessment criteria					
	N/A	*N/A*	*2*	*30*	*90*	*4*
Private receptors						
23A	4	4	0.1	16	34	1.6
23B	3	3	0.1	15	33	1.6
25	3	3	0.1	15	33	1.6
26	3	3	0.1	15	32	1.6
28B	2	2	0.1	14	32	1.6
28C	2	2	0.1	15	32	1.6
31	3	3	0.1	16	33	1.6
33B-5	2	2	0.0	18	35	1.7
45	4	4	0.1	17	34	1.7
49	1	1	0.0	13	30	1.6
52A	3	3	0.1	16	33	1.6
52B	3	3	0.1	16	33	1.6
53	4	4	0.1	16	33	1.7
55	4	4	0.1	16	34	1.7
57	3	3	0.1	15	33	1.6
58	3	4	0.1	16	33	1.7
68A	1	1	0.0	13	30	1.6
68B	2	2	0.0	13	31	1.6
69	1	1	0.0	12	29	1.5
70A	0	0	0.0	12	29	1.5
70B	0	0	0.0	12	29	1.5
82	2	2	0.1	14	31	1.6
83	2	2	0.1	14	31	1.6
100A	1	1	0.0	13	30	1.5
100B	2	2	0.1	15	32	1.6
102	2	2	0.0	14	31	1.6
118	2	2	0.1	15	32	1.6
119	2	2	0.1	15	32	1.6
122B	2	2	0.1	14	31	1.6
123	3	3	0.1	15	32	1.6
124	3	3	0.1	15	32	1.6
125	2	2	0.1	15	32	1.6
126	2	2	0.1	14	31	1.6
127	2	2	0.1	15	32	1.6
128	2	2	0.1	14	32	1.6
129A	2	2	0.1	14	31	1.6
129B	2	2	0.1	14	31	1.6
130	2	2	0.1	14	31	1.6
131	2	2	0.1	14	31	1.6
133	2	2	0.1	14	31	1.6
135	2	2	0.0	14	31	1.6
136	2	2	0.0	14	31	1.6
137	1	2	0.0	14	31	1.6
139	1	1	0.0	14	31	1.6
140	1	1	0.0	13	31	1.6
141	1	1	0.0	13	30	1.6
142	1	2	0.0	13	31	1.6
143	2	2	0.0	14	31	1.6
144	1	2	0.0	14	31	1.6
145	2	2	0.0	14	31	1.6
147	2	2	0.1	14	31	1.6
148	2	2	0.0	14	31	1.6
149	1	1	0.0	13	30	1.6
150A	1	1	0.0	14	31	1.6
900	2	2	0.0	13	30	1.6
901	2	2	0.0	14	31	1.6



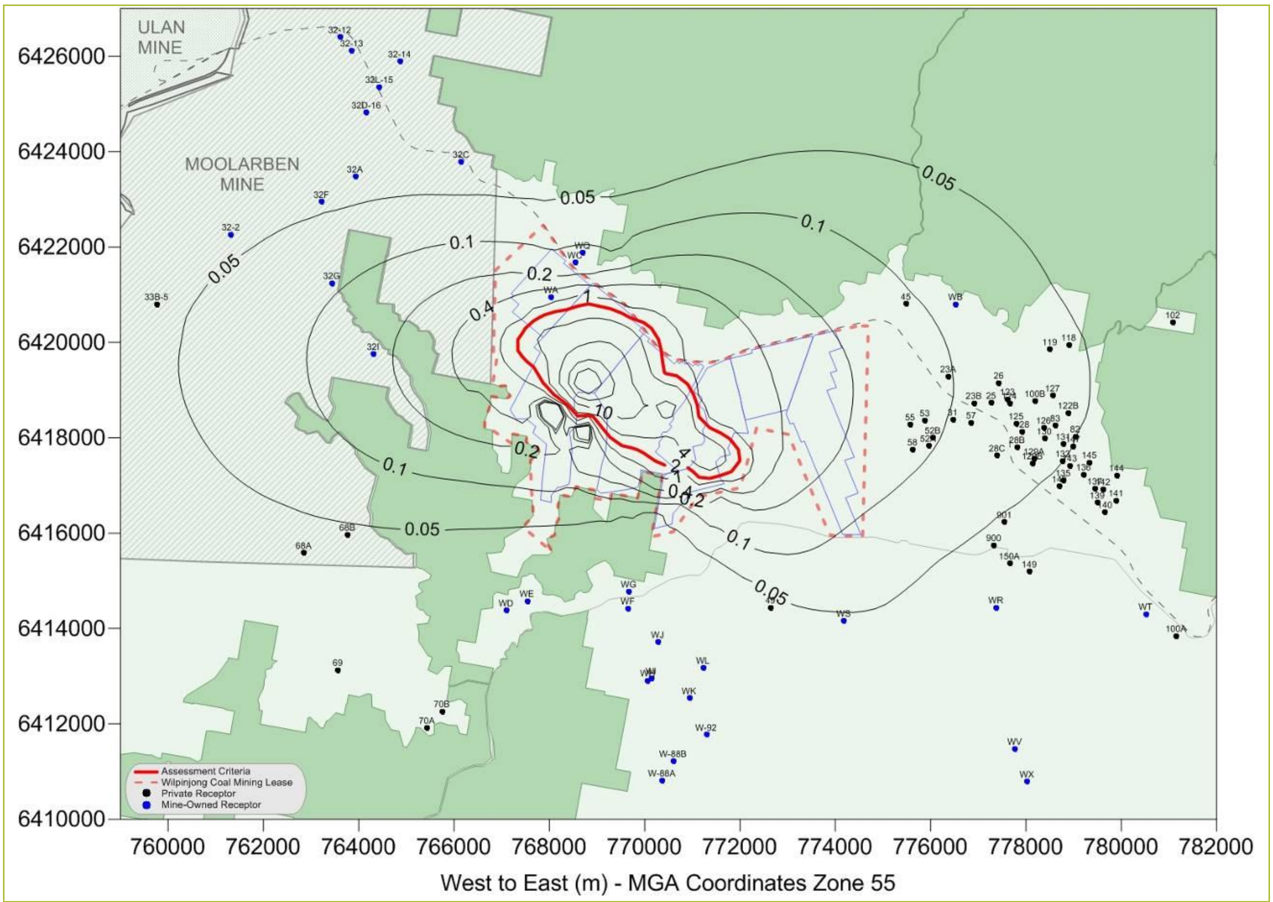
Species:	Averaging Time:	Percentile:	Scenario:	Location:
PM_{10}	Annual	N/A	Year 6 Project only	Wilpinjong
Model Used:	**Units:**	**Assessment criteria:**	**Met Data:**	**Plot:**
ISCMOD	µg/m^3	N/A	Wilpinjong 2008	F Triffett

Figure 7.1 : Predicted annual average PM_{10} concentrations due to emissions from the Project alone in Year 6



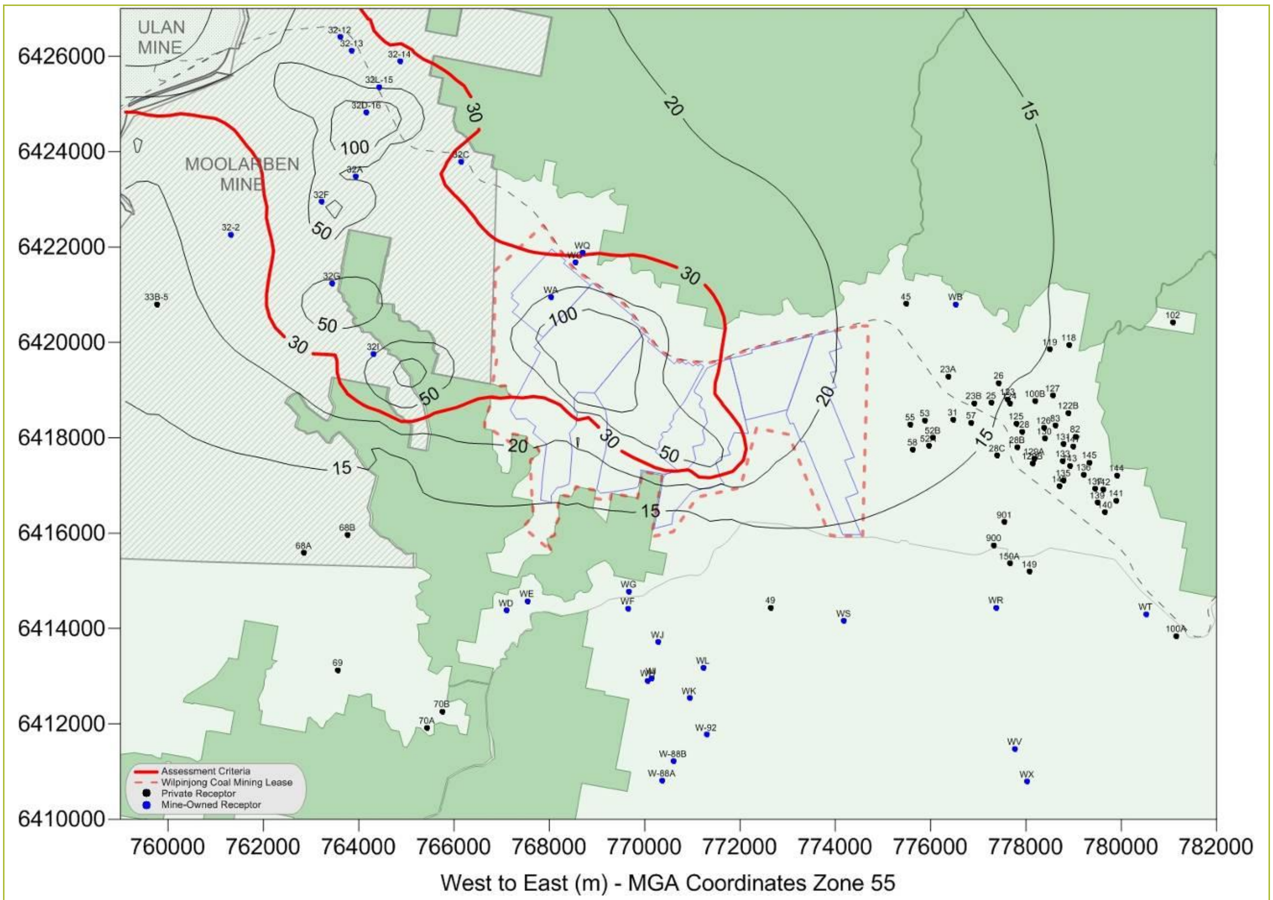
Species: TSP	Averaging Time: Annual	Percentile: N/A	Scenario: Year 6 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** $\mu g/m^3$	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.2 : Predicted annual average TSP concentrations due to emissions from the Project alone in Year 6



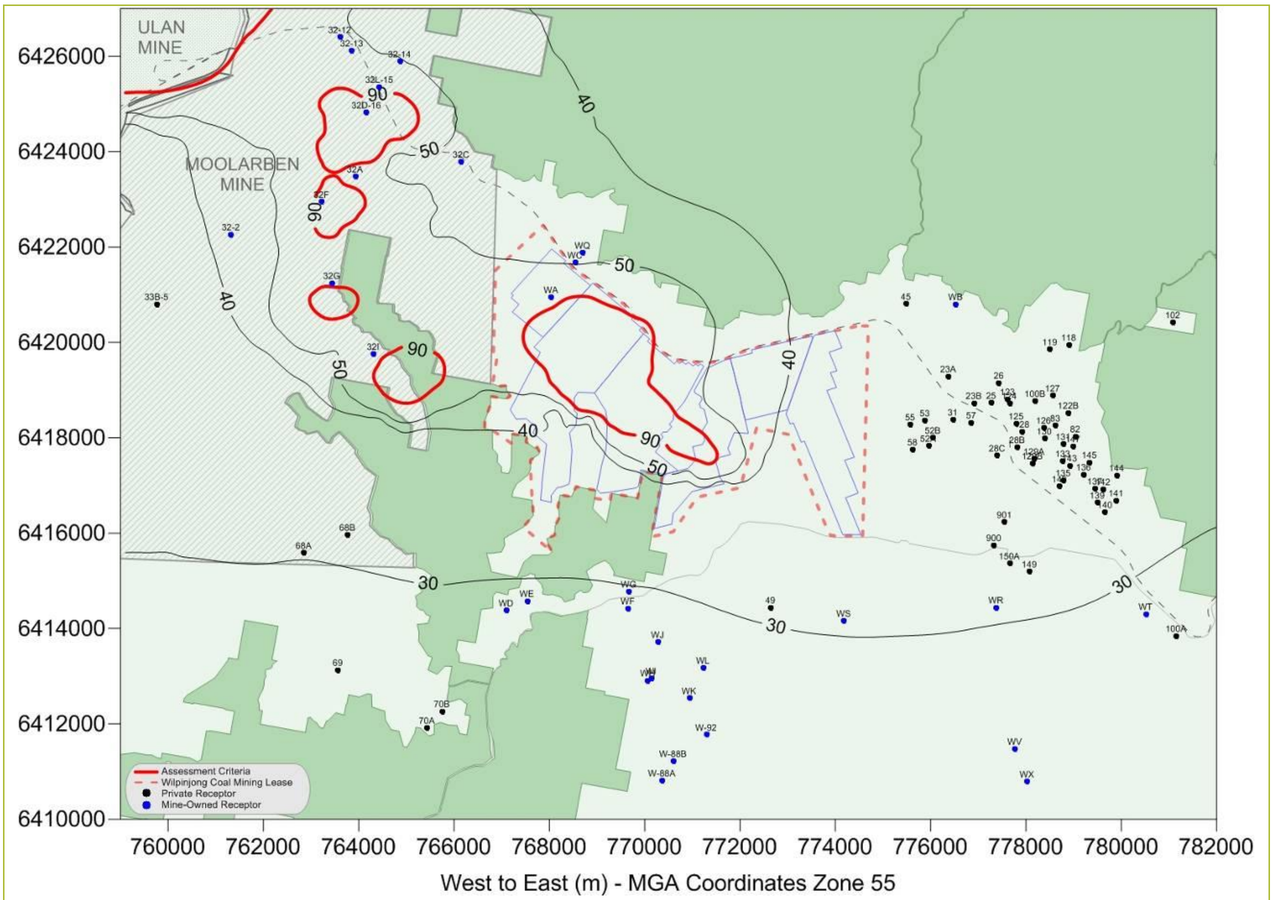
Species: Dust Deposition	**Averaging Time:** Annual	**Percentile:** N/A	**Scenario:** Year 6 Project only	**Location:** Wilpinjong
Model Used: ISCMOD	**Units:** g/m^2/month	**Assessment criteria:** DECCW = 2 g/m^2/month	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.3 : Predicted annual average dust deposition levels due to emissions from the Project alone in Year 6



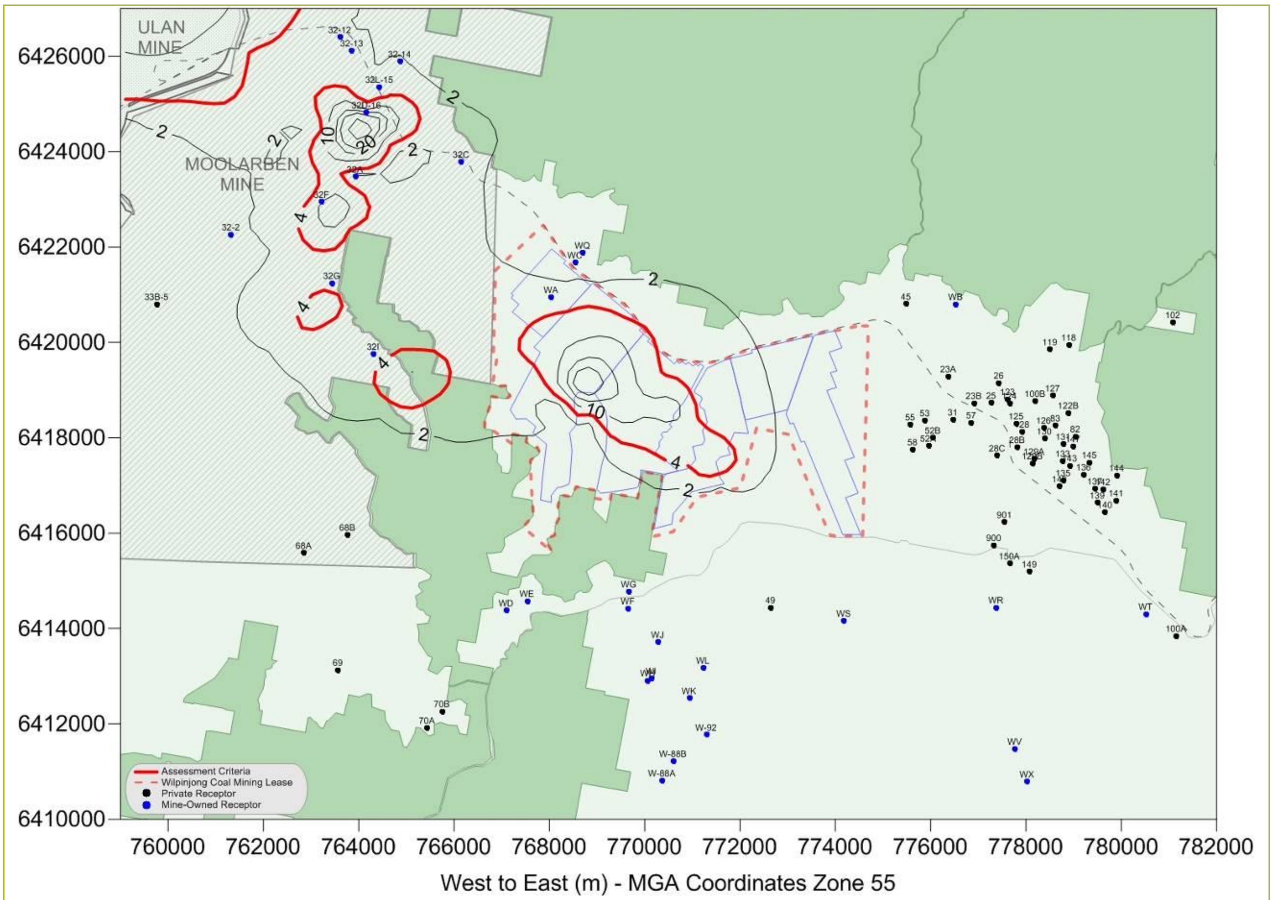
Species: PM_{10}	**Averaging Time:** Annual	**Percentile:** N/A	**Scenario:** Year 6 Project and other sources	**Location:** Wilpinjong
Model Used: ISCMOD	**Units:** $\mu g/m^3$	**Assessment criteria:** DECCW = 30 $\mu g/m^3$	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.4 : Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources in Year 6



Species: TSP	**Averaging Time:** Annual	**Percentile:** N/A	**Scenario:** Year 6 Project and other sources	**Location:** Wilpinjong
Model Used: ISCMOD	**Units:** $\mu g/m^3$	**Assessment criteria:** DECCW = 90 $\mu g/m^3$	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.5 : Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 6



Species:	Averaging Time:	Percentile:	Scenario:	Location:
Dust Deposition	Annual	N/A	Year 6 Project and other sources	Wilpinjong
Model Used: ISCMOD	**Units:** g/m²/month	**Assessment criteria:** DECCW = 4 g/m²/month	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.6 : Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 6

7.3.1.2 Year 9

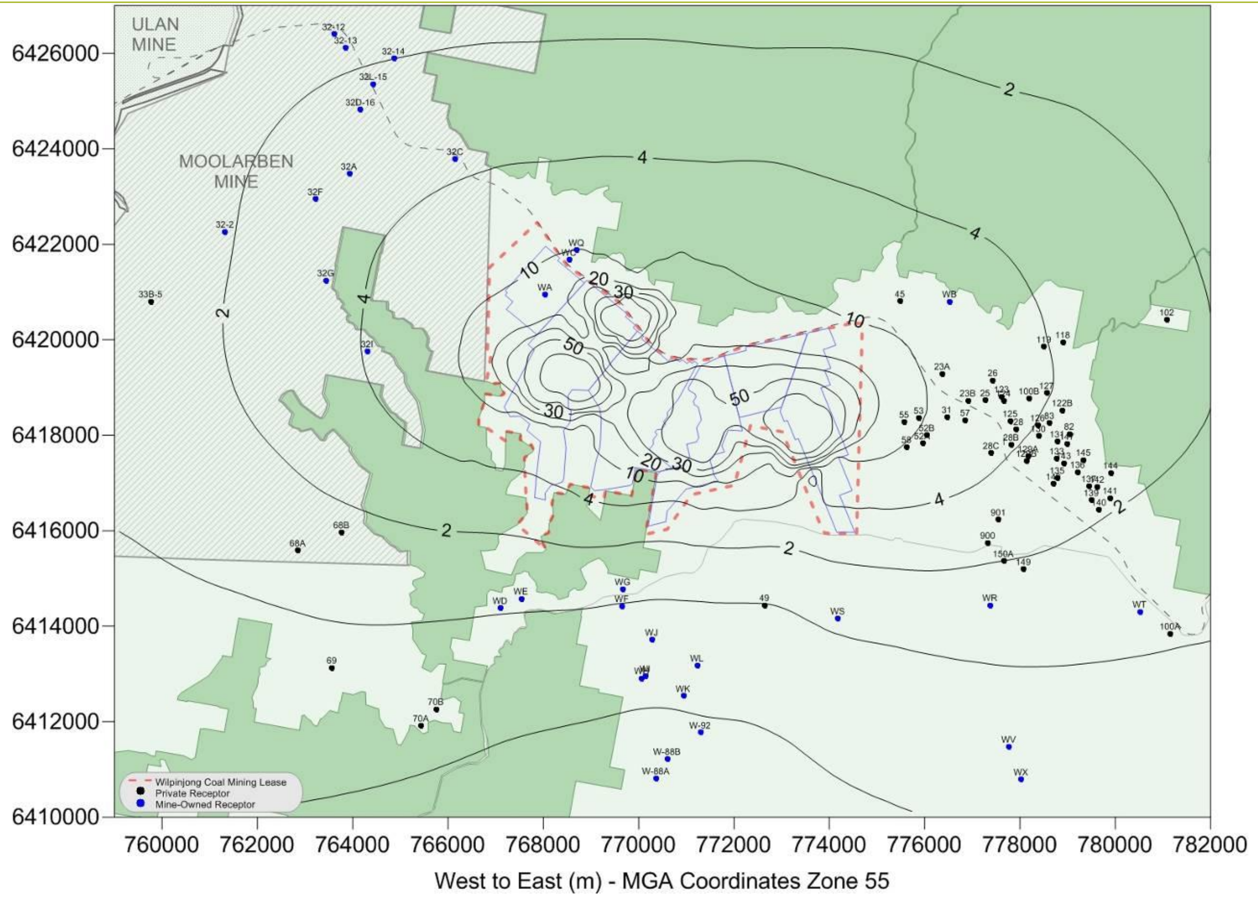
Table 7.2 presents a summary of the Year 9 predicted concentrations at each of the nearby private receptors, due to the operations of the Project alone and the Project and other sources.

Figure 7.7 to **Figure 7.12** show the predicted annual average PM_{10}, TSP concentrations and dust deposition levels in Year 9 due to the operations of the Project alone and the Project and other sources.

Modelling results for Year 9 show no exceedances of the annual average PM_{10}, TSP and dust deposition DECCW criteria for the Project alone and the Project and other sources at any of the private receptors.

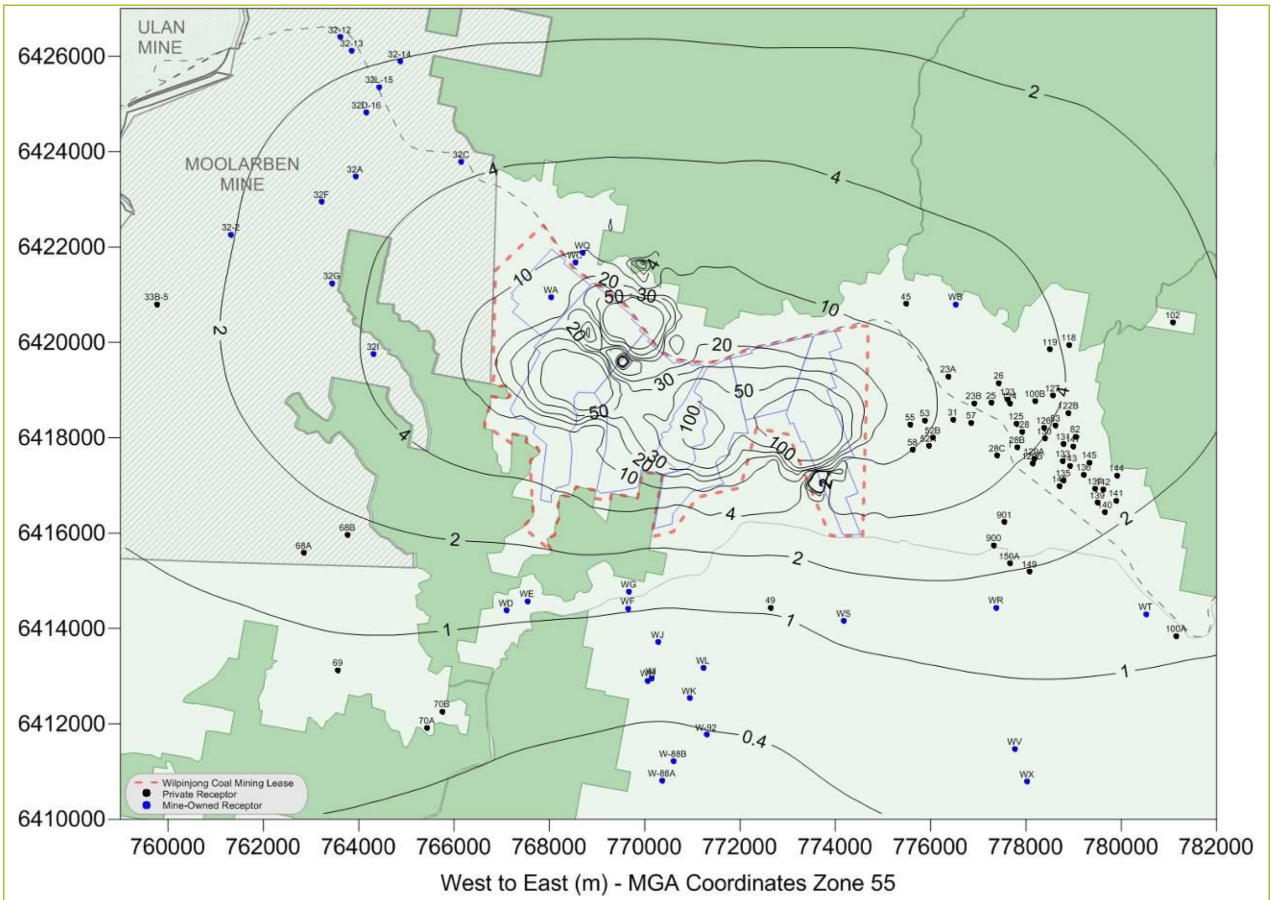
Table 7.2: Year 9 – predicted PM_{10} and TSP concentrations and dust deposition levels due to the Project alone and the Project and other sources

ID	Year 9 – Project alone			Year 9 - Project and other sources		
	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust deposition (g/m^2/month)	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust deposition (g/m^2/month)
	Assessment criteria					
	N/A	*N/A*	*2*	*30*	*90*	*4*
Private receptors						
23A	8	9	0.3	16	34	1.6
23B	7	7	0.3	19	37	1.8
25	7	7	0.3	19	37	1.8
26	6	6	0.2	18	36	1.7
28B	4	4	0.2	16	34	1.7
28C	5	5	0.2	17	34	1.7
31	8	8	0.3	21	38	1.9
33B-5	2	2	0.0	18	35	1.7
45	7	7	0.2	20	37	1.7
49	1	1	0.0	13	30	1.6
52A	8	9	0.4	21	39	1.9
52B	9	9	0.4	21	39	1.9
53	11	11	0.5	23	41	2.0
55	12	13	0.6	25	43	2.2
57	7	7	0.3	19	37	1.8
58	9	10	0.5	22	40	2.0
68A	1	1	0.0	13	30	1.6
68B	2	2	0.1	13	31	1.6
69	1	1	0.0	12	29	1.5
70A	1	1	0.0	12	29	1.5
70B	1	1	0.0	12	29	1.5
82	3	3	0.1	16	33	1.6
83	4	4	0.1	16	33	1.7
100A	1	1	0.0	13	30	1.5
100B	4	5	0.2	17	34	1.7
102	2	2	0.1	15	32	1.6
118	4	4	0.1	16	34	1.6
119	4	4	0.1	17	34	1.7
122B	4	4	0.1	16	33	1.7
123	5	5	0.2	18	35	1.7
124	5	5	0.2	17	35	1.7
125	5	5	0.2	17	34	1.7
126	4	4	0.1	16	33	1.7
127	4	4	0.1	17	34	1.7
128	4	5	0.2	17	34	1.7
129A	4	4	0.1	16	33	1.7
129B	4	4	0.1	16	33	1.7
130	4	4	0.1	16	33	1.7
131	3	4	0.1	16	33	1.7
133	3	3	0.1	16	33	1.6
135	3	3	0.1	15	32	1.6
136	3	3	0.1	15	32	1.6
137	3	3	0.1	15	32	1.6
139	2	3	0.1	15	32	1.6
140	2	2	0.1	14	32	1.6
141	2	2	0.1	14	31	1.6
142	2	2	0.1	14	31	1.6
143	2	2	0.1	14	32	1.6
144	3	3	0.1	15	33	1.6
145	2	3	0.1	15	32	1.6
147	3	3	0.1	15	32	1.6
148	3	3	0.1	16	33	1.6
149	3	3	0.1	15	32	1.6
150A	2	2	0.1	14	31	1.6
900	2	2	0.1	14	31	1.6
901	2	2	0.1	14	32	1.6



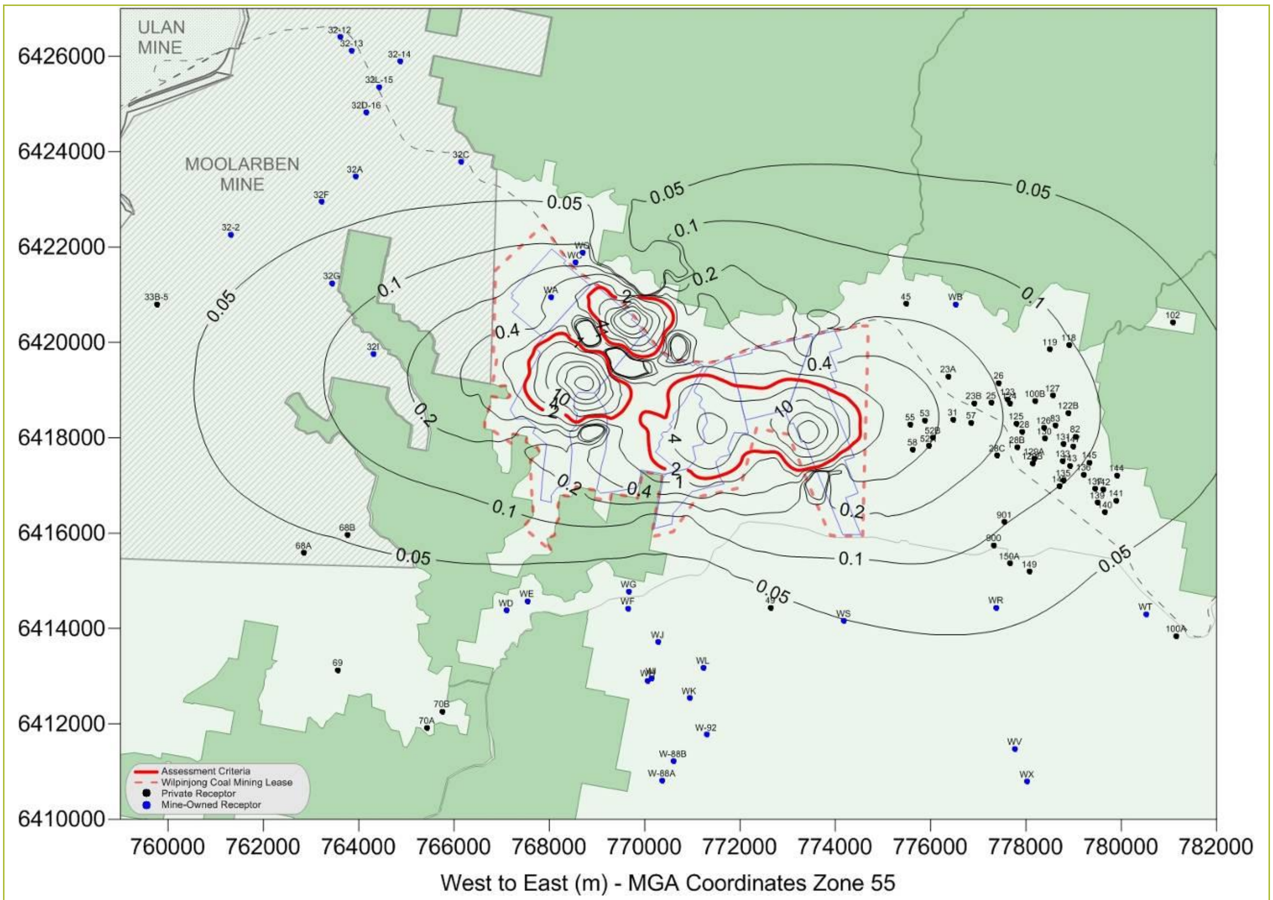
Species: PM_{10}	Averaging Time: Annual	Percentile: N/A	Scenario: Year 9 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** μg/m^3	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.7 : Predicted annual average PM_{10} concentrations due to emissions from the Project alone in Year 9



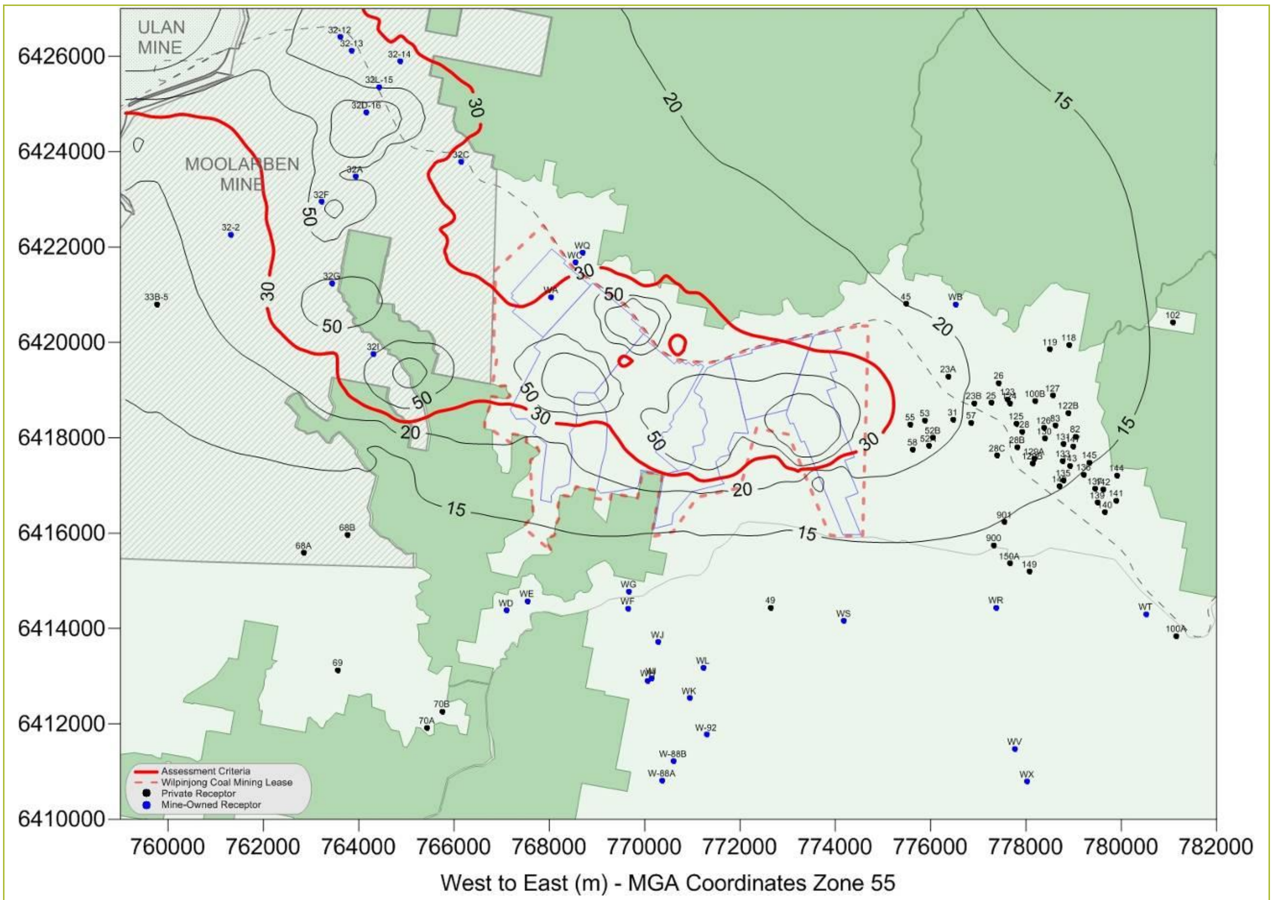
Species: TSP	Averaging Time: Annual	Percentile: N/A	Scenario: Year 9 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** $\mu g/m^3$	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.8 : Predicted annual average TSP concentrations due to emissions from the Project alone in Year 9



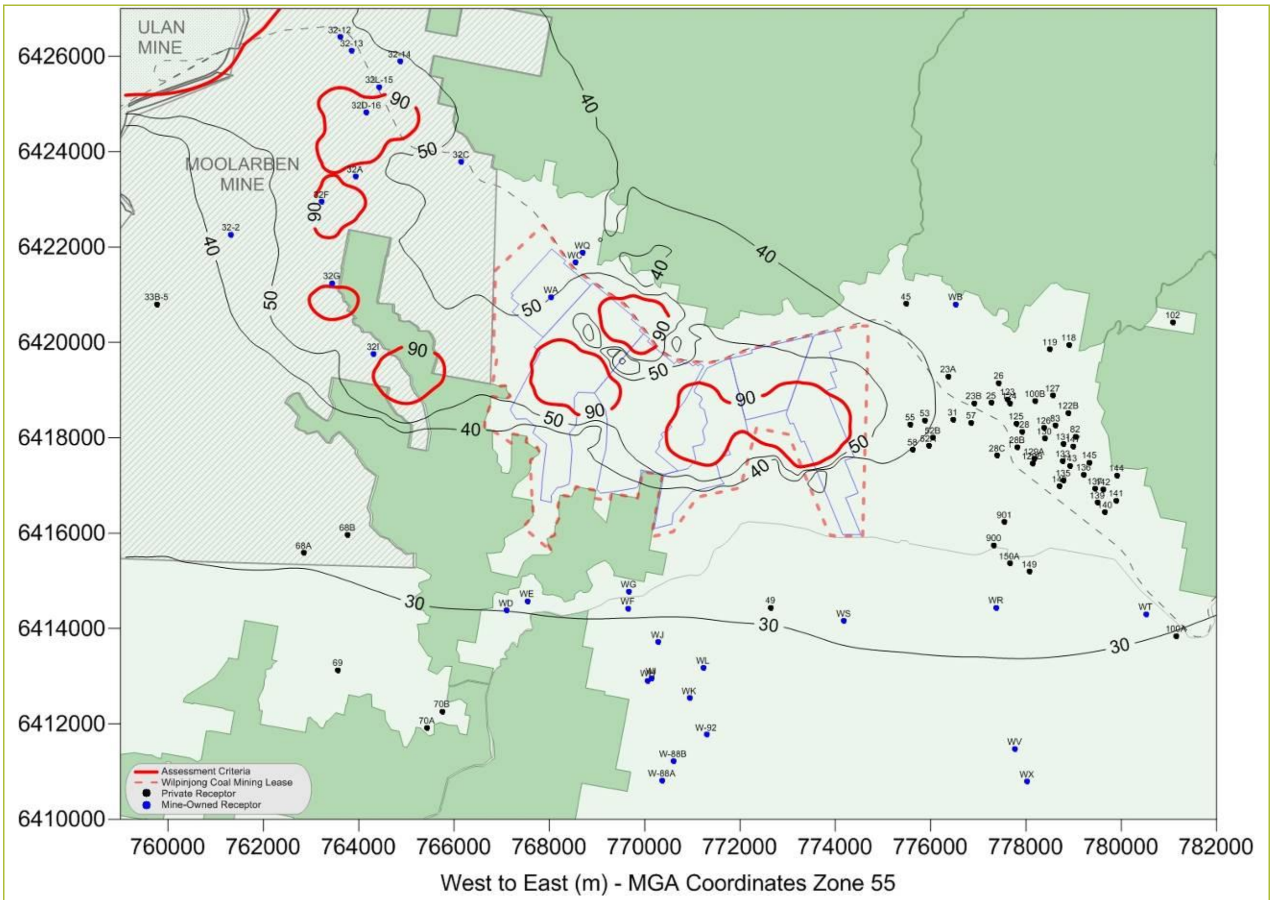
Species: Dust Deposition	Averaging Time: Annual	Percentile: N/A	Scenario: Year 9 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** $g/m^2/month$	**Assessment criteria:** DECCW = 2 $g/m^2/month$	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.9 : Predicted annual average dust deposition levels due to emissions from the Project alone in Year 9



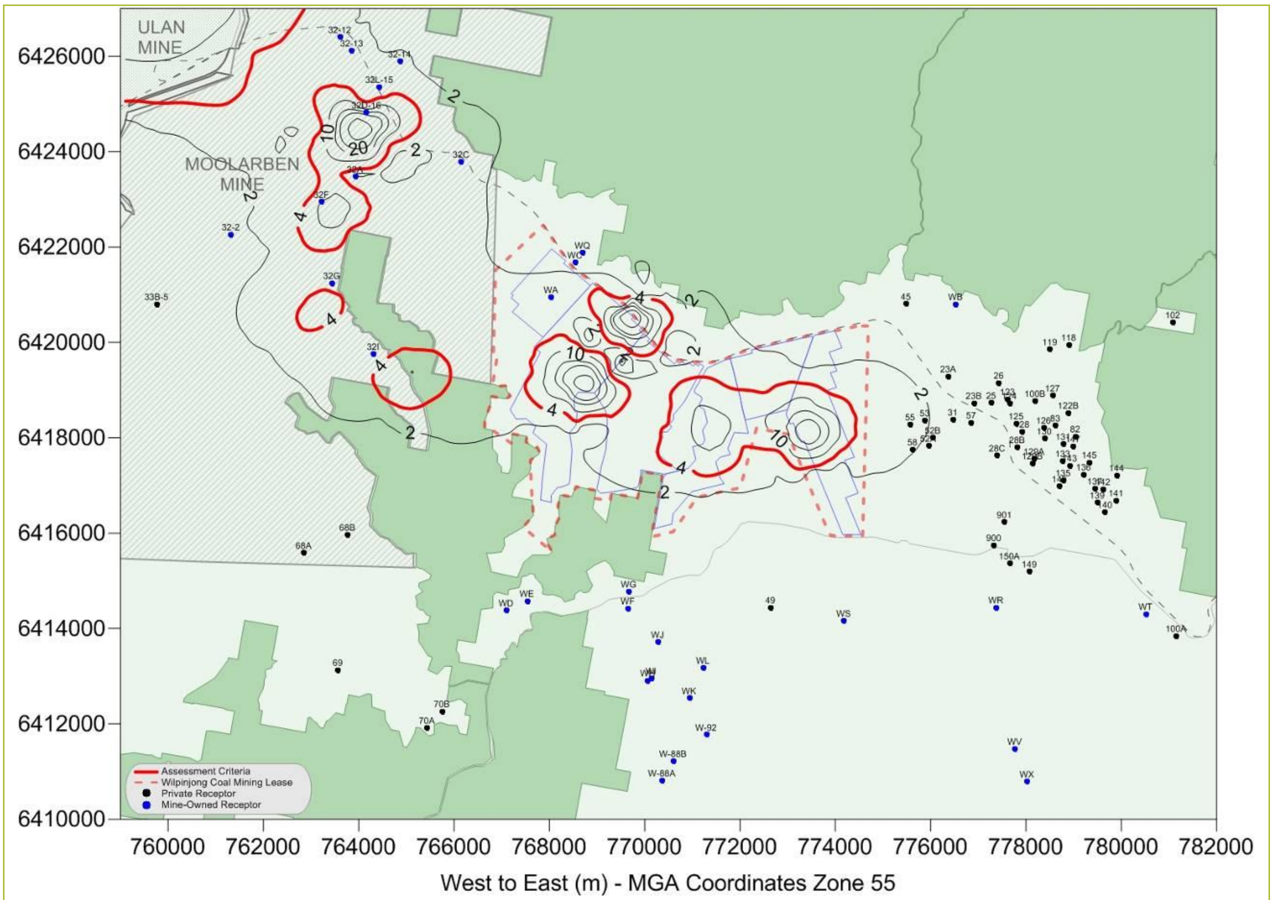
Species: PM$_{10}$	**Averaging Time:** Annual	**Percentile:** N/A	**Scenario:** Year 9 Project and other sources	**Location:** Wilpinjong
Model Used: ISCMOD	**Units:** µg/m^3	**Assessment criteria:** DECCW = 30 µg/m^3	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.10 : Predicted annual average PM$_{10}$ concentrations due to emissions from the Project and other sources in Year 9



Species:	Averaging Time:	Percentile:	Scenario:	Location:
TSP	Annual	N/A	Year 9 Project and other sources	Wilpinjong
Model Used: ISCMOD	**Units:** µg/m^3	**Assessment criteria:** DECCW = 90 µg/m^3	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.11 : Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 9



Species: Dust Deposition	Averaging Time: Annual	Percentile: N/A	Scenario: Year 9 Project and other sources	Location: Wilpinjong
Model Used: ISCMOD	**Units:** g/m^2/month	**Assessment criteria:** DECCW = 4 g/m^2/month	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.12 : Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 9

7.3.2 24-hour average PM_{10} concentrations

Table 7.3 presents the predicted maximum 24-hour PM_{10} concentrations at the private receptors. Values that are above the assessment criterion are highlighted **bold red**.

Figure 7.13 and **Figure 7.14** show the predicted 24-hour average PM_{10} concentrations in Year 6 and Year 9 respectively, due to the operations of the Project alone.

Modelling results for Year 6 show no exceedances of the 24-hour average PM_{10} DECCW criteria for the Project alone at any of the private receptors.

Privately owned receptors predicted to experience a 24-hour average PM_{10} concentration above the DECCW criterion in Year 9 are 31 (DE & AM Conradt), 53 (RW & JL Reynolds) and 55 (SC & M Fox).

To facilitate Department of Planning (DoP) assessment, further analysis was conducted on privately owned receptors 31, 53 and 55 to determine the number of days that the 50 µg/m^3 criterion are predicted to be exceeded. Recent Conditions of Consent (for example, Integra North Open Cut) have required acquisition of properties if the 24-hour average PM_{10} concentration is exceeded more than five times per year (i.e. the 98.6th percentile), due to emissions from the Project alone.

Figure 7.15 presents a plot showing the spread of predicted 24-hour PM_{10} concentrations across the modelled year for private receptors 31, 53 and 55 in Year 9.

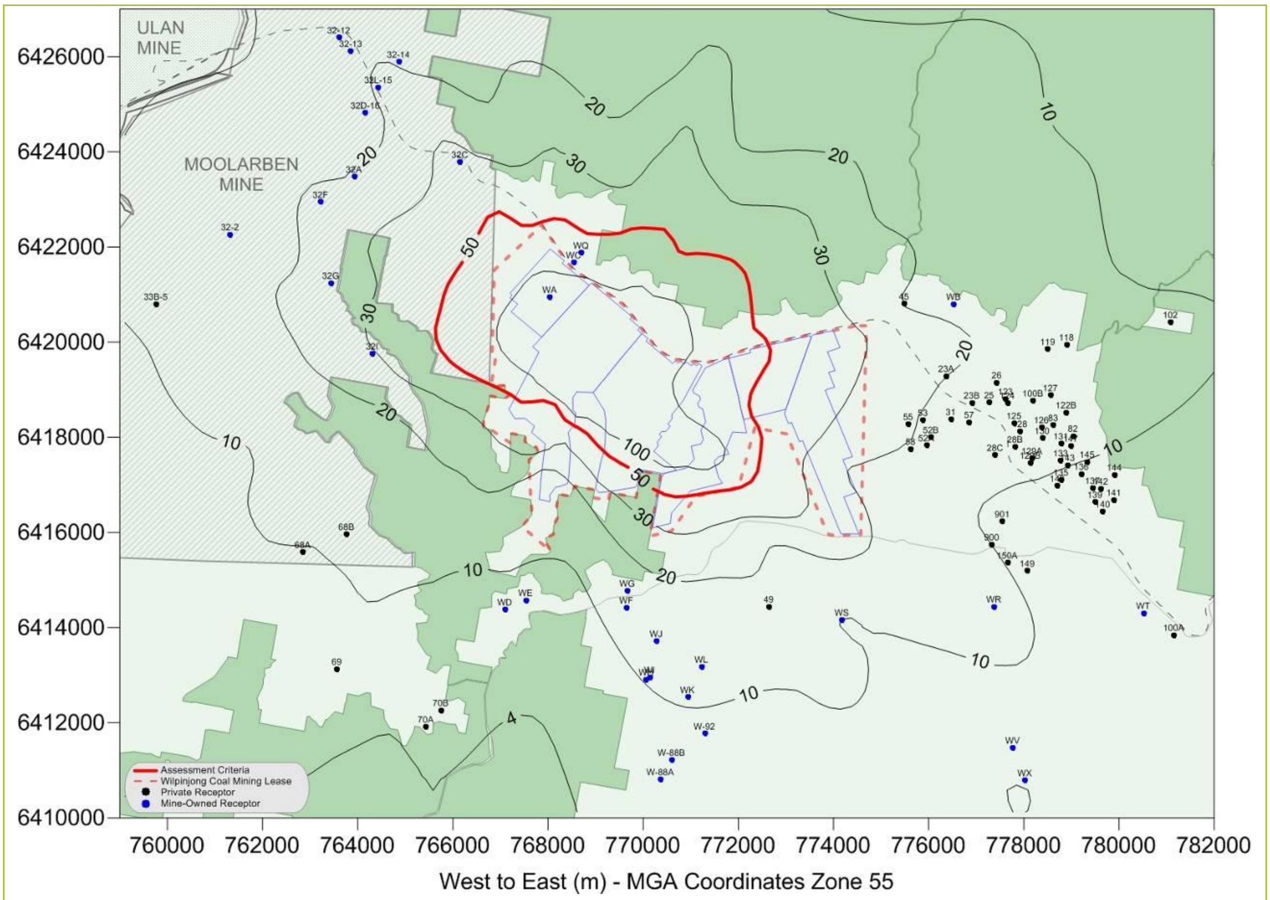
Table 7.4 summarises the number of days predicted to exceed the 24-hour average PM_{10} concentration at the private receptors in Year 9 and highlights in **bold red** those predicted to experience more than five days per above the criteria. In Year 9 Residence 31 is predicted to exceed the 24-hour PM_{10} criteria on one day, Residence 53 is predicted to exceed the criteria on three days and Residence 55 is predicted to exceed the criteria on six days of the year.

Figure 7.16 presents a histogram showing the frequency (or number of days) of predicted PM_{10} 24-hour average concentrations at private receptors 31, 53 and 55 in Year 9. The histogram shows that there are higher proportions of lower concentrations (i.e. the majority of concentrations are less than 25 µg/m^3).

Table 7.5 should be read in conjunction with **Figure 7.16** and shows that at Residence 31 94% of concentrations fall below 25 µg/m^3, at Residence 53 87% fall below 25 µg/m^3 and at Residence 55 86% of concentrations fall below 25 µg/m^3. This suggests that there is a low risk of high 24-hour PM_{10} concentrations due to mining operations at these private receptors in Year 9.

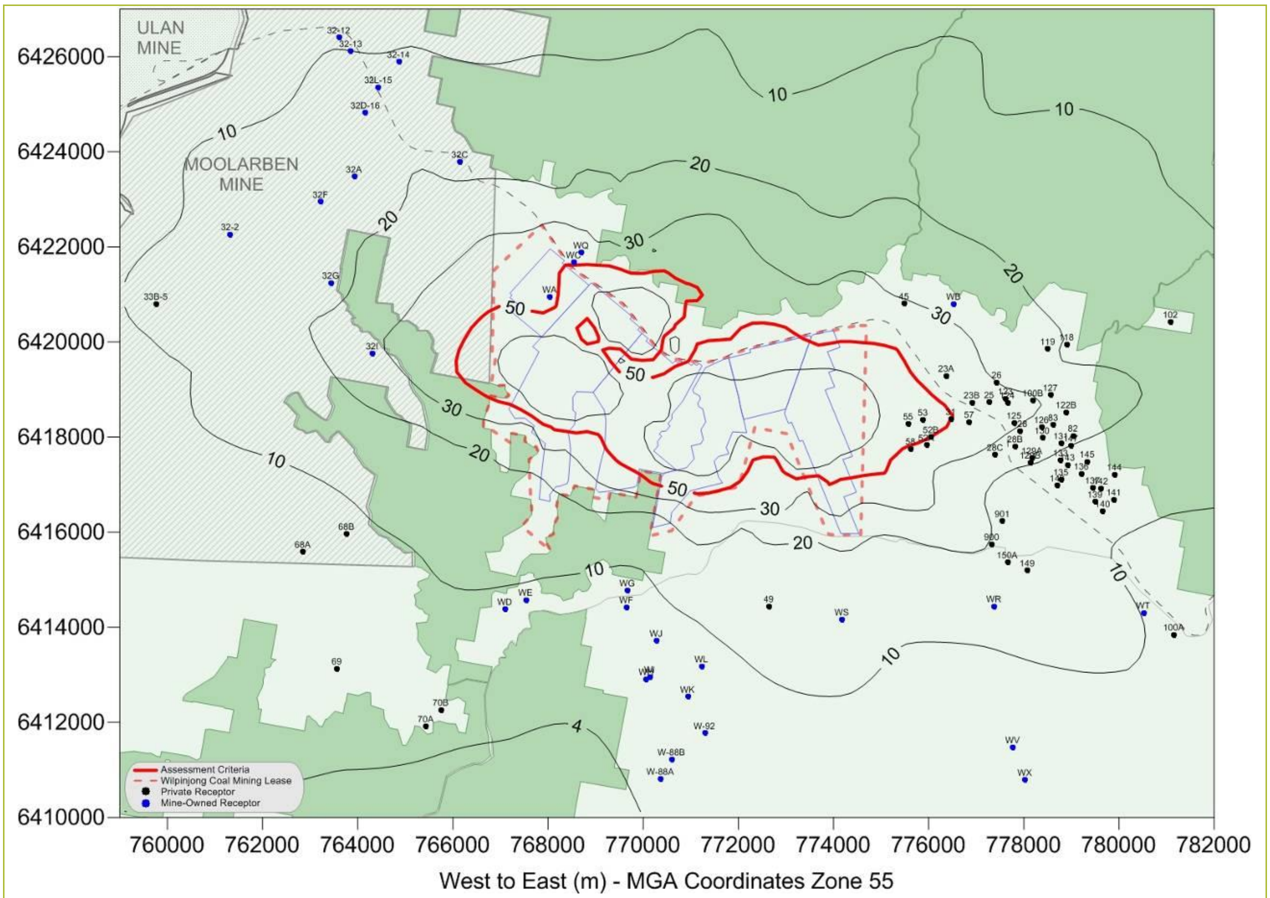
Table 7.3: Summary of maximum predicted 24-hour average PM_{10} concentrations from the Project alone in Year 6 and Year 9 ($\mu g/m^3$)

ID	Year 6	Year 9
	Assessment criteria = 50 µg/m³	
Private Receptors		
23A	20	40
23B	17	42
25	16	42
26	17	30
28B	12	24
28C	13	26
31	18	**51**
33B-5	12	12
45	19	31
49	16	13
52A	18	44
52B	18	50
53	19	**62**
55	21	**70**
57	16	44
58	19	45
68A	9	8
68B	11	9
69	8	6
70A	5	5
70B	5	5
82	11	22
83	12	26
100A	6	9
100B	14	31
102	12	12
118	15	20
119	16	22
122B	12	27
123	15	34
124	15	34
125	14	32
126	12	27
127	14	29
128	13	28
129A	11	21
129B	11	20
130	12	24
131	11	21
133	11	19
135	10	17
136	9	15
137	9	14
139	8	13
140	8	12
141	8	12
142	8	14
143	10	18
144	9	14
145	10	17
147	11	20
148	9	16
149	9	16
150A	10	18
900	10	20
901	9	18



Species: PM_{10}	Averaging Time: 24-hour	Percentile: Maximum	Scenario: Year 6 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** µg/m^3	**Assessment criteria:** DECCW = 50 µg/m^3	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.13 : Predicted 24-hour average PM_{10} concentrations due to emissions from the Project in Year 6



Species: PM$_{10}$	Averaging Time: 24-hour	Percentile: N/A	Scenario: Year 9 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** µg/m^3	**Assessment criteria:** DECCW = 50 µg/m^3	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure 7.14 : Predicted 24-hour average PM$_{10}$ concentrations due to emissions from the Project in Year 9

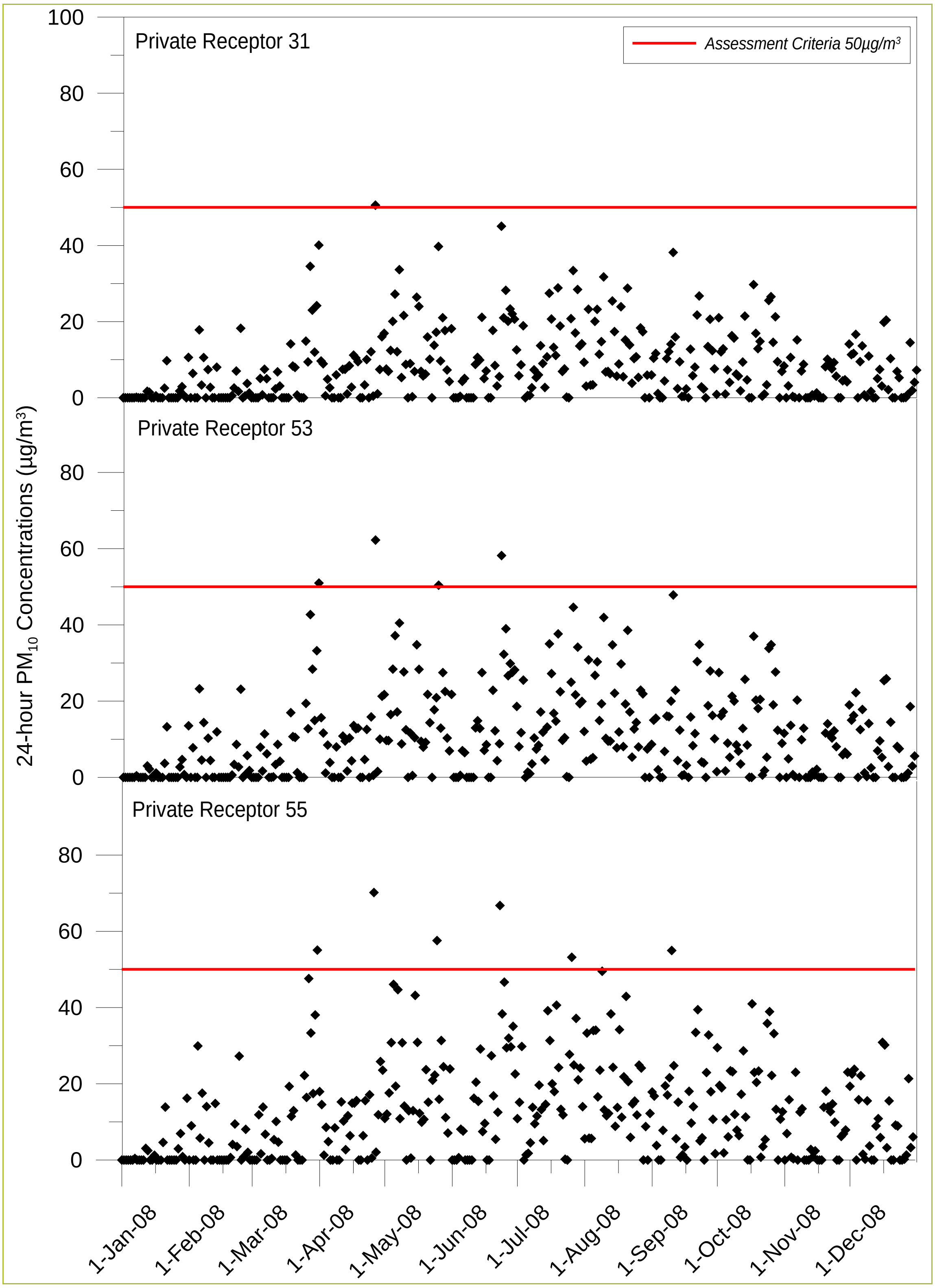
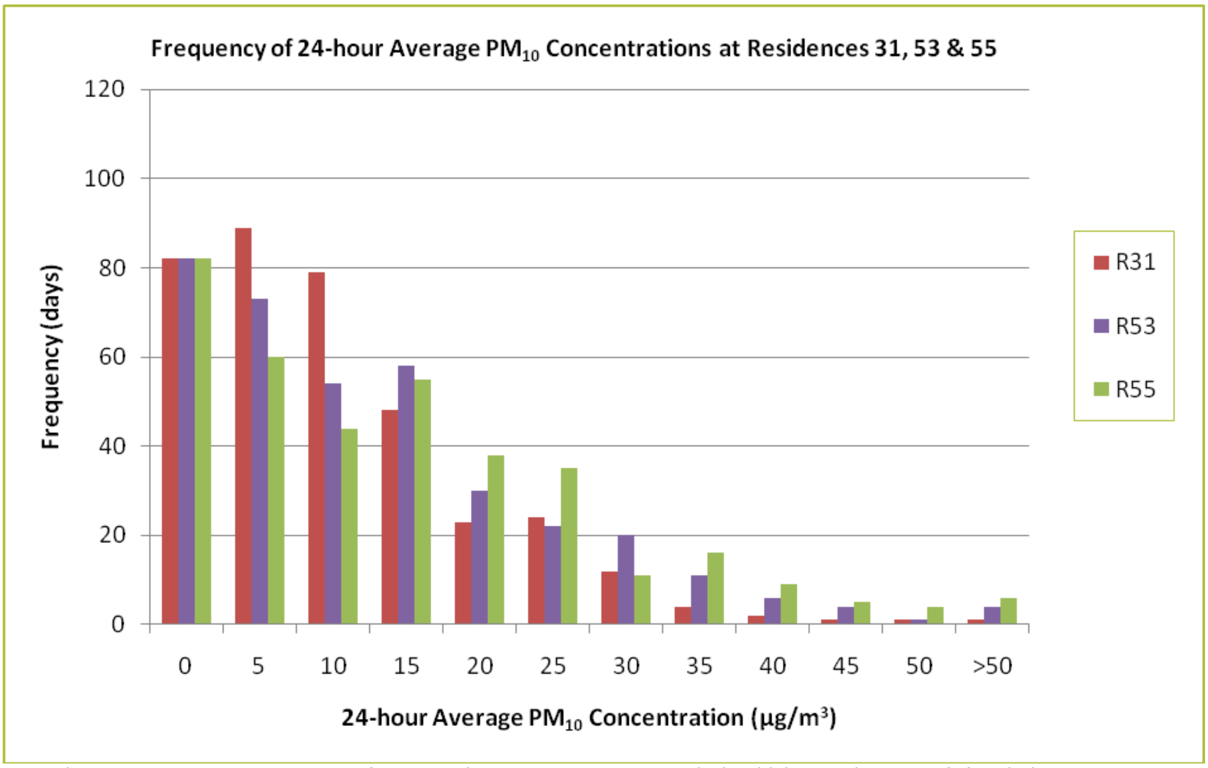


Figure 7.15: Predicted 24-hour PM_{10} concentrations at private receptors predicted to exceed the DECCW criteria in Year 9

Table 7.4: Number of days 24-hour average PM_{10} concentrations are predicted to exceed 50 µg/m³ due to Project alone at private receptors only in Year 9

Residence ID	Number of days exceeding	DoP 98.6 percentile Criterion (5 days)
31	1	Below
53	3	Below
55	**6**	Above



N.B: The X axis represents groups of PM_{10} 24-hour concentrations and should be read as e.g. '5' includes concentrations between 0µg/m³ and 5µg/m³.

Figure 7.16: Frequency of 24-hour average PM_{10} concentrations at private receptors predicted to exceed the DECCW criteria in Year 9

Table 7.5: Statistical analysis of 24-hour average PM_{10} concentrations at private receptors predicted to exceed the DECCW criteria in Year 9

24-hour Average PM_{10} Concentrations (µg/m³)	R31		R53		R55	
	Frequency	*Cumulative %*	*Frequency*	*Cumulative %*	*Frequency*	*Cumulative %*
0	82	22%	82	22%	82	22%
5	89	47%	73	42%	60	39%
10	79	68%	54	57%	44	51%
15	48	81%	58	73%	55	66%
20	23	88%	30	81%	38	76%
25	24	94%	22	87%	35	86%
30	12	98%	20	93%	11	89%
35	4	99%	11	96%	16	93%
40	2	99%	6	98%	9	96%
45	1	99%	4	99%	5	97%
50	1	100%	1	99%	4	98%
>50	1	100%	4	100%	6	100%

8 MITIGATION MEASURES

8.1 Introduction

The modelling results presented above are based on the assumption that WCPL applies the control measures discussed in following sections to minimise dust emissions. This section outlines procedures proposed for the management and control of dust emissions.

8.2 Proposed dust management and control procedures

The term "best practice" is frequently used in pollution control and pollution management. However, what constitutes "best practice" is difficult to define in practical situations. Environment Australia has published a series of booklets to assist the mining industry with incorporating best practice environmental management through all phases of mineral production from exploration through construction and eventual closure. In the booklet for Dust Control (**Environment Australia, 1998**) "best practice" is defined as follows:

> *Best Practice can be defined as the most practical and effective methodology that is currently in use or otherwise available. Best practice dust management can be achieved by appropriate planning in the case of new or expanding mining operations and by identifying and controlling dust sources during the active phases of all mining operations.*

This document since been updated by the Department of Energy, Resources and Tourism (DERT) who have published the handbook *Leading Practice Sustainable Development Program for the Mining Industry* (**DERT, 2009**). This new handbook introduces the term "leading practice", in which:

> "...considers the latest and most appropriate technology applied in order to seek better financial, social and environmental outcomes for present stakeholders and future generations."

The following procedures are proposed for the management of dust emissions from the Project. The aim of these is to minimise the emission of dust in a cost effective manner. The effects of these controls are included in the model simulations. Dust can be generated from two primary sources:

- wind blown dust from exposed areas; and
- dust generated by mining activities.

The proposed controls have been considered against those determined to be best or leading practice in the Environment Australia booklet for Dust Control.

Table 8.1, **Table 8.2** and **Table 8.3** list the mine design, wind-blown and mining-generated dust sources respectively and associated controls. These have been incorporated in the analysis, where relevant.

Table 8.1: Best/Leading Practice Control Procedures for Mine Design

Source	Control Procedures
Transport of coal	Largest practical truck size Shortest route Conveyors to be used in processing plant Water sprays on key transfer points
Overburden dumps	Orientation to minimise profile exposure to receptors Profiling of surfaces to reduce surface speed Contouring of dump shape to avoid strong wind flows and smooth gradients to reduce turbulence at surface
Revegetation	Complete as soon as practical after disturbance Apply as widely as practical

Table 8.2: Best/Leading Practice Control Procedures for Wind-blown Dust

Source	Control Procedures
Areas disturbed by mining	Disturb only the minimum area necessary for mining. Reshape, topsoil and rehabilitate completed overburden emplacement areas as soon as practicable after the completion of overburden tipping.
Ore handling areas/stockpiles	Maintain ore handling areas / stockpiles in a moist condition as required using water carts to minimise wind-blown and traffic-generated dust.
ROM Stockpiles	Have available water sprays on ROM stockpiles to minimise the generation of dust.

Table 8.3: Best/Leading Practice Control Procedures for Mining-generated Dust

Source	Control Procedures
Haul Road Dust	All roads and trafficked areas will be watered as required using water trucks to minimise the generation of dust. All haul roads will have edges clearly defined with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas. Obsolete roads will be ripped and re-vegetated.
Minor roads	Development of minor roads will be limited and the locations of these will be clearly defined. Minor roads used regularly for access etc will be watered. Obsolete roads will be ripped and re-vegetated.
Topsoil Stripping	Access tracks used by topsoil stripping equipment during their loading and unloading cycle will be watered.
Topsoil Stockpiling	Long term topsoil stockpiles not regularly used will be re-vegetated.
Drilling	Dust aprons will be lowered during drilling. Drills will be equipped with dust suppression systems will be used when high levels of dust are being generated.
Blasting	Meteorological conditions will be assessed prior to blasting. Adequate stemming will be used at all times.
Processing	Activities in the processing plant will be dust controlled.

It is also understood that as part of a revision of the Wilpinjong Coal Mine Air Quality Monitoring Programme that is currently being undertaken by WCPL, an additional TEOM to the west of the mine is proposed and a real time trigger and response protocol is being developed.

8.3 Spontaneous Combustion

Spontaneous combustion occurs when coal and other carbonaceous materials undergo natural oxidation and heat up. Under the right conditions, the heat from the oxidation reaction can build up to a point where the coal will ignite and burn. For self heating to occur, the composition of the coal must be such that low temperature oxidation can occur. Further, the material must be confined in such a way that heat from the oxidation is trapped, allowing the temperature to build up, but not so confined as to preclude the ingress of oxygen to the combustible material at a rate sufficient to promote the combustion and release of heat energy.

Once the coal reaches a high enough temperature it will liberate smoke, steam and volatile organic compounds (VOCs), some of which are odorous and can be harmful.

8.3.1 Spontaneous Combustion Management Plan

WCPL have developed a Spontaneous Combustion Management Plan (SCMP) for current operations at the site, approved as part of their Mining Operations Plan in accordance with Project Approval 05-0021. The SCMP outlines controls for the management of spontaneous combustion as part of the continued operations at the Project.

The objectives of the SCMP are to:

- minimise the risk of spontaneous combustion occurring on the Project;
- manage any occurrence of spontaneous combustion at the Project effectively and efficiently;
- minimise off-site impacts generated by spontaneous combustion; and
- minimise the impacts generated by spontaneous combustion to any personnel on site.

Management strategies have been in place at the Project since operation commenced and will continue for the Modification. Efforts are focussed on prevention of outbreaks, by reducing the risk, rather than management of outbreaks.

Spontaneous combustion events have occurred at the Project and have been effectively dealt with as follows:

- When smoke or other visible evidence of spontaneous combustion is identified in coal stockpiles (with the exception of flames), the stockpiles are reshaped using a fleet of dozers to expose the heated coal to air and allow cooling;
- In addition the reshaping process may also aid in the track rolling the coal which will also reduce the risk of potential spontaneous combustion outbreaks through slight compaction;
- In the overburden dumps, when smoke or other visible evidence of spontaneous combustion is identified (with the exception of flames) the angle of the batters will be reduced and the batters track rolled to accelerate airflow over the top of the compacted batters;
- Appropriate inert material will be placed over the top of the oxidised coal;
- Where there is an outbreak of spontaneous combustion and open flames are identified the area will be saturated in water to put out the flames and cool the combustible material. The Emergency Response Procedure will be initiated in the event of the identification of any open flames.

8.3.1.1 Impact Assessment

Management controls in place at the mine are designed to ensure that the likelihood of a spontaneous combustion event occurring are low. However, sporadic spontaneous combustion events do occur, and the potential for adverse air quality / odour impacts exists. However, given separation distances of 1 – 2 km to the nearest receptors, the potential for adverse health impacts due to a spontaneous combustion event is considered to be low. Previous studies undertaken by CSIRO (**Carras et al., 1999**) and assessments for other coal mines (**Holmes Air Sciences, 2007**) indicate that health impacts from toxic pollutants released from spontaneous combustion events are extremely unlikely at distances beyond 500m. However, from time to time emissions may cause detectable odour at residential areas. The frequency of impact, however, is expected to be low, due to the sporadic spontaneous combustion events and infrequent odour complaints received to date (refer **Section 4.4**).

9 GREENHOUSE GAS ASSESSMENT

It should be noted that the proposed Modification does not involve any expansion of the approved extent of mining or seek approval for the extraction of any additional coal. The potential impacts of the Modification on greenhouse gas emissions would therefore be largely limited to varying the timing of approved emissions, rather than any change to the total emissions of the Project. Notwithstanding, the following assessment has been undertaken to examine the contributions that may be expected from the remaining life of the approved Project incorporating data from fuel and electricity consumption of the current mining operation and the proposed Modification.

9.1 Greenhouse gas science

The temperature of the earth's atmosphere is determined almost entirely[4] by the balance in radiation received from the sun and that re-radiated to outer space (see for example **IPCC, 2001**).

The parts of the radiation spectrum through which the earth can re-radiate and lose energy to outer space depends on the composition of the atmosphere. Certain gases including water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and a range of other gases absorb electromagnetic energy in the infrared spectrum. Solar radiation from the sun contains most of its energy in the infrared, visible and ultraviolet parts of the spectrum.

Sunlight passes through the atmosphere and warms both the atmosphere and the earth's surface. Clouds and the earth's surface directly reflect some of the sun's radiation back to space, but much of the sun's radiation is absorbed by the earth's surface and some by the atmosphere, which are warmed. The warmed earth and its atmosphere then reradiate this energy back to space. For the average global temperature to remain constant, the incoming radiation from the sun must be balanced by the outgoing energy radiated from the earth and atmosphere.

Global warming (and the associated climate change) occurs because of the changing composition of the atmosphere, namely the increasing concentrations of GHGs, in particular CO_2, CH_4 and N_2O. These gases reduce the parts of the electromagnetic spectrum through which energy can be re-radiated from the earth. In response, the earth's temperature must increase to allow the rate of energy loss from the earth to increase and thereby allow the incoming and outgoing radiation to be brought back into balance. In summary, GHGs absorb electromagnetic energy and change the radiation balance of the earth causing the temperature to increase so that the radiation balance is restored.

4 The words "almost entirely" are used because the residual heat from the earth's formation and from the decay of radioactive elements in the earth have some effect on the earth's temperature.

Without the presence of any GHGs, the earth's average temperature would be extremely cold (-18 C) (**Seinfeld and Pandis, 1998**) and most of the planet would be uninhabitable. However, the effect of increasing greenhouse gases is to change existing climates and this will place stresses on current ecological systems that have adapted to current climate regimes.

Increasing concentrations of CO_2, CH_4 and other GHGs will cause the temperature of the atmosphere to increase but, because the earth transports heat from the equator towards the poles in a complicated way via ocean currents and winds, the precise effect of increasing concentrations is difficult to estimate for any particular location. The cause of the increasing concentrations of CO_2 and CH_4 is largely attributable to the increase in the worldwide use of fossil fuels to provide energy for increasing populations, which also have increasing per capita consumptions of energy. However, land clearing on a global scale is also an important cause in the change in the concentrations of CO_2.

9.2 Greenhouse gas assessment policy summary

9.2.1 Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is a panel established in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP), to provide independent scientific advice on climate change. The panel was asked to prepare, based on available scientific information, a report on all aspects relevant to climate change and its impacts and to formulate realistic response strategies. This first assessment report of the IPCC served as the basis for negotiating the United Nations Framework Convention on Climate Change (UNFCCC).

Since the UNFCCC has entered into force, the IPCC remains the pivotal source for its scientific, technical and socio-economic information.

The stated aims of the IPCC are to assess scientific information relevant to:

- human-induced climate change;
- the impacts of human-induced climate change; and
- options for adaptation and mitigation.

The fourth IPCC assessment report was released in 2007 (**IPCC, 2007**). IPCC reports are widely cited in climate change debates and policies, and are generally regarded as authoritative.

9.2.2 United Nations Framework Convention on Climate Change (UNFCCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognises that the climate system is a shared resource, the stability of which can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 183 countries (Parties) having ratified the contained treaty, the Kyoto Protocol (refer **Section 9.2.3**), including Australia, who ratified the Kyoto Protocol in December 2007.

Under the UNFCCC, governments:

- gather and share information on greenhouse gas emissions, national policies and best practices;

- launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and
- cooperate in preparing for adaptation to the impacts of climate change.

9.2.3 Kyoto Protocol

The Kyoto Protocol entered into force on 16 February 2005. The Kyoto Protocol builds upon the UNFCC by committing Annex I Parties to individual, legally-binding targets to limit or reduce their GHG emissions for the following gases:

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

The emission reduction targets are calculated based on a Party's domestic emission greenhouse inventories (which include the sectors land use change and forestry clearing, transportation, stationary energy, etc). Domestic inventories require approval by the Kyoto Enforcement Branch. The Kyoto Protocol requires developed countries to meet national targets for greenhouse gas emissions over a five year period between 2008 and 2012.

To achieve their targets, Annex I Parties must put in place *domestic policies and measures.* The Kyoto Protocol provides an indicative list of policies and measures that might help mitigate climate change and promote sustainable development.

Under the Kyoto Protocol, developed countries can use a number of flexible mechanisms to assist in meeting their targets. These are trading-based market mechanisms which include:

- Joint Implementation – where developed countries invest in GHG emission reduction projects in other developed countries; and
- Clean Development Mechanism – where developed countries invest in GHG emission reduction projects in developing countries.

Annex I countries that fail to meet their emissions reduction targets during the 2008-2012 period may be liable for a 30 percent penalty, to be made up in the post 2012 commitment period.

9.2.4 Australia and the Kyoto Protocol

The Kyoto Protocol is an international agreement under the United Nations Framework on Climate Change (UNFCC) that was agreed in 1997. As of January 2009 it has been ratified by 183 countries. Australia ratified the protocol in December 2007. The aim of the Protocol is to reduce global greenhouse gas emissions by requiring developed countries to meet national targets for greenhouse gas emissions over the five year period from 2008 to 2012. Australia's annual target is 108% of the 1990 emissions. Countries are required to take on a range of monitoring and reporting commitments, which are designed to ensure they remain on track to meet their obligations and to measure the overall success of the Protocol.

9.2.5 National Greenhouse and Energy Reporting Act

The *National Greenhouse and Energy Reporting Act 2007 (*NGER Act) was passed in September 2007. The NGER Act establishes a mandatory corporate reporting system for greenhouse gas emissions, energy consumption and production. The NGER scheme consolidates existing greenhouse reporting schemes. The NGER Act is underpinned by a number of legislative instruments that provide greater detail about obligations, which in conjunction with the NGER Act, form the National Greenhouse and Energy Reporting System, as follows:

- The National Greenhouse and Energy Reporting Regulations 2008; and
- The National Greenhouse and Energy Reporting (Measurement) Determination 2008;

NGER is seen as an important first step in the establishment of a domestic emissions trading scheme. Companies must register and report if they emit greenhouse emissions or produce/consume energy at or above the following trigger thresholds:

- if they own facilities that emit greater than 25 kilotonnes (kt) greenhouse emissions (expressed as CO_2-e) or produce consume greater than 100 terajoules (TJ) of energy; and
- if the corporate group emits greater than 125 kt of greenhouse emissions (expressed as CO_2-e) or produce consume greater than 500 TJ of energy.

9.2.6 Carbon Pollution Reduction Scheme

A green paper detailing Australia's plans to implement a domestic emissions trading scheme was released on the 16 July 2008. A subsequent white paper was released in December 2008 (**DCC, 2008**) with the intent that a Carbon Pollution Reduction Scheme (CPRS) would commence in July 2010. Due to the global financial crisis, the proposed start date was deferred to July 2011. The proposed CPRS is a 'cap and trade' emissions trading mechanism scheme whereby emitters of greenhouse gases greater than 25,000 t carbon dioxide-equivalent (CO_2-e) (Scope 1 only) are required to purchase a permit for every tonne of greenhouse gas that they emit. Legislation was introduced to Parliament in May 2009, and again in November 2009 but was voted down in the senate. The government has now decided to defer implementation of the CPRS until 2013 due to parliamentary opposition.

9.3 Greenhouse Gas Emission Calculation

Emissions of CO_2 and CH_4 will be the most significant greenhouse gases for the project. These gases are formed and released during the combustion of fuels used on site and from fugitive emissions occurring during the mining process, due to the fracturing of coal seams.

Inventories of greenhouse gas emissions can be calculated using published emission factors. Different gases have different greenhouse warming effects (referred to as global warming potentials) and emission factors take into account the global warming potentials of the gases created during combustion. The estimated emissions are referred to in terms of carbon dioxide equivalent or CO_2-equivalent (CO_2-e) emissions by applying the relevant global warming potential.

The greenhouse gas assessment has been conducted using the National Greenhouse Accounts (NGA) Factors, published by the Department of Climate Change (**DCC, 2009a**). DCC defines three 'scopes' (or emission categories):

- Scope 1 emissions cover direct emissions from sources within the project boundary such as fuel combustion and fugitive CH_4;

- Scope 2 emissions cover indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- Scope 3 emissions includes all other indirect emissions that are a consequence of the organisations activities but are not from sources owned or controlled by the organisations, for example, production of diesel fuel, off-site transport of the product, etc.

Project-related greenhouse gas sources included in the assessment are as follows:

- Fuel consumption (diesel) during mining operations -Scope 1;
- Release of fugitive CH_4 during mining – Scope 1;
- Indirect emissions resulting from the consumption of purchased electricity - Scope 2;
- Indirect emissions associated with the production and transport of fuels – Scope 3;
- Indirect emissions associated with transmission and distribution losses from electricity supply – Scope 3;
- Emissions from coal transportation – Scope 3; and
- Emissions from the burning of the product coal – Scope 3.

9.3.1 On-site Fuel Consumption

Greenhouse gas emissions from diesel consumption were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1000}$$

where:

E_{CO2-e}	=	Emissions of GHG from diesel combustion	(t CO_2-e)
Q	=	Estimated combustion of diesel	(GJ)[1]
EF	=	Emission factor (Scope 1 or Scope 3)for diesel combustion	(kg CO_2-e/GJ)[2]

[1] GJ = giga joules

[2] kg CO_2-e/GJ = kilograms of carbon dioxide equivalents per gigajoule

The quantity of diesel consumed (Q) in each year is based on a derived diesel intensity rate (megalitres per million tonnes per annum of run of mine coal [ML/Mtpa ROM]) derived from the 2009 average diesel consumption (15.6 megalitres [ML]) and ROM rate of 8.6 Mtpa. The quantity of diesel consumed in GJ is then calculated using an energy content factor for diesel of 38.6 gigajoules per kilolitre (GJ/kL). Greenhouse gas emission factors and energy content for diesel were sourced from the NGA Factors (**DCC, 2009a**). The estimated annual and project total GHG emissions from diesel usage are presented in **Table 9.1**.

Table 9.1: Estimated CO_2-e (tonnes) for On-site Diesel Consumption

Year	ROM (Mtpa)	Emissions (t CO_2-e)		Total
		Scope 1	Scope 3	
2010	10.6	51,583	371	51,954
2011	13.5	65,695	371	66,066
2012	13.5	65,695	371	66,066
2013	15	72,994	371	73,365
2014	15	72,994	371	73,365
2015	14.2	69,101	371	69,472
2016	13	63,262	371	63,633
2017	13	63,262	371	63,633
2018	13	63,262	371	63,633
2019	13	63,262	371	63,633
2020	12	58,396	371	58,767
2021	10.5	51,096	371	51,467
2022	10.1	49,150	371	49,521
2023	9.5	46,230	371	46,601
2024	9.4	45,743	371	46,114
2025	9.4	45,743	371	46,114
2026	6.2	30,171	371	30,542
Total	**200.9**	**977,638**	**6,309**	**983,947**

9.3.2 Electricity

Greenhouse gas emissions from electricity usage were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1000}$$

where:

$E_{CO2\text{-}e}$	=	Emissions of greenhouse gases from electricity usage	(tCO_2-e/annum)
Q	=	Estimated electricity usage	(kWh/annum)[1]
EF	=	Emission factor (Scope 2 or Scope 3) for electricity usage	($kgCO_2$-e/kWh)[2]

[1] kWh/annum = kilowatt hours per annum

[2] $kgCO_2$-e/kWh = kilograms of carbon dioxide equivalents per kilowatt hour

The quantity of electricity used each year is based on a derived intensity rate (kWh/Mtpa ROM) derived from the 2008/2009 annual electricity consumption (15,867,629 kilowatt hours [kWh]) and ROM rate of 8.6 Mtpa for 2009. Greenhouse gas emission factors were sourced from the NGA Factors (**DCC, 2009a**). The estimated annual and project total GHG emissions from electricity usage are presented in **Table 9.2**.

Table 9.2: Estimated CO_2-e (tonnes) for On-site Electricity Use

Year	ROM (Mtpa)	Emissions (t CO_2-e)		Total
		Scope 2	Scope 3	
2010	10.6	17,406	3,520	20,927
2011	13.5	22,169	4,484	26,652
2012	13.5	22,169	4,484	26,652
2013	15	24,632	4,982	29,613
2014	15	24,632	4,982	29,613
2015	14.2	23,318	4,716	28,034
2016	13	21,347	4,317	25,665
2017	13	21,347	4,317	25,665
2018	13	21,347	4,317	25,665
2019	13	21,347	4,317	25,665
2020	12	19,705	3,985	23,691
2021	10.5	17,242	3,487	20,729
2022	10.1	16,585	3,354	19,940
2023	9.5	15,600	3,155	18,755
2024	9.4	15,436	3,122	18,558
2025	9.4	15,436	3,122	18,558
2026	6.2	10,181	2,059	12,240
Total	**200.9**	**329,901**	**66,722**	**396,622**

9.3.3 Fugitive Methane

Emissions from fugitive CH_4 were estimated based on the using the following equation:

$$E_{co2-e} = Q \times EF$$

where:

E_{CO2-e}	=	Emissions of greenhouse gases from fugitive CH_4	(t CO_2-e/annum)
Q	=	ROM coal extracted during the year	(t)
EF	=	Scope 1 emission factor	(t CO_2-e/tonne)

Emission factors for fugitive methane (1.2 kg CO_2-e /tonne ROM) were sourced from site specific emissions data for the Project (**Holmes Air Sciences, 2005**). Test results from 5 borehole samples indicated average gas volumes of 0.51 cubic metres per tonne (m^3/t) and average composition of 4% CH_4 and 92% CO_2. Based on these values and taking into account the global warming potential of methane, the total fugitive CO_2-e emissions were estimated at 1.2 kilograms per tonne ROM (kg/tonne ROM).

The estimated annual and project total GHG emissions from fugitive methane are presented in **Table 9.3**.

Table 9.3: Estimated CO_2-e (tonnes) for Fugitive Methane

Year	ROM (Mtpa)	Scope 1 Emissions (t CO_2-e)
2010	10.6	12,720
2011	13.5	16,200
2012	13.5	16,200
2013	15	18,000
2014	15	18,000
2015	14.2	17,040
2016	13	15,600
2017	13	15,600
2018	13	15,600
2019	13	15,600
2020	12	14,400
2021	10.5	12,600
2022	10.1	12,120
2023	9.5	11,400
2024	9.4	11,280
2025	9.4	11,280
2026	6.2	7,440
Total	**200.9**	**241,080**

9.3.4 Explosives

Emissions from explosive usage were estimated based on the using the following equation:

$$E_{co2-e} = Q \times EF$$

where:

E_{CO2-e}	=	Emissions of greenhouse gases from explosives	(tCO_2-e/annum)
Q	=	Quantity of explosive used (assumed ANFO)	(t)
EF	=	Scope 1 emission factor	(tCO_2-e/tonne explosive)

Greenhouse gas emission factors were sourced from the Australian Greenhouse Office (AGO) Factors and Methods Workbook – December 2006. It is noted that the AGO Factors and Methods were replaced by the NGA Factors (**DCC, 2009a**), however the emission factor for explosives was dropped from the latest version. Emissions from explosives do not have to be reported under NGERS.

The estimated annual and project total GHG emissions from explosive usage are presented in **Table 9.4.**

Table 9.4: Estimated CO_2-e (tonnes) for Explosive Use

Year	ROM (Mtpa)	Scope 1 Emissions (t CO_2-e)
2010	10.6	600
2011	13.5	764
2012	13.5	764
2013	15	849
2014	15	849
2015	14.2	803
2016	13	736
2017	13	736
2018	13	736
2019	13	736
2020	12	679
2021	10.5	594
2022	10.1	571
2023	9.5	538
2024	9.4	532
2025	9.4	532
2026	6.2	351
Total	**200.9**	**11,368**

9.3.5 Other Scope 3 Emissions

9.3.5.1 Transportation

Emissions from coal transportation have been estimated based on 7 Mtpa of product coal being transported to Macquarie Generation with the remainder being transported to Newcastle for export. Emissions associated with product coal transportation have been estimated based on an emission factor for loaded trains of 12.3 g/net tonne-km (**QR Network Access, 2002**).

Emission factors were not available for unloaded trains so the factor for loaded trains is conservatively applied for the return trip. The return rail trip to Macquarie Generation is assumed to be 300 km and 500 km to Newcastle.

The total estimated GHG emissions from rail transport are provided in **Table 9.5**.

Table 9.5: Estimated CO_2-e (tonnes) for Rail Transportation

Year	Product Coal Mtpa			Scope 3 Emissions (t CO_2-e)
	Total	Newcastle	Macquarie Generation	
2010	8.5	1.5	7.0	35,055
2011	10.8	3.8	7.0	49,200
2012	10.8	3.8	7.0	49,200
2013	12.0	5.0	7.0	56,580
2014	12.0	5.0	7.0	56,580
2015	11.4	4.4	7.0	52,890
2016	10.4	3.4	7.0	46,740
2017	10.4	3.4	7.0	46,740
2018	10.4	3.4	7.0	46,740
2019	10.4	3.4	7.0	46,740
2020	9.6	2.6	7.0	41,820
2021	8.4	1.4	7.0	34,440
2022	8.1	1.1	7.0	32,595
2023	7.6	0.6	7.0	29,520
2024	7.5	0.5	7.0	28,905
2025	7.5	0.5	7.0	28,905
2026	5.0	-	5.0	18,450
Total	**160.8**	**43.8**	**117.0**	**701,100**

Emissions from the shipping of product coal are not included in this assessment due to the difficulties in emission estimates, including uncertainty in export markets and limited data on emission factors and / or fuel consumption for ocean going vessels.

9.3.5.2 Burning Product Coal

Greenhouse gas emissions from the burning of product coal were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EC \times EF}{1000}$$

Where:

$E_{CO2\text{-}e}$	=	Emissions of GHG from coal combustion	(t CO_2-e)
Q	=	Quantity of product coal burnt	(GJ)
EC	=	Energy Content Factor for black coal	(GJ/t)[1]
EF	=	Emission factor for coal combustion	(kg CO_2-e/GJ)

[1] GJ/t = gigajoules per tonne

The quantity of coal burnt in Mtpa is converted to GJ using an energy content factor for black coal of 27 GJ/t. The greenhouse gas emission factor and energy content for coal were sourced from the NGA Factors (**DCC, 2009a**).

The emissions associated with burning of the product coal are presented in **Table 9.6**.

Table 9.6: Scope 3 Emissions for Product Coal

Year	Product Coal Mtpa	Scope 3 Emissions (t CO_2-e)
2010	8.5	20,294,685
2011	10.8	25,786,188
2012	10.8	25,786,188
2013	12.0	28,651,320
2014	12.0	28,651,320
2015	11.4	27,218,754
2016	10.4	24,831,144
2017	10.4	24,831,144
2018	10.4	24,831,144
2019	10.4	24,831,144
2020	9.6	22,921,056
2021	8.4	20,055,924
2022	8.1	19,339,641
2023	7.6	18,145,836
2024	7.5	17,907,075
2025	7.5	17,907,075
2026	5.0	11,938,050
Total	**160.8**	**383,927,688**

9.4 Summary of GHG Emissions

A summary of the total GHG emissions associated with the Project incorporating the Modification are presented in **Table 9.7**.

Table 9.7: Summary of GHG Emissions (t CO_2-e)

Emission Source	Scope 1	Scope 2	Scope 3	Total
	t CO_2-e/annum			
Diesel	57,508		371	57,879
Electricity		19,406	3,925	23,331
Explosives	669			669
Fugitive CH_4	14,181			14,181
Coal Transportation			41,241	41,241
Coal Burning			22,583,982	22,583,982
Total –Average Annual	**72,358**	**19,406**	**22,629,519**	**22,721,283**
Total – 2010 to 2026	**1,230,086**	**329,901**	**384,701,818**	**386,261,805**

A comparison is made with the baseline 1990 Australian emissions, which are reported under the Kyoto Protocol as 547.7 Mt CO_2-e (**DCC, 2009b**). The baseline is used to assign Australian target under the Kyoto Protocol, which is 108% of the 1990 level.

Comparing the average annual Scope 1 emissions from the Project incorporating the Modification against the 1990 baseline indicates that the Project emissions are 0.01% of the 1990 levels.

The annual greenhouse emissions for NSW in 2007 were 151.6 Mt (**DCC, 2009c**). Average annual Scope 1 emissions from the Project incorporating the Modification are 0.05% of these levels.

10 CONCLUSIONS

This report has assessed the air quality associated with a proposed Modification to the approved Wilpinjong Coal Mine in central New South Wales. The approved Project is an open cut coal mine that is approved to operate over a period of approximately 21 years and includes open cut mining, processing facilities, rail loading and coal stockpiling areas, waste rock emplacement areas and associated infrastructure.

The potential impacts of the approved Project were assessed by Holmes Air Sciences (**2005**) as a component of the original Environmental Impact Statement (**WCPL, 2005**). The 2005 Holmes Air Sciences assessment predicted compliance with relevant air quality criteria at all nearby private receptors except the nearest private residence to the north of Pit 6 (now mine owned).

The Modification of the Project would involve an increase in the approved maximum ROM coal mining rate from 13 Mtpa to 15 Mtpa and a small increase in the maximum annual rate of overburden mined. No change is proposed to the approved life of the Project or the approved extent of open cut mining.

While the location of the approved mining operation would not be altered and the proposed incremental changes to production rates associated with the Modification would not significantly alter the overall dust emissions of the approved Project, the mining sequence and the focus of mining operations in the peak production year would be further to the east than anticipated in the original proposal. Re-modelling of the potential peak air quality emissions was therefore undertaken.

Two operating scenarios have been assessed to represent the potential air quality impacts that the Project would have on private receptors (e.g. residences) in the proximity of the Project.

Dispersion modelling has been used to assess the impact that dust emissions from the modified operation would have on the local air quality. The emissions inventories developed for each scenario have been used with local meteorological data and a modified version of the US EPA's ISCST3 model to predict the maximum 24-hour PM_{10}, annual average PM_{10}, annual average TSP and annual average dust deposition. The modelling has been undertaken to show the effects of the modified Project alone and with background dust levels considered.

Air quality impacts are not predicted to exceed the applicable annual assessment criteria at any private receptor.

Modelling results show potential exceedances of the DECCW's 24-hour average PM_{10} criteria at three private receptors located to the immediate east of Pit 3 (31, 53 and 55) during the peak year of mining operations (Year 9 or 2014). However, statistical analysis was conducted to show that the majority of PM_{10} concentrations lie below 25 $\mu g/m^3$ at each residence which suggests that there is a low risk of high 24-hour PM_{10} concentrations due to mining operations at these private receptors, even in Year 9.

The Modification would not significantly alter the total greenhouse gas emissions of the approved Project. However, a greenhouse gas assessment has been conducted using fuel and electricity consumption information from the existing mining operation and the current National Greenhouse Accounts Factors.

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Appendix A: Joint wind speed, wind direction and stability class tables for Wilpinjong Coal meteorological station

STATISTICS FOR FILE: C:\Jobs\Wilpinjong\Met\Processed Met\Wilpinjong08_Met.isc
MONTHS: All
HOURS : All
OPTION: Frequency

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001252	0.001025	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002277
NE	0.003188	0.005237	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008424
ENE	0.003301	0.009107	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012409
E	0.004212	0.009791	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014003
ESE	0.002277	0.006034	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008311
SE	0.002846	0.002163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005009
SSE	0.001480	0.002163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003643
S	0.001708	0.001480	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003188
SSW	0.001708	0.001935	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003643
SW	0.001821	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
WSW	0.002505	0.002163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004668
W	0.004440	0.002049	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006489
WNW	0.005692	0.004212	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.009904
NW	0.002391	0.003529	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005920
NNW	0.001366	0.001252	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002618
N	0.001025	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001821
CALM									0.011270
TOTAL	0.041211	0.055669	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.108151

MEAN WIND SPEED (m/s) = 1.52
NUMBER OF OBSERVATIONS = 950

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000114	0.000228	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455
NE	0.001025	0.001821	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.003643
ENE	0.000797	0.004326	0.006148	0.000000	0.000000	0.000000	0.000000	0.000000	0.011270
E	0.000911	0.004212	0.005123	0.000000	0.000000	0.000000	0.000000	0.000000	0.010246
ESE	0.000569	0.000797	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.002049
SE	0.000342	0.000455	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.001025
SSE	0.000000	0.000455	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
S	0.000228	0.000228	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
SSW	0.000114	0.000114	0.000569	0.000000	0.000000	0.000000	0.000000	0.000000	0.000797
SW	0.000114	0.000455	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.001366
WSW	0.000455	0.001480	0.003871	0.000000	0.000000	0.000000	0.000000	0.000000	0.005806
W	0.000569	0.001708	0.003188	0.000000	0.000000	0.000000	0.000000	0.000000	0.005464
WNW	0.002277	0.001594	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.006603
NW	0.000683	0.001935	0.002163	0.000000	0.000000	0.000000	0.000000	0.000000	0.004781
NNW	0.000342	0.000797	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480
N	0.000114	0.000228	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
CALM									0.001821
TOTAL	0.008652	0.020833	0.027209	0.000000	0.000000	0.000000	0.000000	0.000000	0.058515

MEAN WIND SPEED (m/s) = 2.60
NUMBER OF OBSERVATIONS = 514

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000114	0.000569	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000797
NE	0.000569	0.001025	0.000797	0.000228	0.000000	0.000000	0.000000	0.000000	0.002618
ENE	0.000455	0.004781	0.014344	0.004895	0.000000	0.000000	0.000000	0.000000	0.024476
E	0.000342	0.007741	0.026639	0.011043	0.000000	0.000000	0.000000	0.000000	0.045765
ESE	0.000569	0.003074	0.003643	0.001025	0.000000	0.000000	0.000000	0.000000	0.008311
SE	0.000342	0.000455	0.001480	0.000000	0.000000	0.000000	0.000000	0.000000	0.002277
SSE	0.000228	0.000683	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.001138
S	0.000000	0.000228	0.000342	0.000228	0.000000	0.000000	0.000000	0.000000	0.000797
SSW	0.000000	0.000342	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000797
SW	0.000114	0.000569	0.002049	0.001821	0.000000	0.000000	0.000000	0.000000	0.004554
WSW	0.000228	0.000911	0.005806	0.007628	0.000000	0.000000	0.000000	0.000000	0.014572
W	0.000455	0.001366	0.005351	0.005806	0.000000	0.000000	0.000000	0.000000	0.012978
WNW	0.001025	0.000797	0.005578	0.001594	0.000000	0.000000	0.000000	0.000000	0.008994
NW	0.000455	0.002391	0.003757	0.001252	0.000000	0.000000	0.000000	0.000000	0.007855
NNW	0.000000	0.000342	0.000797	0.000342	0.000000	0.000000	0.000000	0.000000	0.001480
N	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000114
CALM									0.000114
TOTAL	0.005009	0.025273	0.071380	0.035861	0.000000	0.000000	0.000000	0.000000	0.137637

MEAN WIND SPEED (m/s) = 3.80
NUMBER OF OBSERVATIONS = 1209

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000228	0.000683	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.001252
NE	0.001252	0.003529	0.001708	0.000000	0.000000	0.000000	0.000000	0.000000	0.006489
ENE	0.002960	0.013889	0.017077	0.002960	0.000342	0.000000	0.000000	0.000000	0.037227
E	0.003074	0.019012	0.021972	0.006148	0.001594	0.000114	0.000000	0.000000	0.051913
ESE	0.005692	0.021858	0.012181	0.005123	0.000683	0.000000	0.000000	0.000000	0.045537
SE	0.007628	0.010587	0.002049	0.000911	0.000000	0.000000	0.000000	0.000000	0.021175
SSE	0.001708	0.002732	0.000114	0.000342	0.000114	0.000000	0.000000	0.000000	0.005009
S	0.000342	0.000797	0.000797	0.000228	0.000114	0.000114	0.000000	0.000000	0.002391
SSW	0.000228	0.001025	0.000797	0.000569	0.000114	0.000114	0.000000	0.000000	0.002846
SW	0.000911	0.002049	0.003415	0.003188	0.001025	0.000455	0.000228	0.000000	0.011270
WSW	0.000911	0.003188	0.009221	0.010474	0.008994	0.001366	0.000228	0.000000	0.034381
W	0.001366	0.006034	0.017760	0.015483	0.011270	0.004554	0.001252	0.000342	0.058060
WNW	0.002163	0.011157	0.009449	0.004098	0.003188	0.000911	0.000797	0.000000	0.031762
NW	0.000911	0.005464	0.005578	0.004212	0.003757	0.001480	0.000911	0.000000	0.022313
NNW	0.000114	0.000797	0.001594	0.001252	0.000683	0.000000	0.000000	0.000000	0.004440
N	0.000114	0.000000	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455
CALM									0.004212
TOTAL	0.029599	0.102801	0.104394	0.054986	0.031876	0.009107	0.003415	0.000342	0.340733

MEAN WIND SPEED (m/s) = 3.71
NUMBER OF OBSERVATIONS = 2993

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000342	0.000342	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911
NE	0.001935	0.001252	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.003301
ENE	0.002391	0.002391	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004781
E	0.005351	0.008766	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014117
ESE	0.005237	0.004554	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.009904
SE	0.006831	0.006944	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.013775
SSE	0.002960	0.001594	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
S	0.001708	0.000911	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.002732
SSW	0.000683	0.001025	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.002391
SW	0.003301	0.001708	0.001252	0.000228	0.000000	0.000000	0.000000	0.000000	0.006489
WSW	0.003301	0.002277	0.001594	0.000342	0.000000	0.000000	0.000000	0.000000	0.007514
W	0.006261	0.003529	0.000455	0.000228	0.000000	0.000000	0.000000	0.000000	0.010474
WNW	0.002618	0.005692	0.000797	0.000114	0.000000	0.000000	0.000000	0.000000	0.009221
NW	0.000797	0.002505	0.001480	0.000114	0.000000	0.000000	0.000000	0.000000	0.004895
NNW	0.000569	0.000683	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480
N	0.000228	0.000228	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000569
CALM									0.014003
TOTAL	0.044513	0.044399	0.007172	0.001025	0.000000	0.000000	0.000000	0.000000	0.111111

MEAN WIND SPEED (m/s) = 1.54
NUMBER OF OBSERVATIONS = 976

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000683
NE	0.003188	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003415
ENE	0.005464	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006375
E	0.009221	0.001138	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010360
ESE	0.012637	0.001935	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014572
SE	0.014913	0.001821	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.016735
SSE	0.014800	0.001821	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.016621
S	0.010929	0.001366	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012295
SSW	0.011612	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012295
SW	0.014800	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015710
WSW	0.018784	0.002277	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.021061
W	0.013092	0.002618	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015710
WNW	0.006375	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007058
NW	0.002277	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003188
NNW	0.001025	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480
N	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000683
CALM									0.085610
TOTAL	0.140483	0.017760	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.243852

MEAN WIND SPEED (m/s) = 0.79
NUMBER OF OBSERVATIONS = 2142

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.002732	0.002846	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.006375
NE	0.011157	0.013092	0.003415	0.000228	0.000000	0.000000	0.000000	0.000000	0.027892
ENE	0.015369	0.035405	0.037568	0.007855	0.000342	0.000000	0.000000	0.000000	0.096539
E	0.023110	0.050660	0.053734	0.017190	0.001594	0.000114	0.000000	0.000000	0.146403
ESE	0.026981	0.038251	0.016621	0.006148	0.000683	0.000000	0.000000	0.000000	0.088684
SE	0.032901	0.022427	0.003757	0.000911	0.000000	0.000000	0.000000	0.000000	0.059995
SSE	0.021175	0.009449	0.000455	0.000342	0.000114	0.000000	0.000000	0.000000	0.031535
S	0.014913	0.005009	0.001366	0.000455	0.000114	0.000114	0.000000	0.000000	0.021972
SSW	0.014344	0.005123	0.002505	0.000569	0.000114	0.000114	0.000000	0.000000	0.022769
SW	0.021061	0.008424	0.007514	0.005237	0.001025	0.000455	0.000228	0.000000	0.043944
WSW	0.026184	0.012295	0.020492	0.018443	0.008994	0.001366	0.000228	0.000000	0.088001
W	0.026184	0.017304	0.026753	0.021516	0.011270	0.004554	0.001252	0.000342	0.109176
WNW	0.020150	0.024135	0.018556	0.005806	0.003188	0.000911	0.000797	0.000000	0.073543
NW	0.007514	0.016735	0.012978	0.005578	0.003757	0.001480	0.000911	0.000000	0.048953
NNW	0.003415	0.004326	0.002960	0.001594	0.000683	0.000000	0.000000	0.000000	0.012978
N	0.002277	0.001252	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.004212
CALM									0.117031
TOTAL	0.269467	0.266735	0.210155	0.091872	0.031876	0.009107	0.003415	0.000342	1.000000

MEAN WIND SPEED (m/s) = 2.47
NUMBER OF OBSERVATIONS = 8784

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 10.8%
B : 5.9%
C : 13.8%
D : 34.1%
E : 11.1%
F : 24.4%

STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0134	0059	0173
02	0000	0000	0000	0112	0070	0184
03	0000	0000	0000	0110	0057	0199
04	0000	0000	0000	0102	0076	0188
05	0000	0000	0000	0100	0074	0192
06	0014	0000	0009	0092	0081	0170
07	0072	0024	0041	0093	0022	0114
08	0150	0044	0073	0067	0010	0022
09	0139	0054	0101	0072	0000	0000
10	0113	0048	0129	0076	0000	0000
11	0096	0060	0133	0077	0000	0000
12	0103	0051	0130	0082	0000	0000
13	0083	0060	0131	0092	0000	0000
14	0073	0068	0120	0105	0000	0000
15	0062	0046	0132	0126	0000	0000
16	0031	0045	0126	0156	0004	0004
17	0013	0013	0071	0238	0017	0014
18	0001	0001	0013	0241	0063	0047
19	0000	0000	0000	0192	0078	0096
20	0000	0000	0000	0172	0078	0116
21	0000	0000	0000	0154	0074	0138

22	0000	0000	0000	0143	0071	0152
23	0000	0000	0000	0134	0074	0158
24	0000	0000	0000	0123	0068	0175

STABILITY CLASS BY MIXING HEIGHT

Mixing height	A	B	C	D	E	F
<=500 m	0307	0070	0114	0472	0935	2103
<=1000 m	0357	0203	0476	1123	0008	0011
<=1500 m	0286	0241	0619	1183	0033	0028
<=2000 m	0000	0000	0000	0166	0000	0000
<=3000 m	0000	0000	0000	0047	0000	0000
>3000 m	0000	0000	0000	0002	0000	0000

MIXING HEIGHT BY HOUR OF DAY

Hour	0000 to 0100	0100 to 0200	0200 to 0400	0400 to 0800	0800 to 1600	1600 to 3200	Greater than 3200
01	0186	0044	0024	0040	0064	0008	0000
02	0195	0053	0020	0034	0055	0009	0000
03	0211	0043	0013	0041	0048	0010	0000
04	0209	0057	0007	0035	0047	0011	0000
05	0236	0045	0014	0029	0039	0003	0000
06	0170	0106	0063	0013	0011	0003	0000
07	0110	0061	0121	0072	0000	0002	0000
08	0000	0072	0123	0171	0000	0000	0000
09	0000	0000	0103	0189	0074	0000	0000
10	0000	0000	0000	0232	0134	0000	0000
11	0000	0000	0000	0146	0220	0000	0000
12	0000	0000	0000	0092	0274	0000	0000
13	0000	0000	0000	0000	0366	0000	0000
14	0000	0000	0000	0000	0366	0000	0000
15	0000	0000	0000	0000	0366	0000	0000
16	0000	0000	0000	0000	0366	0000	0000
17	0002	0002	0003	0011	0345	0003	0000
18	0028	0039	0013	0027	0242	0017	0000
19	0088	0055	0026	0040	0137	0019	0001
20	0119	0061	0022	0039	0108	0017	0000
21	0144	0059	0012	0040	0091	0020	0000
22	0160	0059	0012	0035	0087	0013	0000
23	0168	0061	0008	0049	0069	0011	0000
24	0182	0061	0012	0042	0057	0012	0000

Appendix B: PM_{10}, TSP and dust deposition monitoring data

Table B.1: HVAS PM_{10} monitoring data

Date	HVAS - PM_{10} ($\mu g/m^3$)			
	HV1 - Wollar Village	HV2 - West	HV3 - East	HV4 - South
04-Jan-06	22.7	-	-	-
10-Jan-06	10.5	-	-	-
16-Jan-06	7.4	-	-	-
22-Jan-06	14.0	-	-	-
28-Jan-06	13.7	-	-	-
04-Feb-06	10.6	-	-	-
09-Feb-06	23.5	-	-	-
15-Feb-06	10.7	-	-	-
21-Feb-06	12.3	-	-	-
27-Feb-06	11.9	-	-	-
05-Mar-06	12.1	-	-	-
11-Mar-06	30.1	-	-	-
17-Mar-06	14.0	-	-	-
23-Mar-06	10.0	-	-	-
29-Mar-06	14.2	-	-	-
04-Apr-06	22.0	-	-	-
10-Apr-06	8.9	-	-	-
16-Apr-06	8.4	-	-	-
22-Apr-06	7.4	-	-	-
28-Apr-06	14.9	-	-	-
04-May-06	10.9	-	-	-
10-May-06	15.2	-	-	-
16-May-06	20.9	-	-	-
22-May-06	14.8	-	-	-
28-May-06	12.7	-	-	-
03-Jun-06	15.9	-	-	-
10-Jun-06	3.7	-	-	-
15-Jun-06	9.6	-	-	-
21-Jun-06	7.7	-	-	-
27-Jun-06	11.3	-	-	-
03-Jul-06	4.8	-	-	-
09-Jul-06	14.1	-	-	-
15-Jul-06	5.2	-	-	-
21-Jul-06	11.1	-	-	-
27-Jul-06	10.2	-	-	-
02-Aug-06	12.9	-	-	-
08-Aug-06	11.2	-	-	-
14-Aug-06	15.9	-	-	-
20-Aug-06	10.7	-	-	-
26-Aug-06	8.3	-	-	-
01-Sep-06	14.0	9.9	-	13.6
07-Sep-06	3.3	3.1	-	3.3
13-Sep-06			-	
19-Sep-06			-	
25-Sep-06	21.1	28.7	-	17.6
27-Sep-06	12.7	14.8	-	10.9
01-Oct-06	19.2	14.5	-	18.4
04-Oct-06		20.1	-	19.3
07-Oct-06	23.2	20.3	-	25.3
12-Oct-06		-	-	-
13-Oct-06	24.3	33.5	-	
17-Oct-06	17.3	-	-	-
19-Oct-06	24.7	21.4	19.8	
25-Oct-06	26.5	26.0	19.6	
31-Oct-06	24.1	23.4	17.3	
06-Nov-06	9.2	8.5	5.7	
12-Nov-06	18.6	14.8	16.6	
18-Nov-06	19.5	12.4	13.3	18.4
24-Nov-06	32.0	29.6	33.7	33.3
30-Nov-06	29.1	24.2		31.8
06-Dec-06	34.5	**59.2**		28.4
12-Dec-06	16.2	15.9		15.6
18-Dec-06	23.9	35.8		26.0
24-Dec-06			8.4	9.3
30-Dec-06	7.2			6.9
05-Jan-07	12.7			12.0
11-Jan-07	24.3			23.0
17-Jan-07	24.9			26.5
23-Jan-07	23.8			20.4
29-Jan-07	20.4			16.7
31-Jan-07	-	-	-	20.8
04-Feb-07	24.6			23.0

Date	HVAS - PM_{10} ($\mu g/m^3$)			
	HV1 - Wollar Village	HV2 - West	HV3 - East	HV4 - South
10-Feb-07				
14-Feb-07	12.0	-	-	11.1
16-Feb-07	12.0			10.4
22-Feb-07	18.0			14.4
28-Feb-07	12.1			13.5
06-Mar-07	1.6	17.1	-	9.3
12-Mar-07		29.9	-	19.9
18-Mar-07	6.4	6.3	-	4.0
21-Mar-07	17.6	-	-	-
24-Mar-07	30.2	22.2	-	21.0
30-Mar-07	25.8	11.6	-	12.5
05-Apr-07	12.7	27.0	-	11.7
11-Apr-07	23.9	27.3	-	14.3
17-Apr-07	23.3	31.4	-	21.3
23-Apr-07	17.9	15.2	-	13.1
29-Apr-07			-	
02-May-07	10.9	9.2	-	10.6
05-May-07	34.5	30.4	-	30.5
11-May-07		13.5	-	10.4
17-May-07		18.1	-	7.8
23-May-07		5.6	-	5.5
29-May-07		13.7	-	8.7
04-Jun-07		4.9	-	4.7
10-Jun-07		4.9	-	6.1
14-Jun-07	9.5	-	-	-
16-Jun-07	6.5	2.6	-	2.7
22-Jun-07	5.1	2.5	-	3.3
28-Jun-07	2.0	1.6	-	1.5
04-Jul-07	5.0	4.6	-	5.1
10-Jul-07	6.6	6.8	-	4.3
16-Jul-07	8.0	6.1	-	7.9
22-Jul-07	6.2	7.7	-	4.8
28-Jul-07	3.5	4.4	-	4.8
03-Aug-07	3.3	1.9	-	2.3
09-Aug-07	7.6	8.7	-	6.6
15-Aug-07	11.0	23.7	-	9.6
21-Aug-07	4.6	7.5	-	4.6
27-Aug-07	9.5	12.7	-	10.1
02-Sep-07	15.9	22.7	-	16.4
08-Sep-07	5.4	12.7	-	3.9
14-Sep-07	18.4	44.0	-	29.1
20-Sep-07	10.2	24.5	-	11.1
26-Sep-07	20.1	30.1	-	21.0
02-Oct-07	22.6	27.3	-	31.5
08-Oct-07	18.9	19.3	-	15.2
14-Oct-07	10.6	18.0	-	
20-Oct-07	35.1	45.1	-	36.5
26-Oct-07	5.5	5.4	-	6.0
01-Nov-07	15.5	18.0	-	14.9
07-Nov-07	4.7	5.9	-	4.0
13-Nov-07	13.1	25.0	-	14.9
19-Nov-07	19.2	25.8	-	19.5
25-Nov-07	10.5	10.4	-	9.3
01-Dec-07	8.9	8.8	-	8.4
07-Dec-07	13.8	14.2	-	14.5
13-Dec-07	13.7	17.5	-	15.2
19-Nov-07	19.2	25.8	-	19.5
25-Dec-07	11.1	10.2	-	12.0
31-Dec-07	25.8	26.5	-	27.5
06-Jan-08	6.1	8.6	-	6.1
12-Jan-08	24.2	32.3	-	31.0
18-Jan-08	3.0	3.3	-	3.3
24-Jan-08	17.3	18.7	-	17.8
30-Jan-08	15.6	22.9	-	17.2
05-Feb-08	9.8		-	-
11-Feb-08	10.9	12.0	-	10.5
14-Feb-08	-	22.4	-	13.5
17-Feb-08	10.0	11.4	-	7.4
23-Feb-08	38.4	39.5	-	36.5
26-Feb-08	-	-	-	-
29-Feb-08	9.2	8.0	-	7.1
04-Mar-08	-	-	-	-
06-Mar-08	19.1	23.1	-	17.2
12-Mar-08	28.6	19.8	-	18.8

Date	HVAS - PM$_{10}$ (µg/m^3)			
	HV1 - Wollar Village	HV2 - West	HV3 - East	HV4 - South
18-Mar-08	16.6	23.3	-	14.6
24-Mar-08	14.3	13.6	-	11.8
30-Mar-08	11.8	12.0	-	13.9
02-Apr-08	-	-	-	-
05-Apr-08	14.9	19.9	-	13.4
11-Apr-08	11.7	16.8	-	10.9
17-Apr-08	10.9	15.1	-	11.5
23-Apr-08	3.3	6.1	-	2.4
29-Apr-08	4.6	4.1	-	3.4
05-May-08	13.3	15.7	-	10.7
11-May-08	14.8	18.7	-	14.3
17-May-08	9.8	8.1	-	9.0
23-May-08	7.7	7.9	-	6.4
29-May-08	10.2	9.9	-	5.3
04-Jun-08	2.5	1.7	-	1.1
10-Jun-08	4.8	4.2	-	2.4
16-Jun-08	4.5	5.2	-	3.4
22-Jun-08	3.7	3.0	-	2.6
28-Jun-08	10.6	10.5	-	3.1
04-Jul-08	2.5	7.5	-	5.7
10-Jul-08	2.2	2.3	-	5.7
16-Jul-08	4.5	5.0	-	2.1
22-Jul-08		7.6	-	3.7
28-Jul-08	5.6	2.4	-	2.7
03-Aug-08	5.3	4.0	-	2.8
09-Aug-08	5.3	3.0	-	2.2
15-Aug-08	2.6	3.2	-	1.8
21-Aug-08	14.0		-	15.5
27-Aug-08	13.2	10.5	-	11.7
02-Sep-08	6.6	6.7	-	4.9
08-Sep-08	5.1	5.3	-	5.4
14-Sep-08	8.4	8.7	-	9.3
20-Sep-08	18.7	19.3	-	21.0
26-Sep-08	10.1	9.8	-	6.8
02-Oct-08	17.9	22.6	-	21.7
08-Oct-08	6.0	6.4	-	4.8
14-Oct-08	4.7	7.6	-	4.9
20-Oct-08	16.1	26.9	-	18.2
26-Oct-08	15.6	-	-	18.8
01-Nov-08	22.9	-	-	20.5
07-Nov-08	23.7	-	-	22.4
13-Nov-08	18.9	-	-	11.8
19-Nov-08	5.1	-	-	4.4
25-Nov-08	18.1	-	-	15.1
01-Dec-08	12.8	-	-	11.4
07-Dec-08	10.7	11.3	-	10.0
13-Dec-08	19.2	17.5	-	18.3
19-Dec-08	8.4	7.1	-	7.3
25-Dec-08	13.3	11.1	-	11.8
31-Dec-08	26.8		-	24.5
06-Jan-09	19.4	17.0	-	20.9
12-Jan-09	16.1	16.2	-	16.1
18-Jan-09	17.6	19.9	-	19.3
24-Jan-09	13.9	22.9	-	14.4
30-Jan-09	17.6	27.7	-	18.1
05-Feb-09	16.5	31.6	-	18.3
11-Feb-09	7.1	8.0	-	7.7
17-Feb-09	4.8	5.6	-	4.0
23-Feb-09	13.7	15.2	-	13.5
01-Mar-09	28.3		-	-
07-Mar-09	18.3	13.5	-	
13-Mar-09	10.2		-	
19-Mar-09	13.1	27.0	-	
25-Mar-09	35.1	32.6	-	30.5
31-Mar-09		12.3	-	
06-Apr-09	15.0	14.5	-	15.5
12-Apr-09	6.4	5.6	-	5.8
18-Apr-09	14.5	21.0	-	18.9
24-Apr-09	9.3	17.4	-	11.3
30-Apr-09			-	
06-May-09	13.1	21.6	-	13.7
12-May-09	24.2	15.9	-	15.5
18-May-09	18.7	22.8	-	18.2
24-May-09	17.6	16.6	-	16.0

Date	HVAS - PM_{10} ($\mu g/m^3$)			
	HV1 - Wollar Village	HV2 - West	HV3 - East	HV4 - South
30-May-09	8.1	10.3	-	3.9
05-Jun-09	4.3	1.1	-	2.1
11-Jun-09	5.6	2.9	-	6.1
17-Jun-09	8.1	7.7	-	4.5
23-Jun-09	5.4	5.2	-	4.2
29-Jun-09	4.3	2.9	-	2.8
05-Jul-09	3.1	4.6	-	2.3
11-Jul-09	5.6	4.6	-	3.7
17-Jul-09	4.7	3.9	-	7.1
23-Jul-09	7.3	6.9	-	5.8
29-Jul-09	4.0	<1	-	3.3
04-Aug-09	10.7	7.3	-	8.2
10-Aug-09	13.3		-	10.1
16-Aug-09	11.8	11.8	-	17.2
22-Aug-09	7.3	<1	-	8.0
28-Aug-09	14.6	15.1	-	11.6
03-Sep-09	16.7	34.6	-	15.0
09-Sep-09	16.7	4.0	-	2.6
15-Sep-09	38.5	33.8	-	30.4
21-Sep-09	9.5	7.2	-	5.7
27-Sep-09	14.8	21.1	-	14.6
03-Oct-09	12.6	13.9	-	12.7
09-Oct-09	8.6	11.8	-	5.3
15-Oct-09	10.5	9.8	-	9.2
21-Oct-09	28.2	38.7	-	
27-Oct-09	4.4	4.0	-	3.9
02-Nov-09	20.1	30.7	-	20.5
08-Nov-09	6.1	4.4	-	5.2
14-Nov-09	14.2	18.3	-	12.2
20-Nov-09	37.1	**56.2**	-	44.9
26-Nov-09	20.9	22.9	-	21.9
02-Dec-09	9.8	16.6	-	9.0
08-Dec-09	**59.9**	**61.6**	-	**52.5**
14-Dec-09		24.2	-	
20-Dec-09	20.8	19.6	-	20.8
26-Dec-09	4.4	3.7	-	4.4
01-Jan-10	4.6	6.1	-	6.7
07-Jan-10	17.7	18.5	-	18.6
13-Jan-10	18.6	22.1	-	20.2
19-Jan-10	14.1	14.7	-	13.2
25-Jan-10	27.7	33.7	-	36.6

N.B: Grey cells indicate monitoring runs that did not occur due to faulty equipment, repair works or the unit being non-operational. Values shown in **bold red** indicate an exceedance of the 24-hour PM_{10} criteria of 50 µg/^{3}.

Table B.2: TEOM PM_{10} monitoring data

Date/Time	PM_{10} 24-hour
1/11/2008	27.7
2/11/2008	16.1
3/11/2008	11.7
4/11/2008	10.6
5/11/2008	13.7
6/11/2008	12.7
7/11/2008	16.2
8/11/2008	19.7
9/11/2008	10.6
10/11/2008	11.8
11/11/2008	13.4
12/11/2008	10.8
13/11/2008	9.7
14/11/2008	13.3
15/11/2008	13.0
16/11/2008	11.4
17/11/2008	12.9
18/11/2008	12.6
19/11/2008	5.2
20/11/2008	6.2
21/11/2008	10.3
22/11/2008	11.4
23/11/2008	17.6
24/11/2008	**87.7**
25/11/2008	17.0
26/11/2008	15.2
27/11/2008	13.1
28/11/2008	8.8
29/11/2008	6.7
30/11/2008	8.0
1/12/2008	6.2
2/12/2008	16.2
3/12/2008	19.0
4/12/2008	19.2
5/12/2008	19.2
6/12/2008	16.6
7/12/2008	14.4
8/12/2008	11.3
9/12/2008	10.6
10/12/2008	13.7
11/12/2008	13.1
12/12/2008	7.7
13/12/2008	5.3
14/12/2008	
15/12/2008	
16/12/2008	1.5
17/12/2008	8.5
18/12/2008	9.9
19/12/2008	8.7
20/12/2008	11.6
21/12/2008	11.7
22/12/2008	11.7
23/12/2008	11.6
24/12/2008	10.5
25/12/2008	9.8
26/12/2008	13.7
27/12/2008	4.7
28/12/2008	0.9
29/12/2008	7.5
30/12/2008	10.2
31/12/2008	24.9
1/01/2009	17.5
2/01/2009	18.6
3/01/2009	15.0
4/01/2009	12.7
5/01/2009	15.1
6/01/2009	18.4
7/01/2009	7.5
8/01/2009	13.5
9/01/2009	8.8
10/01/2009	10.3
11/01/2009	12.2
12/01/2009	7.4

Date/Time	PM_{10} 24-hour
13/01/2009	13.3
14/01/2009	15.2
15/01/2009	8.7
16/01/2009	13.0
17/01/2009	16.2
18/01/2009	12.2
19/01/2009	12.6
20/01/2009	16.2
21/01/2009	14.1
22/01/2009	11.6
23/01/2009	6.6
24/01/2009	7.1
25/01/2009	15.4
26/01/2009	15.3
27/01/2009	7.7
28/01/2009	8.6
29/01/2009	12.1
30/01/2009	5.4
31/01/2009	8.5
1/02/2009	23.2
2/02/2009	20.4
3/02/2009	13.1
4/02/2009	0.3
5/02/2009	6.1
6/02/2009	18.2
7/02/2009	20.1
8/02/2009	16.8
9/02/2009	24.2
10/02/2009	22.8
11/02/2009	4.3
12/02/2009	8.5
13/02/2009	6.4
14/02/2009	6.3
15/02/2009	3.7
16/02/2009	5.3
17/02/2009	7.4
18/02/2009	6.1
19/02/2009	6.8
20/02/2009	11.8
21/02/2009	21.6
22/02/2009	16.4
23/02/2009	14.8
24/02/2009	12.4
25/02/2009	11.8
26/02/2009	19.5
27/02/2009	14.3
28/02/2009	12.4
1/03/2009	26.4
2/03/2009	23.4
3/03/2009	15.8
4/03/2009	30.6
5/03/2009	**55.6**
6/03/2009	32.2
7/03/2009	19.2
8/03/2009	18.2
9/03/2009	19.8
10/03/2009	12.1
11/03/2009	9.5
12/03/2009	9.0
13/03/2009	9.9
14/03/2009	6.9
15/03/2009	6.9
16/03/2009	10.9
17/03/2009	8.3
18/03/2009	10.8
19/03/2009	15.0
20/03/2009	13.6
21/03/2009	12.4
22/03/2009	8.3
23/03/2009	9.7
24/03/2009	13.3
25/03/2009	23.5
26/03/2009	22.7
27/03/2009	17.5
28/03/2009	23.7

Date/Time	PM_{10} 24-hour
29/03/2009	32.4
30/03/2009	19.0
31/03/2009	5.8
1/04/2009	2.7
2/04/2009	5.2
3/04/2009	8.7
4/04/2009	7.6
5/04/2009	10.4
6/04/2009	12.5
7/04/2009	14.7
8/04/2009	11.5
9/04/2009	9.4
10/04/2009	8.7
11/04/2009	9.6
12/04/2009	6.9
13/04/2009	6.9
14/04/2009	6.3
15/04/2009	5.5
16/04/2009	28.9
17/04/2009	45.5
18/04/2009	28.6
19/04/2009	13.1
20/04/2009	7.1
21/04/2009	6.8
22/04/2009	6.7
23/04/2009	5.7
24/04/2009	8.1
25/04/2009	**61.5**
26/04/2009	35.4
27/04/2009	22.8
28/04/2009	14.9
29/04/2009	7.7
30/04/2009	5.0
1/05/2009	2.1
2/05/2009	10.0
3/05/2009	11.1
4/05/2009	7.9
5/05/2009	11.0
6/05/2009	11.5
7/05/2009	13.5
8/05/2009	18.5
9/05/2009	19.6
10/05/2009	15.7
11/05/2009	11.1
12/05/2009	6.9
13/05/2009	22.1
14/05/2009	22.7
15/05/2009	18.3
16/05/2009	17.9
17/05/2009	12.7
18/05/2009	12.8
19/05/2009	10.9
20/05/2009	11.0
21/05/2009	9.8
22/05/2009	10.1
23/05/2009	10.4
24/05/2009	16.5
25/05/2009	15.0
26/05/2009	10.8
27/05/2009	17.3
28/05/2009	9.8
29/05/2009	6.5
30/05/2009	6.5
31/05/2009	7.3
1/06/2009	13.5
2/06/2009	10.0
3/06/2009	6.3
4/06/2009	6.6
5/06/2009	2.6
6/06/2009	2.0
7/06/2009	5.9
8/06/2009	5.8
9/06/2009	5.4
10/06/2009	6.1
11/06/2009	6.4

Date/Time	PM_{10} 24-hour
12/06/2009	8.5
13/06/2009	7.3
14/06/2009	7.4
15/06/2009	7.1
16/06/2009	11.0
17/06/2009	7.5
18/06/2009	7.4
19/06/2009	7.9
20/06/2009	7.6
21/06/2009	6.5
22/06/2009	5.0
23/06/2009	4.4
24/06/2009	5.4
25/06/2009	3.5
26/06/2009	3.8
27/06/2009	7.6
28/06/2009	4.6
29/06/2009	2.5
30/06/2009	2.7
1/07/2009	32.0
2/07/2009	19.7
3/07/2009	8.3
4/07/2009	6.7
5/07/2009	5.2
6/07/2009	5.6
7/07/2009	10.8
8/07/2009	5.0
9/07/2009	4.2
10/07/2009	2.2
11/07/2009	5.7
12/07/2009	8.0
13/07/2009	8.8
14/07/2009	6.2
15/07/2009	5.1
16/07/2009	2.3
17/07/2009	5.4
18/07/2009	3.4
19/07/2009	6.0
20/07/2009	7.4
21/07/2009	10.6
22/07/2009	11.3
23/07/2009	4.2
24/07/2009	3.6
25/07/2009	3.4
26/07/2009	6.6
27/07/2009	3.4
28/07/2009	6.2
29/07/2009	6.2
30/07/2009	5.7
31/07/2009	5.8
1/08/2009	3.8
2/08/2009	5.8
3/08/2009	7.4
4/08/2009	1.3
5/08/2009	
6/08/2009	2.3
7/08/2009	12.2
8/08/2009	6.8
9/08/2009	8.3
10/08/2009	6.1
11/08/2009	12.7
12/08/2009	8.0
13/08/2009	9.1
14/08/2009	16.2
15/08/2009	13.6
16/08/2009	18.5
17/08/2009	15.0
18/08/2009	13.0
19/08/2009	8.7
20/08/2009	6.0
21/08/2009	13.6
22/08/2009	19.7
23/08/2009	12.2
24/08/2009	9.7
25/08/2009	10.0

Date/Time	PM_{10} 24-hour
26/08/2009	14.2
27/08/2009	18.9
28/08/2009	6.9
29/08/2009	16.9
30/08/2009	7.4
31/08/2009	10.1
1/09/2009	3.5
2/09/2009	5.8
3/09/2009	9.1
4/09/2009	6.3
5/09/2009	3.0
6/09/2009	3.1
7/09/2009	5.8
8/09/2009	6.2
9/09/2009	4.1
10/09/2009	4.6
11/09/2009	5.3
12/09/2009	6.8
13/09/2009	9.1
14/09/2009	11.4
15/09/2009	15.0
16/09/2009	14.8
17/09/2009	13.4
18/09/2009	9.0
19/09/2009	4.7
20/09/2009	6.1
21/09/2009	5.6
22/09/2009	5.8
23/09/2009	**436.6**
24/09/2009	**279.5**
25/09/2009	11.2
26/09/2009	26.9
27/09/2009	19.7
28/09/2009	10.6
29/09/2009	8.1
30/09/2009	10.6
1/10/2009	15.7
2/10/2009	20.7
3/10/2009	10.1
4/10/2009	3.1
5/10/2009	4.8
6/10/2009	1.4
7/10/2009	0.0
8/10/2009	2.7
9/10/2009	6.9
10/10/2009	7.5
11/10/2009	6.4
12/10/2009	6.1
13/10/2009	26.3
14/10/2009	**114.1**
15/10/2009	33.5
16/10/2009	11.2
17/10/2009	11.7
18/10/2009	10.5
19/10/2009	12.7
20/10/2009	15.2
21/10/2009	23.2
22/10/2009	24.3
23/10/2009	26.1
24/10/2009	20.7
25/10/2009	18.5
26/10/2009	10.6
27/10/2009	5.0
28/10/2009	7.8
29/10/2009	10.1
30/10/2009	11.7
31/10/2009	10.5
1/11/2009	11.2
2/11/2009	16.4
3/11/2009	18.9
4/11/2009	26.5
5/11/2009	27.9
6/11/2009	12.9
7/11/2009	8.3
8/11/2009	9.3

Date/Time	PM_{10} 24-hour
9/11/2009	6.0
10/11/2009	9.8
11/11/2009	16.6
12/11/2009	20.3
13/11/2009	18.3
14/11/2009	14.6
15/11/2009	22.7
16/11/2009	27.2
17/11/2009	37.5
18/11/2009	25.8
19/11/2009	22.3
20/11/2009	30.7
21/11/2009	30.1
22/11/2009	44.5
23/11/2009	**62.6**
24/11/2009	15.4
25/11/2009	8.4
26/11/2009	17.2
27/11/2009	23.6
28/11/2009	48.0
29/11/2009	**158.6**
30/11/2009	**95.4**
1/12/2009	10.7
2/12/2009	9.9
3/12/2009	9.3
4/12/2009	13.6
5/12/2009	25.9
6/12/2009	23.1
7/12/2009	20.9
8/12/2009	24.4
9/12/2009	**55.4**
10/12/2009	27.2
11/12/2009	**52.9**
12/12/2009	16.5
13/12/2009	19.1
14/12/2009	
15/12/2009	
16/12/2009	15.9
17/12/2009	20.8
18/12/2009	25.9
19/12/2009	12.1
20/12/2009	16.5
21/12/2009	17.9
22/12/2009	10.8
23/12/2009	10.1
24/12/2009	11.3
25/12/2009	13.7
26/12/2009	8.0
27/12/2009	4.0
28/12/2009	6.2
29/12/2009	4.5
30/12/2009	7.7
31/12/2009	9.2
1/01/2010	7.1

N.B: Grey cells indicate missing values. Values shown in **bold red** indicate an exceedance of the 24-hour PM_{10} criteria of 50 $\mu g/^{3}$.

Table B.3: HVAS TSP monitoring data

Date	HVAS - TSP (µg/m³)
	HV3 - East
5-Jan-07	-
11-Jan-07	-
17-Jan-07	-
23-Jan-07	-
29-Jan-07	-
31-Jan-07	-
4-Feb-07	-
10-Feb-07	-
14-Feb-07	-
16-Feb-07	-
22-Feb-07	-
28-Feb-07	-
6-Mar-07	19.2
12-Mar-07	
18-Mar-07	10.5
21-Mar-07	29.8
24-Mar-07	48.3
30-Mar-07	27.2
5-Apr-07	21.2
11-Apr-07	21.7
17-Apr-07	31.5
23-Apr-07	19.3
29-Apr-07	
2-May-07	15.6
5-May-07	46.4
11-May-07	14.6
17-May-07	10.8
23-May-07	11.7
29-May-07	11.9
4-Jun-07	11.9
10-Jun-07	7.1
14-Jun-07	-
16-Jun-07	4.5
22-Jun-07	5.4
28-Jun-07	2.6
4-Jul-07	12.5
10-Jul-07	4.6
16-Jul-07	17
22-Jul-07	6.3
28-Jul-07	9.3
3-Aug-07	6.1
9-Aug-07	15.5
15-Aug-07	15.6
21-Aug-07	8.1
27-Aug-07	17.9
2-Sep-07	26.4
8-Sep-07	7.8
14-Sep-07	39.5
20-Sep-07	26.5
26-Sep-07	36.7
2-Oct-07	
8-Oct-07	30.1
14-Oct-07	
20-Oct-07	53.6
26-Oct-07	7.3
1-Nov-07	29.3
7-Nov-07	3.9
13-Nov-07	22.3
19-Nov-07	28.7
25-Nov-07	13.1
1-Dec-07	13.7
7-Dec-07	
13-Dec-07	20.4
15-Dec-07	22.5
19-Dec-07	25.2
25-Dec-07	14.6
31-Dec-07	34.7
6-Jan-08	15.3

Date	HVAS - TSP (µg/m³)
	HV3 - East
12-Jan-08	43.6
18-Jan-08	6.1
24-Jan-08	25.6
30-Jan-08	24.8
5-Feb-08	
11-Feb-08	20.6
14-Feb-08	-
17-Feb-08	
23-Feb-08	
26-Feb-08	27.7
29-Feb-08	12.1
4-Mar-08	22.1
6-Mar-08	28.8
12-Mar-08	20.9
18-Mar-08	18.7
24-Mar-08	16.2
30-Mar-08	20.6
2-Apr-08	30.4
5-Apr-08	18
11-Apr-08	13.9
17-Apr-08	14.7
23-Apr-08	5.9
29-Apr-08	5.2
5-May-08	17.2
11-May-08	16.2
17-May-08	15.5
23-May-08	8.9
29-May-08	11.2
4-Jun-08	3
10-Jun-08	4.2
16-Jun-08	3.6
22-Jun-08	3.8
28-Jun-08	10
4-Jul-08	11.8
10-Jul-08	7.4
16-Jul-08	6.8
22-Jul-08	9.8
28-Jul-08	5.8
3-Aug-08	7.7
9-Aug-08	6.7
15-Aug-08	12
21-Aug-08	21
27-Aug-08	19.9
2-Sep-08	9.1
8-Sep-08	8.5
14-Sep-08	
20-Sep-08	34.3
26-Sep-08	20.6
2-Oct-08	36.1
8-Oct-08	
14-Oct-08	10.5
20-Oct-08	51.6
26-Oct-08	35.8
1-Nov-08	50.6
7-Nov-08	52
13-Nov-08	24.7
19-Nov-08	9.8
25-Nov-08	38.1
1-Dec-08	26.1
7-Dec-08	29.5
13-Dec-08	
19-Dec-08	18.3
25-Dec-08	18.4
31-Dec-08	69.1
6-Jan-09	43.1
12-Jan-09	28.2
18-Jan-09	26.8
24-Jan-09	26.3
30-Jan-09	
5-Feb-09	30.6

Date	HVAS - TSP (µg/m³)
	HV3 - East
11-Feb-09	11.1
17-Feb-09	7.5
23-Feb-09	18.5
1-Mar-09	55.4
7-Mar-09	37.2
13-Mar-09	15.5
19-Mar-09	
25-Mar-09	
31-Mar-09	
6-Apr-09	
12-Apr-09	
18-Apr-09	
24-Apr-09	
30-Apr-09	
6-May-09	
12-May-09	23.2
18-May-09	25.7
24-May-09	24.8
30-May-09	6.7
5-Jun-09	5.5
11-Jun-09	13.2
17-Jun-09	9.1
23-Jun-09	5.8
29-Jun-09	6.6
5-Jul-09	8.2
11-Jul-09	8.9
17-Jul-09	6
23-Jul-09	16.3
29-Jul-09	7.1
4-Aug-09	15.4
10-Aug-09	22.9
16-Aug-09	21.2
22-Aug-09	22.8
28-Aug-09	28.2
3-Sep-09	22.6
9-Sep-09	11.1
15-Sep-09	48.3
21-Sep-09	13.2
27-Sep-09	65.7
3-Oct-09	27.5
9-Oct-09	8.9
15-Oct-09	23.9
21-Oct-09	56.3
27-Oct-09	5.4
27-Oct-09	5.4
2-Nov-09	31.6
8-Nov-09	8.6
14-Nov-09	26.7
20-Nov-09	53.7
26-Nov-09	39.6
2-Dec-09	16
8-Dec-09	112
14-Dec-09	
20-Dec-09	31.1
26-Dec-09	5.7

N.B: Grey cells indicate monitoring runs that did not occur due to faulty equipment, repair works or the unit being non-operational.

Table B.4: Dust deposition monitoring data

Date	Insoluble Solids (g/m²/month)												
	DG1-Wyangle	DG2/7-Mittaville Sth	DG3-Mittaville Nth	DG4-Castle View	DG5-Wollar	DG6-Retreat	DG8-'Ulan Coal Mines-owned' dwelling	DG9-'Power' dwelling	DG10-'Maher' dwelling	DG11-'Smith' dwelling	DG12-Aboriginal rock art site 72	DG13-Aboriginal rock art site 153	DG14-Aboriginal rock art site 152
Jun-04	2.1	1.8	2.0	1.7	-	2.4	-	-	-	-	-	-	-
Jul-04	1.0	1.1	1.2	0.8	2.9	0.8	-	-	-	-	-	-	-
Aug-04	0.6	0.6	0.7	0.4	0.4	1.7	-	-	-	-	-	-	-
Sep-04	1.5	1.0	3.9	0.5	0.7	2.4	-	-	-	-	-	-	-
Oct-04	0.5	0.7	0.2	0.2	0.5	3.6	-	-	-	-	-	-	-
Nov-04	0.1	0.3	**5.4**	0.1	0.2	1.8	-	-	-	-	-	-	-
Dec-04	2.3	**5.5**	0.7	0.3	0.3	1.2	-	-	-	-	-	-	-
Jan-05	1.7	1.8	3.6	1.2	1.4	2.9	-	-	-	-	-	-	-
Feb-05	1.0	1.4	1.5	1.1	1.2	1.7	-	-	-	-	-	-	-
Mar-05	1.7	2.5	3.7	2.9	1.1	1.9	-	-	-	-	-	-	-
Apr-05	1.1	1.0	2.8	1.8	**5.9**	1.7	-	-	-	-	-	-	-
May-05	0.6	1.8	1.4	0.5	0.8	0.8	-	-	-	-	-	-	-
Jun-05	0.5	0.4	0.6	0.4	0.5	0.4	-	-	-	-	-	-	-
Jul-05	0.2	0.4	0.2	0.1	0.2	0.1	-	-	-	-	-	-	-
Aug-05	0.7	0.4	1.1	0.2	0.3	2.8	-	-	-	-	-	-	-
Sep-05	0.5	0.5	0.8	0.3	0.4	0.5	-	-	-	-	-	-	-
Oct-05	0.3	0.5	0.5	0.5	0.3	1.7	-	-	-	-	-	-	-
Nov-05	2.2	2.2	3.5	1.2	1.7	1.1	-	-	-	-	-	-	-
Dec-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan-06	**7.0**	1.4	**6.0**	0.8	1.0	1.1	-	-	-	-	-	-	-
Feb-06	1.3	1.1	**5.8**	1.1	3.4	0.8	-	-	-	-	-	-	-
Mar-06	0.6	0.5	1.7	1.8	0.8	0.7	-	-	-	-	-	-	-
Apr-06	0.5	0.4	0.8	0.4	0.4	0.2	-	-	-	-	-	-	-
May-06	0.7	0.8	0.7	0.7	1.1	1.2	-	-	-	-	-	-	-
Jun-06	0.3	0.6	0.4	0.9	0.6	0.8	-	-	-	-	-	-	-
Jul-06	0.7	0.7	0.4	0.5	**8.2**	2.6	-	-	-	-	-	-	-
Aug-06	0.6	0.6	0.5	1.1	0.7	0.5	-	-	-	-	-	-	-
Sep-06	0.8	1.5	**5.4**	0.5	0.5	0.5	-	1.0	-	0.7	1.3	0.5	0.6
Sep-06	1.0	2.2	**13.0**	2.4	1.1	**4.1**	-	0.9	-	0.9	1.8	1.0	0.7
Oct-06	1.5	0.5	0.9	1.8	0.7	0.4	-	0.8	-	0.8	2.4	0.8	0.9
Nov-06	1.9	2.0	1.3	1.6	1.6	2.2	-	**5.0**	0.9	1.9	1.3	1.2	2.4
Jan-07	1.5	1.2	2.8	1.6	1.2	1.6	-	0.5	1.8	1.8	1.5	1.4	0.9
Feb-07	1.0	1.2	1.2	0.9	0.9	0.9	1.8	1.8	0.6	2.1	1.2	1.4	1.2
Mar-07	2.2	2.2	-	1.9	**7.4**	**6.0**	-	**6.0**	1.3	**4.2**	2.1	1.8	2.1
Apr-07	0.8	1.3	2.3	0.9	1.5	2.5	2.6	**8.0**	0.9	0.8	2.3	1.2	1
May-07	1.1	1.4	**5.8**	2.5	0.9	**4.3**	1.0	3.3	1.1	1.1	2.0	1.5	1.5
Jun-07	0.7	0.8	0.7	0.4	0.4	**4.5**	0.8	0.9	0.9	1.5	1.6	0.8	0.8
Jul-07	1.4	0.5	0.5	0.3	0.2	**5.4**	0.2	**4.7**	0.4	0.4	0.5	0.2	0.9
Aug-07	1.3	1.3	0.6	0.6	0.4	0.8	0.6	0.6	0.6	-	2.1	0.4	0.3
Aug-07	0.6	0.6	0.8	1.4	0.5	0.5	0.4	0.8	0.7	0.5	1.1	1.4	0.5
Sep-07	0.6	0.4	0.6	1.3	0.4	0.5	0.6	0.4	0.7	0.5	1.3	0.6	0.6
Nov-07	0.8	1.3	3.5	0.7	0.9	2.5	1.4	**6.5**	1.9	3.4	2.8	1.4	1.6
Dec-07	-	-	-	-	-	-	-	-	-	-	-	-	-

Date	Insoluble Solids (g/m^2/month)												
	DG1-Wyangle	DG2/7-Mittaville Sth	DG3-Mittaville Nth	DG4-Castle View	DG5-Wollar	DG6-Retreat	DG8-'Ulan Coal Mines-owned' dwelling	DG9-'Power' dwelling	DG10-'Maher' dwelling	DG11-'Smith' dwelling	DG12-Aboriginal rock art site 72	DG13-Aboriginal rock art site 153	DG14-Aboriginal rock art site 152
Feb-08	1.6	0.9	1.9	0.7	1.8	1.5	1.1	2.6	3.5	-	1.2	1.1	0.9
Mar-08	**7.3**	0.8	2.1	2.6	2.4	3.8	1.3	2.8	**4.6**	-	0.9	0.2	0.7
Apr-08	1.4	0.9	0.7	**7.1**	0.8	1.3	1.4	1.6	**4.1**	1.8	1.9	1.0	0.8
May-08	1.5	2.8	2.6	**8.3**	1.4	3.2	1.4	3.3	2.9	**30.3**	3.0	1.5	1.5
Jun-08	0.6	0.4	1.5	**6.8**	0.6	1.0	1.2	3.6	3.0	**4.5**	2.7	0.6	0.6
Jul-08	1.5	0.6	0.6	0.6	0.7	**9.2**	0.5	1.9	**4.5**	**4.7**	1.2	0.5	0.3
Jul-08	1.0	0.7	0.7	0.5	0.6	**7.4**	0.7	3.7	3.5	2.9	2.1	2.3	0.5
Sep-08	0.9	0.5	0.5	0.3	0.9	1.7	0.6	1.5	2.0	**19.3**	2.9	1.7	0.5
Oct-08	1.5	1.5	1.5	1.4	2.4	**4.8**	1.2	1.1	2.5	**15.4**	2.1	1.0	0.9
Oct-08	2.4	2.8	2.8	0.9	2.0	3.9	2.3	2.2	2.9	**7.5**	2.5	1.8	1.1
Dec-08	1.5	**10.9**	**10.9**	3.3	1.6	**5.2**	2.0	**6.1**	**6.1**	3.5	3.2	0.9	1.9
Dec-08	1.7	1.5	1.5	1.0	0.8	**8.1**	1.6	1.9	3.8	2.4	2.9	1.9	1.2
Jan-09	1.4	0.9	0.9	1.1	**4.9**	**4.6**	1.8	1.5	1.2	1.1	1.5	2.1	0.9
Mar-09	2.4	1.6	1.6	0.6	**4.1**	**6.6**	1.2	1.8	1.6	1.8	1.9	2.2	**4.3**
Apr-09	4.0	1.4	**22.7**	0.9	1.3	**4.9**	1.6	**7.1**	**9.7**	**5.8**	**6.3**	**5.8**	1.8
May-09	1.7	1.5	**5.9**	3.1	0.9	**5.5**	1.1	**7.3**	0.9	0.9	4.0	2.9	3.5
Jun-09	0.6	1.0	**11.2**	0.7	1.9	**5.5**	0.5	**8.0**	0.7	0.9	2.1	1.1	1.5
Jul-09	0.7	0.7	0.8	0.9	0.5	**6.5**	0.4	3.5	0.4	0.4	**4.7**	2.9	0.7
Aug-09	0.8	0.6	0.5	0.4	1.4	**5.3**	0.5	1.1	0.9	0.6	**5.7**	0.7	0.5
Sep-09	**4.4**	1.1	2.8	0.8	3.5	1.8	0.9	1.3	2.3	1.1	3.8	1.3	1.1
Sep-09	**4.4**	**5.7**	**4.4**	**5.4**	**7.4**	**7.2**	**5.0**	**5.2**	**7.1**	**5.5**	**6.6**	**5.3**	3.9
Oct-09	3.0	2.8	2.7	2.8	3.0	**15.2**	**4.8**	**6.3**	2.0	2.5	**5.3**	**9.4**	**4.6**
Nov-09	2.0	2.0	1.8	1.9	2.4	**10.1**	1.3	**8.0**	**5.4**	**4.6**	3.5	**14.9**	**10.8**
Dec-09		1.9	1.4	**9.2**	1.9		**7.2**	3.3	2.4	2.3	2.3	**7.6**	3.3

N.B: Grey cells indicate the unit no longer being operational. Values shown in **bold red** indicate an exceedance of the dust deposition criteria of 4 g/m^2/month.

Appendix C: Emission Calculations

Wilpinjong Mine Emissions Inventory

Description of operations

The dust emission inventories have been prepared using the operational description of the proposed mining activities provided by Wilpinjong Coal Pty Ltd (WPCL).

Topsoil would be removed using a scraper fleet supported by dozers and graders. The topsoil material would then be utilised on backfilled areas.

Some weathered overburden material would be free dug with excavators, however the bulk of overburden would be drilled and blasted to fragment the waste rock. Approximately 65% of overburden would be moved with excavators and haul trucks and approximately 35% by dozer bulk push into the adjoining mined strip. Some interburden (and/or coal) within the coal seam would also drilled and blasted.

Following removal of the waste rock, the exposed coal would be cleaned using a dozer. Coal would be loaded into haul trucks using an excavator or front-end-loader (FEL) and transported directly to the ROM pad. The coal would then be screened, crushed and approximately 50% washed in the Coal Handling Preparation Plant (CHPP) prior to being stockpiled for transport off-site by rail.

Coarse coal reject materials would be hauled back to the in-pit waste rock emplacements.

Emission estimates

Estimated emissions are presented for all significant dust generating activities associated with the operations. The relevant emission factors used for the study are described below.

All activities have been modelled for 24 hours per day, with the exception of topsoil removal, which has been assumed to occur between the hours of 8am and 6pm, and the drilling blasting of overburden/interburden, which has been assumed to occur between the hours of 7am and 7pm.

Dust from wind erosion is assumed to occur over 24 hours per day, however, wind erosion is also assumed to be proportional to the third power of wind speed. This will mean that most wind erosion occurs in the day, when wind speeds are highest.

Scraper stripping topsoil
The TSP emission factor used for removal of topsoil with a scraper has been taken to be 1.4 kg/VKT (**SPCC, 1983**).

Drilling overburden
The emission factor used for drilling has been taken to be 0.59 kg/hole (**US EPA, 1985 and updates**).

The number of holes per year were calculated based on information provided by WPCL.

Blasting overburden
TSP emissions from blasting were estimated using the **US EPA (1985 and updates)** emission factor equation given in **Equation 1**.

Equation 1

$$\mathrm{E}_{\mathrm{TSP}} = 0.00022 \times A^{1.5} \qquad \text{kg/blast}$$

where,

A = area to be blasted in m^2

The area to be blasted per blast and number of blasts per year were calculated based on information provided by WPCL.

Loading material / dumping overburden
Each tonne of material loaded will generate a quantity of TSP that will depend on the wind speed and the moisture content. **Equation 2** shows the relationship between these variables.

Equation 2

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right) \qquad kg/t$$

where,
$E_{TSP} = TSP\ emissions$
$k = 0.74$
$U = wind\ speed (m/s)$
$M = moisture\ content (\%)$
$[where\ 0.25 \leq M \leq 4.8]$

The wind speed value was taken from the Wilpinjong 2008 meteorological dataset. The moisture content for overburden was assumed to be 2% for topsoil and overburden.

Hauling material / product on unsealed surfaces
After the application of water, the emission factor used for trucks hauling waste rock or ROM coal on unsealed surfaces is 1 kg per vehicle kilometre travelled (kg/VKT).

The return trip for each year was measured from the location of the haul routes. It was assumed haul trucks with a capacity of 136 t are used for the hauling of overburden and ROM coal.

Dozers on overburden
Emissions from dozers on overburden have been calculated using the US EPA emission factor equation (**US EPA, 1985 and updates**), per **Equation 3**.

Equation 3

$$\mathrm{E}_{\mathrm{TSP}} = 2.6 \times \frac{s^{1.2}}{M^{1.3}} \qquad \text{kg/hour}$$

where,
$\mathrm{E}_{\mathrm{TSP}} = TSP\ \ emissions$
$\mathrm{s} = \text{silt content} (\%), \text{and}$
$\mathrm{M} = \text{moisture} (\%)$

The silt content in the overburden was assumed to be 10%, and the moisture content 2%. This results in a emission factor of 16.735 kg/h.

Dozers on coal
The **US EPA (1985 and updates)** emission factor equation has been used. It is given below in **Equation 4**.

Equation 4

$$E_{TSP} = 35.6 \times \frac{s^{1.2}}{m^{1.4}} \quad \frac{kg}{hour}$$

Where,
s = silt content (%), and
M = moisture (%)

The silt content in the coal was assumed to be 5%, and the moisture content 6%, resulting in an emission factor of 19.9 kg/h.

Loading coal
The **US EPA (1985 and updates)** emission factor equation has been used. It is given below in **Equation 5**.

Equation 5

$$\mathrm{E_{TSP}} = \frac{0.580}{M^{1.2}} \qquad \mathrm{kg/t}$$

where,

$$\mathrm{E_{TSP}} = TSP\ \ emissions$$

$$\mathrm{M = moisture(\%)}$$

The moisture content was assumed to be 6%.

Reloading coal from stockpiles to trains
Equation 2 was used and the moisture content was assumed to be 7%.

Wind erosion
The emission factor for wind erosion was assumed to be 0.4kg/ha/h as per **SPCC (1986)**.

Grading roads
Estimations of TSP emissions from grading roads have been made using the **US EPA (1985 and updates)** emission factor equation (**Equation 7**).

Equation 7

$$\mathrm{E_{TSP}} = 0.0034 \times S^{2.5} \qquad \mathrm{kg/VKT}$$

where,

S = speed of the grader in km/h (taken to be 8 km/h)

The following tables (**Table C.1** to **Table C.4**) present the calculated emissions for each year of operations modelled and the allocation of the sources as represented in **Figure 6.1** and **Figure 6.2**.

The abbreviations used in the following tables are as follows:

- OB - overburden
- CL - coal
- WE - wind erosion emissions
- WI - wind insensitive emissions
- WS - wind sensitive emissions

Table C.1: Year 6 – Detailed emission calculations

ACTIVITY	TSP emission for Year 6 in(kg/y)	Intensity	Units	Emission factor	units	Variable 1	Units	Variable 2	Units	Variable 3	Units
Topsoil Removal (Pit 1) - Scrapers ripping topsoil	210	128	VKT/y	1.64	kg/VKT	8	speed of scraper in km/h	50%	control		
Topsoil Removal (Pit 2) - Scrapers ripping topsoil	210	128	VKT/y	1.64	kg/VKT	8	speed of scraper in km/h	50%	control		
Topsoil Removal (Pit 5) - Scrapers ripping topsoil	10,076	6,144	VKT/y	1.64	kg/VKT	8	speed of scraper in km/h	50%	control		
Topsoil Removal (Pit 1) - Dozer on topsoil	134	8	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
Topsoil Removal (Pit 2) - Dozer on topsoil	134	8	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
Topsoil Removal (Pit 5) - Dozer on topsoil	6,426	384	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
Topsoil Removal (Pit 1) - Grader on topsoil	20	64	VKT/y	1	kg/VKT	8	speed of graders in km/h	50%	control		
Topsoil Removal (Pit 2) - Grader on topsoil	20	64	VKT/y	1	kg/VKT	8	speed of graders in km/h	50%	control		
Topsoil Removal (Pit 5) - Grader on topsoil	945	3,072	VKT/y	1	kg/VKT	8	speed of graders in km/h	50%	control		
OB - Drilling (Pit 1)	422	715	holes/y	0.59	kg/hole						
OB - Drilling (Pit 2)	422	715	holes/y	0.59	kg/hole						
OB - Drilling (Pit 5)	20,249	34,320	holes/y	0.59	kg/hole						
OB - Blasting (Pit 1)	1,763	1	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
OB - Blasting (Pit 2)	1,763	1	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
OB - Blasting (Pit 5)	84,607	48	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
OB - Excavator loading OB to haul truck in Pit 1	1,179	780,000	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.3 ir	2	moisture content in %		
OB - Excavator loading OB to haul truck in Pit 2	1,179	780,000	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.3 ir	2	moisture content in %		
OB - Excavator loading OB to haul truck in Pit 5	56,608	37,440,000	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.3 ir	2	moisture content in %		
OB - Hauling to emplacement area from Pit 1	2,638	780,000	t/y	0.00338	kg/t	136	t/truck load	0.5	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 2	4,129	780,000	t/y	0.00529	kg/t	136	t/truck load	0.7	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 5 North	272,541	33,696,000	t/y	0.00809	kg/t	136	t/truck load	1.1	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 5 South	22,024	3,744,000	t/y	0.00588	kg/t	136	t/truck load	0.8	km/return trip	1.0	kg/VKT
OB- Emplacing at dumps in Pit 1	1,179	780,000	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.3 ir	2	moisture content in %		
OB- Emplacing at dumps in Pit 2	1,179	780,000	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.3 ir	2	moisture content in %		
OB- Emplacing at dumps in Pit 5	56,608	37,440,000	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.3 ir	2	moisture content in %		
OB - Dozers on OB in Pit 1	5,848	349	h/y	16.735	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on OB in Pit 2	5,848	349	h/y	16.735	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on OB in Pit 5	280,704	16,773	h/y	16.735	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling (Pit 1)	2,531	4,290	holes/y	0.59	kg/hole						
CL - Drilling (Pit 2)	4,219	7,150	holes/y	0.59	kg/hole						
CL - Drilling (Pit 5)	77,620	131,560	holes/y	0.59	kg/hole						
CL - Blasting (Pit 1)	10,576	6		1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
CL - Blasting (Pit 2)	17,626	10		1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
CL - Blasting (Pit 5)	324,326	184		1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
CL - Dozers on Pit 1	8,232	412	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers on Pit 2	13,721	686	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers on Pit 5	252,463	12,630	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in Pit 1	27,359	405,000	t/y	0.06755	kg/t	6	moisture content in %				
CL - Loading ROM to trucks in Pit 2	45,598	675,000	t/y	0.06755	kg/t	6	moisture content in %				
CL - Loading ROM to trucks in Pit 5	839,012	12,420,000	t/y	0.06755	kg/t	6	moisture content in %				
CL - Hauling ROM coal to dump hopper from Pit 1	5,658	405,000	t/y	0.01397	kg/t	136	t/load	1.9	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 2	6,452	675,000	t/y	0.00956	kg/t	136	t/load	1.3	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 5	271,231	11,178,000	t/y	0.02426	kg/t	136	t/load	3.3	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 5	25,571	1,242,000	t/y	0.02059	kg/t	136	t/load	2.8	km/return trip	1.0	kg/VKT
CL - Unloading ROM to pile/hopper (all pits)	1,315	13,500,000	t/y	0.0003	kg/t	1.277	average of (wind speed/2.2)^1.3	6	moisture content in	70%	control
CL - Rehandle coal to hopper	1,315	4,050,000	t/y	0.0003	kg/t	1.277	average of (wind speed/2.2)^1.3	6	moisture content in		
CL - Screening	14,850	13,500,000	t/y	0.0011	kg/t						
CL - Crushing	8,100	13,500,000	t/y	0.0006	kg/t						
CL - Sized Coal Unloading to Existing Product/Raw	1,096	13,500,000	t/y	0.0003	kg/t	1.277	average of (wind speed/2.2)^1.3	6	moisture content in	75%	control
CL - Loading from Raw to CHPP	1,096	6,750,000	t/y	0.0003	kg/t	1.277	average of (wind speed/2.2)^1.3	6	moisture content in	50%	control
CL - Loading from Existing Product Stockpiles to trains	3,507	10,800,000	t/y	0.0003	kg/t	1.277	average of (wind speed/2.2)^1.3	6	moisture content in		
CL - Unloading from CHPP to Product Stockpile	658	4,050,000	t/y	0.0003	kg/t	1.277	average of (wind speed/2.2)^1.3	6	moisture content in	50%	control
CL - Dozers on ROM Coal stockpiles	39,979	2,000	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers on Existing Product/Raw stockpiles	79,958	4,000	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Hauling rejects to Pit 1	626	44,820	t/y	0.01397	kg/t	136	t/load	1.9	km/return trip	1.0	kg/VKT
CL - Hauling rejects to Pit 2	461	44,820	t/y	0.01029	kg/t	136	t/load	1.4	km/return trip	1.0	kg/VKT
CL - Hauling rejects to Pit 5	87,004	2,151,360	t/y	0.04044	kg/t	136	t/load	5.5	km/return trip	1.0	kg/VKT
WE - Backfill Pit 1	115,632	33	ha	0.4	kg/ha/h	8,760	h/y				
WE - Backfill Pit 2	23,757	7	ha	0.4	kg/ha/h	8,760	h/y				
WE - Backfill Pit 5	154,947	44	ha	0.4	kg/ha/h	8,760	h/y				
WE - Pit 1	15,453	6	ha	0.4	kg/ha/h	8,760	h/y	30%	control		
WE - Pit 2	20,604	8	ha	0.4	kg/ha/h	8,760	h/y	30%	control		
WE - Pit 5	176,847	72	ha	0.4	kg/ha/h	8,760	h/y	30%	control		
WE - ROM coal stockpiles	36,792	21	ha	0.4	kg/ha/h	8,760	h/y	50%	control		
WE - Existing product/raw stockpiles	4,030	2.3	ha	0.4	kg/ha/h	8,760	h/y	50%	control		
Grading roads	77,637	126,144	km	1	kg/VKT	8	speed of graders in km/h				

Table C.2: Year 6 – Source allocation

ACTIVITY	Source ID				
Topsoil Removal (Pit 1) - Scrapers ripping topsoil	9	18	19		
Topsoil Removal (Pit 2) - Scrapers ripping topsoil	1-3				
Topsoil Removal (Pit 5) - Scrapers ripping topsoil	15	17	27-30	37-41	
Topsoil Removal (Pit 1) - Dozer on topsoil	9	18	19		
Topsoil Removal (Pit 2) - Dozer on topsoil	1-3				
Topsoil Removal (Pit 5) - Dozer on topsoil	15	17	27-30	37-41	
Topsoil Removal (Pit 1) - Grader on topsoil	9	18	19		
Topsoil Removal (Pit 2) - Grader on topsoil	1-3				
Topsoil Removal (Pit 5) - Grader on topsoil	15	17	27-30	37-41	
OB - Drilling (Pit 1)	9	18	19		
OB - Drilling (Pit 2)	1-3				
OB - Drilling (Pit 5)	15	17	27-30	37-41	
OB - Blasting (Pit 1)	9	18	19		
OB - Blasting (Pit 2)	1-3				
OB - Blasting (Pit 5)	15	17	27-30	37-41	
OB - Excavator loading OB to haul truck in Pit 1	9	18	19		
OB - Excavator loading OB to haul truck in Pit 2	1-3				
OB - Excavator loading OB to haul truck in Pit 5	15	17	27-30	37-41	
OB - Hauling to emplacement area from Pit 1	19	21	23		
OB - Hauling to emplacement area from Pit 2	3	5			
OB - Hauling to emplacement area from Pit 5 North	14	16	17		
OB - Hauling to emplacement area from Pit 5 South	14-16				
OB- Emplacing at dumps in Pit 1	20				
OB- Emplacing at dumps in Pit 2	5				
OB- Emplacing at dumps in Pit 5	14				
OB - Dozers on OB in Pit 1	20-26				
OB - Dozers on OB in Pit 2	4	5			
OB - Dozers on OB in Pit 5	14	16	31-36		
CL - Drilling (Pit 1)	9	18	19		
CL - Drilling (Pit 2)	1-3				
CL - Drilling (Pit 5)	15	17	27-30	37-41	
CL - Blasting (Pit 1)	9	18	19		
CL - Blasting (Pit 2)	1-3				
CL - Blasting (Pit 5)	15	17	27-30	37-41	
CL - Dozers on Pit 1	9	18	19		
CL - Dozers on Pit 2	1-3				
CL - Dozers on Pit 5	15	17	27-30	37-41	
CL - Loading ROM to trucks in Pit 1	9	18	19		
CL - Loading ROM to trucks in Pit 2	1-3				
CL - Loading ROM to trucks in Pit 5	15	17	27-30	37-41	
CL - Hauling ROM coal to dump hopper from Pit 1	8	9	42		
CL - Hauling ROM coal to dump hopper from Pit 2	3	5	6	42	
CL - Hauling ROM coal to dump hopper from Pit 5 North	8	10-14	16	17	42
CL - Hauling ROM coal to dump hopper from Pit 5 South	8	10-15	42		
CL - Unloading ROM to pile/hopper (all pits)	7				
CL - Rehandle coal to hopper	7				
CL - Screening	7				
CL - Crushing	7				
CL - Sized Coal Unloading to Existing Product/Raw Stockpiles	44				
CL - Loading from Raw to CHPP	43				
CL - Loading from Existing Product Stockpiles to trains	45				
CL - Unloading from CHPP to Product Stockpile	44				
CL - Dozers on ROM Coal stockpiles	7				
CL - Dozers on Existing Product/Raw stockpiles	44				
CL - Hauling rejects to Pit 1	6	8	9	20	42
CL - Hauling rejects to Pit 2	5	6			
CL - Hauling rejects to Pit 5	6	8	10	11-14	42
WE - Backfill Pit 1	20-26				
WE - Backfill Pit 2	4	5			
WE - Backfill Pit 5	14	16	31-36		
WE - Pit 1	9	18	19		
WE - Pit 2	1-3				
WE - Pit 5	15	17	27-30	37-41	
WE - ROM coal stockpiles	7				
WE - Existing product/raw stockpiles	44				
Grading roads	5	6	8-17	42	

Table C.3: Year 9 – Detailed emission calculations

ACTIVITY	TSP emission for Year 9 in(kg/y)	Intensity	Units	Emission factor	units	Variable 1	Units	Variable 2	Units	Variable 3	Units
Topsoil Removal (Pit 2) - Scrapers ripping topsoil	1,417	864	VKT/y	1.64	kg/VKT	8	speed of scraper in km/h	50%	control		
Topsoil Removal (Pit 3) - Scrapers ripping topsoil	6,612	4,032	VKT/y	1.64	kg/VKT	8	speed of scraper in km/h	50%	control		
Topsoil Removal (Pit 5) - Scrapers ripping topsoil	7,715	4,704	VKT/y	1.64	kg/VKT	8	speed of scraper in km/h	50%	control		
Topsoil Removal (Pit 2) - Dozer on topsoil	904	54	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
Topsoil Removal (Pit 3) - Dozer on topsoil	4,217	252	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
Topsoil Removal (Pit 5) - Dozer on topsoil	4,920	294	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
Topsoil Removal (Pit 2) - Grader on topsoil	133	432	VKT/y	1	kg/VKT	8	speed of graders in km/h	50%	control		
Topsoil Removal (Pit 3) - Grader on topsoil	620	2,016	VKT/y	1	kg/VKT	8	speed of graders in km/h	50%	control		
Topsoil Removal (Pit 5) - Grader on topsoil	724	2,352	VKT/y	1	kg/VKT	8	speed of graders in km/h	50%	control		
OB - Drilling (Pit 2)	1,898	3,218	holes/y	0.59	kg/hole						
OB - Drilling (Pit 3)	8,859	15,015	holes/y	0.59	kg/hole						
OB - Drilling (Pit 5)	10,335	17,518	holes/y	0.59	kg/hole						
OB - Blasting (Pit 2)	7,932	5	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
OB - Blasting (Pit 3)	37,015	21	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
OB - Blasting (Pit 5)	43,185	25	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
OB - Excavator loading OB to haul truck in Pit 2	5,944	3,931,200	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.	2	moisture content in %		
OB - Excavator loading OB to haul truck in Pit 3	27,738	18,345,600	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.	2	moisture content in %		
OB - Excavator loading OB to haul truck in Pit 5	32,361	21,403,200	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.	2	moisture content in %		
OB - Hauling to emplacement area from Pit 2 North	24,715	3,734,640	t/y	0.00662	kg/t	136	t/truck load	0.9	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 2 South	1,012	196,560	t/y	0.00515	kg/t	136	t/truck load	0.7	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 3 North	109,264	16,511,040	t/y	0.00662	kg/t	136	t/truck load	0.9	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 3 South	2,698	1,834,560	t/y	0.00147	kg/t	136	t/truck load	0.2	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 5 North	56,656	19,262,880	t/y	0.00294	kg/t	136	t/truck load	0.4	km/return trip	1.0	kg/VKT
OB - Hauling to emplacement area from Pit 5 South	7,869	2,140,320	t/y	0.00368	kg/t	136	t/truck load	0.5	km/return trip	1.0	kg/VKT
OB- Emplacing at dumps in Pit 2	5,944	3,931,200	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.	2	moisture content in %		
OB- Emplacing at dumps in Pit 3	27,738	18,345,600	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.	2	moisture content in %		
OB- Emplacing at dumps in Pit 5	32,361	21,403,200	t/y	0.00151	kg/t	1.277	average of (wind speed/2.2)^1.	2	moisture content in %		
OB - Dozers on OB in Pit 2	26,316	1,572	h/y	16.735	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on OB in Pit 3	122,808	7,338	h/y	16.735	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on OB in Pit 5	143,276	8,561	h/y	16.735	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling (Pit 2)	9,281	15,730	holes/y	0.59	kg/hole						
CL - Drilling (Pit 3)	37,967	64,350	holes/y	0.59	kg/hole						
CL - Drilling (Pit 5)	37,123	62,920	holes/y	0.59	kg/hole						
CL - Blasting (Pit 2)	38,778	22	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
CL - Blasting (Pit 3)	158,638	90	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
CL - Blasting (Pit 5)	155,112	88	blasts/y	1,763	kg/blast	40,040	Area of blast in square metres	715	holes/blast		
CL - Dozers on Pit 2	30,186	1,510	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers on Pit 3	123,487	6,178	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers on Pit 5	120,743	6,040	h/y	19.9895	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in Pit 2	111,463	1,650,000	t/y	0.06755	kg/t	6	moisture content in %				
CL - Loading ROM to trucks in Pit 3	455,985	6,750,000	t/y	0.06755	kg/t	6	moisture content in %				
CL - Loading ROM to trucks in Pit 5	445,852	6,600,000	t/y	0.06755	kg/t	6	moisture content in %				
CL - Hauling ROM coal to dump hopper from Pit 2	23,051	1,567,500	t/y	0.01471	kg/t	136	t/load	2	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 2	382	82,500	t/y	0.00463	kg/t	136	t/load	0.63	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 3	147,408	6,075,000	t/y	0.02426	kg/t	136	t/load	3.3	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 3	17,868	675,000	t/y	0.02647	kg/t	136	t/load	3.6	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 5	187,809	5,940,000	t/y	0.03162	kg/t	136	t/load	4.3	km/return trip	1.0	kg/VKT
CL - Hauling ROM coal to dump hopper from Pit 5	13,588	660,000	t/y	0.02059	kg/t	136	t/load	2.8	km/return trip	1.0	kg/VKT
CL - Unloading ROM to pile/hopper (all pits)	45,000	15,000,000	t/y	0.01	kg/t	1.277	average of (wind	6	moisture content	70%	control
CL - Rehandle coal to hopper	45,000	4,500,000	t/y	0.01	kg/t	1.277	average of (wind	6	moisture content		
CL - Screening	16,500	15,000,000	t/y	0.0011	kg/t						
CL - Crushing	9,000	15,000,000	t/y	0.0006	kg/t						
CL - Sized Coal Unloading to Existing Product/Raw	37,500	15,000,000	t/y	0.01	kg/t	1.277	average of (wind	6.4	moisture content	75%	control
CL - Loading from Raw to CHPP	1,113	7,500,000	t/y	0.0003	kg/t	1.277	average of (wind	6.4	moisture content	50%	control
CL - Loading from Existing Product Stockpiles to	1,113	7,500,000	t/y	0.0003	kg/t	1.277	average of (wind	6.4	moisture content		
CL - Unloading from CHPP to Product Stockpile	22,500	4,500,000	t/y	0.01	kg/t	1.277	average of (wind	6.4	moisture content	50%	control
CL - Loading from Product Coal stockpile No.2 to	2,436	4,500,000	t/y	0.0003	kg/t	1.277	average of (wind	6.4	moisture content		
CL - Dozers on ROM Coal stockpiles	39,979	2,000	h/y	19.9895	kg/h	5	silt content in %	6.4	moisture content in %		
CL - Dozers on Existing Product/Raw stockpiles	39,979	2,000	h/y	19.9895	kg/h	5	silt content in %	6.4	moisture content in %		
CL - Dozers on New Product Coal Stockpile	39,979	2,000	h/y	19.9895	kg/h	5	silt content in %	6.4	moisture content in %		
CL - Hauling rejects to Pit 2	5,784	201,690	t/y	0.02868	kg/t	136	t/load	3.9	km/return trip	1.0	kg/VKT
CL - Hauling rejects to Pit 3	44,985	941,220	t/y	0.04779	kg/t	136	t/load	6.5	km/return trip	1.0	kg/VKT
CL - Hauling rejects to Pit 5	47,456	1,075,680	t/y	0.04412	kg/t	136	t/load	6.0	km/return trip	1.0	kg/VKT
WE - Backfill Pit 1	11,563	3	ha	0.4	kg/ha/h	8,760	h/y				
WE - Backfill Pit 2	143,594	41	ha	0.4	kg/ha/h	8,760	h/y				
WE - Backfill Pit 3	30,064	9	ha	0.4	kg/ha/h	8,760	h/y				
WE - Backfill Pit 5	234,207	67	ha	0.4	kg/ha/h	8,760	h/y				
WE - Pit 2	73,584	30	ha	0.4	kg/ha/h	8,760	h/y	30%	control		
WE - Pit 3	180,036	73	ha	0.4	kg/ha/h	8,760	h/y	30%	control		
WE - Pit 5	84,131	34	ha	0.4	kg/ha/h	8,760	h/y	30%	control		
WE - ROM coal stockpiles	36,792	21.0	ha	0.4	kg/ha/h	8,760	h/y	50%	control		
WE - Existing product/raw stockpiles	4,030	2.3	ha	0.4	kg/ha/h	8,760	h/y	50%	control		
WE - New Product stockpile	1,927	1.1	ha	0.4	kg/ha/h	8,760	h/y	50%	control		
Grading roads	77,637	126,144	km	1	kg/VKT	8	speed of graders in km/h				

Table C.4: Year 9 – Source allocation

ACTIVITY	Source ID					
Topsoil Removal (Pit 2) - Scrapers ripping topsoil	22-24	27				
Topsoil Removal (Pit 3) - Scrapers ripping topsoil	1	2	5-10			
Topsoil Removal (Pit 5) - Scrapers ripping topsoil	35-38	50				
Topsoil Removal (Pit 2) - Dozer on topsoil	22-24	27				
Topsoil Removal (Pit 3) - Dozer on topsoil	1	2	5-10			
Topsoil Removal (Pit 5) - Dozer on topsoil	35-38	50				
Topsoil Removal (Pit 2) - Grader on topsoil	22-24	27				
Topsoil Removal (Pit 3) - Grader on topsoil	1	2	5-10			
Topsoil Removal (Pit 5) - Grader on topsoil	35-38	50				
OB - Drilling (Pit 2)	22-24	27				
OB - Drilling (Pit 3)	1	2	5-10			
OB - Drilling (Pit 5)	35-38	50				
OB - Blasting (Pit 2)	22-24	27				
OB - Blasting (Pit 3)	1	2	5-10			
OB - Blasting (Pit 5)	35-38	50				
OB - Excavator loading OB to haul truck in Pit 2	22-24	27				
OB - Excavator loading OB to haul truck in Pit 3	1	2	5-10			
OB - Excavator loading OB to haul truck in Pit 5	35-38	50				
OB - Hauling to emplacement area from Pit 2 North	16	24	25			
OB - Hauling to emplacement area from Pit 2 South	16	26	27			
OB - Hauling to emplacement area from Pit 3 North	4	9	10			
OB - Hauling to emplacement area from Pit 3 South	2	4				
OB - Hauling to emplacement area from Pit 5 North	45	50				
OB - Hauling to emplacement area from Pit 5 South	34	35				
OB- Emplacing at dumps in Pit 2	16					
OB- Emplacing at dumps in Pit 3	4					
OB- Emplacing at dumps in Pit 5	39	46				
OB - Dozers on OB in Pit 2	14-21					
OB - Dozers on OB in Pit 3	3	4				
OB - Dozers on OB in Pit 5	34	39-42	46-49			
CL - Drilling (Pit 2)	22-24	27				
CL - Drilling (Pit 3)	1	2	5-10			
CL - Drilling (Pit 5)	35-38	50				
CL - Blasting (Pit 2)	22-24	27				
CL - Blasting (Pit 3)	1	2	5-10			
CL - Blasting (Pit 5)	35-38	50				
CL - Dozers on Pit 2	22-24	27				
CL - Dozers on Pit 3	1	2	5-10			
CL - Dozers on Pit 5	35-38	50				
CL - Loading ROM to trucks in Pit 2	22-24	27				
CL - Loading ROM to trucks in Pit 3	1	2	5-10			
CL - Loading ROM to trucks in Pit 5	35-38	50				
CL - Hauling ROM coal to dump hopper from Pit 2 North	16	24-26	28	29		
CL - Hauling ROM coal to dump hopper from Pit 2 South	27-29					
CL - Hauling ROM coal to dump hopper from Pit 3 North	10	11	13-16	26	28	29
CL - Hauling ROM coal to dump hopper from Pit 3 South	2	12-16	26	28	29	
CL - Hauling ROM coal to dump hopper from Pit 5 North	29	30-34	43-45	50		
CL - Hauling ROM coal to dump hopper from Pit 5 South	29-35					
CL - Unloading ROM to pile/hopper (all pits)	54					
CL - Rehandle coal to hopper	54					
CL - Screening	54					
CL - Crushing	54					
CL - Sized Coal Unloading to Existing Product/Raw Stockpiles	53					
CL - Loading from Raw to CHPP	52					
CL - Loading from Existing Product Stockpiles to trains	55					
CL - Unloading from CHPP to Product Stockpile	52					
CL - Loading from Product Coal stockpile No.2 to trains	55					
CL - Dozers on ROM Coal stockpiles	54					
CL - Dozers on Existing Product/Raw stockpiles	53					
CL - Dozers on New Product Coal Stockpile	53					
CL - Hauling rejects to Pit 2	16	26	28			
CL - Hauling rejects to Pit 3	2	12-16	26	28		
CL - Hauling rejects to Pit 5	28-34					
WE - Backfill Pit 1	51					
WE - Backfill Pit 2	14-21					
WE - Backfill Pit 3	3	4				
WE - Backfill Pit 5	34	39-42	46-49			
WE - Pit 2	22-24	27				
WE - Pit 3	1	2	5-10			
WE - Pit 5	35-38	50				
WE - ROM coal stockpiles	54					
WE - Existing product/raw stockpiles	53					
WE - New Product stockpile	53					
Grading roads	2	10-16	24-26	28-35	43-45	50

Appendix D: Example ISCMOD input file

```
**  ISCST3 model input runstream : Dust - Wilpinjong 2011 less dozer hours Jan-Mar08
CO STARTING
   TITLEONE ISCST3 Dust Model Run
   MODELOPT RURAL CONC DDEP DRYDPLT HE>ZI
   AVERTIME 24 PERIOD
   POLLUTID TSP
   ERRORFIL C:\Jobs\Wilpingjong\2011_JanMar\error.log
   TERRHGTS ELEV
   RUNORNOT RUN
CO FINISHED

SO STARTING
   LOCATION  POINT1  VOLUME  771398 6417902 401.2
   LOCATION  POINT2  VOLUME  771440 6417736 407.5
   LOCATION  POINT3  VOLUME  771468 6417604 411.3
   LOCATION  POINT4  VOLUME  771190 6417764 403.3
   LOCATION  POINT5  VOLUME  771218 6417573 406.0
   LOCATION  POINT6  VOLUME  770925 6417509 401.6
   LOCATION  POINT7  VOLUME  770603 6417709 395.1
   LOCATION  POINT8  VOLUME  770164 6417736 405.4
   LOCATION  POINT9  VOLUME  770317 6417999 401.7
   LOCATION  POINT10  VOLUME  769970 6418055 401.9
   LOCATION  POINT11  VOLUME  769880 6418380 395.5
   LOCATION  POINT12  VOLUME  769658 6418727 381.7
   LOCATION  POINT13  VOLUME  769423 6418956 383.3
   LOCATION  POINT14  VOLUME  769173 6419219 392.3
   LOCATION  POINT15  VOLUME  768861 6418928 408.5
   LOCATION  POINT16  VOLUME  769319 6419614 385.5
   LOCATION  POINT17  VOLUME  769534 6419885 376.3
   LOCATION  POINT18  VOLUME  770109 6418235 400.2
   LOCATION  POINT19  VOLUME  769977 6418401 391.8
   LOCATION  POINT20  VOLUME  770393 6418297 404.4
   LOCATION  POINT21  VOLUME  770137 6418540 391.8
   LOCATION  POINT22  VOLUME  770476 6418561 383.4
   LOCATION  POINT23  VOLUME  770220 6418748 377.8
   LOCATION  POINT24  VOLUME  769977 6419032 367.0
   LOCATION  POINT25  VOLUME  769658 6419212 364.3
   LOCATION  POINT26  VOLUME  769395 6419441 379.0
   LOCATION  POINT27  VOLUME  768716 6419164 381.5
   LOCATION  POINT28  VOLUME  768431 6419469 374.2
   LOCATION  POINT29  VOLUME  768168 6419718 373.0
   LOCATION  POINT30  VOLUME  767842 6420003 386.3
   LOCATION  POINT31  VOLUME  768896 6419337 378.4
   LOCATION  POINT32  VOLUME  768632 6419580 369.6
   LOCATION  POINT33  VOLUME  768362 6419829 366.2
   LOCATION  POINT34  VOLUME  768646 6419996 362.2
   LOCATION  POINT35  VOLUME  768854 6419815 362.4
   LOCATION  POINT36  VOLUME  769132 6419628 367.1
   LOCATION  POINT37  VOLUME  769312 6419919 356.7
   LOCATION  POINT38  VOLUME  769076 6420100 351.8
   LOCATION  POINT39  VOLUME  768875 6420328 355.4
   LOCATION  POINT40  VOLUME  768626 6420543 365.6
   LOCATION  POINT41  VOLUME  768452 6420439 368.3
   LOCATION  POINT42  VOLUME  770546 6417602 362.6
   LOCATION  POINT43  VOLUME  770782 6417595 361.6
   LOCATION  POINT44  VOLUME  770903 6417709 359.4
   LOCATION  POINT45  VOLUME  770781 6417944 352.6
   LOCATION  POINT46  VOLUME  771398 6417902 401.2
   LOCATION  POINT47  VOLUME  771440 6417736 407.5
   LOCATION  POINT48  VOLUME  771468 6417604 411.3
   LOCATION  POINT49  VOLUME  771190 6417764 403.3
   LOCATION  POINT50  VOLUME  771218 6417573 406.0
   LOCATION  POINT51  VOLUME  770925 6417509 401.6
   LOCATION  POINT52  VOLUME  770603 6417709 395.1
   LOCATION  POINT53  VOLUME  770164 6417736 405.4
   LOCATION  POINT54  VOLUME  770317 6417999 401.7
   LOCATION  POINT55  VOLUME  769970 6418055 401.9
   LOCATION  POINT56  VOLUME  769880 6418380 395.5
   LOCATION  POINT57  VOLUME  769658 6418727 381.7
   LOCATION  POINT58  VOLUME  769423 6418956 383.3
   LOCATION  POINT59  VOLUME  769173 6419219 392.3
   LOCATION  POINT60  VOLUME  768861 6418928 408.5
   LOCATION  POINT61  VOLUME  769319 6419614 385.5
   LOCATION  POINT62  VOLUME  769534 6419885 376.3
   LOCATION  POINT63  VOLUME  770109 6418235 400.2
```

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   LOCATION   POINT65   VOLUME   770393 6418297 404.4
   LOCATION   POINT66   VOLUME   770137 6418540 391.8
   LOCATION   POINT67   VOLUME   770476 6418561 383.4
   LOCATION   POINT68   VOLUME   770220 6418748 377.8
   LOCATION   POINT69   VOLUME   769977 6419032 367.0
   LOCATION   POINT70   VOLUME   769658 6419212 364.3
   LOCATION   POINT71   VOLUME   769395 6419441 379.0
   LOCATION   POINT72   VOLUME   768716 6419164 381.5
   LOCATION   POINT73   VOLUME   768431 6419469 374.2
   LOCATION   POINT74   VOLUME   768168 6419718 373.0
   LOCATION   POINT75   VOLUME   767842 6420003 386.3
   LOCATION   POINT76   VOLUME   768896 6419337 378.4
   LOCATION   POINT77   VOLUME   768632 6419580 369.6
   LOCATION   POINT78   VOLUME   768362 6419829 366.2
   LOCATION   POINT79   VOLUME   768646 6419996 362.2
   LOCATION   POINT80   VOLUME   768854 6419815 362.4
   LOCATION   POINT81   VOLUME   769132 6419628 367.1
   LOCATION   POINT82   VOLUME   769312 6419919 356.7
   LOCATION   POINT83   VOLUME   769076 6420100 351.8
   LOCATION   POINT84   VOLUME   768875 6420328 355.4
   LOCATION   POINT85   VOLUME   768626 6420543 365.6
   LOCATION   POINT86   VOLUME   768452 6420439 368.3
   LOCATION   POINT87   VOLUME   770546 6417602 362.6
   LOCATION   POINT88   VOLUME   770782 6417595 361.6
   LOCATION   POINT89   VOLUME   770903 6417709 359.4
   LOCATION   POINT90   VOLUME   770781 6417944 352.6
   LOCATION   POINT91   VOLUME   771398 6417902 401.2
   LOCATION   POINT92   VOLUME   771440 6417736 407.5
   LOCATION   POINT93   VOLUME   771468 6417604 411.3
   LOCATION   POINT94   VOLUME   771190 6417764 403.3
   LOCATION   POINT95   VOLUME   771218 6417573 406.0
   LOCATION   POINT96   VOLUME   770925 6417509 401.6
   LOCATION   POINT97   VOLUME   770603 6417709 395.1
   LOCATION   POINT98   VOLUME   770164 6417736 405.4
   LOCATION   POINT99   VOLUME   770317 6417999 401.7
   LOCATION   POINT100   VOLUME   769970 6418055 401.9
   LOCATION   POINT101   VOLUME   769880 6418380 395.5
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   LOCATION   POINT103   VOLUME   769423 6418956 383.3
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   LOCATION   POINT109   VOLUME   769977 6418401 391.8
   LOCATION   POINT110   VOLUME   770393 6418297 404.4
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   LOCATION   POINT113   VOLUME   770220 6418748 377.8
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   LOCATION   POINT117   VOLUME   768716 6419164 381.5
   LOCATION   POINT118   VOLUME   768431 6419469 374.2
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   LOCATION   POINT125   VOLUME   768854 6419815 362.4
   LOCATION   POINT126   VOLUME   769132 6419628 367.1
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   LOCATION   POINT132   VOLUME   770546 6417602 362.6
   LOCATION   POINT133   VOLUME   770782 6417595 361.6
   LOCATION   POINT134   VOLUME   770903 6417709 359.4
   LOCATION   POINT135   VOLUME   770781 6417944 352.6
** Point Source       QS    RH   IL   IV
** Parameters        ----  ---  ---  ---
   HOUREMIS  C:\Jobs\Wilpingjong\2011_JanMar\Y2011_Wilp_emiss.dat POINT1-POINT135
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SRCPARAM  POINT75  1.0 2.0 10.0 2.0
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   SRCPARAM  POINT134  1.0 2.0 10.0 2.0
   SRCPARAM  POINT135  1.0 2.0 10.0 2.0
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   PARTDIAM  POINT46-POINT90  5.0
   PARTDIAM  POINT91-POINT135  17.3
   MASSFRAX  POINT1-POINT135  1.0
   PARTDENS  POINT1-POINT135  2.5
   SRCGROUP  FP  POINT1-POINT45
   SRCGROUP  CM  POINT46-POINT90
   SRCGROUP  REST  POINT91-POINT135
SO FINISHED

RE STARTING
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RE DISCCART 770470.9979 6419287.902 381.9410314
RE DISCCART 771041.1931 6418922.978 382.1444249
RE DISCCART 770539.4213 6418580.86 401.1595635
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RE DISCCART 772409.6615 6418466.821 377.2557512
RE DISCCART 771657.0039 6418717.707 386.9088089
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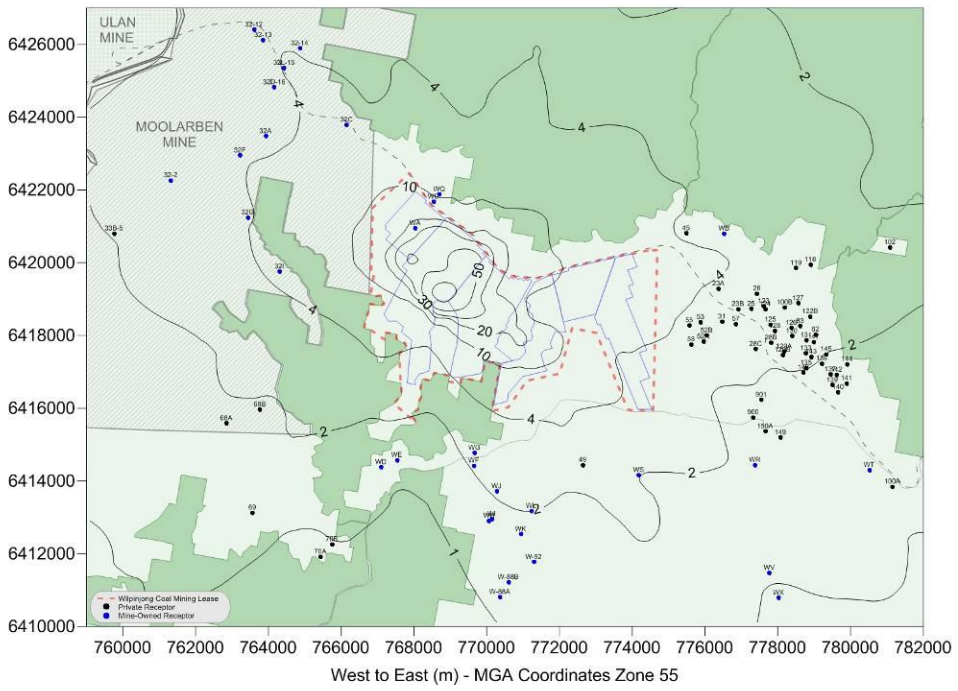
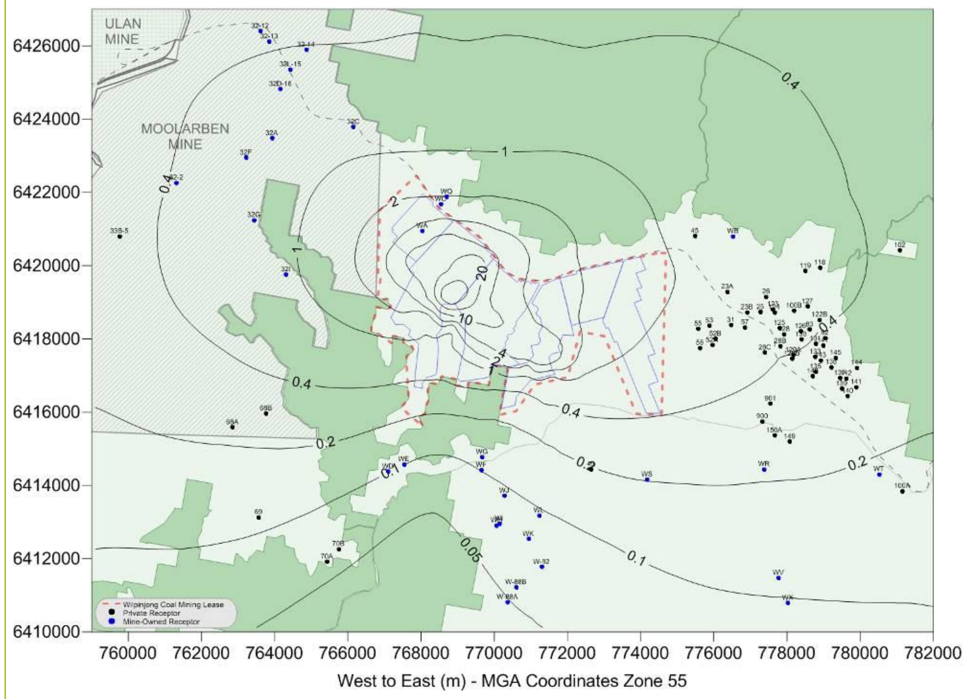
Appendix E: Predicted $PM_{2.5}$ emissions from mining sources



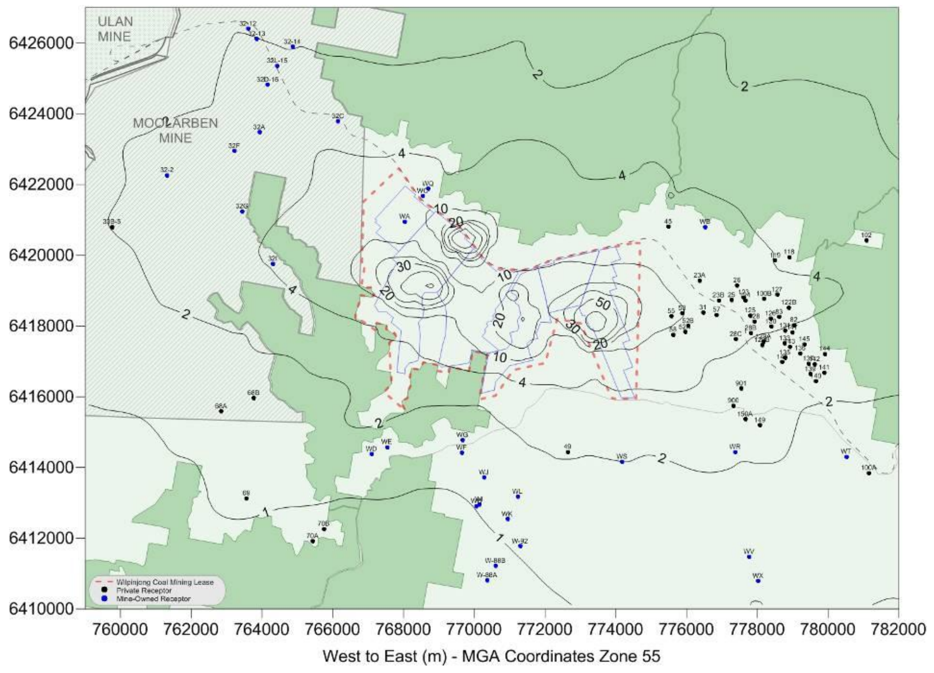
Species: PM2.5	Averaging Time: 24-hour	Percentile: Maximum	Scenario: Year 6 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** $\mu g/m^3$	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure E.1: Predicted 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project alone in Year 6



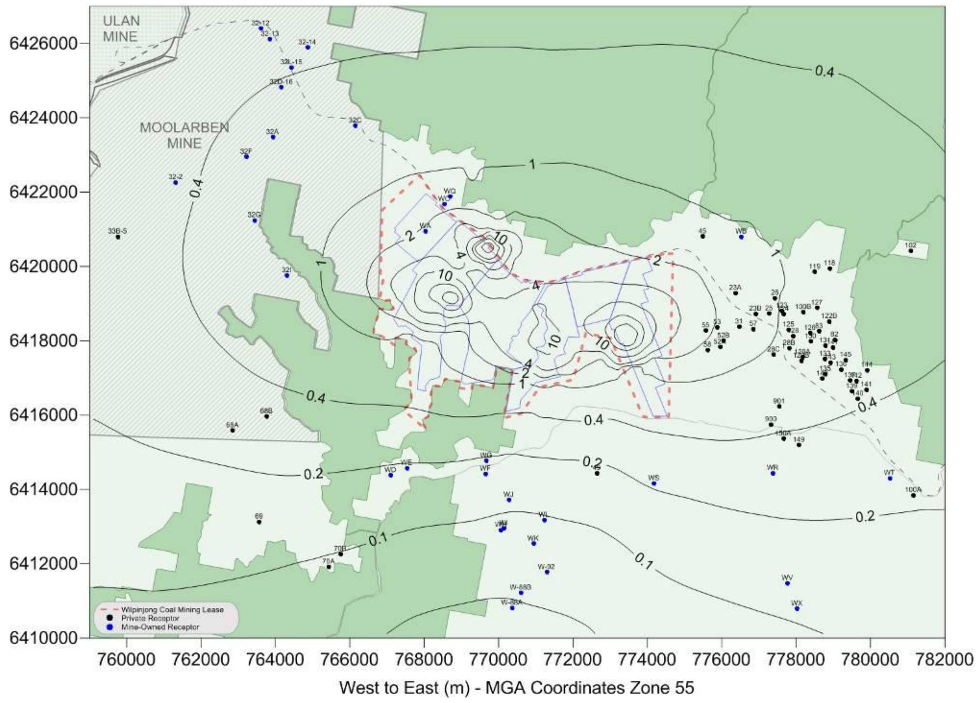
Species: PM2.5	Averaging Time: Annual	Percentile: N/A	Scenario: Year 6 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** $\mu g/m^3$	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure E.2: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project alone in Year 6



Species: PM$_{2.5}$	Averaging Time: 24-hour	Percentile: N/A	Scenario: Year 9 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** µg/m^3	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure E.3: Predicted 24-hour average PM$_{2.5}$ concentrations due to emissions from the Project alone in Year 9



Species: PM$_{2.5}$	Averaging Time: Annual	Percentile: N/A	Scenario: Year 9 Project only	Location: Wilpinjong
Model Used: ISCMOD	**Units:** µg/m^3	**Assessment criteria:** N/A	**Met Data:** Wilpinjong 2008	**Plot:** F Triffett

Figure E.4: Predicted annual average PM$_{2.5}$ concentrations due to emissions from the Project alone in Year 9

Appendix F: Mine-owned receptor modelling predictions

Table F.1: Maximum predicted 24-hour average PM_{10} concentrations due to the Project alone at mine-owned receptors

ID	Year 6	Year 9
	Assessment criteria = 50 µg/m³	
Mine-Owned Receptors		
32A	21	14
32C	35	17
32F	22	15
32G	23	18
32I	29	27
32-2	14	12
32-12	17	9
32-13	18	10
32-14	19	10
32D-16	18	14
32L-15	21	12
W88A	7	5
W88B	8	5
W-92	9	6
WA	**179**	45
WB	17	26
WC	**76**	47
WD	8	8
WE	7	9
WF	14	8
WG	15	9
WH	10	7
WI	11	7
WJ	13	8
WK	10	7
WL	12	8
WQ	**62**	43
WR	12	14
WS	9	13
WT	6	10
WV	6	6
WX	4	5

N.B. Values shown in **bold red** are predicted to exceed the assessment criteria.

Table F.2: Year 6 – Predicted PM_{10} and TSP concentrations and dust deposition levels due to the Project alone and the Project and other sources

ID	Year 6 – Project alone			Year 6 - Project and other sources		
	PM_{10} (µg/m³)	TSP (µg/m³)	Dust deposition (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	Dust deposition (g/m²/month)
	Assessment criteria					
	N/A	*N/A*	*2*	*30*	*90*	*4*
Mine-owned receptor						
32A	4	4	0.0	**44**	**63**	2.3
32C	5	5	0.0	28	**47**	2.1
32F	3	3	0.0	**73**	**124**	8.6
32G	4	4	0.1	**51**	72	2.4
32I	5	5	0.2	**48**	**70**	2.9
32-2	2	2	0.0	25	42	1.9
32-12	2	2	0.0	**35**	53	2.2
32-13	2	2	0.0	**36**	54	2.2
32-14	2	2	0.0	**32**	50	2.0
32D-16	3	3	0.0	**189**	**307**	**11.4**
32L-15	3	3	0.0	**47**	66	2.3
W88A	0	0	0.0	12	29	1.5
W88B	0	0	0.0	12	29	1.5
W92	0	0	0.0	12	29	1.5
WA	37	39	0.6	**54**	73	2.4
WB	3	3	0.1	16	33	1.6
WC	16	16	0.1	**32**	49	1.9
WD	1	1	0.0	12	30	1.5
WE	1	1	0.0	13	30	1.5
WF	1	1	0.0	13	30	1.6
WG	1	1	0.0	13	30	1.6
WH	0	0	0.0	12	29	1.5
WI	0	0	0.0	12	29	1.5
WJ	1	1	0.0	12	29	1.5
WK	0	0	0.0	12	29	1.5
WL	1	1	0.0	12	29	1.5
WQ	13	14	0.1	29	47	1.8
WR	1	1	0.0	13	30	1.6
WS	1	1	0.0	13	30	1.6
WT	1	1	0.0	13	30	1.5
WV	1	1	0.0	12	29	1.5
WX	0	0	0.0	12	29	1.5

N.B: Mine-owned receptors with the prefix '32' are owned by other mining corporations and mine-owned receptors with the prefix 'W' are owned by Wilpinjong Coal Pty Ltd. Values shown in **bold red** are predicted to exceed the assessment criteria.

Table F.23: Year 9 – Predicted PM_{10} and TSP concentrations and dust deposition levels due to the Project alone and the Project and other sources

ID	Year 9 – Project alone			Year 9 - Project and other sources		
	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust deposition ($g/m^2/month$)	PM_{10} ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Dust deposition ($g/m^2/month$)
	Assessment criteria					
	N/A	*N/A*	*2*	*30*	*90*	*4*
Mine-owned receptors						
32A	3	3	0.0	**44**	63	2.3
32C	4	4	0.0	28	47	2.1
32F	3	3	0.0	**73**	**124**	**8.6**
32G	3	3	0.1	**51**	72	2.4
32I	4	4	0.1	**48**	70	2.9
32-2	2	2	0.0	25	42	1.9
32-12	2	2	0.0	**35**	53	2.2
32-13	2	2	0.0	**36**	54	2.2
32-14	2	2	0.0	**32**	50	2.0
32D-16	2	2	0.0	**189**	**307**	**11.4**
32L-15	2	2	0.0	**47**	66	2.3
W-88A	0	0	0.0	12	29	1.5
W-88B	0	0	0.0	12	29	1.5
W-92	0	0	0.0	12	29	1.5
WA	14	15	0.5	**54**	73	2.4
WB	6	6	0.1	16	33	1.6
WC	11	12	0.2	**32**	49	1.9
WD	1	1	0.0	12	30	1.5
WE	1	1	0.0	13	30	1.5
WF	1	1	0.0	13	30	1.6
WG	1	1	0.0	13	30	1.6
WH	0	1	0.0	12	29	1.5
WI	0	1	0.0	12	29	1.5
WJ	1	1	0.0	12	29	1.5
WK	0	0	0.0	12	29	1.5
WL	1	1	0.0	12	29	1.5
WQ	10	10	0.1	29	47	1.8
WR	1	2	0.1	13	30	1.6
WS	1	1	0.0	13	30	1.6
WT	1	1	0.0	13	30	1.5
WV	1	1	0.0	12	29	1.5
WX	1	1	0.0	12	29	1.5

N.B: Mine-owned receptors with the prefix '32' are owned by other mining corporations and mine-owned receptors with the prefix 'W' are owned by Wilpinjong Coal Pty Ltd. Values shown in **bold red** are predicted to exceed the assessment criteria.

Appendix C




Road Transport Assessment

Halcrow
Suite 20, 809 Pacific Highway, Chatswood NSW 2067 Australia
Tel +61 2 9410 4100 Fax +61 2 9410 4199
www.halcrow.com/australasia

Wilpinjong Coal Pty Ltd
Locked Bag 2005
MUDGEE NSW 2850

Attention: Mr Keith Downham

9 March 2010

Dear Sir,

Wilpinjong Coal Mine – Mining Rate Modification Road Transport Assessment

This letter sets out Halcrow's assessment of the road transport implications of a proposal to increase the mining rate at the Wilpinjong Coal Mine (WCM). This assessment has been prepared with reference to transport assessment reports which are listed in Attachment A, and which relate to the WCM, Ulan Coal Mines and Moolarben Coal Mines.

This study has examined the existing traffic conditions in the vicinity of the WCM, the contribution of the approved WCM to existing conditions, and the likely increases in traffic expected to result from the proposed modification during its busiest year. The implications of the increases, combined with potential increases from other proposed and approved projects in the area have also been assessed.

1. Background

The WCM is located some 40 kilometres (km) north-east of Mudgee in central New South Wales (NSW) (**Figure 1**). It is an open cut coal mining operation which commenced construction in February 2006, and is approved to produce a maximum of 13 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Coal products are moved by rail to domestic customers for use in electricity generation and to port for export. In 2009, the WCM produced approximately 8.4 million tonnes of ROM coal. The mine currently generates road traffic relating to the movement of employees and consumables/deliveries only.

2. Proposed Mining Rate Modification

The WCM Mining Rate Modification (the Modification) would involve an increase in the approved maximum ROM coal mining rate from 13 Mtpa to 15 Mtpa, and a small increase in the maximum annual rate of overburden mined. The number of employees is proposed to increase from 296 to approximately 350 people. The proposed Modification does not include any alteration to the approved extent of mining or the approved 21 year mine life.

To facilitate the increased coal production and improve the efficiency of coal handling and preparation on-site, the existing Coal Handling and Preparation Plant (CHPP) and general coal handling and stockpiling systems would be upgraded. Additional mobile fleet would be required on-site to achieve the higher production rates.

Construction of the CHPP and coal handling upgrades is expected to commence in January 2011, and would be completed over a period of approximately 9 months. Construction works would take place 24 hours per day, seven days per week. Construction heavy vehicle movements would be restricted to daytime hours. The construction phase is expected to employ an average of 150 employees and a peak of 280 employees.

The potential road transport impacts associated with the Modification relate principally to the movement of additional employees and consumables/deliveries during the construction phase, together with the lesser movement of operational workers and supplies during the operational phase.

Table B.1 in Attachment B sets out the anticipated modified mine schedule over the life of the mine. This demonstrates that with the Modification, the ROM coal production is expected to exceed the existing approved maximum of 13 Mtpa during years 2011 to 2015 inclusive only. In all other years of the 21 year mine life, the maximum ROM coal production would be at or below the existing approved level.

Given that coal product is moved by rail, it is anticipated that road transport increases associated with the increase in production would be moderate, while increases associated with the 2011 construction phase would be more significant. This suggests that 2011 would be the critical year, i.e., the year during which the road transport impacts of the Modification would be greatest, combining some increased production with construction activity. Following completion of the construction phase, additional operational traffic volumes would be relatively minor.

On this basis, this assessment has focused on 2011 as the critical year for road transport implications. Furthermore, the mine generates more traffic on weekdays rather than weekends, thus the assessment uses the average weekday volumes, i.e. average volumes measured Monday to Friday, which are somewhat higher than average daily volumes, i.e. average volumes measured Monday to Sunday.

3. Existing Road Transport Situation

3.1 Existing Road Network

Vehicular access to the WCM is via a sealed Mine Access Road from Ulan-Wollar Road. Ulan-Wollar Road is a local rural road which provides an east-west connection between the towns of Ulan and Wollar. Wilpinjong Coal Pty Ltd (WCPL) has recently funded the upgrading of Ulan-Wollar Road between Ulan and the Wilpinjong mine access road, and this section is now sealed with a carriageway width of about 8 metres (m) with unsealed shoulders. A short section (approximately 2.3km) was already sealed and has a 6m wide carriageway with unsealed shoulders. To the east of the mine access road, it is unsealed for the majority of its length, and sealed for approximately 4km on its approach to Wollar.

To the west, its intersection with Ulan Road was also recently upgraded by the owner of the Moolarben Coal Mines, and includes a "CHR" right turn and passing bay in Ulan Road, allowing northbound vehicles to pass around vehicles turning right into Ulan-Wollar Road, and an "AUL" auxiliary lane (deceleration lane) in Ulan Road for the left turn into Ulan-Wollar Road, and intersection lighting.

Wollar Road, also known as Main Road 208 (MR208) extends between Castlereagh Highway (State Highway 18) at Mudgee and Golden Highway (State Highway 27) at Sandy Hollow. Between Mudgee and Bylong, it is known as Ulan Road, Wollar Road and Wollar-Bylong Road. MR208 is a two lane rural road with bitumen seal and unsealed shoulders. Between Mudgee and Budgee Budgee, the sealed carriageway is 7 to 7.5m wide and the unsealed shoulders are 2 to 3m wide. Between Budgee Budgee and Sandy Hollow, the sealed carriageway varies in width between 6 and 7.5m, and the unsealed shoulders have an average width about 2m.

Main Road 214 (MR214) extends from MR208 at Budgee Budgee to the Golden Highway at Cassilis to the north. It is known as Ulan Road between Mudgee and Ulan, and as Ulan-Cassilis Road between Ulan and Cassilis.

Main Road 598 (MR598) is known as Cope Road, and provides an east-west link between Gulgong and Ulan. It is a sealed road with a width of 6 to 7.5m, with unsealed 2m wide shoulders. This route extends farther to the east of Ulan as Ulan-Wollar Road, and it intersects with MR208 at the township of Wollar.

3.2 Existing Average Weekday Traffic Conditions

Automatic counts were undertaken over a one week period in February 2010 at eight sites on key routes used by WCM traffic. The locations of the eight survey sites are presented on **Figure 1**, and the average weekday traffic volume and proportion of heavy vehicles for each site are summarised in Table 3.1.

Table 3.1 – Existing Average Weekday Traffic Volumes (February 2010)

Road	Location	Survey Site	Volume (vehicles/day)	Percent Heavy Vehicles
Cope Road	West of Ulan Road	8	1,043	15.7
Ulan-Cassilis Road	North of Ulan-Wollar Road	6	2,241	13.2
Ulan-Wollar Road	West of WCM	1	415	15.9
Ulan-Wollar Road	East of WCM	2	119	17.4
Wollar Road	East of Wollar	3	161	26.1
Wollar Road	North of Lindburn Road	7	455	7.3
Ulan Road	North of Cooks Gap	5	1,841	14.3
Ulan Road	South of Budgee Budgee	4	6,624	9.1

It is noted that the average weekday volumes were around 11 percent (%) higher than the average volumes measured over the seven-day week.

3.3 *Existing Peak Hour Intersection Operation*

A morning and evening peak hour turning movement survey was undertaken at the intersection of Ulan-Wollar Road and Ulan Road. The survey was conducted between 6.00am and 9.00am on 12 February 2010, and between 4.00pm and 7.00pm on 11 February 2011. The morning peak hour occurred between 6.00 and 7.00am and the evening peak hour between 4.30pm and 5.30pm. The peak hour turning movements are presented on **Figure 2.**

The peak hour operation of the surveyed intersection was analysed using Sidra Intersection, an analysis program which determines characteristics of intersections operating conditions including the degree of saturation, average delays, and levels of service. The degree of saturation, or x-value, is the ratio of the arrival rate of vehicles to the capacity. The operating characteristics can be compared with the performance criteria set out in Table 3.2 below. It is noted that average delay per vehicle is expressed in seconds per vehicle and is measured for the movement with the highest average delay at priority intersections.

Table 3.2 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

The results of the analysis are presented in Table 3.3, noting that the average delay is for the movement with the highest average delay per vehicle. In this situation, this is the right turn movement from Ulan-Wollar Road into Ulan Road. The existing evening on-street peak was analysed, together with the future peak hour for the Modification.

Table 3.3 – Existing Intersection Operating Conditions (February 2010)

	X-value	Average Delay (sec)	Level of Service
6.00 to 7.00am	0.15	16.4	B
4.30 to 5.30pm (on-street peak)	0.10	15.2	B
6.00 to 7.00pm (Modification peak)	0.04	13.8	A

The results indicate that the intersection currently operates at good Levels of Service during the morning and evening peak hours. There is spare capacity, and the average delays experienced by drivers are low.

3.4 Existing Wilpinjong Coal Mine Employee Traffic

WCM presently employs a workforce of 296 people, made up of approximately 11 Peabody employees, 170 Theiss employees, and 115 full-time equivalent Subcontractors. Table B.2 in Attachment B sets out the existing distribution of employees, while Table B.3 of Attachment B lists the existing and additional workforce during construction of the Modification..

The mine operates shifts, and not all employees are on-site each day. Table B.4 in Attachment B details the existing shift arrangements and estimated employee numbers. This indicates that the total number of employees on-site on an average weekday is 145 people, excluding on-site contractors. Car pooling amongst employees is reasonably low, thus conservatively assuming one employee per vehicle, the existing employees would generate some 290 vehicle trips per day. A vehicle trip is a one way movement, thus an employee arriving and departing the site generates two vehicle trips.

On-site contractors account for some 75 to 80 additional people on-site on an average weekday. Car pooling is more prevalent among contractors, and it is estimated that contractors would generate around 120 vehicle trips per day. Thus, when combined, existing employees and on-site contractors generate approximately 410 vehicle trips per day.

Based on the distribution of employees and the total number of vehicle trips, Table 3.4 presents an estimation of the distribution of employee-generated vehicle trips on routes travelling to and from the mine, using the shortest or quickest route between the mine and the source location. Employees travelling between the WCM and Mudgee have a choice of two routes, one being via Ulan-Wollar Road (west) and Ulan Road, the other being via Ulan-Wollar Road (east) and Wollar Road. Both routes are of very similar length, however the former represents the much better quality road, having been recently upgraded as described in Section 3.1. It is assumed that all employees travelling between WCM and locations south of Budgee Budgee would travel via Ulan Road rather than Wollar Road.

Table 3.4 – Existing Average Weekday WCM Employee Vehicle Trips (veh/day)

Road	Location	Percent of Employee Trips at Location	Average Weekday Employee Vehicle Trips (veh/day)
Mine Access Road	South of Ulan-Wollar Road	100	410
Cope Road	West of Ulan	16	65
Ulan-Cassilis Road	North of Ulan	3	13
Ulan-Wollar Road	West of WCM	90	370
	East of WCM	10	40
Wollar Road	East of Wollar	3	13
	North of Lindburn Road	1	4
Ulan Road	North of Cooks Gap	71	292
	South of Budgee Budgee	68	278

Note: Employees includes on-site contractors

Vehicle trips generated by employees are all by light vehicles, which include motorcycles, cars, vans, 4WDs and utes, including those towing a trailer or caravan.

3.5 *Existing Wilpinjong Coal Mine Delivery Traffic*

WCM attracts vehicles associated with deliveries to the site, including fuel, machine parts, and other consumables. During an average weekday, an estimated eight delivery vehicles visit the site per day. Half of these are heavy vehicles, which include single unit trucks with two to four axles and articulated vehicles such as semi-trailers, and rigid trucks with trailers. The remaining half of delivery trips are light vehicles, such as vans, 4WDs, and utes.

The main source of consumables is Mudgee, which is the source for 89% of the major consumables and deliveries to the site. As for employee traffic, all deliveries between WCM and Mudgee are assumed to use Ulan Road. Some 9% of deliveries come from Newcastle, and 2% from Orange. It is assumed that deliveries from Newcastle would be via the Golden Highway and Ulan-Cassilis Road, rather than accessing the WCM by Ulan-Wollar Road and Ulan-Bylong Road to the east. The average weekday delivery trips on roads around WCM are summarised in Table 3.5.

Table 3.5 – Existing Average Weekday WCM Delivery Vehicle Trips (veh/day)

Road	Location	Percent of Delivery Trips at Location	Delivery Vehicle Trips (veh/day)
Mine Access Road	South of Ulan-Wollar Road	100	16
Cope Road	West of Ulan	2	0
Ulan-Cassilis Road	North of Ulan	9	2
Ulan-Wollar Road	West of WCM	100	16
	East of WCM	0	0
Wollar Road	East of Wollar	0	0
	North of Lindburn Road	0	0
Ulan Road	North of Cooks Gap	89	14
	South of Budgee Budgee	89	14

Note: Deliveries would generate fewer than one trip per day on Cope Road.

3.6 *Total Existing Wilpinjong Coal Mine Traffic*

Table 3.6 summarises the existing vehicle trips generated by the WCM during the average weekday at key locations on the surrounding road network.

Table 3.6 – 2010 Average Weekday WCM Total Vehicle Trips (veh/day)

Road	Location	Employee Trips	Delivery Trips	Total Trips
Mine Access Road	South of Ulan-Wollar Road	410	16	426
Cope Road	West of Ulan	65	0	65
Ulan-Cassilis Road	North of Ulan	13	2	15
Ulan-Wollar Road	West of WCM	370	16	386
	East of WCM	40	0	40
Wollar Road	East of Wollar	13	0	13
	North of Lindburn Road	4	0	4
Ulan Road	North of Cooks Gap	292	14	306
	South of Budgee Budgee	278	14	292

Note: Employees includes on-site contractors.

Thus, the WCM is estimated to currently generate some 426 vehicle trips per day on an average weekday. The majority of these trips are by light vehicles, with less than 2% being heavy vehicle trips associated with deliveries, significantly less than the existing proportion of heavy vehicles on roads in the vicinity (Table 3.1).

The contribution of WCM traffic to existing traffic volumes is summarised in Table 3.7.

Table 3.7 – Existing Average Weekday WCM Traffic Contribution

Road	Location	Total Traffic (veh/day)	WCM Traffic (veh/day)	WCM % of Total
Mine Access Road	South of Ulan-Wollar Road	426	426	100
Cope Road	West of Ulan	1,043	65	6
Ulan-Cassilis Road	North of Ulan	2,241	15	1
Ulan-Wollar Road	West of WCM	415	386	93
	East of WCM	119	40	34
Wollar Road	East of Wollar	161	13	8
	North of Lindburn Road	455	4	1
Ulan Road	North of Cooks Gap	1,841	306	17
	South of Budgee Budgee	6,624	292	4

These results demonstrate that the WCM contributes significantly to traffic volumes on Ulan-Wollar Road, being some 93% of total traffic between the mine access road and Ulan Road. Its contribution declines as distance from the WCM increases, with 17% of traffic on Ulan Road near Cooks Gap being related to WCM, and 4% on Ulan Road south of Budgee Budgee.

4. Modification Traffic Generation

4.1 Modification Construction Workforce Traffic

The 9 month construction phase is expected to employ an average of 150 employees and a peak of 280 employees. It is expected that up to 85% of the construction workforce would be on-site during any given weekday. The construction workers would work 12-hour shifts, with day shifts employing around 75% of the construction workforce, and night shifts employing 25%.

The times of shifts would vary according to the work being undertaken, the season and weather. Generally it is anticipated that the day shift would nominally start at 6.30am, varying to start no earlier than 5.30am and no later than 7.00am. The night shift would nominally start at 6.30pm.

Table 4.1 presents the estimated average weekday vehicle trips generated by the construction workforce. This assumes that the construction workforce would follow a similar distribution on the surrounding road system as existing employees, and conservatively assumes one employee per vehicle. As for the existing operational employee traffic, construction employees would be expected to use light vehicles only.

Table 4.1 – 2011 Average Weekday Construction Employee Vehicle Trips (veh/day)

Road	Location	During Average Activity	During Peak Activity
Mine Access Road	South of Ulan-Wollar Road	255	476
Cope Road	West of Ulan	41	76
Ulan-Cassilis Road	North of Ulan	8	15
Ulan-Wollar Road	West of WCM	230	430
	East of WCM	25	46
Wollar Road	East of Wollar	8	15
	North of Lindburn Road	3	5
Ulan Road	North of Cooks Gap	181	339
	South of Budgee Budgee	173	323

4.2 *Modification Construction Delivery Traffic*

During the construction period, various deliveries would be required, including machine parts, and concrete. During peak construction activity, deliveries are expected to attract ten heavy vehicles on a typical weekday.

Assuming that the majority of deliveries would be sourced from Mudgee (similar to existing operational deliveries), Table 4.2 presents the likely distribution of construction vehicle trips on the surrounding road system during the peak construction period.

Table 4.2 – 2011 Average Weekday Construction Delivery Vehicle Trips (veh/day)

Road	Location	During Peak Activity
Mine Access Road	South of Ulan-Wollar Road	20
Cope Road	West of Ulan	0
Ulan-Cassilis Road	North of Ulan	2
Ulan-Wollar Road	West of WCM	20
	East of WCM	0
Wollar Road	East of Wollar	0
	North of Lindburn Road	0
Ulan Road	North of Cooks Gap	18
	South of Budgee Budgee	18

4.3 *Additional Modification Operational Employee Traffic*

The number of operational employees is proposed to increase by 54 people from 296 to approximately 350 people with the Modification. As at present, not all employees would be present on the site on any given day.

It is estimated that the number of employees on-site on any given day would increase from 145 people to 165 people, while the number of on-site contractors on-site on any given day would increase from 75-80 up to 90 people. Conservatively assuming one employee per vehicle due to low uptake of car pooling, employees would generate an additional 40 vehicle trips per day on an average weekday. The additional contractors are estimated to generate an additional 10 vehicle trips per day, assuming a higher rate of car pooling amongst contractors than employees.

Table 4.3 presents the estimated additional employee and contractor traffic generated by the Modification. This assumes that future employees would follow a similar distribution of approach and departure routes as the existing employees.

Table 4.3 – 2011 Average Weekday Additional WCM Employee Vehicle Trips (veh/day)

Road	Location	Additional Employee and Contractor Vehicle Trips (veh/day)
Mine Access Road	South of Ulan-Wollar Road	50
Cope Road	West of Ulan	8
Ulan-Cassilis Road	North of Ulan	2
Ulan-Wollar Road	West of WCM	45
	East of WCM	5
Wollar Road	East of Wollar	2
	North of Lindburn Road	1
Ulan Road	North of Cooks Gap	36
	South of Budgee Budgee	34

4.4 Additional Modification Operational Delivery Traffic

The increased production resulting from the Modification would generate additional demand for consumables, thus increasing the number of delivery vehicle trips to and from the mine. It is estimated that the increased production would generate a demand for an additional eight delivery vehicles per day, with half being heavy vehicles (for machine parts and fuel) and half being small trucks and couriers.

Assuming that, like the present situation, future deliveries would be primarily drawn from Mudgee, Table 4.4 presents the increase in delivery vehicle trips at key locations on the surrounding road network.

Table 4.4 – 2011 Average Weekday Additional WCM Delivery Vehicle Trips (veh/day)

Road	Location	Delivery Vehicle Trips (veh/day)
Mine Access Road	South of Ulan-Wollar Road	16
Cope Road	West of Ulan	0
Ulan-Cassilis Road	North of Ulan	2
Ulan-Wollar Road	West of WCM	16
	East of WCM	0
Wollar Road	East of Wollar	0
	North of Lindburn Road	0
Ulan Road	North of Cooks Gap	14
	South of Budgee Budgee	14

4.5 Total Modification Traffic Generation Increase

Table 4.5 summarises the expected increases in traffic on the surrounding road network during 2011 resulting from the proposed Modification.

Table 4.5 – 2011 Average Weekday Additional Traffic due to Modification (veh/day)

Road	Location	Operational		Construction Peak		Total
		Workforce *(light)*	Deliveries *(50% heavy)*	Workforce *(light)*	Deliveries *(100% heavy)*	Increase 2011
Mine Access Rd	S of Ulan-Wollar Rd	50	16	476	20	562
Cope Road	W of Ulan	8	0	76	0	84
Ulan-Cassilis Rd	N of Ulan	2	2	15	2	21
Ulan-Wollar Rd	W of WCM	45	16	430	20	511
	E of WCM	5	0	46	0	51
Wollar Rd	E of Wollar	2	0	15	0	17
	N of Lindburn Rd	1	0	5	0	6
Ulan Road	N of Cooks Gap	36	14	339	18	407
	S of B. Budgee	34	14	323	18	389

Note: Additional average weekday traffic is above 2010 average weekday traffic.

Thus, during the critical year, and conservatively assuming peak construction coincides with increased operational movements, the Modification would be expected to generate an additional 562 vehicle trips per day on an average weekday above the 2010 traffic generation. These trips would be primarily by light vehicles, with heavy vehicles making up some 28 trips per day, or around 5% of the total trips generated. This is significantly below the surveyed proportion of heavy vehicles on key roads in the area (Table 3.1).

The additional traffic generated by the Modification during morning and evening peak hours was estimated assuming that employees arrive in the half hour before their shift starts, and depart within half an hour of their shift finishing. Delivery traffic was assumed to be spread throughout the day, with a conservatively high assumption that some delivery trips would coincide with employee arrival and departures. Based on the nominal shift start and end times, and increases in employees, the morning peak generation would occur between 6.00am and 7.00am, and the evening peak would occur between 6.00pm and 7.00pm. The evening peak generation of the Modification is therefore not expected to coincide with the existing on-street peak, which occurs between 4.30pm and 5.30pm. The Modification traffic generation during the on-street evening peak has therefore also been assessed separately.

Table 4.6 summarises the traffic expected to be generated by the proposed Modification during the morning and evening peak hours.

Table 4.6 – 2011 Peak Hour Additional Traffic due to Modification (veh/hour)

Time	Direction	Operational		Peak Construction		Total
		Workforce *(light)*	Deliveries *(50% heavy)*	Workforce *(light)*	Deliveries *(100% heavy)*	Increase 2011
6.00 to 7.00	Inbound	16	2	179	2	199
	Outbound	1	2	60	2	65
	Two Way	17	4	239	4	264
16.30 to 17.30	Inbound	0	1	0	1	2
	Outbound	8	1	0	1	10
	Two way	8	2	0	2	12
18.00 to 19.00	Inbound	7	2	60	2	71
	Outbound	3	2	179	2	186
	Two way	10	4	239	4	257

Note: Additional peak hourly traffic is above 2010 average weekday traffic.

Thus, the Modification would generate in the order of 260 vehicle trips during the morning and evening peak hours.

5. Cumulative Traffic Potential

The traffic implications of other potential developments in the vicinity of the WCM and general background growth in traffic have been considered as part of this assessment. The Ulan Coal – Continued Operations Project and Moolarben Coal Project – Stage 2 have not yet been approved, however these have been included to present a robust assessment of future traffic conditions using the "worst case" scenario that all projects are operational in 2011.

5.1 Background Traffic Growth

As part of their assessment of the Moolarben Coal Project Stage 2, Sinclair Knight Merz (SKM) developed forecasts of traffic volumes on key roads based on historic traffic volume data from the NSW Roads and Traffic Authority. Key results from that assessment are summarised below in Table 5.1.

Table 5.1 – Traffic Volume Growth Trends

Road	Location	2002	2005	2009	2019
SH18	Between Mudgee and Gulgong	3,131	3,310	3,549	4,146
MR214	North of Budgee Budgee	1,421	1,507	1,622	1,909
MR598	East of Gulgong	1,480	1,556	1,657	1,910

Source: Figures 4-1 to 4-3, SKM, November 2008

The results indicate that the growth forecast by SKM from 2009 to 2019 was between 1.5% and 1.8% per annum (linear), or an average of 1.7% per annum (linear).

Applying the higher growth rate to the 2010 non-WCM generated traffic, estimates of background growth in traffic to the critical year for the WCM have been calculated, and are presented in Table 5.2.

Table 5.2 – Growth in Average Weekday Traffic to 2011 (veh/day)

Road	Location	2010 WCM Traffic	2010 Non-WCM Traffic	Non-WCM Growth to 2011
Mine Access Road	South of Ulan-Wollar Road	426	0	0
Cope Road	West of Ulan	65	978	17
Ulan-Cassilis Road	North of Ulan	15	2,226	39
Ulan-Wollar Road	West of WCM	386	29	1
	East of WCM	40	79	1
Wollar Road	East of Wollar	13	148	3
	North of Lindburn Road	4	451	8
Ulan Road	North of Cooks Gap	306	1,535	27
	South of Budgee Budgee	292	6,332	112

5.2 *Ulan Coal Mines*

The WCM is located approximately 11km to the east of the Ulan Coal Mines, which is currently seeking approval for continued open cut and underground mining operations for a further 21 years. Consultants Transport & Urban Planning prepared the traffic assessment for the Ulan Coal – Continued Operations Project Environmental Assessment. That assessment found that peak traffic generation would occur during Year 4 of the Continued Operations Project, which is estimated to be 2013, depending on timing of Project Approval.

The existing and estimated future traffic generation of the Ulan Coal Mine is shown below in Table 5.3.

Table 5.3 – Estimated Average Weekday Two Way Traffic Generated by Ulan Coal Mines

	Existing 2009	Year 2 2011	Year 4 2013	Year 6 2015	Year 10 2019	Year 14 2023	Year 21 2030
Workforce/visitors	930	1,486	1,902	1,558	1,330	658	448
Deliveries	22	34	34	34	32	16	12
Total	952	1,520	1,936	1,592	1,362	674	460
Change from Existing	-	+568	+984	+640	+410	-278	-492

Source: Table 3.2 "Traffic & Transport Impact Assessment for the Ulan Coal Continued Operations Project at Ulan" Transport & Urban Planning, August 2009

The assessment calculated the additional traffic volumes on the road network near Ulan generated by the Project in Year 4 (2013). This is presented in Table 5.4 below, together with an estimate of the additional traffic generated in Year 2 (2011), calculated based on the relative increase in traffic in 2011.

Table 5.4 – Additional Average Weekday Two Way Traffic with Ulan Coal (veh/day)

Location	Year 2 – 2011	Year 4 – 2013
Ulan Road south of Cope Road	393	680
Ulan Road north of Cope Road	497	862
Ulan Road south of Ulan-Wollar Road	338	586
Ulan Road north of Ulan-Wollar Road	338	586
Ulan Road north of UCML underground access road	17	30
Cope Road west of Ulan Village	148	256
Cope Road (Main Street) west of Ulan Road	185	320

Source: Table 5.1 "Traffic & Transport Impact Assessment for the Ulan Coal Continued Operations Project at Ulan" Transport & Urban Planning, August 2009

The assessment which follows assumes that during the February 2010 surveys, the traffic generation of the Ulan Coal Mine was equivalent to the reported "Existing (2009)" generation.

The report estimates that during the 6.00am to 7.00am peak hour in Year 4 (2013), the Ulan Coal – Continued Operations Project would contribute an additional 235 vehicles northbound and 13 vehicles per hour southbound on Ulan Road past Ulan-Wollar Road (Transport and Urban Planning, 2009). Applying the relative increase in total traffic in Year 2 (2011), it can be expected that during Year 2 (2011), the Ulan Coal – Continued Operations Project would contribute some 136 vehicles northbound and 8 vehicles per hour southbound on Ulan Road past Ulan-Wollar Road. The report notes that the morning peak hour generation assumes that 100% of the construction workforce arrives during the 6.00am to 7.00am hour, whereas it is likely that perhaps only two-thirds would arrive within that hour. It is thus considered to be a worst case assessment.

The traffic report does not present estimates of evening peak hour generation. It notes that the additional mining workforce for Ulan West Underground Mine would generally work three shifts per day on weekdays, and that the finish times of shifts on weekdays would not coincide with the start times of the following shifts. Construction hours are expected to be 7.00am to 7.00pm.

In the absence of a detailed assessment of evening peak hour implications of the Ulan Coal – Continued Operations Project, the assessment which follows assumes that during the evening peak on-street and Modification peak hours, the Ulan Coal – Continued Operations Project would generate two-thirds of the morning peak hour generation. This is assumed to be the reverse distribution to the morning peak hour, and is considered to be a conservatively high assumption with regard to the potential implications of the Ulan Coal – Continued Operations Project during the evening peak hours.

5.3 Moolarben Coal Mines

The Moolarben Coal Mines are located near Ulan, and has its vehicle access from Ulan Road in Stage 1 and from Ulan-Wollar Road in Stage 2. SKM prepared the traffic impact assessments for the Moolarben Coal Project Stage 1 and Stage 2. Access to Stage 1 is from Ulan Road approximately 400m north of the rail bridge at Ulan. Stage 2 comprises one open cut and two underground mines which would operate concurrently with Stage 1, with vehicle access for employees from Ulan-Wollar Road east of Ulan Road.

Stage 1 is already under construction, and thus traffic generated by Stage 1 was included in the February 2010 surveyed volumes presented in Sections 3.2 and 3.3. The additional traffic generated by Stage 2 has therefore been estimated, assuming that Stage 2 is operational during the critical year for the WCM.

In the recent assessment of the Ulan Coal – Continued Operations Project, Traffic & Urban Planning summarised the traffic generation of the Moolarben Coal Mines as follows for the average weekday for Stage 2:

- Average weekday 244 vehicle trips per day.
- 196 vehicles per day on Ulan Road between Mudgee and Ulan.
- 48 vehicles per day on Cope Road between Gulgong and Ulan.

- 66 vehicles per hour northbound on Ulan Road between Mudgee and the Moolarben Coal Mines' Ulan-Wollar Road access during the 6.00am to 7.00am weekday peak hour.
- 16 vehicles per hour eastbound on Cope Road between Gulgong and the Moolarben Coal Mines' Ulan-Wollar Road access during the 6.00am to 7.00am weekday peak hour.

Thus, Stage 2 of the Moolarben Coal Project would be expected to contribute some 82 vehicle trips on Ulan-Wollar Road during the 6.00am to 7.00am weekday morning peak hour.

The SKM report indicates that the evening peak hour would occur between 5.00pm and 6.00pm, when 96 people would leave the site (Stage 1 and 2 combined). Of these, 41 would be generated by Stage 2, with these drivers exiting via Ulan-Wollar Road. Between 6.00pm and 7.00pm, which is the evening peak hour for the WCM Modification, SKM estimated that some 75 people would arrive for night shift (Stage 1 and 2 combined), of which 40 would be associated with Stage 2, and would use the Ulan-Wollar Road access.

6. Future Traffic Conditions

Future average weekday traffic volumes on roads in the vicinity of the WCM are presented in Table 6.1 below. The future traffic volumes are assumed to be made up of existing volumes with background growth, additional traffic associated with the proposed Modification, and additional traffic associated with the Ulan and Moolarben Projects.

Table 6.1 – Existing and Future Average Weekday Traffic on Road System (veh/day)

Road	Location	Existing 2010	Additional Traffic in 2011				Future 2011
			Growth	Wilpinjong Modification	Ulan Coal Project	Moolarben Stage 2	
Mine Access Rd	S of U-Wollar Rd	426	0	562	0	0	988
Cope Road	W of Ulan	1,043	17	84	148	48	1,340
Ulan-Cassilis Rd	N of Ulan	2,241	39	21	17	0	2,319
Ulan-Wollar Rd	W of WCM	415	1	511	0	0	926
	E of WCM	119	1	51	0	0	172
Wollar Rd	E of Wollar	161	3	17	0	0	181
	N of Lindburn Rd	455	8	6	0	0	469
Ulan Road	N of Cooks Gap	1,841	27	407	393	196	2,864
	S of B. Budgee	6,624	112	389	393	196	7,714

6.1 Roadway Capacity

The Austroads (1988) *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* provides guidelines for the capacity of two lane, two way rural roads. Level of Service is defined as a qualitative measure describing the operational conditions within a traffic stream as perceived by drivers and/or passengers. Level of Service A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. Levels of Service B to D describe progressively worse conditions. Level of Service E occurs when traffic conditions are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre in the traffic stream. The service flow rate for Level of Service E is taken as the capacity of a lane or roadway.

Austroads (1988) presents a general method for assessing the Level of Service on two way, two lane rural roads, which can be applied to some of the roads serving the WCM. This is a general assessment for planning purposes only, rather than a detailed assessment of the particular characteristics of these roads. Assuming generally rolling terrain, the maximum Annual Average Daily Traffic (AADT) for various Levels of Service is shown below in Table 6.2. It is noted that the volumes assessed in this report are Average Weekday volumes, which as discussed in Section 3.2, were some 11% higher than the daily average measured over seven days. By way of comparison, Table 6.2 also presents the estimated average weekday equivalent volume for the Levels of Service.

Table 6.2 – Level of Service for Two Lane Two Way Rural Roads

Level of Service	Maximum AADT	Estimated Weekday Average Equivalent
A	1,100	1,220
B	2,800	3,110
C	5,200	5,770
D	8,000	8,880
E	14,800	16,430

Table 6.3 compares the future 2011 traffic forecasts on the surrounding roads with the Austroads' general Level of Service criteria presented above.

Table 6.3 – Indicative Levels of Service

Road	Location	Existing 2010		Future 2011	
		Volume	LoS	Volume	LoS
Mine Access Road	South of Ulan-Wollar Road	426	A	988	A
Cope Road	West of Ulan	1,043	A	1,340	B
Ulan-Cassilis Road	North of Ulan	2,241	B	2,319	B
Ulan-Wollar Road	West of WCM	415	A	926	A
	East of WCM	119	A	172	A
Wollar Road	East of Wollar	161	A	181	A
	North of Lindburn Road	455	A	469	A
Ulan Road	North of Cooks Gap	1,841	B	2,864	C
	South of Budgee Budgee	6,624	D	7,714	D

Note: Future 2011 includes Ulan Project and Moolarben Stage 2

The results indicate that with the exception of Ulan Road, Levels of Service on the surrounding roads would be expected to remain at A to B, with the volume on Ulan Road near Cooks Gap forecast as at the low end of the range for Level of Service C. Ulan Road south of Budgee Budgee would remain Level of Service D, which is acceptable conditions, and well within the nominal capacity of the road. The section of road shown above to experience Level of Service D is a short section a little over 1km long, which links between Mudgee and the turnoff at Henry Lawson Drive.

It is noted that the increases on these sections of road relate to:

- background traffic growth unrelated to the Modification;
- operational traffic associated with the WCM Modification;
- construction traffic associated with the WCM Modification;
- employee traffic associated with the Ulan Coal Mines; and
- employee traffic associated with the Moolarben Coal Mines.

The proposed Modification traffic represents about 36% of the total forecast increase in traffic in 2011, and most of WCM's contribution would occur only during the 9 month construction period. In the longer term, the future volumes on Ulan Road would be significantly lower than those forecast for 2011 and WCM's contribution would also fall significantly after the construction period.

6.2 Future Peak Hour Intersection Conditions

The operation of the intersection of Ulan Road and Ulan-Wollar Road was re-assessed for the future conditions with the Modification, and other approved and proposed developments. The forecast future turning movements at the intersection are shown in Table 6.4 and on **Figure 3**.

Table 6.4 – Existing and Future Intersection Operating Conditions

Ulan Rd and Ulan-Wollar Rd	X-value	Average Delay (sec)	Level of Service
Existing (February 2010)			
6.00 to 7.00am	0.15	16.4	B
4.30 to 5.30pm (on-street peak)	0.10	15.2	B
6.00 to 7.00pm (Modification peak)	0.04	13.8	A
Future 2011 Peak Construction			
6.00 to 7.00am	0.32	21.6	B
4.30 to 5.30pm (on-street peak)	0.15	15.2	B
6.00 to 7.00pm (Modification peak)	0.17	14.2	A

The results in Table 6.4 indicate that the intersection of Ulan Road and Ulan-Wollar Road would continue to operate at good levels of service during the peak hours with the combined effects of the additional traffic generated by the WCM Modification, Ulan Coal – Continued Operations Project and Moolarben Coal Project Stage 2. It is noted that these results do not specifically include the effects of background growth, however the increases in background traffic during the peak hours expected until 2011 would be very low, the forecasts of future traffic generated by the various developments are considered to be conservatively high, and the results demonstrate plenty of spare capacity would still be available at the intersection.

7. Conclusions

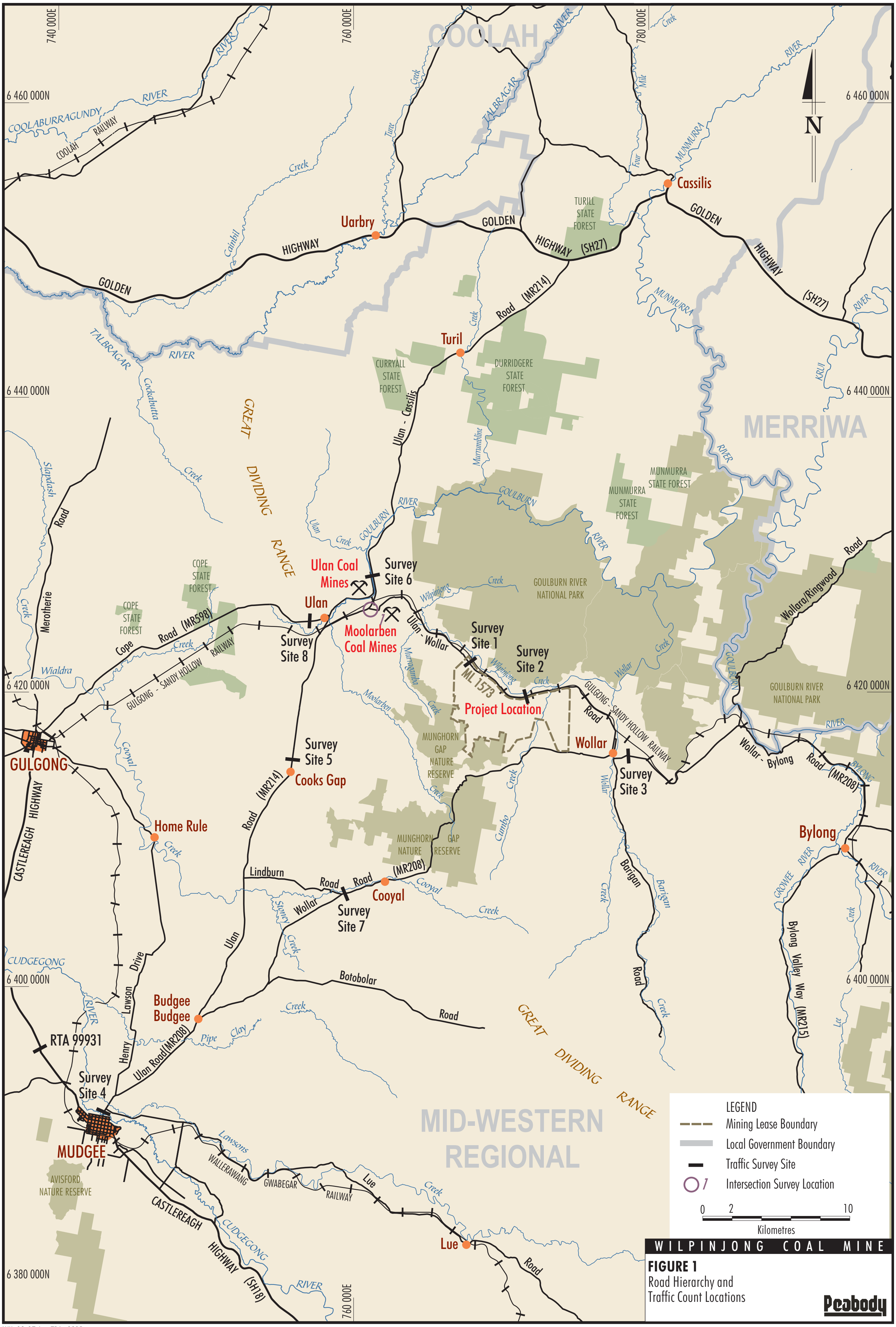
This study has found that for the proposed Modification at the WCM, 2011 would be the critical year with regard to potential impacts on the road system, as minor operational traffic increases would combine with significant construction traffic increase in that year. The contribution of the Modification to traffic conditions would decrease significantly after 2011.

No significant impacts on the performance and safety of the road network are expected to arise as a result of the Modification, even with the cumulative effects of the proposed changes to the Ulan Coal Mines and Moolarben Coal Mines, and no specific management or mitigation measures are considered to be warranted.

I trust that this submission meets your requirements, however do not hesitate to contact the undersigned should you wish to discuss any aspect.

Yours sincerely,

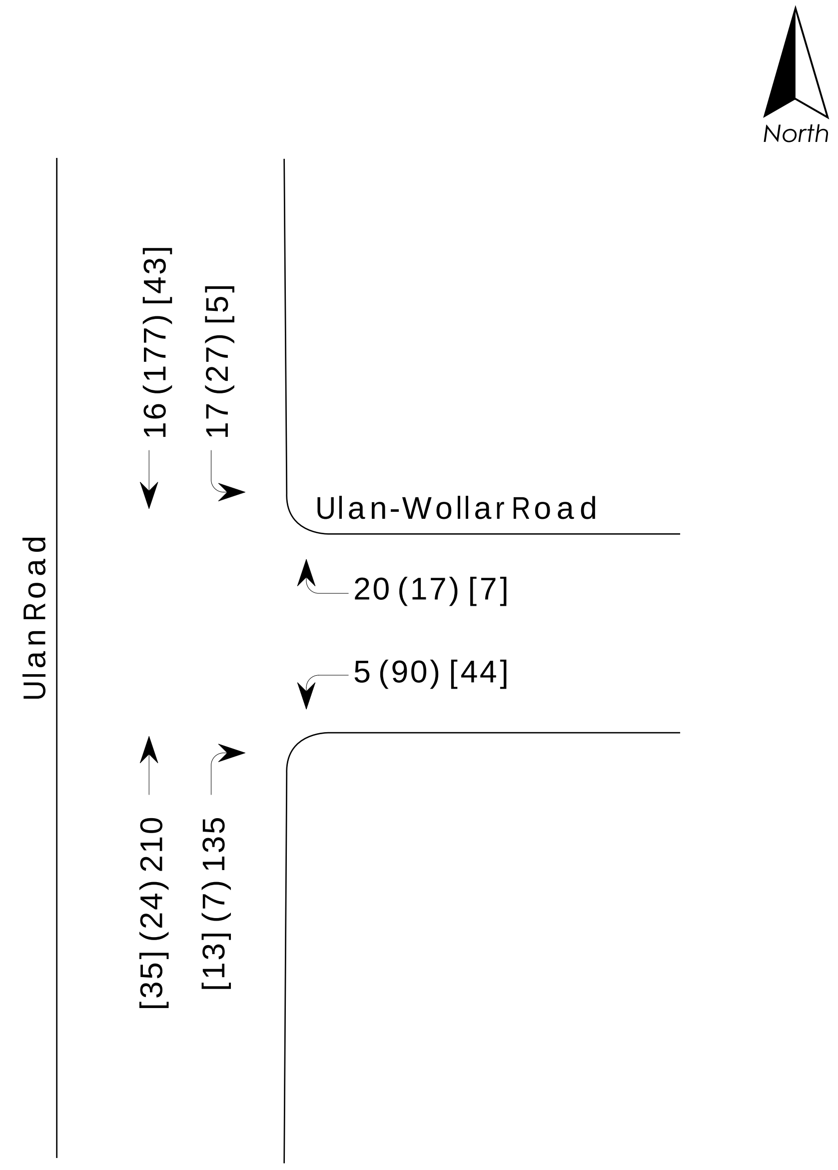
Penny Dalton
Principal Consultant, Transport Planning
Email: DaltonP@Halcrow.com



WIL-09-07 App TRA_001B

EXISTING (FEBRUARY 2010) PEAK HOUR TRAFFIC VOLUMES

WILPINJONG COAL MINE MODIFICATION



Key

5: 6:00 - 7:00am

(5): 4:30 - 5:30pm

[5]: 6:00 - 7:00pm

Halcrow

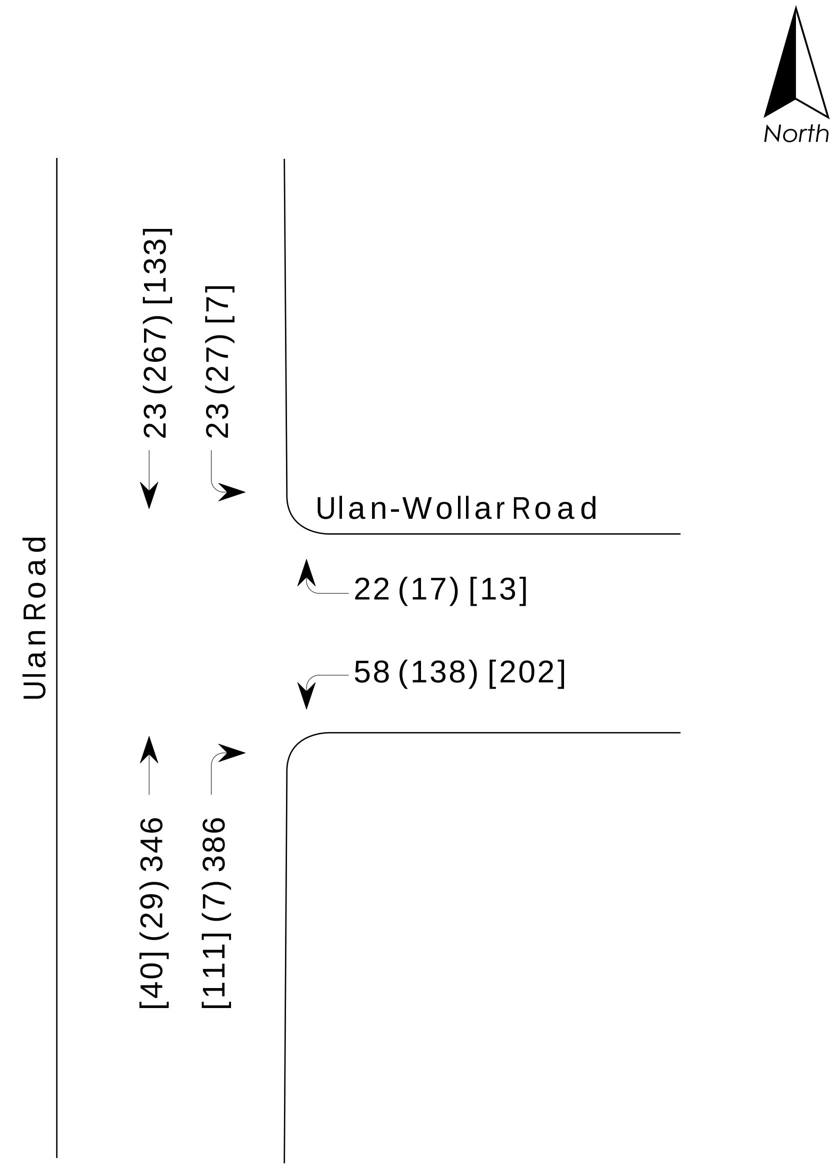
Figure 2

Filename: CTLRFOdi01.ai

Date: 4 march 2010

FUTURE 2011 PEAK HOUR TRAFFIC VOLUMES

WILPINJONG COAL MINE MODIFICATION



Note: Includes Wilpinjong Coal Mine Modification peak construction, Year 2 Ulan Coal Project, and Stage 2 Moolarben Coal Mine traffic

Key

5: 6:00 - 7:00am

(5): 4:30 - 5:30pm

[5]: 6:00 - 7:00pm

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Figure 3

Filename: CTLRFOdi02.ai

Date: 4 march 2010

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Attachment A – References

Guide to Traffic Engineering Practice Part 2: Roadway Capacity, Austroads, 1988

Moolarben Coal Project Stage 2 Traffic Impact Assessment, Sinclair Knight Merz, November 2008

Traffic & Transport Impact Assessment for the Ulan Coal Continued Operations Project at Ulan, Transport & Urban Planning, August 2009

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Attachment B – Data Tables

Table B.1 – Proposed Modified Mining Schedule

Year		Waste (Mbcm)	ROM (Mt)	Reject (Mt)	Product (Mt)
2010	5	17.5	10.6	2.1	8.5
2011	6	25.0	13.5	2.7	10.8
2012	7	27.0	13.5	2.7	10.8
2013	8	27.0	15.0	3.0	12.0
2014	9	28.0	15.0	3.0	12.0
2015	10	27.0	14.2	2.8	11.4
2016	11	24.0	13.0	2.6	10.4
2017	12	22.0	13.0	2.6	10.4
2018	13	21.0	13.0	2.6	10.4
2019	14	18.0	13.0	2.6	10.4
2020	15	15.0	12.0	2.4	9.6
2021	16	15.0	10.5	2.1	8.4
2022	17	15.0	10.1	2.0	8.1
2023	18	15.0	9.5	1.9	7.6
2024	19	15.0	9.4	1.9	7.5
2025	20	12.0	9.4	1.9	7.5
2026	21	10.0	6.2	1.2	5.0
Total		**366.6**	**223.7**	**43.2**	**180.5**

Table B.2 – Existing Workforce Distribution

Employer	Existing Employees	Existing Distribution	
		Percent	Location
Peabody	11	80	Mudgee
		20	Gulgong
Theiss and Subcontractors	170+115	55	Mudgee
		13	Gulgong
		3	Cooks Gap
		2	Merriwa
		2	Cooyal
		2	Ilford
		2	Wollar
		1	Parkes
		1	Dunedoo
		1	Kains Flat
		1	Dubbo
		1	Grattai
		1	Bowral
		1	Kandos
		1	Bowen Mountain
		1	Botobolar
		1	Laheys Creek
		11	Unknown

Table B.3 – Existing and Modification Workforce

	Workforce
Existing Operations	296
Proposed Operations	350
Proposed Construction Average	150
Proposed Construction Peak	280

Table B.4 – Existing Shifts at Wilpinjong Coal Mine

Theiss and WCPL Personnel	Nominal Shift Start	Nominal Shift Finish	Average Employees On-Site per Weekday
Day Shift Crews (production)	7.00am	7.00pm	40
Swing Shift Crews (production)	5.00am	7.00am	CHPP Crew
Night Shift Crews (production)	7.00pm	5.00am	40
CHPP and Workshop	6.30am	6.30pm	10
	6.30pm	6.30am	10
Office Staff	7.00am	5.00pm	45
Total per Day			**145**

Note: Total does not include on-site contractors

On-site contractors would arrive between 6.00am and 8.00am, and depart between 4.00pm and 7.00pm.

Appendix D




Water Balance Review

Gilbert & Associates Pty Ltd

9 March 2010

General Manager
Wilpinjong Coal Mine
Locked Bag 2005
Mudgee NSW 2850

Attention: Keith Downham

Dear Keith

Re: Wilpinjong Coal Mine Water Balance Review for Proposed Mine Modification

As requested, we have completed an upgrade of the Wilpinjong water balance model to incorporate the proposed mine modification and to identify any changes to the water management/water supply system required to support the increased rate of production. This letter summarises our findings, builds upon and references the site water balance[1] undertaken for the initial phase of mining. The upgraded water balance model incorporates the period from the beginning of 2010 to the end of 2026.

1. OUTLINE OF PROPOSED MODIFICATION

We understand that the proposed modification would involve increasing the maximum run-of-mine (ROM) coal production rate from 13 million tonnes per annum (Mtpa) to approximately 15 Mtpa in the medium term with a reduced production rate in the later mine life. The modification would also involve an upgrade of the existing Coal Handling and Preparation Plant (CHPP) (50% of ROM coal will be washed in the CHPP, with the remainder crushed and sold as an unwashed product). Mining activities are to occur within the currently approved mining extent.

2. PROJECT WATER MANAGEMENT SYSTEM

2.1 Open Cut Development

As currently approved, open cut development would occur in six open cuts, designated Pits 1 to 6. Advancing mine pits will generally be backfilled with overburden as mining progresses. The order of pit development is illustrated in Figure 1. Fine rejects (tailings) disposal has to date occurred in a remnant void at the northern end of Pit 1. A similar remnant void at the northern end of Pit 2 is subsequently planned for tailings storage and, once this is filled, tailings disposal will relocate to another remnant void at the northern end of Pit 5. Consistent with the approved mine, two final voids are planned at the end of 2026 – in Pit 3 (North) and Pit 6.

[1] WCPL (2006). *Wilpinjong Coal Project Site Water Balance.* Wilpinjong Coal Pty Limited, July.

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2.2 Water Management System Description

The mine water management system is based on the collection, storage and use of water collected from areas used for the mining and handling of coal and mine waste rock. These areas include:

- open cut pits;
- non-rehabilitated or partially rehabilitated portions of the waste rock dumps;
- tailings disposal areas;
- coal handling areas (i.e. ROM Pad, CHPP, haul roads); and
- runoff from undisturbed areas which cannot be diverted around mine areas and report to one of the above areas.

The generation of mine water is minimised by the interception and diversion of runoff from undisturbed and rehabilitated landforms around mining areas where practicable. Diversions will be developed progressively as required over the life of the mine in accordance with the open pit mining progression. It has been assumed that diversions would be located immediately upslope of active mine areas and would be periodically reconstructed as the mine areas advance. The assumed progressive layout of diversions is shown in Figure 2.

The water management system is shown in schematic form on Figure 3 and will be progressively developed as water management requirements for open cut development and rehabilitation change over time. The water management system is an expansion of the system described in the 2006 water balance.

The main components of the system include the following (refer Figure 3):

- The Recycle Water Dam (RWD), complete with pumps to provide water for haul road dust suppression and transfer to/from the Rail Loop Pond or Clean Water Dam (CWD). The RWD has a capacity of 450 megalitres (ML).
- The CWD, an above-ground water storage constructed within the rail loop, which is supplied with water by reclaim from tailings storages, transfer from the RWD and from water supply bores, if required. Pumped transfer from the CWD to the RWD can also occur. The CWD has a capacity of 50 ML.
- The Pit 1 Water Storage (P1WS) which is effectively a surge storage for the RWD. It is understood that the P1WS is planned for construction in the south of the Pit 1 area in 2010 with a design capacity of 1,250 ML.
- Clean water diversions, designed to divert runoff from areas undisturbed by mining and related activities.
- Collection drains to capture runoff from areas disturbed by mining and direct runoff to one of the open cut pits.
- A pit dewatering system, which allows removal of water from pit sumps to the RWD, P1WS or tailings storages to allow mining to proceed.
- A water reclaim system which allows recovery of water from the tailings disposal areas to the CWD for re-use.

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3. WATER SOURCES

The mine water supply system consists of collection of runoff from a number of open cut mining areas, groundwater inflows to the open cuts, runoff collected from associated disturbance areas and supply from the approved water supply borefield. It is understood that Wilpinjong Coal Pty Ltd (WCPL) also has an agreement with the nearby Ulan Coal Mine to source excess water from this mining operation (by pipeline) if required in the future. Any such pipeline would be subject to separate environmental assessment and approval.

The water supply system will remain similar to that described in the 2006 water balance. The majority of the mine make-up water supply requirements will be met by dewatering of the open cut mining areas (refer Section 5). Sumps excavated in the floor of each open cut as part of routine mining operations will capture both runoff from surrounding disturbed areas and groundwater inflow from the Ulan Coal seam and the underlying Marangaroo Sandstone formation. Groundwater inflows to the open cuts are predicted to vary over the mine life and have been estimated by Australasian Groundwater and Environmental Consultants Pty Ltd (AGEC, 2010[2]).

Supernatant water will continue to be recovered from tailings storages (remnant open cut voids) and be recycled in the CHPP.

The approved Wilpinjong Coal Project includes a water supply borefield of up to 19 production bores located to the north of the extent of mining producing between 1 and 3 litres/second (L/s) per bore and over 43 L/s collectively. Five existing production bores, tapping the Ulan Seam and the underlying Marangaroo sandstone aquifer have been developed and are licensed to each provide up to 110 ML annually (equivalent to 3.5 L/s if pumped continuously). Additional production bores will be established as required over the life of the mine. The water balance includes a conservative assumption of the contribution of the borefield to the site water supply.

4. WATER USE AND MANAGEMENT

4.1 Water Supply Requirement

The main water usage for the mine is and will continue to be associated with the washing of ROM coal in the CHPP. CHPP make-up water is required to replace water pumped out with thickened tailings slurry and also due to moisture increases in product coal and coarse reject material caused by the processing of ROM coal. Other water supply requirements include water for dust suppression on haul roads and other non-potable water uses such as vehicle washing.

The net make-up water demand for the CHPP has been estimated for the period from 2010 to 2026 from monitored make-up usage data provided by Thiess (mining contractor). Based on the data provided, the average CHPP make-up requirement up to the end of 2009 has been calculated to be 250 L/ROM tonne washed in the CHPP.

[2] Australasian Groundwater and Environmental Consultants Pty Ltd (2010). *Review of Groundwater Inflow Projections – Wilpinjong Coal Mine.* Report prepared for Wilpinjong Coal Pty Ltd.

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Haul road (dust suppression) demands were estimated on the basis of active haul road length derived from projected mine plans provided by WCPL and evaporation allowance, including seasonal variations.

Table 1 summarises predicted annual water supply requirements for the CHPP and for dust suppression. The 17 year average CHPP make-up demand is 1,477 ML/year.

Table 1
Estimated Mine Water Supply Requirements

Year	CHPP ROM Feed (Mt)*	CHPP Make-up		Average Haul Road Requirement (ML/day)
		ML/year	ML/day	
2010	5.3	1325	3.63	1.44
2011	6.75	1688	4.62	1.61
2012	6.75	1688	4.62	1.86
2013	7.5	1875	5.14	2.42
2014	7.5	1875	5.14	3.15
2015	7.1	1775	4.86	3.08
2016	6.5	1625	4.45	3.24
2017	6.5	1625	4.45	3.74
2018	6.5	1625	4.45	4.28
2019	6.5	1625	4.45	4.83
2020	6	1500	4.11	4.71
2021	5.25	1313	3.60	3.38
2022	5.05	1263	3.46	2.19
2023	4.75	1188	3.25	2.02
2024	4.7	1175	3.22	1.67
2025	4.7	1175	3.22	1.29
2026	3.1	775	2.12	0.67

* 50% of projected ROM coal production; Mt = million tonnes

Comparison of the estimated peak CHPP make-up water demand in Table 1 and the water demand modelled in the Wilpinjong Coal Mine Environmental Impact Statement (EIS)[3] indicates that with the modification, estimated peak water demand is not expected to exceed the maximum water demand modelled in the EIS.

[3] Wilpinjong Coal Pty Limited (2005). *Wilpinjong Coal Project Environmental Impact Statement.* May.

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Hydrology and Water Management Consultants

Where practicable, mine water supply is and will continue to be prioritised as follows:

1. Internal recycling of water within the CHPP (thickener overflow).

2. Capture of runoff from active mine operational areas (i.e. CHPP, facilities and stockpile areas).

3. Dewatering of active open cut mining areas including groundwater inflows, upslope runoff and infiltration/runoff from adjacent mine waste rock emplacements. Recovery of supernatant waters and seepage collected from tailings disposal areas.

4. Dewatering of inactive open cut mining areas (including mine water storages) including groundwater inflows, upslope runoff and infiltration/runoff from adjacent mine waste rock emplacements.

5. Licensed extraction from mine water supply bores.

4.2 Upslope Diversion Works

Temporary and permanent upslope diversion works have and will continue to be constructed over the mine life to divert runoff from undisturbed areas around the open cut and mine waste rock emplacement areas to off-site drainages. Diversions have been planned for construction ahead of the advancing open cuts.

The design principles for diversion works and waste rock emplacement toe drainage (refer 2006 water balance[4]) remain unchanged for the modification.

5. WATER BALANCE MODELLING

5.1 Model Description

A water balance model of the mine has been developed which simulates future changes in stored volumes of water in response to inflows (rainfall-runoff, groundwater, tailings water and water supply bore extraction), outflows (evaporation, CHPP make-up, dust suppression usage and spill [if any]) and pumped transfers. Modelling includes simulation of storage in the CWD, the RWD, the P1WS, the tailings storages and each of the open cut pits (refer Figure 3). The catchments of each of the storages and open cuts have been calculated on an annual basis for the period 2010 to 2026 using mine development plans provided by WCPL.

The model operates on a less than daily time-step and was set up to run over a large number of different daily climate "realizations" compiled from the 121-year available record. Each realization comprised a 17-year period. The realizations were formed by moving along the historical record one year at a time with the first realization comprising the first 17 years in the record. The second realization comprised years 2 to 18 in the record while the third realization comprised years 3 to 19 and so on. At

4 Wilpinjong Coal Pty Ltd (2006). *Wilpinjong Coal Project Site Water Balance*.

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the end of the record, 16 years of data from the start of the record was added, so that data at the beginning and end of the record were used in as many realizations as data from the rest of the record. Using this methodology, 121 mine life realizations were simulated and used to generate statistics relating to mine water supply and spill risk. This method effectively includes all historical climatic events in the water balance model, including high, low and median rainfall periods.

5.2 Data and Assumptions

5.2.1 Groundwater Inflows

The mine groundwater model has been updated by AGEC[5]. The model was revised using the modified mine plan and allowing for extraction from mine water supply bores. The mine open cuts were assumed to contain no water in the groundwater model. Actual groundwater inflow rates would be lower if the open cuts contained significant water or saturated tailings. Therefore, in the water balance model, predicted groundwater inflows were "scaled down" in proportion to the predicted water level in each open cut. The water balance model also makes allowance for loss of groundwater inflow to evaporation from the highwall of each open cut. The predicted average 17-year groundwater inflow rate is 1.74 ML/day.

5.2.2 Other Data

Other key data and assumptions used in the model include the following:

- 121 years of rainfall data (1889-2009) was obtained for the site from the Queensland Department of Natural Resources and Mines Silo Data Drill (refer http://www.nrm.qld.gov.au/silo/datadrill/). A 121-year evaporation data set for the site was also obtained from this source. The final 3½ years of rainfall data in this data set was replaced with site records.

- The Australian Water Balance Model (AWBM)[6] was used to simulate runoff from rainfall on the various catchments and landforms across the mine area, with nine different sub-catchment types modelled and catchment areas varying with time according to mine plans provided by WCPL.

- Evaporative losses from open cut voids and on-site water storages (including tailings disposal areas) were estimated on the basis of the above evaporation rates and storage/void surface areas derived from supplied mine plans.

- Transfer pumps capable of pumping up to 150 L/s from open cuts and 73 L/s from water storages.

- Internal spills between storages as indicated on Figure 3. Storages without a spill path on Figure 3 were modelled as spilling externally (to Wilpinjong Creek).

[5] Australasian Groundwater and Environmental Consultants Pty Ltd (2010). *Review of Groundwater Inflow Projections – Wilpinjong Coal Mine.* Report prepared for Wilpinjong Coal Pty Ltd.

[6] Boughton W.C. (2004). *The Australian Water Balance Model.* Environmental Modelling & Software, Vol. 19, pp 943-956.

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- Sourcing of water from the CWD to meet CHPP demands and from the RWD for haul road dust suppression. In 2026, the RWD is planned to be mined through as part of Pit 2. Therefore it was assumed that dewatering of the RWD would be required from 2025. Therefore in 2025, haul road dust suppression water was assumed to be sourced from the P1WS – however this is understood to be backfilled in 2026, and therefore haul road dust suppression water was assumed to be sourced from Pit 6 (final void) in 2026.

- Availability of 11.5 L/s (1 ML/day) from five existing water supply bores from 1 July 2010, with an additional 13.8 L/s (1.2 ML/day) available from 1 January 2011 from development of more bores in the approved borefield. It is recognised that a significant volume of water is held on site as at the end of 2009 (approximately 1,100 ML). It was assumed that pumping from water supply bores would not commence until the volume of water stored on site fell below 1,000 ML and would cease if the volume of water stored rose above 1,000 ML. Note that the above borefield pumping rates are lower than the supply rates given in Table 1 and therefore there is an inherent reliance for water supply on mine area rainfall runoff and the storage of water in between rainfall runoff events.

5.3 Model Results and Implications

5.3.1 Water Supply Reliability

Predicted water supply reliability is summarised below. Reliability is calculated as volume supplied divided by CHPP and haul road demand volume (no allowance is made for temporary mine shutdown should water supply shortfall occur). Average reliability is averaged over all realizations and over the 17 year mine life, maximum reliability refers to the highest reliability in any realization (averaged over the 17 years of that realization) and minimum reliability is the lowest reliability in any 17 year realization (also averaged over the 17 years of that realization).

The estimated supply reliability is as follows:

- Average 83.6%
- Maximum 90.7%
- Minimum 76.5%

There is a very low predicted risk of CHPP water supply shortfall prior to 2012 – mainly due to the significant volume of water currently stored on site. There is a higher risk of supply shortfall in years after 2012. As stored water volume falls below 1,000 ML, WCPL will need to implement sourcing of water from water supply bores to maintain a storage “reserve” and supply reliability in line with the above predictions. Ongoing reviews of the mine water balance will provide updated information on future supply reliability, which is inherently highly influenced by site rainfall. Depending on the results of these reviews, WCPL could initiate sourcing additional water supply under agreement with the nearby Ulan Coal Mine (subject to separate environmental assessment and approval).

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5.3.2 Average Water Balance

The average water balance model inflows and outflows (averaged over all realizations and 17 years) are summarised in Table 2 below.

Table 2
Average Water Balance

Inflows (ML/year)	
Groundwater	637
Rainfall-runoff	843
Tailings supernatant water	141
Bore water supply	606
TOTAL	2,227
Outflows (ML/year)	
CHPP supply	1344
Haul road water	703
Evaporation	165
External spill	0.0
TOTAL	2,212

5.3.4 Water Containment

The predicted risk of spill from water storages off site is very low, provided that water is transferred between site storages to maintain adequate freeboard in those storages that would spill to WIlpinjong Creek. Although priority sourcing of water is undertaken from the active mine open cut pits, if there is no available capacity elsewhere, the model assumes water remains within the active pits.

No external spills are predicted from site storages in the model in any realization.

In accordance with the requirements of the Project Approval (Conditions 42 and 43) a Final Void Management Plan and Mine Closure Plan are to be prepared for the Wilpinjong Coal Mine. It is recommended that mine water balance reviews conducted over the last five years of mining operations include modelling of the predicted water and salinity balance of the final voids.

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6. CONCLUSION

The proposed modification to the Wilpinjong Coal Mine would not involve any change to the approved extent of mining or the life of the mine.

Review of the water balance implications of the proposed increased ROM coal production rates indicate that CHPP water consumption would increase above current consumption rates, but would remain below the peak annual make up water demand that was estimated in the EIS.

There is a very low predicted risk of CHPP water supply shortfall prior to 2012 – mainly due to the significant volume of water currently stored on site. The estimated average total supply reliability for the remainder of the mine life is 83.6%.

It is recommended that WCPL continue to undertake annual water balance reviews to examine the site water supply status and the potential requirement to source supplementary water supplies from the Ulan Coal Mine to achieve WCPL water supply reliability targets.

Provided that the water management principles as outlined in the Erosion and Sediment Control Plan and the Surface Water Management and Monitoring Plan continue to be implemented, this site water balance review has not identified any material changes that would significantly alter the approved impacts of the Wilpinjong Coal Mine on off site surface water quality or quantity.

Yours faithfully,

Tony Marszalek
Principal Water Resources Engineer

Lindsay Gilbert
Director

…/Figures

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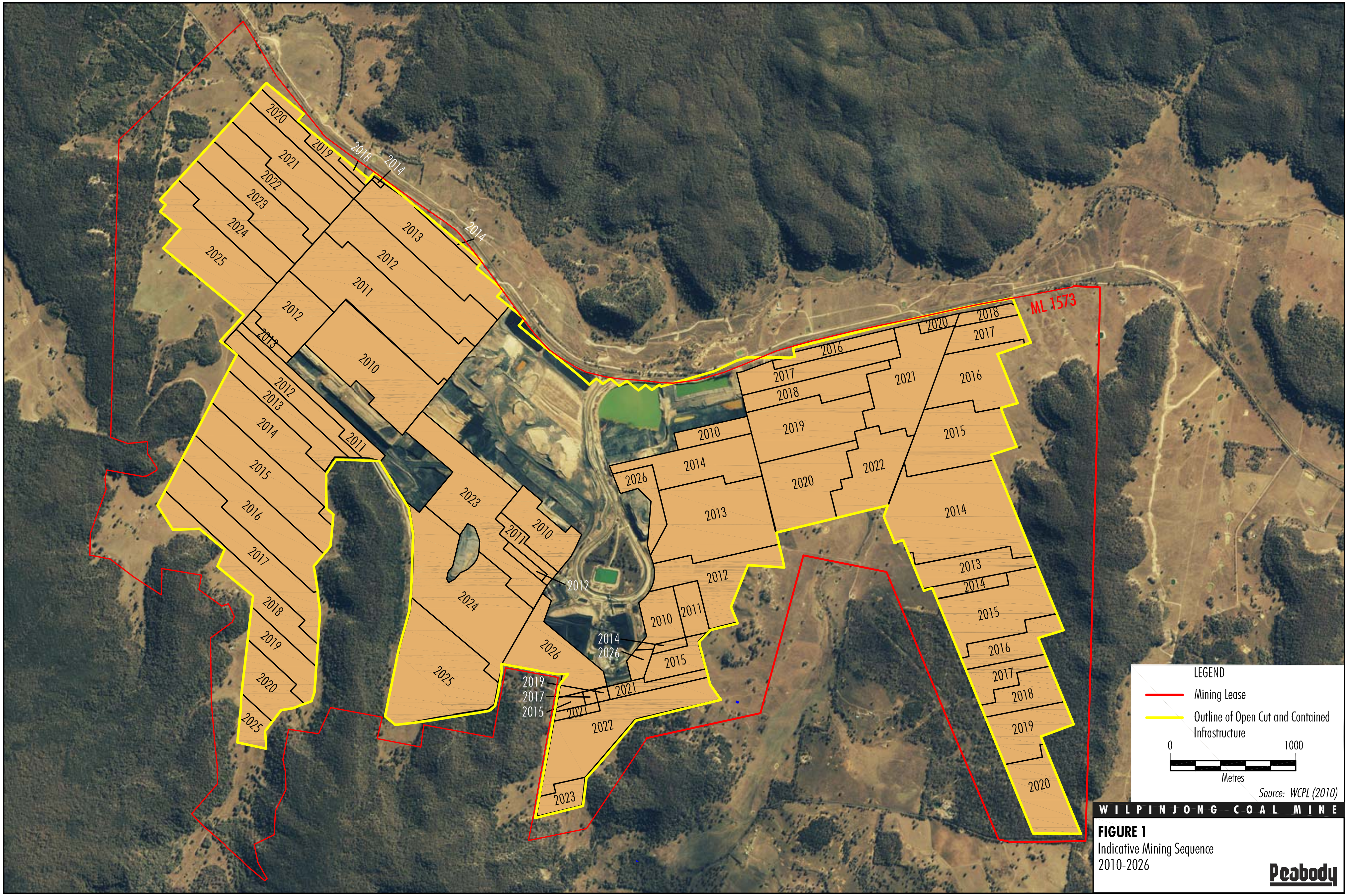
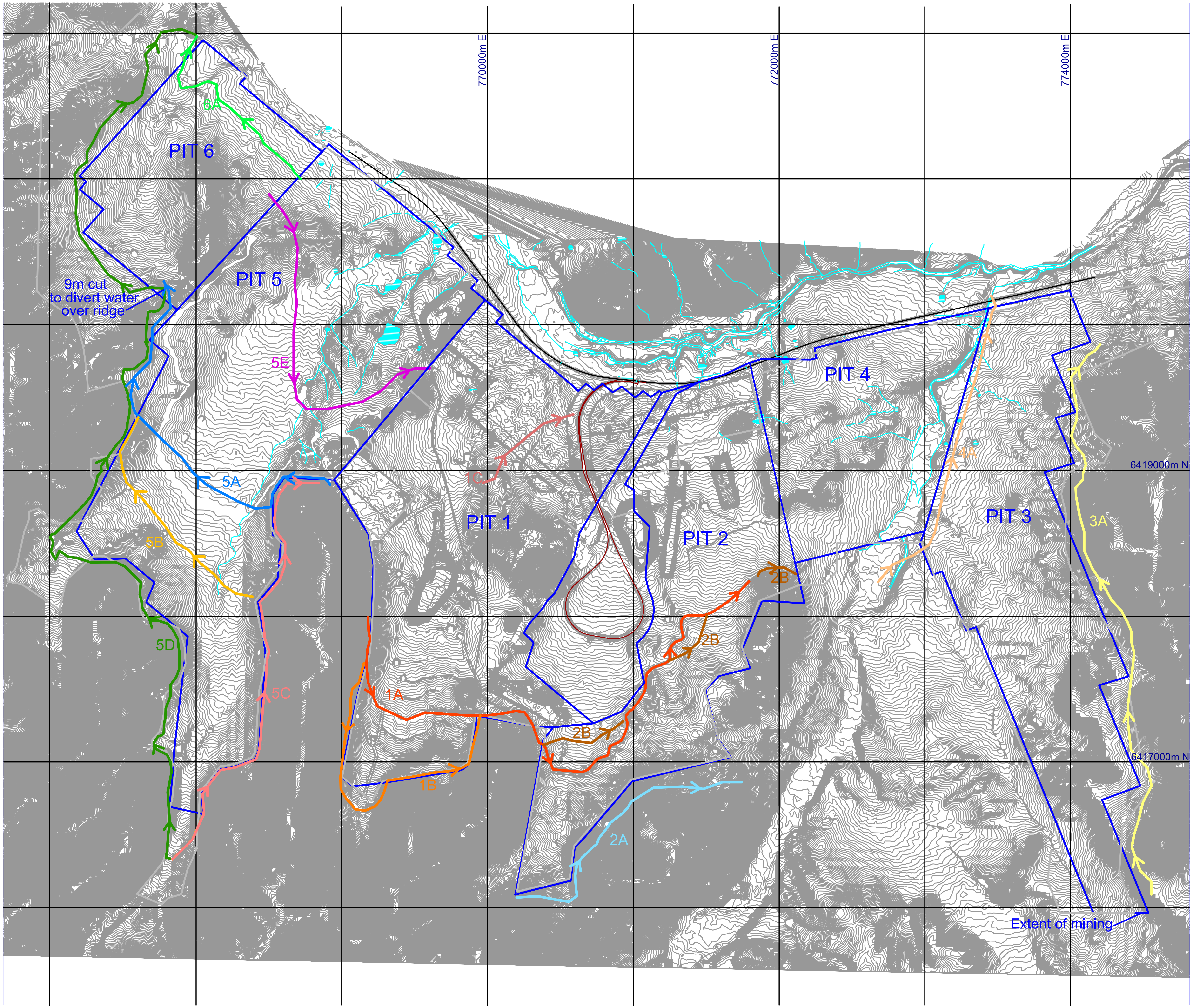


FIGURE 1
Indicative Mining Sequence
2010-2026

WIL-09-07 SW_101B



REV	DESCRIPTION	DATE	APPR.

LEGEND

		Start Snapshot	End Snapshot
←	1A	2009	2023
←	1B	2010	2027
←	1C	2012	2014
←	2A	2010	2027
←	2B	2015	2027
←	3A	2013	2022
←	4A	2020	2024
←	5A	2009	2013
←	5B	2014	2015
←	5C	2015	2022
←	5D	2015	2027
←	5E	2015	2027
←	6A	2018	2020

DESIGNED	SCALE 1:20,000
DRAWN SK	LEVEL DATUM
CHECKED TSM	SHEET SIZE A3
APPROVED	CAD FILE
DATE MAR, 2010	ISSUE FINAL

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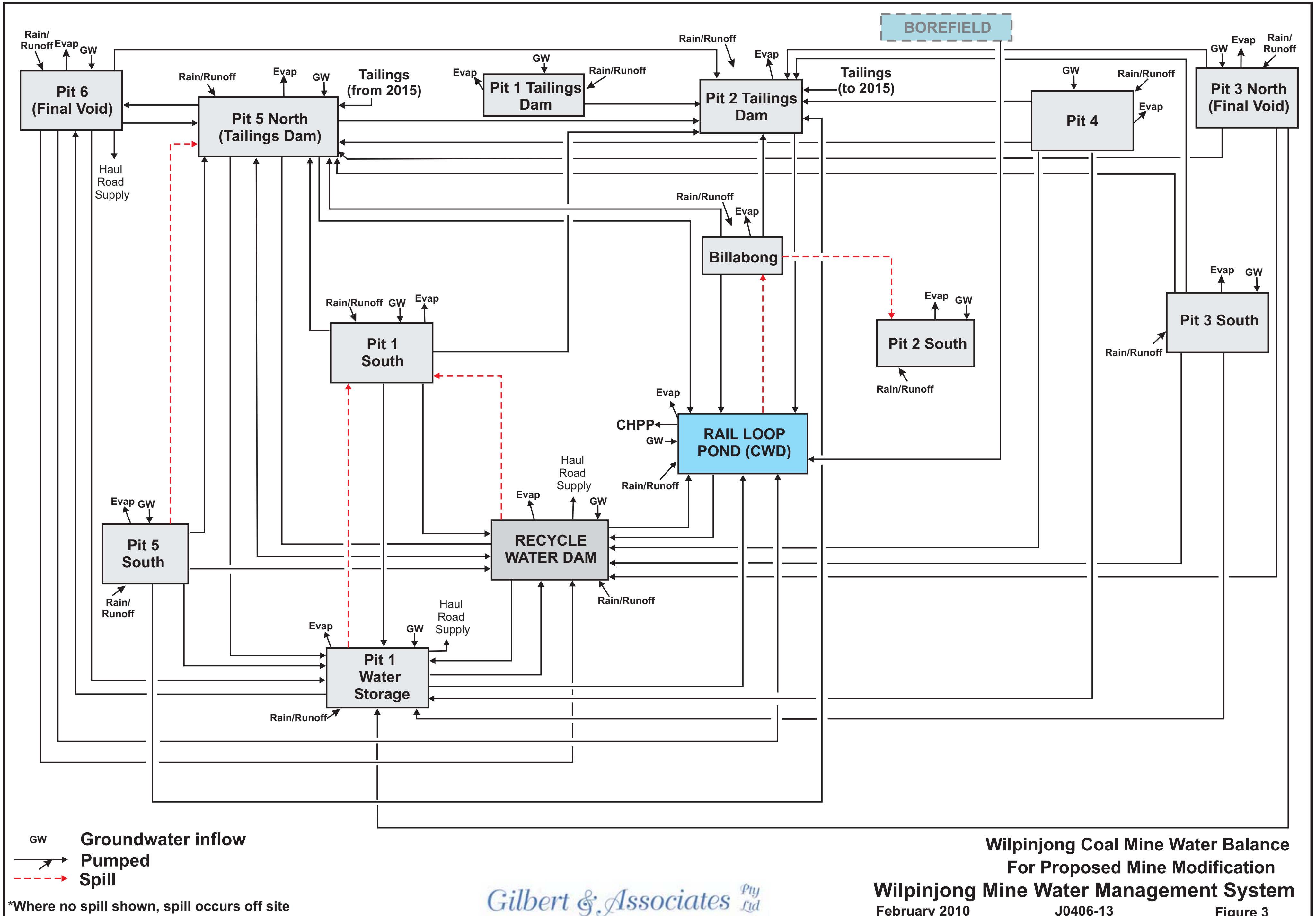
CLIENT
WILPINJONG COAL PTY LTD

PROJECT
**WILPINJONG COAL MINE
WATER BALANCE FOR PROPOSED
MINE MODIFICATION**

TITLE
UPSLOPE DIVERSION LOCATIONS

JOB NUMBER J0406/13
FIGURE 2
REV



Gilbert & Associates Pty Ltd

Wilpinjong Coal Mine Water Balance For Proposed Mine Modification

Wilpinjong Mine Water Management System

February 2010 J0406-13 Figure 3

Appendix E




Socio-Economic Assessment

Wilpinjong 75W Modification
Socio-Economic Assessment

Prepared for

Wilpinjong Coal Pty Ltd

By

Gillespie Economics
Tel: (02) 9804 8562
Email: gillecon@bigpond.net.au

April 2010

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EXECUTIVE SUMMARY

The Wilpinjong Coal Mine is an existing open cut coal mining operation situated approximately 40 kilometres north-east of Mudgee, near the village of Wollar, within the Mid-Western Regional Local Government Area (LGA), in central New South Wales (NSW).

The Wilpinjong 75W Modification (the Modification) involves an increase in the approved maximum run-of-mine (ROM) coal mining rate from 13 to 15 million tonnes per annum, a small increase in the maximum annual rate of overburden mined, and upgrade to the existing Coal Handling and Preparation Plant and general coal handling/stockpiling systems.

From a socio-economic perspective there are three important aspects of the Modification that can be considered:

- its economic efficiency (i.e. consideration of the economic costs and benefits of the Modification) which can be evaluated using benefit cost analysis (BCA);
- its regional economic impacts (i.e. the economic stimulus that the Modification would provide to the regional economy) which can evaluated using regional economic impact assessment; and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations) often considered in terms of the impacts on employment, population and community infrastructure.

A BCA of the Modification indicated that it would have a net production benefit in the order of $47 million (M). The net production benefit is distributed amongst a range of stakeholders including:

- Wilpinjong Coal Pty Ltd (WCPL) shareholders;
- the NSW Government via royalties; and
- the Commonwealth Government in the form of company tax.

The NSW Government receives additional benefits in the form of payroll tax.

The Modification also has a few external economic costs and benefits. External costs associated with noise and dust emissions have been included in the estimate of net production benefits through accounting for the potential acquisition costs for affected properties and associated buffer lands. It has been assumed that the Modification would have no material impact on environmental externalities such as flora, fauna, surface water, groundwater and Aboriginal heritage as the extent of mining at the Wilpinjong Coal Mine would be unchanged.

The incremental environmental cost of bringing forward some greenhouse gas emissions are estimated at approximately $1M. These costs would ultimately be internalised into the Modification through the purchase of emission credits under any emissions trading scheme introduced by the Commonwealth Government.

Overall the Modification is estimated to have net benefits to society of $47M and hence is desirable and justified from an economic efficiency perspective.

The Modification would generate 202 direct and indirect jobs during the construction phase.

During the peak increase in ROM production (years 2013 and 2014) the following economic benefits for the Mid-Western Regional LGA are estimated as a result of the Modification (i.e. the incremental increase in economic benefits when compared to the existing approved Wilpinjong Coal Mine):

- $179M in annual direct and indirect regional output or business turnover;
- $106M in annual direct and indirect regional value added;
- $13M in annual direct and indirect household income; and
- 137 direct and indirect jobs.

Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities.

The additional construction workforce from the Modification that is assumed to temporarily migrate into the region is likely to place some temporary upward pressure on the rental housing market. However, this can be mitigated to some extent through the potential use of a number of local residences owned by WCPL. The construction phase is likely to create minimal demand for other community infrastructure such as schools or health facilities, since mine construction workforces tend to be single or do not bring their families with them.

The estimated population change during the peak ROM production of the Modification is also likely to place some temporary upward pressure on the rental market. The effect on other community infrastructure is likely to be minimal given that the estimated population growth represents a 0.65% increase in the regional population.

The Modification does not alter the life of the Wilpinjong Coal Mine and hence there will be no additional cessation consequences as a result of the Modification.

1 INTRODUCTION

The Wilpinjong Coal Mine is an existing open cut coal mining operation situated approximately 40 kilometres (km) north-east of Mudgee, near the village of Wollar, within the Mid-Western Regional Local Government Area (LGA), in central New South Wales (NSW).

Construction of the Wilpinjong Coal Mine commenced in February 2006, and the Mine is approved to produce up to 13 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Thermal coal products from the Wilpinjong Coal Mine are transported by rail to domestic customers for use in electricity generation and to port for export. In 2009, the Wilpinjong Coal Mine produced approximately 8.4 million tonnes (Mt) of ROM coal.

The Wilpinjong 75W Modification (the Modification) involves an increase in the approved maximum ROM coal mining rate from 13 Mtpa to 15 Mtpa and a small increase in the maximum annual rate of overburden mined. Additional mobile fleet would be required on-site to achieve the higher production rates.

To facilitate increased coal production and improve the efficiency of coal handling and preparation on-site, the existing Coal Handling and Preparation Plant (CHPP) and general coal handling/stockpiling systems would be upgraded as part of the Modification. However, part of the upgrade is required to meet the existing approved production rates (e.g. the CHPP was only built to approximately two-thirds of the currently approved maximum capacity).

Construction of the CHPP/coal handling upgrades would commence in January 2011 and would be completed over a period of approximately 9 months.

The proposed Modification does not include any alteration to the approved extent of mining or the 21 year mine life.

From a socio-economic perspective there are three important aspects of the Modification that can be considered:

- the economic efficiency of the Modification (i.e. consideration of economic costs and benefits);
- the regional economic impacts of the Modification (i.e. the economic stimulus that the Modification would provide to the regional economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations).

The draft *Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie, 2002) identified economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. James and Gillespie (2002) identified BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts.

James and Gillespie (2002) also indicate that regional economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic stimulus to the local economy can be estimated using input-output modelling of the regional economy (regional economic impact assessment).

James and Gillespie (2002) also identify the need to consider the distribution of benefits and costs in terms of:

- intra-generational equity effects – the incidence of benefits and costs within the present generation; and
- inter-generational equity effects – the distribution of benefits and cost between present and future generations.

These social impacts are often considered in terms of the impacts on employment, population and community infrastructure. This study relates to the preparation of each of the following types of analyses:

- a BCA of the Modification;
- a regional economic impact assessment of the Modification; and
- an Employment, Population and Community Infrastructure Assessment (EPCIA).

A consultation programme for the Modification Environmental Assessment (EA) was undertaken by Wilpinjong Coal Pty Ltd (WCPL) and is described in Section 1.3 of the EA.

2 BENEFIT COST ANALYSIS

2.1 INTRODUCTION

For the Modification to be economically desirable from a community perspective, it must be economically efficient. Technically, a project is economically efficient and desirable on economic grounds if the benefits to society exceed the costs (James and Gillespie, 2002). For mining projects, the main economic benefit is the producer surplus generated by the mine and the employment benefits it provides, while the main economic costs relate to environmental costs. The main technique that is used to weigh up these benefits and costs is BCA.

A BCA involves the following key steps:

- identification of the base case or “without” Modification scenario;
- identification of the “with” Modification scenario;
- physical quantification and valuation of the Modifications incremental benefits and costs;
- consolidation of values using discounting to account for the different timing of costs and benefits;
- application of decision criteria;
- sensitivity testing; and
- consideration of non-quantified benefits and costs, where applicable.

What follows is a BCA of the Modification based on financial, technical and environmental advice provided by WCPL and its specialist consultants.

2.2 IDENTIFICATION OF THE BASE CASE AND MODIFICATION

Identification of the “base case” or “without” Modification scenario is required in order to facilitate the identification and measurement of the incremental economic benefits and costs of the Modification.

In this study, the base case or “without” Modification scenario involves:

- continuation of mining at a rate of 13 Mtpa in accordance with the current approval;
- upgrade of the existing CHPP to a capacity of 1,100 tonnes per hour (tpa) to achieve the current approved production rates;
- additional mobile fleet to achieve the currently approved production rates;
- ramping down of mining from 2023 with cessation of mining activity in 2026; and
- decommissioning of the mine site in 2026 with rehabilitated land allocated to its next best use and the residual value of capital equipment realised.

In contrast to the “base case”, the main activities associated with the development of the Modification would include:

- an increase in the maximum approved mining rate from 13 to 15 Mtpa;
- an incremental increase in the annual rate of overburden mined;
- an incremental increase in the mobile fleet to achieve the higher production rates;
- an upgrade of the existing CHPP to 1,200 tpa;
- gradual ramping down of mining production from 2020; and

- decommissioning of the mine site in 2026 with rehabilitated land allocated to its next best use and the residual value of capital equipment realised.

WCPL's alternatives for the mining of coal are essentially limited to different scales, designs, technologies, processes, modes of transport, timing, impact mitigation measures, etc. However, these alternatives could be considered to be variants of the preferred proposal rather than distinct alternatives. Consequently, this BCA focuses on WCPL's preferred proposal (the Modification) compared to the base case identified above.

2.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case or "without" Modification scenario, the Modification may have the potential incremental economic benefits and costs shown in Table 2.1.

It should be noted that the potential external costs, listed in Table 2.1, are only economic costs to the extent that they affect individual and community wellbeing through direct use of resources by individuals or non-use. If the potential impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.

Table 2.1
Economic Benefits and Costs of the Modification

Category	Costs	Benefits
Production	• Opportunity cost of land • Capital costs associated with the incremental CHPP and materials handling upgrade • Additional operating costs associated with bringing some production forward	• Value of incremental coal production • Residual value of additional capital • Residual value of additional buffer land
Externalities	• Greenhouse gas generation • Noise impacts • Air quality impacts	• Economic and social benefits of employment

2.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

In accordance with the NSW *Treasury Guidelines for Economic Appraisal* (NSW Treasury, 2007), where competitive market prices are available, they have generally been used as an indicator of economic values. Externality values have been estimated, where practicable, using market data and benefit transfer.

2.4.1 Production Costs and Benefits[1]

Economic Costs

Opportunity Cost of Land

There is an opportunity cost associated with using land recently purchased or soon to be purchased by WCPL as buffer lands for the Modification instead of its next best use. An indication of the opportunity cost of the land can be gained from its market value and this has been included in the evaluation.

[1] All values reported in this section are undiscounted unless specified.

Capital Cost of the Modification

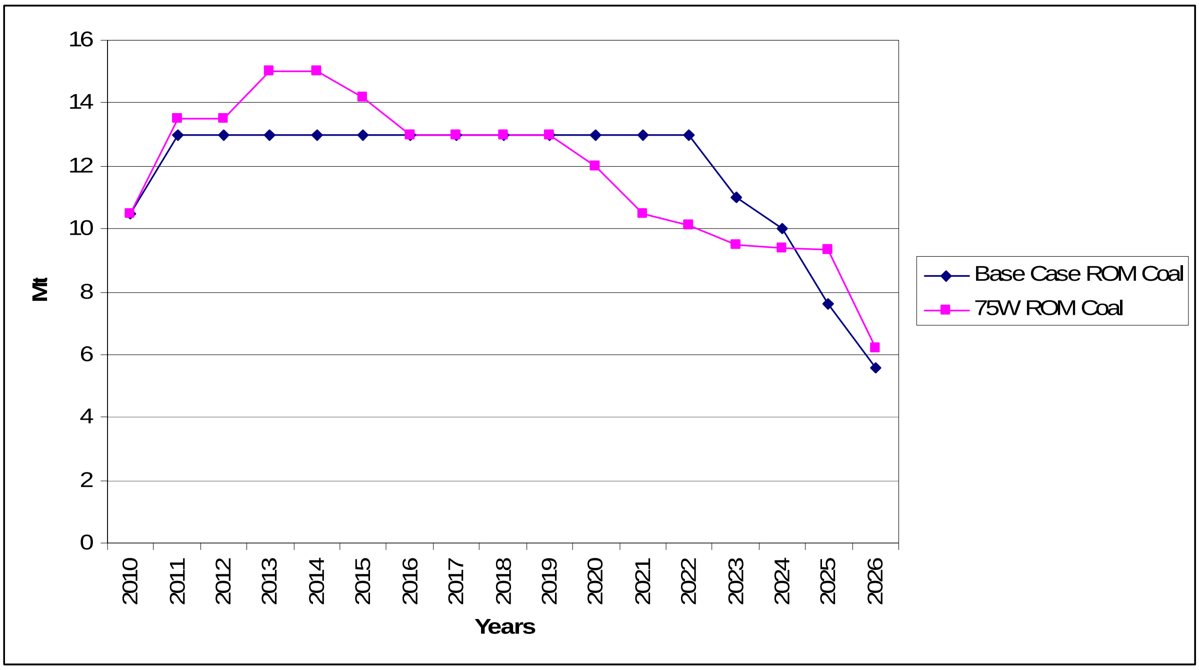
Capital costs of the Modification are associated with an upgrade of the CHPP and materials handling.

While the total cost of the CHPP and materials handling upgrade is estimated at $109 to $117 million (M), CHPP rates of up to 1,100 tpa and associated materials handling systems were a component of the original proposal and hence for the purpose of the BCA this level of investment is assumed to occur regardless of the Modification. The incremental capital cost of the Modification is therefore estimated to be $37.4M.

Annual Operating Costs of the Mine

The modification will result in the same level of total coal production as under the existing approval. However, the timing of production will alter with some production brought forward in time. A comparison of ROM production levels “with” and “without” the Modification is provided in Figure 2.1 (note: these values have been adjusted to reflect the estimated remaining ROM coal within the approved extent of the mine).

Figure 2.1 – ROM Production “With” and “Without” the Modification



The incremental operating costs from this change in timing, including the use of some additional mobile fleet to achieve the higher production rates, are included in the analysis.

While royalties are a cost to WCPL they are part of the overall producer surplus benefit of the mining and processing activity that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Modification. Nevertheless, it should be noted that the change in timing of production would increase the present value of royalties by in the order of $11M.

Economic Benefits

Sale Value of Coal

The change in timing of production will also change the revenue profile for the mine. Incremental revenue from export sales is a benefit of the Modification. For this analysis, a coal price of Australian Dollars (AUD) $99 per tonne (/t) is assumed for export coal.

There is obviously considerable uncertainty around future coal prices and hence the value of coal has been subjected to sensitivity analysis (Section 2.6).

Residual Value of Capital

The additional capital invested in the Modification has a value at the cessation of the Modification life that is additional to the residual value of capital under the base case. Conservatively, this is assumed to be zero.

Residual value of Land

The additional buffer land purchased by WCPL for the Modification has a residual value at the end of the mine life and this has been estimated.

2.4.2 External Costs and Benefits

Greenhouse Gases

The changed production profile as a result of the Modification will result in a change in the greenhouse gas time profile, but no change in total emissions. To place an economic value on changed time profile of carbon dioxide equivalent (CO_2-e) emissions, a shadow price of CO_2-e is required that reflects its social costs. The social cost of CO_2-e is the present value of additional economic damages now and in the future caused by an additional tonne of CO_2-e emissions. There is great uncertainty around the social cost of CO_2-e with a wide range of estimated damage costs reported in the literature. An alternative method to trying to estimate the damage costs of CO_2-e is to examine the price of CO_2-e credits. Again, however, there is a wide range of permit prices. For this analysis, a shadow price of AUD $30/t CO_2-e was used, with sensitivity testing from AUD $8/t CO_2-e to AUD $40/t CO_2-e (Attachment A).

Operational Noise

As described in the Noise Impact Assessment (Heggies, 2010) (Appendix A of the EA), the Modification would result in some additional noise generation due to the additional mobile fleet, and some elevated noise emissions at some nearby private rural residences, as is the case for the existing approved Wilpinjong Coal Mine .

Some two private residences and four vacant land holdings have been identified in Appendix A of the EA as being in the noise affectation zone. It is expected that the owners of properties located within the Modification noise affection zone would be granted the opportunity to be acquired by WCPL via conditions of the Modification Approval. The full costs of such land acquisition (or opportunity costs of land that has already been acquired) have been incorporated into the analysis.

Dust

As described in the Air Quality Impact Assessment (PAEHolmes, 2010) (Appendix B of the EA), one residence in Slate Gully has been identified as being affected by particulate emissions above applicable 24 hour average particulate matter less than 10 microns in size (PM_{10}) NSW Department of Environment, Climate Change and Water criteria more than five times in one year (this property is also within a noise management zone). It is expected that the owner of this property would be granted the opportunity for their property to be acquired by WCPL via conditions of the Modification Approval. The full costs of such land acquisition (or opportunity costs of land that has already been acquired) have been incorporated into the analysis.

Social and Economic Value of Employment

The construction of the CHPP and materials handling upgrades would generate on average 150 additional construction jobs for a period of approximately 9 months. The operation of the Modification would generate an additional direct on-site workforce of 54 for the period of additional production. However, towards the end of the Mine's approved life some reduction in employment may occur as the production rates taper off. Therefore, for the purpose of the BCA, the employment benefits of the Modification are conservatively assumed to be negligible.

2.5 CONSOLIDATION OF VALUE ESTIMATES

The present value of costs and benefits, using a 7% discount rate, is provided in Table 2.2.

Table 2.2
Benefit Cost Analysis Results of the Modification (Present Values)

	COSTS	$M*	BENEFITS	$M*
Production[1]	Opportunity cost of land	$13	Value of incremental coal	$137
	Capital costs	$33	Residual value of capital	$0
	Operating costs	$49	Residual value of land	$5
	Production Sub-total	***$95***	-	***$142***
	Net Production Benefits	-	-	**$47**
Externalities	Greenhouse gas emissions	$1	Economic and social benefits of employment	$0
	Operational noise	Included in opportunity cost of land	-	-
	Air quality	Included in opportunity cost of land	-	-
	Externalities sub-total	***$1***	-	***$0***
	Net externalities	***$1***	-	-
NET BENEFITS				**$47**

* Totals may have minor discrepancies due to rounding to the nearest $1M.

The main decision criterion for assessing the economic desirability of a project to society is its Net Present Value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the Modification, because the community as a whole would obtain net benefits from the Modification.

Table 2.2 indicates that the Modification would have net production benefits of $47M. The net production benefit is distributed amongst a range of stakeholders including:

- WCPL shareholders;
- the NSW Government via royalties; and
- the Commonwealth Government in the form of Company tax.

The NSW Government receives additional benefits in the form of payroll tax.

The main external costs from the Modification relate to greenhouse gas generation, noise and dust. Noise and dust costs have already been incorporated into the estimation of net production benefits via a conservative allowance for acquisition costs for nearby affected properties. Incremental greenhouse gas costs due to the bringing forward of coal production have been estimated at $1M.

Overall the Modification is estimated to have net benefits of $47M and hence is desirable and justified from an economic efficiency perspective.

The external environmental impacts of the Modification would initially be borne by affected residents but the majority of these would ultimately be met by WCPL through land acquisition costs. External greenhouse costs would also be internalised through the purchase of required carbon pollution permits under any emissions trading scheme that is implemented.

2.6 SENSITIVITY ANALYSIS

The NPV presented in Table 2.2 is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a BCA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV.

In this analysis, the BCA result was tested for changes to the following variables:

- opportunity cost of land;
- capital costs;
- operating costs;
- value of export thermal coal;
- residual value of land; and
- value of greenhouse gas emissions.

This analysis indicated (Attachment B) that the results of the BCA are not sensitive to reasonable changes in assumptions regarding any of these variables. In particular, significant increases in the values used for external impact such as greenhouse gas costs, or opportunity cost of land had little impact on the overall economic desirability of the Modification.

The results were most sensitive to decreases in the value of ROM coal, although substantial (34%) and sustained reductions in assumed coal prices would be required to make the Modification undesirable from an economic efficiency perspective.

3 REGIONAL ECONOMIC IMPACT ASSESSMENT

3.1 INTRODUCTION

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

These indicators can be defined as follows:

- ***Gross regional output*** – the gross value of business turnover.
- ***Value-added*** – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.
- ***Income*** – the wages paid to employees including imputed wages for self employed and business owners.
- ***Employment*** – the number of people employed (including full-time and part-time).

An impacting agent may be an existing activity within an economy or may be a change to a local economy (Powell *et al.,* 1985; Jensen and West, 1986). This assessment is concerned with the impact of a 9 month construction phase and additional annual ROM coal production of up to 2 Mtpa. The economy on which the impact is estimated in this report is Mid-Western Regional LGA.

For this assessment, Gillespie Economics have applied Type 11A output, value-added, income and employment ratio multipliers reported for the Wilpinjong Coal Project Economic Assessment (Gillespie Economics, 2005) to the estimated direct output, value-added, income and employment impacts of the Modification during construction and in the years of maximum increase in production.

There are well documented limitations with "borrowing" multipliers from other studies. However, these multipliers are considered to represent reasonable approximations of impacts as they relate to a previous estimate of the impacts of the Wilpinjong Coal Mine on a similar regional economy (i.e. the former LGAs of Mudgee, Merriwa and Rylstone).

3.2 CONSTRUCTION

The construction workforce for the full CHPP/material handling upgrade (as opposed to the component that would happen anyway under the existing approval) is estimated at an average of 150 (Table 3.1) for a period of 9 months, with a peak of 280. Applying the employment ratio multiplier from Gillespie Economics (2005) (which assumes 60% of the construction workforce temporarily relocates into the region) the total employment impact for 9 months would be 202 (Table 3.1).

Table 3.1
Construction Employment Impacts

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	Total Effect
EMPL. (No.)	150	29	23	52	202
Type 11A Ratio	*1.00*	*0.19*	*0.16*	*0.35*	*1.35*

3.3 OPERATION

The additional stimulus from the operation of the Modification arises from an incremental increase in ROM production from 2011 to 2015, with the maximum increase in ROM production occurring in 2013 and 2014 (Figure 2.1). The regional economic impact assessment relates to the incremental production in these two years.

Table 3.2
Annual Regional Impact of the Modification (Year 2013 and Year 2014)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	Total Effect
OUTPUT ($M)	*158,000*	17,380	3,160	20,540	178,540
Type 11A Ratio	*1.00*	*0.11*	*0.02*	*0.13*	*1.13*
INCOME ($M)	7,560	4,309	907	5,216	12,776
Type 11A Ratio	*1.00*	*0.57*	*0.12*	*0.69*	*1.69*
VALUE-ADDED ($M)	98,400	6,888	984	7,872	106,272
Type 11A Ratio	*1.00*	*0.07*	*0.01*	*0.08*	*1.08*
EMPLOYMENT (No.)	54	65	18	83	137
Type 11A Ratio	*1.00*	*1.21*	*0.33*	*1.54*	*2.54*

The incremental annual regional economic impact associated with the increased ROM production as a result of the Modification (i.e. in addition to the economic benefits of the approved Wilpinjong Coal Mine) is estimated at up to (Table 3.2):

- $179M in annual direct and indirect regional output or business turnover;
- $106M in annual direct and indirect regional value added;
- $13M in annual direct and indirect household income; and
- 137 direct and indirect jobs.

These impacts would occur in 2013 and 2014. From 2019 onwards there would be a reduction in regional economic stimulus as ROM production reduces below those currently proposed without the Modification.

3.4 MODIFICATION CESSATION

The Modification does not alter the life of the Wilpinjong Coal Mine and hence there will be no additional Modification cessation consequences as a result of the Modification. As discussed in the *Wilpinjong Coal Project Environmental Impact Statement* (WCPL, 2005), the significance of the ultimate cessation impacts of the Mine would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing, diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Given these uncertainties it is not possible to foresee the likely circumstances within which cessation of the Wilpinjong Coal Mine (with the Modification) would occur. It is therefore important for regional authorities and leaders to take every opportunity provided by the regional economic stimulus of the mine, to strengthen and broaden the region's economic base.

4 EMPLOYMENT, POPULATION AND COMMUNITY INFRASTRUCTURE ASSESSMENT

4.1 INTRODUCTION

Changes in the workforce and populations of a region may well have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities. This may include the number of services that are available to be used and the accessibility of these services.

The objective of this EPCIA is to examine the potential impacts of the Modification on the existing community infrastructure as a result of employment and population change associated with the Modification.

The basic methodology for carrying out the EPCIA was to:

- analyse the existing socio-economic environment of the region potentially impacted by the Modification;
- analyse the likely incremental magnitude of the additional Modification work force and associated population growth including estimated flow-on employment effects;
- consider the impacts of estimated employment and population change on community infrastructure based on Australian Bureau of Statistics (ABS) data; and
- recommend impact mitigation or management measures for any substantive impacts that are identified.

The geographic scope of the EPCIA was determined by the location of Wilpinjong Mine and the region that services the mine and its employees. The mine is located approximately 40 km north-east of Mudgee, near the village of Wollar, within the Mid-Western Regional LGA in central NSW. Approximately 82% of current employment at the mine resides in the Mid-Western Regional LGA and so this LGA is used for the purpose of the EPCIA.

This assessment draws on a range of publications and reports as well as data provided by WCPL, the ABS Census (ABS, 2006), and information from Section 3 on the potential regional economic impacts of the Modification. While the Modification would also be expected to have population and workforce effects at a NSW state level and in other nearby regions such as Wellington LGA, Warrumbungles LGA, Lithgow LGA and Bathurst LGA, these effects would not be of sufficient magnitude to warrant consideration of potential adverse effects.

4.2 REGIONAL PROFILE

Population

In the 2006 census, there were 21,086 persons living in Mid-Western Regional LGA (50.1% males, 49.9% females), and 2.7% Indigenous persons, compared to 2.1% Indigenous person in NSW (Table 4.1).

Table 4.1
Mid-Western Regional LGA and NSW Population 2006

Person Characteristics	Mid-Western Regional LGA	% of Total Person in Region	NSW	% of Total Person in Region
Total persons (excluding overseas visitors)	21,086	-	6,549,177	-
Males	10,561	50.1%	3,228,451	49.3%
Females	10,525	49.9%	3,320,726	50.7%
Indigenous Person	572	2.7%	138,506	2.1%

Source: ABS (2006).
Note: Percentages may not add to 100% due to rounding.

The Mid-Western Regional LGA has a greater proportion of the population in the 5 to 14 years of age, 55 to 64 years of age and 65 years and over compared to NSW (Table 4.2).

Table 4.2
Distribution of the Mid-Western Regional LGA and NSW Population by Age Group

Age Groups	Mid-Western LGA	%	NSW	%
0-4 years	1,284	6.1	420,434	6.4
5-14 years	3,142	14.9	878,483	13.4
15-24 years	2,265	10.7	871,714	13.3
25-54 years	7,944	37.7	2,753,218	42.0
55-64 years	2,983	14.1	719,551	11.0
65 years and over	3,468	16.4	905,778	13.8
Median age	41	-	37	-

Source: ABS (2006).
Note: Percentages may not add to 100% due to rounding.

Employment

At the time of the 2006 Census, 9,221 people aged 15 years and over who were usually resident in Mid-Western Regional LGA were in the labour force (Table 4.3). Of these, a lower proportion (57.1%) than NSW (60.8%) were employed full-time and a higher proportion were employed part-time (29.8%) (Table 4.3). A total of 671 persons or 7.3% of the workforce were unemployed (Table 4.3). This was higher than for NSW (5.9%) (Table 4.3).

Table 4.3
Labour Force in the Mid-Western Regional LGA and NSW

	Mid-Western LGA	%	NSW	%
Total No. in Labour Force	9,221		3,092,600	
Employed full-time	5,267	57.1	1,879,631	60.8
Employed part-time	2,747	29.8	842,714	27.2
Employed away from work	282	3.1	103,522	3.3
Employed hours not stated	254	2.8	**83,576**	2.7
Unemployed	**671**	**7.3**	**183,157**	5.9
Not in labour force	**6,474**		**1,801,011**	
Unemployment rate	**7.3%**		**5.9%**	

Source: ABS (2006).
Note: Percentages may not add to 100% due to rounding.

Since the 2006 census, the global financial crisis has resulted in a trend of rising unemployment levels, albeit from lower unemployment levels than those reported at the 2006 census. The level of unemployment in the June 2009 quarter is reported as 635 people (6%) for Mid-Western Regional SLA (Commonwealth Department of Education, Employment and Workplace Relations, 2009).

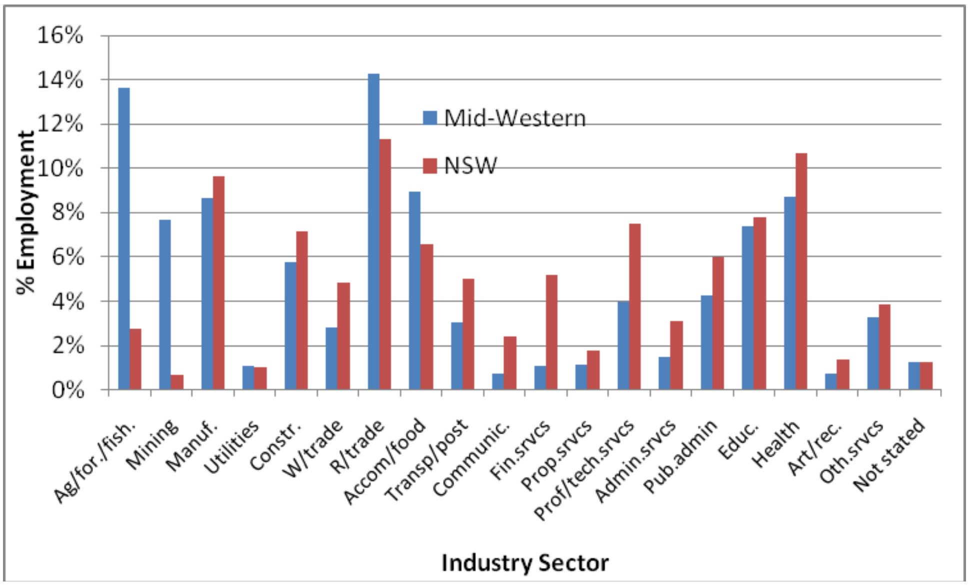
Table 4.4
Unemployment in the Mid-Western Regional LGA and NSW

	Sep 2008	Dec 2008	Mar 2009	Jun 2009
Mid-Western Regional LGA				
Unemployment	625	604	609	635
%	5.7	5.6	5.7	6.0
NSW				
Unemployment	165,800	170,600	188,000	203,800
%	4.6	4.8	5.2	5.7

Source: Commonwealth Department of Education, Employment and Workplace Relations (2009).
Note: Percentages may not add to 100% due to rounding.

Employment by industry data is presented on Figure 4.1. This figure shows the greater relative importance of agriculture/forestry/fishing, mining, retail trade and accommodation and food services in the Mid-Western Regional LGA compared to NSW.

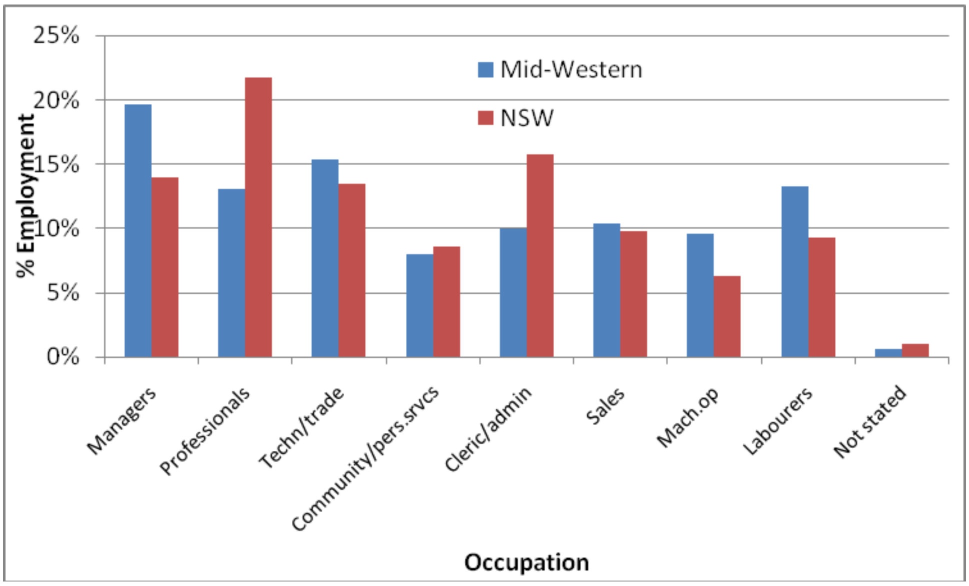
Figure 4.1
Employment by Industry in the Mid-Western Regional LGA and NSW



Source: ABS (2006).

Reflecting the employment by industry data, the Mid-Western Regional LGA has a higher relative proportion of managers (mainly rural), technician and trade workers, sales workers, machinery operators and labourers (Figure 4.2).

Figure 4.2
Occupations in the Mid-Western Regional LGA and NSW



Source: ABS (2006).

Median individual weekly income in 2006 in the Mid-Western Regional LGA was $353 compared to $461 for NSW (ABS, 2006).

Housing

In 2006 there were approximately 8,461 private occupied dwellings in the Mid-Western Regional LGA, about 0.3% of the NSW total (Table 4.5). The Mid-Western Regional LGA had a higher proportion of separate houses than the State (approximately 90% compared with approximately 70% for NSW) and a lower proportion of townhouses/units/flats/apartments (approximately 7% compared with 29% in NSW) (Table 4.5).

Table 4.5
Housing Stock in the Mid-Western Regional LGA and NSW

Housing Stock	Mid-Western Regional LGA	NSW
Total Private Dwellings (including unoccupied private dwellings)	10,041	2,728,719
Occupied private dwellings:	8,461	2,470,451
% Separate Houses	90.1	69.7
% Semi-detached, row or terrace house, townhouse etc	3.4	9.8
% Flat, Unit, Apartment	3.6	19.0
% Other dwellings	2.8	1.4
% Not Stated	0.1	0.1

Source: ABS (2006).

At the 2006 Census, there were 1,412 unoccupied dwellings in the Mid-Western LGA with most of these being separate houses (Table 4.6).

Table 4.6
Unoccupied Housing Stock in the Mid-Western LGA

Housing Type	Number
Separate house	1,412
Semi-detached, row or terrace house, townhouse	49
Flat, unit or apartment	45
Other dwelling	67
Dwelling structure not stated	3
Total	**1,576**

Source: ABS (2006).

While there were 1,576 unoccupied houses in the Mid-Western LGA, the supply of rentals in the regional is relatively low (Snyder, 2009). Mudgee’s rental market has seen an increase in demand at the end of 2009, resulting in slight week-to-week price rises for some tenants as real estate agents and landlords come into line with market values. Most rental increases have not been any more than $5 to $10.

There is considerable short stay tourism accommodation available in the Mid-Western Regional LGA with 17 establishments providing 392 rooms and 1,234 beds (Table 4.7).

Table 4.7
Mid-Western Regional SLA - Hotels, Motels and Serviced Apartments with Five or More Rooms (September Quarter 2009)

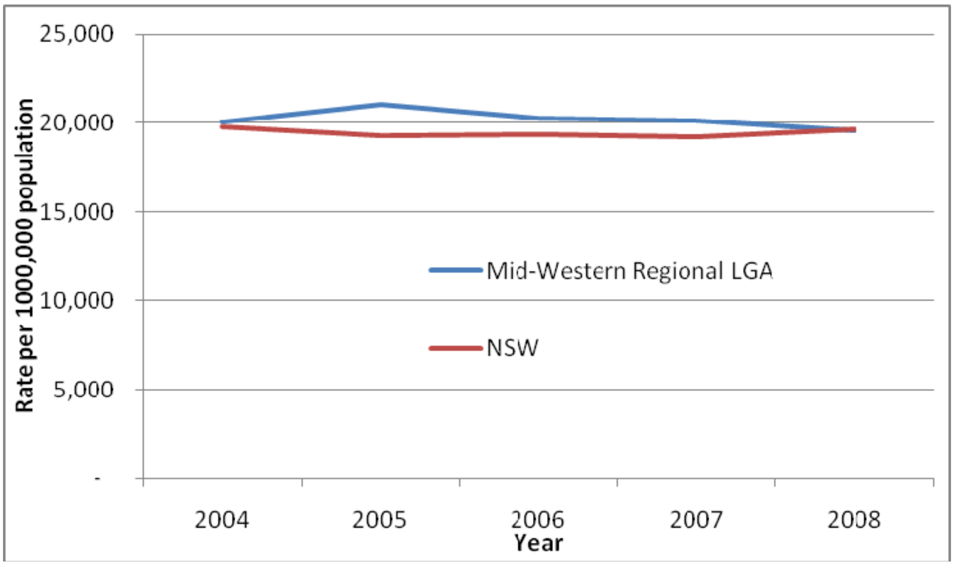
Short Stay Tourism Accommodation	Mid-Western Regional
Establishments	17
Rooms	392
Beds	1,234
Guest Nights	11,958
Room Occupancy Rates	62.8%
Bed Occupancy Rate	32.3%
Accommodation Gross Takings ($)	758,547

Source: ABS (2009).

Crime and Safety

NSW Bureau of Crime Statistics and Research (2009) indicates that the incidence of crime in the Mid-Western Regional LGA per 100,000 head of population is trending downwards and since 2008 the incidence of crime has been similar to that for NSW (Figure 4.3).

Figure 4.3
Mid-Western Regional LGA and NSW Incidence of Crime per 100,000 Head of Population over Time



Source: NSW Bureau of Crime Statistics and Research (2009).

While the overall incidence of crime per capita in the Mid-Western Regional LGA was similar to NSW, the per capita incidence of different crimes varied (Table 4.8).

Table 4.8
Mid-Western Regional LGA and NSW Incidence of Crime per 100,000 Head of Population (2008)

	Mid-Western Regional LGA	NSW
Homicide	9	4
Assault	1,385	1,046
Sexual offences	199	137
Abduction and kidnapping	-	6
Robbery	18	100
Blackmail and extortion	-	1
Harassment, threatening behaviour and private nuisance	670	361
Other offences against the person	41	22
Theft	3,110	4,132
Arson	95	105
Malicious damage to property	2,105	1,589
Drug offences	910	419
Prohibited and regulated weapons offences	231	125
Disorderly conduct	715	379
Betting and gaming offences	23	5
Liquor offences	502	260
Pornography offences	5	2
Prostitution offences	5	3
Against justice procedures	828	649
Driving offences	8,410	9,500
Transport regulatory offences	9	573
Other offences	312	226
Total*	19,580	19,643

Source: NSW Bureau of Crime Statistics and Research (2009).
* Totals may have minor discrepancies due to rounding.

It is difficult to specify reasons for the higher incidence of some categories of crime in the Mid-Western Regional LGA than in the State since causal factors that lead to criminal activity are complex and include many and varied social and economic circumstances and conditions. However, socio-economic characteristics of the Mid-Western Regional LGA that may be relevant include relatively lower income levels and higher unemployment rates.

Community Infrastructure

Education

The Mid-Western Regional LGA has four high schools, 11 primary schools and a TAFE college (Mid-Western Regional Council, 2006).

The NSW Department of Education and Training is the main provider of primary and secondary education to residents of the Mid-Western Regional LGA, accounting for 77% of primary school enrolments and 87% of secondary school enrolments in 2006 (Table 4.9).

Table 4.9
Education in the Mid-Western Regional LGA

	Great Lakes		
	1996	**2001**	**2006**
Preschool	330	361	342
Infants/Primary	2,291	2,244	1,901
Public	*83%*	*82%*	*77%*
Private	*17%*	*18%*	*23%*
Secondary	1,442	1,520	1,518
Public	*92%*	*90%*	*87%*
Private	*9%*	*11%*	*14%*
TAFE	550	679	561
University	148	222	157
Other	72	103	80
Not Stated	1,103	1,109	1,614
Total	5,936	6,238	6,173

Source: ABS (2006).

There has been declining total enrolments at infants/primary schools with an increasing proportion of enrolments being in private schools (Table 4.9). While the enrolment level in secondary school has been relatively static, there has been an increase in the proportion of enrolments at private schools (Table 4.9). There is therefore likely to be some spare capacity in both the public and private infants/primary school and secondary school infrastructure.

Health, Arts and Recreation

Mid-Western Regional LGA is serviced by three hospitals and numerous community health services supported by both resident general practitioners and visiting specialists.

According to the Council's Social Plan (Mid-Western Regional Council, 2006) the Mid-Western Regional LGA is experiencing a shortage of general practitioners with a lower doctor to population ratio than the state average and that experienced in many comparative regional centres.

According to the 2006 population census there were 684 people employed in the health care and social assistance industries in the Mid-Western Regional LGA (Table 4.10). The proportion of employment in these health care and social assistance sectors in the Mid-Western Regional LGA was lower than for NSW (Table 4.10).

Table 4.10
Employment in Health, Arts and Recreation Services

	Mid-Western Regional LGA*		**NSW***	
Health care and social assistance				
Health care and social assistance	24	0.3%	9,400	0.3%
Hospitals	164	2.1%	94,187	3.4%
Medical and other health care services	164	2.1%	85,108	3.1%
Residential care services	165	2.1%	44,648	1.6%
Social assistance services	167	2.1%	59,618	2.2%
Total	684	8.7%	***292,961***	***10.7%***
Arts and recreation services				
Arts and recreation services	0	0.0%	1,740	0.1%
Heritage activities	12	0.2%	4,424	0.2%
Creative and performing arts activities	10	0.1%	8,122	0.3%
Sports and recreation activities	31	0.4%	18,873	0.7%
Gambling activities	5	0.1%	4,799	0.2%
Total	58	0.7%	***37,958***	***1.4%***
TOTAL	**742**	9.5%	**330,919**	**12.0%**
TOTAL EMPLOYMENT	**7,851**	100.0%	**2,748,394**	**100.0%**

Source: ABS (2006).

* Totals may have minor discrepancies due to rounding.

The proportion of employment in Mid-Western Regional LGA in arts and recreation services was also lower than for NSW (Table 4.10).

4.3 MODIFICATION WORKFORCE AND POPULATION CHANGE

The main drivers for impacts on community infrastructure are changes in employment and population and the spatial location of these changes in employment and population. Employment that is directly generated by the Modification may be sourced from:

- the local region either from:
  - the unemployment pool; and/or
  - workers from other industries;
- in-migration; or
- commuters.

Sourcing labour from the local region has minimal direct impact on local community infrastructure and services since it results in no changes to the regional population and hence demand for services. It may, however, have an indirect impact on some local community infrastructure and services where changes in employment status or income result in changes in demand for some particular services (e.g. health services).

Whether local labour is sourced from the unemployment pool or from other industries, it can reduce unemployment levels - directly in the case of employing unemployed people and indirectly via the filter effect[2] where labour is sourced from other industries.

The impact of commuter workers would depend on the extent to which they integrate into the regional communities. However, for the purpose of this analysis it is assumed that the impact of commuter workers is likely to be modest.

In-migration resulting in population change is likely to have the greatest potential impact on demand for community services and infrastructure with this impact dependent on the new residential location of the migrating workforce and their families.

As well as direct employment and population changes, mining projects may also generate indirect labour demand through expenditure by employees in the local region and mine operation expenditure in the local region on other inputs to production. This induced demand for labour may also have consequences for population change and demand for community infrastructure and services.

To facilitate consideration of potential community infrastructure impacts, this section explores the likely direct and indirect employment and population effects of the Modification.

4.3.1 Construction Workforce and Population Change

The construction phase of the Modification would last for approximately 9 months and require a direct workforce averaging around 150 people, with a maximum of approximately 280.

In the order of 60% of the direct construction workforce is assumed to temporarily migrate into the region with the remainder sourced from the region.

Construction generally requires a labour force with highly specialised skills including specialised welders, fitters, electrical contractors, machinery mechanics and construction engineers (Centre for International Economics, 2001). It is anticipated that the majority of non-local workers who temporarily migrate into the region would be single or not bring their families into the region. This reflects the fact that the construction workforce in the mining industry and large infrastructure projects is generally very mobile and tends not to have accompanying spouses and children.

It is considered that the short-term and temporary nature of flow-on employment generated from the construction phase would tend to filled with local employment or through overtime and associated management strategies rather than in-migration.

Based on these assumptions the temporary population growth associated with the construction phase would be approximately 90 workers, without families.

4.3.2 Operation Workforce and Population Change

The Modification relates to the continuation of an existing activity, albeit at increased rates of ROM coal production, particularly in years 2013 and 2014. Assuming 50% of the direct and indirect workforce migrates into the region and has the same average household size as the NSW population (2.6), the additional population in the region would be 178 (Table 4.11).

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[2] The filter effect refers to the situation where labour is sourced from other industries in the region making jobs available in those industries which are subsequently filled by people either from the unemployment pool or other industries with the latter making jobs available in that industry, etc.

Table 4.11
Employment and Population Change in the Region

	Direct	Production-induced Flow-on	Consumption-induced Flow-on	Total Flow-on	Total
Modification - employment in the region	54	65	18	83	137
Ratio Multiplier	1.00	1.21	0.33	1.54	2.54
Employment residing in the region @ 50%	*27*	*32.67*	*8.91*	*41.58*	*68.58*
Population impacts @ 2.6 per household	*70*	*85*	*23*	*108*	*178*

4.4 COMMUNITY INFRASTRUCTURE IMPACT ASSESSMENT

4.4.1 Construction

It is anticipated that the temporary population growth associated with the construction phase (90 individuals) would be housed in a combination of:

- available short stay accommodation (of which there is 392 rooms and 1,234 beds in hotels, motels and services apartments with five or more rooms);
- rental houses; and
- nearby residences owned by WCPL.

Some temporary upward pressure on the rental market would be expected.

The construction phase is likely to create minimal demand for other community infrastructure such as schools or health facilities.

4.4.2 Operation

A population increase of 178 people to the Mid-Western Regional LGA during the peak ROM production represents a 0.85% increase in the population (Table 4.1). The demand this population increase would create for housing represents 0.68% of total housing stock in 2006 (Table 4.5) or 4.35% of unoccupied residential properties in 2006 (Table 4.6). It is anticipated that the population growth associated with the peak years of ROM production) would be accommodated in a combination of:

- available short stay accommodation (of which there is 392 rooms and 1,234 beds in hotels, motels and services apartments with five or more rooms); and
- rental houses.

Some upward pressure on the rental market would be expected, which may have the effect of inducing unoccupied premises onto the rental market to increase supply.

During the operation of the Modification, any incoming workers would be expected to exhibit average family structures and hence would be associated with some children, creating some increased demand for education facilities within the region. Assuming that the incoming population exhibits the same characteristics as the NSW working age population, Table 4.12 summarises the likely demand for pre-school, infants/primary and high school places.

Table 4.12
Predicted Modification-Related Demand for Children's Schooling

Type	Demand	2006 Enrolment (No.)	School Change in Enrolment 2001-2006
Gloucester			
Pre-school	16	342	-19
Infants/Primary	19	1,901	-343
High School	17	1,518	-2

These demands can be compared to the total enrolments in 2006 and growth/decline in school enrolments between 2001 and 2006 (Table 4.9). In this context, it is evident that the increased demand for schooling associated with incremental Modification employment effects could be considered to be insignificant.

There is potential for the Modification to increase the demand for public health facilities in the region such as for Hospitals, General Practitioners Medical Services, Dental, Physiotherapy, Chiropractors, Optometrists, etc. via the potential increase in population as a result of increased direct and indirect flow-on employment associated with the Modification. However, the potential population increase from the Modification is very small compared to the total population and the region and the population increase is likely to reduce after the peak production period.

The Modification also has the potential to indirectly positively impact public health through the provision of employment opportunities and the reduction in unemployment. Prolonged unemployment can generate a range of personal and social problems including increased drug and alcohol dependency and increased demand for health services (University of NSW, 2006). Providing opportunities to reduce unemployment can therefore be beneficial.

Demand for additional investment in community services such as child care, aged care and community care services, by Local, State and Commonwealth Governments can arise from increases in the population. However, as identified above the expected increases in population would be very small in the context of the existing population. No requirement for additional investment in community services and facilities infrastructure is therefore anticipated to result from the Modification.

5 CONCLUSION

A BCA of the Modification indicated that it would have a net production benefit in the order of $47M. The net production benefit is distributed amongst a range of stakeholders including:

- WCPL shareholders;
- the NSW Government via royalties; and
- the Commonwealth Government in the form of company tax.

The NSW Government receives additional benefits in the form of payroll tax.

The Modification also has a few external economic costs and benefits. External costs associated with noise and dust emissions have been included in the estimate of net production benefits through accounting for the potential acquisition costs for affected properties and associated buffer lands. It has been assumed that the Modification would have no material impact on environmental externalities such as flora, fauna, surface water, groundwater and Aboriginal heritage as the extent of mining at the Wilpinjong Coal Mine would be unchanged.

The incremental environmental cost of bringing forward some greenhouse gas emissions are estimated at approximately $1M. These costs would ultimately be internalised into the Modification through the purchase of emission credits under any emissions trading scheme introduced by the Commonwealth Government.

Overall the Modification is estimated to have net benefits to society of $47M and hence is desirable and justified from an economic efficiency perspective.

The Modification would generate 202 direct and indirect jobs during the construction phase. During the peak increase in ROM production (years 2013 and 2014) the following economic benefits for the Mid-Western Regional LGA are estimated as a result of the Modification (i.e. the incremental increase in economic benefits when compared to the existing approved Wilpinjong Coal Mine):

- $179M in annual direct and indirect regional output or business turnover;
- $106M in annual direct and indirect regional value added;
- $13M in annual direct and indirect household income; and
- 137 direct and indirect jobs.

Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities.

The additional construction workforce from the Modification that is assumed to temporarily migrate into the region is likely place some temporary upward pressure on the rental housing market. However, this can be mitigated to some extent through the use of residences owned by WCPL. The construction phase is likely to create minimal demand for other community infrastructure such as schools or health facilities, since the construction workforce tends to be single or does not bring their families with them.

The estimated population change during the peak ROM production of the Modification is also likely to place some temporary upward pressure on the rental market. The effect on other community infrastructure is likely to be minimal given that the estimated population growth represents a 0.65% increase in the regional population.

The Modification does not alter the life of the Wilpinjong Coal Mine and hence there will be no additional cessation consequences as a result of the Modification.

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ATTACHMENT A – VALUING GREENHOUSE GAS EMISSIONS

To place an economic value on carbon dioxide equivalent (CO_2-e) emissions a shadow price of carbon is required that reflects its social costs. The social cost of carbon is the present value of additional economic damages now and in the future caused by an additional tonne of carbon emissions.

A prerequisite to valuing this environmental damage is scientific dose-response functions identifying how incremental emissions of CO_2-e would impact climate change and subsequently impact human activities, health and the environment on a spatial basis. Only once these physical linkages are identified is it possible to begin to place economic values on the physical changes using a range of market and non market valuation methods. Neither the identification of the physical impacts of additional greenhouse gas nor valuation of these impacts is an easy task, although various attempts have been made using different climate and economic modelling tools. The result is a great range in the estimated damage costs of greenhouse gas.

The *Stern Review: The Economics of Climate Change* (Stern, 2006) acknowledged that the academic literature provides a wide range of estimates of the social cost of carbon. It adopted an estimate of United States (US) $85 per tonne (/t) of carbon dioxide (CO_2) for the "business as usual" case, i.e. an environment in which there is an annually increasing concentration of greenhouse gas in the atmosphere.

Tol (2006) highlights some significant concerns with Stern's damage cost estimates including:

- that in estimating the damage of climate change Stern has consistently selected the most pessimistic study in the literature in relation to impacts;
- Stern's estimate of the social cost of carbon is based on a single integrated assessment model, PAGE2002, which assumes all climate change impacts are necessarily negative and that vulnerability to climate change is independent of development; and
- Stern uses a near zero discount rate which contravenes economic theory and the approach recommended by Treasury's around the world.

All these have the effect of magnifying the social cost of carbon estimate, providing what Tol (2006) considers to be an outlier in the marginal damage cost literature.

Tol (2005) in a review of 103 estimates of the social cost of carbon from 28 published studies found that the range of estimates was right-skewed: the mode was US$0.55/t CO_2 (in 1995 US$), the median was US$3.82/t CO_2, the mean US$25.34/t CO_2 and the 95th percentile US$95.37/t CO_2. He also found that studies that used a lower discount rate and those that used equity weighting across regions with different average incomes per head, generated higher estimates and larger uncertainties. The studies did not use a standard reference scenario, but in general considered 'business as usual' trajectories.

Tol (2005) concluded that "it is unlikely that the marginal damage costs of carbon dioxide emissions exceed US$14/t CO_2 and are likely to be substantially smaller than that". Nordhaus's (2008) modelling using the DICE-2007 Model suggests a social cost of carbon with no emissions limitations of US$30 per tonne of carbon (US$8/t CO_2).

An alternative method to trying to estimate the damage costs of carbon dioxide is to examine the price of carbon credits. This is relevant because emitters can essentially emit CO_2 resulting in climate change damage costs or may purchase credits that offset their CO_2 impacts, internalising the cost of the externality at the price of the carbon credit. The price of carbon credits therefore provides an alternative estimate of the economic cost of greenhouse gas. However, the price is ultimately a function of the characteristics of the scheme and the scarcity of permits, etc. and hence may or may not reflect the actual social cost of carbon.

In 2008, the price of carbon credits under the European Union Emissions Trading Scheme were around Pounds (£) 24/t CO_2, the equivalent of about US$38/t CO_2 while spot prices in the Chicago Climate Exchange were in the order of US$3.95/t CO_2.

As of July 2008 the spot price under the New South Wales (NSW) Government Greenhouse Gas Reduction Scheme was Australian Dollars (AUD) $7.25/t CO_2. Prices under the Commonwealth Governments Greenhouse Friendly Voluntary Scheme were AUD$8.30/t CO_2 and Australian Emissions Trading Unit (in advance of the Australian Governments Emissions Trading Scheme) was priced at AUD$21/t CO_2-e (Next Generation Energy Solutions, pers. comms., 24 July 2008).

A National Emissions Trading Scheme is foreshadowed in Australia by 2010. While the ultimate design and hence liabilities under the scheme are still a work in progress, the National Emissions Trading Taskforce cited a carbon permit price of around AUD$35/t CO_2.

The *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future* (Commonwealth of Australia, 2008) cited a carbon permit price of AUD$23/t CO_2-e in 2010 and AUD$35/t CO_2-e in 2020 (in 2005) dollars for a 5% reduction in carbon pollution below 2000 levels by 2020.

Given the above information and the great uncertainty around damage cost estimates, a range for the social cost of greenhouse gas emissions from AUD$8/t CO_2-e to AUD$40/t CO_2-e was used in the sensitivity analysis described in Section 2.6 of the Socio-Economic Assessment, with a conservatively high central value of AUD$30/t CO_2-e.

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ATTACHMENT B – BCA SENSITIVITY TESTING

Table B-1
Benefit Cost Analysis Sensitivity Testing Project Net Present Value ($Millions)

INCREASE 20%	4% Discount Rate	7% Discount Rate	10% Discount Rate
Opportunity cost of land	$20	$45	$59
Capital costs	$14	$40	$54
Operating costs	$14	$37	$49
Revenue	$41	$74	$92
Residual value of land	$23	$48	$61
GREENHOUSE COSTS @ $40/TONNE (T)	$21	$46	$60

DECREASE 20%	4% Discount Rate	7% Discount Rate	10% Discount Rate
Opportunity cost of land	$23	$48	$63
Capital costs	$28	$53	$67
Operating costs	$28	$56	$72
Revenue	$2	$19	$29
Residual value of land	$20	$46	$60
GREENHOUSE COSTS @ $8/T	$22	$47	$61