AECOM

Baal Bone Colliery
ENVIRONMENTAL ASSESSMENT

March 2010

Volume 3 - Appendices J to N

Prepared for The Wallerawang Collieries (TWCL)
PO Box 13 | Lithgow | New South Wales | 2790

Prepared by AECOM
Level 5, 828 Pacific Highway | Gordon | New South Wales | 2073 | T +61 2 8484 8999 | F +61 2 8484 8989
www.aecom.com

xstrata coal

APPENDIX J

Air Quality Impact Assessment

Commercial in Confidence

The Wallerawang Collieries Limited
17 December 2009
Document No

AECOM

Air Quality Impact Assessment

Continued Operations at Baal Bone Colliery

Air Quality Impact Assessment

Continued Operations at Baal Bone Colliery

Prepared for

The Wallerawang Collieries Limited

Prepared by

AECOM Australia Pty Ltd
PO Box 73 HRMC NSW 2310 Australia
T +61 2 4911 4900 F +61 2 4911 4999   www.aecom.com
ABN 20 093 846 925

17 December 2009

S6068306

Quality Information

Document	Air Quality Impact Assessment
Ref	S6068306 \\auntl1fp001\public\jobncl\syd\s6\s60600-699\s6068306 baal bone aqia\5. delivery\5.2 reports final\s6068306_fnl_aqia_17dect09.docx
Date	17 December 2009
Prepared by	Adam Plant Author Signature
Reviewed by	David Rollings Technical Peer Reviewer Signature

Distribution

Copies	Recipient	Copies	Recipient
1	**Tony King** The Wallerawang Collieries Limited PO Box 13 Lithgow NSW 2790	1	**AECOM** File Copy

"This page has been left blank intentionally"

Contents

List of Tables

List of Figures

List of Appendices

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by The Wallerawang Collieries Limited (TWCL) to perform an air quality impact assessment (AQIA) for the existing surface activities and mine ventilation shafts at the Baal Bone Colliery near Lithgow NSW. This AQIA was undertaken as part of an Environmental Assessment (EA) which is required to allow the continued operation of the Baal Bone Colliery.

The assessment outlines the current emissions from the mine based on operational information and emission factors provided in relevant manuals. The emissions inventory along with meteorological data are used to predict the potential worst case total suspended particulate (TSP), particulate matter less than 10 microns (PM_{10}), deposited dust and odour ground level concentrations (GLCs), including the influence of background concentrations where available. The predicted GLCs were assessed against criteria sourced from regulatory guidelines.

1.1 Scope of Work

The scope of work for the air quality impact assessment is as follows:

- **Development of an emissions inventory**. The inventory contains emissions information based on the mine shaft exhaust data, operational information and the emission factors supplied in the National Pollution Inventory (NPI) Emissions Estimation Technique Manual (Commonwealth of Australia, 2001). The mine shaft data was provided by a previous air quality assessment and the operational information was provided by TWCL.
- **Preparation of the Dispersion Model**. The AUSPLUME dispersion model has been used for the assessment of odour and particulates (dust). As the issues involved with this assessment relate primarily to short term near-field impacts, the AUSPLUME model is considered acceptable for use. Model inputs include meteorology, terrain, source characteristics, and odour and dust emissions data.
- **Preparation of a report**. The report was prepared detailing the findings of the modelling for the assessment. The report outlines the model assumptions and inputs, model findings and recommendations for achieving compliance with regulatory guidelines (if required).

1.2 Applicable Guidelines

The air quality impact assessment was conducted in accordance with the following guideline:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, Department of Environment and Conservation New South Wales (DEC) 2005, hereafter referred to as the Approved Methods.

The Approved Methods outline the requirements for developing air dispersion modelling methodology, analysing meteorological data, and the criteria applicable when considering the potential impacts likely as a result of the mining operations.

The emission factors for mining activities used in the assessment have been generated according to the following manual:

- *National Pollution Inventory Emissions Estimation Technique Manual for Mining*, Version 3, Commonwealth of Australia, 2001.

The manual describes the procedures and recommended approaches for estimating emissions from facilities engaged in mining. It provides emission factor equations that are applied to the operational data of the facility to generate emission inputs for the modelling process.

"This page has been left blank intentionally"

2.0 Project Background

2.1 Site Location

The Baal Bone Colliery is located near the village of Cullen Bullen off the Castlereagh Highway, approximately 25km north west of the City of Lithgow. The surface activities of the mine are established on a plateau with an elevation of approximately 860m, skirted in an arc clockwise from north to south by steep forest with elevations over 1,000m. One mine ventilation shaft is located next to the infrastructure on the plateau and another within densely forested hills at an elevation of 1,036m. A locality map of the region around the Baal Bone Colliery is provided in **Figure 1**. The location of the pollutant sources, sensitive receptors and dust deposition gauges are provided in **Figure 2**.

2.2 Pollutants of Concern

2.2.1 Particulate Matter

Particulate matter is the term for solid or liquid particles found in the air. Some particles are large or dark enough to be seen as smoke, but fine particulate matter is tiny and is generally not visible to the naked eye. Particulate matter is typically produced by the mechanical break-up of larger solid particles. The larger or coarse fraction can include dust from roads, agricultural processes, uncovered soil or mining operations, as well as non-combustible materials released when burning fossil fuels. Pollen grains, mould spores, evaporation of sea spray and plant and insect parts can also contribute to the coarse fraction. The smaller or fine particulates are largely formed by the oxidation of primary gases.

There are two main effects of particulate; nuisance effects and health effects. Nuisance effects are primarily due to deposited dust and the coarser fraction of total suspended particulate. Health effects are primarily due to particles in the size range less than 10 µm in diameter (PM_{10}) and particles less than 2.5 µm in diameter ($PM_{2.5}$). PM_{10} refers to the range of particulate matter that is inhalable and is able to penetrate the nose or mouth under normal breathing conditions. $PM_{2.5}$ is respirable and is able to penetrate the nasal cavity and ultimately the lungs.

Deposited dust refers to the larger fractions that fall from the air and deposit on exposed surfaces. In general, deposited dust has an aerodynamic diameter of greater than about 20 µm, however there is no size threshold limit between these particles and the smaller particles that remain suspended in the air for long periods. Larger dust particles are generally responsible for nuisance (amenity) effects including vegetation damage and surface soiling. Depending on its physical or chemical characteristics, dust may also cause surface deterioration of materials due to its abrasive or corrosive properties. If the dust composition is dangerous then it is considered a hazardous air pollutant (and may contain toxic material).

2.2.2 Odour

Odour is a sensory response to the inhalation of one or more chemicals in the air we breathe. A person's perception of an odour can vary significantly depending on the sensitivity of the person, the acuteness of the person's sense of smell and the connotations that the odour bestows on that person. Odour primarily affects a person's quality of life and can have a large range of adverse effects including stress and other physical symptoms.

"This page has been left blank intentionally"

3.0 Methodology

3.1 Dispersion Modelling

AUSPLUME is an advanced Gaussian plume dispersion model with algorithms based on the Industrial Source Complex – Short Term (ISCST3) model approved by the US EPA for use in regulatory assessments undertaken within the United States. AUSPLUME was developed by the Victorian EPA to enhance the ISCST3 model and make it applicable to Australian conditions. AUSPLUME is approved by the NSW Department of Environment, Climate Change and Water (DECCW) for use in regulatory assessments undertaken in NSW. A complete description of the model is provided in the AUSPLUME user manual, which is available upon request.

The model uses the Gaussian dispersion model equation to simulate the dispersion of a plume from point, area or volume sources. Mechanisms for determining the effect of terrain on plume dispersion are also provided. AUSPLUME operates on an hourly time step, and, therefore, requires hourly wind speed, wind direction and other dispersion parameter data. The dispersion of each pollutant plume is determined for each hour using conventional Gaussian model assumptions. It should be noted that Gaussian models are best used to identify pollutant concentrations at receptor locations close to emissions sources, as they can overestimate concentrations at longer distances.

Atmospheric dispersion modelling was conducted using AUSPLUME 6.0 (the latest approved version of the model) in accordance with the guidelines published by Australian regulatory authorities (DEC NSW, 2005). The document prescribes calculation modes for accounting for terrain effects, building wake effects, horizontal and vertical dispersion curves, buoyancy effects, surface roughness, plume rise, wind speed categories and wind profile exponents. An example AUSPLUME modelling input file is provided in **Appendix A**.

Input parameters used for the AUSPLUME dispersion modelling are summarised in **Table 1**.

Table 1: Summary of AUSPLUME Input Parameters

Parameter	Input
AUSPLUME Version	Version 6
Modelling Domain	41 km x 25 km
AUSPLUME Modelling Grid Resolution	0.25 km
Number of Discrete Receptors	12
Terrain Data	Included as an external terrain file
Building Wake Data	Not Required
Dispersion Algorithm	PG (rural ISC curves) & MP Coeff. (Rural)
Hours Modelled	8784 hours (366 days)
Meteorological Data Period	January 2004 – December 2004

3.2 Model Inputs

AUSPLUME requires six main categories of data to determine the dispersion of pollutants:

- Meteorology;
- Terrain effects;
- Building wake effects;
- Modelling scenarios;
- Source characteristics; and
- Emissions inventory.

The above inputs are addressed separately in the following sections. An example modelling input file is provided in Appendix A.

3.3 Meteorology

Meteorological data required by AUSPLUME includes wind speed, wind direction, temperature and an estimation of the stability class and mixing height for the area surrounding the subject site. Preferably, meteorological data is sourced from on-site dedicated meteorological stations which have recorded data over a number of years.

For the sake of consistency, meteorological data included in the air dispersion modelling was sourced from the Mt Piper Power Station monitoring station for the period of 2004 as provided by TWCL from a previous air quality study (Heggies, 2007). Meteorological quality checks were conducted during the previous assessment and the data is considered acceptable for use in this AQIA. The monitoring site is approximately 10km to the south of the Baal Bone Colliery site at an elevation of 950m. The station measures wind speed, wind direction, ambient temperature, relative humidity and rain fall.

Wind roses analysing wind direction and wind speed were produced from the meteorological data to compare seasonal trends for 2004 and are provided in **Figure 3**. The wind patterns for the station throughout the year are dominated by winds from the southwest and to a lesser extent the northeast. The annual average wind speed for the year was 2.33 m/s with 2.4% calm conditions and an annual wind vector (the mean wind direction and frequency count for that direction) of 226 degrees (south west).

3.4 Terrain Effects

The topography of the site includes densely forested steep hills and escarpments with scattered small plateaus cleared for residential use. The surface activities of the mine are located on a plateau and are adjacent to rolling forest. As such, a terrain file has been generated for the region surrounding both the surface activities and the mine ventilation shaft covering an area of 33km by 25km and applied in the AUSPLUME model.

3.5 Building Wake Effects

Due to the nature of the odour and dust sources, no building wake effects have been included in the dispersion modelling.

3.6 Modelling Scenarios

Dispersion modelling for the Baal Bone Colliery was performed for one scenario. The scenario considered emissions from surface activities combined with emissions from the mine ventilation shafts. Background PM_{10} and TSP concentrations were considered in the model predictions.

3.7 Source Characteristics

The area source characteristics used in the calculation of dust emissions are provided in **Table 2**. The dimensions and areas of the sources were chosen to represent the active surface sections of the mine where dust would potentially be generated and did not include revegetated areas or sealed roads. The Run Of Mine stockpile is referred to as the ROM stockpile. Refer to the assumptions in **Section 3.8** for more information as to the selection of active sources.

Table 2: Area Source Characteristics

Sources	Source Coordinates (m)[1]			Area[2]
	Easting	Northing	Elevation (AHD)	m^2
Coal and ROM Stockpile	225122	6314777	883	206,500
Infrastructure Area	225730	6315070	860	18,000
Coarse Reject Emplacement	226016	6314020	880	292,350

[1] - Source coordinates are the SW corner of the source.
[2] – Areas confirmed from discussions with TWCL.

The volume source characteristics used in the dispersion modelling are provided in **Table 3**. The dust emissions caused by the movement of coarse reject haulage trucks on the site were modelled as volume sources spread out every 150m on the road (line source). The initial lateral and vertical dimensions were calculated from the ISC3 air dispersion model Users Guide (US EPA 1995). Ten (10) volume sources were chosen for the Baal Bone Colliery coarse reject haulage road.

Table 3: Volume Source Characteristics

Sources	Source Coordinates (m) [1]			Horizontal Spread (m)	Vertical Spread (m)	Centre Height (m)
	Easting	Northing	Elevation			
Coal Train Loader	225210	6314579	892	3	5	3
Coarse Reject Truck Loader	225484	6314901	874	3	5	3
Haulage Road	NA	NA	NA	70	2.3	3
Mine Ventilation Shaft – Forest	229902	6313683	1037	2.8	2.8	3
Mine Ventilation Shaft – Adit 5	226051	6314996	867	2.8	2.8	3

[1] - Source coordinates are the centre of the source.

3.8 Emissions Inventory

The emissions inventories for TSP, PM_{10} and odour are provided in **Table 4**, **Table 5** and **Table 6** respectively. The input emissions file used in the model designates hourly varying dust emission rates to reflect the surface operations of the colliery. The emission rates (ER) for TSP and PM_{10} from the surface activities have been generated according to the National Pollution Inventory (NPI) manual for mining (Commonwealth of Australia, 2001). The manual provides emission factors that are applied to the operational data to generate particulate emission inputs for the modelling process. The mine ventilation shaft TSP and odour concentrations was provided by TWCL from past air quality reports. An outline of the information and calculations used to generate the emission rates is provided **Appendix B.**

Table 4: TSP Emissions Inventory

Source	ID	Source Type	ER Units	TSP Variable ER	
				5pm to 8am	8am to 5pm
Coal and ROM Stockpile [1]	AS2	Area	$g/m^2.s$	0.000007	0.000034
Coal Train Loader	VS1	Volume	g/s	0.06	0.06
Coarse Reject Haulage Truck Loader	VS2	Volume	g/s	0.008	0.008
Coarse Reject Emplacement	AS1	Area	$g/m^2.s$	0.000012	0.000033
Infrastructure Area	AS3	Area	$g/m^2.s$	0.000006	0.000006
Truck Haulage	VS3-VS12	Volume	g/s	0.49	0.49
Mine Ventilation Shaft - Forest	VS13	Area	g/s	0.31	0.31
Mine Ventilation Shaft - Adit 5	VS14	Area	g/s	0.31	0.31

[1] – This source varied due to the intermittent operation of bulldozers between 8am and 5pm each day.

Table 5: PM_{10} Emissions Inventory

Source	ID	Source Type	ER Units	PM10 Variable ER	
				5pm to 8am	8am to 5pm
Coal and ROM Stockpile [1]	AS2	Area	$g/m^2.s$	0.000004	0.000011
Coal Train Loader	VS1	Volume	g/s	0.03	0.03
Coarse Reject Haulage Truck Loader	VS2	Volume	g/s	0.004	0.004
Coarse Reject Emplacement	AS1	Area	$g/m^2.s$	0.000006	0.000006
Infrastructure Area	AS3	Area	$g/m^2.s$	0.000003	0.000003
Truck Haulage	VS3-VS12	Volume	g/s	0.12	0.12
Mine Ventilation Shaft - Forest	VS13	Area	g/s	0.12	0.12
Mine Ventilation Shaft - Adit 5	VS14	Area	g/s	0.12	0.12

[1] – This source varied due to the intermittent operation of bulldozers between 8am and 5pm each day.

The evaluation of odour impacts requires the estimation of short or peak concentrations on the time scale of less than one second. The predication of peak concentrations from estimates of ensemble means can be obtained from a ratio between extreme short term concentration and long term averages, defined as peak-to-mean ratios. The ratio of 1 second average concentrations to mean 1 hour average concentrations (P/M60) are provided in the Approved Methods. The P/M60 ratio for volume sources has been applied in the AQIA for the mine shafts.

Table 6: Odour Emissions Inventory

Source	ID	Source Type	Peak to mean ratio		ER Units	Odour ER	
			Near-field	Far-field		ER	P/M60 ER
Mine Ventilation Shaft - Forest	VS13	Volume	2.3	2.3	OU/s	3590	8257
Mine Ventilation Shaft - Adit 5	VS14	Volume	2.3	2.3	OU/s	3590	8257

The following comments and assumptions have been made in relation to generating the emissions inventory and modelling inputs for the Baal Bone colliery:

- The operational process description, operational time frames and the volume of material excavated were supplied by TWCL;
- A coal yield value of 75% was used in the calculation of coarse reject volume;
- Where possible conservative assumptions have been applied in the generation of the emissions inventory e.g. maximum continuous production rate;
- Mine ventilation shaft parameters were gained from a previous air quality report for the site (Heggies, 2007) supplied by TWCL and included pollutant concentration, dimensions, velocity, and temperature;
- The mine ventilation shafts were modelled as volume sources;
- Emission factors used to calculate TSP and PM_{10} emission rates were gained from the NPI manual for mining (Commonwealth of Australia, 2001);
- The watering of the haul road, infrastructure surfaces and coal and ROM stockpiles was assumed to be conducted at less than 2 $L/m^2/hr$ and the appropriate reduction applied to PM_{10} and TSP emissions as stated in the NPI manual (50%);
- The TSP background concentration data was generated on the assumption that 40% of TSP is PM_{10}. Refer to **Section 4.0** for more details.
- The kilometres travelled by the haulage trucks were calculated from the distance of the unsealed road between the centre of the coarse reject emplacement and the coarse reject truck loader;

- Bulldozers are used to manage the reject emplacement on an interim basis. Their use is very low and was not included in the emission calculations;
- The Baal Bone Colliery has the potential to transport coal off site by trucks for use at local power stations and other domestic locations. Whilst Baal Bone Colliery does not currently transport coal off site by road, there is the provision that the Colliery is able to transport 900,000 tonnes of coal per annum. These trucks are covered and travel on sealed roads within the Colliery. Therefore, truck haulage off site was not included in the emission calculations;
- The calculated area of the coal & ROM stockpile, infrastructure area and coarse reject emplacement was based on the active area that has the potential to generate dust through process activities or windblown dust. The following areas are not included in this area: sealed roads, infrastructure, dirt roads that are not often used, vegetated or rehabilitated soil, water/liquid bodies.

"This page has been left blank intentionally"

4.0 Existing Air Quality Environment

The pollutant concentrations from the Bathurst DECCW monitoring station for the year 2004 (provided in the previous assessment (Heggies, 2007)) have been used in this assessment to calculate background PM_{10} and TSP concentrations. No background odour concentrations were available.

The Bathurst DECCW monitoring station is located at the Bathurst sewage treatment plant off Morisset Street, approximately 50km west of the Colliery. Monitoring data was also available for the Mt Piper Power Station for 2004, however the results from this location were deemed inappropriate for use in the assessment (Heggies, 2007).

The Bathurst monitoring station measures daily averaged PM_{10} concentrations. The calculated annual average PM_{10} concentration was applied as the background value for the PM_{10} annual average dispersion modelling. No background concentration has been applied to the 24 hour average dispersion modelling (refer to discussion in **Section 4.1**). To allow an estimation of likely impacts due to TSP, the daily TSP concentrations were assumed from a typical PM_{10} to TSP ratio for the Hunter Valley of 40% i.e. 40% of TSP is PM_{10} (NSW Minerals Council 2000). The ratio was applied to the daily PM_{10} concentrations measured at the Bathurst DECCW monitoring station for 2004 and the resulting TSP annual average concentration was applied in the assessment.

Dust deposition has been monitored at four locations surrounding the Baal Bone Colliery using dust deposition gauges. Samples were collected monthly according to Australian Standard AS3580.1 and analysed for insoluble solids and ash residue. The TSP dust deposition results, expressed as total solid particles, from the 2008 Baal Bone Annual Environmental Management Report (AEMR) (TWCL, 2009) were used to calculate the background dust deposition level. The highest average monthly TSP value for 2008 for all the monitoring locations was applied as the background value. As the solid particles provided in the AEMR have been applied instead of insoluble particles (as stated in the DECCW assessment criteria) the background deposition rate and subsequent cumulative deposition rates (impact of the Baal Bone Colliery and background deposition rates) are considered conservative. It should be noted that two locations showed very high results for the month of March 2008. However, after review of the field sheets it was identified that leaf matter was found in both samples which may have affected the results. As such these two results were omitted when calculating the background dust deposition level.

A summary of the pollutant background levels is provided in **Table 7.**

Table 7 Assumed Background Pollutant Levels

Pollutant	Units	Background Level	Averaging Period
TSP	$\mu g/m^3$	45	Annual
PM_{10}	$\mu g/m^3$	18	Annual
	$\mu g/m^3$	NA	24 hours
Deposited Dust	g/m^2.month	2.6	Annual
Odour	OU	NA	1 Second

4.1 Application of Bathurst DECCW data for 24 hour averages

The Bathurst PM_{10} data has not been applied as the background concentration for the PM_{10} 24 hour average modelling. An examination of the monitoring site's location and the measured data showed that the short term impacts measured at the monitoring station were unrealistic for the Baal Bone Colliery and unsuitable for application in the short term PM_{10} 24 hour average modelling. As highlighted in the following discussion, the high short term concentrations in the DECCW data applied to the short term PM_{10} 24 hour average would be likely to considerably overestimate the actual impacts of the Colliery. The following justification can be made in relation to this issue:

- An examination of the 2004 Bathurst DECCW PM_{10} data shows that there is a short term increase in PM_{10} levels between March and May 2004, with daily concentrations reaching 73 $\mu g/m^3$ (above the assessment criteria of 50$\mu g/m^3$).

- A review of the daily averaged PM_{10} concentrations from the Bathurst DECCW site for the period June 2003 to June 2009 shows that there is a high variation in concentrations, with several periods of high concentrations and peaks of up to 2,141 $\mu g/m^3$, as presented in **Figure 4**. The results from the 2004 data and the extended time period suggest that there are unknown localised influences on the Bathurst DECCW monitoring station, and that the results are considered unrealistic for the area surrounding the Baal Bone Colliery.
- The DECCW monitoring site is located approximately 50km west of the Colliery and is surrounded by commercial, industrial and agricultural land uses. The Colliery however is located in an isolated valley surrounded by steep forest and some minor pasture fields, making the potential pollution sources and surface roughness (i.e. vegetation type impacts dispersion of pollutants) of the landscape very different from that of the monitoring station.

Although the Bathurst DECCW data is not considered to be suitable for calculating short term averages such as the background 24 hour average PM_{10} concentration, the data is considered suitable for use in calculating the background annual average PM_{10} and TSP concentrations. The high peaks measured in the DECCW data will have a reduced impact in the calculation of the annual average. However, the use of the DECCW pollutant data in the annual averages should be viewed as very conservative and will most likely over predict actual cumulative impacts attributed to the Colliery.

5.0 Sensitive Receptors

Sensitive receptors are identified by the DECCW as anywhere someone works or resides or may work or reside, including residential, hospitals, hotels, shopping centres, play grounds, recreational centres, etc. **Table 8** presents the discrete sensitive receptor locations chosen to represent the local community. The receptor locations are presented in **Figure 2**.

Table 8: Discrete Representative Sensitive Receptor Locations

Receptor Number	Distance from Nearest Project Area Boundary (m)	Receptor Type	Base Elevation (AHD m)
1	60	Residence	861
2	180	Residence	862
3	266	Residence	862
4	1300	Residence	844
5	1100	Residence	844
6	4800	Residence	705
7	5000	Residence	700
8	5300	Residence	680
9	1300	Residence	920
10	1100	Residence	895
11	1400	Residence	915
12	1900	Residence	931
13	2300	Residence	912

The receptor identified as receptor 3 is positioned close to the Colliery and adjacent to receptor 2. Receptor 2 is considered to be representative of the pollutant levels at receptor 3, and as such, predicted impacts at receptor 3 are not included as part of this air quality assessment.

"This page has been left blank intentionally"

6.0 Assessment Criteria

Assessment of the predicted dust and odour concentrations and deposition rates for the Baal Bone Colliery was performed using assessment criteria and methodology defined in the DECCW Approved Methods (DEC, 2005). The method states that the criteria must be applied “at the nearest existing or likely future off-site sensitive receptor”. Assessment criteria are presented for TSP, PM_{10}, and dust deposition.

The odour criterion for the AQIA was selected from the Approved Methods (DEC, 2005) as 5 odour units (OU) nose- response time average at the 99th percentile. The method provides for the selection of assessment criteria based upon the population of the affected community. The community surrounding the Baal Bone Colliery within the zone of affectation has been estimated to be approximately 36 people; 12 residences multiplied by an average of 3 residents per residence. The method states that for a population around 30 people that an impact assessment criterion of 5 OU be applied.

The relevant impact assessment criteria specified by the DECCW Approved Methods for the AQIA is presented in **Table 9**. The Approved Method provides for dust impact assessment as PM_{10}, TSP and deposited dust concentrations in ug/m^3 and odour concentrations in OU. The relevant averaging periods for each pollutant is provided. The assessment compares the impact assessment criteria to the predicted isolated GLC impact (predicted impacts due to the Baal Bone Colliery alone) as well as the predicted cumulative GLC impact (predicted isolated impacts plus the background concentration).

Table 9 Assessment Criteria

Pollutant	Units	Assessment Criteria	Averaging Period	Percentile
TSP	$\mu g/m^3$	90	Annual	100th
PM_{10}	$\mu g/m^3$	30	Annual	100th
	$\mu g/m^3$	50	24 hours	100th
Deposited Dust	g/m^2.month	4	Annual	100th
Odour	OU	5	1 Second	99th

"This page has been left blank intentionally"

7.0 Dispersion Modelling Results

The maximum predicted dust and odour concentrations in isolation from the background concentrations at each discrete sensitive receptor have been presented in **Table 10.** The predicted cumulative pollutant concentration including the background concentration is provided in brackets next to the isolation concentration where appropriate (refer to **Section 4.1** for discussion of background 24 hour average PM_{10} concentration). **Figures 5** to **9** present the predicted isolated ground level concentration contours for the TSP annual average, PM_{10} annual average, PM_{10} 24 hour average, deposited dust deposition rate and odour 1 second average respectively. Note that deposited dust results are expressed as deposition rates and not concentrations.

Table 10: Maximum Predicted Pollutant Results at the Discrete Sensitive Receptors

Receptor Number	TSP (µg/m³)	PM_{10} (µg/m³)		Deposited Dust (g/m².month)	Odour (OU)
	Annual	Annual	24 Hour	Annual	1 Second
1	13.5 (58.5)	5.0 (23.0)	36.2	0.7 (3.3)	2.6
2 / 3	7.4 (52.4)	2.6 (20.6)	23.2	0.4 (3.0)	1.8
4	3.3 (48.3)	1.2 (19.2)	12.5	0.2 (2.8)	1.0
5	4.2 (49.2)	1.5 (19.5)	16.1	0.2 (2.8)	0.9
6	4.5 (49.5)	1.7 (19.7)	13.2	0.2 (2.8)	2.1
7	2.5 (47.5)	0.9 (18.9)	13.6	0.2 (2.8)	1.3
8	2.6 (47.6)	1.0 (19.0)	16.4	0.2 (2.8)	1.8
9	5.2 (50.2)	1.7 (19.7)	26.5	0.4 (3.0)	1.1
10	5.4 (50.4)	1.8 (19.8)	19.4	0.4 (3.0)	2.5
11	3.8 (48.8)	1.3 (19.3)	13.0	0.2 (2.8)	0.7
12	3.3 (48.3)	1.1 (19.1)	18.5	0.2 (2.8)	1.5
13	2.8 (47.8)	0.8 (18.8)	10.6	0.2 (2.8)	0.7
Criteria	90	30	50	4	5

7.1 Dust Deposition Validation

A comparison of the monthly average dust deposition rate for the 2008 measured data (as provided in the AEMR, TWCL, 2009) and the predicted isolated deposition rate from the AQIA is provided in **Table 11**. The table is presented to 'ground truth' the dust deposition results gained from the AQIA. The validation of the dust deposition in turn supports the TSP and PM_{10} results as all dust modelling is generated using the an analogous modelling approach and subsequent emissions inventory. The predicted isolated deposition rates have been compared to the measured data to assess the relative contribution of the Baal Bone Colliery to existing deposition levels.

Table 11: Comparison of Measured and Predicted Dust Deposition Rates

Sample Location	Dust Deposition Rates (g/m².month)	
	2008 Measured Rates	Predicted Isolated Rates
DM1	0.6	0.8
DM2	1.0	0.5
DM3	0.7	0.9
DM4	0.6	0.4

The comparison of the 2008 AEMR measured dust deposition rates and predicted isolated dust deposition rates in **Table 11** shows that the modelling resulted in predictions close to the measured values. The measured and predicted deposition rates are not expected to be indistinguishable as external impacts from other activities cannot be considered in the comparison, as well as periodic variations in mining activities. In general, the predicted isolated dust deposition rates show a good correlation with the measured data.

It should be noted that the assessment of the continued operations of an 'existing operation' requires the use of background information that will already include the existing operations contributions. Therefore, the assessment will double count the operations contributions in both the background data and the predicted contributions. The resulting cumulative GLC and dust deposition rates are likely to be conservative and over predict the actual impacts of the Colliery contribution. As such, the predicted isolated (and not cumulative) deposition rates have been compared to the measured data. The predicted isolated pollutant GLC and deposition rates are shown in **Figures 5** to **9**.

8.0 Impact Assessment

Based on the AQIA undertaken for the Baal Bone Colliery by AECOM, the following discussion is provided:

- The modelling results show that TSP annual average, PM_{10} annual average, deposited dust monthly average and odour 1 second average all met the stated assessment criteria at the discrete representative sensitive receptors for both isolated and cumulative predicted GLCs and deposition rates.
- The PM_{10} 24 hour average predicted GLC (in isolation from the background) met the stated assessment criteria at the discrete sensitive receptors. The cumulative predicted GLC was not able to be reliably calculated as the nearest available pollutant data were deemed unacceptable for use for short term averages (see **Section 4.1** and below).
- The following points briefly outline the methodology followed to assess ambient short term PM_{10} concentrations at Baal Bone Colliery. The recommended DECCW dispersion modelling assessment methodology for assessing 24 hour PM_{10} impacts included:
    1. A site specific emissions inventory was developed and dispersion modelling undertaken using an appropriate dispersion model (AUSPLUME);
    2. Maximum background 24 hour average PM_{10} concentration was calculated for application to the maximum predicted PM_{10} concentration. It was noted that this concentration exceeded the assessment criteria, triggering a more detailed alternative approach for the assessment of predicted cumulative PM_{10} 24 hour average concentration i.e. contemporaneous assessment (daily measured data added to daily predicted dust concentrations); and
    3. Contemporaneous measured background 24 hour average PM_{10} concentrations were reviewed for addition to the predicted PM_{10} concentrations to assess the predicted cumulative GLCs to the relevant assessment criteria.
- Following an analysis of the Bathurst DECCW monitoring data for contemporaneous assessment, it was considered that the short term background concentrations were not realistic, given the nature of the area surrounding the Baal Bone area (see **Section 4.1**). Examination of the Bathurst DECCW monitoring site location and the measured data shows that the short term impacts measured at the monitoring station are unrealistically high to be considered as representative of background particulate concentration for the Baal Bone Colliery and hence unsuitable for application in the short term PM_{10} 24 hour average modelling.
- Although the short term peak PM_{10} concentrations were considered unrealistic, the longer term annual average appears to be in the range one would expect for an area such as that surrounding Baal Bone Colliery. Hence the long term average data were considered as acceptable for use in the assessment of cumulative background PM_{10} annual average.

"This page has been left blank intentionally"

9.0 Conclusion

The Baal Bone Colliery AQIA predicts that ground level concentrations and deposition rates for all modelled parameters, TSP, PM_{10}, deposited dust and odour, met the DECCW assessment criteria at the nearest representative sensitive receptor. Due to the conservativeness of using the Bathurst DECCW pollutant data as the background concentration for TSP and PM_{10} annual average, the cumulative GLCs provided in the AQIA for these parameters are considered to be conservative and likely to over predict the actual impacts of the colliery at sensitive receptors. Applying the measured deposited dust deposition rate as the background deposition rate is also considered conservative and likely to over predict the actual impacts of the colliery.

In conclusion, the AQIA predicts that the continued operations of the Baal Bone Colliery are not expected to adversely impact the air quality of the local community around the Colliery.

"This page has been left blank intentionally"

10.0 References

Commonwealth of Australia. 2001, *National Pollution Inventory Emissions Estimation Technique Manual*.

Department of Environment and Conservation New South Wales (DEC NSW). 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, Sydney.

Heggies, 2007, *Baal Bone Colliery Ventilation Shaft Installation and Operation Air Quality Assessment*, Prepared for Umwelt Pty Ltd, Sydney.

New South Wales Minerals Council. 2000, *Particulate Matter and Mining; A NSW Minerals Council Technical Paper*, Version 3.

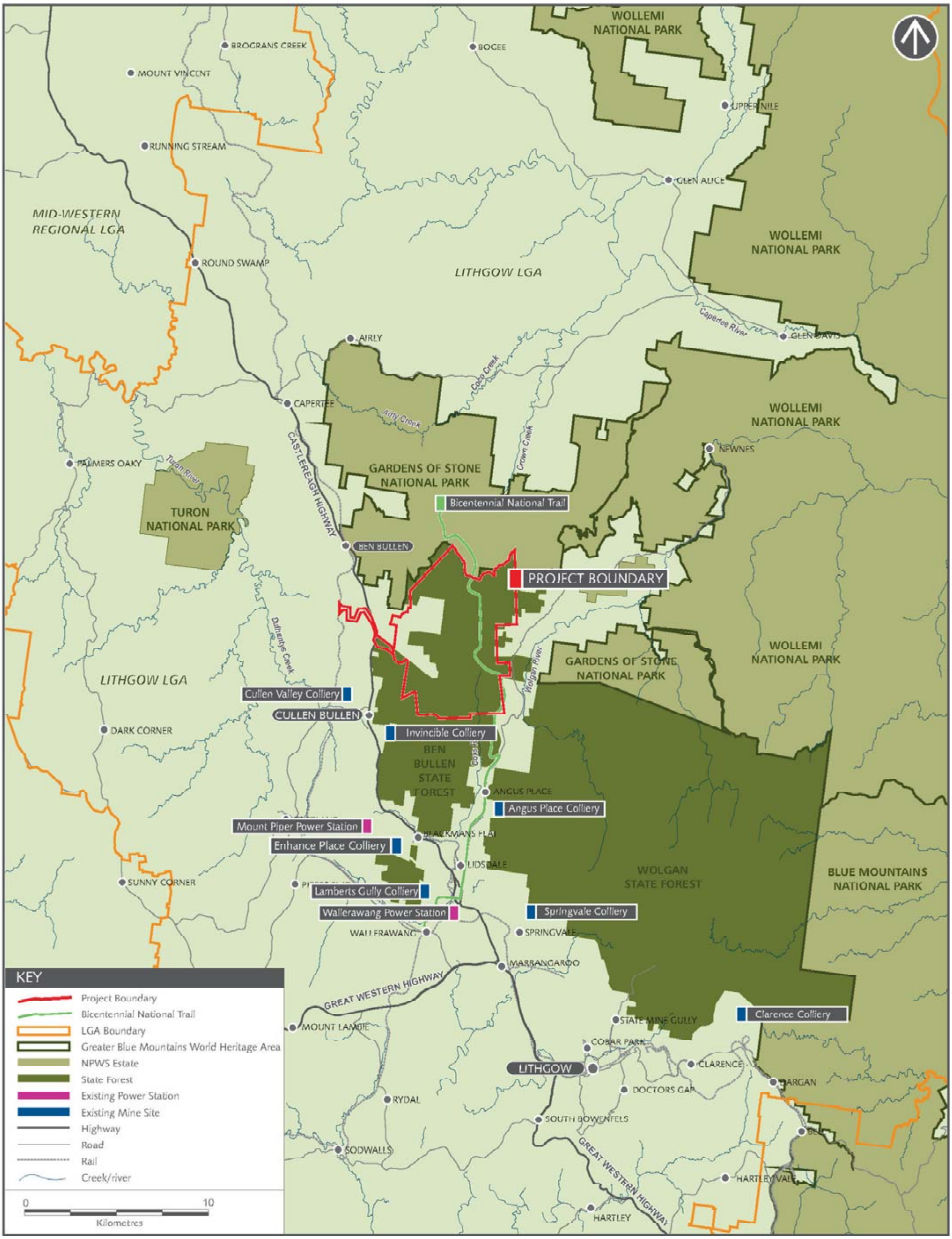
The Wallerawang Collieries Limited (TWCL), 2009, *Baal Bone 2008 Annual Environmental Management Report*, prepared for Xstrata Coal.

United States Environmental Protection Agency (US EPA). 1995, *ISC3 Users Guide*.

"This page has been left blank intentionally"

Figures

"This page has been left blank intentionally"



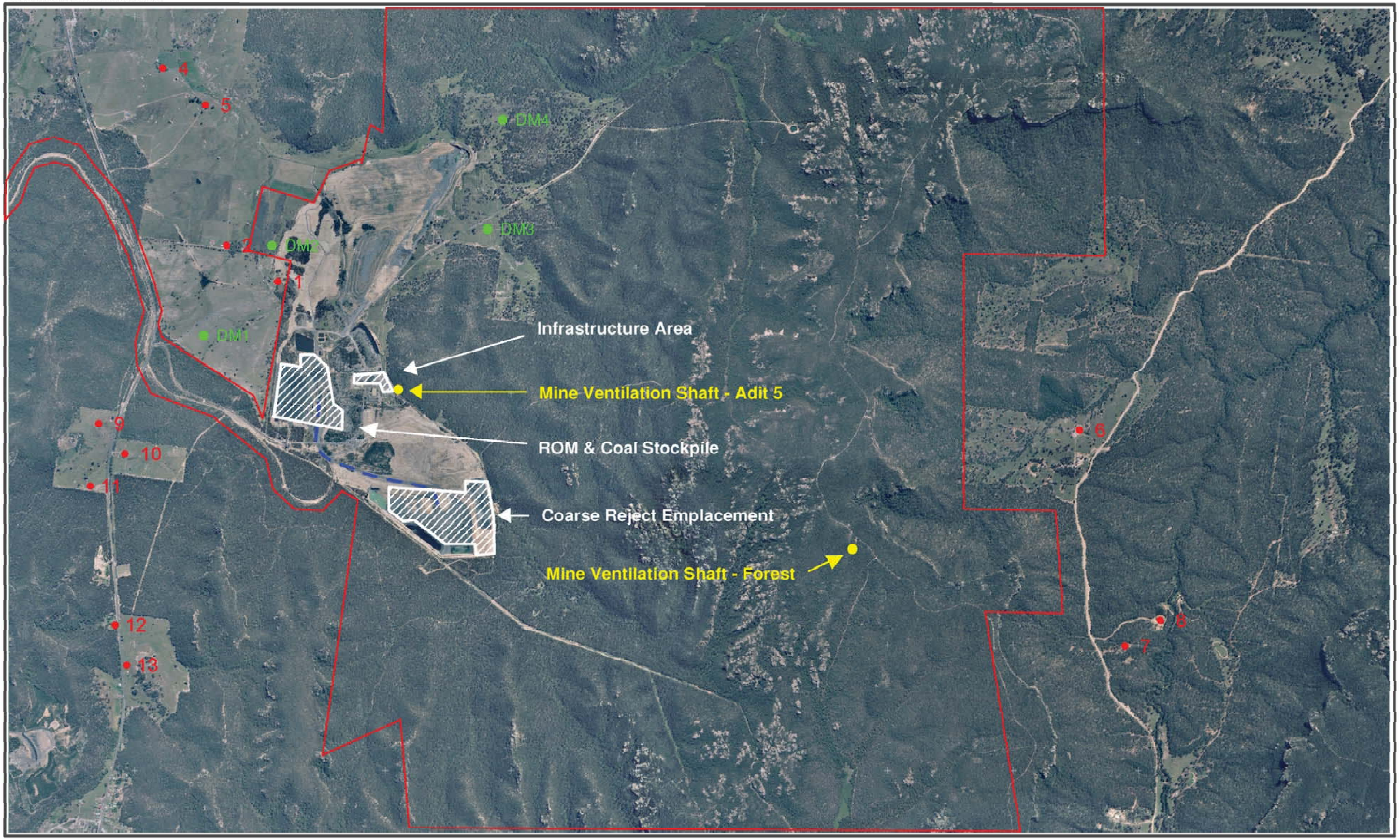
AECOM

REGIONAL CONTEXT

Continued Operations at Baal Bone Colliery - Air Quality Impact Assessment

Baal Bone Colliery, Cullen Bullen NSW

Figure 1

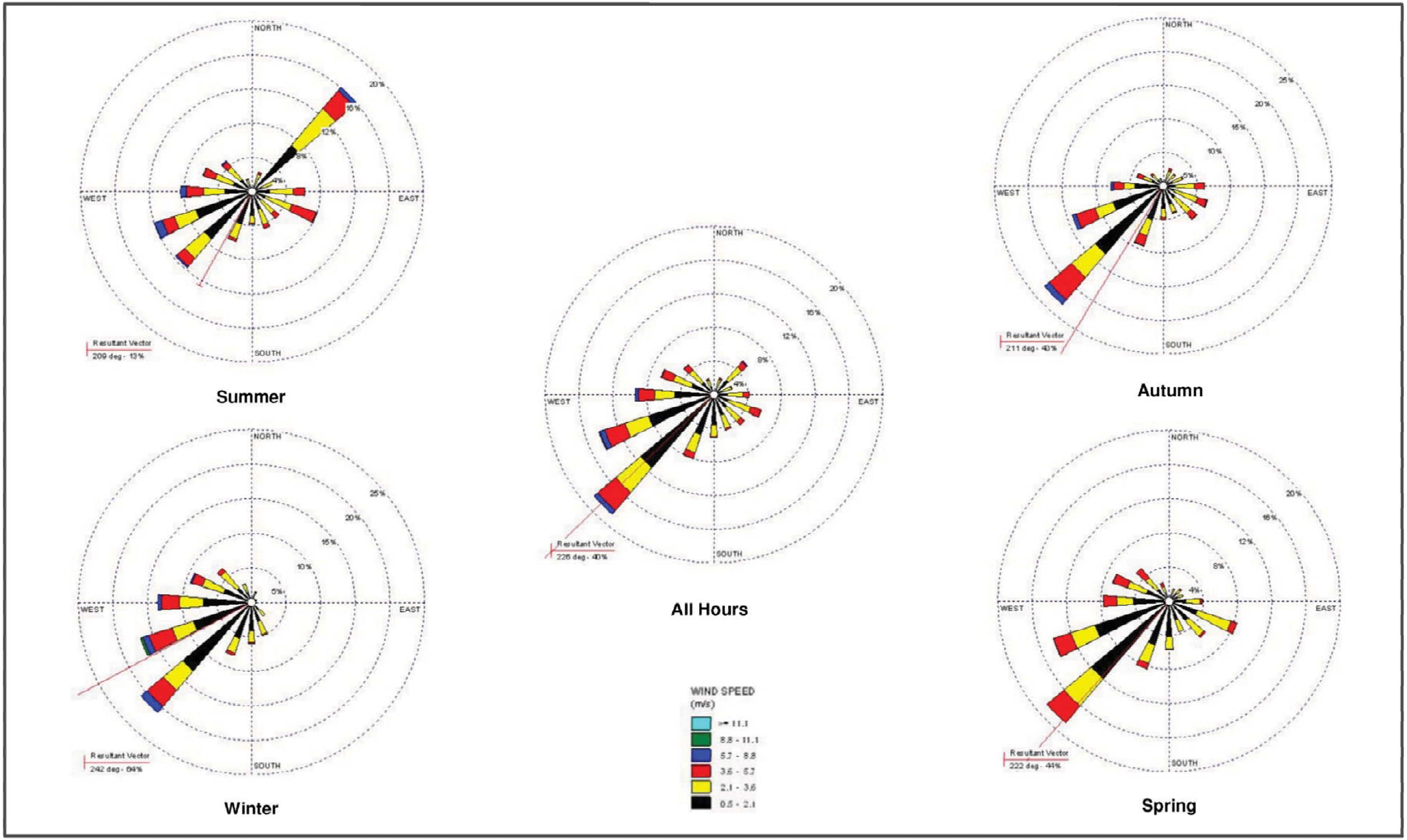


AECOM

0 1000m

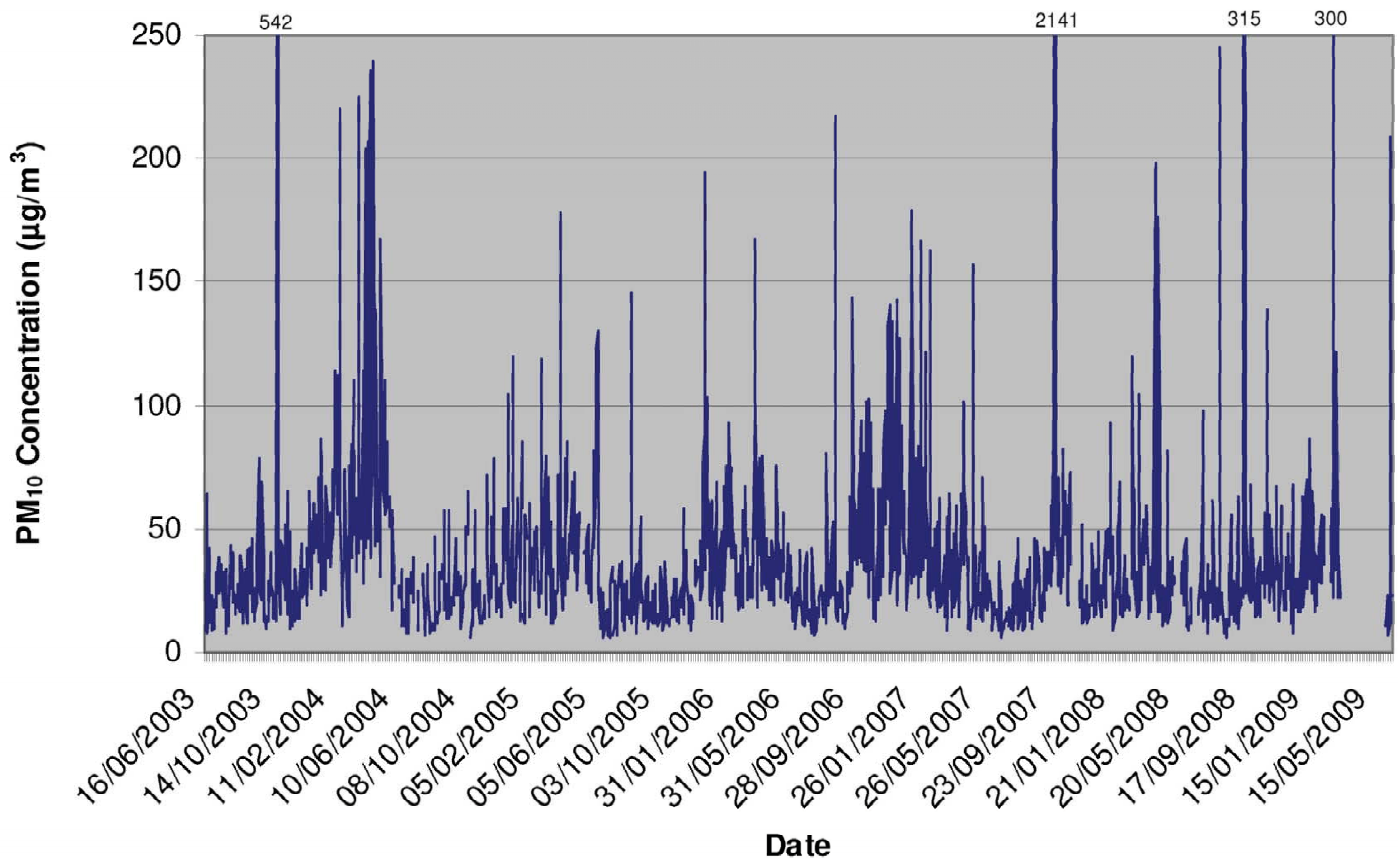
Sensitive Receptor
Dust Deposition Gauge Location
Project Boundary
Unsealed Haul Road

Figure 2 Baal Bone Colliery Source Location Map
Wallerawang Collieries Limited
Continued Operations at Baal Bone Colliery Air Quality Impact Assessment



AECOM

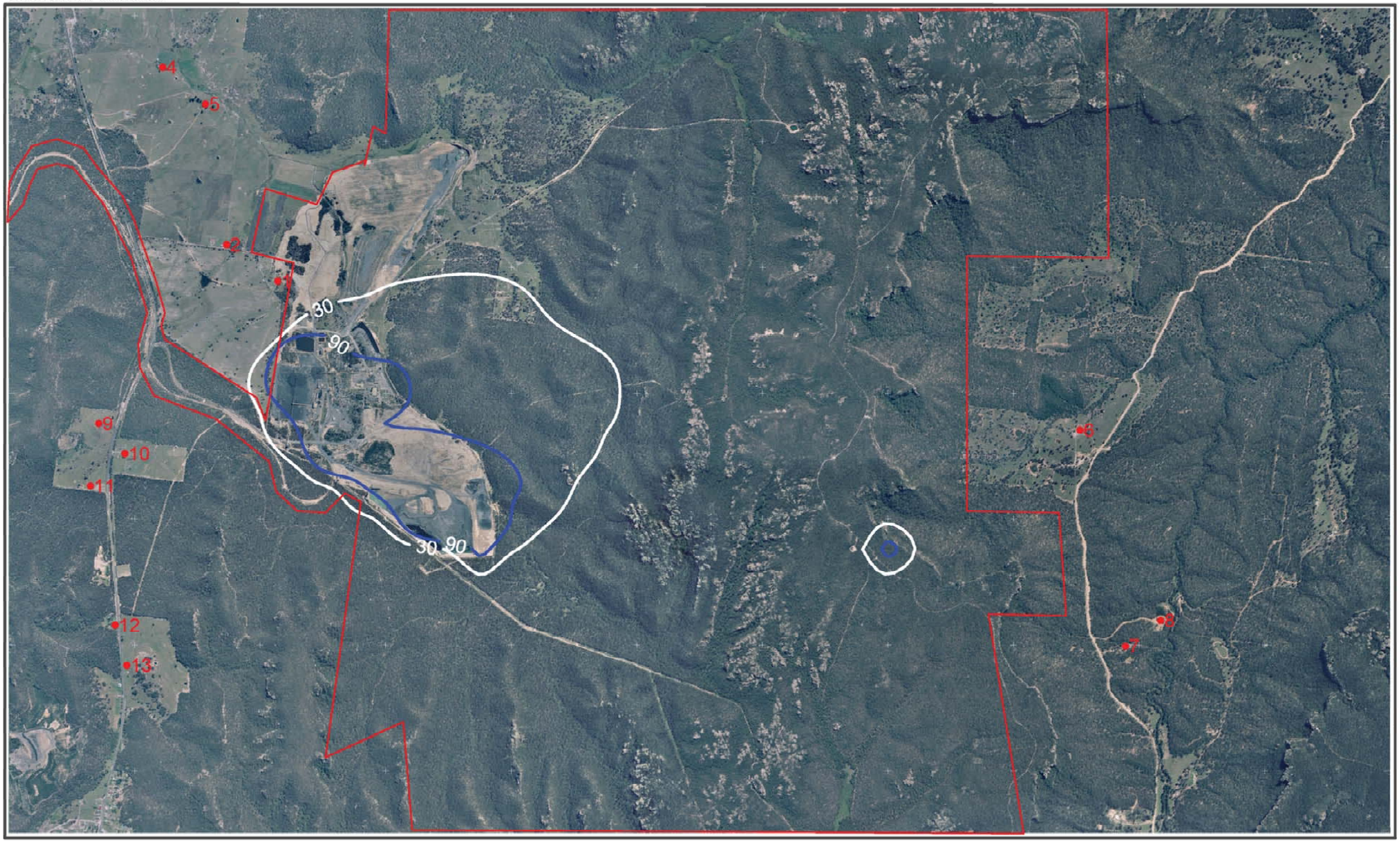
Figure 3 Wind Roses for Mt Piper Power Station 2004 Meteorological Data
Wallerawang Collieries Limited
Continued Operations at Baal Bone Colliery Air Quality Impact Assessment



AECOM

Figure 4 Bathurst DECC Monitoring Station Historical PM_{10} Concentration
Wallerawang Collieries Limited
Continued Operations at Baal Bone Colliery Air Quality Impact Assessment

S6068306 25/06/09 AP www.aecom.com



AECOM

Figure 5 Baal Bone Colliery TSP Annual GLCs (in isolation)

Wallerawang Collieries Limited

Continued Operations at Baal Bone Colliery Air Quality Impact Assessment

S6068306 25/06/09 AP www.aecom.com

AECOM

0 1000m

- Sensitive Receptor
- Assessment Criteria
- Project Boundary

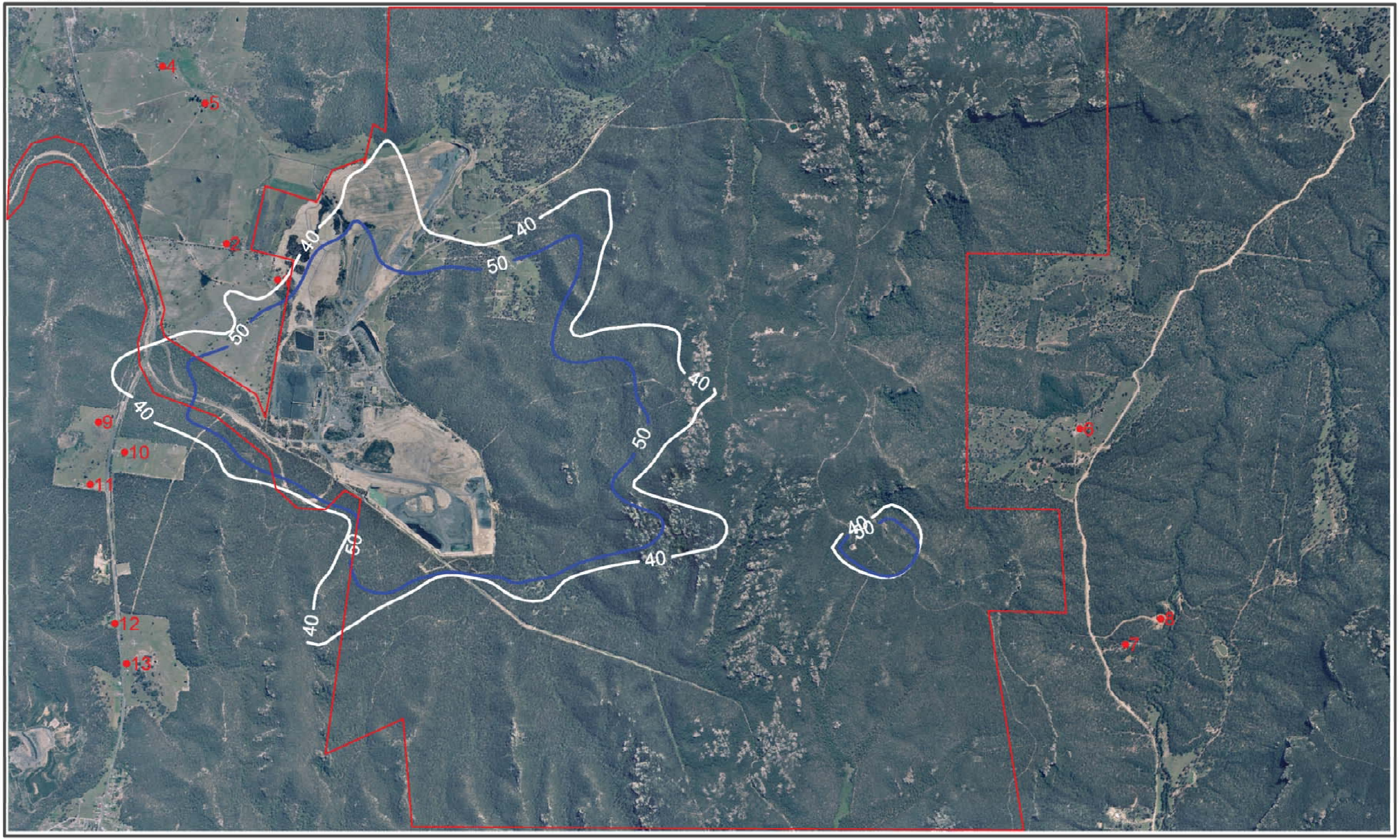
Units: ug/m³

Figure 6 Baal Bone Colliery PM_{10} Annual GLCs (in isolation)

Wallerawang Collieries Limited

Continued Operations at Baal Bone Colliery Air Quality Impact Assessment

S6068306 25/06/09 AP www.aecom.com



AECOM

Figure 7 Baal Bone Colliery PM_{10} 24 Hour GLCs (in isolation)
Wallerawang Collieries Limited
Continued Operations at Baal Bone Colliery Air Quality Impact Assessment

S6068306 25/06/09 AP www.aecom.com

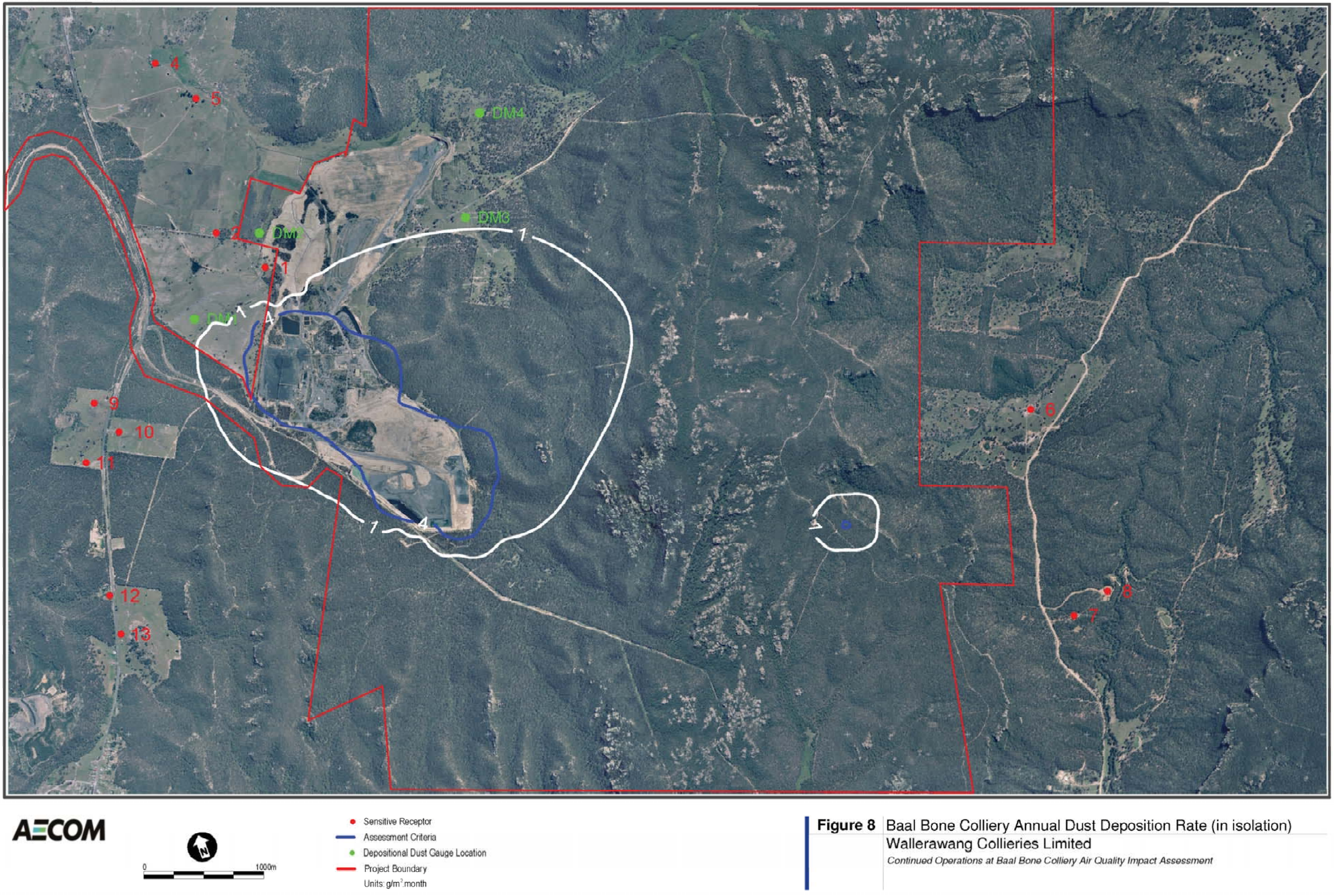


Figure 8 Baal Bone Colliery Annual Dust Deposition Rate (in isolation)
Wallerawang Collieries Limited
Continued Operations at Baal Bone Colliery Air Quality Impact Assessment

S6068306 25/06/09 AP www.aecom.com

AECOM

Figure 9 Baal Bone Colliery Odour GLCs

Wallerawang Collieries Limited

Continued Operations at Baal Bone Colliery Air Quality Impact Assessment

"This page has been left blank intentionally"

Appendix A

Example AUSPLUME Input File

1

Baal Bone Collier Operation TSP Annual

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
Constant background concentration	0.00E+00
Terrain effects	Egan method
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Averaging time for sigma-theta values	60 min.

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Sigma-theta
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.400m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES
average over all hours

1

Baal Bone Collier Operation TSP Annual

SOURCE CHARACTERISTICS

INTEGRATED POLYGON AREA SOURCE: AS1

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
226016	6314020	880m	10	1m	1m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	226016	6314020	2	226003	6314218
3	226703	6314210	4	226700	6314319
5	226812	6314318	6	226849	6313720
7	226733	6313718	8	226728	6313795
9	226505	6313786	10	226152	6314011

(Constant) emission rate = 1.20E-05 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: AS2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
225122	6314777	874m	6	1m	1m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	225122	6314777	2	225139	6315279
3	225520	6315257	4	225522	6314907
5	225638	6314895	6	225638	6314741

Emission rates by hour of day in grams/second per square metre:

1	7.00E-06	2	7.00E-06	3	7.00E-06	4	7.00E-06
5	7.00E-06	6	7.00E-06	7	7.00E-06	8	3.40E-05
9	3.40E-05	10	3.40E-05	11	3.40E-05	12	3.40E-05
13	3.40E-05	14	3.40E-05	15	3.40E-05	16	3.40E-05
17	3.40E-05	18	7.00E-06	19	7.00E-06	20	7.00E-06
21	7.00E-06	22	7.00E-06	23	7.00E-06	24	7.00E-06

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: AS3

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
225730	6315070	860m	6	1m	1m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	225730	6315070	2	225722	6315137
3	225973	6315159	4	226011	6315034
5	225949	6315023	6	225943	6315086

(Constant) emission rate = 6.00E-06 grams/second per square metre
No gravitational settling or scavenging.

VOLUME SOURCE: VS1

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
225210	6314579	892m	3m	1m	2m

(Constant) emission rate = 7.00E-02 grams/second
No gravitational settling or scavenging.

VOLUME SOURCE: VS2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
225484	6314901	874m	3m	1m	2m

```
               (Constant) emission rate = 7.00E-03 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS3

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225484  6314901           874m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS4

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225462  6314752           877m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS5

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225456  6314602           881m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS6

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225538  6314490           883m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS7

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225658  6314399           884m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS8

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225805  6314350           886m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS9

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 225954  6314332           885m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS10

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 226100  6314300           877m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS11

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 226247  6314274           877m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS12

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 226362  6314170           866m               2m          70m             2m

               (Constant) emission rate = 5.00E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS13

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 229902  6313683           1037m              2m           1m             1m

               (Constant) emission rate = 3.10E-01 grams/second
                   No gravitational settling or scavenging.

                    VOLUME SOURCE: VS14

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 226051  6314996           867m               2m           1m             1m

               (Constant) emission rate = 3.10E-01 grams/second
                   No gravitational settling or scavenging.
 ______________________________________________________________________________
1                  __________________________________________

                     Baal Bone Collier Operation TSP Annual

                               RECEPTOR LOCATIONS
                   __________________________________________

 The Cartesian receptor grid has the following x-values (or eastings):
 223000.m  223250.m  223500.m  223750.m  224000.m  224250.m  224500.m
 224750.m  225000.m  225250.m  225500.m  225750.m  226000.m  226250.m
 226500.m  226750.m  227000.m  227250.m  227500.m  227750.m  228000.m
 228250.m  228500.m  228750.m  229000.m  229250.m  229500.m  229750.m
 230000.m  230250.m  230500.m  230750.m  231000.m  231250.m  231500.m
 231750.m  232000.m  232250.m  232500.m  232750.m  233000.m

 and these y-values (or northings):
6312000.m 6312250.m 6312500.m 6312750.m 6313000.m 6313250.m 6313500.m
6313750.m 6314000.m 6314250.m 6314500.m 6314750.m 6315000.m 6315250.m
6315500.m 6315750.m 6316000.m 6316250.m 6316500.m 6316750.m 6317000.m
6317250.m 6317500.m 6317750.m 6318000.m

 DISCRETE RECEPTOR LOCATIONS (in metres)

 No.      X        Y     ELEVN  HEIGHT       No.      X        Y     ELEVN  HEIGHT
```

1	231519 6314698	705.0	0.0		7	224724 6316170	862.0	0.0
2	231881 6312983	700.0	0.0		8	223706 6314751	920.0	0.0
3	232160 6313187	680.0	0.0		9	223914 6314511	895.0	0.0
4	224216 6317583	844.0	0.0		10	223639 6314255	915.0	0.0
5	224556 6317290	844.0	0.0		11	223836 6313150	931.0	0.0
6	225132 6315882	861.0	0.0		12	223929 6312830	912.0	0.0

METEOROLOGICAL DATA : AUSPLUME METFILE

AVERAGE OVER ALL HOURS AND FOR ALL SOURCES
in microgram/m3

Y (km) \ X (km):	223.000	223.250	223.500	223.750	224.000	224.250
6318.000	2.34E+00	2.46E+00	2.52E+00	2.58E+00	2.72E+00	3.03E+00
6317.750	2.44E+00	2.61E+00	2.72E+00	2.78E+00	2.91E+00	3.18E+00
6317.500	2.61E+00	2.74E+00	2.93E+00	3.03E+00	3.14E+00	3.38E+00
6317.250	2.87E+00	2.94E+00	3.12E+00	3.32E+00	3.43E+00	3.64E+00
6317.000	3.05E+00	3.24E+00	3.36E+00	3.59E+00	3.81E+00	3.98E+00
6316.750	3.12E+00	3.46E+00	3.73E+00	3.92E+00	4.21E+00	4.47E+00
6316.500	3.21E+00	3.58E+00	4.01E+00	4.37E+00	4.68E+00	5.06E+00
6316.250	3.32E+00	3.70E+00	4.17E+00	4.75E+00	5.29E+00	5.78E+00
6316.000	3.49E+00	3.87E+00	4.36E+00	5.00E+00	5.81E+00	6.67E+00
6315.750	3.67E+00	4.07E+00	4.57E+00	5.27E+00	6.24E+00	7.50E+00
6315.500	3.92E+00	4.36E+00	4.93E+00	5.66E+00	6.66E+00	8.16E+00
6315.250	3.91E+00	4.48E+00	5.13E+00	5.94E+00	7.06E+00	8.74E+00
6315.000	3.69E+00	4.17E+00	4.83E+00	5.74E+00	6.98E+00	8.71E+00
6314.750	3.61E+00	4.05E+00	4.61E+00	5.35E+00	6.38E+00	7.88E+00
6314.500	3.26E+00	3.67E+00	4.18E+00	4.83E+00	5.67E+00	6.96E+00
6314.250	2.80E+00	3.11E+00	3.50E+00	4.00E+00	4.78E+00	6.22E+00
6314.000	2.42E+00	2.65E+00	2.94E+00	3.47E+00	4.42E+00	5.62E+00
6313.750	2.08E+00	2.29E+00	2.70E+00	3.43E+00	4.28E+00	5.15E+00
6313.500	1.88E+00	2.24E+00	2.83E+00	3.48E+00	4.08E+00	4.35E+00
6313.250	1.93E+00	2.45E+00	2.99E+00	3.42E+00	3.57E+00	3.63E+00
6313.000	2.18E+00	2.63E+00	2.97E+00	3.06E+00	3.06E+00	3.20E+00
6312.750	2.38E+00	2.64E+00	2.70E+00	2.67E+00	2.76E+00	3.03E+00
6312.500	2.39E+00	2.42E+00	2.39E+00	2.45E+00	2.67E+00	3.06E+00
6312.250	2.21E+00	2.18E+00	2.22E+00	2.41E+00	2.74E+00	3.00E+00
6312.000	2.01E+00	2.05E+00	2.21E+00	2.49E+00	2.71E+00	2.74E+00

Y (km) \ X (km):	224.500	224.750	225.000	225.250	225.500	225.750
6318.000	3.40E+00	3.67E+00	4.03E+00	4.35E+00	4.60E+00	4.99E+00
6317.750	3.61E+00	3.95E+00	4.34E+00	4.74E+00	5.09E+00	5.54E+00
6317.500	3.83E+00	4.28E+00	4.70E+00	5.21E+00	5.66E+00	6.20E+00
6317.250	4.09E+00	4.67E+00	5.16E+00	5.76E+00	6.37E+00	7.02E+00
6317.000	4.42E+00	5.12E+00	5.73E+00	6.43E+00	7.26E+00	8.08E+00
6316.750	4.83E+00	5.65E+00	6.48E+00	7.31E+00	8.41E+00	9.52E+00
6316.500	5.45E+00	6.27E+00	7.50E+00	8.52E+00	9.96E+00	1.15E+01
6316.250	6.30E+00	7.14E+00	8.77E+00	1.03E+01	1.22E+01	1.45E+01
6316.000	7.49E+00	8.45E+00	1.05E+01	1.32E+01	1.61E+01	1.94E+01
6315.750	9.00E+00	1.06E+01	1.34E+01	1.85E+01	2.37E+01	2.96E+01
6315.500	1.05E+01	1.39E+01	1.94E+01	3.17E+01	4.78E+01	5.56E+01
6315.250	1.16E+01	1.73E+01	3.21E+01	2.37E+02	2.59E+02	9.77E+01
6315.000	1.15E+01	1.74E+01	3.72E+01	2.68E+02	4.02E+02	1.42E+02
6314.750	1.03E+01	1.55E+01	2.82E+01	7.57E+01	3.59E+02	1.27E+02
6314.500	9.41E+00	1.35E+01	2.03E+01	3.49E+01	1.56E+02	1.90E+02
6314.250	8.19E+00	1.08E+01	1.39E+01	1.75E+01	2.62E+01	6.74E+01
6314.000	7.00E+00	8.18E+00	9.30E+00	1.02E+01	1.23E+01	1.88E+01
6313.750	5.67E+00	6.13E+00	6.50E+00	6.74E+00	7.49E+00	1.10E+01
6313.500	4.54E+00	4.85E+00	5.10E+00	5.26E+00	6.13E+00	7.13E+00
6313.250	3.85E+00	4.18E+00	4.48E+00	4.76E+00	4.83E+00	5.22E+00
6313.000	3.51E+00	3.93E+00	4.16E+00	4.02E+00	3.83E+00	3.30E+00
6312.750	3.46E+00	3.73E+00	3.62E+00	3.22E+00	2.53E+00	1.90E+00
6312.500	3.34E+00	3.32E+00	2.90E+00	2.17E+00	1.54E+00	1.28E+00
6312.250	3.02E+00	2.68E+00	1.99E+00	1.40E+00	1.11E+00	1.00E+00
6312.000	2.46E+00	1.89E+00	1.34E+00	1.05E+00	9.18E-01	8.15E-01

Y (km) \ X (km):	226.000	226.250	226.500	226.750	227.000	227.250
6318.000	5.25E+00	5.57E+00	5.99E+00	6.28E+00	6.50E+00	6.66E+00
6317.750	5.84E+00	6.24E+00	6.71E+00	6.99E+00	7.26E+00	7.49E+00
6317.500	6.58E+00	7.08E+00	7.57E+00	7.86E+00	8.23E+00	8.60E+00
6317.250	7.52E+00	8.13E+00	8.62E+00	9.00E+00	9.52E+00	1.02E+01
6317.000	8.75E+00	9.47E+00	1.00E+01	1.06E+01	1.14E+01	1.24E+01
6316.750	1.04E+01	1.12E+01	1.20E+01	1.30E+01	1.42E+01	1.53E+01
6316.500	1.27E+01	1.37E+01	1.50E+01	1.66E+01	1.81E+01	1.88E+01
6316.250	1.61E+01	1.79E+01	2.02E+01	2.17E+01	2.27E+01	2.26E+01
6316.000	2.22E+01	2.54E+01	2.75E+01	2.82E+01	2.77E+01	2.61E+01
6315.750	3.45E+01	3.67E+01	3.67E+01	3.50E+01	3.22E+01	2.88E+01
6315.500	5.40E+01	5.20E+01	4.67E+01	4.08E+01	3.52E+01	3.15E+01
6315.250	8.98E+01	7.05E+01	5.49E+01	4.35E+01	3.90E+01	3.60E+01
6315.000	1.33E+02	7.62E+01	5.76E+01	5.14E+01	4.74E+01	4.28E+01
6314.750	8.72E+01	7.97E+01	7.38E+01	6.80E+01	6.04E+01	5.18E+01
6314.500	1.56E+02	1.41E+02	1.20E+02	1.01E+02	8.42E+01	5.89E+01
6314.250	1.51E+02	3.12E+02	2.73E+02	3.17E+02	1.04E+02	5.10E+01
6314.000	4.02E+01	1.93E+02	3.00E+02	3.09E+02	8.07E+01	3.45E+01
6313.750	1.48E+01	2.02E+01	3.23E+01	1.12E+02	3.18E+01	2.00E+01
6313.500	8.73E+00	9.03E+00	9.41E+00	1.01E+01	1.22E+01	1.09E+01
6313.250	5.06E+00	4.49E+00	4.45E+00	5.37E+00	7.01E+00	7.31E+00
6313.000	2.75E+00	2.62E+00	2.80E+00	3.40E+00	4.50E+00	5.17E+00
6312.750	1.72E+00	1.79E+00	1.91E+00	2.38E+00	3.12E+00	3.74E+00
6312.500	1.26E+00	1.27E+00	1.35E+00	1.79E+00	2.30E+00	2.80E+00
6312.250	9.34E-01	9.20E-01	9.94E-01	1.37E+00	1.80E+00	2.17E+00
6312.000	7.01E-01	6.79E-01	7.67E-01	1.06E+00	1.45E+00	1.75E+00

Y (km) \ X (km):	227.500	227.750	228.000	228.250	228.500	228.750
6318.000	6.87E+00	7.17E+00	7.58E+00	8.02E+00	8.45E+00	8.85E+00
6317.750	7.81E+00	8.27E+00	8.81E+00	9.30E+00	9.73E+00	1.01E+01
6317.500	9.11E+00	9.74E+00	1.04E+01	1.08E+01	1.11E+01	1.13E+01
6317.250	1.09E+01	1.16E+01	1.22E+01	1.24E+01	1.25E+01	1.25E+01
6317.000	1.32E+01	1.38E+01	1.41E+01	1.41E+01	1.39E+01	1.37E+01
6316.750	1.60E+01	1.62E+01	1.60E+01	1.56E+01	1.53E+01	1.49E+01
6316.500	1.90E+01	1.85E+01	1.78E+01	1.72E+01	1.67E+01	1.61E+01
6316.250	2.18E+01	2.06E+01	1.96E+01	1.87E+01	1.79E+01	1.71E+01
6316.000	2.42E+01	2.25E+01	2.13E+01	2.02E+01	1.91E+01	1.76E+01
6315.750	2.64E+01	2.46E+01	2.32E+01	2.17E+01	1.99E+01	1.77E+01
6315.500	2.91E+01	2.72E+01	2.54E+01	2.29E+01	1.99E+01	1.68E+01
6315.250	3.32E+01	3.04E+01	2.69E+01	2.26E+01	1.85E+01	1.51E+01
6315.000	3.82E+01	3.27E+01	2.63E+01	2.05E+01	1.61E+01	1.29E+01
6314.750	4.21E+01	3.15E+01	2.30E+01	1.72E+01	1.35E+01	1.10E+01
6314.500	3.85E+01	2.58E+01	1.84E+01	1.41E+01	1.14E+01	9.66E+00
6314.250	2.93E+01	1.96E+01	1.48E+01	1.19E+01	9.99E+00	8.65E+00
6314.000	2.15E+01	1.59E+01	1.27E+01	1.06E+01	9.09E+00	7.99E+00
6313.750	1.52E+01	1.23E+01	1.04E+01	9.05E+00	8.04E+00	7.29E+00
6313.500	9.70E+00	8.69E+00	7.85E+00	7.09E+00	6.49E+00	6.00E+00
6313.250	6.75E+00	6.18E+00	5.81E+00	5.51E+00	5.18E+00	4.86E+00
6313.000	5.23E+00	4.92E+00	4.54E+00	4.27E+00	4.14E+00	4.04E+00
6312.750	4.01E+00	4.06E+00	3.88E+00	3.61E+00	3.43E+00	3.54E+00
6312.500	3.10E+00	3.26E+00	3.31E+00	3.26E+00	3.24E+00	3.00E+00
6312.250	2.44E+00	2.63E+00	2.80E+00	3.00E+00	2.87E+00	2.59E+00
6312.000	2.00E+00	2.20E+00	2.44E+00	2.47E+00	2.41E+00	2.36E+00

X (km): 229.000 229.250 229.500 229.750 230.000 230.250

Y (km)						
6318.000	9.14E+00	9.32E+00	9.40E+00	9.42E+00	9.40E+00	9.35E+00
6317.750	1.02E+01	1.03E+01	1.03E+01	1.02E+01	1.01E+01	9.96E+00
6317.500	1.13E+01	1.12E+01	1.11E+01	1.10E+01	1.08E+01	1.04E+01
6317.250	1.23E+01	1.22E+01	1.20E+01	1.17E+01	1.13E+01	1.07E+01
6317.000	1.35E+01	1.32E+01	1.28E+01	1.22E+01	1.14E+01	1.06E+01
6316.750	1.46E+01	1.40E+01	1.33E+01	1.23E+01	1.13E+01	1.02E+01
6316.500	1.55E+01	1.45E+01	1.33E+01	1.21E+01	1.08E+01	9.74E+00
6316.250	1.59E+01	1.45E+01	1.30E+01	1.15E+01	1.03E+01	9.18E+00
6316.000	1.59E+01	1.41E+01	1.23E+01	1.09E+01	9.59E+00	8.53E+00
6315.750	1.53E+01	1.33E+01	1.15E+01	9.98E+00	8.75E+00	7.74E+00
6315.500	1.42E+01	1.20E+01	1.03E+01	8.90E+00	7.78E+00	6.90E+00
6315.250	1.25E+01	1.05E+01	8.96E+00	7.79E+00	6.92E+00	6.24E+00
6315.000	1.06E+01	8.97E+00	7.88E+00	7.02E+00	6.41E+00	5.89E+00
6314.750	9.26E+00	8.02E+00	7.22E+00	6.64E+00	6.26E+00	5.94E+00
6314.500	8.46E+00	7.51E+00	6.84E+00	6.61E+00	6.50E+00	6.31E+00
6314.250	7.71E+00	7.15E+00	6.70E+00	6.97E+00	7.45E+00	7.35E+00
6314.000	7.28E+00	6.80E+00	7.00E+00	7.84E+00	1.21E+01	1.62E+01
6313.750	6.76E+00	6.57E+00	7.42E+00	1.47E+01	1.14E+02	1.13E+01
6313.500	5.62E+00	5.35E+00	5.35E+00	7.35E+00	7.39E+00	6.27E+00
6313.250	4.59E+00	4.53E+00	4.93E+00	4.27E+00	3.80E+00	4.15E+00
6313.000	4.13E+00	4.11E+00	3.57E+00	3.34E+00	3.08E+00	3.25E+00
6312.750	3.46E+00	3.16E+00	3.13E+00	2.90E+00	2.74E+00	2.74E+00
6312.500	2.73E+00	2.66E+00	2.61E+00	2.49E+00	2.44E+00	2.45E+00
6312.250	2.40E+00	2.34E+00	2.26E+00	2.14E+00	2.09E+00	2.10E+00
6312.000	2.26E+00	2.11E+00	2.00E+00	1.92E+00	1.87E+00	1.83E+00

X (km):	230.500	230.750	231.000	231.250	231.500	231.750
Y (km)						
6318.000	9.23E+00	8.97E+00	8.61E+00	8.20E+00	7.73E+00	7.22E+00
6317.750	9.67E+00	9.24E+00	8.72E+00	8.17E+00	7.60E+00	7.05E+00
6317.500	9.92E+00	9.29E+00	8.63E+00	7.99E+00	7.38E+00	6.81E+00
6317.250	9.92E+00	9.12E+00	8.39E+00	7.72E+00	7.08E+00	6.51E+00
6317.000	9.68E+00	8.80E+00	8.04E+00	7.35E+00	6.72E+00	6.16E+00
6316.750	9.26E+00	8.37E+00	7.63E+00	6.94E+00	6.33E+00	5.78E+00
6316.500	8.75E+00	7.91E+00	7.17E+00	6.49E+00	5.89E+00	5.38E+00
6316.250	8.20E+00	7.39E+00	6.65E+00	6.00E+00	5.46E+00	4.99E+00
6316.000	7.57E+00	6.81E+00	6.10E+00	5.52E+00	5.04E+00	4.65E+00
6315.750	6.87E+00	6.17E+00	5.55E+00	5.06E+00	4.69E+00	4.41E+00
6315.500	6.20E+00	5.59E+00	5.11E+00	4.75E+00	4.51E+00	4.35E+00
6315.250	5.74E+00	5.23E+00	4.88E+00	4.67E+00	4.57E+00	4.35E+00
6315.000	5.49E+00	5.12E+00	4.93E+00	4.92E+00	4.66E+00	4.23E+00
6314.750	5.51E+00	5.35E+00	5.50E+00	5.15E+00	4.56E+00	4.07E+00
6314.500	6.03E+00	6.51E+00	5.91E+00	5.02E+00	4.32E+00	3.78E+00
6314.250	8.66E+00	7.13E+00	5.55E+00	4.50E+00	3.86E+00	3.46E+00
6314.000	9.32E+00	5.84E+00	4.64E+00	4.03E+00	3.61E+00	3.30E+00
6313.750	6.48E+00	5.01E+00	4.28E+00	3.81E+00	3.48E+00	3.21E+00
6313.500	5.18E+00	4.50E+00	4.04E+00	3.68E+00	3.39E+00	3.15E+00
6313.250	3.88E+00	3.64E+00	3.45E+00	3.23E+00	3.06E+00	2.92E+00
6313.000	3.18E+00	3.04E+00	2.88E+00	2.77E+00	2.69E+00	2.58E+00
6312.750	2.67E+00	2.62E+00	2.51E+00	2.39E+00	2.31E+00	2.24E+00
6312.500	2.42E+00	2.32E+00	2.26E+00	2.16E+00	2.06E+00	1.99E+00
6312.250	2.13E+00	2.12E+00	2.06E+00	2.01E+00	1.92E+00	1.84E+00
6312.000	1.84E+00	1.85E+00	1.84E+00	1.83E+00	1.81E+00	1.74E+00

X (km):	232.000	232.250	232.500	232.750	233.000
Y (km)					
6318.000	6.74E+00	6.30E+00	5.89E+00	5.52E+00	5.17E+00
6317.750	6.55E+00	6.10E+00	5.69E+00	5.31E+00	4.96E+00
6317.500	6.31E+00	5.85E+00	5.43E+00	5.06E+00	4.71E+00
6317.250	6.01E+00	5.55E+00	5.14E+00	4.77E+00	4.43E+00
6317.000	5.67E+00	5.22E+00	4.82E+00	4.47E+00	4.18E+00
6316.750	5.30E+00	4.88E+00	4.51E+00	4.22E+00	3.95E+00
6316.500	4.93E+00	4.56E+00	4.26E+00	4.00E+00	3.76E+00
6316.250	4.61E+00	4.31E+00	4.06E+00	3.83E+00	3.58E+00
6316.000	4.36E+00	4.13E+00	3.90E+00	3.65E+00	3.40E+00
6315.750	4.21E+00	3.99E+00	3.73E+00	3.47E+00	3.23E+00
6315.500	4.14E+00	3.84E+00	3.55E+00	3.30E+00	3.08E+00
6315.250	4.00E+00	3.68E+00	3.39E+00	3.15E+00	2.93E+00
6315.000	3.85E+00	3.52E+00	3.23E+00	2.98E+00	2.77E+00
6314.750	3.66E+00	3.31E+00	3.04E+00	2.81E+00	2.62E+00
6314.500	3.38E+00	3.08E+00	2.85E+00	2.67E+00	2.51E+00
6314.250	3.18E+00	2.94E+00	2.74E+00	2.57E+00	2.42E+00
6314.000	3.06E+00	2.86E+00	2.68E+00	2.53E+00	2.39E+00
6313.750	2.99E+00	2.81E+00	2.65E+00	2.50E+00	2.37E+00
6313.500	2.95E+00	2.78E+00	2.63E+00	2.49E+00	2.37E+00
6313.250	2.78E+00	2.66E+00	2.54E+00	2.43E+00	2.33E+00
6313.000	2.48E+00	2.39E+00	2.32E+00	2.24E+00	2.17E+00
6312.750	2.19E+00	2.13E+00	2.07E+00	2.01E+00	1.96E+00
6312.500	1.93E+00	1.88E+00	1.84E+00	1.79E+00	1.75E+00
6312.250	1.76E+00	1.71E+00	1.65E+00	1.61E+00	1.58E+00
6312.000	1.68E+00	1.61E+00	1.55E+00	1.50E+00	1.45E+00

Concentrations at the discrete receptors (No. : Value):

1:4.48E+00 2:2.50E+00 3:2.64E+00 4:3.26E+00 5:4.18E+00 6:1.35E+01 7:7.38E+00 8:5.20E+00
9:5.39E+00 10:3.77E+00 11:3.33E+00 12:2.80E+00

Appendix B

Emissions Inventory Calculations

"This page has been left blank intentionally"

Baal Bone Colliery Emissions Inventory

The following dust emitting activites are assumed:

1. Coal Stockpile Activities (ex. wind erosion)
2. Loading Coal to Train
3. Loading coarse rejects to Trucks
4. Coarse rejects Emplacement Activities (ex. wind erosion)
5. Wind Erosion
6. Truck Haulage

1. ROM AND COAL STOCKPILE

Loading ROM Stockpile

Annual ROM Coal Produced	2200000	tpa	
Days active per year =	240		
Hours active per day =	24		
	9166.67	t/day	
	381.94	t/hour	
EF =	0.004	kg/t	TSP
	0.0017	kg/t	PM10
ER =	1.53	kg/hr	TSP
	0.65	kg/hr	PM10
	0.42	g/s	TSP
	0.18	g/s	PM10
Reduction for water sprays	50	%	
	0.21	g/s	TSP
	0.09	g/s	PM10

Loading product coal stockpile

Annual ROM Coal Produced	2200000	tpa	
Days active per year =	240		
Hours active per day =	24		
Mass of coal loaded =	1650000	tpa	
	6875.00	t/day	
	286.46	t/hour	
EF =	0.004	kg/t	TSP
	0.0017	kg/t	PM10
ER =	1.15	kg/hr	TSP
	0.49	kg/hr	PM10
	0.32	g/s	TSP
	0.14	g/s	PM10
Reduction for water sprays	50	%	
	0.16	g/s	TSP
	0.07	g/s	PM10

Coal Stockpile Management - Bulldozers (x2)

Hours active per month =	200	hrs per month	
	9	hrs per day	
Hours active per year =	2400		
EF =	20.0	kg/hr	TSP
	5.8	kg/hr	PM10
ER =	5.55	g/s	TSP
	1.60	g/s	PM10

2. LOADING COAL TO TRAIN

Area =	50		
Days active per year =	261		
Hours active per day =	3.3		
Mass of coal loaded =	1650000	t/yr	
	6328.77	t/day	
	1925.18	t/hour	
EF =	0.0004	kg/t	TSP
	0.00017	kg/t	PM10
ER =	0.77	kg/hr	TSP
	0.33	kg/hr	PM10
	0.21	g/s	TSP
	0.09	g/s	PM10
Reduction for enclosure	70	%	
	0.06	g/s	TSP
	0.03	g/s	PM10

3. LOADING COARSE REJECTS TO TRUCKS

Area =	25		
Days active per year =	240		
Hours active per day =	24		
Mass of reject loaded =	550000	t/yr	
	2291.67	t/day	
	95.49	t/hour	
EF =	0.00032	kg/t	TSP
	0.00015	kg/t	PM10
ER =	0.03	kg/hr	TSP
	0.014	kg/hr	PM10
	0.008	g/s	TSP
	0.004	g/s	PM10

4. COARSE REJECTS EMPLACEMENT
Trucks dumping coarse rejects

Days active per year =	240		
Hours active per day =	18		
Mass of reject loaded =	550000	t/yr	
	2291.67	t/day	
	127.31	t/hour	
EF =	0.01	kg/t	TSP
	0.0042	kg/t	PM10
ER =	1.27	kg/hr	TSP
	0.53	kg/hr	PM10
	0.35	g/s	TSP
	0.15	g/s	PM10

Bull Dozer on coarse rejects (emplacement management)

Hours active per day =	5		
Days active per year =	24		
Hours active per year =	120		
EF =	20.0	kg/hr	TSP
	5.8	kg/hr	PM10

ER =	5.55	g/s	TSP
	1.60	g/s	PM10

5. WIND EROSION

Area of Coal stockpile			
Area =	206500	m2	
	20.65	ha	
EF =	0.4	kg/ha/hr	TSP
	0.2	kg/ha/hr	PM10
ER =	8.26	kg/hr	TSP
	4.13	kg/hr	PM10
	2.29	g/s	TSP
	1.15	g/s	PM10
Assume water sprays (% reduction)	50	% reduction	
	1.15	g/s	TSP
	0.57	g/s	PM10

Area of infrastructure area			
Area =	18000	m2	
	1.80	ha	
EF =	0.4	kg/ha/hr	TSP
	0.2	kg/ha/hr	PM10
ER =	0.72	kg/hr	TSP
	0.36	kg/hr	PM10
	0.20	g/s	TSP
	0.10	g/s	PM10
Assume water sprays (% reduction)	50	% reduction	
	0.10	g/s	TSP
	0.05	g/s	PM10

Area of coarse reject emplacement			
Area =	292350	m2	
	29.24	ha	
EF =	0.4	kg/ha/hr	TSP
	0.2	kg/ha/hr	PM10
ER =	11.69	kg/hr	TSP
	5.85	kg/hr	PM10
	3.25	g/s	TSP
	1.62	g/s	PM10
Assume No water sprays (% reduction)	0	% reduction	
	3.25	g/s	TSP
	1.62	g/s	PM10

Haul Road to emplacement area	6000	m2	
	0.60	ha	
EF =	0.4	kg/ha/hr	TSP
	0.2	kg/ha/hr	PM10
ER =	0.24	kg/hr	TSP
	0.12	kg/hr	PM10
No. of Volume Sources =	10.00		
	0.01	g/s	TSP
	0.00	g/s	PM10
Assume water sprays < 2 L/m2/hr (% reduction)	50	% reduction	
	0.003	g/s	TSP
	0.002	g/s	PM10

6. TRUCK HAULAGE TO EMPLACEMENT

Area =	7500		
Hours active per day =	18		
Trucks per hour =	3	trucks per hour	
EF =	3.88	kg/VKT	TSP
	0.96	kg/VKT	PM10
Haul Distance =	3.00	km/truck	Round Trip
ER =	11.64	kg/truck/hour	TSP
	34.92	kg/hr	TSP
	2.88	kg/truck/hour	PM10
	8.64	kg/hr	PM10
No. of Volume Sources =	10.00		
	0.97	g/s	TSP
	0.24	g/s	PM10
Watering haul roads < 2 L/m2/hr (% reduction)	50.00	%	
	0.49	g/s	TSP
	0.12	g/s	PM10

Summary

Operation	*Hrs of Operation*	*Source Area m2*	*TSP g/s*	*PM10 g/s*	Contribution %
1. Coal and ROM Stockpile Activities (ex. wind erosion)	24 hrs/day	206500	0.37	0.16	2
	8 am - 1 pm	206500	5.55	1.60	32
2. Loading Coal to Train	8 am - 1 pm	NA	0.06	0.03	0
3. Loading Coarse Reject to Trucks	24 hrs/day	NA	0.008	0.004	0
4. Waste Rock Emplacement Activities (ex. wind erosion)	24 hrs/day	NA	0.35	0.15	2
	8 am - 1 pm	NA	5.91	1.75	34
5. Wind Erosion on Coal & ROM Stockpile	24 hrs/day	206500	1.15	0.57	7
5. Wind Erosion on Infrastructure Area	24 hrs/day	18000	0.10	0.05	1
5. Wind Erosion on Emplacement Haul Road	24 hrs/day	6000	0.0033	0.0017	0
5. Wind Erosion on Coal Reject Emplacement	24 hrs/day	292350	3.25	1.62	19
6. Truck Haulage	24 hrs/day	NA	0.49	0.12	3
Total =			17.24	6.06	

Final Emission Rates

Source	Source	ER	TSP Variable Rates		PM10 Variable Rates		Source ID
	Type	Units	5pm - 8am	8am-5pm(coal) 8am-1pm(reject)	5pm - 8am	8am-5pm(coal) 8am-1pm(reject)	
Coal and ROM Stockpile Activities	Area	g/m2.s	0.000007	0.000034	0.000004	0.000011	AS2
Coal Train Loader	Volume	g/s	0.06	0.06	0.03	0.03	VS1
Coarse Reject Haulage Truck Loader	Volume	g/s	0.008	0.008	0.004	0.004	VS2
Waste Rock Emplacement - Annual	Area	g/m2.s	0.000012	0.000033	0.000006	0.000012	AS1
Infrastructure Area	Volume	g/s	0.000006	0.000006	0.000003	0.000003	AS3
Truck Haulage	Volume	g/s	0.49	0.49	0.1	0.1	VS3-12
Mine Vent Forest	Volume	g/s	0.31	0.31	0.12	0.12	VS13
Mine Vent - Adit 5	Volume	g/s	0.31	0.31	0.12	0.12	VS14

Odour Sources

Source	Source	ER	TSP Variable Rates		PM10 Variable Rates		Source ID
	Type	Units	1pm - 8am	8am-5pm(coal) 8am-1pm(reject)	1pm - 8am	8am-5pm(coal) 8am-1pm(reject)	
Mine Vent Forest	Area	g/m2.s	3590	3590	3590	3590	VS13
Mine Vent - Adit 5	Volume	g/s	3590	3590	3590	3590	VS14

Mass Fraction

Source	TSP	PM10
Coal and ROM Stockpile Activities	0.59	0.41
Coal Train Loader	0.58	0.43
Coarse Reject Haulage Truck Loader	0.53	0.47
Waste Rock Emplacement - Annual	0.60	0.40
Infrastructure Area	0.50	0.50
Truck Haulage	0.63	0.37
Mine Vent Forest	0.61	0.39
Mine Vent - Adit 5	0.61	0.39

Worldwide Locations

Australia	+61-2-8484-8999
Azerbaijan	+994 12 4975881
Belgium	+32-3-540-95-86
Bolivia	+591-3-354-8564
Brazil	+55-21-3526-8160
China	+86-20-8130-3737
England	+44 1928-726006
France	+33(0)1 48 42 59 53
Germany	+49-631-341-13-62
Ireland	+353 1631 9356
Italy	+39-02-3180 77 1
Japan	+813-3541 5926
Malaysia	+603-7725-0380
Netherlands	+31 10 2120 744
Philippines	+632 910 6226
Scotland	+44 (0) 1224-624624
Singapore	+65 6295 5752
Thailand	+662 642 6161
Turkey	+90-312-428-3667
United States	+1 978-589-3200
Venezuela	+58-212-762-63 39

Australian Locations

Adelaide
Brisbane
Canberra
Darwin
Melbourne
Newcastle
Perth
Sydney
Singleton

www.aecom.com

APPENDIX K

Greenhouse Gas Assessment

Commercial in Confidence

The Wallerawang Collieries Limited
17 December 2009
Document No

Greenhouse Gas Assessment

Continued Operations at Baal Bone Colliery

Greenhouse Gas Assessment

Continued Operations at Baal Bone Colliery

Prepared for

The Wallerawang Collieries Limited

Prepared by

AECOM Australia Pty Ltd
PO Box 73 HRMC NSW 2310 Australia
T +61 2 4911 4900 F +61 2 4911 4999 www.aecom.com
ABN 20 093 846 925

17 December 2009

S6068306

Quality Information

Document	Greenhouse Gas Assessment
Ref	S6068306 \\auntl1fp001\public\jobncl\syd\s6\s60600-699\s6068306 baal bone aqia\ghg assessment\delivery\s6068306_fnlrpt_ghg_17dec09.docx
Date	17 December 2009
Prepared by	Adam Plant Author Signature
Reviewed by	David Rollings Technical Peer Reviewer Signature

Distribution

Copies	Recipient	Copies	Recipient
1	**Tony King** The Wallerawang Collieries Limited PO Box 13 Lithgow NSW 2790	1	**AECOM** File Copy

"This page has been left blank intentionally"

Contents

List of Tables

Figures

"This page has been left blank intentionally"

1.0 Introduction

AECOM Australia Pty Ltd (hereafter referred to as AECOM) was commissioned by The Wallerawang Collieries Limited (TWCL) to prepare a Greenhouse Gas (GHG) Assessment for the continued operations at the Baal Bone Colliery. The purpose of the assessment was to estimate the annual GHG emissions associated with the operation of the Colliery. Scope 1, 2 and 3 GHG emissions (as defined in **Section 2.0**) have been estimated for the Baal Bone Colliery using the *National Greenhouse Accounts Factors* (NGA) (DCC, 2008) and the *Xstrata Coal Estimation of Scope 3 Emissions – SEE Version December 2008* excel spreadsheet originally developed by Energetics for Xstrata.

Scope 1 and 2 GHG emissions have been estimated following the NGA Factors (DCC, 2008). The GHG assessment has followed the Xstrata Coal Estimation of Scope 3 Emissions excel spreadsheet for scope 3 emissions. The Xstrata Coal Estimation of Scope 3 Emissions excel spreadsheet is a first order assessment of scope 3 emissions associated with the extraction, transport and use of coal product.

1.1 Site Location

The Baal Bone Colliery is located near the village of Cullen Bullen off the Castlereagh Highway. The site is approximately 25km north west of the City of Lithgow. The surface activities of the mine are established on a plateau with an elevation of approximately 860m, skirted in an arc clockwise from north to south by steep forest with elevations over 1,000m. The Baal Bone Colliery in a regional context is provided in **Figure 1**.

"This page has been left blank intentionally"

2.0 Greenhouse Gas Emissions

A number of conventions on the determination, assessment and the reporting of greenhouse gas emissions from human activity have been developed. These are discussed in the *National Greenhouse Accounts* (NGA) *Factors* (DCC, 2008). The DCC Workbook adopts the reporting approach outlined in the document *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks (*DCC, 2006). This methodology divides emissions into three broad categories or "Scopes" referred to as Scopes 1, 2 and 3.

Scope 1 covers direct emissions from sources within the boundary of an organisation including fuel combustion, manufacturing processes and onsite waste disposal.

Scope 2 covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate the electricity, steam or heat and do not include emissions associated with the production of fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.

Scope 3 includes all other indirect emissions that are a consequence of an organisations activities but are not from sources owned or controlled by the organisation.

The estimation and reporting of greenhouse gas emissions are calculated via a number of different methods. The procedures specified in the *NGA Factors* (DCC, 2008) have been used to estimate the scope 1 and 2 GHG emissions. The NGA workbook is consistent with internationally applied methods. The Xstrata Scope 3 Assessment excel – SEE Version December 2008 has been used to estimate the scope 3 GHG emissions.

The NGA Factors methodology identifies the primary greenhouse gases as follows:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Synthetic Gases (hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)).

Inventories of greenhouse gas emissions can be calculated using published emission factors. These are detailed in the NGA Factors. Different gases have different greenhouse warming effects (potentials) and emission factors take into account the global warming potentials of the reaction products or chemicals.

The global warming potentials (GWP) detailed in the NGA Factors (DCC, 2008) are as follows:

- CO_2 – 1
- CH_4 – 21
- N_2O – 310

When the GWP are applied to the estimated emissions then the resulting estimate is referred to as "CO_2-equivalent emissions" (CO_2-e).

"This page has been left blank intentionally"

3.0 Description of Sites GHG Emissions

The potential GHG emissions as a result of operations at the Baal Bone Colliery can be defined in three categories (as described in **Section 2.0**):

Scope 1 – Direct process GHG emissions

Fugitive emissions from underground mines involving the release of methane and carbon dioxide can occur during the mining process due to the fracturing of coal seems, overburden and underburden strata. Due to the non-gaseous underground nature of the mining operation the Baal Bone Colliery is assessed as a 'non-gassy mine' in the assessment.

The combustion of fuel by diesel powered equipment and vehicles are a potential source of GHG emissions. This would include bulldozers, on-site haul trucks, and other vehicles under the control of TWCL.

Scope 2 – Energy related (indirect) GHG emissions

The consumption of purchased electricity during the normal operations of the Colliery is a potential source of GHG emissions.

Scope 3 – Associated External GHG Emissions

Emission sources which arise from the Baal Bone Colliery operation but are not directly emitted by the Colliery include:

- Transport of products from the site; and
- Emissions due to the end use of the coal product itself.

"This page has been left blank intentionally"

4.0 Emission Calculation

TWCL has provided information associated with the operation of the Baal Bone Colliery during the calendar year 2008 including production rate, diesel use, electricity use, consumable rates, transport information and product end use. The 2008 data has been used to linearly scale up usage rates to allow the estimation of the above parameters for future production rates of the Colliery. This information has been used to estimate scope 1, 2 and 3 GHG emissions for the continued operations of the Baal Bone Colliery.

An annual Run of Mine (ROM) coal production value of 2.2 million tonnes of coal per year (mtpa) has been used in calculating GHG emissions, as provided by TWCL. As provided by Xstrata, a yield value of 75% has been applied to the ROM production resulting in an annual product value of 1.65 mtpa. This production value is a best estimate of the annual average coal production based on the remaining life of the mine, with actual development consent approved for 2.8 mtpa.

4.1 Scope 1: Direct Process GHG Emissions

The total tonnes of CO_2-e for direct process GHG emissions are provided in **Table 1**. Details of each GHG emission source are further defined in the subsequent sections. The Scope 1 GHG emissions have been estimated using the *NGA Factors* (DCC, 2008).

Table 1: Direct Process GHG Emissions Summary

GHG Emission Source	GHG Emission (tonnes CO_2-e/annum)
Fugitive Emissions	17,600
Diesel Use	3,910
Total CO_2-e	**21,510**

Fugitive Emissions

Fugitive emissions from underground mines involve the release of methane and carbon dioxide during the mining process due to the fracturing of coal seems, overburden and underburden strata.

Due to the non-gaseous undergr ound nature of the mining operation, the Baal Bone Colliery is assessed as a ‘non-gassy mine’ under the NGA Factors method. The emission factors for non-gassy underground mines are substantially lower than those for gassy mines. The total ROM coal extracted is estimated to be 2,200,000 t/annum with an emission factor of 0.008 tonnes CO_2-e/tonne of coal. This results in GHG emissions of **17,600 t CO_2-e/annum** [2,200,000 tonnes of coal x 0.008].

Diesel use

Diesel equipment would include bulldozers, forklifts, and other vehicles under the control of TWCL. The total annual diesel usage is estimated to be 1,449 kL. This results in GHG emissions of **3,910 t CO_2-e/annum** [(1,449 kL x 38.6 GJ/kL x (69.2 + 0.2 + 0.5#))/1000] for the full fuel cycle in producing the diesel.

#The three factors represent emissions for CO_2, N_2O and CH_4 respectively.

4.2 Scope 2: Energy Related (Indirect) GHG Emissions

The total tonnes of CO_2-e for energy related (indirect) GHG emissions are provided in **Table 2**. Details of each GHG emission source are further defined in the subsequent sections. The Scope 2 GHG emissions have been estimated using the *NGA Factors* (DCC, 2008).

Table 2: Energy Related (Indirect) GHG Emissions Summary

GHG Emission Source	GHG Emission (tonnes CO_2-e/annum)
Electrical Energy Consumption	46,489
Total CO_2-e	**46,489**

Electricity

The estimated annual electricity consumption of the Ball Bone Colliery for continued operations is 52,234,921kWh. The electricity generation emission factor for New South Wales of 0.89 kg CO_2-e/ kWh is applied, resulting in total equivalent CO_2 emissions due to electricity consumption of **46,489 t CO_2-e/annum** (52,234,921kWh x (0.89 / 1000)). This includes the emission for the full fuel cycle in generating the electricity.

4.3 Scope 3: Associated External GHG Emissions

Emission sources which arise from the Baal Bone Colliery operation but are not directly emitted by the Colliery are determined in this section. Sources include consumable material transportation, transport of products from the site, and emissions due to the use of the coal product itself.

The total tonnes of CO_2-e for associated external GHG emissions are provided in **Table 3**. Details of each GHG emission source are further defined in the subsequent sections. The Scope 3 GHG emissions have been estimated using the Xstrata Scope 3 Assessment excel spreadsheet – SEE Version December 2008, supplied to AECOM by Xstrata.

Table 3: Associated External GHG Emissions Summary

GHG Emission Source	GHG Emission (tonnes CO_2-e/annum)
Product Transportation	157,425
Product End Use	4,150,300
Total CO_2-e	**4,307,725**

Product Transportation

Coal product is exported to overseas customers by train and ship and delivered domestically to customers by trucks. The Xstrata Scope 3 Assessment provides the following emission factors for transportation in kg CO_2-e per tonne km; road transport 0.138, rail transport 0.0054, and ship transport 0.0126. The Xstrata Scope 3 Assessment excel spreadsheet calculates the GHG emissions from transport using these emission factors and transport distance. **Table 4** details the equivalent CO_2 emissions due to product transportation.

Table 4: Product Transportation GHG Emissions Summary

GHG Emission Source	GHG Emission (tonnes CO_2-e/annum)
Road Transportation	102
Rail Transportation	1,865
Ship Transportation	155,457
Total CO_2-e	**157,424**

The road transport value in **Table 4** has been calculated using a best estimate of the annual operations of the colliery. However, the Baal Bone Colliery is licensed to domestically transport 900,000 tonnes of coal per annum by road. If this license value was used to calculate the tonnes of CO_2-e per annum, the resulting road transport GHG emission would be **18, 630 t CO_2-e/annum.**

Product End Use

Coal product in NSW is generally used for either electricity production (thermal coal) or steel production (coking coal). The coal product exported overseas and delivered domestically to customers from the Baal Bone Colliery is thermal coal for electricity generation.

The total coal product is estimated to be 1,650,000 t/annum for the continued operations of the Baal Bone Colliery. It is assumed that 100% of the coal extracted will be used for electricity generation. The carbon in coal content is assumed to be 70%. The emission factor for electricity generation as provided by the Xstrata Coal Scope 3 excel (December 2008) is 2.52 tonnes CO_2-e per tonne of coal (rounded to 2 decimal places). The resulting equivalent CO_2 emissions due to product end use is provided in **Table 5**.

Table 5: Product End Use GHG Emissions Summary

GHG Emission Source	GHG Emission (tonnes CO_2-e/annum)
Product End Use	4,150,300
Total CO_2-e	**4,150,300**

4.4 Total GHG emission

The total annual GHG emission from the continued operations of the Baal Bone Colliery for scope 1, 2 and 3 emission sources is provided in **Table 6**.

Table 6: Total GHG Emissions Summary

GHG Emission Source	GHG Emission (tonnes CO_2-e/annum)
Scope 1 GHG emission	21,510
Scope 2 GHG emission	46,489
Scope 3 GHG emission	**4,307,725**
Total CO_2-e	**4,375,724**

As reported in the Department of Climate Change publication *State and Territory Greenhouse Gas Inventories 2007* (Commonwealth, 2009), Australia's GHG emissions for the year 2007 are estimated to be 597.2 Mt (million tonnes) CO_2-e. New South Wales (NSW) GHG emissions were 162.7 Mt CO_2-e for 2007, a contribution of 27.3% to the total national emissions. The Baal Bone contribution to the NSW GHG emissions is approximately 2.7%, with a contribution of 0.73% towards the total national GHG emission.

4.5 Greenhouse and Energy Mitigation Management

As Baal Bone is a Xstrata operation, TWCL is committed to the Xstrata Coal Climate Change Position Statement (Xstrata Coal 2008). Xstrata is committed to playing its part in the international collaborative effort to implement solutions to the challenge of climate change.

TWCL is currently preparing an Energy Savings Action Plan (ESAP) for Baal Bone as part of its requirements under the NSW Government's ESAP legislation. The purpose of the ESAP is to review energy usage, identify energy savings opportunities and implement ongoing energy management activities.

Some of the energy savings opportunities and management activities implemented at Baal Bone include:

- Reporting, feedback and control systems;
- Review of standard operating and maintenance procedures to ensure that they address energy efficient operation of major equipment;

- Regular monitoring the energy use of all major facilities, metering and recording of electricity and diesel usage at CHPP;
- Auditing process comprising of a formal, in-house review each year to review of all aspects of energy management (targets, plans, processes etc) and compare energy savings results against original projections;
- Upgrade of Diesel engines to Tier 2 with cleaner burns and greater power output; and
- Conveyor Sequencing - Conveyor shut downs during down shift.
- Xstrata's climate change strategy for reducing GHG emissions from the extraction and use of coal in power generation is focused on policy, management of emissions, carbon markets, technology and communication. Xstrata actively supports research and development into low emission technologies and developing a portfolio of options to reduce GHG emissions. Baal Bone has a number of GHG and energy management systems in place. And is committed to the Xstrata Coal Climate Change Position Statement (Xstrata Coal, 2008a) and participates in the Energy Efficiency Opportunities (EOO) Program (Xstrata Coal, 2008b).
- Xstrata participates in the Carbon Disclosure Project which is a global initiative that aims at encouraging private and public sector organisations to measure, manage and reduce emissions and climate change impacts of their business. Baal Bone therefore publically reports on its actions to reduce its greenhouse footprint and the potential impacts of climate change.
- Baal Bone would continue to contribute to initiatives and programs such as the National Greenhouse and Energy Reporting System (NGERS), EEO Program and the proposed Carbon Pollution Reduction Scheme (CPRS).

Baal Bone would continue to seek to provide maximum resource extraction with maximum efficiency. Baal Bone would also assess and consider implementation, where feasible, of GHG and energy management and mitigation initiatives during the design, operation and decommissioning of the mine.

5.0 Conclusion

AECOM was commissioned by The Wallerawang Collieries Limited to prepare a Greenhouse Gas Assessment for the continued operations of the Baal Bone Colliery. The purpose of the assessment was to estimate the annual scope 1, 2 and 3 GHG emissions associated with the operation of the Colliery based on a coal ROM production value of 2.2 million tonnes of coal per year. The procedures specified in the *NGA Factors* (DCC, 2008) have been used to estimate the scope 1 and 2 GHG emissions. The *Xstrata Coal Estimation of Scope 3 Emissions – SEE Version December 2008* has been used to estimate the scope 3 GHG emissions.

The GHG assessment estimates that the total annual GHG emission for the continued operations of the Baal Bone Colliery, including scope 1, 2 and 3 GHG emissions, is **4,375,724 tonnes CO_2-e/annum**.

"This page has been left blank intentionally"

6.0 References

Department of Climate Change (DCC), 2006. *Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006,* Commonwealth of Australia.

Department of Climate Change (DCC), 2008, *National Greenhouse Accounts (NGA) Factors, November 2008,* Commonwealth of Australia.

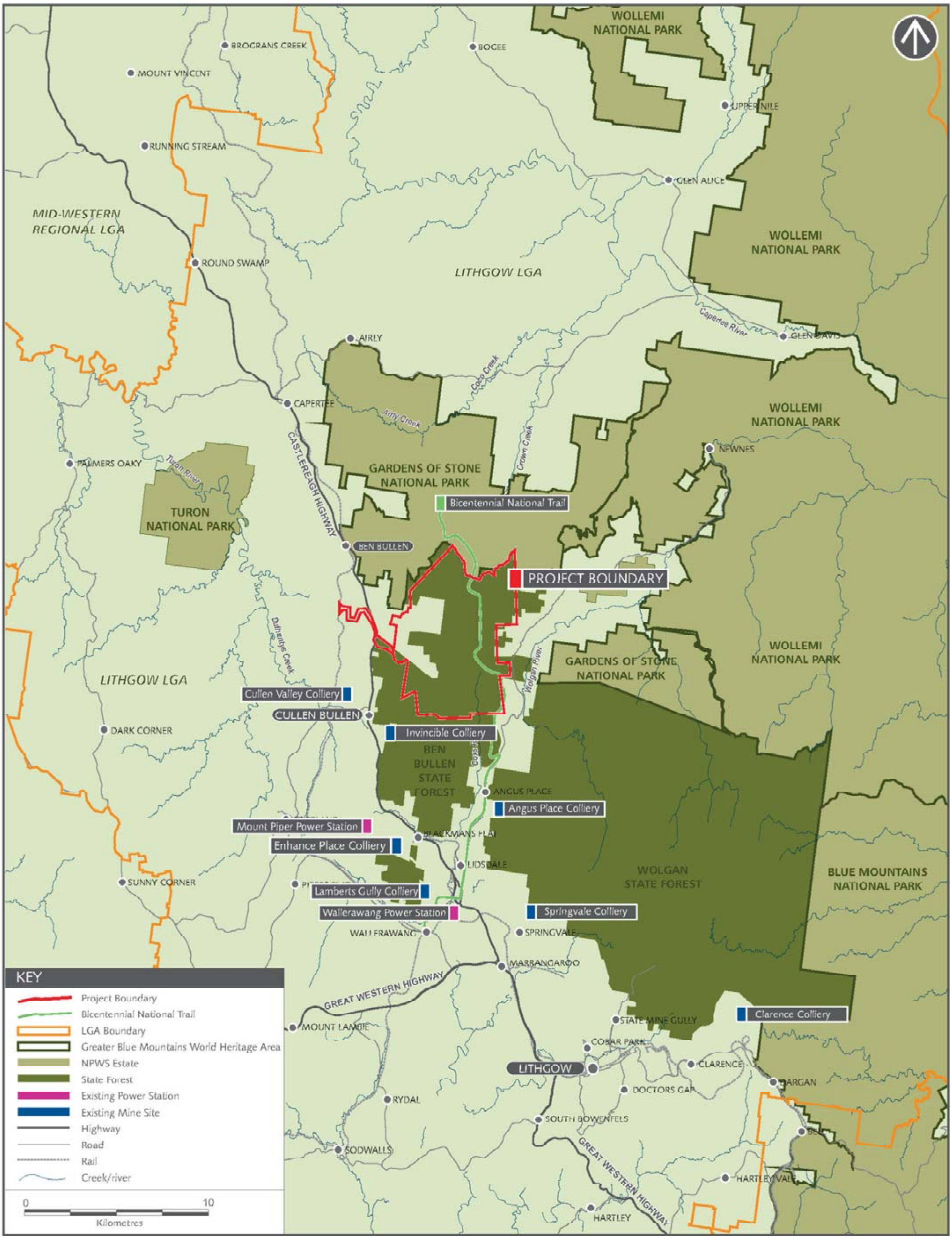
Department of Climate Change (DCC), 2009, *State and Territory Greenhouse Gas Inventories 2007,* Commonwealth of Australia.

Xstrata Coal*, 2008, Xstrata Coal Estimation of Scope 3 Emissions – SEE Version December 2008*, prepared by Energetics *Pty Ltd*

"This page has been left blank intentionally"

Figures

"This page has been left blank intentionally"



AECOM

REGIONAL CONTEXT

Continued Operations at Baal Bone Colliery - Air Quality Impact Assessment

Baal Bone Colliery, Cullen Bullen NSW

Figure 1

Worldwide Locations

Australia	+61-2-8484-8999
Azerbaijan	+994 12 4975881
Belgium	+32-3-540-95-86
Bolivia	+591-3-354-8564
Brazil	+55-21-3526-8160
China	+86-20-8130-3737
England	+44 1928-726006
France	+33(0)1 48 42 59 53
Germany	+49-631-341-13-62
Ireland	+353 1631 9356
Italy	+39-02-3180 77 1
Japan	+813-3541 5926
Malaysia	+603-7725-0380
Netherlands	+31 10 2120 744
Philippines	+632 910 6226
Scotland	+44 (0) 1224-624624
Singapore	+65 6295 5752
Thailand	+662 642 6161
Turkey	+90-312-428-3667
United States	+1 978-589-3200
Venezuela	+58-212-762-63 39

Australian Locations

Adelaide
Brisbane
Canberra
Darwin
Melbourne
Newcastle
Perth
Sydney
Singleton

www.aecom.com

APPENDIX L

Flora Assessment

BAAL BONE COLLIERY CONTINUED OPERATIONS

FLORA ASSESSMENT

June 2009

report prepared by:

Roger Lembit
Gingra Ecological Surveys
P.O. Box 1
CANTERBURY NSW 2193

1.0 INTRODUCTION

The Wallerawang Collieries Limited (TWCL) is currently seeking to gain approval for the continuation of mining activities at Baal Bone within the current lease area. Baal Bone Colliery is a longwall coal mine located near the township of Cullen Bullen, approximately 25km north west of Lithgow in the state of NSW.

Currently a variety of consents, dating back to 1982, apply to Baal Bone Colliery and allow the mine to operate. Renewal of the primary consent will be required to allow the continued mining operations as mine workings will not be completed by 1 August 2010 when Clause 35 of the Model Provisions will expire.

In accordance with the requirements of the Mining Act 1992, approval must be obtained under the EP&A Act before mining can continue in the lease areas. An Environmental Assessment is to be undertaken as part of the approval process under Part 3A of the EP&A Act and this will guided by many constraints, including the requirements of the Director-General of the Department of Planning, and Xstrata Coal NSW HSEC STD1.16.

Project Approval under Part 3A of the EP&A Act is being sought for the following project components at Baal Bone:

- Continuation of underground mining in Longwalls 28 to 31, which are the subject of a current approved SMP;
- Continued operation of associated surface infrastructure and a prepared saleable coal production of 2.0 Mtpa (equating to 2.8 Mtpa ROM coal);
- Continued road and rail haulage of prepared saleable coal to domestic markets in accordance with current approvals; and
- Mining of other isolated remnant unmined areas within the existing lease areas.

This flora assessment has been prepared as part of the environmental impact assessment of the proposed mining operations (the Project).

The aim of this report is to identify flora species and vegetation patterns across the area likely to be affected by the proposed mining operations, to assess the conservation significance of these plant species and communities, assess impacts of the Project upon these species and habitats with particular reference to those species listed on the NSW Threatened Species Conservation Act 1995 (TSC Act) and Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and recommend appropriate mitigation measures.

2.0 METHODS

2.1 Literature Review

The Baal Bone Colliery has been the subject of ecological assessments since the preparation of the original Baal Bone Colliery Environmental Impact Statement in 1981.

In recent years the following flora surveys and assessments have been conducted:

- Baseline survey for Longwall panels 26-28, 2005
- Assessment of exploratory borehole sites for Longwalls 29 to 31, 2005
- Subsidence Management Plan (SMP) flora assessment for Longwalls 29-31, March 2007
- Inspection of flora for end of panel report for Longwall 25, July 2007
- Flora assessment for ventilation shaft and transmission line, December 2007
- Inspection of flora for end of panel report for Longwall 26, June 2008
- Inspection of flora for end of panel report for Longwall 27, March 2009
- Flora surveys for continued operations of Baal Bone Colliery, December 2008 to May 2009
- Flora monitoring for Longwalls 29-31 conducted from January 2007 to May 2009

2.2 Field Surveys

The study area for the purposes of this report includes the surface above Longwalls 28 to 31, including areas within angle of draw for these Longwalls, surface areas (including angle of draw) above remnant unmined areas and surface infrastructure areas (see Figure 2).

Flora field survey techniques undertaken at Baal Bone Colliery have generally been consistent with the draft Threatened Biodiversity Survey and assessment guidelines (DEC 2004) and Threatened Species assessment guidelines (DECC 2007).

All of the surveys over recent years and listed in section 2.1 have been used to characterise the vegetation patterns and flora species of the continued operations study area.

Table 1 details the field survey search effort for each of these surveys and the timing of field work.

The timing of the surveys over several years and a range of seasons has allowed for detection of plants such as spring flowering annuals, lilies and orchids. Seasonal conditions from spring 2008 and autumn 2009, in particular, have been favourable for detection of cryptic species which flower in response to rainfall.

Field surveys of the study area have involved a range of techniques aimed at identifying:

- the patterns of vegetation across the study area, including the influence of past natural and man-made disturbance;
- the presence of threatened flora species or other species of conservation significance;
- the condition of the vegetation; and
- the presence of invasive exotic and non-local plant species.

Table 1. Field Survey Search Effort

SURVEY	TIMING	SEARCH EFFORT
Baseline survey for panels 26-28	October 2005	8 hours
Survey of borehole sites LW29-31	October 2005	8 hours
End of panel LW 25	February 2007	4 hours
Survey of emergency pipeline route	April 2007	4 hours
Flora survey of ventilation shaft and transmission line	November 2007	6 hours
End of panel LW 26	May 2008	4 hours
End of panel LW 27	November 2008	4 hours
Flora Survey for Continued Operations	December 2008 March 2009 May 2009	30 hours
Flora Monitoring for LW29-31 SMP	January 2007 April 2007 October 2007 May 2008 October 2008 May 2009	48 hours

3.0 ENVIRONMENTAL SETTING

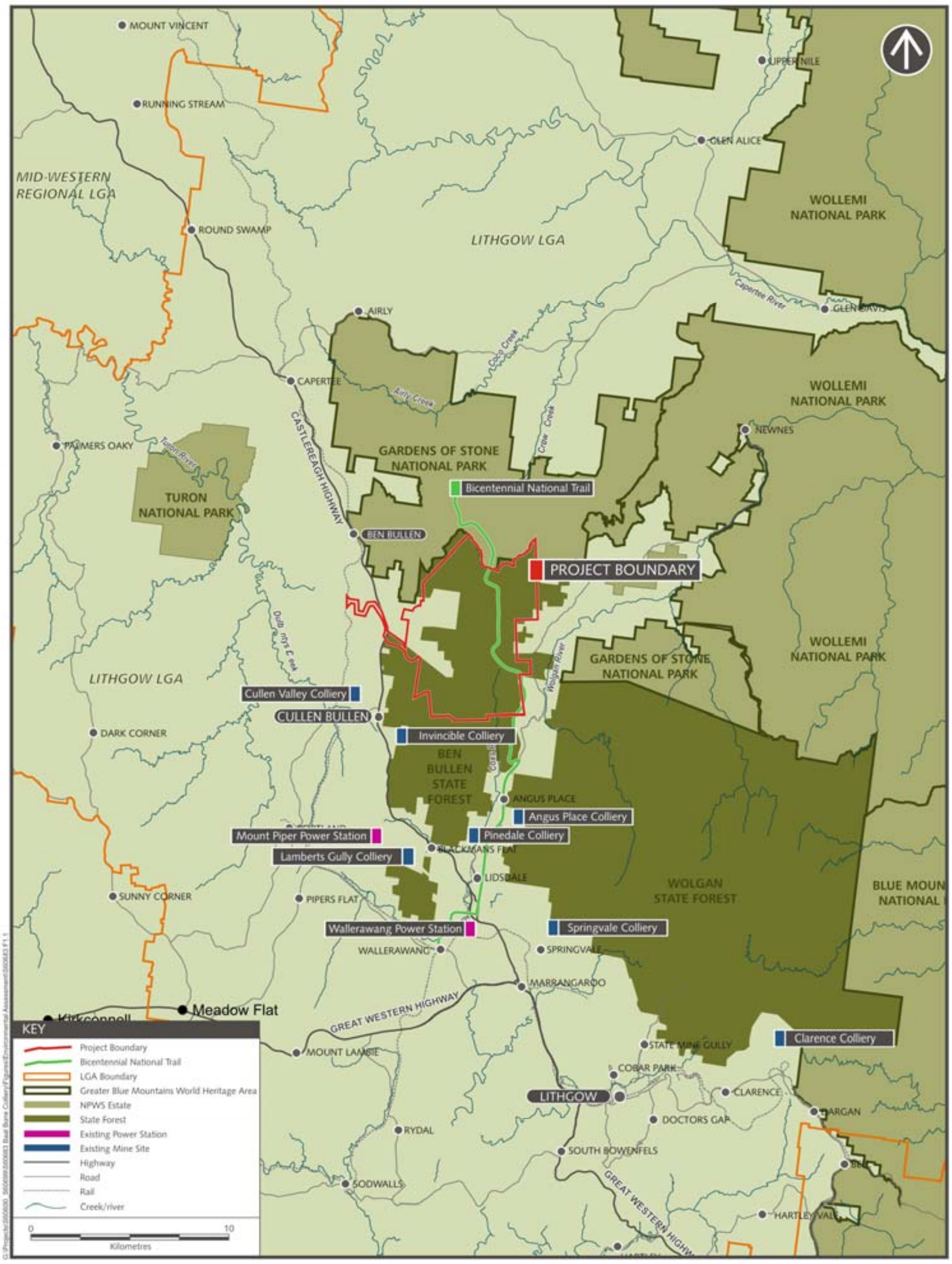
3.1 Location and Topography

The study area is located to the north-west of Wolgan Gap and includes parts of Ben Bullen State Forest. It lies approximately 25 km north-west of Lithgow in the Central Tablelands of New South Wales. Longwalls 29 to 31 extend south from the Great Dividing Range into the upper catchment of the Coxs River and Long Swamp. This is in the Hawkesbury-Nepean catchment.

The mine pit top and coal handling and preparation plant (CHPP) are in the catchment of Ben Bullen Creek, in the Central West catchment.

There is an altitudinal range from 850m a.s.l. in the vicinity of the Colliery pit top to about 1050m a.s.l. on points along the Great Dividing Range.

The area lies along the boundary of the Sydney Basin and South Eastern Highlands Bioregions (Thackway and Cresswell 1995).

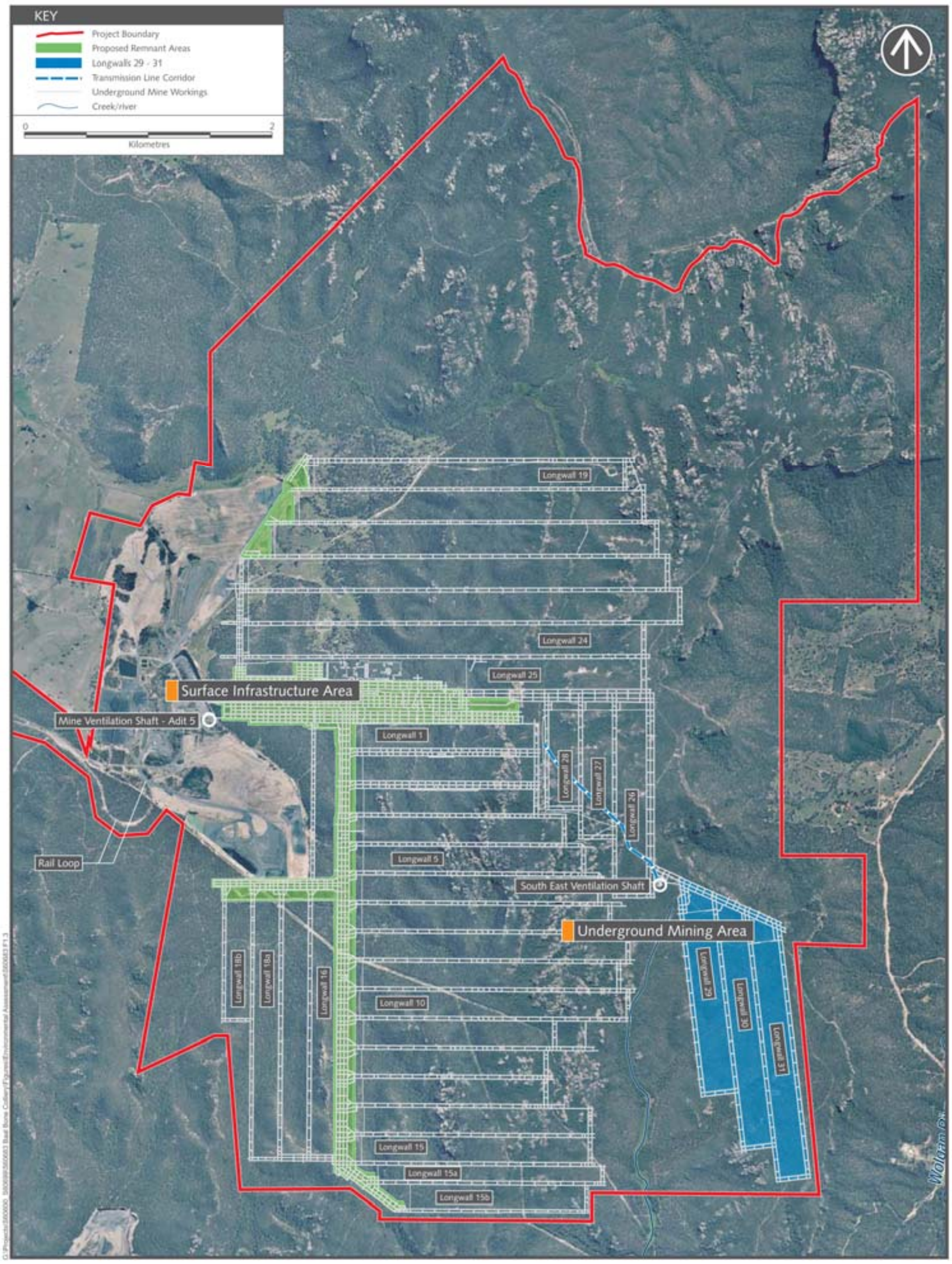


AECOM

BAAL BONE COLLIERY REGIONAL SITE CONTEXT

Baal Bone Colliery, Cullen Bullen NSW

Figure 1



AECOM

LOCATION OF EXISTING SURFACE INFRASTRUCTURE FACILITIES AND UNDERGROUND MINE WORKINGS
Baal Bone Colliery, Cullen Bullen NSW

Figure 2

3.2 Geology

The ridges and hills in the study area are underlain by Triassic sediments of the Narrabeen Group. Lower slopes and valleys along the upper Coxs River, Jews Creek and Ben Bullen Creek are underlain by the Illawarra Coal Measures of Permian age. Long Swamp occurs on Quaternary alluvial deposits.

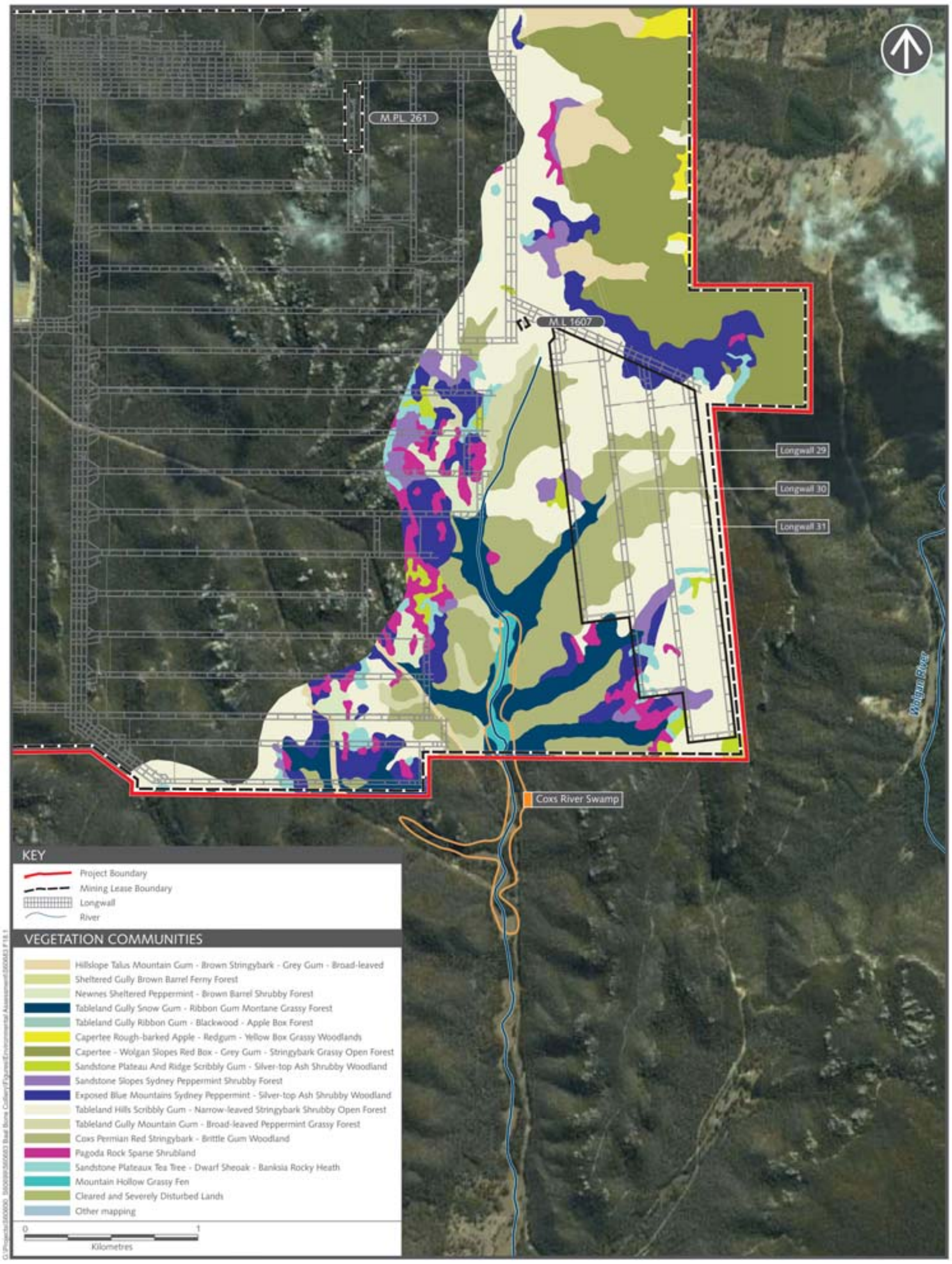
4.0 VEGETATION OF THE BAAL BONE COLLIERY

As discussed previously the vegetation of the Baal Bone Colliery area has been the subject of study associated with development of the mine for almost thirty years.

In addition the vegetation of the Wallerawang 1:100 000 map sheet, was mapped by the Royal Botanic Gardens, Sydney (Benson & Keith 1990) and the vegetation of the Wolgan and Capertee catchments outside of the conservation reserve system was mapped by the Department of Environment, Climate Change and Water (DECCW) (DEC 2005). The DECCW report incorporates finer scale mapping than that within Benson and Keith (1990) and is used as a basis for understanding vegetation patterns within the study area for this report.

In addition, in 1999 the author was contracted to conduct a field survey of five threatened species of the Western Blue Mountains, including Capertee Stringybark (*Eucalyptus cannonii*) and the Clandulla Geebung (*Persoonia marginata*). Field work for that project was undertaken within the section of Ben Bullen State Forest south of the rail access line. Beyond this area, in 1996 the author conducted a flora survey for the Cullen Valley mine, including Tyldesley Hill and parts of Ben Bullen State Forest.

Characterisation of vegetation map units for vegetation types for this report uses vegetation map units described in DEC (2005) wherever patterns within the study area are consistent with the DEC map units. Figure 3 shows the distribution of these map units across the part of the study area covered by the DEC (2005) mapping.



AECOM

VEGETATION COMMUNITIES - LONGWALLS 29 TO 31
Baal Bone Colliery, Cullen Bullen NSW

Data Source:
Department of Environment and Conservation (2006)

Figure 3

4.1 Vegetation Patterns in the Study Area

Nine vegetation types are identified for the study area, based on the field survey and relating the results of that survey to descriptions of vegetation map units (VWBM) reported by DEC (2005). These vegetation types are described below.

Sandstone Plateau and Ridge Scribbly Gum – Silvertop Ash Scrubby Forest

VWBM unit no 28

This forest type occurs on shallow soils and rocky sites on ridges to the east of the upper Coxs River. The dominant tree species are Silvertop Ash (*E. sieberi*) and Hard-leaved Scribbly Gum (*E. sclerophylla*). Associated tree species include Blaxland's Stringybark (*E. balxlandii*) and Narrow-leaved Peppermint (*E. radiata*).

The shrub layer is of medium to high cover and the ground layer of medium cover.

Common shrub species include Sunshine Wattle (*Acacia terminalis*), Conesticks (*Petrophile pulchella*), Drumsticks (*Isopogon anemonifolius*), *Hakea dactyloides*, *Boronia microphylla* and Paperbark Tea-tree (*Leptospermum trinervium*).

Common ground layer species include *Lomandra glauca*, Curly Sedge (*Caustis flexuosa*), *Patersonia glabrata*, *Platysace linearifolia* and *Stylidium lineare*.

Sandstone Slopes Sydney Peppermint Shrubby Forest

VWBM unit no 29

This vegetation type occurs on slopes below VWBM map units 32 & 30 in the Baal Bone Creek valley and upper Coxs River catchment. It is associated with deeper soils and sheltered aspects along the side of the Great Dividing Range, within Ben Bullen State Forest, north from Wolgan Gap.

The canopy layer is dominated by Sydney Peppermint (*E. piperita*), with Blaxland's Stringybark (*E. blaxlandii*) being a common associate. Narrow-leaved Peppermint (*E. radiata*), Grey Gum (*E. punctata*), Brittle Gum (*E. mannifera*) and Blue Mountain Mallee (*E. stricta*) may also be present.

There is a shrub layer of medium to high cover and a ground layer of low cover.

Common shrub species include Mountain Holly (*Podolobium ilicifolium*), Yellow Tea-tree (*Leptospermum polygalifolium*), Narrow-leaved Geebung (*Persoonia linearis*), *Monotoca scoparia*, Lance-leaf Beard-heath (*Leucopogon lanceolatus*) and *Acacia obtusifolia*.

Common ground layer plants include Snow Grass (*Poa sieberiana* ssp. *sieberiana*), Bracken fern (*Pteridium esculentum*), *Pomax umbellata*, *Lomandra filiformis* ssp. *coriacea*, *Dianella revoluta*, *Gonocarpus tetragynus* and Redanther Wallaby Grass (*Joycea pallida*).

This vegetation type is widespread in the study area and within Blue Mountains and Wollemi National Parks.

<u>Exposed Blue Mountains Sydney Peppermint – Silvertop Ash Shrubby Woodland</u>

VWBM unit no 30

This vegetation type occurs on exposed ridges on shallow Triassic geology along the top of the escarpment above the Wolgan Valley, along the Great Dividing Range. The dominant tree species are Silvertop Ash (*E. sieberi*) and Sydney Peppermint (*E. piperita*). Associated tree species include Inland Scribbly Gum (*E. rossii*), Brittle Gum (*E. mannifera*) and Narrow-leaved Stringybark (*E. sparsifolia*).

The shrub layer is of medium cover and the ground layer of low to medium cover.

Common shrub species include *Leucopogon muticus, Calytrix tetragona, Acacia obtusifolia*, *Platysace lanceolata*, *Leptospermum sphaerocarpum*, *Dillwynia elegans*, *Dillwynia phylcioides,* Sunshine Wattle (*Acacia terminalis*), Paperbark Tea-tree (*Leptospermum trinervium*), *Monotoca scoparia* and *Leptospermum parvifolium*.

Common ground layer species include *Lomandra confertifolia* var. *rubiginosa*, *Dianella revoluta*, Curly Sedge (*Caustis flexuosa*), *Dampiera stricta* and *Lomandra glauca*.

<u>Tableland Hills Scribbly Gum – Narrow-leaved Stringybark Shrubby Open-Forest</u>

VWBM unit no 32

This vegetation type occurs across the study area on hills and exposed ridges with relatively shallow soils; along the Great Dividing Range and side ridges, generally above 1000m altitude. It occurs on somewhat deeper soils and more sheltered aspects than Exposed Blue Mountains Sydney Peppermint – Silvertop Ash Shrubby Woodland (described above). Dominant tree species are Inland Scribbly Gum (*E. rossii*), Narrow-leaved Stringybark (*E. sparsifolia*) and Grey Gum (*E. punctata*). Associated tree species include Sydney Peppermint (*E. piperita*), Blaxland's Stringybark (*E. blaxlandii*), Brittle Gum (*E. mannifera*) and Silvertop Ash (*E. sieberi*).

The shrub layer is of low to medium cover and the ground layer is of low cover.

Common shrub species include Sunshine Wattle (*Acacia terminalis*), Prickly Moses (*Acacia ulicifolia*), *Acacia buxifolia*, *Monotoca scoparia*, Mountain Holly (*Podolobium ilicifolium*), *Dillwynia phylicoides* and *Brachyloma daphnoides*.

Common ground layer plants include Weeping Meadow Grass (*Microlaena stipoides*), Wiry Panic (*Entolasia stricta*), *Gonocarpus tetragynus*, *Hibbertia obtusifolia*, Redanther Wallaby Grass (*Joycea pallida*) and *Dianella revoluta*.

Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest

VWBM unit no 35

Broad flats and lower slopes associated with Permian sediments along Baal Bone Creek, upper Ben Bullen Creek and upper Cox River support woodland dominated by Mountain Gum (*E. dalrympleana*) and Broad-leaved Peppermint (*E. dives*). Associated tree species include Sydney Peppermint (*E. piperita*), Capertee Stringybark (*E. canonnii*) and Red Stringybark (*E. macrorhyncha*). Small trees include Blackwood (*Acacia melanoxylon*) and Native Cherry (*Exocarpos cupressiformis*).

The is a tall shrub or small tree layer with a height range of 4 to 10m dominated by Mountain Hickory (*Acacia falciformis*). The small shrub layer is of low cover and the ground layer of medium cover.

Shrub species include Elderberry Panax (*Polyscias sambucifolius* ssp. B), *Banksia cunninghamii* and *Acacia buxifolia*.

Ground layer species include Bracken Fern (*Pteridium esculentum*), Weeping Meadow Grass (*Microlaena stipoides*), Prickly Starwort (*Stellaria pungens*), *Hydrocotyle laxiflora* and Snow Grass (*Poa sieberiana* ssp. *sieberiana*).

This vegetation is widespread in the study area and appears to be more widespread in the upper Coxs River catchment than the DEC (2005) mapping indicates. DEC have mapped areas of this vegetation type as VWBM map unit 11 Tablelands Gully Snow Gum – Ribbon Gum Montane Grassy Forest.

Coxs River Permian Red Stringybark – Brittle Gum Woodland

VWBM map unit 37

This vegetation type is associated with shallow soils on exposed slopes in the Baal Bone Creek and Cox River valleys and elsewhere across the study area. The dominant tree species include Red Stringybark (*E. macrorhyncha*), Brittle Gum (*E. mannifera*), Broad-leaved Peppermint (*E. dives*) and Western Scribbly Gum (*E. rossii*).

The community occupies the topographic position between VWBM map units 30 and 35.

The shrub layer is of low to medium cover and the ground layer is of low to medium cover.

Common shrub species include *Monotoca scoparia*, *Pultenaea microphylla*, *Gompholobium huegelii* and Purple Twining Pea (*Hardenbergia violacea*).

Common ground layer species include Snow Grass (*Poa sieberiana* ssp. *Sieberiana*), Red-anther Wallaby Grass (*Joycea pallida*), *Gonocarpus tetragynus* and *Helichrysum scorpioides*.

Pagoda Rock Sparse Shrubland

VWBM map unit 43

This vegetation type occurs on exposed rocky areas on the western fringe of the Great Dividing Range and east of the upper Coxs River, normally occupying relatively small areas. More extensive patches occur near Gardiners Gap. The vegetation formation is open-scrub dominated by Scrub She-oak (*Allocasuarina distyla*) and *Leptospermum parvifolium*.

The shrub cover is of medium cover and the ground layer is of very low to low cover.

Common shrub species also include *Calytrix tetragona*, *Leptospermum arachnoides, Acacia obtusifolia*, *Leucopogon muticus, Isopogon anethifolius, Platysace lanceolata* and *Leucopogon microphyllus*.

Common ground layer species are *Lomandra glauca*, *Lepidosperma laterale*, *Lomandra confertifolia* var. *rubiginosa* and *Stylidium lineare*.

This vegetation type has a restricted distribution in the study area.

Sandstone Plateaux Tea Tree – Dwarf Sheoak – Banksia Rocky Heath

VWBM map unit 44

This vegetation occurs on shallow soils associated with rock outcrops along ridges off the Great Dividing Range and the Wolgan Valley escarpment. The dominant shrub species are Heath-leaved Banksia (*Banksia ericifolia*), *Leptospermum arachnoides* and Dwarf She-oak (*Allocasuarina nana*).

Shrub cover is in the low to medium range with extensive areas of bare rock. The ground layer is of low cover.

Associated shrub species include *Baeckea brevifolia*, *Hakea dactyloides*, Conesticks (*Petrophile pulchella*), Woolly Tea-tree (*Leptospermum grandifolium*) and Paperbark Tea-tree (*Leptospermum trinervium*).

Common ground layer plants include *Stylidium lineare*, *Platysace linearifolia*, *Lepidosperma laterale*, *Dampiera stricta*, *Lomandra glauca* and *Lomandra confertifolia* var. *rubiginosa*.

This vegetation has a restricted distribution in the study area due to its particular habitat requirements.

Mountain Hollow Grassy Fen

VWBM map unit 53

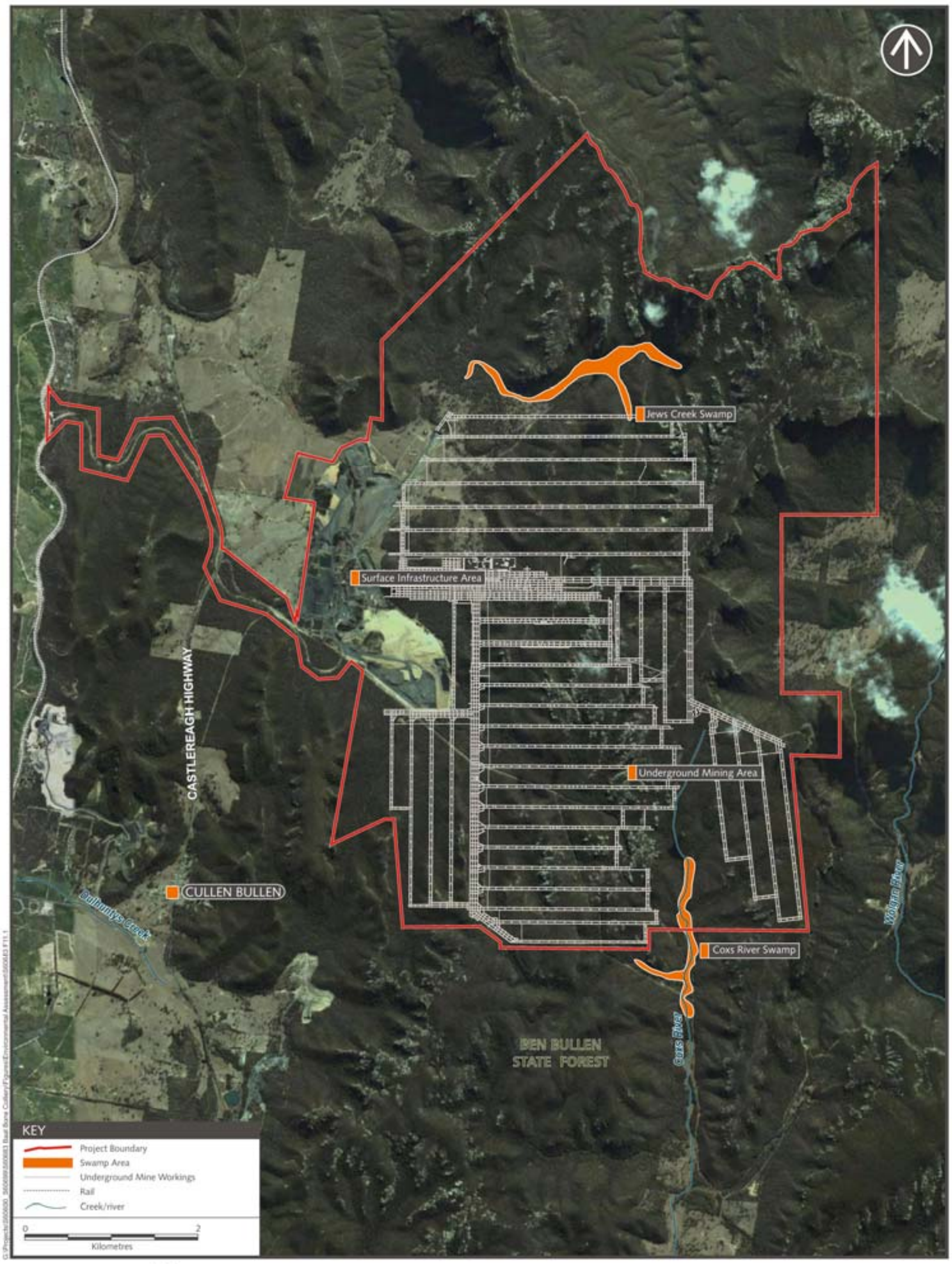
Swamp vegetation is present along Baal Bone Creek and lower arms of its tributaries and at Long Swamp along the upper Coxs River. The vegetation is typically closed sedgeland with patches of closed scrub and emergent trees.

Trees present include Mountain Gum (*E. dalrympleana*) and Blackwood (*Acacia melanoxylon*).

Shrub patches include the tea-trees, *Leptospermum continentale*, *Leptospermum obovatum* and *Leptospermum grandifolium*.

The ground layer is dominated by *Carex gaudichaudiana* and Tussocky Poa (*Poa labillardieri*). Associated ground layer species include *Stellaria angustifolia*, *Epilobium gunnianum*, *Juncus sarophorus*, *Geranium homeanum* and Brooklime (*Gratiola latifolia*).

This vegetation type has a restricted distribution. It corresponds to the listed as Montane Peatlands and Swamps Endangered Ecological Community (EEC) under the NSW TSC Act. It does not correspond to the EPBC listed Temperate Highland Peat Swamps on Sandstone endangered ecological community. An assessment of significance in relation to this EEC has been completed in section 5.1.1. of this report.



AECOM

Note:
Coxs River Swamp extends further south than shown on this figure. The area shown is applicable to this project

SWAMP LOCATIONS

Baal Bone Colliery, Cullen Bullen NSW

Figure 4

4.2 Flora Species Diversity

The recent field surveys of the Baal Bone Colliery have detected 243 flora species within the study area including 227 native species and 16 exotic species (Appendix 1). This is a high level of species richness reflecting the variety of habitat types present.

4.3 Conservation Status of Vegetation Map Units

Table 2 provides information on the conservation status of vegetation map units which occur across the study area.

Table 2. Conservation Status of Vegetation Map Units at Baal Bone Colliery

VEGETATION MAP UNIT	CONSERVATION STATUS	DISTRIBUTION / PRESENCE IN STUDY AREA
Sandstone Plateau and Ridge Scribbly Gum – Silvertop Ash Scrubby Forest	Adequately conserved in Blue Mountains, Kanangra-Boyd and Wollemi National Parks	Restricted distribution in study area
Sandstone Slopes Sydney Peppermint Shrubby Forest	Adequately conserved in Blue Mountains and Wollemi National Parks	Limited distribution in study area
Exposed Blue Mountains Sydney Peppermint – Silvertop Ash Shrubby Woodland	Extensive through Blue Mountains and Wollemi National Parks	Limited distribution in study area
Tableland Hills Scribbly Gum – Narrow-leaved Stringybark Shrubby Open-Forest	Limited distribution in conservation reserve system	Widespread in study area
Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest	Limited areas present in Marrangaroo National Park and Winburndale Nature Reserve	Common in study area
Coxs River Permian Red Stringybark – Brittle Gum Woodland	Not reported in DEC 2005. Apparently not conserved	Common in upper Coxs River Valley
Pagoda Rock Sparse Shrubland	Present in Wollemi and Gardens of Stone National Park, but restricted distribution	Restricted distribution in study area
Sandstone Plateaux Tea Tree – Dwarf Sheoak – Banksia Rocky Heath	Present in Wollemi, Kanangra-Boyd, Blue Mountains and Gardens of Stone National Parks, but	Restricted distribution in study area

VEGETATION MAP UNIT	CONSERVATION STATUS	DISTRIBUTION / PRESENCE IN STUDY AREA
	restricted distribution	
Mountain Hollow Grassy Fen	**Endangered ecological community** Limited areas protected in Kanangra-Boyd and Blue Mountains National Parks	Restricted distribution in study area

4.4 Flora Species of Conservation Significance

A data request from the DECC Atlas of NSW Wildlife was supplied on 13th May 2009, covering the area of the Wallerawang 1:100 000 map sheet. This data set was searched to determine those flora species occurring from within a 5km radius of the study area. In all, six such species were identified through this process. In addition, *Prostanthera hindii* is known from Cape Horn (Fairley 2004) and a Prostanthera of uncertain taxonomic status, possibly *Prostanthera howelliae* was found on exposed sandstone rocks west of the Great Dividing Range. Details about these eight species are provided in Table 3 and below.

Table 3. Threatened Flora Species of the Baal Bone area.

SPECIES	RISK STATUS	LOCATIONS
Derwentia blakelyi	V	Wolgan Gap to upper Coxs River and Newnes Plateau
Eucalyptus cannonii	V	Present at Baal Bone; on lower slopes on south east side of Baal Bone Creek, SW of pit top and rail loop in Ben Bullen State Forest and lower slopes along Ben Bullen Creek
Genoplesium superbum	E1	Wolgan River
Grevillea obtusiflora ssp. fecunda	E1	North of Baal Bone Gap
Persoonia marginata	V	Unreliable records from along Moffits Trail, rocky areas east of Jews Creek Swamp & Ben Bullen SF, 1.5km NE of pit top
Prostanthera cryptandroides	V	rocky areas east of Jews Creek Swamp; Cape Horn
Prostanthera hindii	Restricted distribution	Cape Horn and Newnes Plateau

SPECIES	RISK STATUS	LOCATIONS
Prostanthera ?howelliae	Range extension if identification confirmed	Exposed sandstone, west of Great Dividing Range

NOTES

E1 Endangered species listed in Part 1 of Schedule 1 of the Threatened Species Conservation Act.

V Vulnerable species listed in Part 1 of Schedule 2 of the Threatened Species Conservation Act.

Derwentia blakelyi

Derwentia blakelyi is a small woody herb to 50cm in height with toothed grey-green leaves and blue-violet flowers. It occurs in sheltered open-forest habitats often at the margin of wet ground. It occurs on the Newnes Plateau and has also been found in forest habitats near Wolgan Gap and on slopes in the upper Coxs River catchment, outside of the study area.

Capertee Stringybark (*E. cannonii*)

Capertee Stringybark is a tree to 25m in height which occurs in forest and woodland from Mount Piper to the Mudgee area. It is closely related to Red Stringybark (*E. macrorhyncha*) and forms hybrids with that species. In some locations hybrids make up 90% of the stand, with older, more mature trees tending to have characteristics closer to true Capertee Stringybark.

Capertee Stringybark is often present within ecotones between different vegetation communities. Over 10,000 plants are estimated to occur within the reserve system in Gardens of Stone and Turon National Parks and Winburndale Nature Reserve.

A targeted search for Capertee Stringybark was undertaken on 13th March 2009. Incidental records of this species were also made in December 2008. There are estimated to be about 20 individuals on lower slopes near Ben Bullen Creek.

Genoplesium superbum

Genoplesium superbum is a ground orchid which reaches a height of 25cm.It has many small red-green flowers in response to rains, often in early autumn (Bishop 1996).

Bishop (1996) states that the species is known from a single site at Nerriga on the southern tablelands, but the Atlas of NSW Wildlife indicates there is a recent record near the Wolgan River, approximately 5km east of the study area.

Grevillea obtusiflora ssp. *fecunda*

This species is a shrub to 1.5m in height which occurs in woodland vegetation. It has pinkish flowers in winter and spring.

This subspecies of *Grevillea obtusiflora* is known from the Capertee Valley (Harden 2002). Records from the Atlas of NSW Wildlife show the species occurs in Gardens of Stone National Park in woodland areas between 500 and 600m altitude on the ridges below Pantoneys Crown.

Clandulla Geebung (*Persoonia marginata*)

Clandulla Geebung (*Persoonia marginata*) is a spreading shrub which rarely exceeds 50cm in height. The young leaves are sparsely hairy and may be slightly scabrous. The flowers are yellow-brown with a densely hairy ovary and appear in spring.

The species profile for this species on the DECC website states "*Core of the species distribution is within Clandulla State Forest, west of Kandos. Disjunct populations occur; to the north at Dingo Creek and Mount Dangar within the Wollemi and Goulburn River National Parks; to the south within Ben Bullen State Forest, south-east of Capertee; and to the south-east at Devils Hole, north of Colo Heights within Parr State Recreation Area*." The Ben Bullen State Forest populations were not confirmed during the field survey. The Atlas of NSW Wildlife also shows two records from along the Wolgan Valley Road from 2007, less than 1.5km from the study area, but at a significantly lower altitude.

Prostanthera cryptandroides

Prostanthera cryptandroides is a low spreading shrub which can reach 2m in height. It has small lobed leaves and hairy branches. The lilac to mauve flowers are borne in spring through summer to April.

Harden (1992) records it as occurring in rocky areas in dry sclerophyll forest form Lithgow to Sandy Hollow. The Atlas of NSW Wildlife records indicate it is present east of Baal Bone Creek within the site, and at Cape Horn, 2km east of the Great Dividing Range overlooking the Wolgan Valley.

Prostanthera ?howelliae

Another Prostanthera of uncertain taxonomic status was found in the study area during the field survey. Specimens have been referred to the Royal Botanic Gardens, Sydney, but is has been preliminarily identified as *Prostanthera howelliae*. This plant has narrow-hairy leaves and is a spreading shrub to 2m in width and 1.5m in height. It occurs on exposed sandstone outcrops west of the Great Dividing Range.

Fairley and Moore (1989) state that *Prostanthera howelliae* occurs in the Sackville-Maroota area and at Orange and Bylong.

It is considered that, of the above eight species a formal assessment is only required in relation to Capertee Stringybark. Capertee Stringybark is the only threatened flora species known to occur within the study area.

5.0 ASSESSMENT OF IMPACTS

The nature of mining proposed involves an extension of existing longwall mining into the area covered by Longwalls 29 to 31 and mining of remnant areas primarily in the vicinity of Ben Bullen Creek.

The impacts of mining of Longwalls 29 to 31 has already been assessed as part of the Subsidence Management Plan (SMP) covering those panels. Longwalls 29 to 31 are adjacent to areas where mining has occurred, and over the history of mining at Baal Bone Colliery there is considerable information related to the levels of subsidence covering land of similar nature and with similar geological conditions as far as coal mining and subsidence are concerned. In assessing the likely effects of subsidence it is understood that the level of subsidence associated with extraction from longwalls 29 to 31 will be similar to that which has previously occurred at the Baal Bone Colliery.

The arrangement of longwall panels has been deliberately planned to avoid impact on the Wolgan Valley escarpment and on cliffs and rock formations in the upper Coxs River catchment. Accordingly, it is expected that impacts on vegetation types which may be more sensitive to subsidence (communities associated with pagodas, rock platforms and escarpments) will be avoided.

Experience from mining of longwalls 25 to 28 indicates that surface expression of subsidence is likely. This may take the form of surface cracks extending 5m to 20m in length, 30cm to 2m in depth and 5cm to 20cm in width. This degree of cracking typically has relatively minor impact on vegetation with sporadic death or dieback of individual plants including ground cover plants, shrubs and trees. The vast majority of plants occurring in the vicinity of surface cracks survive, with no apparent impact.

Long Swamp which lies about 600 m from the south-western corner, and downstream, of the SMP area for Longwalls 29 to 31, supports vegetation which corresponds to the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community listed under the Threatened Species Conservation Act. This community does not correspond to any community listed under the Commonwealth EPBC Act.

The proposed development will not directly impact on this endangered ecological community and there is an extremely low likelihood of a localised and temporary impact due to indirect impact associated with changes in groundwater (Connell Wagner 2006). The flora monitoring program includes two sites in Long Swamp. This program is designed to enable detection of impacts of longwall mining on vegetation within the Swamp.

Extraction of coal from remnant areas elsewhere at the mine may contribute to an additional level of subsidence, depending on the method and pattern of extraction. This may cause additional surface expression in terms of extension of cracking or minor rock falls. This may result in localised death or dieback of individual plants or groups of plants.

5.1 Threatened Species Assessment

5.1.1 NSW Threatened Species Conservation Act

The Department of Planning is yet to finalise guidelines on flora and fauna impact assessments in relation to those Proposals prepared under Part 3A of the *Environmental Planning and Assessment Act 1979*. In the absence of such guidelines, the criteria provided by Section 5A of the *Environmental Planning and Assessment Act 1979* are used to determine whether the proposed development is likely to have a significant effect on those threatened species listed on the *Threatened Species Conservation Act 1995* or on endangered ecological communities.

The only relevant flora species for consideration under these guidelines is Capertee Stringybark. An assessment has also been completed in relation to the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community.

Capertee Stringybark (*E. cannonii*)

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The scale of any impact is expected to be extremely small in relation to the local occurrence of Capertee Stringybark and its habitat. The proposed continuation of mining operations will not place the local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not relevant

(c) in the case of an endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not relevant

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

(iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

The continuation of mining operations will not involve clearing of habitat or any significant degree of habitat modification. No fragmentation or isolation of Capertee Stringybark habitat will occur. The habitat to be removed has no particular importance. Substantial areas of habitat occur south and north of the study area in Ben Bullen State Forest and the Capertee Valley.

Proposed rehabilitation areas as part of mine closure will provide suitable habitat for Capertee Stringybark.

(e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

Critical habitat for Capertee Stringybark has not been defined.

(f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

A recovery plan for Capertee Stringybark has not been completed. The DECC website (DECC 2009) lists a number of priority recovery actions in relation to recovery of this species. Those priority recovery actions include:

- *revegetation of cleared areas with locally-collected (sic) seed;*
- *survey and mapping of Capertee Stringybark populations within the study area (including ongoing monitoring); and*
- *management of grazing pressure, including feral animal control.*

In these respects the proposed action is consistent with priority recovery actions.

(g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed action will not result in the operation of any listed key threatening process to any significant degree. Post-mine rehabilitation involves replanting of historically cleared areas, and control of pest species, activities which are appropriate recovery actions.

Conclusion

The proposed action is not likely to have a significant effect on Capertee Stringybark and a Species Impact Statement is not required.

Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Not relevant.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not relevant.

(c) in the case of an endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Long Swamp which lies about 600 m from the south-western corner, and downstream, of the SMP area for Longwalls 29 to 31, supports vegetation which corresponds to the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community listed under the Threatened Species Conservation Act. This community does not correspond to any community listed under the Commonwealth EPBC Act.

The proposed development will not directly impact on this endangered ecological community and there is an extremely low likelihood of a localised and temporary impact due to indirect impact associated with changes in groundwater (Connell Wagner 2006). Any such effect would not be of a scale which would be likely to threaten the continued existence of swamp vegetation at Long Swamp.

No significant modification of swamp vegetation will occur as a result of the proposed mining operations.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

(iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

The proposed continuation of mining operations is highly unlikely to result in any removal, modification, fragmentation or isolation of the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community present at Long Swamp.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat has not been defined for the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan for the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community has not been completed. The DECC website (DECC 2009) lists a number of priority recovery actions in relation to recovery of this endangered ecological community. The proposed continuation of mining operations is not inconsistent with these priority actions. Ongoing monitoring of Long Swamp is contributing to knowledge about the condition and species composition of the swamp, as well as its response to rainfall variation. As such, these aspects of the mining operation are contributing to the tenth listed priority action:
"Collate existing information on vegetation mapping and associated data for this EEC and identify gaps in knowledge. Conduct targeted field surveys and ground truthing to fill data gaps and clarify condition of remnants."

(f) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed continuation of mining operations is not likely to increase the impact of any relevant key threatening process.

Conclusion

The proposed action is not likely to have a significant effect on the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community.

5.1.2 Environment Protection and Biodiversity Conservation Act

Under the EPBC Act, actions likely to have a significant impact on matters of national environmental significance must be referred to the Federal Minister for the Environment.

In determining whether a referral need take place it must first be established whether listed threatened species or communities are likely to be present. Having established their likely presence, EPBC Act administrative guidelines on significance are followed to determine whether the action needs to be referred.

The presence of one threatened flora species, Capertee Stringybark, has been confirmed within the study area.

No EPBC endangered ecological communities are present within the study area.

5.1.2.1 EPBC Act Assessment for Capertee Stringybark

Under the EPBC Act, an action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- *lead to a long-term decrease in the size of an important population of a species, or*

    Within the study area Capertee Stringybark occurs in areas where surface expression of subsidence is rare and in vegetation types which are not regarded as sensitive to the effects of subsidence. It is possible that one or a few individual plants may suffer death or dieback. There are sufficient mature trees in the area to provide a seed source to allow natural recruitment in those localised areas where there is a low possibility of impact. Capertee Stringybark juveniles are present in the area indicating an existing level of recruitment.

    Capertee Stringybark occurs adjacent to the study area in Ben Bullen State Forest. The extent of any loss would be of extremely low magnitude in relation to the population of Capertee Stringybark in the Capertee Valley, where thousands of Capertee Stringybark plants are present, including over 6000 plants within the Gardens of Stone National Park.

    Practice across the western coalfields is to use Capertee Stringybark in rehabilitation works.

    As a result, the Project would not lead to a long-term decrease in the size of the population of the species on the site or the surrounding area.

- *reduce the area of occupancy of an important population, or*

  The vegetation types in which Capertee Stringybark occurs are considered to have a low sensitivity to the effects of subsidence. Soils and their associated microflora will remain largely intact. Clearing of native vegetation does not form part of the proposed actions. There is a very low likelihood that the area of occupancy of Capertee Stringybark will be reduced. The population within the study area has no particular importance, with many more plants to the south in Ben Bullen State Forest and in the Capertee Valley.

- *fragment an existing important population into two or more populations, or*

  Habitat fragmentation will not occur as a result of the proposed continuation of mining operations. Rehabilitation works will decrease the degree of existing fragmentation.

- adversely affect habitat critical to the survival of a species, or

  The study area does not support critical habitat for Capertee Stringybark.

- *disrupt the breeding cycle of an important population, or*

  There is a possibility that there may be death or dieback of individual trees. Based on experience at Baal Bone Colliery over the past almost thirty years virtually all Capertee Stringybark trees will remain in healthy condition, including mature trees and regenerating saplings. The breeding cycle will not be disrupted.

- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or*

  The nature of modification for Capertee Stringybark habitat is such that no impact on the local population is likely in the medium to long term. The habitat will remain and will not be diminished as a result of the proposed mining operations.

- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or*

  Impacts of subsidence such as surface cracking have the potential to provide a niche suitable for the establishment of exotic weed species. The experience at Baal Bone over recent years is that any such occurrence is extremely rare as end of panel inspections have not identified any weed establishment associated with surface cracks. In any event the scale of weed invasion is not likely to restrict the survival or establishment of Capertee Stringybark plants.

- *interferes substantially with the recovery of the species.*

  The proposed ongoing mining operations will not affect the recovery of the species, other than rehabilitation works in former open cut areas which will aid recovery of the species.

Conclusion

The proposed continuation of mining operations at Baal Bone Colliery is not likely to have a significant impact on Capertee Stringybark and a referral to the Federal Minister for the Environment, Water, Heritage and the Arts is not required.

6.0 MONITORING AND MANAGEMENT RECOMMENDATIONS

The current monitoring strategy involves twice yearly monitoring of six vegetation quadrats, four in woodland and forest areas over Longwalls 29 to 31, and two within Long Swamp downstream from that Longwall area. This scale of monitoring has been established based on predictions of the level and likely impact of subsidence, a risk assessment process and an approved Subsidence Management Plan. Current practice also includes inspection of longwall panels at the commencement and completion of extraction and assessment of lease area vegetation condition as directed by mine management.

It is considered that this is an appropriate scale of monitoring, which allows for attention to be drawn to issues, such as weed or pest animal species invasion, which may impact on health of vegetation across the lease area.

7.0 CONCLUSIONS

The proposed continuation of mining operations at Baal Bone Colliery will involve:

- Continuation of underground mining in Longwalls 28 to 31, which are the subject of a current approved SMP;
- Continued operation of associated surface infrastructure and a prepared saleable coal production of 2.0 Mtpa (equating to 2.8 Mtpa ROM coal);
- Continued road and rail haulage of prepared saleable coal to domestic markets in accordance with current approvals; and
- Mining of other isolated remnant unmined areas within the existing lease areas.

A flora assessment has been conducted to characterise the vegetation patterns across the Baal Bone study area, to identify flora species which occur across the study area, to identify threatened flora species and endangered ecological communities, assess vegetation condition and assess the likely impacts of the proposed continued operations on flora.

The study area supports nine vegetation types, one of which, Mountain Hollow Grassy Fen, corresponds to the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions endangered ecological community listed under the NSW TSC Act.

The area supports a diverse range of flora with 227 native species having been recorded from the area over the past 5 years. One threatened flora species, Capertee Stringybark (*E. cannonii*), has been confirmed as occurring within the area likely to be affected by the proposed continued mining operations.

An assessment of the likely impact of the proposed continued mining operations on the threatened species, Capertee Stringybark, and the endangered ecological community, the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions, has been completed. No significant effect is likely.

An EPBC Act assessment has also been completed in relation to Capertee Stringybark. A significant effect on Capertee Stringybark is not likely and a referral to the Federal Minister for the Environment is not required.

REFERENCES

Benson D.H. and Keith D.A. (1990) 'The Natural Vegetation of the Wallerawang 1 : 100 000 Map Sheet', *Cunninghamia*, 2(2), pp 305 - 335.

Bishop A (1996) *Field Guide Orchids of New South Wales and Victoria* UNSW Press, Sydney.

Department of Environment and Climate Change (2007) *Threatened species assessment guidelines: The assessment of significance*. Department of Environment and Climate Change, Hurstville, NSW.

Department of Environment and Conservation (2004) *Threatened biodiversity survey and assessment: guidelines for developments and activities (working draft).* Department of Environment and Conservation, Hurstville, NSW.

Department of Environment and Conservation (2005) *The Vegetation of the Western Blue Mountains including the Capertee, Coxs, Jenolan and Gurnang Areas*. DECC, Hurstville.

Fairley A. (2004) *Seldom Seen. Rare Plants of Greater Sydney* Reed New Holland, Sydney.

Fairley, A. and Moore, P., (1989), *'Native Plants of the Sydney District'*, Kangaroo Press/S.G.A.P. (NSW), Kenthurst.

Gingra Ecological Surveys (2005) '*Baal Bone Colliery Proposed Borehole Sites: Eastern Area Flora Assessment Report*' report to Baal Bone Colliery Gingra Ecological Surveys, Canterbury.

Harden G.J. ed. (1992) *Flora of New South Wales* Volume 3, NSW Uni Press, Kensington.

Harden G.J. ed. (2002) *Flora of New South Wales* Volume 2, Second Edition, NSW Uni Press, Kensington.

Nexus Environmental Studies (1981) *Baal Bone Colliery Environmental Impact Statement* Nexus Environmental Studies.

Thackway, R., & Cresswell, I.D., (1995) *'An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program'*, Australian Nature Conservation Agency, Canberra.

APPENDIX 1. Flora Species List for Baal Bone Colliery

Scientific Name
Acacia brownii
Acacia buxifolia
Acacia dealbata
Acacia echinula
Acacia falciformis
Acacia filicifolia
Acacia gunnii
Acacia hamiltonii
Acacia longifolia
Acacia melanoxylon
Acacia obtusifolia
Acacia terminalis
Acacia ulicifolia
Acaena novae-zelandii
Acaena ovina
* Acetosella vulgaris
Acianthus sp.
Acrotriche serrulata
Agrostis avenaceus
Agrostis sp.
Ajuga australis
Allocasuarina distyla
Allocasuarina littoralis
Amperea xiphoclada
Amyema pendulum ssp. pendulum
Arrhenechthites mixta
Arthropodium milleflorum
Austrodanthonia racemosa
Austrodanthonia tenuior
Austrostipa pubescens
Babbingtonia densifolia
Banksia cunninghamii
Banksia penicillata
Baumea rubiginosa
Billardiera scandens
Blechnum cartilagineum
Blechnum nudum
Boronia microphylla
Bossiaea heterophylla
Brachyloma daphnoides
Brachyscome diversifolia
Brachyscome spathulata
Callistemon citrinus
Callistemon linearis
Calochlaena dubia
Calytrix tetragona
Carex gaudichaudiana
Carex sp.
Cassinia aculeata
Cassinia arcuata

Cassytha glabella
Caustis flexuosa
* Centaurea erythraea
Centella asiatica
Centipeda minima
Chiloglottis sp.
Choretrum pauciflorum
* Cirsium vulgare
Clematis aristata
Clematis glycinoides
* Conyza sp.
Coprosma quadrifida
Crassula sieberiana
* Crepis capillaris
Cyathea australis
Cymbonotus lawsonianus
Cynoglossum suaveolens
Cyperus sp.
Dampiera stricta
Daviesia leptophylla
Dianella caerulea
Dianella revoluta
Dichelachne micrantha
Dichelachne parva
Dichondra repens
Dicksonia antarctica
Dillwynia elegans
Dillwynia phylicoides
Dipodium punctatum
Dodonaea boronifolia
Echinopogon ovatus
* Echium plantagineum
Elaeocarpus reticulatis
Entolasia stricta
Epacris pulchella
Epilobium gunnianum
Eucalyptus blaxlandii
Eucalyptus cannonii
Eucalyptus cypellocarpa
Eucalyptus dalrympleana
Eucalyptus dives
Eucalyptus fastigata
Eucalyptus macrorhyncha
Eucalyptus mannifera
Eucalyptus piperita
Eucalyptus punctata
Eucalyptus radiata
Eucalyptus rossii
Eucalyptus sieberi
Eucalyptus sparsifolia
Eucalyptus stellulata
Eucalyptus stricta
Euchiton involucratum

Euchiton sphaericus
Exocapros cupressiformis
Gahnia sieberiana
Galium gaudichaudii
Galium migrans
Galium propinquum
Geitonoplesium cymosum
Geranium homeanum
Geranium solanderi
Glycine clandestina
Gompholobium huegelii
Gonocarpus micranthus
Gonocarpus tetragynus
Goodenia bellidifolia
Goodenia hederacea
Gratiola latifolia
Hakea dactyloides
Hakea laevipes ssp. laevipes
Hardenbergia violacea
Helichrysum scorpioides
Hemarthria uncinata
Hibbertia obtusifolia
Hibbertia riparia
* Holcus lanatus
Hovea linearis
Hydrocotyle laxiflora
Hydrocotyle peduncularis
Hypericum gramineum
Hypericum japonicum
* Hypochaeris radicata
Hypolepis muelleri
Isopogon anethifolius
Isolepis ?prolifer
Joycea pallida
Juncus continuus
Juncus planifolius
Juncus sp.
Lagenifera stipitata
Lamiaceae - herb in swamp
Leionema dentatum
Lepidosperma filiforme
Lepidosperma laterale
Lepidosperma urophorum
Leptomeria acida
Leptospermum arachnoides
Leptospermum continentale
Leptospermum obovatum
Leptospermum parviflorum
Leptospermum polygalifolium
Leptospermum sphaerocarpum
Leptospermum trinervium
Leucopogon lanceolatus
Leucopogon microphyllus

Leucopogon muticus
Leucopogon setiger
Leucopogon virgatus
Lomandra confertifolia var. rubiginosa
Lomandra filiformis ssp. coriacea
Lomandra glauca
Lomandra longifolia
Lomandra multiflora
Lomatia silaifolia
Luzula flaccida
Lythrum salicaria
Microlaena stipoides
Microtis unifolia
Monotoca scoparia
Myriophylum pedunculatum
Myriophyllum sp.
Notelaea longifolia
Notodanthonia longifolia
Ochrosperma oligomerum
Olearia asterotricha
Olearia erubescens
Oxalis perennans
Patersonia glabrata
Patersonia sericea
Persoonia chamaepitys
Persoonia linearis
Persoonia mollis
Persoonia myrtilloides
Petrophile pedunculata
Phyllanthus hirtellus
Phyllota phylicoides
Pimelea linifolia
Plantago debilis
Platysace lanceolata
Poa labillardieri
Poa sieberiana var. cyanophylla
Poa sieberiana var. sieberiana
Podolobium ilicifolium
Polyscias sambucifolius ssp. B
Pomaderris andromedifolia
Pomaderris lanigera
Pomaderris sp.
Pomax umbellata
Poranthera microphylla
Pratia surrepans
Prostanthera ?howelliae
Prostanthera sp.
* Prunella vulgaris
Pteridium esculentum
Pultenaea microphylla
Ranunculus lappaceus
Ranunculus sp.
Ranunculus sp.

Rapanea howittiana
Rapanea variabilis
Rhytidosporum procumbens
* Rosa rubiginosa
Rubus parvifolius
* Rubus ulmifolius
* Rumex crispus
Schoenus melanostachys
Scleria mackaviensis
Senecio diaschides
Senecio linearifolius
Senecio prenanthoides
* Sonchus asper
Stellaria angustifolia
Stellaria pungens
Stylidium graminifolium
Stylidium productum
Styphelia tubiflora
* Taraxacum officinale
Tetratheca thymifolia
Thelymitra pauciflora
Todea barbara
* Trifolium repens
unknown herb
Utricularia dichotoma
* Verbascum thapsus
Veronica plebeia
Veronica sp.
Viola betonicifolia
Viola hederacea
Viola sieberiana
Wahlenbergia communis
Wahlenbergia stricta
Xanthosia pilosa

APPENDIX 2.

BAAL BONE COLLIERY SUBSIDENCE MANAGEMENT PLAN
FLORA ASSESSMENT

report prepared by:

Roger Lembit
Gingra Ecological Surveys
P.O. Box 1
CANTERBURY NSW 2193
December 2006

BAAL BONE COLLIERY SUBSIDENCE MANAGEMENT PLAN
FLORA ASSESSMENT

report prepared by:

Roger Lembit
Gingra Ecological Surveys
P.O. Box 1
CANTERBURY NSW 2193
December 2006

1.0 INTRODUCTION

This report seeks to identify the vegetation communities and flora species present over that part of the Baal Bone Colliery lease area which is the subject of a new Subsidence Management Plan (SMP). A second objective of the report is to discuss the potential impacts of subsidence on vegetation associated with the mining of longwalls 29 to 31.

As the area proposed for mining is adjacent to areas where mining has occurred, there is considerable information related to the historical effects of subsidence covering land of similar nature and with similar geological conditions as far as coal mining and subsidence are concerned. In assessing the likely effects of subsidence it is understood that subsidence associated with longwalls 29 to 31 will be similar to that which has previously occurred at the Baal Bone Colliery.

2.0 METHODS

The SMP area was the subject of a baseline flora survey conducted to assess the environmental impact of exploratory boreholes. That baseline survey was conducted in October 2005, over a 3 day period.

The authors' experience in the Baal Bone area extends back over 20 years and includes survey and assessment of regeneration of vegetation on exposed rock faces and a survey of threatened species, including Capertee Stringybark (*Eucalyptus cannonii*) within the adjoining Gardens of Stone National Park for the National Parks and Wildlife Service.

The baseline survey was conducted through a combination of foot and vehicle traverses. Detailed assessment of vegetation at particular sites within the SMP area was made by systematic searches of within an area of up to 50 metres radius around each location.

Species unable to be identified in the field were collected for later identification which was undertaken with the aid of Harden (1990-2002). A floristic list for the SMP area has been prepared (Appendix 1).

The Atlas of NSW Wildlife was consulted to create a list of known plant species from within a 5 km radius of the study area.

3.0 PHYSICAL ATTRIBUTES OF SMP AREA

<u>3.1 Location</u>

The SMP area is located just to the south-east of the Great Dividing Range approximately 4 kilometres north of Wolgan Gap and about 25 km north of Lithgow. The land slopes generally to the south-west from a ridgeline which runs south from the Great Dividing Range to Wolgan Gap. Elevation ranges from about 980 m in a gully which lies over Longwall 29 to 1050 m along the ridge crest.

The SMP area lies within the Sydney Basin Bioregion and the Central Tablelands Botanical Subdivision.

3.2 Physiography

The SMP area is within the upper catchment of the Coxs River. Gullies run down in a generally south-westerly direction from the ridge to the Coxs River. Not far downslope of the SMP area is the upper end of Long Swamp. Long Swamp extends over 7 km along the upper Coxs River valley.

The Coxs River is part of the catchment for Lake Burragorang, the major water supply for the Sydney Metropolitan Area.

The land surface is generally moderately inclined with flat areas along the ridge crest and small areas of steeper slopes. There are small rock faces and pagoda rock formations to the south of Longwalls 29 and 30.

3.3 Climate

Lithgow is the nearest location for which climatic data are available through the website of the Bureau of Meteorology – www.bom.gov.au.

At Lithgow summer days are warm to hot with an average maximum temperature of 25.5^{o}C in January. In winter days are cool with a mean maximum temperature of 10.4^{o}C in July and nights are cold with a mean minimum temperature of 0.7^{o}C in July. On average there are 44 frost days per annum.

Average annual rainfall is 860 mm with a reasonably even distribution through the year. The driest month is September with 59 mm and the wettest is January with 93 mm. The SMP area is expected to have a similar rainfall pattern to that which has been recorded at Lithgow.

4.0 VEGETATION MAP UNITS

4.1 Wallerawang 1:100 000 Vegetation Map

Vegetation of the Wallerawang 1:100 000 map sheet, which includes the study area, has been mapped by Benson & Keith (1990). The vegetation map units and sub-units described by Benson & Keith which are of relevance to the study area for this report are described below.

<u>1. Tablelands Sheltered Valley Forest</u>

Dominant Species

Mountain Gum (*E. dalrympleana*)
Broad-leaved Peppermint (*E. dives*)

Tablelands Sheltered Valley Forest occurs in sheltered gullies with deeper soils. Tree height may exceed 20 metres. Associated tree species include Red Stringybark (*E. macrorhyncha*), Apple Box (*E. bridgesiana*) and Narrow-leaved Peppermint (*E. radiata*).

There may be a small tree layer of low density dominated by *Acacia falciformis*. The shrub layer is of medium density and the ground layer is of medium density and dominated by grasses and ferns.

Common shrub species include Chinese Scrub (*Cassinia arcuata*), *Acacia buxifolia*, and Yellow Tea Tree (*Leptospermum polygalifolium*).

Common ground layer species include Wallaby Grass (*Austrodanthonia racemosa*), Snow Grass (*Poa sieberiana* ssp. *sieberiana*), Bracken Fern (*Pteridium esculentum*), *Viola betonicifolia*, Weeping Meadow Grass (*Microlaena stipoides*), *Lomandra filiformis* var. *coriacea*, *Senecio* sp. E, *Geranium solanderi* and *Veronica plebeia*.

This vegetation type is part of the vegetation map unit 10h “Tablelands Grassy Woodland Complex” described by Benson & Keith (1990).

Tablelands Sheltered Valley Forest falls within the Tablelands Grassy Woodland Complex of Benson & Keith 1990. Examples of this community occur in Gardens of Stone National Park.

<u>2. Sandstone Dry Ridgetop Woodland</u>

Dominant Species

Inland Scribbly Gum (*Eucalyptus rossii*)
Narrow-leaved Stringybark (*E. sparsifolia*)

Sandstone Dry Ridgetop Woodland occurs on hills of Narrabeen Sandstone geology. Benson & Keith (1990) describe this vegetation type as map unit 10g. It is found along the western fringes of the sandstone country of the Blue Mountains with extensive areas in Wollemi National Park. The community also occurs within Gardens of Stone National Park.

The dominant species are Inland Scribbly Gum (*E. rossii*) and Narrow-leaved Stringybark (*E. sparsifolia*). Other tree species may be locally frequent. These include Silvertop Ash (*E. sieberi*), Blaxland's Stringybark (*E. blaxlandii*) and Sydney Peppermint (*E. piperita*).

The understorey includes a shrub layer of medium density and a ground layer of low density. Exposed, rocky areas support open heath vegetation, however these areas are relatively small in extent.

Common shrub species include *Acacia ulicifolia*, *Dillwynia phylicoides*, *Persoonia linearis*, Sunshine Wattle (*Acacia terminalis*), *Leucopogon muticus*, *Platysace lanceolata*, *Phyllanthus hirtellus* and *Monotoca scoparia*.

Ground layer species include Purple Flag Iris (*Patersonia longifolia*), Redanther Wallaby Grass (*Joycea pallida*), *Platysace lanceolata*, Wiry Panic (*Entolasia stricta*), *Lomandra confertifolia* var. *rubiginosa* and Rock Fern (*Cheilanthes sieberi*).

This vegetation type is part of the vegetation map unit 10g “Scribbly Gum-Stringybark Woodland” described by Benson & Keith (1990).

3 Tablelands Dry Woodland

Dominant Species:

Broad-leaved Peppermint (*E. dives*)
Red Stringybark (*E. macrorhyncha*)
Inland Scribbly Gum (*E. rossii*)
Brittle Gum (*E. mannifera*)

Tablelands Dry Woodland occurs in areas underlain by Permian Illawarra Group geology with on more exposed aspects and drier, more shallow soils than areas which support Tablelands Sheltered Valley Forest. The dominant species are Red Stringybark (*E. macrorhyncha*), Broad-leaved Peppermint (*E. dives*), Brittle Gum (*E. mannifera*) and Inland Scribbly Gum (*E. rossii*). Associated tree species may include Long-leaved Box (*E. goniocalyx*) and Silvertop Ash (*E. sieberi*).

The shrub layer is generally of low density, with medium density patches on sheltered slopes. The ground layer is grassy and of low to medium density.

Shrub species present include Silver Wattle (*Acacia dealbata*), *Persoonia linearis*, *Pultenaea microphylla, Hibbertia obtusifolia*, Mountain Holly (*Podolobium ilicifolium*), *Brachyloma daphnoides*, *Monotoca scoparia* and *Acacia buxifolia*.

Ground layer species include Wallaby Grass (*Austrodanthonia racemosa*), Redanther Wallaby Grass (*Joycea pallida*), Rock Fern (*Cheilanthes sieberi*), Blue-leaved Snow Grass (*Poa sieberiana* ssp. *cyanophylla*), *Goodenia hederacea*, *Gonocarpus tetragynus*, *Dianella revoluta* and Bluebell (*Wahlenbergia gracilis*).

Tablelands Dry Woodland falls within the “Tablelands Grassy Woodland Complex”, map unit 10h of Benson & Keith 1990. Examples of this community occur in Gardens of Stone National Park, Winburndale Nature Reserve and Blue Mountains National Park.

This is the most widespread community in the study area.

4.2 The Vegetation of the Western Blue Mountains

The Department of Environment and Conservation has recently published a report “The Vegetation of the Western Blue Mountains including the Capertee, Coxs, Jenolan & Gurnang Areas” (DEC 2005). The study area covers the SMP area.

The vegetation map which forms part of the report indicates that the SMP area supports the following vegetation map units as described in the DEC (2005) report:

28. Sandstone Plateau and Ridge Scribbly Gum – Silvertop Ash Shrubby Woodland
29. Sandstone Slopes Sydney Peppermint Shrubby Forest
32. Tableland Hills Scribbly Gum - Narrow-leaved Stringybark Shrubby Open Forest
35. Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest
37. Coxs Permian Red Stringybark – Brittle Gum Woodland
44. Sandstone Plateau Tea Tree – Dwarf She-oak – Banksia Rocky Heath

Vegetation map units 32, 35 & 37 are indicated to be the most widespread within the SMP area.

4.3 Vegetation Map Unit Relationships

The relationship between vegetation map units described for the Wallerawang 1:100 000 map sheet and “The Vegetation of the Western Blue Mountains is presented in Table 1.

Table 1. Vegetation Map Unit Relationships in SMP Area

NPWS Western Blue Mountains Mapping	**Wallerawang Map Sheet**

28. Sandstone Plateau and Ridge Scribbly Gum – Silvertop Ash Shrubby Woodland	mapped as 2. Sandstone Dry Ridgetop Woodland (10g)
29. Sandstone Slopes Sydney Peppermint Shrubby Forest	mapped as 1. Tablelands Sheltered Valley Forest (10h)
32. Tableland Hills Scribbly Gum - Narrow-leaved Stringybark Shrubby Open Forest	2. Sandstone Dry Ridgetop Woodland (10g)
35. Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest	1. Tablelands Sheltered Valley Forest (10h)
37. Coxs Permian Red Stringybark – Brittle Gum Woodland	mapped as 1. Tablelands Sheltered Valley Forest (10h)
Exposed Sandstone Scribbly Gum Woodland Woronora Tall Mallee-Heath	3. Tablelands Dry Woodland

4.4 Potential Impacts of Subsidence on Vegetation

Table 2 presents a summary of the potential impact of predicted subsidence on each of the identified vegetation types.

The vegetation map units most susceptible to impacts of subsidence are outside the direct influence of longwall mining. This is due to the engineering design for the longwall panels which are laid out in a manner which avoids impact on sensitive vegetation types such as heath and swamp communities.

Table 2. Sensitivity of Vegetation Types to Potential Subsidence in the SMP area

VEGETATION MAP UNIT	POTENTIAL DISTURBANCE
1. Tablelands Sheltered Valley Forest (10h)	Detectable impact unlikely
2. Sandstone Dry Ridgetop Woodland (10g)	Detectable impact unlikely
3. Tablelands Dry Woodland	Detectable impact unlikely

5.0 THREATENED FLORA

The Atlas of NSW Wildlife published by the National Parks and Wildlife Service indicates that three plant species listed in schedules to the NSW Threatened Species Conservation Act have been recorded within a 5 kilometre radius of the study area. These species are Capertee Stringybark (*Eucalyptus cannonii*), Clandulla Geebung (*Persoonia marginata*) and *Prostanthera densa*.

The latter two species represent dubious records. According to Harden (1992) and Fairley and Moore (1989) *Prostanthera densa* occurs on rocky slopes close to the ocean, with no records confirmed for the Central Tablelands. It is likely this record is either *Prostanthera hindii* or *Prostanthera* sp. C. A similar plant was observed by the author in heath vegetation near Cape Horn approximately 5 km north of the SMP area. Suitable habitat for this species does not occur within the SMP area.

Persoonia marginata is found in dry woodland associated with Permian Shoalhaven group sediments in Clandulla State Forest. An outlying population is known from an area north of Dark Corner. The Wildlife Atlas record close to the SMP area is within the Baal Bone Colliery lease area in a valley along a tributary of Jews Creek, about 5 km away from the SMP area. As collection details are not available from the Atlas and no herbarium specimen has been lodged it is not possible to verify the accuracy of this record.

The field survey did not reveal any populations of any of the three threatened plant species within the SMP area. As no confirmed specimens of *Eucalyptus cannonii* and *Persoonia marginata* were found at the proposed borehole sites, as the habitat in the study area is sub-optimal for both species, and the development is only likely to have a localised impact in terms of surface expression of subsidence, it is considered that it is not necessary to formally assess whether the development is likely to have a significant effect on these species.

6.0 CONCLUSION

The SMP area supports woodland vegetation on slopes and valleys close to the head of the Coxs River. The vegetation is characterised by typical examples of Tablelands Sheltered Valley Forest, Tablelands Dry Ridgetop Woodland or Tablelands Dry Woodland. No threatened plant species have been detected within the SMP area and the proposed development will not impact on threatened flora.

The mine layout has been designed to avoid sensitive vegetation types such as heath and swamp vegetation.

REFERENCES

Benson, D.H., and Keith, D.A., (1990), 'The Natural Vegetation of the Wallerawang 1 : 100 000 Map Sheet', Cunninghamia, Vol 2, No 2, pp 305 - 335.

Fairley, A. and Moore, P., (1989), 'Native Plants of the Sydney District', Kangaroo Press/S.G.A.P. (NSW), Kenthurst.

Harden G.J. ed. (1990) *Flora of New South Wales* Volume 1, NSW Uni Press, Kensington.

Harden G.J. ed. (1991) *Flora of New South Wales* Volume 2, NSW Uni Press, Kensington.

Harden G.J. ed. (1992) *Flora of New South Wales* Volume 3, NSW Uni Press, Kensington.

Harden G.J. ed. (1993) *Flora of New South Wales* Volume 4, NSW Uni Press, Kensington.

Harden G.J. ed. (2002) *Flora of New South Wales* Volume 2, Second Edition, NSW Uni Press, Kensington.

APPENDIX M

Fauna Assessment Report

CONTINUED OPERATIONS AT BAAL BONE COLLIERY – FAUNA ASSESSMENT REPORT

by BIODIVERSITY MONITORING SERVICES, May 2009

1.0 BACKGROUND

The Wallerawang Collieries Limited (TWCL) is currently seeking to gain Project Approval for the continuation of mining activities at Baal Bone Colliery within the current lease area. Baal Bone Colliery is an underground longwall coal mine located near the township of Cullen Bullen, approximately 25km north west of Lithgow in the state of New South Wales (NSW).

Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) is sought for the continued operations at Baal Bone Colliery including operation of the CHPP and mining related facilities within the Surface Infrastructure Area, and mining of Longwalls 29 to 31 and Remnant Areas within the Underground Mining Area. The proposed continuation of mining operations does not seek to alter the approved extraction limit.

Following 1 August 2010, the project will be a project to which Part 3A of the EP&A Act applies pursuant to Clause 6 and Item 5 of Schedule 1 of the *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP).

An Environmental Assessment under Part 3A of the EP&A Act is to be undertaken as part of the approval process and this will guided by many constraints, including the requirements of the Director-General of the Department of Planning and Xstrata Coal NSW HSEC STD1.16.

Project Approval is being sought for the following project components at Baal Bone:

- Continuation of underground mining in Longwalls 29 to 31, which are the subject of a current approved Subsidence Management Plan (SMP);
- Continued operation of associated surface infrastructure and a prepared saleable coal production of 2.0 Million tonnes per annum (Mtpa) (equating to 2.8 Mtpa Run of Mine (ROM) coal);
- Continued haulage of prepared saleable coal to domestic markets in accordance with current approvals; and
- Mining of remnant areas within the existing workings.

This fauna assessment has been prepared as part of the environmental impact assessment of the proposed mining operations (the Project). The Project Area is shown in Figure 1.

The aim of this report is to identify fauna species and associated habitats across the area likely to be affected by the proposed mining operations, to assess the conservation significance of these species and habitats, and to assess impacts of the Project upon these species and habitats with particular reference to those species listed on the *NSW Threatened Species Conservation Act 1995* (TSC Act) and *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Figure 1: Survey Areas within Baal Bone Colliery

2.0 METHODOLOGY

The fauna assessment was undertaken in three stages:

Stage One – Gap and Constraints Analysis

A gap/constraints analysis was required to assess what level of existing information about fauna is available to use in preparing the Environmental Assessment. This analysis was a desk-top study of literature available on fauna known to occur within the general area surrounding Baal Bone Colliery. This information was derived from data held in the DECC Atlas of NSW Wildlife and other relevant fauna databases (e.g. State Forests, Australian Museum), and from documents relating to previous environmental assessments undertaken at Baal Bone Colliery.

Stage Two – Baseline Data Acquisition

Fauna surveys have been undertaken in several of the lease areas where operations are currently occurring. Areas of land not currently approved to be mined were surveyed for fauna and habitat condition in March 2009. Detailed descriptions of these surveys are given in a separate report.

Stage Three – Production of an Assessment Report

The information obtained from the above two stages was used to develop an assessment report to be used in the overall Environment Assessment required under Part 3A of the NSW EP&A Act and under the Commonwealth EPBC Act, if required. This report provides information on the fauna, particularly threatened species, likely to be present in the areas to be assessed and includes the potential likely impacts from underground mining on critical habitats and threatened fauna within the development areas and identifies constraints and relevant management strategies.

3.0 GAP AND CONSTRAINTS ANALYSIS

Records of fauna species known to occur within the boundaries of Baal Bone Colliery, as well as within an area surrounding the mine having a radius of 20km (the "locality"), were obtained from a variety of sources. These included:

- Records from the wildlife database held by the Department of Environment and Conservation (formerly National Parks & Wildlife Service). Fauna records within the 1:100 000 Wallerawang, Bathurst and Katoomba map sheets were obtained under licence No. CON93005;
- Records from the Australian Museum, Forests NSW and National Parks and Wildlife Service obtained from www.bionet.nsw.gov.au;
- Records from internal and published impact assessment reports (**Table 1** lists reports covering Baal Bone Colliery); and
- Personal records.

Where possible geographic references were obtained for each record and overlaid onto a base topographic map that contained the boundaries of the Colliery. By using the Arc-View geographic information system, it was possible to draw a 20km buffer around the colliery boundary and accurately determine those records that were within the locality.

Records of threatened species were separated from the general listings and their locations were added to the map. This provided relatively accurate listings of threatened species that are known to have occurred within the boundaries and the locality of the colliery. Some of the records are more than 20 years old (e.g. surveys for the original Baal Bone Colliery EIS were undertaken in 1981), and the dates of the records were entered as part of their attributes. Although such records do not indicate the present-day presence of the species, they are helpful in determining whether such a species could occupy the area.

Thus, this exercise provided two major outputs:

1. A list of fauna species known to occur within the boundaries of the Colliery. This list provides baseline data to be in future monitoring of the area.

2. A list of threatened species known to occur within the boundaries of the Colliery as well as within 20km of the Colliery area. This list was used to determine those threatened species potentially to be affected by any mining activity (notably impacts from subsidence) could be targeted during any fauna surveys.

Table 1: Reports Reviewed for the Gap Analysis

Reference	Relevance
Denny, M.J.S. 1981 Report on the impact of coal mining upon fauna at the Baal Bone site, Cullen Bullen. Report to Coalex PL in Baal Bone Colliery EIS, Nexus Environmental Studies	Provides list of terrestrial and aquatic species located during fauna surveys in 1980
Brian Stone Environmental Services 1989 CLA192 EIS	Area now CL391. Uses fauna listings from Denny 1981
Lim, L. 1995 A Fauna Survey of Baal Bone Colliery. Report to RW Corkery and Co. PL for Wallerawang Collieries Ltd	Describes fauna located within an area approximating CCL749
Mjadwesch Environmental Service Support 2000 Flora and Fauna Survey and Impact Assessment for Proposed Baal Bone Colliery Mine Dewatering Facility (LW19) and Pipeline (LW1)	Provides list of terrestrial and aquatic fauna located within an area in Baal Bone Northern Area (near Baal Bone Creek and Gap)
Appendix to HSEC SSTD 5.12 Flora and Fauna Management 2005	Species list developed from earlier unreferenced survey and other reported sightings
Mount King Ecological Surveys October 2005 Terrestrial Fauna Assessment of Proposed Longwall and Exploratory Drilling Areas at Baal Bone Colliery Report to Baal Bone Colliery	Reports on the results from fauna surveys covering LW 25-28 and LW 29-31
Mount King Ecological Surveys December 2006 Terrestrial Fauna Assessment of Proposed Longwall 29-31 SMP Area at Baal Bone Colliery Baseline Data Spring 2005 and Summer 2006	Reports on the results from fauna surveys of LW29-31 in 2005 and 2006
Mount King Ecological Surveys December 2006 Terrestrial Fauna Assessment of Proposed SMP Application Area for Longwall Panels 29-31 at Baal Bone Colliery	Review of existing information about fauna known from Baal Bone Colliery
OzArk Environmental & Heritage Management P/L May 2007 Flora and Fauna Assessment: Proposed 1.7km, 11kV Powerline Corridor and Ventilation Compound Baal Bone Colliery	Uses previous survey results, but provides a short species list of fauna observed in an area within Baal Bone Northern Area
Umwelt 2007 Environmental Assessment Ventilation Shaft and Powerline Corridor for SE Mining Area Baal Bone Colliery	Uses results from OzArk report

Reference	Relevance
Mount King Ecological Surveys September 2007 Terrestrial Fauna Assessment of proposed Longwall 29-31 SMP Area at Baal Bone Colliery Baseline Data Winter 2007	Provides list of fauna located within SMP Area in late winter 2007
Mount King Ecological Surveys April 2008 Fauna Monitoring During 2007 within the LW29-31 Subsidence Management Plan Application Area at Baal Bone Colliery	Provides list of fauna located within SMP Area in winter, spring and summer 2007
Mount King Ecological Surveys July 2008 Fauna Monitoring within the Longwall 29-31 Subsidence Management Plan Application Area at Baal Bone Colliery Autumn 2008 Sample	Provides list of fauna located within SMP Area in autumn 2008
Biodiversity Monitoring Services January 2009 Fauna Monitoring within the Longwall 29-31 Subsidence Management Plan Application Area at Baal Bone Colliery Spring 2008 Sample	Provides list of fauna located within SMP Area in spring 2008
Biodiversity Monitoring Services March 2009 Fauna Monitoring During 2008 within the LW29-31 Subsidence Management Plan Application Area at Baal Bone Colliery	Provides list of fauna located within SMP Area in winter, spring and summer 2008
Biodiversity Monitoring Services May 2009 Baal Bone Colliery Fauna Survey Report	Provides data obtained from fauna surveys of the Northern Area and a small area within Baal Bone Colliery

Data on the distribution of fauna within Baal Bone Colliery was used in the assessment within the area and provides information on the known and potential threatened species that may occur within Baal Bone Colliery. This list of threatened species has been used in the Assessment of Significance in the present report.

4.0 Fauna Known from Baal Bone Colliery

It is now possible to amalgamate the results from the surveys reported above with existing information about fauna known from Baal Bone Colliery. Surveys for fauna in the Colliery were first undertaken in 1980 and there have been a total of 11 surveys of varying effort since that time (see **Table 1**). **Table 2** provides a list of fauna species known to occur within the boundaries of Baal Bone Colliery together with their conservation status

Table 2: Fauna Known from Baal Bone Colliery

A. MAMMALS

Scientific Name	Common Name	Status
Tachyglossidae		
Tachyglossus aculeatus	Short-beaked Echidna	P
Dasyuridae		
Antechinus stuartii	Brown Antechinus	P
Antechinus agilis	Agile Antechinus	P
Petauridae		
Petaurus norfolcensis	Squirrel Glider	V
Petaurus breviceps	Sugar Glider	P
Phalangeridae		
Trichosurus vulpecula	Common Brushtail Possum	P
Pseudocheiridae		
Petauroides volans	Greater Glider	P
Pseudocheirus peregrinus	Common Ringtail Possum	P
Vombatidae		
Vombatus ursinus	Common Wombat	P
Macropodidae		
Macropus giganteus	Eastern Grey Kangaroo	P
Macropus robustus	Common Wallaroo	P
Macropus rufogriseus	Red-necked Wallaby	P
Wallabia bicolor	Swamp Wallaby	P
Muridae		
Mus musculus	House Mouse	U
Rattus rattus	Black Rat	U
Rattus fuscipes	Southern Bush Rat	P
Hydromys chrysogaster	Water Rat	P
Vespertilionidae		
Nyctinomus australis	White-striped Freetail Bat	P
Vespadelus darlingtoni	Large Forest Bat	P
Chalinolobus dwyeri	Large-eared Pied Bat	V
Chalinolobus gouldii	Gould’s Wattled Bat	P
Chalinolobus morio	Chocolate Wattled Bat	P
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V
Vespadelus regulus	Southern Forest Bat	P
Vespadelus vulturnus	Little Forest Bat	P
Canidae		
Canis familiaris	Dog	U
Vulpes vulpes	Red Fox	U

Scientific Name	Common Name	Status
Felidae		
Felis catus	Cat	U
Bovidae		
Bos taurus	European Cattle	U
Suidae		
Sus scrofa	Feral Pig	U
Leporidae		
Oryctolagus cuniculus	Rabbit	U

Notes: P – Protected, U - Unprotected, V - Vulnerable

B. BIRDS

Scientific Name	Common Name	Status
Phasianidae		
Coturnix ypsilophora	Brown Quail	P
Anatidae		
Anas gracilis	Grey Teal	P
Anas superciliosa	Pacific Black Duck	P
Chenonetta jubata	Australian Wood Duck	P
Podicipedidae		
Poliocephalus poliocephalus	Hoary-headed Grebe	P
Tachybaptus novaehollandiae	Australasian Grebe	P
Phalacrocoracidae		
Phalacrocorax melanoleucos	Little Pied Cormorant	P
Phalacrocorax sulcirostris	Little Black Cormorant	P
Ardeidae		
Egretta novaehollandiae	White-faced Heron	P
Ardea pacifica	White-necked Heron	P
Accipitridae		
Accipiter fasciatus	Brown Goshawk	P
Aquila audax	Wedge-tailed Eagle	P
Hieraaetus morphnoides	Little Eagle	P
Falconidae		
Falco berigora	Brown Falcon	P
Charadriidae		
Elseyornis melanops	Black-fronted Dotterel	P
Vanellus miles	Masked Lapwing	P
Columbidae		
Ocyphaps lophotes	Crested Pigeon	P
Phaps chalcoptera	Common Bronzewing	P
Phaps elegans	Brush Bronzewing	P

Scientific Name	Common Name	Status
Cacatuidae		
Cacatua galerita	Sulphur-crested Cockatoo	P
Callocephalon fimbriatum	Gang-gang Cockatoo	V
Calyptorhynchus lathami	Glossy Black-Cockatoo	V
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P
Eolophus roseicapillus	Galah	P
Psittacidae		
Alisterus scapularis	Australian King-Parrot	P
Platycercus adscitus eximius	Eastern Rosella	P
Platycercus elegans	Crimson Rosella	P
Neophema pulchella	Turquoise Parrot	V
Cuculidae		
Cacomantis flabelliformis	Fan-tailed Cuckoo	P
Strigidae		
Ninox novaeseelandiae	Southern Boobook	P
Podargidae		
Podargus strigoides	Tawny Frogmouth	P
Caprimulgidae		
Eurostopodus mystacalis	White-throated Nightjar	P
Aegothelidae		
Aegotheles cristatus	Australian Owlet-nightjar	P
Halcyonidae		
Dacelo novaeguineae	Laughing Kookaburra	P
Todiramphus sanctus	Sacred Kingfisher	P
Menuridae		
Menura novaehollandiae	Superb Lyrebird	P
Climacteridae		
Climacteris erythrops	Red-browed Treecreeper	P
Climacteris picumnus	Brown Treecreeper	V
Cormobates leucophaeus	White-throated Treecreeper	P
Maluridae		
Malurus cyaneus	Superb Fairy-wren	P
Malurus lamberti	Variegated Fairy-wren	P
Pardalotidae		
Pardalotus punctatus	Spotted Pardalote	P
Pardalotus striatus	Striated Pardalote	P
Acanthizidae		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P
Acanthiza lineata	Striated Thornbill	P
Acanthiza nana	Yellow Thornbill	P
Acanthiza pusilla	Brown Thornbill	P
Acanthiza reguloides	Buff-rumped Thornbill	P
Gerygone mouki	Brown Gerygone	P
Gerygone olivacea	White-throated Gerygone	P

Scientific Name	Common Name	Status
Origma solitaria	Rockwarbler	P
Sericornis frontalis	White-browed Scrubwren	P
Smicrornis brevirostris	Weebill	P
Meliphagidae		
Acanthorhynchus tenuirostris	Eastern Spinebill	P
Anthochaera carunculata	Red Wattlebird	P
Lichenostomus chrysops	Yellow-faced Honeyeater	P
Lichenostomus leucotis	White-eared Honeyeater	P
Lichenostomus virescens	Singing Honeyeater	P
Manorina melanocephala	Noisy Miner	P
Melithreptus brevirostris	Brown-headed Honeyeater	P
Melithreptus lunatus	White-naped Honeyeater	P
Philemon corniculatus	Noisy Friarbird	P
Phylidonyris nigra	White-cheeked Honeyeater	P
Phylidonyris novaehollandiae	New Holland Honeyeater	P
Petroicidae		
Eopsaltria australis	Eastern Yellow Robin	P
Microeca fascinans	Jacky Winter	P
Petroica boodang	Scarlet Robin	P
Eupetidae		
Cinclosoma punctatum	Spotted Quail-thrush	P
Psophodes olivaceus	Eastern Whipbird	P
Neosittidae		
Daphoenositta chrysoptera	Varied Sittella	P
Pachycephalidae		
Colluricincla harmonica	Grey Shrike-thrush	P
Falcunculus frontatus	Eastern Shrike-tit	P
Pachycephala pectoralis	Golden Whistler	P
Pachycephala rufiventris	Rufous Whistler	P
Dicruridae		
Myiagra rubecula	Leaden Flycatcher	P
Grallina cyanoleuca	Magpie-lark	P
Rhipidura albiscapa	Grey Fantail	P
Rhipidura leucophrys	Willie Wagtail	P
Artamidae		
Cracticus nigrogularis	Pied Butcherbird	P
Cracticus torquatus	Grey Butcherbird	P
Gymnorhina tibicen	Australian Magpie	P
Strepera graculina	Pied Currawong	P
Strepera versicolor	Grey Currawong	P
Campephagidae		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P
Coracina tenuirostris	Cicadabird	P
Oriolidae		
Oriolus sagittatus	Olive-backed Oriole	P

Scientific Name	Common Name	Status
Corvidae		
Corvus coronoides	Australian Raven	P
Corvus mellori	Little Raven	P
Corcoracidae		
Corcorax melanorhamphos	White-winged Chough	P
Sturnidae		
Sturnus vulgaris	Common Starling	U
Ptilonorhynchidae		
Ptilonorhynchus violaceus	Satin Bowerbird	P
Hirundinae		
Hirundo neoxena	Welcome Swallow	P
Petrochelidon nigricans	Tree Martin	P
Zosteropidae		
Zosterops lateralis	Silvereye	P
Dicaeidae		
Dicaeum hirundinaceum	Mistletoebird	P
Passeridae		
Passer domesticus	House Sparrow	U
Motacillidae		
Anthus australis	Australian Pipit	P
Estrilidae		
Neochmia temporalis	Red-browed Finch	P
Stagonopleura guttata	Diamond Firetail	V
Fringillidae		
Carduelis carduelis	European Goldfinch	U

Notes: P – Protected, U - Unprotected, V - Vulnerable

C. REPTILES

Scientific Name	Common Name	Status
Varanidae		
Varanus varius	Lace Monitor	P
Agamidae		
Amphibolurus muricatus	Jacky Lashtail	P
Pogona barbata	Eastern Bearded Dragon	P
Scincidae		
Acritoscincus platynota	Red-throated Cool-skink	P
Acritoscincus duperreyi	Eastern Three-lined Skink	P
Ctenotus taeniolatus	Copper-tailed Ctenotus	P
Hemiergis decresiensis	Three-toed Earless Skink	P
Lampropholis delicata	Dark-flecked Garden Sunskink	P
Lampropholis guichenoti	Grass Skink	P
Saproscincus mustelinus	Weasel Shadeskink	P
Tiliqua nigrolutea	Blotched Blue-tongued Lizard	P
Elapidae		
Pseudechis porphyriacus	Red-bellied Black Snake	P
Pseudonaja textilis	Eastern Brown Snake	P

Notes: P – Protected, U - Unprotected, V - Vulnerable

D. AMPHIBIANS

Scientific Name	Common Name	Status
Hylidae		
Litoria lesueuri	Lesueur's Frog	P
Litoria ewingii	Brown Tree Frog	P
Myobatrachidae		
Limnodynastes dumerilii	Eastern Banjo Frog	P
Limnodynastes tasmaniensis	Spotted Marsh Frog	P
Crinea signifera	Common Eastern Toadlet	P

Notes: P – Protected, U - Unprotected, V - Vulnerable

4.0 Known and Expected Threatened Species

Analysis of the records for threatened species derived from the DECC Wildlife Database (accessed 13th January 2009) shows that there are 36 Threatened species known to occur within 20km of Baal Bone Colliery. These are listed in **Table 3**.

Table 3: Threatened Species Identified on the DECCW Wildlife Database that are Known or Expected to occur within Baal Bone Colliery

A. Mammals

Scientific Name	Common Name	Status
Dasyuridae		
Dasyurus maculatus	Spotted-tailed Quoll	V
Burramyidae		
Cercartetus nanus	Eastern Pygmy Possum	V
Petauridae		
Petaurus norfolcensis	Squirrel Glider	V
Petaurus australis	Yellow-bellied Glider	V
Phascolarctidae		
Phascolarctos cinereus	Koala	V
Macropodidae		
Petrogale penicillata	Brush-tailed Rock-wallaby	V
Molossidae		
Mormopterus norfolkensis	Eastern Freetail Bat	V
Vespertilionidae		
Chalinolobus dwyeri	Large-eared Pied Bat	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V
Miniopterus australis	Little Bentwing-bat	V
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V

Notes: V - Vulnerable

B. Reptiles

Scientific Name	Common Name	Status
Varanidae		
Varanus rosenbergi	Rosenberg's Goanna	V
Scincidae		
Eulamprus leuraensis	Blue Mountains Water skink	E1
Elapidae		
Hoplocephalus bungaroides	Broad-headed Snake	E1

Notes: V – Vulnerable, E1 – Endangered (TSC Act)

C. Amphibians

Scientific Name	Common Name	Status
Myobatrachidae		
Pseudophryne australis	Red-crowned Toadlet	V
Mixophyes balbus	Stuttering Frog	V

Notes: V - Vulnerable

D. Birds

Scientific Name	Common Name	Status
Accipitridae		
Lophoictinia isura	Square-tailed Kite	V
Cacatuidae		
Callocephalon fimbriatum	Gang-gang Cockatoo	V
Calyptorhynchus lathami	Glossy Black-Cockatoo	V
Psittacidae		
Lathamus discolor	Swift Parrot	E1
Neophema pulchella	Turquoise Parrot	V
Strigidae		
Ninox connivens	Barking Owl	V
Ninox strenua	Powerful Owl	V
Tytonidae		
Tyto novaehollandiae	Masked Owl	V
Tyto tenebricosa	Sooty Owl	V
Climacteridae		
Climacteris picumnus	Brown Treecreeper	V
Acanthizidae		
Pyrrholaemus sagittatus	Speckled Warbler	V
Meliphagidae		
Grantiella picta	Painted Honeyeater	V
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subsp.)	V
Xanthomyza phrygia	Regent Honeyeater	E1

Petroicidae		
Melanodryas cucullata	Hooded Robin	V
Pomatostomidae		
Pomatostomus temporalis temporalis	Grey-crowned Babbler (south-eastern sub-species)	V
Estrilidae		
Stagonopleura guttata	Diamond Firetail	V

Notes: V – Vulnerable, E1 – Endangered (TSC Act)

E. INVERTEBRATES

Scientific Name	Common Name	Status
Paralucia spinifera	Bathurst Copper Butterfly	E1
Petalura giganteua	Giant Dragonfly	V

Notes: V – Vulnerable, E1 – Endangered (TSC Act)

All of the 36 threatened species listed in **Table 3** have the potential to occur within Baal Bone Colliery, and seven of these species are known to occur within Baal Bone Colliery. Consequently, all 36 threatened species would require an Assessment of Significance test if any development goes ahead. This assessment is undertaken in **Section 5.0**.

5.0 APPLICATION OF AN ASSESSMENT OF SIGNIFICANCE ("7-Part Test") TO THREATENED SPECIES KNOWN OR EXPECTED TO OCCUR WITHIN BAAL BONE COLLIERY, PARTICULARLY WITHIN THE SOUTH-WESTERN AREA

5.1 LEGISLATIVE REQUIREMENTS

A development or activity undertaken under the EP&A Act requires an Assessment of Significance to be provided to the appropriate determining authority. Under the *Threatened Species Conservation Amendment Act 2002*, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats (known previously as the "8-part test"), have been revised. This affects s5A EP&A Act, s94 *Threatened Species Conservation Act* 1995 (TSC Act) and s220ZZ *Fisheries Management Act* 1994 (FM Act).

The revised factors (now called "7-part test") maintain the same intent but focus consideration of likely impacts in the context of the local rather than the regional environment as the long-term loss of biodiversity at all levels arises primarily from the accumulation of losses and depletions of populations at a local level. A description of each factor follows, together with short notes on their application. These notes have been taken from "Guidelines for undertaking the Assessment of Significance (Section 5A EP&A Act)" (Department of Environment and Conservation, 2005).

The factors of assessment are:

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

This factor refers only to those species listed on Part 1 and Part 4 of Schedule 1 and Part 1 of Schedule 1A of the TSC Act, and Part 1 and Part 4 of Schedule 4 of the FM Act.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

This factor is essentially identical to factor (a) except that it refers only to endangered populations listed on Part 2 of Schedule 1 of the TSC Act and Part 2 of Schedule 4 of the FM Act, whereas factor (a) refers to species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

This factor applies to endangered ecological communities listed under Part 3 of Schedule 1 of the TSC Act and Part 3 of Schedule 4 of the FM Act, and critically endangered ecological communities listed under Part 2 of Schedule 1A of the TSC Act and Part 2 of Schedule 4A of the FM Act.

(d) in relation to the habitat of a threatened species, population or ecological community:

- **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,**

When applying this factor, consideration must be given to all short-term and long-term impacts (direct and indirect) on habitat that is likely to support threatened biota regardless of whether the habitat occurs on the subject site. This is equally true for occupied and unoccupied habitat as the recovery of threatened species, populations and ecological communities relies on having access to suitable habitat to move into as numbers increase.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

This factor is aimed at assessing whether the proposal is likely to affect (directly or indirectly) areas of critical habitat present in the study area. Critical habitat refers only to those areas of land listed in the Register of Critical Habitat kept by the Director General of DECC and the Register of Critical Habitat kept by the Director General of Department of Primary Industries (DPI).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

When deciding whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan, consideration must be given to relevant approved recovery plans and threat abatement plans.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

This factor refers only to those key threatening processes (KTP) listed on Schedule 3 of the TSC Act and Schedule 6 of the FM Act. In addition to deciding whether the action/activity constitutes a KTP, consideration must also be given to whether the proposal is likely to exacerbate a KTP.

5.2 DETERMINATION OF THREATENED SPECIES LIKELY TO OCCUR

Analysis of the records for threatened species derived from the DECC Wildlife Database (accessed 13th January 2009) and from published and unpublished reports of fauna surveys at Baal Bone Colliery shows that there are 36 Threatened species known to occur within 20km of the Colliery. These are listed in **Table 3** above.

Although listed for the locality (i.e. within 20km of Baal Bone Colliery), not all of the threatened species are likely to occur within the area of woodland habitat in the Colliery, nor are all likely to be affected by subsidence effects from underground mining. The major impacts from underground mining are upon sensitive habitats such as wetlands, water courses, wet gullies (dells), clifflines and rocky outcrops. The area to be assessed for continued mining does not contain these sensitive habitats. There is an ephemeral water course within the area, but this was dry during the survey and it is unlikely to be considered as permanently watered throughout the year. **Table 4** lists the threatened species known from the locality and determines the likelihood of any impact upon each species.

Table 4: Threatened Animal Species Known From the Locality and the Likelihood of any Impact from the Development

Common Name	Habitat Preferences	Likely to be Affected
Spotted-tailed Quoll	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Eastern Pygmy Possum	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Squirrel Glider	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Yellow-bellied Glider	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Koala	Forest and woodland	Preferred habitat in area, but no loss of feed trees
Brush-tailed Rock-wallaby	Rocky outcrops	No preferred habitat in area, unlikely to be affected
Eastern Freetail Bat	Forest and woodland for foraging and roosting	Preferred habitat in area, but minor loss of resources
Large-eared Pied Bat	Forest and woodland for foraging and caves for roosting	Preferred foraging habitat in area, but loss of resources minimal
Eastern False Pipistrelle	Forest and woodland for foraging and roosting	Preferred habitat in area, but loss of resources minimal
Little Bentwing-bat	Forest and woodland for foraging, caves for roosting	Preferred foraging habitat in area, but loss of resources minimal
Eastern Bent-wing Bat	Forest and woodland for foraging, caves for roosting	Preferred foraging habitat in area, but loss of resources minimal

Common Name	Habitat Preferences	Likely to be Affected
Greater Broad-nosed Bat	Forest and woodland for foraging and roosting	Preferred habitat in area, but loss of resources minimal
Rosenberg's Goanna	Heath and rocky outcrops	Preferred habitat not significantly affected
Blue Mountains Water Skink	Wetlands, water courses	No preferred habitat in area, unlikely to be affected
Broad-headed Snake	Exfoliated rocky surfaces, trees with hollows	Preferred habitat in area, but loss of resources minimal
Red-crowned Toadlet	Moist, narrow rock crevices	No preferred habitat in area, unlikely to be affected
Stuttering Frog	Water courses	No preferred habitat in area, unlikely to be affected
Bathurst Copper Butterfly	Requires blackthorn	Limited blackthorn in area, and loss of resources minimal
Giant Dragonfly	Edges of wetlands	No preferred habitat in area, unlikely to be affected
Square-tailed Kite	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Gang-gang Cockatoo	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Glossy Black-Cockatoo	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Swift Parrot	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Turquoise Parrot	Woodland and grassland	Preferred habitat in area, but minor loss of resources
Barking Owl	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Powerful Owl	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows

Common Name	Habitat Preferences	Likely to be Affected
Masked Owl	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows
Sooty Owl	Forest and woodland	Preferred habitat in area, but no loss of trees with hollows or rocky outcrops
Brown Treecreeper	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Speckled Warbler	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Painted Honeyeater	Mistletoe and woodland	Preferred habitat in area, but minor loss of resources
Black-chinned Honeyeater	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Regent Honeyeater	Blossoming forest and woodlands	Preferred habitat in area, but minor loss of resources
Hooded Robin	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Grey-crowned Babbler	Forest and woodlands	Preferred habitat in area, but minor loss of resources
Diamond Firetail	Forest and woodlands	Preferred habitat in area, but minor loss of resources

From the above analysis, it can be seen that the potential for any threatened species to be significantly affected is very low. The effects from underground mining on areas of woodland have been shown to be low or not measurable (see on-going monitoring reports for Baal Bone Colliery). Consequently, it is possible to conclude that there should be no significant impacts upon any population of threatened species found within the existing approved workings of Baal Bone Colliery. However, to ensure a complete assessment is undertaken the majority of the species listed above will be subjected to an Assessment of Significance (7-part test).

The following threatened species have not been addressed in this assessment because there is no preferred habitat within the currently mined area and remnant areas:

- Red-crowned Toadlet;
- Stuttering Frog;
- Giant Dragonfly;
- Blue Mountains Water Skink;
- Brush-tailed Rock-wallaby;
- Rosenberg's Goanna; and
- Broad-headed Snake.

The remaining 29 species are assessed in the following section.

5.3 NOTES ON THE 7-PART TEST

The application of the 7-part test of significance to each threatened species is based upon their known or expected presence within the existing approved workings at Baal Bone Colliery and the potential impacts due to mine disturbance (primarily subsidence) and any surface disturbance from infrastructure construction and operation. Subsidence due to longwall mining may result in destabilisation of cliff-lines and changes to hydrology of creek systems and swamps.

The on-going monitoring of a range of fauna (mammals including bats, avifauna, reptiles and amphibians), particularly threatened species, within sites sampling woodland habitat, creeks, swamps and valley forest within Baal Bone Colliery will ensure that any effects from subsidence can be recognised quickly.

From the results of the detailed assessment of potential impacts upon the threatened species listed under the NSW TSC Act likely to occur within Baal Bone Colliery (see Appendix 1 for this assessment) it is concluded that it is unlikely that any threatened species would be significantly affected by the operation of the existing surface infrastructure area (including the coal handling and preparation plant, stockpiles and infrastructure), as well as coal haulage via road and rail from the site. There is no need for any Species Impact Statement to be developed for any of the species assessed.

6.0 APPLICATION OF ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 TO FAUNA KNOWN OR EXPECTED TO OCCUR WITHIN THE SOUTH-WESTERN AREA AT BAAL BONE COLLIERY

6.1 BACKGROUND

With the commencement of the Environment Protection and Biodiversity Conservation Act (EPBC Act) it is now necessary to assess whether an action[1] is likely to have a significant impact on a matter of national environmental significance. Consequently, all actions are subject to an assessment and approval process. Matters of National Environmental Significance (NES) identified in the EPBC Act are:

- World Heritage properties;
- Ramsar wetlands;
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas, and
- Nuclear actions.

Those matters relevant to any action at Baal Bone Colliery are nationally threatened species and ecological communities and migratory species.

Threatened species are listed under the EPBC Act as:

- Extinct in the wild; or
- Critically endangered; or
- Endangered; or

[1] An action includes a project, development, undertaking or an activity or series of activities.

- Vulnerable.

Ecological communities are listed as critically endangered and endangered.

There are criteria for assessing whether an impact upon a threatened species or ecological community is significant and would trigger an approval under the Act. The criteria are essentially the same for critically endangered, endangered or vulnerable species and are:

An impact is significant if:

- Decreases the size of a population (“important population of a species” for vulnerable), or
- Reduces the area of occupancy of the species (“an important population” for vulnerable), or
- Fragments an existing population into two or more populations (add “important” for vulnerable), or
- Adversely affects critical habitat, or
- Disrupts the breeding cycle of a population, or
- Modifies, destroys, removes, isolates or decreases the availability or quality of habitat to the extent that the species is likely to decline, or
- Introduces potentially harmful species into habitat, or
- Interferes with the recovery of the species (add “substantially” for vulnerable).

An impact on a critically endangered ecological community or an endangered community is significant if it:

- Adversely affects an ecological community, or
- Reduces the extent of a community, or
- Fragments an occurrence of the community, or
- Adversely affects critical habitat, or
- Modifies or destroys abiotic (non-living) factors necessary for the community’s survival, or
- Introduces potentially harmful species into an ecological community, or
- Interferes with the recovery of an ecological community.

There is also a requirement for approval under the EPBC Act if an action has a significant impact upon a migratory species. An impact upon a migratory species is significant if it:

- Modifies (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroys or isolates an area of habitat important for the survival of the species in Australia, or
- Introduces invasive species into important habitat of the species, or
- Seriously disrupts the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically meaningful proportion of the population of the species.

These criteria must be applied to any listed species or community that may occur within the South-western Area at Baal Bone Colliery.

6.2 POTENTIAL LISTED SPECIES AND COMMUNITIES

An inquiry to the online database for the EPBC Act, on the Environment Australia web site (http://www.environment.gov.au/epbc), provided an EPBC Act Protected Matters Report. This showed that there are 12 migratory species, 20 threatened species and 12 Listed Marine Species (11 of these are species that overfly marine areas during migration) known from an area of 50km radius surrounding Baal Bone Colliery. These are listed in **Table 5**.

An assessment whether each of these species would occur within the South-western Area and whether any species could be affected by the development follows.

TABLE 5: POTENTIAL THREATENED AND MIGRATORY FAUNA SPECIES

Scientific Name	**Common Name**	**Status**
Haliaeetus leucogaster	White-bellied Sea-Eagle	Migratory, Listed Marine Species
Hirundapus caudacutus	White-throated Needletail	Migratory, Listed Marine Species (overfly)
Myiagra cyanoleuca	Satin Flycatcher	Migratory, Listed Marine Species (overfly)
Rhipidura rufifrons	Rufous Fantail	Migratory, Listed Marine Species (overfly)
Gallinago hardwickii	Latham's Snipe	Migratory, Listed Marine Species (overfly)
Rostratula benghalensis	Painted Snipe	Migratory, Listed Marine Species (overfly)
Merops ornatus	Rainbow Bee-eater	Migratory, Listed Marine Species (overfly)
Monarcha melanopsis	Black-faced Monarch	Migratory, Listed Marine Species (overfly)
Ardea alba	Great Egret	Migratory, Listed Marine Species (overfly)
Ardea ibis	Cattle Egret	Migratory, Listed Marine Species (overfly)
Apus pacificus	Fork-tailed Swift	Migratory, Listed Marine Species (overfly)
Xanthomyza phrygia	Regent Honeyeater	Endangered, Migratory
Rostratula australis	Australian Painted Snipe	Vulnerable
Polytelis swainsonii	Superb Parrot	Vulnerable
Lathamus discolor	Swift Parrot	Endangered, Listed Marine Species (overfly)
Dasyurus maculatus ssp. *maculatus*	Spotted-tailed Quoll	Endangered
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable
Nyctophilus timoriensis	Eastern Long-eared Bat	Vulnerable
Isoodon obesulus obesulus	Southern Brown Bandicoot	Endangered
Potorous tridactylus tridactylus	Long-nosed Potoroo	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Eulamprus leuraensis	Blue Mountains Water Skink	Endangered
Hoplocephalus bungaroides	Broad-headed Snake	Vulnerable
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable
Litoria littlejohni	Heath Frog	Vulnerable
Mixophyes balbus	Stuttering Frog	Vulnerable
Paralucia spinifera	Purple Copper Butterfly	Vulnerable
Macquaria australasica	Macquarie Perch	Endangered
Prototroctes maraena	Australian Grayling	Vulnerable
Maccullochella peelii peelii	Murray Cod	Vulnerable

6.3 DESCRIPTION OF EXPECTED IMPACTS

There is little likelihood of any significant effects from the longwall mining. There are no swamps or other wetlands within the Area, although there are swamps associated with nearby Cox's River. Although rocky formations are considered to be sensitive to subsidence, these formations are not found within the south-western area of the Colliery (adjacent to LW18A).

On-going monitoring of fauna populations and wildlife habitats will occur within and close to the south western area should mining of the remnant coal resources (see Figure 1) occur. Changes in species diversities and habitat condition that could indicate some influence from subsidence will be responded to by Baal Bone Colliery.

6.4 WOULD ANY LISTED SPECIES BE AFFECTED?

Each listed species is assessed in terms of likelihood of occurrence in the remnant areas within the existing workings, and the likelihood of a significant impact from the development if the species could occur. This assessment is given in Appendix 2 of this report.

From the analysis provided in Appendix 2 of the threatened and migratory species listed under the Commonwealth EPBC Act that could potentially occur within the remnant areas within the existing workings at Baal Bone Colliery, it is concluded that it is unlikely that any such species would be significantly affected by the continued underground mining within the remnant areas within the existing workings at Baal Bone Colliery.

APPENDIX 1: ASSESSMENT OF SIGNIFICANCE FOR THREATENED SPECIES LIKELY TO OCCUR AT BAAL BONE COLLIERY

Bathurst Copper Butterfly *Paralucia spinifera*

A small butterfly with a thick body and wings coloured black or deep brown and displaying a bronze or green iridescence.

Distribution:

General The Bathurst Copper (or Purple) Butterfly occurs on the Central Tablelands in an area generally bounded by Oberon, Hartley and Bathurst (NPWS 1999).

Locality There is a cluster of records of this species in lower altitude land about 15km to the south of the Colliery.

Baal Bone Colliery There are no records of this species within the boundaries of the Colliery.

Preferred Habitat:
This butterfly occurs above 900m in altitude and is generally associated with exposure to full day sun. It is closely associated with the shrub Blackthorn, *Bursaria spinosa*, and the ant, *Ananychomyrma itinerans*, for breeding. Blackthorn is associated with the drier woodland communities such as the Tablelands Dry Woodland and Tablelands Grassy Woodland Complex.

Occurrence of Habitat within Baal Bone Colliery:
All preferred habitats are widely distributed throughout the Colliery, although there is little evidence for the presence of Blackthorn.

Sensitivity to Disturbance:

Woodland habitat has a low sensitivity to disturbance by subsidence. It is concluded that the Bathurst Copper Butterfly would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from State Forests in the region.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Bathurst Copper Butterfly is closely associated with the shrub Blackthorn, *Bursaria spinosa*, and the ant, *Ananychomyrma itinerans*. These are mainly found at lower altitudes than that within the study area and it is unlikely that this species would be found in the Colliery. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

There is limited preferred habitat of the Bathurst Copper Butterfly within the Colliery and none of this habitat would be affected by subsidence.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The threat abatement objectives of the recovery plan for the Bathurst Copper Butterfly are to prevent the continuation of factors that are detrimentally affecting the butterfly and its habitat, and to prevent the occurrence of activities that may affect the butterfly and its habitat. As no preferred habitat should be affected by subsidence the action is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Bathurst Copper Butterfly would not be significantly affected by the development.

Square-tailed Kite *Lophoictinia isura*

This raptor is usually seen singly, soaring over woodland and forest canopy in search of bird nestlings for food.

Distribution:

General The Square-tailed Kite is found throughout much of Australia, and within all of NSW. Although widely distributed, it is considered rare over its range (Morcombe, 2000). There are scattered records of this species throughout NSW, with most records being along the coast and tablelands.

Locality There are two records for the Square-tailed Kite within 20km of the Colliery.

Colliery There are no records within the boundaries of the Colliery.

Preferred Habitat:

The Square-tailed Kite inhabits forest and woodland habitats and is often associated with ridge and gully forests (NPWS, 1999). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Square-tailed Kite would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from the following National Parks: Goulburn River, Wollemi, Morton, Mount Kaputar, Ingalba, Mootwingee and Ben Boyd. Also found in the following Nature Reserves: Nocoleche, Morrisons Lake and Macquarie Marshes (NPWS, 1999).

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

There are no records of the Square-tailed Kite within the Colliery and any preferred habitat (woodland) would not be affected by the proposed action. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Square-tailed Kite but the species profile lists the following priority actions:

- Protect known habitat from fires of a frequency greater than that recommended for the retention of biodiversity.
- Retain and protect nesting and foraging habitat, particularly along watercourses.
- Report suspected illegal bird shooting and egg-collecting to DEC.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Square-tailed Kite would not be significantly affected by the development.

Barking Owl *Ninox connivens*

A robust owl with piecing yellow eyes that roosts by day in leafy trees, often near watercourses. It nests in tree hollows.

Distribution:

General The Barking Owl occurs in northern, eastern and south-western Australia. This species is found throughout most of NSW, but is most abundant in the west of the State (NPWS, 2003b).

Locality There are six records of the Barking Owl within the locality of the Colliery.

Colliery There are no records for the Barking Owl within the boundaries of the Colliery.

Preferred Habitat:

It inhabits open forest and woodland in warm lowland areas on gentle terrain and roosts by day in dense streamside galleries and thickets (Ayres *et al*, 1996). It breeds in hollows of large eucalypts or paperbarks, usually near water courses or wetlands (NPWS, 2003b). All the woodland communities would represent the preferred habitats of this species.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery, although there are no sufficiently large watercourses in the Colliery.

Sensitivity to Disturbance:

The communities have a low sensitivity to disturbance by subsidence. It is concluded that the Barking Owl would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

According to the recovery plan for the Barking Owl (NPWS, 2003b), this bird is known from 53 conservation reserves in NSW, including Goulburn River, Kanangra-Boyd, Blue Mountains and Wollemi National Parks. It is also known from 25 State Forests.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,* There are no records of the Barking Owl within the Colliery despite several surveys for nocturnal fauna and any preferred habitat (woodland) would not be affected by the proposed action. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The objectives of the recovery plan for the Barking Owl include:

- Increase understanding of the biology, ecology and management of the Barking Owl
- Undertake threat abatement and mitigation (actions include Protect known Barking Owl nest sites and surrounding habitat; Assist with the protection of Barking Owl habitat from disturbance due to developments and activities)

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Barking Owl would not be significantly affected by the development.

Powerful Owl *Ninox strenua*

A very large owl with large golden eyes that roosts in on tree branches and nests in tree hollows.

Distribution:

General This species is mainly distributed along the coast and tablelands of NSW.

Location There are 17 records of the Powerful Owl distributed throughout the 20km area surrounding the Colliery, the closest being about 1.5km to the north-west.

Colliery The Powerful Owl has not been located within the Colliery.

Preferred Habitat:

This species is associated with moist and dry sclerophyll forests and woodlands, often with dense vegetation and old trees in sheltered valleys (Ayres *et al*, 1996). All the woodland communities would represent the preferred habitats of this species.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Powerful Owl would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Blue Mountains, Wollemi, Royal, Kur-ring-gai Chase and Kanangra-Boyd National Parks.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

There are no records of the Powerful Owl within the Colliery despite several surveys for nocturnal fauna and any preferred habitat (woodland) would not be affected by the proposed action. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Recovery Plan for the Large Forest Owls (DEC 2005) includes the Powerful Owl. There are several objectives for this species including minimising further loss and fragmentation of habitat outside conservation reserves and the mitigation of development related threats. The DECC web site provides a list of priority actions for this species. These are:

- Apply low-intensity, mosaic pattern fuel reduction regimes.
- Searches for the species should be conducted in suitable habitat in proposed development areas and proposed forest harvesting compartments.

- Retain at least a 200 metre buffer of native vegetation around known nesting sites.
- Retain large stands of native vegetation, especially those containing hollow-bearing trees.
- Protect riparian vegetation to preserve roosting areas.
- Protect hollow-bearing trees for nest sites. Younger recruitment trees should also be retained to replace older trees in the long-term.
- Minimise visits to nests and other disturbances, including surveys using call playback, when owls are breeding.
- Assess the importance of the site to the species' survival. Include the linkages the site provides for the species between ecological resources across the broader landscape.

The action would be consistent with such priority actions.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Powerful Owl would not be significantly affected by the development.

Masked Owl *Tyto novaehollandiae*

This species lives in dry eucalypt forests and woodlands from sea level to 1100 m and roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. This habitat is available, albeit limited, within the study area and there are few trees containing hollows within the study area and these could be utilised for shelter and breeding.

Distribution:

General This species is mainly distributed along the coast and tablelands of NSW.

Location There is only one record of the Masked Owl within the 20km area surrounding the Colliery.

Colliery The Masked Owl has not been located within the Colliery.

Preferred Habitat:

This species is associated with dry sclerophyll forests and woodlands in the west and wet forests on the coast, often with dense vegetation and old trees in sheltered valleys. All the woodland communities would represent the preferred habitats of this species. It roosts and nests in tree hollows.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Masked Owl would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from a number of conservation reserves and State Forests.

(a) *in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

As no trees with hollows will be affected, it is unlikely that the life cycle of the Masked Owl will be significantly affected.

(b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the study area.

(c) *in the case of an endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not relevant to this assessment.

d) In relation to the habitat of a threatened species, population or ecological community:
i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Recovery Plan for the Large Forest Owls (DEC 2005) includes the Masked Owl. There are several objectives for this species including minimising further loss and fragmentation of habitat outside conservation reserves and the mitigation of development related threats. The DECC web site provides a list of priority actions for this species. These are:

- Drive carefully at night through forest areas.
- Retain and protect stands of native vegetation, especially those with hollow-bearing trees.
- Retain hollow-bearing trees as well as large, mature trees that will provide hollows in the future.
- Limit the use of pesticides used in suitable native habitat.

The action would be consistent with such priority actions.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Masked Owl would not be significantly affected by the development.

Sooty Owl *Tyto tenebricosa*

Sooty Owls are limited mainly to the tall, moist eucalypt forests and rainforests of the escarpments and coastal areas. They are strongly associated with sheltered gullies with tall, dense understorey. This species roost in hollows in live or occasionally dead trees, caves or recesses in cliffs. Preferred habitat is available, albeit limited, within the study area and there are few trees containing hollows within the study area and these could be utilised for shelter and breeding.

Distribution:

General This species is mainly distributed along the coast and eastern tablelands of NSW.

Location There is only one record of the Sooty Owl within the 20km area surrounding the Colliery.

Colliery The Sooty Owl has not been located within the Colliery.

Preferred Habitat:

This species is associated with tall, moist eucalypt forests and rainforests of the escarpment and coastal areas. Some sheltered gullies within the Colliery, but not found in the South-western Area would represent the preferred habitats of this species. Roosts and nests in tree hollows.

Occurrence of Habitat within Colliery:

There is limited preferred habitat within the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Sooty Owl would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from a number of conservation reserves and State Forests.

APPLICATION OF 7-PART TEST:

(a) *in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

As no trees with hollows will be affected, it is unlikely that the life cycle of the Sooty Owl will be significantly affected.

(b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the study area.

(c) *in the case of an endangered ecological community, whether the action proposed:*
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not relevant to this assessment.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Recovery Plan for the Large Forest Owls (DEC 2005) includes the Sooty Owl. There are several objectives for this species including minimising further loss and fragmentation of habitat outside conservation reserves and the mitigation of development related threats. The DECC web site provides a list of priority actions for this species. These are:

- Retain and protect stands of rainforest and moist forest, especially those with hollow-bearing trees.
- Retain hollow-bearing trees as well as large, mature trees that will provide hollows in the future.
- Limit the use of pesticides used in suitable native habitat.

The action would be consistent with such priority actions.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Sooty Owl would not be significantly affected by the development.

Glossy Black-Cockatoo *Calyptorhynchus lathami*

Small blackish brown cockatoo with a broad, bulbous bill.

Distribution:

General The Glossy Black-Cockatoo is found throughout eastern NSW where it occurs in coastal or inland woodlands and forests or timbered watercourses.

Locality There are 30 records of the Glossy Black-cockatoo distributed throughout the 20km area surrounding the Colliery.

Colliery There one record for this species within the boundaries of the Colliery, near the LW29-31 in the south east of the Colliery's mining lease area.

Preferred Habitat:

This species is closely associated with she-oaks (*Casuarina* and *Allocasuarina* species) for food and hollows in mature or dead trees for nesting (Ayres *et al*, 1996). Woodland communities containing she-oak species would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Area.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Glossy Black-cockatoo would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Blue Mountains, Wollemi, Goulburn River, Morton, Brisbane Waters and Kanangra-Boyd National Parks, as well as many conservation reserves along the NSW coast.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

There is one record of the Glossy Black-cockatoo within the Colliery and it is likely that it would feed upon any she-oaks in the Colliery. However, any preferred habitat (woodland) would not be affected by the proposed action. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Glossy Black-cockatoo but the species profile lists the following priority actions:

- Reduce the impact of burning to retain diverse understorey species and in particular to permit the regeneration of she-oaks.
- Protect existing and future hollow-bearing trees for nest sites.
- Retain and protect areas of native forest and woodland containing she-oaks.
- Establish forested corridors linking remnant areas of habitat; include local she-oak species in bush revegetation works.
- Report suspected illegal bird trapping and egg-collecting to the DEC.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Glossy Black-cockatoo would not be significantly affected by the development.

Gang-gang Cockatoo *Callocephalon fimbriatum*

Small grey and pink parrot with a wispy scarlet crest.

Distribution:

General The Gang-gang Cockatoo is distributed from southern Victoria through south and central-eastern NSW. It is known from the south coast to the Hunter region and inland to the Central Tablelands.

Locality There are 56 records within the locality of the Colliery

Colliery There were several sightings of Gang-gang Cockatoos within the boundaries of the Baal Bone Colliery, particularly within the south-eastern area (near LW29-31).

Preferred Habitat:

In summer this species utilises tall montane forests and woodlands and, in winter, it occurs at lower altitudes in drier more open eucalypt forests and woodlands. It requires tree hollows for breeding, usually close to water. All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Gang-gang Cockatoo would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Blue Mountains, Wollemi, Goulburn River National Parks, as well as many conservation reserves along the NSW coast.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

There are records of the Gang-gang Cockatoo within the Colliery but it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Gang-gang Cockatoo but the species profile lists several priority actions including management of fire to protect tree hollows.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Gang-gang Cockatoo would not be significantly affected by the development.

<u>Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*</u>

A medium-sized insectivorous bird that nests in tree hollows within permanent territories. They forage on tree trunks and on the ground amongst leaf litter.

Distribution:

General The eastern subspecies of the Brown Treecreeper is distributed through south-eastern Queensland, eastern NSW and south-eastern Victoria (Schodde and Mason, 1999). In NSW, they are mainly found on the western slopes of the Great Dividing Range, and are sparsely scattered to the east of the Divide in drier areas, such as western parts of Cumberland Plain (NPWS, 2002c).

Locality There are 73 records of the Brown Treecreeper in the locality of the Colliery.

Colliery There are three records of the Brown Treecreeper within the Colliery. These sightings have been within the LW29-31 Colliery during the on-going monitoring surveys.

Preferred Habitat:

This medium-sized insectivorous bird occupies eucalypt woodlands, mainly with grassy understorey, but is also found in paddocks and grasslands where there are sufficient logs and dead trees nearby (Environment ACT, 1997). It is sedentary and nests in tree hollows within permanent territories. Studies have shown that Brown Treecreepers are unable to disperse to isolated woodland patches and that remnant connectivity influences dispersal success (Cooper, 2000; Cooper *et* al, 2002). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Brown Treecreeper would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from New England, Blue Mountains, Wollemi and Kanangra-Boyd National Parks, and Longneck Lagoon and Munghorn Gap Nature Reserves.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Brown Treecreeper is known to occur within the Colliery but it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,
No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Brown Treecreeper but the species profile includes the following priority actions:

- Modify grazing management practices that will maintain or improve habitat values and still allow some grazing to occur at strategic times of the year.
- Do not allow further loss of dead standing or fallen timber from firewood collection or on-farm practices such as 'tidying up'; do not allow removal of hollow-bearing dead or living trees and stumps on private and public lands.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Brown Treecreeper would not be significantly affected by the development.

Regent Honeyeater *Xanthomyza phrygia*

A striking honeyeater with a black head and back and bold yellow edges to the wings and tail feathers. Forages and nests in the foliage of woodlands.

Distribution:

General Within NSW, the Regent Honeyeater is found from the coast to the western slopes and as far inland as Narrabri (NPWS, 1999). This species is semi-nomadic and will exploit areas when trees are in blossom.

Locality There is a cluster of records to the north of the Colliery. Most records are more than 10km from the Colliery, but there are two records (one in 1996 and another in 2004) at the western and southern edge of the Colliery.

Colliery There are no records of the Regent Honeyeater within the boundaries of the Colliery.

Preferred Habitat:
Mainly found in box-ironbark woodlands and wet lowland forests dominated by Swamp Mahogany, Spotted Gum and River Oak (NPWS, 1999). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within Colliery:
All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:
The communities have a low to moderate potential for disturbance by subsidence. It is concluded that the Regent Honeyeater would have a low sensitivity to disturbance.

Occurrence within Conservation Reserves:

Known from the following National Parks: Yengo, Warrumbungle, Gardens of Stone, Wollemi, Scheyville, Goulburn River, Broadwater, Bundjalong, Yuraygir, Brisbane Waters, Ingalba, Hat Head, Royal and Seven Mile Beach. Also found the following Nature Reserves: Munghorn Gap, Pilliga, Cocklebay, and The Charcoal Tank (NPWS, 1999).

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Regent Honeyeater is not known to occur within the Colliery but there would be preferred habitat (e.g. flowering ironbark) during the year. However, it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is a National and NSW Recovery Plan for the Regent Honeyeater (NSW DEC 2004) that has the objective of ensuring that the species persists in the wild and maintains current status by stopping population decline and securing habitat extent and quality in currently regularly used areas, ensuring that the current significant habitat area remain viable and to undertake habitat improvement at strategic sites. There are several priority actions for this species are available from the DECC web site. These are:

- Maintain a captive population of Regent Honeyeaters.
- Provide landholders and other community members with information on the ecology and conservation requirements of the Regent Honeyeater. Use incentives on private land to encourage landholders to manage key areas.
- Encourage landholders/agistees to remove stock from sensitive riparian breeding sites.
- No loss of mature key nectar tree species. Minimise the removal of mistletoes at key sites.
- Protect and enhance key breeding and foraging habitats.
- Encourage natural regeneration and increase the remnant size of known and potential Regent Honeyeater habitats.
- Continue treeplanting programs at key breeding and foraging locations.
- No further loss of known woodland and forest habitat throughout the range of the Regent Honeyeater from developments.
- Conduct research into habitat selection in non-breeding season and long-distance movements.
- Investigate impacts of interspecific competition for resources and nest predation by native birds.

The action would be consistent with such priority actions.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Regent Honeyeater would not be significantly affected by the development.

Swift Parrot *Lathamus discolor*

A slender mid-green parrot related to rosellas, with nectar-eating habits of lorikeets.

Distribution:

General Swift Parrots migrate to mainland Australian from Tasmania during winter to feed on blossoms. Bred in Tasmania. They are found in the coast, tablelands and western slopes of NSW.

Locality There is a cluster of records to the north of the Colliery.

Colliery There are no records of the Swift Parrot within the boundaries of the Colliery.

Preferred Habitat:

Mainly found in dry sclerophyll forests and woodlands. All the woodland communities would represent the preferred habitats of this species e.g. Newnes Plateau Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Swift Parrot would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Royal, Kur-ring-Gai Chase and Brisbane Waters National Parks, as well as many conservation reserves along the NSW coast.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Swift Parrot is not known to occur within the Colliery but there would be preferred habitat. However, it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Swift Parrot but the species profile includes the following priority actions:

- Searches for the species should be conducted in suitable habitat in proposed development areas. Known feeding areas should be protected.
- Retain stands of winter-flowering feed-trees, particularly large mature individuals.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Swift Parrot would not be significantly affected by the development.

Turquoise Parrot *Neophema pulchella*

A small grass-green coloured parrot with a swift flight. Nests in dead stump or spout of eucalypt.

Distribution:

General The Turquoise Parrot is found throughout eastern Australia and its range in NSW extends from the coast to the western slopes and plains (its western limit is about the eastern edge of the Western Division).

Locality Known from ten sites in the locality of the Colliery, mainly to the north.

Colliery The Turquoise Parrot was located in open grassland near the old open cut during the 1980 surveys.

Preferred Habitat:

Edges of woodland adjoining clearings and on timbered ridges and creeks in farmland (Blakers *et al*, 1984). This parrot forages on the ground for seeds of grasses and forbs. "In my experience the birds have always been found in open forest and grassy glades in woodland close to a creek that contains permanent waterholes. The open forests of Yellow Box, White Box and Blakely's Redgum appear to be particularly favoured" (P.65, Morris, 1980). Nests are located in hollows of small trees, stags and fence posts[2]. All the woodland communities would represent the preferred habitats of this species.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Turquoise Parrot would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from a number of conservation reserves in eastern and central NSW, including the Blue Mountains National Park.

[2] Higgins, P.J. 1999 *Handbook of Australian, New Zealand and Antarctic Birds Volume 4.* Oxford University Press, Melbourne

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Turquoise Parrot is not known to occur within the Colliery in recent years, but there would be preferred habitat. However, it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),* No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Turquoise Parrot but the species profile includes the following priority actions:

- Undertake fox and feral cat control programs in key habitat areas.
- Retain areas of open woodland with grassy under-storey and adjoining grassland.
- Protect hollow-bearing trees for nest sites. Younger mature trees should also be retained to provide replacements for the older trees when they eventually die and fall over.
- Protect sites where Turquoise Parrots forage and nest from heavy, prolonged grazing.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Turquoise Parrot would not be significantly affected by the development.

Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*

The Hooded Robin is a small ground and aerial feeding insectivore that has experienced substantial declines in agricultural regions.

Distribution:

General The south-eastern form of the Hooded Robin occurs within the Central Tablelands and Blue Mountains.

Locality There are 31 scattered records for the Hooded Robin within the locality of the Colliery.

Colliery There have been no sightings of the Hooded Robin within the Colliery.

Preferred Habitat:

The Hooded Robin favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover[3]. All the woodland communities would represent the preferred habitats of this species e.g. Newnes Plateau Woodland.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Hooded Robin would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Several conservation reserves in the Central Tablelands, including Blue Mountains National Park.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

[3] Final Determination to list the Hooded Robin (south-eastern form), NSW Scientific Committee, NPWS, 26th October, 2001

The Hooded Robin is not known to occur within the Colliery but there would be preferred habitat. However, it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,
No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan, There is no recovery plan for the Hooded Robin but the species profile includes the following priority actions:

- Retain dead timber on the ground in open woodland areas.
- Enhance potential habitat through regeneration by reducing the intensity and duration of grazing.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Hooded Robin would not be significantly affected by the development.

Speckled Warbler *Pyrrholaemus sagittata*

The Speckled Warbler is a small perching bird that forages on the ground and in the understorey. It nests on the ground in grass tussocks, litter and fallen branches.

Distribution:

General The Speckled Warbler is distributed from south-eastern Queensland to Victoria. In NSW, they occupy eucalypt and cypress woodlands with grassy understorey, mainly on the western slopes. They are also found in drier coastal areas such as the Cumberland Plain, western Sydney and the Hunter River (Schodde and Mason 1999).

Locality There are nine scattered records to the north and south of the Colliery.

Colliery There are no records of the Speckled Warbler within the boundaries of the Colliery.

Preferred Habitat:

This species inhabits woodlands with a grassy understorey, often on ridges or gullies. All the woodland communities would represent the preferred habitats of this species e.g. Newnes Plateau Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Speckled Warbler would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Scheyville, Goulburn River, Warrabah and Cocoparra National Parks, and Burning Mountain, Castlereagh and Windsor Downs Nature Reserves. It is also found at St Albans Common.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Speckled Warbler is not known to occur within the Colliery but there would be preferred habitat. However, it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Speckled Warbler but the species profile includes the following priority actions:

- Retain dead timber on the ground in open woodland areas.
- Retain existing vegetation along roadsides, in paddocks and remnant stands of native trees.
- Encourage regeneration of habitat by fencing remnant stands.
- Assess the importance of the site to the species' survival. Include the linkages the site provides for the species between ecological resources across the broader landscape.
- Report any new sightings of the speckled warbler to the Department of Environment and Conservation.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Speckled Warbler would not be significantly affected by the development.

Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*

The Black-chinned Honeyeater is a medium-sized green and white passerine bird with a black head. They are branch and foliage gleaners and breed communally (Schodde and Mason, 1999).

Distribution:

General The eastern subspecies of the Black-chinned Honeyeater is distributed from south-eastern Queensland to Victoria. In NSW, they occupy eucalypt woodlands containing box-ironbark associations and River Red Gum, mainly on the western slopes. They are also found in drier coastal areas such as the Cumberland Plain, western Sydney and the Hunter River (NPWS 2001c).

Locality There are 14 scattered records of the Black-chinned Honeyeater within the locality of the Colliery.

Colliery No Black-chinned Honeyeater has been located within the Colliery.

Preferred Habitat:

This species is found in eucalypt woodlands, especially those containing box-ironbark associations and Red River Gum, within an approximate annual rainfall range of 400-700mm. All the woodland communities would represent the preferred habitats of this species e.g. Newnes Plateau Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Black-chinned Honeyeater would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Blue Mountains, Wollemi, Goulburn River, Scheyville, Weddin, Warrumbungle and Comibla National Parks, and Longneck Lagoon, Ingalba, Castlereagh and Munghorn Gap Nature Reserves. Also known from St Albans Common, Weddin SF and Lake Burragorang catchment.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Black-chinned Honeyeater is not known to occur within the Colliery but there would be preferred habitat. However, it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Black-chinned Honeyeater but the species profile includes the following priority actions:

- Retain suitable woodland habitats, particularly those with unimproved pasture and an intact native ground plant layer.
- Increase the size and connectivity of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Black-chinned Honeyeater would not be significantly affected by the development.

<u>Diamond Firetail *Stagonopleura guttata*</u>

The Diamond Firetail is a brightly coloured finch that occupies woodland where there is a grassy understorey. They nest in trees and bushes and forage on the ground for seeds and insects. Considered a ‘decliner’ species within the western slopes (Reid, 1999)

Distribution:

General The Diamond Firetail is distributed through central and eastern NSW as well as southern and central Queensland, Victoria and Eyre Peninsula, South Australia (NPWS 2001d). In NSW, it mainly occurs west of the Great Dividing Range, although there are populations known from the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys.

Locality There are 37 scattered records within the locality of Colliery.

Colliery There are several records for this species within the boundaries of the Colliery. A small flock appears to be resident within the shrubbery at the Colliery headworks and another flock was sighted in cleared land in the north of the Colliery.

Preferred Habitat:

This bird is found in eucalypt woodlands, forests and mallee where there is grassy understorey. They nest in trees and bushes and forage on the ground. All the woodland communities would represent the preferred habitats of this species e.g. Newnes Plateau Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Diamond Firetail would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from Blue Mountains, Goulburn River, Yengo, and Gunderbooka National Parks.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Diamond Firetail is known to occur within disturbed areas in the Colliery. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:
i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Diamond Firetail but the species profile includes the following priority actions:

- Search for the species in suitable habitat in areas that are proposed for development or management actions.
- Retain dead timber on the ground in open woodland areas.
- Reduce heavy grazing by domestic stock in areas of known or potential habitat, to enable flowering and subsequent seeding of grasses and forbs that this species requires.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Diamond Firetail would not be significantly affected by the development.

<u>Grey-crowned Babbler (south-eastern sub-species) *Pomatostomus temporalis temporalis*</u>

The Grey-crowned Babbler is the largest of the four Australian babblers that lives in large family groups.

Distribution:

General The Grey-crowned Babbler is found throughout large parts of northern Australia and in south-eastern Australia. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Hay.

Locality There is only one sighting of this bird within the locality, to the north-east of the Colliery.

Colliery No records of the Grey-crowned Babbler from within the Colliery boundaries.

Preferred Habitat:

Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Grey-crowned Babbler would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Found in a number of conservation reserves and State Forests.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Grey-crowned Babbler is not known to occur within the Colliery but there would be preferred habitat. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Grey-crowned Babbler but the species profile includes the following priority actions:

- Retain existing woodland vegetation.
- Retain dead timber on the ground in open woodland areas.
- Encourage regeneration of habitat by fencing remnant stands.
- Increase the size of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Grey-crowned Babbler would not be significantly affected by the development.

Painted Honeyeater *Grantiella picta*

The Painted Honeyeater is small bird with a distinctive black head and back and white underparts with dark streaks on the flanks.

Distribution:

General The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution.

Locality There is a single record to the south of the Colliery.

Colliery There are no records of this bird within the Colliery boundaries.

Preferred Habitat:

Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests and a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias.

Occurrence of Habitat within Colliery:

All preferred habitats are sparsely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Painted Honeyeater would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Found in a number of conservation reserves and State Forests.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Painted Honeyeater is not known to occur within the Colliery but there would be limited preferred habitat. It is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Painted Honeyeater but the species profile includes the following priority actions:

- Manage grazing on sites where Painted Honeyeater habitat occurs.

- Encourage regeneration of habitat by fencing remnant stands and undertaking new plantings.
- Protect remnant woodland and open forest throughout the range of the species.
- Regenerate and replant local flora species to maintain breeding and foraging habitat.

Protection of the surface land is part of the actions proposed.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Painted Honeyeater would not be significantly affected by the development.

Koala *Phascolarctos cinereus*

A stocky arboreal marsupial that sends most of its time in trees.

Distribution:

General This species has a fragmented distribution throughout eastern Australia. It is known from both sides of the Great Dividing Range but mainly occurs on the central and northern coasts of NSW.

Locality There are 15 records for the Koala within the locality of the Colliery, all to the east of the Colliery.

Colliery There are no records from within the boundaries of the Colliery.

Preferred Habitat:

The Koala inhabits eucalypt forest and woodland feeding upon preferred tree species such as Ribbon Gum and Forest Red Gum (NPWS, 1999). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Koala would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from the Blue Mountains National Park and 'have been recorded in numerous conservation reserves along the coast and the slopes and tablelands of the Great Dividing Range' (NPWS, 1999). There are listed endangered populations of this species at Hawkes Nest and Pittwater LGA.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Koala is not known to occur within the Colliery despite several surveys. It is highly unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The draft recovery plan for the Koala has seven objectives and which the first is to 'Conserve the Koala in their existing habitat'

The action proposed is consistent with this objective.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Koala would not be significantly affected by the development.

Spotted-tailed Quoll *Dasyurus maculatus*

The Tiger or Spotted-tailed Quoll is a relatively large dasyurid (carnivorous) marsupial that is partly arboreal.

Distribution:

General Sparsely distributed along the Great Dividing Range from Queensland to Victoria.

Locality There are two Spotted-tailed Quoll records known from about two km to the south of the Colliery.

Colliery There are no records of the Spotted-tailed Quoll within the boundaries of the Colliery.

Preferred Habitat:

Tiger Quolls inhabit sclerophyll forests, woodlands and rainforest where they mainly hunt on the ground (Ayres *et al*, 1996). Nest sites are rock shelters, hollow logs or tree hollows. All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Spotted-tailed Quoll would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from the Blue Mountains, Morton, Kanangra-Boyd and Wollemi National Parks. Occurs in numerous conservation throughout eastern NSW (NPWS, 1999).

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Spotted-tailed Quoll is not known to occur within the Colliery despite several surveys, but there is preferred habitat within the Colliery. It is highly unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Spotted-tailed Quoll but the species profile lists several priority actions including:

- Consult with DEC if Spotted-tailed Quolls are raiding poultry, rather than taking direct action.
- Retain and protect large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understorey or dense vegetation along drainage lines.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Spotted-tailed Quoll would not be significantly affected by the development.

Squirrel Glider *Petaurus norfolkensis*

A small arboreal marsupial that can glide between trees.

Distribution:

General The Squirrel Glider is found along the Great Dividing Range and the coastal plains in eastern Australia from Cape York to Victoria. Mainly found on inland slopes.

Locality There are scattered records within the locality of the Colliery.

Colliery A Squirrel Glider responded to a broadcast call and was observed emerging from a small hollow at the base of a dead tree limb in the Colliery during a 2005 survey in 2005 and a Squirrel Glider was trapped in the Northern Area of the Colliery during surveys in 2009.

Preferred habitat:

Generally dry sclerophyll forest and woodlands which have mature or mixed-age stands of more than one eucalypt species. The stands usually include smooth-barked gums and high-nectar-producing species, such as *Acacia,* as a source of carbohydrate during winter (Menkhorst *et al,* 1988). The Squirrel Glider requires hollows in trees as den sites and utilises a range of hollows at various heights in living and dead trees and are known to travel up to 1 km from their foraging area to a preferred hollow (Menkhorst, 1995). Dead trees with hollows and iron-barked eucalypts are preferred nesting sites for this species (Rowston, 1998). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Squirrel Glider would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from the Blue Mountains, Brisbane Water, Goulburn River, Wollemi, Kanangra-Boyd, Tooloom, Border Ranges, Mount Warning, Warrumbungle National Parks and Binnaway Nature Reserve (NPWS, 1999). There are listed endangered populations of this species at Barrenjoey Peninsula and Wagga Wagga.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Squirrel Glider is known to occur within the Colliery and there is preferred habitat. It is highly unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Squirrel Glider but the species profile lists several priority actions including:

- Retain den trees and recruitment trees (future hollow-bearing trees).
- Retain food resources, particularly sap-feeding trees and understorey feed species such as Acacias and banksias.
- Retain and protect areas of habitat, particularly mature or oldgrowth forest containing hollow-bearing trees and sap-feeding trees.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Squirrel Glider would not be significantly affected by the development.

Yellow-bellied Glider *Petaurus australis*

An active, highly mobile large arboreal marsupial.

Distribution:

General Patchily distributed along the Great Dividing Range and coast from Mackay to Melbourne.

Locality There are ten records of the Yellow-bellied Glider to the north-east of the Colliery. There are reports of its presence in Wolgan Valley during the Australian Museum surveys for the Emirate's Resort development.

Colliery There are no records within the boundaries of the colliery, although there have been observations of characteristic 'sap cuts' within wet gullies in the Northern Area of the Colliery.

Preferred Habitat:

This species is found in sclerophyll forests (wet and dry) and woodlands, preferring tall mature forests (Ayres *et al*, 1996). It forages at night in the crowns of eucalypts and at distinctive sap sites on the trunks of trees. During the day it rests in leaf-lined dens in hollow tree limbs and trunks. Recent studies have shown that the probability of Yellow-bellied Glider occurrence was highest at sites located in large patches of old-growth forest (Incoll *et* al, 2001). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery, but would be limited in the remnant areas within the existing workings.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Yellow-bellied Glider would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Known from the Blue Mountains, Kanangra-Boyd, Morton and Brisbane Water National Parks and from Muogamarra Nature Reserve. Occurs in various conservation reserves along the east coast and adjacent inland areas of NSW (NPWS, 1999).

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Yellow-bellied Glider is not known to occur within the Colliery but there is preferred habitat within the Colliery. It is highly unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The recovery plan for the Yellow-bellied Glider has five objectives including:

- To encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat
- To identify and monitor significant populations of the species

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Yellow-bellied Glider would not be significantly affected by the development.

Eastern Pygmy-possum *Cercartetus nanus*

A small arboreal marsupial that mainly feeds on pollen and nectar from banksias, eucalypts and understorey plants.

Distribution:

General This species is distributed in the south-eastern corner of Australia. It is mainly found in coastal areas and tablelands in NSW.

Locality The Eastern Pygmy-possum has recently been captured within stands of banksia shrub at Springvale and Clarence Collieries and is known from old records near Pipers Flat.

Colliery There are no records within the boundaries of the colliery.

Preferred Habitat:

Found in a variety of habitats including wet and dry sclerophyll forest, woodland, coastal banksia scrub and wet heath. All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex, Tablelands Dry Woodland and Cox River Swamps communities.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The communities have a low to moderate sensitivity to disturbance by subsidence. It is concluded that the Eastern Pygmy-possum would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Located in Barren Grounds Nature Reserve, and Budderoo, Royal and Heathcote National Parks and several state forests.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Eastern Pygmy-possum is not known to occur within the Colliery but there is preferred habitat within the southwest portion of the Colliery, particularly within stands of banksia. It is highly unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Eastern Pygmy-possum but the species profile provides priority actions including:

- Avoid frequent burning of habitat.
- Protect habitat in proposed development areas and retain linkages across the broader landscape .
- Avoid overgrazing by stock and fire wood collection in areas of heathy understorey vegetation.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

It is concluded that the Eastern Pygmy-possum would not be significantly affected by the development.

<u>Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*</u>

A medium sized insectivorous bat that roosts in caves etc.

Distribution:

General The Eastern Bentwing Bat is a species that occurs along the coast and ranges from Cape York to Adelaide, and Northern Australia.

Locality There are scattered records of the Eastern Bentwing Bat within the locality of the Colliery.

Colliery This bat has been located, by call analysis, within the LW29-31 SMP Area and in the Northern Area of the Colliery.

Preferred Habitat:

It is cave roosting, congregating at a few select maternity roosts to give birth, with congregations at such roosts often numbering in the many thousands. It spends much of the year in small scattered roosts on caves, mines, tunnels, culverts and suitable buildings emerging at night to forage for insects. In spring, females congregate at a small number of suitable nursery caves where a single young is born in December. These maternity sites are normally situated in limestone cave systems which provide the correct temperature and humidity range to raise the young (Dwyer, 1995). This bat is typically found in well timbered areas where it forages above the tree canopy on small insects. It may travel relatively large distances between roost sites according to seasonal and local needs.

All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland. The roosting habitat (e.g. caves) would be associated with rocky formations and clifflines.

Occurrence of Habitat within the Colliery:

Foraging and roosting habitats are distributed throughout the Colliery, and there is the potential for maternity roosts within the clifflines and rocky outcrops. However, there would not be any maternity roosts within the remnant areas within the existing workings.

Sensitivity to Disturbance:

The woodland communities have a low to moderate sensitivity to disturbance by subsidence. However, the rocky formations are considered to be sensitive to subsidence. This could result in loss of roosting habitat due to cliff collapse. However, there is a likelihood of the creation of preferred habitat (cliff cracks) and it is concluded that the Eastern Bentwing Bat would have a moderate sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

This species is represented in Newington Nature Reserve and Sydney Harbour, Wollemi, Blue Mountains and Kur-ring-gai National Parks.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Eastern Bentwing Bat is known to occur within the Colliery and there is preferred foraging habitat within the remnant areas to the south west of Colliery. Rocky formations are considered to be sensitive to subsidence, but these formations are limited within the Colliery and will possibly be avoided during underground mining. Also, there is a likelihood of the creation of preferred habitat (cliff cracks) and it is concluded that it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Eastern Bentwing Bat but the species profile provides priority actions including:

- Retain native vegetation around roost sites, particularly within 300 m of maternity caves.
- Minimise the use of pesticides in foraging areas.
- Protect roosting sites from damage or disturbance.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Eastern Bent-wing Bat would not be significantly affected by the development.

Eastern False Pipistrelle *Falsestrelis tasmaniensis*

A large and robust insectivorous bat that flies within or just below the tree canopy.

Distribution:

General The Eastern False Pipistrelle is known from south eastern Queensland, eastern NSW, Victoria and Tasmania.

Locality There are 15 scattered records of the Eastern False Pipistrelle in the locality of the Colliery.

Colliery There are no records within the boundaries of the Colliery.

Preferred Habitat:

This species prefers forests and woodlands, particularly wet habitats where trees are more than 20m high (Churchill, 1998). It roosts in tree hollows and occasionally caves and buildings (Ayres *et al*, 1996). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland. The occasional roosting habitat of caves would be associated with rocky formations.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The woodland communities have a low to moderate sensitivity to disturbance by subsidence and rocky formations are considered to be highly sensitive to subsidence (loss of roosting habitat due to cliff collapse). However, this species mainly roosts in tree hollows and it is concluded that the Eastern False Pipistrelle would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

There are records for this bat from Blue Mountains, Goulburn River and Wollemi National Parks, and it likely to use other reserves for forage and roost habitat.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Eastern False Pipistrelle is not known to occur within the Colliery but there is preferred habitat within the south western portion of the Colliery. Rocky formations are considered to be sensitive to subsidence, but these formations are limited within the Colliery and will possibly be avoided during underground mining. Also, there is a likelihood of the creation of preferred habitat (cliff cracks) and it is concluded that it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Eastern False Pipistrelle but the species profile provides priority actions including:

- Retain native vegetation that is floristically and structurally diverse.
- Minimise the use of pesticides within or adjacent to areas where insectivorous bats occur.
- Protect roost sites from disturbance.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Eastern False Pipistrelle would not be significantly affected by the development.

Eastern Freetail-bat *Mormopterus norfolkensis*

An insectivorous bat that prefers open areas and waterways.

Distribution:

General East coast of NSW, mainly on the coastal side of the Great Dividing Range.

Locality There is one record of the Eastern Freetail-bat in the locality of the Colliery.

Colliery There are no records within the boundaries of the Colliery.

Preferred Habitat:

This species prefers dry sclerophyll forests and woodlands with a preference for open spaces and are more active in the upper slopes of forest areas rather than in riparian areas (Churchill, 2008). It roosts in tree hollows and occasionally buildings.

Occurrence of Habitat within the Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The woodland communities have a low to moderate sensitivity to disturbance by subsidence and rocky formations are considered to be highly sensitive to subsidence (loss of roosting habitat due to cliff collapse). However, this species mainly roosts in tree hollows and it is concluded that the Eastern Freetail-bat would have a low sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

There are records for this bat from Blue Mountains, Goulburn River and Wollemi National Parks, and it likely to use other reserves for forage and roost habitat.

APPLICATION OF 7-PART TEST:

(a) *in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Eastern Freetail-bat is not known to occur within the Colliery but there is preferred habitat within the south western portion of the Colliery. It is concluded that it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No such population is known to exist.

(c) in the case of an endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community is present in the study area.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as result of the result of the action proposed, and

The extent of removal or modification of habitat will be slight.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as result of the proposed action, and

No area of habitat will become fragmented or isolated as result of the action proposed.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The amount of habitat to be removed, modified, fragmented or isolated will be small compared to that available in the area.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat for the species is yet to be defined.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for this species, but the priority actions for this species include:

Retain hollow-bearing trees and provide for hollow tree recruitment.

Retain foraging habitat.

Minimise the use of pesticides in foraging areas.

Hollow-bearing trees and foraging habitat will be retained during the construction and maintenance of the power lines.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development is not recognised as a key threatening process.

From the above test, it is concluded that the Eastern Freetail-bat would not be significantly affected by the development.

Large-eared Pied Bat *Chalinolobus dwyeri*

An insectivorous bat with large ears and curly wattles.

Distribution:

General The Large-eared Pied Bat is distributed in south eastern Queensland and from the coast to the western slopes in NSW.

Locality There are 22 records to the east and south of the Colliery.

Colliery This species has been located by call analysis in the Northern Area of the Colliery.

Preferred Habitat:

The Large-eared Pied Bat is found in dry forest and woodland habitats and mainly roost in caves and mines (Churchill, 1998). All the woodland communities would represent the preferred habitats of this species. These include Tablelands Grassy Woodland Complex and Tablelands Dry Woodland. The roosting habitat of caves could be associated with rocky formations.

Occurrence of Habitat within Colliery:

All preferred habitats are widely distributed throughout the Colliery.

Sensitivity to Disturbance:

The woodland communities have a low to moderate sensitivity to disturbance by subsidence and rocky formations are considered to be highly sensitive to subsidence (loss of roosting habitat due to cliff collapse). However, the loss of roosting habitat due to subsidence would be balanced by the creation of new roosting habitat (from cracking) and it is concluded that the Large-eared Pied Bat would have a moderate sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

This bat is found in the Warragamba Dam catchment area, as well as Wollemi, Kanangra-Boyd and Blue Mountains National Parks.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Large-eared Pied Bat is known to occur within the Colliery and there is preferred habitat within the south western portion of the Colliery. Rocky formations are considered to be sensitive to subsidence, but these formations are limited within the Colliery and will possibly be avoided during underground mining. Also, there is a likelihood of the creation of preferred habitat (cliff cracks) and it is concluded that it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Large-eared Pied Bat but the species profile provides priority actions including:

- Protect known and potential habitat from burning at too-frequent intervals.
- Reduce the use of pesticides and consider alternatives where available.
- Protect known and potential forest and woodland habitat around cliffs, rock overhangs and old mine workings from clearing and isolation.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Large-eared Pied Bat would not be significantly affected by the development.

Little Bentwing-bat *Miniopterus australis*

Little Bentwing-bats are small chocolate brown insectivorous bats with a body length of about 45 mm.

Distribution:

General Coastal north-eastern NSW and eastern Queensland.

Locality There is one record about 11km north-east of the Colliery.

Colliery This species has not been located in the Colliery.

Preferred Habitat:

Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.

Occurrence of Habitat within Colliery:

Preferred foraging habitats are widely distributed throughout the Colliery and roosting habitat could be found in the rocky outcrops.

Sensitivity to Disturbance:

The woodland communities have a low to moderate sensitivity to disturbance by subsidence and rocky formations are considered to be highly sensitive to subsidence (loss of roosting habitat due to cliff collapse). However, the loss of roosting habitat due to subsidence would be balanced by the creation of new roosting habitat (from cracking) and it is concluded that the Little Bentwing-bat would have a moderate sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Found in a number of conservation reserves and State Forests.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Little Bentwing-bat is not known to occur within the Colliery but there is preferred habitat within the south western portion of the Colliery. Rocky formations are considered to be sensitive to subsidence, but these formations are limited within the Colliery and will possibly be avoided during underground mining. Also, there is a likelihood of the creation of preferred habitat (cliff cracks) and it is concluded that it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Little Bentwing-bat but the species profile provides priority actions including:

- Retain stands of native vegetation.
- Reduce use of pesticides.
- Protect known roosting and nursery sites and surrounding forest.
- Check with DECC before undertaking recreational caving activities.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Little Bentwing-bat would not be significantly affected by the development.

Greater Broad-nosed Bat *Scoteanax rueppellii*

A large powerful bat with a broad head and a short square muzzle.

Distribution:

General The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m.

Locality There are three records to the south of the Colliery.

Colliery This species has not been located in the Colliery.

Preferred Habitat:

This species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.

Occurrence of Habitat within Colliery:

Preferred foraging and roosting habitats are widely distributed throughout the Colliery. However, this bat is unlikely to occur in much of the Colliery as it does not occur at altitudes above 500m.

Sensitivity to Disturbance:

The woodland communities have a low to moderate sensitivity to disturbance by subsidence and it is concluded that the Greater Broad-nosed Bat would have a moderate sensitivity to disturbance from subsidence.

Occurrence within Conservation Reserves:

Found in a number of conservation reserves and State Forests.

APPLICATION OF 7-PART TEST:

a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Greater Broad-nosed Bat is not known to occur within the Colliery but there is preferred habitat within the south western portion of the Colliery. It is concluded that it is unlikely that the life cycle of this species would be disrupted by subsidence due to underground mining in the Colliery.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

No endangered population occurs in the Colliery.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological community occurs within the Colliery.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

No preferred habitat would be removed or modified within the Colliery.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

No area of preferred habitat is likely to become fragmented or isolated as a result of the proposed action.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No preferred habitat will be removed, modified, fragmented or isolated within the Colliery.

e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

No critical habitat is listed for the Colliery.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Greater Broad-nosed Bat but the species profile provides priority actions including:

- Raise landowners' awareness of the presence of this species, and provide information on how their management actions will affect the species' survival.
- Actively encourage the conservation of the riparian vegetation and water quality of streams and rivers.
- DECC should be consulted when planning development/s to minimise impact/s on populations.
- Conduct searches for the species in suitable habitat in proposed development areas.
- Protect hollow-bearing trees for breeding sites, including those on farmland; younger mature trees should also be retained to provide replacements for the older trees as they die and fall over.
- Retain stands of native vegetation, especially those with hollow-bearing trees (including dead trees), and retain other structures containing bats.
- Retain a buffer of vegetation around roost sites in vegetated areas.
- Reduce the use of pesticides in the environment and enter known sites of this species and its potential habitat onto maps used for planned poison spraying activities.
- Encourage regeneration and replanting of local flora species to maintain bat foraging habitat.
- Assess the site's importance to the species' survival, including linkages provided between ecological resources across the broader landscape.

The action proposed is consistent with these objectives.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Alteration of habitat following subsidence due to longwall mining is listed as a Key Threatening Process.

From the above test, it is concluded that the Greater Broad-nosed Bat would not be significantly affected by the development.

APPENDIX 2: ASSESSMENT UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 OF FAUNA KNOWN OR EXPECTED TO OCCUR WITHIN THE SOUTH-WESTERN AREA AT BAAL BONE COLLIERY

Migratory Species

1. *Haliaeetus leucogaster* White-bellied Sea-Eagle

Distribution: Within range
Broad Habitat Preferences: Usually coastal and seasonally flooded inland swamps.
Likelihood of Occurrence: Unlikely within the remnant areas within the existing workings, no preferred habitat
Expected Impacts from Development: Low, as no preferred habitat will be affected

2. *Hirundapus caudacutus* White-throated Needletail

Distribution: Within main part of range
Broad Habitat Preferences: Aerial over most habitats
Likelihood of Occurrence: Known to occur on the Newnes Plateau on one occasion (M. Denny *pers. comm.*).
Expected Impacts from Development: Low, as capable of using cleared areas, as well as timbered land

3. Myiagra cyanoleuca Satin Flycatcher

Distribution: Within range, recorded in Newnes Plateau area.
Broad Habitat Preferences: Forests and woodlands, heath, prefers wet gullies during breeding
Likelihood of Occurrence: Not known from the South-western Area and unlikely to occur, as no preferred habitat
Expected Impacts from Development: Low, as no preferred habitat will be affected

4. Rhipidura rufifrons Rufous Fantail

Distribution: Within range, known from Newnes State Forest
Broad Habitat Preferences: Rainforest, dense wet forest, riverside vegetation
Likelihood of Occurrence: Not known from the remnant areas within the existing workings and unlikely to occur, as no preferred habitat
Expected Impacts from Development: Low, as no preferred habitat to be affected

5. Gallinago hardwickii Latham's Snipe

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Low vegetation around wetlands, irrigated crops
Likelihood of Occurrence: Not known from the remnant areas within the existing workings, as no preferred habitat
Expected Impacts from Development: Low, as preferred habitat would not be affected

6. Rostratula benghalensis Painted Snipe

Distribution: Within range, but no records from region
Broad Habitat Preferences: Surrounds and shallows of wetlands that are well vegetated with dense low cover
Likelihood of Occurrence: Low at site, as no preferred vegetation within remnant areas within the existing workings
Expected Impacts from Development: Low, as no preferred habitat

7. *Merops ornatus* Rainbow Bee-eater

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Surrounds and shallows of wetlands that are well vegetated with dense low cover
Likelihood of Occurrence: Not known from the remnant areas within the existing workingsbut could occur during the summer months foraging in the area
Expected Impacts from Development: Low, as preferred habitat would not be affected.

8. *Monarcha melanopsis* Black-faced Monarch

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Rainforests, mangroves, eucalypt forests and woodlands
Likelihood of Occurrence: Not known from remnant areas within the existing workingsbut could occur
Expected Impacts from Development: Low, as preferred habitat in the remnant areas within the existing workings (woodland) would not be affected.

9. *Ardea alba* Great Egret

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Wetlands, flooded pastures, dams, estuarine mudflats, mangroves and reefs
Likelihood of Occurrence: Not known from the remnant areas within the existing workingsand unlikely to occur as no preferred habitat

Expected Impacts from Development: Low, as no preferred habitat in the remnant areas within the existing workings

10. *Ardea ibis* Cattle Egret

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Moist pastures with tall grass, shallow open wetlands and margins, mudflats
Likelihood of Occurrence: Not known from the remnant areas within the existing workingsand unlikely to occur as no preferred habitat
Expected Impacts from Development: Low, as no preferred habitat in the remnant areas within the existing workings

11. *Apus pacificus* Fork-tailed Swift

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Aerial over a range of habitats
Likelihood of Occurrence: Not known from the remnant areas within the existing workingsbut likely to occur as a summer migrant
Expected Impacts from Development: Low, as no preferred habitat in the remnant areas within the existing workingswould be affected

Threatened Species

1. Lathamus discolor Swift Parrot

Distribution: : Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Forests and woodlands with flowering trees
Likelihood of Occurrence: Likely when sufficient trees are flowering
Expected Impacts from Development: Low, as no preferred habitat would be affected

2. *Xanthomyza phrygia* Regent Honeyeater (also listed as Migratory species)

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Ironbark forest and box woodlands
Likelihood of Occurrence: Could occur, but only occasionally recorded from Newnes State Forest
Expected Impacts from Development: Low, as expected impacts on box woodland and ironbark forest are very low.

3. *Polytelis swainsonii* Superb Parrot

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Open woodland and riverine habitats
Likelihood of Occurrence: Possible, but at it's eastern edge of distribution
Expected Impacts from Development: Low, as no preferred habitat would be affected

4. *Rostratula australis* Australian Painted Snipe

Distribution: Within its range, but not known from the region.
Broad Habitat Preferences: Muddy, shallow freshwater swamps
Likelihood of Occurrence: Possible (within range, but no suitable habitat)
Expected Impacts from Development: Very low, as no preferred habitat would be affected

5. *Dasyurus maculatus* ssp. *maculatus* Spotted-tailed Quoll

Distribution: Within its range, and known from Newnes State Forest
Broad Habitat Preferences: Forest, woodland, rocky outcrops
Likelihood of Occurrence: Possible, but not recorded from region in recent years or found in the remnant areas within the existing workings
Expected Impacts from Development: Very low, as only a very small amount of habitat would be affected

6. *Petrogale penicillata* Brush-tailed Rock-wallaby

Distribution: Known from surrounding national parks (e.g. Wollemi, Yengo and Blue Mountains)
Broad Habitat Preferences: North-facing cliff ledges
Likelihood of Occurrence: Low within the site, as no preferred habitat.
Expected Impacts from Development: Very low, as no preferred habitat at site

7. *Chalinolobus dwyeri* Large-eared Pied Bat

Distribution: Known from Newnes State Forest
Broad Habitat Preferences: Roosts in caves and rocky overhangs, forages in woodland
Likelihood of Occurrence: Found at adjoining coal mines, but not known from remnant areas within the existing workings
Expected Impacts from Development: Low, as preferred habitat only slightly affected

8. *Nyctophilus timoriensis* Eastern Long-eared Bat (south-eastern form)
Distribution: Within its range, but there are no records for Newnes Plateau area
Broad Habitat Preferences: A variety of vegetation types, including box/ironbark/cypress pine along the western slopes. Roosts in tree hollows, crevices and loose bark.
Likelihood of Occurrence: Could occur
Expected Impacts from Development: Very low, as preferred habitat at site not affected

9. *Pteropus poliocephalus* Grey-headed Flying-fox

Distribution: Within range, but not known from the Newnes Plateau area
Broad Habitat Preferences: Roost at camps and feeds on nectar, pollen and fruits of various trees
Likelihood of Occurrence: Low
Expected Impacts from Development: Very low, as not expected in area and preferred habitat not affected

10. *Isoodon obesulus obesulus* Southern Brown Bandicoot

Distribution: Not recorded from the region
Broad Habitat Preferences: Sandy soil with low vegetation
Likelihood of Occurrence: Low, as not known from the area and outside recorded range
Expected Impacts from Development: Very low, as not expected in area and preferred habitat not affected

11. *Potorous tridactylus tridactylus* Long-nosed Potoroo

Distribution: Not recorded from the region
Broad Habitat Preferences: Woodland with dense understorey
Likelihood of Occurrence: Low, as not known from the area and outside recorded range
Expected Impacts from Development: Very low, as not expected in area and preferred habitat not affected

12. *Eulamprus leuraensis* Blue Mountains Water Skink

Distribution: Known from Newnes Plateau State Forest
Broad Habitat Preferences: High elevation sedge and shrub swamps with boggy soil
Likelihood of Occurrence: Low, as there is no preferred habitat within the remnant areas within the existing workings
Expected Impacts from Development: Low, as preferred habitat not affected

13. *Hoplocephalus bungaroides* Broad-headed Snake

Distribution: Within range, and recorded in the Newnes Plateau area
Broad Habitat Preferences: Loose rock and tree hollows
Likelihood of Occurrence: Could occur within the remnant areas within the existing workings, as there is preferred habitat available
Expected Impacts from Development: Low, as preferred habitat not affected

14. *Heleioporus austaliacus* Giant Burrowing Frog

Distribution: Sydney Basin, but not recorded in the Newnes Plateau area
Broad Habitat Preferences: Upland swamps and rocky pools
Likelihood of Occurrence: Low, as there is no preferred habitat within the remnant areas within the existing workings
Expected Impacts from Development: Low, as preferred habitat not affected

15. *Mixophyes balbus* Stuttering Frog

Distribution: Within range and recorded from Newnes State Forest
Broad Habitat Preferences: Flowing streams in wet forests
Likelihood of Occurrence: Low, as there is no preferred habitat within the remnant areas within the existing workings
Expected Impacts from Development: Low, as preferred habitat not affected

16. *Litoria littlejohni* Heath Frog

Distribution: Not recorded from the region**,** but known from Mount Wilson, Blue Mountains
Broad Habitat Preferences: Sedgelands, wet and dry sclerophyll forests and woodlands
Likelihood of Occurrence: Low, as possibly outside range
Expected Impacts from Development: Low, as preferred habitat not affected and possible outside range

17. *Paralucia spinifera* Purple Copper Butterfly

Distribution: Within range and known from the Newnes Plateau region
Broad Habitat Preferences: Associated with Blackthorn at altitudes above 900m
Likelihood of Occurrence: Possible, but limited preferred habitat
Expected Impacts from Development: Low, as preferred habitat not affected

18. *Maccullochella peelii* Murray Cod

Distribution: No records for region
Broad Habitat Preferences: Deep water, rivers
Likelihood of Occurrence: Extremely low, as no preferred habitat
Expected Impacts from Development: Very low, as preferred habitat not available

19. *Macquaria australasica* Macquarie Perch

Distribution: Within range but there are no records for the Newnes Plateau region
Broad Habitat Preferences: Cool, clear water in the upper reaches of rivers

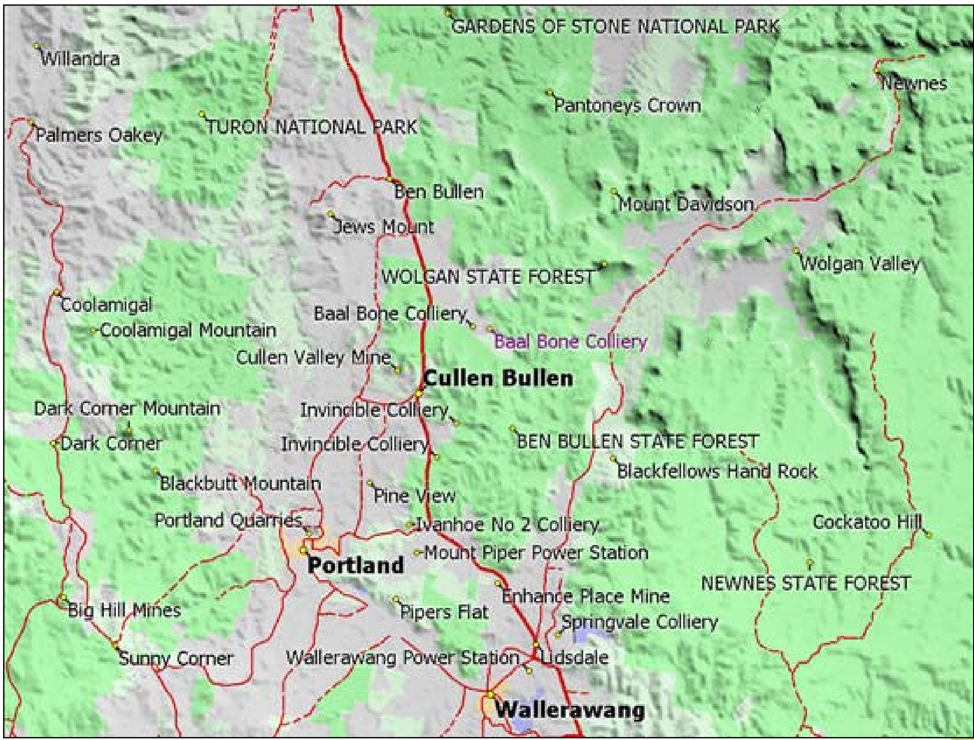
Likelihood of Occurrence: Extremely low, as no preferred habitat
Expected Impacts from Development: Very low, as preferred habitat not available

20. *Prototroctes maraena* Australian Grayling

Distribution: No records for region, only known from eastern fall of Dividing Range
Broad Habitat Preferences: Clear gravely streams
Likelihood of Occurrence: Extremely low, as no preferred habitat
Expected Impacts from Development: Very low, as preferred habitat not available and outside range

APPENDIX N

Indigenous Heritage Assessment



Location of Baal Bone Colliery.

Environmental and Heritage Management P/L

Indigenous Heritage Assessment

Continuing operations area: Baal Bone Colliery

Western Blue Mountains (Cullen Bullen) NSW

June 2009

Report Prepared by

OzArk Environmental and Heritage Management Pty Ltd

For AECOM

Executive Summary

OzArk Environmental and Heritage Management (OzArk EHM) was commissioned by AECOM to conduct a desktop heritage assessment of areas within Baal Bone Colliery for the Continued Operations Environmental Assessment (EA).

The purpose of this review is to determine the extent and results of previous heritage surveys in this area.

As a desktop review, the present integrity of any previously recorded sites within the designated area is undetermined.

With the restraints of a desktop study in mind, the following conclusions can be made:

1. The region designated as the ‘Surface Infrastructure Area’ (refer **Figure 2**) has had extensive disturbance of the original ground surface due to mining activities. While the landforms in this region of the Study Area would have once held potential to contain Aboriginal sites, the high degree of prior disturbance would indicate that the integrity of any site in this area has already been destroyed. Due to the nature of these disturbances, and the likelihood that any sites in this region have been destroyed, it is assessed that there is a low probability of locating further intact Aboriginal sites in this area. It is therefore argued that no further Aboriginal heritage assessment is required in this area.
2. The region designated ‘Remnant Areas’ (refer **Figure 2**) has not been subjected to a full heritage survey although portions of it have been surveyed and contiguous landforms adjacent to the Remnant Areas have been subjected to heritage surveys. The region has generally had low disturbance; mostly resulting from logging. The region has one previously recorded site. It is assessed that there is potential for this region to contain further Aboriginal sites. It is noted, however, that open sites containing low densities of artefacts are the prominent site type predicted for this area: a site type that is less-affected by subsidence than other site types such as shelters that are not expected to occur. It is recommended that should any future developments in this area be required that a full heritage survey be conducted to ascertain the present condition of the site Ben Bullen Creek 1 (45-1-0240) and to comprehensively assess this region for its heritage significance.
3. The region designated Longwalls 29 to 31 within the ‘Underground Mining Areas’ (refer **Figure 2**) has been subjected to a full heritage survey. Therefore the recommendations contained in OzArk 2007a and 2007b should be adhered to regarding any future developments in this region of the Study Area (see Section 4.8). The management recommendations for the two recorded sites in this area are as follows.
   - BBC-IF1 (45-1-2664/2666) was assessed as being a one-off drop artefact of overall low significance. No further archaeological assessment in relation to this site was considered necessary (OzArk 2007a: 27).

- BBC-RS1 (45-1-2665/2667). Management of this rockshelter was formulated with respect to the predicted affects of subsidence on the location of the rockshelter, once these have been modelled. Hence, two options for BBC-RS1 are recommended (as in OzArk 2007a: 27):
    - If subsidence predictions indicate that the location of BBS-RS1 will be only minimally impacted by potential subsidence, then no further archaeological assessment of this location is considered necessary.
    - If, however, subsidence predictions indicate that this location is likely to suffer extensive disturbance and plans of the underlying Longwalls cannot be altered to alleviate this, then a programme of limited sub-surface test excavation within the rockshelter and its immediate environs is recommended to determine the presence or absence of Indigenous occupation evidence. The resultant information will allow an informed assessment of the scientific and cultural significance of the rockshelter thus enabling the formulation of appropriate management recommendations.

Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Brief description of the project

Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) is sought for the continued operations at Baal Bone Colliery, including the following project components:

- Continuation of underground mining within the Underground Mining Area, including Longwalls 29 to 31, which are the subject of a current approved Subsidence Management Plan and Mine Operations Plan;
- Continued operation of the associated Surface Infrastructure Area and a prepared saleable coal production of 2.0 Mtpa (equating to 2.8 Mtpa ROM coal);
- Continued transport of prepared saleable coal to markets in accordance with current approvals; and
- Mining of other isolated Remnant Areas within existing workings.

Project Approval is required by 1 August 2010 to allow continued underground mining operations (Longwalls 29 to 31) which currently do not operate under a development consent.

1.2 Location

Baal Bone Colliery is located 25 km northwest of Lithgow NSW (**Figure 1**). The colliery consists of underground longwall mining operations and associated coal handling and preparation facilities in the Surface Infrastructure Area.

The Study Area of this desktop review includes those areas designated in **Figure 2** as:

1. Surface Infrastructure Area;
2. Remnant Areas; and
3. Longwalls 29 to 31 within the Underground Mining Area.

Figure 3 shows a detail of the existing Surface Infrastructure Area.

Figure 1: Location of Baal Bone Colliery.

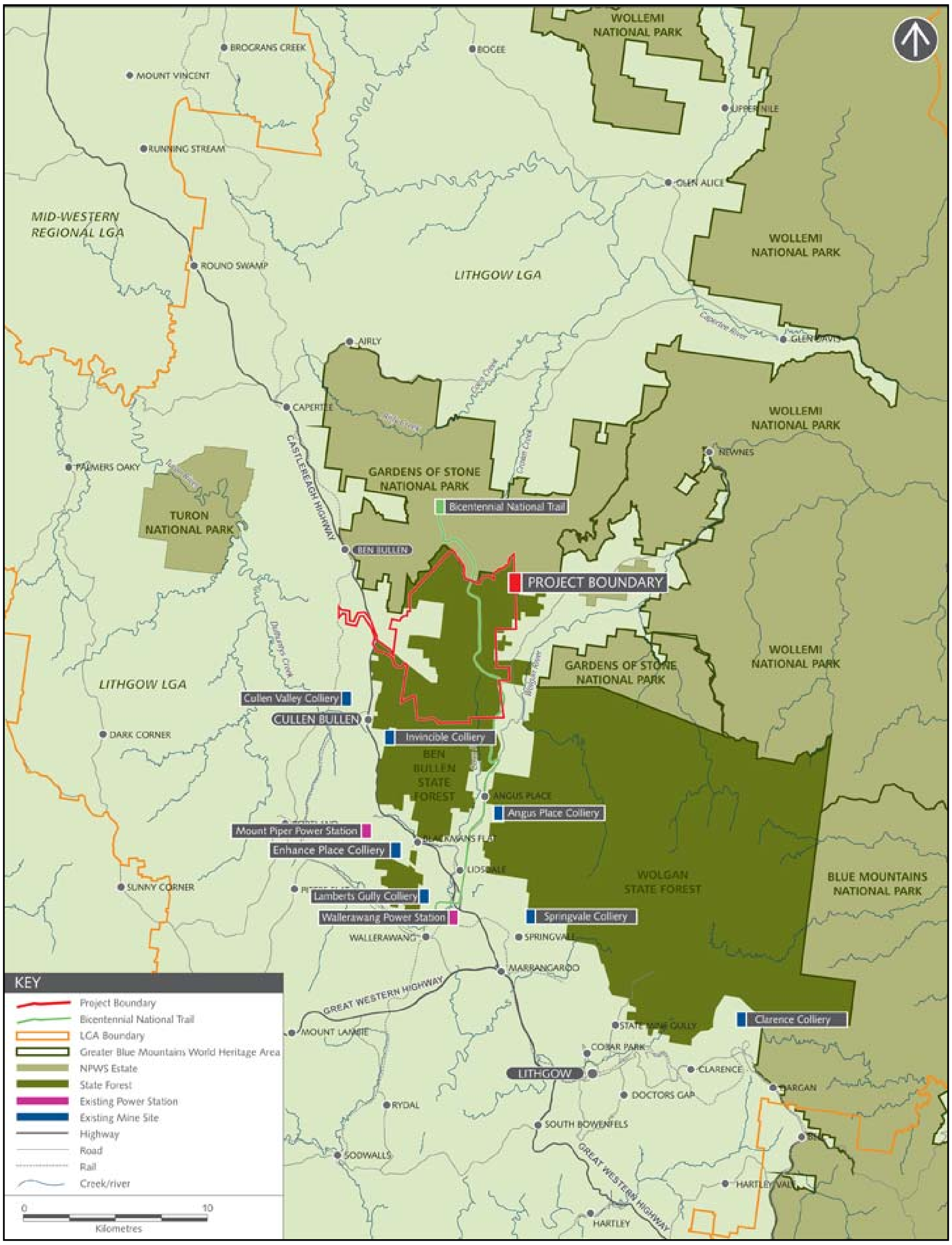


Figure 2: Location of the Study Area.

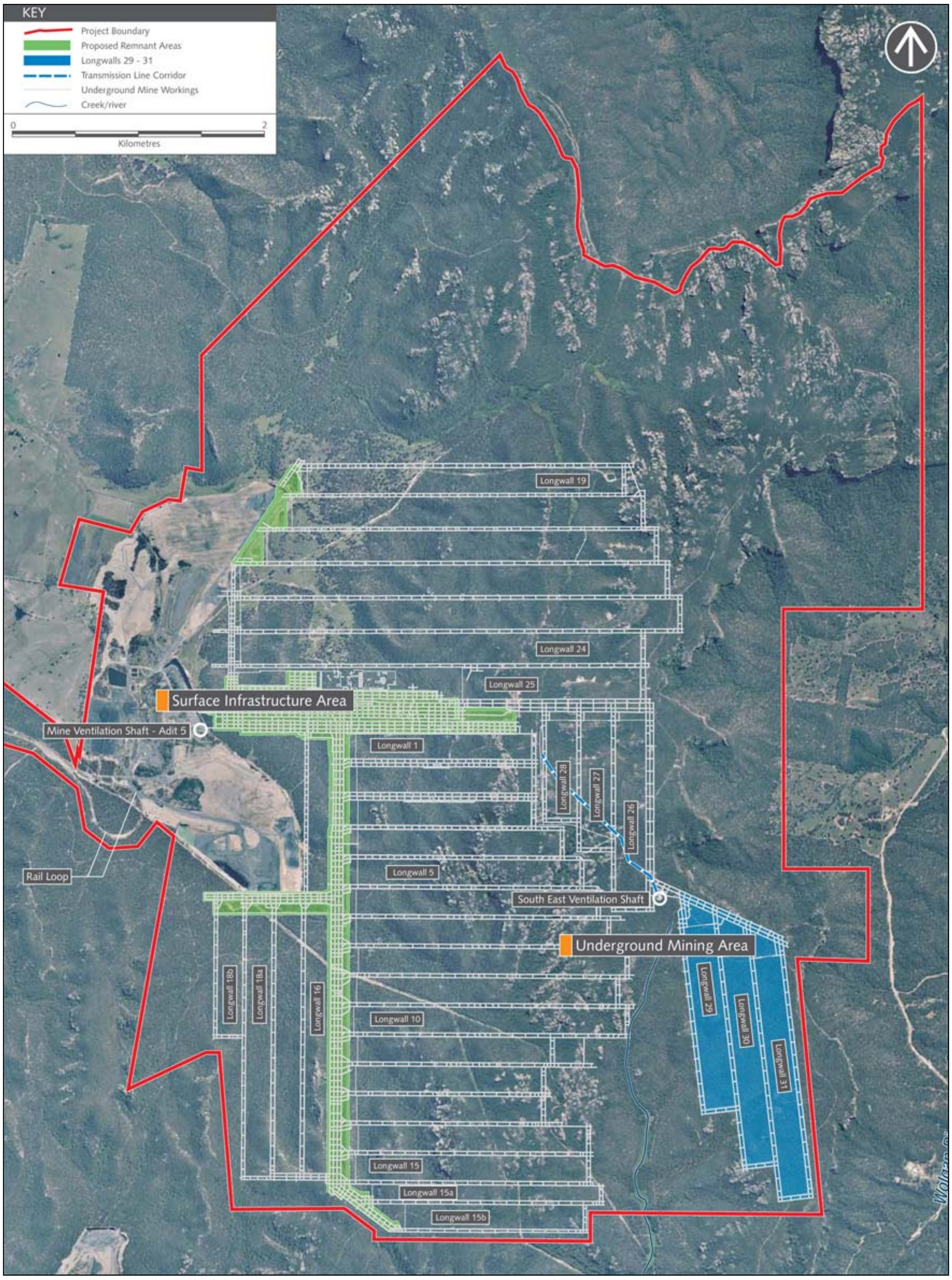
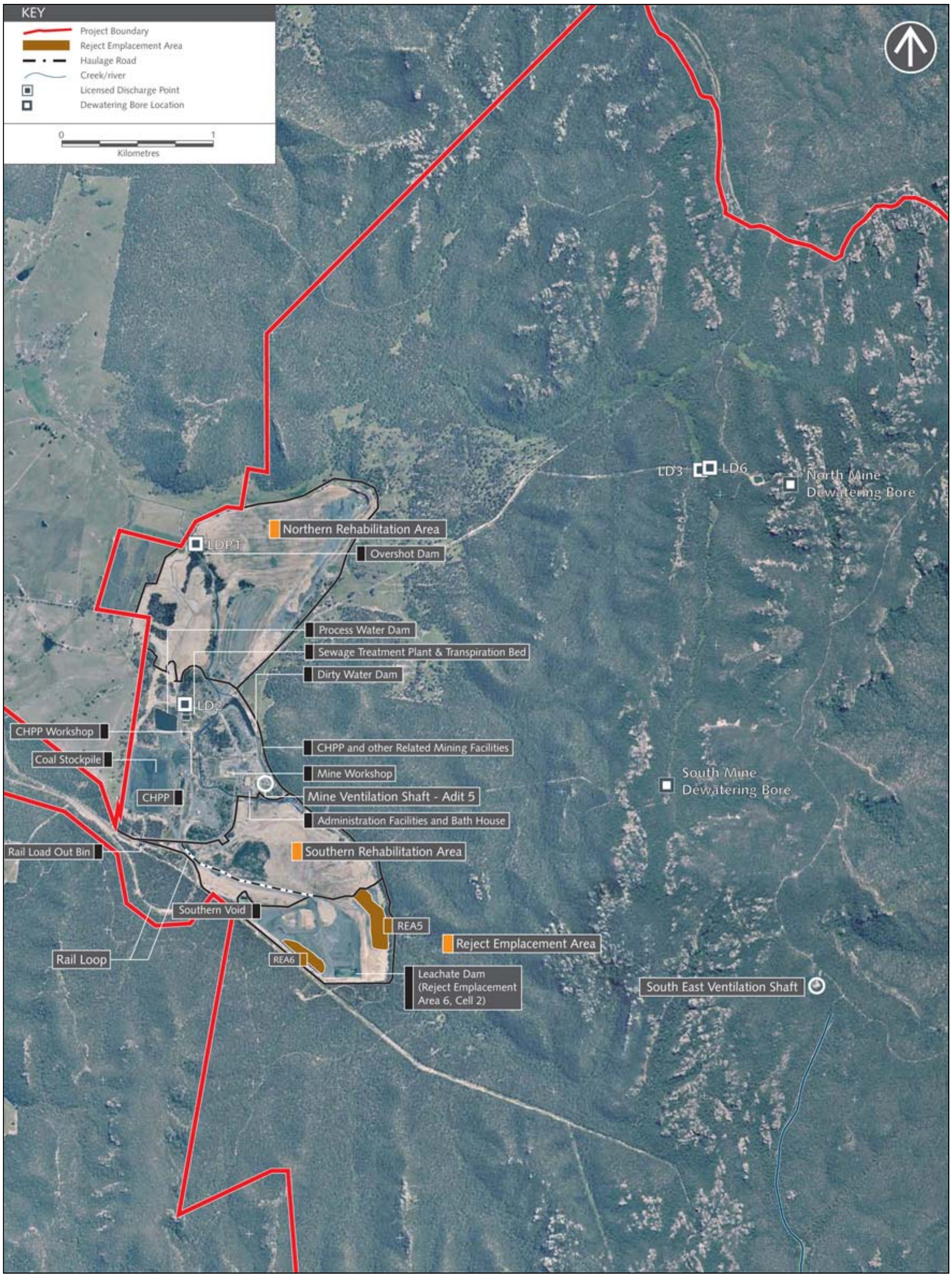


Figure 3: Detail of the Surface Infrastructure Area.



1.3 Date of heritage assessment

The desktop heritage assessment took place in June 2009.

1.4 Native Title

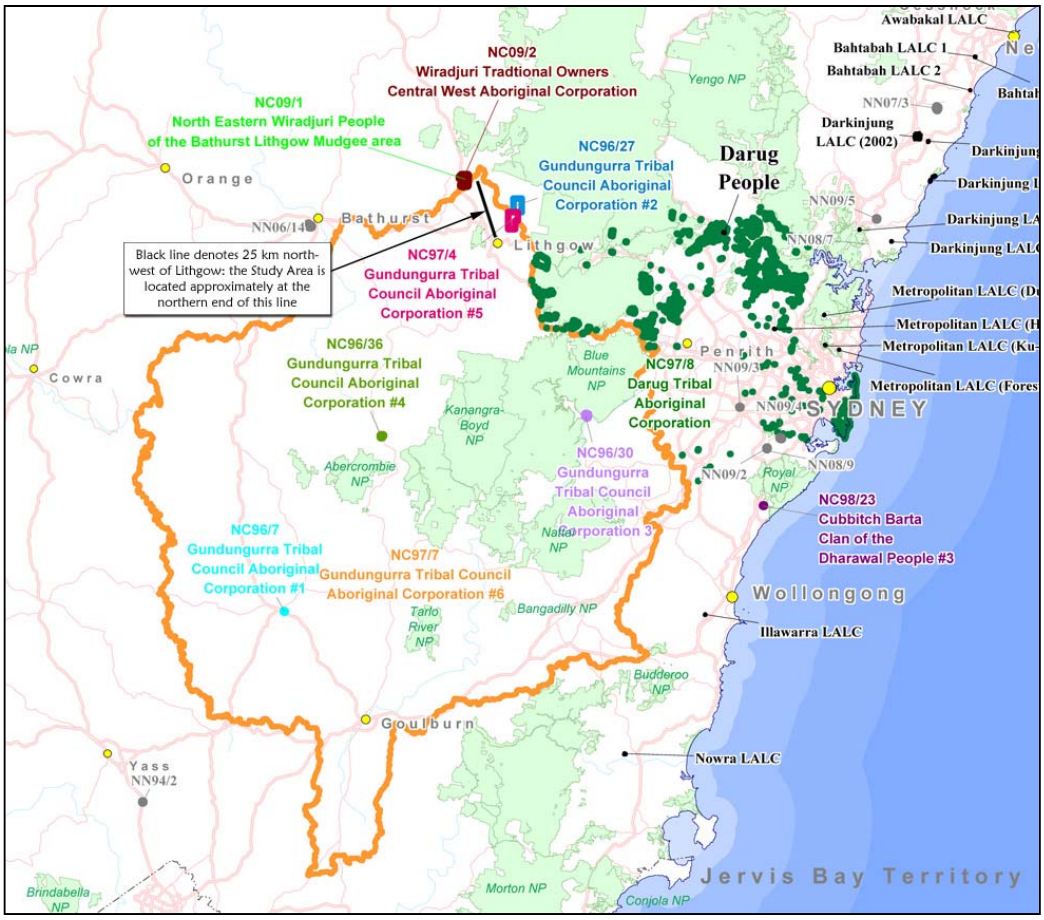
A search of the National Native Title Tribunal website undertaken prior to the desktop assessment indicated that the Study Area is inside the Native Title claim boundary of Native Title Claim NC97/7, Gundungurra Tribal Council Aboriginal Corporation #6. **Figure 4**, taken from the National Native Title Tribunal website (www.nntt.gov.au), indicates that at least portions of the Study Area are within the boundaries of this Native Title claim although detail is lacking. Further ambiguity is added by the National Native Title Tribunal website stating that this claim is "south of Katoomba to Goulburn" and, as such, would not appear to extend into the area of the current Study Area. However, in 2007 OzArk (OzArk 2007a) conducted a heritage assessment on the Baal Bone mining lease area related to mining operations of Longwalls 29 to 31 (refer **Figure 2**). During this assessment the Aboriginal community representatives said that this area was located within the northern boundaries of the Native Title Claim NC97/7. Although the exact portions of the Study Area covered by Native Title Claim NC97/7 remain ambiguous, as there is an existing mining lease held over the whole of the Study Area, Native Title does not present an issue with Baal Bone Colliery's continuing operations as Section 44H of the *Native Title Act 1993* states that if a mining lease is held to be valid then (paragraph numbering as in the *Act* under Section 44H):

c) the requirement or permission, and the doing of the activity, prevail over any native title rights and interests and any exercise of those rights and interests, but do not extinguish them; and

d) the existence and exercise of the native title rights and interests do not prevent the doing of the activity; and

e) native title holders are not entitled to compensation under this Act for the doing of the activity.

Figure 4: Map showing the extent of Native Title Claim NC97/7: orange border (source: www.nntt.gov.au).



1.5 OzArk EHM involvement

In recent years OzArk EHM has been engaged to conduct heritage assessments relating to several portions of the Baal Bone Colliery. Specifically the areas previously surveyed by OzArk EHM are:

1. OzArk 2009: Heritage Assessment of areas within and adjacent to Baal Bone Colliery.
   - ➢ This heritage assessment examined areas to the north, east and south of the current Study Area.
2. OzArk 2007a: Indigenous heritage assessment for Subsidence Management Plan over three proposed longwalls (29-31), Baal Bone Colliery. This assessment is provided in full in **Appendices 1**–**2** to this report.
   - ➢ The area of this heritage assessment coincides with the current Study Area in the region Underground Mining Area in **Figure 2**.
3. OzArk 2007b: Proposed 1.7 km, 11kV powerline corridor and ventilation fan compound. An abridged version of this report is provided in **Appendix 3**.

- The area of this heritage assessment coincides with the current Study Area in the Longwalls 29 to 31 area in **Figure 2**.

Ben Churcher (senior archaeologist) wrote this assessment and it was edited by Dr Jodie Benton (Director).

2.0 The Project

Ozark EHM was engaged to conduct a desktop heritage assessment of Indigenous heritage items within the confines of the designated Study Area (see Section 3).

2.1 Proposed Works

The heritage assessment will be part of a larger environmental study which will assess areas that constitute those areas designated as 'continuing operations' at the Baal Bone Colliery.

Project Approval under Part 3A of the EP&A Act is sought for the following project components at Baal Bone:

- Continuation of underground mining within the Underground Mining Area, including Longwalls 29 to 31, which are the subject of a current approved Subsidence Management Plan and Mine Operations Plan;
- Continued operation of the associated Surface Infrastructure Area and a prepared saleable coal production of 2.0 Mtpa (equating to 2.8 Mtpa ROM coal);
- Continued transport of prepared saleable coal to markets in accordance with current approvals; and
- Mining of other isolated Remnant Areas within existing workings.

Project Approval is required to allow continued underground mining operations which will not be complete prior to 1 August 2010.

Surface Infrastructure and Facilities

The primary surface infrastructure and facilities at Baal Bone include the Coal Handling and Preparation Plant (CHPP), workshop, administration facilities and bath house, reject emplacement areas (REA), water management system and rail transport facilities. The location of surface infrastructure and facilities is shown on **Figure 3**.

2.2 Heritage Assessment Methodology

The heritage assessment constitutes a desktop study that includes searching relevant data bases to determine the nature and findings of previous heritage assessments within the Study Area. Databases searched were:

- NSW Department of Environment, Climate Change and Water (DECCW) Aboriginal Heritage Information Management System (AHIMS);
- State Heritage Inventory and Register;
- Australian Heritage Database (AHD);
- National Native Title Tribunal; and
- Lithgow City Local Environment Plan (LEP) 2000.

The area of Longwalls 29 to 31 within the Underground Mining Area has been subject to a full heritage assessment along with Aboriginal community consultation. The results of this assessment and records of community consultation are presented in **Appendices 1**–**2** of this report. Assessment of contiguous and nearby landforms to the area of Longwalls 29 to 31 within the Underground Mining Area was also carried out by OzArk in 2007. An abridged version of this report is attached in **Appendix 3**.

2.3 Heritage Survey constraints

The major constraints of the desktop study are:

1. The nature of previous heritage assessment reports, particularly in the years immediately following 1989, that give imprecise study area locations;
2. Irregularities between sites recorded in heritage assessment reports and the AHIMS database administered by DECCW;
3. No in-field survey was conducted to ascertain the veracity or integrity of previously recorded sites in both the regions designated Remnant Areas and Surface Infrastructure; and
4. The area of Longwalls 29 to 31 within the Underground Mining Area has been recently subject to a full heritage assessment along with Aboriginal community consultation. The results of this assessment and records of community consultation are presented in **Appendices 1**–**2** of this report. However, the present condition of sites recorded during this survey is not known as the sites were not re-located for the purposes of this report.

However, given the number of previous heritage assessments across the Study Area, along with fact that certain areas, such as the surface infrastructure area, have had high degrees of disturbance, the level of assessment undertaken for this report is, in the author's view, deemed acceptable.

3.0 The Study Area

The Study Area of this desktop assessment includes those areas designated in **Figure 2** as:

1. Existing Surface Infrastructure Areas;
2. Remnant Areas; and
3. Longwalls 29 to 31 within the Underground Mining Area.

Figure 3 shows a detailed site layout of the existing Surface Infrastructure Area.

3.1 Topography of the Study Area

Baal Bone is located 5 km north east of the township of Cullen Bullen, and approximately 25 km northwest of Lithgow. The precise location of the Baal Bone Colliery is shown in **Figure 1**. The Surface Infrastructure Area covers an area of approximately 380 ha of freehold land predominantly owned by TWCL within the Parish of Ben Bullen, County of Roxburgh. The Underground Mining Area operated by the Colliery is located to the east of the Surface Infrastructure Area, and is located within the mining authority boundaries operated by Baal Bone, which cover an area of approximately 4,622 ha.

The site is bordered to the north and east by the Capertee and Wolgan Valleys respectively, to the south by the Invincible Colliery and to the west by private property which adjoins the Castlereagh Highway.

The surrounding landscape of the Study Area is dramatic. Gently undulating forested plateaus give way to steep escarpments and valleys. Ben Bullen State Forest, the Gardens of Stone National Park and Wolgan State Forest lie in close proximity to the north-west and north-east of the site. These features provide significant and high local visual amenity. Baal Bone is generally located on the plateau of the surrounding escarpments.

Valleys within the Study Area range from gently undulating landforms in the west of the Study Area, to steep-sided hills in the east.

Soils, mostly derived from the underlying sandstone, are predominately sandy.

The topography of the Study Area presents a range of landforms that may have been utilised by traditional Aboriginal groups. Although not part of the Study Area, Baal Bone Gap is located just to the north and it is likely that groups using this pass would have traversed through the Study Area. In addition, the valley floors contained within the Study Area would have offered shelter and food resources. While water was never plentiful in the Study Area (see Section 3.2), swamp resources found in the valleys would have encouraged foraging; even if this was relatively limited. The escarpment cliffs and plateaus would have provided temporary shelter and areas of ceremonial significance.

3.2 Hydrology of the Study Area

The Study Area contains several first and second order drainage systems: the larger being Baal Bone Creek and Jews Creek. These creeks, along with smaller tributaries in the Study Area, have their source in the escarpment to the east and flow in a westerly direction.

As the Study Area is located close to the escarpment, all drainage systems within the Study Area are either of the first or second order and none hold permanent water. Most drainage systems within the Study Area are run-off gullies that would only contain water at times of rain. In the valley systems there are swampy areas; although they are often without running water.

While large bodies of permanent water are absent from the Study Area, there was sufficient water to encourage traditional Aboriginal groups to forage in the region. The swamps along the creeks would have provided useful resources and at certain times of the year (and in different seasons) there may have well been more water available in the Study Area. This water would have allowed hunting parties or transit parties to stay within the Study Area, albeit for a limited period of time.

3.3 Vegetation of the Study Area

The vegetation of the Study Area (where extant) is best described as woodland with a dominance of Eucalyptus species. In places, swamp vegetation predominates.

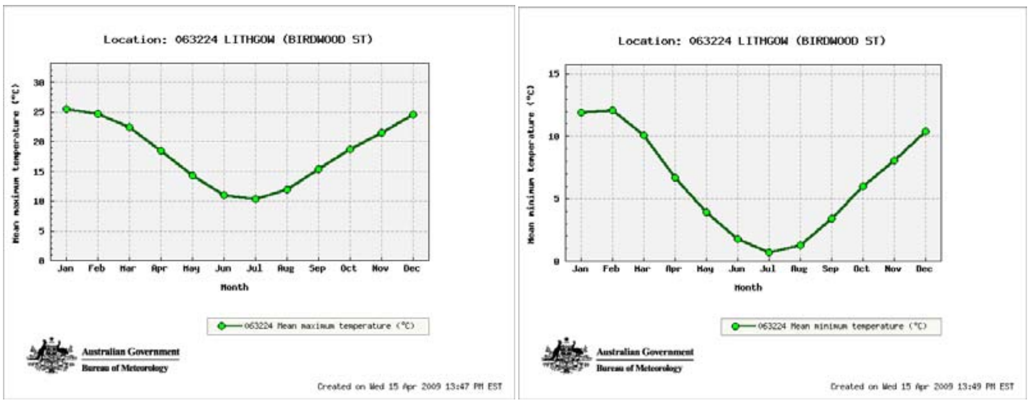
Mr William (Bill) Allen (Mingaan Aboriginal Corporation) has identified that Bracken fern, which is abundant within the Study Area, was processed as a food by traditional Aboriginal groups (OzArk 2009).

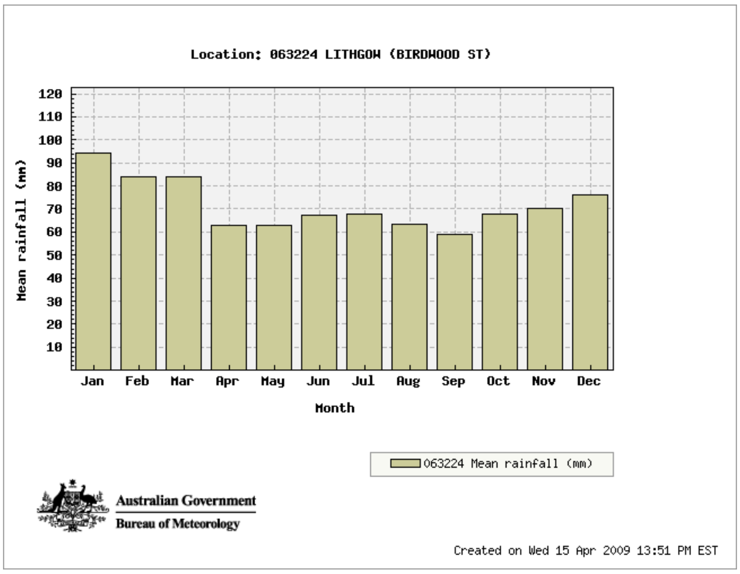
3.4 Climate of the Study Area

Information supplied by the Lithgow weather station (Bureau of Meteorology) shows that the region has warm summers and mild to cold winters. Rainfall is evenly distributed throughout the year with maximums in the summer months.

With regards to traditional Aboriginal settlement in the region, the climate would indicate that occupation was possible all year round as there is not a pronounced dry season which would encourage people to depart from the region. The low winter temperatures would indicate that sheltered locations, such as enclosed valleys, would be sought and that occupation would likely be away from the lowest points of the valley where cold air would accumulate.

Figure 6: Climate statistics for Lithgow.





3.5 Existing levels of disturbance

The Study Area has high overall levels of disturbance.

As indicated on **Figure 3**, the major area in the west of the Study Area (Surface Infrastructure Area and access to the Castlereagh Highway) has been almost completely impacted by present and past mining activities, construction of road and rail infrastructure, dam construction and coal storage areas.

An EIS (Nexus 1981) was undertaken in 1981 to examine the impact of renewed mining operations on the Surface Infrastructure Area, shown on **Figure 3**. This EIS includes highly disturbed areas historically mined as part of the Ben Bullen open cut operations which occurred at the site prior to the 1980s. The northern part of the Surface Infrastructure Area includes former open cut areas, which have now been partly or fully rehabilitated. The southern portion of the Surface Infrastructure Area contains REAs, some of which are currently in use and others which have been partly and fully rehabilitated.

In 1995, an EIS (Corkrey 1995) was prepared for open cut mining which was to take place in Surface Infrastructure Area to the north and south of the CHPP. These areas have now either been rehabilitated or areas are currently being used for reject emplacement. Open cut mining at Baal Bone as since ceased.

It is unlikely that intact archaeological deposits would exist in the Surface Infrastructure Area, had any been present prior to the impacts of mining.

The other regions of the Study Area (**Figure 2**: Longwalls 29 to 31 and Remnant Areas) have had low disturbance as the mining activity here is underground.

The Remnant Areas (**Figure 2**) are the areas of coal in between the barrier pillars and gate roads that have been constructed to allow the extraction of the Longwalls (which have now been mined). The project includes potential mining of these areas of remnant coal at some time in the future.

As part of the Ben Bullen State Forest, this area has been logged and fire trails have been constructed.

Ground surface impacts have been minor and the area is likely to contain intact archaeological deposits.

In the eastern portion of the Underground Mining Area within the Study Area (**Figure 2**), the only area to have high disturbance and a low probability of intact archaeological deposits is the ventilation shaft compound to the northeast of Longwalls 29 to 31 (refer **Figure 3**). The remainder has had low ground surface impact, apart from logging activities and the construction of fire trails.

4.0 Indigenous Heritage

4.1 Ethno-historic sources of past Aboriginal culture

According to Tindale (1974), the Study Area falls within the eastern limits of the lands occupied by the Wiradjuri tribe. However, due to the location of this area at the western base of the mountains it has often been referred to as zone of interaction between the Wiradjuri, the Dharug to the east and the Gundungurra to the south (Bowdler 1984).

Few archival sources are available which give any great detail regarding local Aboriginal culture at the time of contact or even soon after. The Lithgow area seems to have undergone little study by professional or amateur ethnologists and anthropologists despite its close proximity to Sydney.

A resident of nearby Lidsdale, Fay Hasler, has written notes based on oral histories of people in the area (reproduced in part in Kelton 2002a: 12–13), which are held by the Lithgow and District Family Historical Society. The salient points derived from these notes are as follows:

1. A large Aboriginal settlement is described as being located at Pipers Flat, with the burial ground being located at Lidsdale;
2. The Pipers Flat Aborigines would regularly travel to Richmond to fight the local Aboriginals and bring back women to combat in-breeding;
3. The tribes occupying the valleys in the area were wiped out by disease including measles and small pox; and
4. Stories of massacres of Aborigines by soldiers at Capertee and settlers at Marrangaroo were often spoken about by the elders, together with the poisoning of flour which killed women, children and men.

Interviews with Fay Hasler during March and May 1999 (Gay 1999) indicate that the burial ground at Lidsdale was located on the river flats either side of the current Coxs River alignment. It is noted that the colliery railway line was constructed through this area in the 1920s and further disturbance would have affected this area during the Coxs River realignment in the 1950s (Gay 1999: 15).

Gay (1999: 16) also notes an historical reference to the burial of an Aboriginal Elder in the Wallerawang area. King Myall (Mylles) had worked for James Walker who had been granted land in the Wallerawang and Lidsdale districts during the 1820s. The burial site of King Myall was drawn and published in the Sydney Illustrated News in October 1880, showing a burial mound and carved trees. This may be part of the burial ground referred to by Fay Hasler (Gay 1999: 16).

4.2 Regional Archaeological Context

Current understanding of the types of sites present or likely to be present, within the Coxs River valley and surrounding hill country remains sketchy. Data from excavated sites combined with information derived from surveys, points to a variable use of the valley, with some sites indicating ephemeral, casual or limited use, while other sites show more intensive or repeated use.

Sites and studies within the current project area will be considered in the following section (4.3: Local Archaeological Context), while those from the general Coxs River valley and surrounds will be briefly reviewed here.

In the mid 1960s, McCarthy excavated a series of sites in the Capertee Valley to the east of the Study Area and identified an early stone tool industry that predated what was then called the Australian Small Tool Tradition. He named this industry the Capertian and described it as consisting of non-specialised flake and core scrapers, also known as the Core Tool and Scraper Tradition (Mulvaney, Kamminga 1999: 44).

Development driven survey in the Coxs River area (south and east of the Study Area) such as that undertaken by Rich (1988) and Silcox (1988) provided further evidence for a site occupation pattern previously postulated by Rich, indicating that open sites are most frequent on elevated ground close to permanent water, such as the Coxs River. Again quartz was seen as the dominant raw material, in contrast to sites on the Newnes Plateau, which appear to have mudstone and chert dominated assemblages. The limited presence of cortex on some of the quartz artefacts led Rich to argue that artefacts may have been carried to these locations after primary/initial flaking elsewhere. The general quality of the quartz was reported as high, with few fracture plains.

In 1992 a survey for the Springvale Colliery and conveyor (Rich, Gorman 1992) recorded 35 sites situated in the Coxs River Valley. Site 2, located on the southern bank of Pipers Flat Creek, consisted of over 100 artefacts within a 200 x 40 m area. Two quartz knapping floors with artefact densities of over 25/m^2 were identified at Site 2 as were a smaller number of indurated mudstone artefacts. Site 9, located c. 700 m west of Duncan street, on elevated terrain above and on the west side of the Coxs River, was comprised of 26 artefacts, primarily quartz, with a maximum artefact density of 6/m^2. As a result of this study, Rich argues that the larger sites within her study area lie closest to the Coxs River and Pipers Flat Creek (Rich, Gorman 1992: 73).

Also in 1992, Haglund and Brayshaw undertook survey for the proposed Lamberts Gully open cut mine at Western Main Colliery (Haglund, Brayshaw 1992a). Six Aboriginal sites were recorded as a result of this survey, predominantly located at the southern end of Lamberts Creek. Later that year test excavations were carried out at two Potential Archaeological Deposits (PAD), one having been recorded during their Lamberts Gully survey (POS A), and the second being a PAD recorded by Rich and Gorman in 1992 (POS 2). The latter site came to be known as Lamberts Creek 6 (45-6-2355) and while POS A came to be known as Lamberts Creek 7 (45-6-2354). Test excavation of these locations revealed them to be open sites although of a ‘one-off’ nature, likely to date within the last 3,000 years due to the presence of a backed blade and bipolar knapping technology (Brayshaw 1993: 8).

Again in 1992, Brayshaw and Haglund surveyed an easement linking Mt Piper Power Station with Angus Place Colliery (Haglund, Brayshaw 1992b). This study recorded two open camp sites and one isolated find. During his 2002 study for the Boulder project, Kelton attempted to relocate these sites and was unsuccessful, concluding that Site 45-2-0217 must have been destroyed during the construction of the transmission line easement immediately south of the haul road (Kelton 2002a: 32). Site 45-2-0216, however, although not relocated by Kelton, was subsequently relocated by OzArk EHM during their 2004 survey in the face of the proposed Neubecks Open Cut Coal Mine (OzArk 2004a).

Brayshaw (1993) undertook further survey for the Western Main colliery, although this extension was to the north of the previous study, being close to the Castlereagh Hwy. Three sites were recorded in this survey, all open camp sites, as the study area was situated within the Neubecks Creek valley rather than in the more hilly country to the south. Brayshaw notes that the open sites identified were relatively small and sparse and were situated in positions elevated above swampy areas and creeks.

Lyell Dam, situated in the Coxs River catchment approximately 20 km south of the Study Area, was formed by damming the Coxs River. Three open sites located on the slopes of spurs overlooking the Coxs River floodplain were investigated in 1994 prior to raising the water level in the lake. All three sites were situated c. 400 m from the river margin (Gay 1999: 14).

At open site Lyell Dam 3 (LD3), a quartz block fractured knapping floor was found. Although the assemblage was dominated by quartz, other raw materials such as indurated mudstone (silicified tuff) and stone of volcanic origin was also present. In terms of surface manifestations of this site, the highest artefact density recorded was 3/m^2, with most sample areas showing lower densities (Barton, McDonald 1995: 25). The excavated assemblage, however, was far larger, with estimated thousands of artefacts present at this location. Barton and McDonald (1995: 35) interpreted this site as being repeatedly occupied by people carrying out the same range of tasks.

Conclusions of the Lyell Dam site investigation project can be summarised as follows (from Barton and McDonald 1995: 67 as summarised in Gay 1999: 15):

- Cobbles of igneous, metamorphic and sedimentary rocks were procured locally, primarily from the bed of the Coxs River;
- Quartz was locally available and the ease with which it was procured eliminated the need to flake using the bipolar technique;
- Quartz was used to create medium sized flakes and some smaller retouched tools;
- Volcanic stone was used to create large or heavy tools; and
- All three sites were interpreted as representing repeated short-term occupation areas that focussed on acquiring resources such as specific plants or animals endemic to the swampy margins of the Coxs River.

As may be expected, research into the known archaeological sites in the region surrounding the Study Area has shown that the majority of sites are located on landforms close to water sources. Most sites were small, containing low densities of artefacts, with only one large site present, being LD 3 situated in the Lyell Dam area. Quartz dominates the artefact assemblages that are characterised by the Core and Flake tradition (Gay 1999: 15).

In 1998 Mills (Mills 1998) undertook survey of the proposed Ivanhoe Stage 4 project c. 12 km southwest of the Study Area. The survey identified six open sites, two isolated artefacts and eight other areas of potential archaeological deposit. Mills concluded that the presence of high quality milky white quartz flakes and debitage at all sites recorded in the survey area may indicate that it was a procurement place for the raw material; however, no source was located.

A survey undertaken by Gay in 1999 indicated the possibility of an Aboriginal burial area being located close to the road alignment between Duncan Street and the coal conveyor at Lidsdale. Oral history from a local informant provided primary data for the location of the burial ground and test excavations of this general area were undertaken in 1993 (McIntyre as reported in Gay 1999: 17). During this work two areas were tested, and although no skeletal remains were uncovered, a minor open site was identified on the west side of the railway line (Site 45-1-237), where stone tools were said to have been manufactured or repaired.

McIntyre concluded that the reported burial ground may have been destroyed during the Coxs River deviation works in the 1950s, although there is still the possibility that skeletal material may occur east of the railway and river. She further notes that the presence of artefacts within the level ground adjacent to the river indicates the potential this landscape unit has for the occurrence of Aboriginal sites (McIntyre as reported in Gay 1999: 16-17).

In 1999 and 2000, Kelton undertook surveys in the Wallerawang and Marrangaroo areas respectively (Kelton 1999, 2000). Of the seventeen sites recorded at Marrangaroo, the majority were rock shelter sites, as most of the study area was within the sandstone escarpment. Kelton notes that the location and nature of sites recorded conforms to previously developed site prediction and distribution models pertaining to the region (Kelton 2000: 101).

An area covering almost 300 ha was surveyed for the proposed Cullen Valley open cut mine extension, northwest of the town of Cullen Bullen (and c. 10 km west of the Study Area) by Kelton in 2002. The landforms encountered included exposed sandstone formations and a few alluvial valleys. One open camp site comprising nine stone artefacts, primarily of chert, and one rock shelter with no artefacts and some charcoal were recorded as a result of this assessment (Kelton 2002b).

To the southeast of Invincible mine and just outside (southwest) the 10 x 10 km area surrounding the Study Area, Kelton (2002a) undertook survey of a c. 50 ha area for the proposed Boulder Road coal mine, which has now been incorporated into the proposal for the Neubecks Open Cut Coal Mine. During this survey, Kelton identified one isolated find (BP-IF1: 45-1-2582), apparently situated on a high flat spur overlooking the tributary into Neubecks Creek, and one open camp site (BP-OS1: 45-1-2581) containing seven artefacts in a disturbed context next to the transmission line easement immediately east of the Castlereagh Highway.

In 2003 further survey was undertaken (Appleton 2004) in the face of proposed coal mining at Pine Dale Coal Mine, immediately north of Enhance Place coal mine, c. 12 km south-southwest of the Study Area. This study recorded one isolated find – WC1A (a silicified metasedimentary flake).

In 1999 and 2000, two surveys by Gay were undertaken in the face of the proposed Castlereagh Highway deviation at Lidsdale. One open site and two PADs were identified and test excavation of the latter two was recommended. Subsequently, large scale test and salvage excavations were carried out at these sites, located on a crest above the Coxs River (OzArk 2004b). Part of the site revealed deep soils with evidence for cultural stratification. Sediment samples were dated using the OSL technique providing determinations of 7,400 $\pm$ 700 BP at 30 cm depth and 13,500 $\pm$ 1,000 BP at 45 cm depth. While these sediment samples may not directly date the lithic assemblage, they do give an indication of potential age range, particularly the presence of a pre-Bondaian assemblage in the deepest spits. This interpretation is supported by an absence of Bondaian technical features within the lithic assemblage from spits 3 and 4.

The assemblage from the lower spits lacked backed artefacts and evidence of asymmetric alternating flaking and no flakes with faceted platforms were recovered. This Pre-Bondaian assemblage is dominated by quartz, and has higher frequencies of quartzite and igneous artefacts than the more recent assemblage. The average artefact weight is also higher than in the upper spits. The assemblage from spits 1 and 2 both include backed artefacts, some cores show asymmetric alternating platforms and some flakes have faceted platforms. Both upper spit assemblages are dominated by quartz, but Siliceous tuff/Fine-grained siliceous is more frequent in spit 1 than in spit 2. A few bipolar artefacts occur in spit 2. A piece of utilised pigment was also found in spit 2. Average artefact weight is lowest in spit 1 (**Table 1**).

Table 1: Summary of the assemblage from Lidsdale open site, Area I.

Age BP	Spits	Total artefacts	% Quartz	% S.Tuff	Mean weight Quartz	Mean weight S.Tuff	% Backed artefacts	% Cores	% Bipolar artefacts
	1	559	71.4	26.1	1.2g	1.2g	2.1	0.6	
7,400 ± 700 before AD 2000 (K-0032) (ANU_{OD}1591)	2	642	84.6	12.8	1.6g	2.4g	1.9	1.1	0.6
13,500 ± 1000 before AD 2000 (K-0033) (ANU_{OD}1592)	3+4	284	79.9	11.6	2.9g	3.9g		1.4	

(Assemblage data from White 2004; sediments dated using OSL, reported in OzArk CHM 2004b)

OzArk (2004a) also undertook survey for the proposed Neubecks open cut coal mine. This survey was carried out over the Neubecks valley, on the property between Pinedale and Boulder, c. 9 km south of the Study Area. The Indigenous heritage component of the study recorded five Indigenous sites. Two were open camp sites with Potential Archaeological Deposit, a further two were small open camp sites and the last is an isolated find. Both open camp sites with PAD were recorded on knolls/elevated spurs while the remaining sites were located on the colluvial/alluvial terraces adjacent to Neubecks Creek.

OzArk (2005a and 2005b) undertook a survey within ML 1448 Lamberts Gully and recorded one open camp site with potential archaeological deposit (SVW-OS1 with PAD). This site was located adjacent to an ephemeral drainage line on flat ground at the base of the surrounding hills. Previous studies undertaken within the same study area (Rich and Gorman 1992, Rich 1993a, 1993b and Brayshaw 1993) identified eight Aboriginal sites. Of these, three Aboriginal open camp sites (45-1-0218, 45-1-0208) and an isolated find IF2 (not registered on the DECCW AHIMS) remain intact within ML 1448. Two of the sites (open camp site 45-1-0208 and IF2) were not relocated during the heritage survey.

OzArk (2005c) undertook archaeological assessment over the North Ivanhoe rehabilitation project which is located on the western side of the Castlereagh Highway, c. 12 km southwest of the Study Area. The survey assessed 23 ha of land over the site of the proposed Ivanhoe North Rehabilitation Project and recorded no Indigenous sites. The degree of slope was assessed as generally unsuitable for camping locations and would have more likely been used for resource gathering.

4.3 Local Archaeological Context

The Study Area has not, to the best of the author's knowledge, been completely subjected to a heritage assessment to date: although portions of it have been surveyed from 1989 to the present.

According to Helen Brayshaw, the first archaeological survey in the vicinity of the Study Area was undertaken by P. Gorecki in 1982 (Stone 1989, Appendix 4). This survey was centred slightly to the northwest of the Study Area towards the headwaters of Jews Creek. In his survey, Gorecki recorded a rock shelter (45-1-0080) near Jews Creek and several other shelters with PADs.

This initial survey was followed by a three day survey by Brayshaw and Leila Haglund in February 1989 (**Figure 5**, Stone 1989, Appendix 4). Five open sites were recorded on the Baal Bone lease by Brayshaw and Haglund as a result of this survey (**Table 2**: 45-1-0118, 45-1-0119, 45-1-0120, 45-1-0121, 45-1-0122), as well as four isolated artefacts that were not entered on the AHIMS database. Brayshaw and Haglund aso recorded two shelter sites in the Birds Rock area and an axe-grinding groove site. The open campsites are situated on the headwater tributaries draining northwest into Jews Creek. None of these sites were recorded within the boundaries of the Study Area. It is noted in Kohen (1996: 12) that Baal Bone 3 (45-1-0120) had a consent to destroy permit issued for it in 1993. However, a recent heritage survey (OzArk 2009) relocated this site at the grid coordinates given by Brayshaw and Haglund.

A subsequent survey (**Figure 5**) during 1992 by James Kohen recorded one Indigenous site; an open camp site on Ben Bullen Creek (Ben Bullen Creek 1: 45-1-0240) which was comprised of 47 stone artefacts (Kohen 1992a).

Later in 1992 (Kohen 1992b) identified two sites in potential danger of impact from longwall mining by Baal Bone Colliery. Both these sites Gardiners Gap 1 (45-1-0123) and Baal Bone Lease 1 (45-1-126) are shelter sites with artefacts exposed at the drip line of the shelters. Kelton recommended test excavation of the sites to form a base line against which other sites in the region could be compared. Excavation of these shelters was carried out by Kohen in 1994. Kohen notes (Kohen 1996: 14) that one of the sites was subsequently destroyed by a rock collapse. Both of these sites are located outside the Study Area.

In 1995 James Kohen surveyed three non-contiguous areas which were proposed for open cut mining activity (**Figure 5**). The major area was immediately to the west of Baal Bone North and the other two areas were to the north of Baal Bone South. No Aboriginal sites were recorded in any of the areas (Kohen 1995).

During Kohen's 1996 survey of the northern extension to the Baal Bone underground mining activities (**Figure 5**), he notes that a single site had been previously recorded within his study area, being a rock shelter recorded by Ian Brown for NPWS in 1984 (45-1-0097). The site is described as an overhang situated along a track under which a chert scraper was recorded. Kohen states that he searched for this shelter but was unable to relocate it (Kohen 1996: 15). A recent survey (OzArk 2009) located a suitable shelter at the grid reference given in the AHIMS database (**Table 2**) and although no artefacts were observed it is likely this is the shelter recorded by Brown. Apart from Kohen's references to Brown's work, the author has not been able to locate any further information on this survey.

In 1996 Kohen recorded two open sites that are located outside Study Area: Baal Bone 6 and Baal Bone 7 (**Figure 5**). Baal Bone 6 is located on the site of a house ruin which is on the southern bank of Baal Bone Creek. At this location Kohen recorded 51 artefacts including a backed blade. Quartz and Quartzite material predominates although Kohen recorded jasper, chert and basalt artefacts as well. Baal Bone 7 is located 400 m south of Baal Bone 6 and consisted of 15 artefacts including a bipolar core and a blade core. 14 of these artefacts were quartz or quartzite with a single chert artefact being recorded. Neither of these sites appears to have been registered on the AIHMS database.

In 2007 OzArk conducted an Indigenous heritage survey in Ben Bullen State Forest for a Subsidence Management Plan over three proposed Longwalls (29–31) at Baal Bone Colliery (OzArk 2007a, refer **Appendices 1**–**2**). This survey is located within the current Study Area to the east (**Figure 5**). As a result of this survey, one isolated find (BBC IF1: 45-1-2664) and a shelter with no surface indication of occupation (BBC-RS1: 45-1-2665) were recorded.

A powerline easement and area for a ventilation fan compound was surveyed by OzArk EHM in 2007 (OzArk 2007b). This survey is within the current Study Area. No Aboriginal sites were recorded as a result of this survey. An abridged version of this assessment is contained in **Appendix 3**.

In 2009 OzArk conducted a survey of areas within the Baal Bone mining lease located to the north, east and south of the current Study Area (OzArk 2009). A small portion of the assessment took place on land owned by the Baal Bone colliery, although the majority was in adjoining State Forest Reserves.

The assessment included two discreet areas: the northern Study Area (Baal Bone North) and the southern Study Area (Baal Bone South).

This heritage assessment recorded eight Aboriginal sites or Sensitive Archaeological landforms (SAL). Although site cards for these recordings have been submitted to DECCW, to date none appear on the AHIMS database.

Table 2. Aboriginal sites recorded during the OzArk 2009 survey.

Site Name	Type of Site	AGD Easting	AGD Northing
Baal Bone North (BBN) IF1	Isolated Find	56226898	6317032
Baal Bone North (BBN) IF2	Isolated Find	56227468	6317040
Baal Bone North (BBN) OS1	Open Site	56228935	6317854
Baal Bone North (BBN) OS2	Open Site	56228875	6317699
Baal Bone North (BBN) OS3	Open Site	56228069	6317312
Baal Bone North (BBN) SAL1	Sensitive Archaeological Landform	56228172	6317372
Baal Bone North (BBN) OS4	Open Site	56228620	6317297
Baal Bone North (BBN) OS5	Open Site	56229047	6317959

The 2009 survey concluded that landforms within the 2009 study area were assessed as having a moderate to high possibility of locating further Indigenous archaeological sites and/or relics. In particular, previous research in the region along with the results of the heritage assessment, indicate that all the major drainage systems within the area have potential to hold further archaeological deposits.

The escarpment areas within the 2009 study area was the target of specific Indigenous heritage surveys, and although no cultural material was recorded in these areas, this does not preclude the use of these features by traditional Aborigines.

A search of the DECCW AHIMS database shows the presence of 20 recorded sites within proximity 10 x 10 km area centred on the Study Area (Search date: 13/7/2009. Search criteria: AHIMS Features. AGD Zone 56: Easting from = 222000, Easting to = 232000, Northing from = 6310000, Northing to = 6320000). **Table 3** provides information on these previously recorded sites.

Table 3: Previously recorded sites within a 10 x 10 km area of the Study Area.

Site id	Site name	Context	Zone	Easting	Northing	Grid reference type	Features	Recorders	asrtypes
45-1-0080	Morenmore Shelter	Enclosed Shelter	56	223600	6318000	AGD	AFT	ASRSYS	Shelter with Deposit
45-1-0097	Gardiners Hill; Baal Bone Creek; Ben Bullen State Forest	Enclosed Shelter	56	229700	6316600	AGD	AFT	Brown	Shelter with Deposit
45-1-0118	Baal Bone 1	Open Site	56	227000	6318420	AGD	AFT	Brayshaw, Haglund	Open Camp Site
45-1-0119	Baal Bone 2	Open Site	56	226880	6317680	AGD	AFT	Brayshaw, Haglund	Open Camp Site
45-1-0120	Baal Bone 3	Open Site	56	227510	6316940	AGD	AFT	Brayshaw, Haglund	Open Camp Site
45-1-0121	Baal Bone 4	Open Site	56	226810	6315820	AGD	AFT	Brayshaw, Haglund	Open Camp Site
45-1-0122	Baal Bone 5	Open Site	56	226380	6316040	AGD	AFT	Brayshaw, Haglund	Open Camp Site
45-1-0123	Gardnes Gap 1	Enclosed Shelter	56	229220	6311600	AGD	AFT	Godwin	Shelter with Deposit
45-1-0124	Baal Bone Lease 2	Enclosed Shelter	56	229950	6312800	AGD	AFT	Godwin	Shelter with Art
45-1-0125	Baal Bone Pagoda 1	Enclosed Shelter	56	230400	6311400	AGD	AFT	Godwin	Shelter with Art

Site id	Site name	Context	Zone	Easting	Northing	Grid reference type	Features	Recorders	asrtypes
45-1-0126	Unknown site (Blue Mountains, Ben Bullen State Forest)	Enclosed Shelter	56	228500	6311400	AGD	AFT	unknown	Shelter with Deposit
45-1-0240	Ben Bullen Creek 10	Open Site	56	227050	6313340	AGD	AFT	Kohen	Open Camp Site
45-1-2542	Forest Lodge (FL:66:1) Forest Lodge	Open Site	56	222110	6315530	AGD	GDG	Mills	Axe grinding groove
45-1-2579	CB-OS-1	Open Site	56	222690	6316150	AGD	AFT	Central West Archaeological Services	none
45-1-2580	CB-S-1	Enclosed Shelter	56	222590	6314210	AGD	PAD	Central West Archaeological Services	none
45-1-2664	BBC-IF1	Open Site	56	229862	6312228	AGD	AFT	OzArk EHM	none
45-1-2665	BBC-RS1	Open Site	56	220426	6311660	AGD	PAD	OzArk EHM	none
45-1-2666	BBC-IF1	Open Site	56	229862	6312228	AGD	AFT	OzArk EHM	none
45-1-2667	BBC-RS1	Open Site	56	220426	6311660	AGD	PAD	OzArk EHM	none
45-1-2668	Invincible OS1	Open Site	56	224955	6310224	AGD	PAD	OzArk EHM	none

Of these 20 previously recorded sites, the major site feature is the presence of artefacts (AFT: objects such as stone tools, spears, manuports, grindstones, discarded stone flakes, modified glass or shell demonstrating evidence of use of the area by Aboriginal people), axe-grinding grooves (GDG: a groove in a rock surface resulting from manufacture of stone tools such as ground edge axes and spears, may also include rounded depressions resulting from grinding of seeds and grains) and potential archaeological deposits (PAD: an area where artefacts may or may not have been identified where further subsurface artefacts and/or other cultural materials are thought likely to occur).

It is also noted that two sites recorded by OzArk EHM have been entered twice in the AIHMS database as represented in **Table 3**. **Table 4** displays the sites that have been entered twice: both sites are within the Study Area. In summary:

1. BBC-IF1 is listed as 45-1-2664 and 45-1-2666, and
2. BBC-RS1 is listed as 45-1-2665 and 45-1-2667.

Table 4: Erroneously recorded sites in the AIHMS database.

45-1-2664	BBC-IF1	Open Site	56	229862	6312228	AGD	AFT	OzArk EHM	none
45-1-2665	BBC-RS1	Open Site	56	220426	6311660	AGD	PAD	OzArk EHM	none
45-1-2666	BBC-IF1	Open Site	56	229862	6312228	AGD	AFT	OzArk EHM	none
45-1-2667	BBC-RS1	Open Site	56	220426	6311660	AGD	PAD	OzArk EHM	none

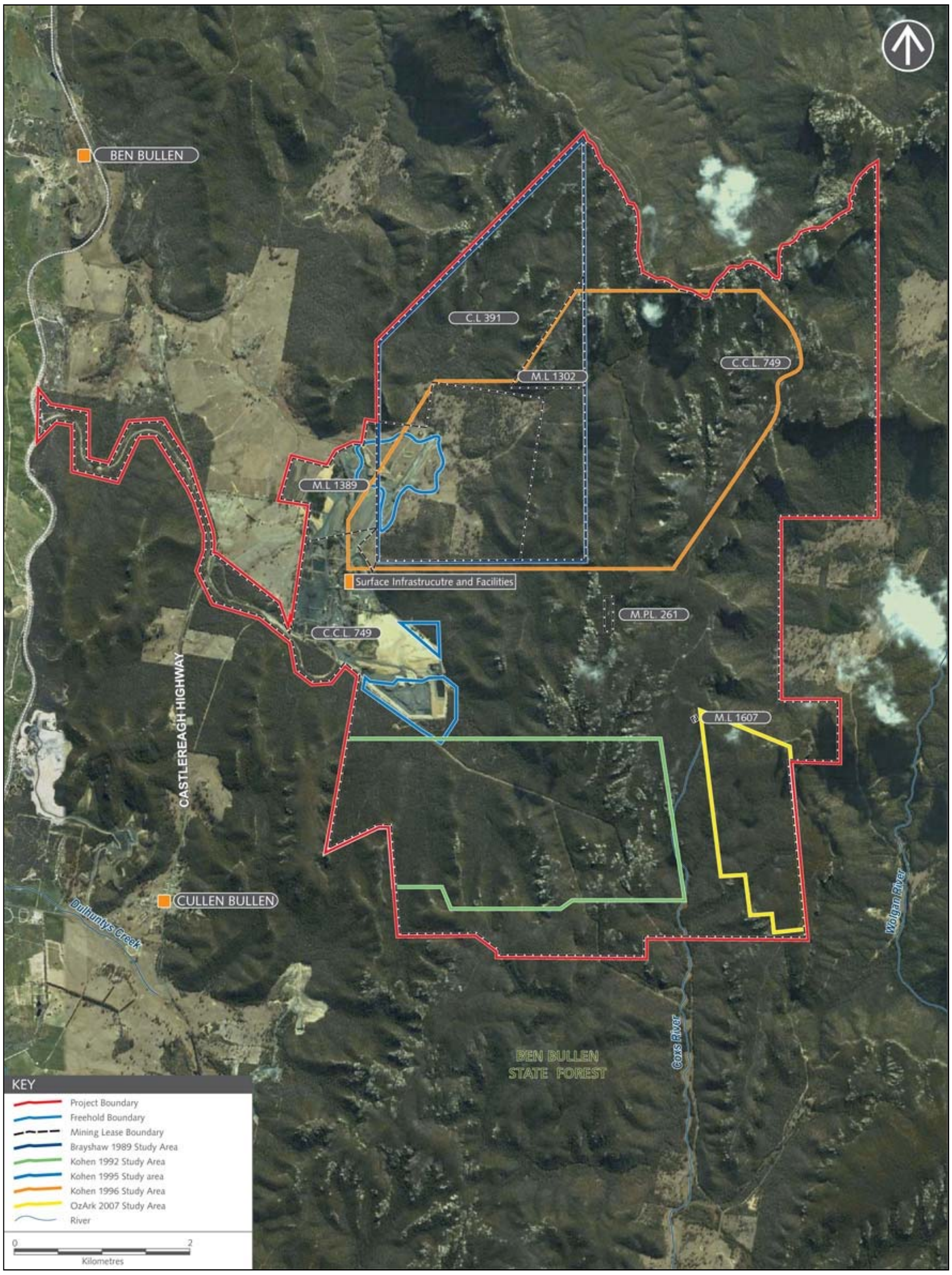
Table 5 shows a breakdown of these sites into their site types. It has a total of 18 to take into account the two sites that have been entered twice on the AIHMS database. The most frequent site type recorded in the vicinity of the Study Area is open sites, comprising 50% of all site types. 39% of all site types are shelters with deposits. One shelter with art has been recorded in the immediate vicinity of the Study Area (5.5%). One axe grinding groove site has been recorded in the immediate vicinity of the Study Area (5.5%).The escarpment country in the east of the Study Area, along with the watered and undulating landscape in the west of the Study Area, provide the requisite geological landforms and environmental niches for these site types.

Table 5: Number, type and percentage frequency of previously recorded sites within a 10 x 10 km area of the Study Area.

Site Type	Total	% Frequency
Shelter with Deposit	7	39
Open Camp Site	9	50
Shelter with Art	1	5.5
Axe Grinding Grooves	1	5.5
Totals	18	100

Figure 5 shows the areas of previous heritage surveys in relation to the Study Area. **Figure 6** shows the location of previously recorded Aboriginal sites in relation to the Study Area.

Figure 5: Previous heritage assessments in relation to the Study Area.



As can be seen in **Figure 5**, the Study Area has had varying degrees of assessment. In general, the following comments can be made:

1. The Surface Infrastructure Area has had a small representative sample previously surveyed, although the northeast corner has been subjected to three surveys (Brayshaw 1989, Kohen 1995 and Kohen 1996).

2. Of the total area designated Remnant Areas, approximately 40% has been previously surveyed (Brayshaw 1989, Kohen 1992, Kohen 1995 and Kohen 1996). In addition, the remaining Remnant Areas have had heritage surveys occur in close proximity, and in identical landscapes (for example the remnant area to the south of Longwalls 24 and 25 has had two surveys along its northern border [Brayshaw 1989, and Kohen 1996] in a contiguous landform).
3. In the Longwalls 29 to 31 area within the Underground Mining Area, complete heritage survey coverage has been achieved (OzArk 2007a). This survey coverage also includes the electricity easement and ventilation fan compound (OzArk 2007b).

Figure 6: Previously recorded Aboriginal sites in the vicinity of the Study Area (this figure displays a larger area than that represented in Table 3).

Figure 6 shows that three previously recorded sites fall within the current Study Area boundaries:

1. 45-1-2664 [also listed as 45-1-2666] (Isolated Find)
2. 45-1-2665 [also listed as 45-1-2667] (Rock Shelter with potential occupation)
3. 45-1-0240 (Open Site: 47 artefacts)

4.4 Predictive model for site location

Predictive modelling aims to establish a theoretical model for site location/distribution within a given area. This model provides a comparative situation against which the results of the investigation can be discussed, taking into account the affects of post formation processes, such as ground surface visibility and past land use.

Proximity to a permanent water supply is generally considered the primary factor determining the location of Aboriginal camp sites. In the Sydney region, stream ordering has been used to predict the potential for site occurrence, and further to indicate the possible nature of these sites in terms of their complexity. Results of an integrated series of studies including a serious excavation component (McDonald 1997), suggests a high correlation between the permanence of a water source and the permanence and/or complexity of the areas' Aboriginal occupation. This was further reflected in the lithic assemblages from sites close to permanent water, which suggested that a greater range of activities were represented (e.g. tool use, manufacture and maintenance, food processing and quarrying). Sites near ephemeral water sources had evidence for one-off occupation (e.g. isolated knapping floors or tool discard), and creek junctions were also proven to be foci for site activity.

More closely related to the Study Area, are some extrapolations concerning site nature and distribution in the Coxs River Valley and surrounding escarpment country.

In 1990 Leila Haglund reviewed the results of archaeological surveys in the region and concluded that large shelters were clearly preferred as occupation sites, but there was no preference for north facing slopes (Kohen 1996: 13). The large numbers of open sites in the region indicated that there was intensive and repeated use of the area by traditional Aboriginals, with many large sites appearing to be base camps. Open sites were often found in association with hanging swamps.

Haglund proposed a model of Aboriginal site distribution based on all earlier studies and she concluded that:

1. The distribution of art sites has a low predictability;
2. Large sites or site complexes are likely to occur at the head of gullies or in locations that combined vantage points with specialised or localised resources;
3. Large or medium sized occupation sites are likely to occur near the junction of major gullies with the river valley, either in rock shelters or on open, level ground;
4. Shelter sites with small amounts of material and small open sites are likely in favourable locations on good routes in more difficult terrain;
5. Ephemeral sites may occur almost anywhere, but evidence is most likely to have survived in rock shelters; and
6. Isolated finds may indicate the presence of subsurface materials.

Based on these results and the using the concept of stream ordering, the following general predictions can be made regarding the nature of sites and their location in the Study area:

1. On major creek lines and rivers, archaeological evidence will tend to indicate more permanent or repeated occupation. Sites may be complex, with a range

of lithic activities represented, and may even be stratified. Proximity to resource rich zones also indicates a higher likelihood of the presence of complex occupation sites.

- From the review of the hydrological data relating to the Study Area (Section 3.2), the waterways appear to be largely ephemeral and the gullies seem to have significant slope. Therefore large (complex) open camps sites may not be present in the Study Area.

2. Further from permanent water, sites are likely to be smaller, less complex and more likely to be the result of one-off occupation episodes.

   - The Study Area appears to fall into this category; consequently small sites may be located on appropriate elevated, well drained areas near ephemeral water.

3. In escarpment country or upper hill slopes where appropriate, habitable sandstone overhangs and caves are present, occupation sites are likely and their size will be determined by the extent of available space in the shelters.

   - The Study Area comprises little high country and sandstone escarpments. Depending on the presence, condition and aspect of available overhangs, rock shelter sites with or without art and/or deposits may be recorded.

From the known sites outlined previously in Sections 4.2–4.3, and the landform potential as detailed above, it is possible to say that the most likely sites to be encountered in the Study Area are:

1. Rock shelter sites may occur wherever there are suitable overhangs/caves. The quality and extent of such features will determine the nature and type of potential occupation;
2. Open camp sites (on elevated terraces and low spurs close to water). Due to the ephemeral nature of the water courses within the study area and the significant slope of the landform, such sites may be unlikely, but if present may be the result of one-off occupation episodes;
3. Culturally modified trees (i.e. scarred trees) are located frequently close to creeks and rivers but also found further afield. Few mature trees of an age to bear cultural scars are likely to remain in the study area (due to logging: see Section 3.5), although some remnant individuals may be present;
4. Grinding grooves may occur where exposed sandstone is evident;
5. Natural mythological or cultural/ceremonial sites may occur anywhere, although are less likely on significant slopes; and
6. Isolated finds may occur anywhere, especially in disturbed locations near water sources or in areas close to ephemeral water – i.e. headwaters.

4.5 Discussion

The Study Area is comprised of three non-contiguous areas that have undergone varying degrees of disturbance and heritage assessment.

The western portion of the Study Area (designated as Surface Infrastructure Area, **Figure 2**), has had the least heritage assessment, the most invasive disturbance to the ground surface (**Figure 3**) and occupies landforms that would have more conducive to Aboriginal occupation than adjoining landforms to the east (Section 4.4).

This area has been subjected to mining since before the 1980s and includes areas of pit top infrastructure, rehabilitated open cut mining areas and REAs (see Section 3.5). As a result the original ground surface has been substantially altered from its original form.

While this area may have once held potential for locating Aboriginal sites, the extensive disturbance since mining began has diminished, or destroyed, the context and integrity of any archaeological deposit that may have once existed.

The region designated Remnant Areas (**Figure 2**), have low levels of disturbance and the presence of previously recorded Aboriginal sites (45-1-0240). Some site types, such as culturally modified trees, have a low potential to occur due to past logging activities (Section 3.5), while others, such as open sites, should not have been greatly affected by past landuse practices. There is therefore potential for the Remnant Areas to contain further Aboriginal sites, although the overall area is relatively small and the landscape would indicate that sites would be less complex than those further west (Section 4.4). Further, although there are plans to mine the coal beneath these Remnant Areas, it is not expected to result in significant subsidence (greater than what has been previously predicted), so the impact on surface features is expected to be minimal (SCT 2009: subsidence protection zones within this report provide further protection for the three cliffs and the Ben Bullen Creek area within the Remnant Areas). As this area is devoid of escarpments that are located further east, it is predicted that disturbance to currently undetected Aboriginal sites (i.e. open sites) in this area will be minimal as subsidence mainly affects sites located within shelters located along escarpments..

The Longwall 29 to 31 area (**Figure 2**) has had complete survey coverage (OzArk 2007a, 2007b) and contains two previously recorded Aboriginal sites (45-1-2664/2666: Isolated Find and 45-1-2665/2667: Rock Shelter with potential occupation). The landforms in this area are predicted to have less-complex occupation sites and an increased probability of shelter sites as this area nears the escarpment country to the east (Sections 3.1, 4.4). Disturbance in this area has been low (Section 3.5) apart from the fan ventilation compound which has had high levels of disturbance.

4.6 Assessment of Heritage Significance

4.6.1 Introduction

The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance as well as the likely impacts of any proposed developments. Scientific, cultural and public significance are currently identified as baseline elements of this assessment, and it is through the combination of these elements that the overall cultural heritage values of a site, place or area are resolved.

Cultural significance

This area of assessment concerns the importance of a site or features to the relevant cultural group – in this case the Aboriginal community. Aspects of cultural significance include assessment of sites, items, and landscapes that are traditionally significant or that have contemporary importance to the Aboriginal community. This importance involves both traditional links with specific areas as well as an overall concern by Aboriginal people for their sites generally and the continued protection of these. This type of significance may not be in accord with interpretations made by the archaeologist - a site may have low scientific significance but high Aboriginal significance (or *vice versa*).

Scientific significance

Assessing a site in this context involves placing it into a broader regional framework, as well as assessing the site's individual merits in view of current archaeological discourse. This type of significance relates to the ability of a site to answer current research questions and is also based on a site's condition (integrity), content and representativeness.

The overriding aim of cultural heritage management is to preserve a representative sample of the archaeological resource. This will ensure that future research within the discipline can be based on a valid sample of the past. Establishing whether or not a site can contribute to current research also involves defining 'research potential' and 'representativeness' (Bowdler 1983). Questions regularly asked when determining significance are: can this site contribute information that no other site can? Is this site representative of other sites in the region?

The scientific significance of isolated finds tends to be limited unless the artefact is in some way rare (contextually) in terms of artefact type or raw material.

It is impossible to determine the significance of rock shelters in which no archaeological material has been discovered as there is no site material or soil data to assess. If a site is assessed as having adequate potential, test excavation may be recommended for sites to investigate the presence, extent, nature and integrity of any possible site material such that their significance can be assessed and appropriate management recommendations devised.

Public significance

Sites that have public significance do so because they can educate people about the past. By reducing ignorance about why sites are important to the Aboriginal and scientific community, important sites can be protected from ignorant or inadvertent destruction. Educating the public to understand the need for site preservation should increase the likelihood of maintaining an archaeological resource into the future. For a site to have high public significance it should contain easily identifiable and interpretable elements, and be relatively easily accessed.

Most open artefact scatters and isolated finds, when *in-situ*, are usually extremely difficult for the lay person to appreciate unless the artefact(s) is/are in some way very unusual or numerous. Rock shelter sites may be easier for the layperson to appreciate as long as they are relatively accessible and display obvious signs of human occupation (i.e. hearths or rock art).

4.6.2 Assessed significance of the previously recorded sites within the Study Area

Cultural

The two sites recorded by OzArk EHM in the Longwalls 29 to 31 area (**Figure 2**) were assessed for their cultural significance through conversations held on-site with Aboriginal representatives (OzArk 2007a: 21). The isolated find (BBC-IF1: 45-1-2664/2666) was assessed as having **moderate cultural significance** to the local Aboriginal people. The Aboriginal community representatives thought the artefact was *in situ*, and it was assessed as most likely to have a been a ‘drop’ artefact, left as someone moved through the landscape rather than as an indicator of an occupation site. Due to the lack of occupation evidence present at BBC-RS1 (45-1-2665/2667), a determination of significance is challenging.

The other site recorded within the Study Area, Ben Bullen Creek 1 (45-1-0240) was recorded during Kohen's 1995 survey (Kohen 1995). No assessment of cultural significance is recorded in his report.

Scientific

The isolated find (BBC-IF1: 45-1-2664/2666) is considered to be of Aboriginal origin (OzArk 2007a: 21) and the report notes that the likelihood of there being associated artefacts or intact, sub-surface deposits related to this artefact was considered to be very low. The site was assessed as having **low scientific significance.**

No direct evidence of Aboriginal occupation of the rockshelter (BBC-RS1: 45-1-2665/2667) was recorded at the time of the 2007 OzArk survey and a significance degree of collapse had occurred in the main portion of the shelter. The report noted that the presence of edible plant foods, the protected aspect and proximity to the ephemeral waterway all provided favourable conditions for human habitation (OzArk 2007a: 22). The report noted that assessment of the scientific significance of this rockshelter was challenging due to the lack of surface information available. OzArk 2007a noted that there was some potential that the roof-collapse overlies evidence of prior human habitation and this evidence may continue to the currently overgrown drip line of the shelter and hence be accessible through test excavation. As a result the site was assessed as holding **moderate scientific significance**.

Kohen, in his 1995 report (Kohen 1995) does not assign scientific significance to the site, Ben Bullen Creek 1 (45-1-0240). He notes, however, that the site displayed a relatively rich array of stone artefacts that included cores and backed tools (Kohen 1995: 17). On the basis of the tool forms, Kohen determined that the site belongs to the Australian Small Tool Tradition. Kohen noted a range of raw materials present at the site including different types of cherts and milk quartz (Kohen 1995: 18).

Although Kohen says that the site is "typical of open sites in the area" (Kohen 1995: 21), he noted that there is the possibility of further undetected archaeological deposits in the area.

Although the author of this assessment has not re-located this site to determine its present condition and integrity; if it retains the features noted by Kohen in 1995, then it would hold scientific significance. However, without a site visit it is impossible to assess the exact nature of its scientific significance.

Public

All sites previously recorded within the Study Area are not located within easily accessible areas and nor are the stone artefacts easily identifiable by the lay person as being Aboriginal in origin. Consequently, the sites previously recorded within the Study Area are assessed to have overall **low-moderate public significance**.

4.7 Likely impacts on Indigenous heritage from the proposed works

It can be predicted that impacts will continue to be severe in the Surface Infrastructure Area (**Figure 2**) and less severe to negligible in the Remnant Areas and Longwalls 29 to 31.

As the Surface Infrastructure Area has already been heavily impacted (Section 3.5), it is assessed that it is extremely unlikely that intact archaeological deposits remain in this area. Aboriginal heritage in this area has already been lost and continued works will not, therefore, impact cultural heritage in this area.

The Remnant Areas and Longwalls 29 to 31 not only contain previously recorded sites, but have had low disturbance to the ground surface in the past. Mining of Longwalls 29 to 31 and the Remnant Areas is underground, and the main impact will be possible subsidence. The impact of subsidence has been assessed (SCT 2009) for the mining of Longwalls 29 to 31, and mining is being undertaken in accordance with an approved Subsidence Management Plan.

Although a Subsidence Management Plan and detailed subsidence assessment has not yet been undertaken for the Remnant Areas, the impact to cultural heritage of any potential subsidence in this area is assessed as low. This is due to the fact that this area does not contain escarpment country which is often impacted by subsidence and, while subsidence may occur, it is unlikely it impact currently undetected Aboriginal sites such as open sites.

4.8 Management options

Impacts to cultural heritage from continued operations at Baal Bone within the Surface Infrastructure Area is assessed as being low due to the complete alteration of the ground surface within this area. Therefore, there are no management recommendations for continued operations in this area with regard to cultural heritage.

In the Remnant Areas, the impacts from continued operations may well have an impact on the cultural heritage of this area; albeit a small one. As this area will be subjected to underground mining, there may well be subsidence issues that need to be addressed. As this area has not been subjected to a full heritage assessment and is known to contain previously recorded sites, management options should include a full heritage survey to ensure that subsidence will not affect currently existing cultural heritage. This heritage survey would also inspect the previously recorded site (45-1-0240) to assess its present condition. However, the nature of the impacts in this area will be relatively minor as there will be no ground surface altering works and subsidence is predicted to be low (SCT 2009: subsidence protection zones within this report provide further protection for the three cliffs and the Ben Bullen Creek area within the Remnant Areas).

Should subsidence occur within the Remnant Areas, it is unlikely to have a great impact on existing cultural heritage as this area does not contain escarpment country (which can be affected by subsidence), has been previously logged (potentially removing sites such as culturally modified trees). Although it may contain further Aboriginal sites such as open sites, these site types are unlikely to be greatly affected by subsidence. Further, the area is relatively small and heritage surveys in contiguous landforms have recorded a generally low density of Aboriginal sites. Therefore it is predicted that the possibility of locating further Aboriginal sites in this area that require management is low.

In the Longwalls 29 to 31 area, full heritage surveys have taken place (OzArk 2007a, 2007b – refer **Appendices 1**–**3**). The management recommendations for the two recorded sites in this area are as follows.

1. BBC-IF1 (45-1-2664/2666) was assessed as being a one-off drop artefact of overall low significance. No further archaeological assessment in relation to this site is considered necessary (as recommended in OzArk 2007a: 27).
2. BBC-RS1 (45-1-2665/2667). Management of this rockshelter was formulated with respect to the predicted affects of subsidence on the location of the rockshelter, once these have been modelled. Hence, two options for BBC-RS1 are recommended (as in OzArk 2007a: 27):
   - If subsidence predictions indicate that the location of BBS-RS1 will be only minimally impacted by potential subsidence, then no further archaeological assessment of this location is considered necessary.
   - If, however, subsidence predictions indicate that this location is likely to suffer extensive disturbance and plans of the underlying Longwalls cannot be altered to alleviate this, then a programme of limited sub-surface test excavation within the rockshelter and its immediate environs is recommended to determine the presence or absence of Indigenous occupation evidence. The resultant information will allow an informed assessment of the scientific and cultural significance of the rockshelter thus enabling the formulation of appropriate management recommendations.

4.9 Relevant Legislation

Baseline principles for the conservation of heritage places and relics can be found in the Burra Charter[1], which recognizes that there are places worth keeping because they can enrich our lives on many levels. The significance of such places may be embodied in fabric (physical material), environmental setting, contents, use or its meaning to people, and should be assessed through methodical data collection. Since its adoption in 1979, The Burra Charter has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The Burra Charter generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a State level.

A number of Acts of parliament provide for the protection of Aboriginal heritage at various levels of government[2]. The three most important statutes in New South Wales are the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act), amended by the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* (EP&AA Act).
- *National Parks and Wildlife Act 1974* (NPW Act).

While at Commonwealth level, the following statute is relevant:

[1] The Burra Charter defines the basic principles and procedures to be followed in the conservation of all kinds of places such as monuments, buildings, Aboriginal sites, roads, archaeological sites, whole districts or even regions. It was first adopted in 1979, based on the Australian ICOMOS (International Council on Monuments and Sites) review (1977) of the 1966 Venice Charter (Australian ICOMOS Inc. 1998).

[2] NSW Heritage Office 1998: *Living with Aboriginal Culture*, p. 3.

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) amended by the *Environment and Heritage Legislation Amendment Act (no. 1) 2003*.

4.9.1 State legislation

The EP&A Act is founded on the *Environmental Planning and Assessment Act 1979* that requires environmental impacts, including cultural heritage, are considered at a land-use planning and decision making level.

Under this Act, Aboriginal heritage is protected in three different ways:

1. Through planning instruments such as State Environmental Planning Policies (SEPP) and Local Environmental Plans (LEPs). Such plans outline permissible land use as well as identifying potential constraints. Section 112 (1) of the EP&A Act delineates that no approval for either prescribed developments or developments likely significantly affect the environment, may be granted without prior appropriate environmental impact assessment.

2. Section 90 of the Act (Part 4, Division 5) lists impacts to the environmental resource, including cultural heritage, which must be considered before development approval is granted.

3. All State Government agencies acting as determining authorities on environmental issues must consider a range of community and cultural factors, including Aboriginal heritage, in their decision-making process. The factors to be considered in such assessments are set out in the EP&A Regulations (1980), Part VII.

On 9 June 2005 the NSW Parliament passed the EP&AA Act. This contains key elements of the NSW Government's planning system reforms through major changes to both plan-making and major development assessment. The *Act* was assented to on 16 June 2005.

A key component of the amendments is the insertion of Part 3A (Major Projects) into the EP&A Act. The aim is to facilitate major project and infrastructure delivery and encourage economic development, while strengthening environmental safeguards and community participation. On 1 August 2005 the new Part 3A and related provisions commenced.

The new Part 3A consolidates the assessment and approval regime for all major projects previously addressed under Part 4 (Development Assessment) or Part 5 (Environmental Assessment) of the *Act*.

Part 3A applies to major State government infrastructure projects, development previously classified as State significant, and other projects, plans or programs of works declared by the Minister.

The amendments provide a streamlined assessment and approvals regime for major infrastructure and other projects of State or regional significance. They also improve the mechanisms available under the EP&A Act to enforce compliance with approval conditions or the *Act*.

The *National Parks and Wildlife Act 1974* (NPW Act) (as amended; particularly sections 83-91A) provides statutory protection for all Aboriginal relics and places, regardless of significance, land tenure or whether they have been previously recorded in the DECCW AHIMS. Areas may be gazetted as Aboriginal 'places' when the Minister is satisfied that sufficient evidence exists to demonstrate that the area is or was of special significance to Aboriginal people.

Under Section 90 of this Act it is an offence to knowingly damage, deface or cause or permit the destruction of an Aboriginal relic or place without the prior written consent of the Director-General of the NSW DECCW. Prosecution for such offences may include the imposition of financial penalties and/or imprisonment. Reporting the discovery of previously unknown Aboriginal sites to the Director-General of the DECCW within a reasonable time of discovery is also obligatory under Section 91 of the Act.

The *Heritage Act 1977* (amended 1999) protects the State's natural and cultural heritage and contains measures to protect archaeological remains. Generally, Aboriginal sites are protected by the NPW Act, but if certain sites are deemed as having great significance, they can be further protected by a heritage order, issued by the Minister, on the advice of the Heritage Council.

4.9.2 Commonwealth legislation

The EPBC Act protects the environment, particularly matters of National Environmental Significance. It streamlines national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places. Under the EPBC Act, definitions of the 'environment' include the following:

1. Ecosystems and their constituent parts, including people and their communities;
2. Natural and physical resources;
3. The qualities and characteristics of locations, places and areas;
4. Heritage values of places; and
5. The social, economic and cultural aspects of a thing mentioned in the above points.

The EPBC Act provides that any action assessed as likely to have a significant effect on listed matters of national environmental significance is to be known as a *controlled action*, and may only proceed with the Minister of the Environment's approval.

In January 2004 changes to the protection of national heritage came into effect through amendments to the EPBC Act (*Environment and Heritage Legislation Amendment Act (no. 1) 2003*).

4.9.3 Applicability to the Study Area

State legislation

The current project is governed by Part 3A of the EP&AA Act.

Commonwealth legislation

No places or sites within the Study Area are governed by the EPBC Act.

6.0 Conclusions

This assessment is a desktop study completed without an accompanying heritage survey. Therefore recommendations are general as the number and heritage significance of Aboriginal sites in the overall Study Area are not comprehensively known, although comprehensive assessments have been undertaken for the Longwalls 29 to 31 area.

In general, the following conclusions can be made:

1. The Surface Infrastructure Area has had extensive disturbance of the original ground surface due to mining activities. While the landforms in this region of the Study Area would have once held potential to contain Aboriginal sites, the high degree of prior disturbance would indicate that the integrity of any site in this area has already been destroyed. Due to the nature of these disturbances, and the likelihood that any sites in this region have been destroyed, it is assessed that there is a low probability of locating further intact Aboriginal sites in this area. It is therefore argued that no further Aboriginal heritage assessment is required in this area.
2. The Remnant Areas have not been subjected to a full heritage survey although portions of this area have been surveyed, and contiguous landforms adjacent to the Remnant Areas have been subjected to heritage surveys. The region has generally had low disturbance, mostly resulting from logging. The region has one previously recorded site. It is assessed that there is potential for this region to contain further Aboriginal sites. It is noted, however, that open sites containing low densities of artefacts are the prominent site type predicted for this area: a site type that is less-affected by subsidence than other site types such as shelters that are not expected to occur. It is recommended that should underground mining in this area proceed in the future, a full heritage survey should be conducted to ascertain the present condition of the site Ben Bullen Creek 1 (45-1-0240) and to comprehensively assess this portion of the Study Area for its heritage significance.
3. The Longwalls 29 to 31 area has been subjected to a full heritage survey. Therefore the recommendations contained in OzArk 2007a and 2007b should be adhered to regarding any future developments in this region of the Study Area (see Section 4.8). Namely:
    - BBC-IF1 (45-1-2664/2666) was assessed as being a one-off drop artefact of overall low significance. No further archaeological assessment in relation to this site is considered necessary (as recommended in OzArk 2007a: 27).
    - BBC-RS1 (45-1-2665/2667). Management of this rockshelter was formulated with respect to the predicted affects of subsidence on the location of the rockshelter, once these have been modelled. Hence, two options for BBC-RS1 are recommended (as in OzArk 2007a: 27):
        - If subsidence predictions indicate that the location of BBS-RS1 will be only minimally impacted by potential subsidence, then no

further archaeological assessment of this location is considered necessary.

- o If, however, subsidence predictions indicate that this location is likely to suffer extensive disturbance and plans of the underlying Longwalls cannot be altered to alleviate this, then a programme of limited sub-surface test excavation within the rockshelter and its immediate environs is recommended to determine the presence or absence of Indigenous occupation evidence. The resultant information will allow an informed assessment of the scientific and cultural significance of the rockshelter thus enabling the formulation of appropriate management recommendations.

7.0 References

Appleton 2004	J. Appleton, *Aboriginal Heritage Assessment Pine Dale Coal Mine Proposal*. Report to R.W. Corkery & Co.
Barton, McDonald 1995	H. Barton and J. McDonald, *Archaeological investigation of sites affected by augmentation works at Lyell Dam, near Lithgow, NSW*. *Salvage and test excavation report*. Report prepared for Pacific Power.
Bowdler 1983	S. Bowdler, *Aboriginal sites on the Crown timber lands of NSW*. Report to the Forestry Commission of NSW.
Brayshaw, Haglund 1992a	H. Brayshaw and L. Haglund, *Western Main Colliery Proposed Open Cut Western Blue Mountains, NSW*. Report to Novacoal Australia Pty Ltd.
Brayshaw, Haglund 1992b	H. Brayshaw and L. Haglund, *Lamberts Creek – Western Main Colliery Archaeological investigation of two potential open sites*. Report to Novacoal Australia Pty Ltd.
Brayshaw 1993	H. Brayshaw, *Western Main Colliery Proposed Open Cut Extension. Archaeological Survey for Aboriginal Sites*. Report to Novacoal Australia Pty Ltd.
Corkery 1995	RW Corkery and Co, *Environmental Imapct Statement for the proposed open cut mining development at Baal Bone Colliery*. Report to The Wallerawang Collieries Limited.
Gay 1999	L. Gay, *Proposed Realignment of the Castlereagh Highway, Lidsdale, NSW: Indigenous Heritage Assessment*. Report to the RTA.
Kelton 1999	J. Kelton, *An Archaeological survey of the proposed silicon plant at Wallerawang, near Lithgow, Central tablelands of NSW*. Report to R.W. Corkery, Orange.
Kelton 2000	J. Kelton, *An Aboriginal Archaeological study of the Marrangaroo Department of Defence site, Lithgow, NSW*. Report to Dames and Moore Pty Ltd, North Sydney.
Kelton 2002a	J. Kelton, *An Aboriginal Archaeological Study & Non-Indigenous Heritage Overview of the Proposed Boulder Road Coal Mine, Near Cullen Bullen*. A report to International Environmental Consultants P/L.
Kelton 2002b	J. Kelton, *An Aboriginal Archaeological Survey & Non-Indigenous Heritage Overview of the Proposed Extension to Cullen Valley Mine*. A report to Lithgow Coal Company.
Kohen 1992a	J. Kohen, *Archaeological Survey of the Proposed Open Cut extension to the Baal Bone Colliery*. Report to Coalex P/L.

Kohen 1992b	J. Kohen, *The impact of longwall mining on Aboriginal sites. The southeast extension to the Baal Bone Colliery*. Report to Coalex P/L.
Kohen 1995	J. Kohen, *Archaeological Survey of the Proposed Open Cut extension to the Baal Bone Colliery*. Report to Coalex P/L.
Kohen 1996	J. Kohen, *Archaeological Survey of the Proposed Northern extension to the Baal Bone Colliery*. Report to Wallerawang Colliers P/L.
McDonald 1997	Jo McDonald CHM, *Interim Heritage Management report: ADI Site St Marys. Volume 1*. Report to Lend Lease.
Mills 1998	R. Mills, *An Archaeological survey for the Proposed Stage 4 of Ivanhoe Mine, Portland*. Report to International Environmental Consultants.
Mulvaney, Kamminga 1999	J. Mulvaney and J. Kamminga, *Prehistory of Australia*. Allen and Unwin: Sydney.
Nexus 1981	Nexus Environmental Studies, *Baal Bone Colliery Environmental Impact Statement*. Report for Coalex Pty Ltd.
OzArk 2004a	*Archaeological Assessment for the proposed Neubecks Creek Open Cut Coal Mine*. Report to International Environmental Consultants.
OzArk 2004b	*Salvage Excavations at Site L2 – # 45-1-2573 & 2574, within the Proposed Corridor the New Castlereagh Highway 86, Lidsdale, NSW. July 2004*. Report to the NSW Roads and Traffic Authority, Parkes.
OzArk 2005a	*Archaeological and Ecological Assessment Open Cut Coal Mine Expansion Mining Lease 1448, Lamberts Gully, NSW*. Report to International Environmental Consultants.
OzArk 2005b	*Addendum to Archaeological and Ecological Assessment Open Cut Coal Mine Expansion Mining Lease 1448, Lamberts Gully, NSW*. Report to International Environmental Consultants.
OzArk 2005c	*Archaeological Assessment–Nth Ivanhoe Rehabilitation Project*. Report to Centennial Coal Pty. Ltd.
OzArk 2007a	*Indigenous Heritage Assessment for Subsidence Management Plan over three proposed longwalls (29–31), Baal Bone Colliery Ben Bullen State Forest, Cullen Bullen, NSW*. Report for Xstrata Coal P/L.
OzArk 2007b	*Indigenous Heritage Assessment for Proposed 1.7 km, 11kV powerline easement and ventilation fan compound, Baal Bone Colliery Ben Bullen State Forest, Cullen Bullen, NSW*. Report for Umwelt Pty Ltd.

OzArk 2009	*Indigenous and non-Indigenous Heritage Assessment of areas within and adjacent to Baal Bone Colliery, Western Blue Mountains (Cullen Bullen) NSW*. Report for AECOM Pty Ltd.
Rich 1988	E. Rich, *Proposed prison at Marrangaroo Creek near Lithgow, NSW: archaeological survey for Aboriginal sites*. Report prepared by Brayshaw McDonald Pty Ltd for the Public Works Department of NSW.
Rich 1993a	E. Rich, *Springvale Coal Project, Wallerawang, NSW: Archaeological inspection of Aboriginal sites affected by construction works*. Report prepared for Howie Herring and Forsyth Pty Ltd.
Rich 1993b	E. Rich, *Additional Archaeological Survey for the Proposed Springvale Colliery and Conveyor, Wallerawang: Archaeological Survey for Aboriginal Sites*. Report prepared for Howie Herring and Forsyth Pty Ltd.
Rich, Gorman 1992	E. Rich and A. Gorman, *Proposed Springvale Colliery and Conveyor, Wallerawang: Archaeological Survey for Aboriginal Sites*. Report prepared for Sinclair Knight.
Silcox 1988	R. Silcox, *An Archaeological Survey of a proposed deviation on State Hwy No. 5 near Lithgow*. Report to DMR.
SCT 2009	SCT Operations Pty Ltd, *Subsidence Zones in the Remnant Areas at Baal Bone Colliery*. Report to AECOM.
Stone 1989	Brian Stone Environmental Services, *Environmental Impact Statement, Baal Bone Colliery*. Report to Wallerawang Collieries.
Tindale 1974	A. Tindale, *Aboriginal Tribes of Australia.* University of California Press.

Appendix 1

INDIGENOUS HERITAGE ASSESSMENT

FOR

SUBSIDENCE MANAGEMENT PLAN OVER THREE PROPOSED LONGWALLS (29-31), BAAL BONE COLLIERY

BEN BULLEN STATE FOREST

CULLEN BULLEN, NSW.

MAY 2007

REPORT PREPARED BY

OZARK ENVIRONMENTAL & HERITAGE

MANAGEMENT P/L

FOR

XSTRATA COAL P/L

Executive Summary

This current study was commissioned by Xstrata Coal Pty Ltd, (Baal Bone Colliery). It details the results of an Indigenous heritage assessment undertaken for the preparation of a Subsidence Management Plan (SMP) over proposed longwalls 29-31 located beneath the Ben Bullen State Forest, near Cullen Bullen, NSW.

One isolated find, BBC-IF1 was recorded in the Baal Bone SMP study area (Figure 4). It has been assessed as being a one-off drop artefact of overall low significance. No further archaeological assessment in relation to this site is considered necessary.

One rockshelter with no surface evidence of Indigenous occupation was also recorded, BBC-RS1 (Figure 4). Management of this rockshelter should be formulated with respect to the predicted impacts of subsidence on the location of the rockshelter, once these have been modelled. Hence, there are two options in terms of the management of the shelter BBC-RS1, as follows:

1) If subsidence predictions indicate that the location of BBS-RS1 will be only minimally impacted by potential subsidence, then no further archaeological assessment of this location is considered necessary.

2) If, however, subsidence predictions indicate that this location is likely to suffer extensive disturbance and plans of the underlying longwalls cannot be altered to alleviate this, then a programme of limited sub-surface test excavation within the rockshelter and its immediate environs is recommended to determine the presence or absence of Indigenous occupation evidence. The resultant information will allow an informed assessment of the scientific and cultural significance of the rockshelter thus enabling the formulation of appropriate management recommendations. The Proponent would be required to engage a suitably qualified archaeologist to prepare a Section 87(1) permit application and research design for lodgement with the Director-General of the NSW DEC. Concomitant Aboriginal community liaison would also be required. Processing time for permit applications with the DEC is a minimum of 8 weeks.

No other Indigenous sites were recorded as a result of the current assessment. Overall the Baal Bone SMP study area was assessed as having low archaeological sensitivity due to the generally sloping nature of the landforms and the distance from permanent water sources. This assessment is supported by the nearby presence of Long Swamp to the west and the Wolgan Valley to the east, of which both locations would have provided plentiful resources and appropriate occupation sites.

There are no further constraints on the grounds of Indigenous heritage to the proposed Baal Bone Colliery underground mining project comprising longwalls 29-31 under the Ben Bullen State Forest, NSW.

The area of the proposed longwalls lies within the northern reaches of Native Title Claim NC97/7 by Gundungurra Council Tribal Aboriginal Corporation. As there is an existing mining lease held over the proposed mining area Native Title does not present an issue with respect to the Subsidence Management Plan application.

TABLE OF CONTENTS (within Appendix 1)

Figures

Tables

Appendices

1. Introduction

This report was commissioned by Xstrata Coal Pty Ltd, owner of Baal Bone Colliery. It details the results of an Indigenous heritage assessment undertaken for the preparation of a Subsidence Management Plan (SMP) over proposed longwalls 29-31 located generally beneath the Ben Bullen State Forest, near Cullen Bullen, NSW (Figures 1-2). This report follows the previously commissioned desktop review (OzArk 2006) which has now been augmented by field survey and full contextual review.

This report comprises part of an environmental impact assessment for the Subsistence Management Plan.

1.1 Project Scope

The consultant was briefed to undertake survey and assessment for Indigenous heritage issues relevant to the establishment of three new longwall panels (29-31) by Baal Bone Colliery, under Ben Bullen State Forest. An area surrounding the footprint of these longwalls has been delineated as requiring a Subsidence Management Plan (SMP) (Figure 3), of which Indigenous cultural heritage forms a part.

For the purposes of the current assessment, the term ‘Baal Bone study area’ refers only to the area surveyed for this project, comprising all land within the pink delineated boundary of the SMP area (Figure 3) and does not cover other portions of the Baal Bone mining lease. The following report uses as its basis the desktop assessment, OzArk 2006.

The current assessment and desktop investigations included the following aspects:

- A search of the NSW DEC Aboriginal Heritage Information Management System (AHIMS) for any previously recorded sites, a search of NSW State Heritage Register and Inventory; the Australian heritage Database, the Register of the National Estate; and the Lithgow Council LEP;
- A review of relevant literature including previous consulting reports, academic theses, articles and published works on the history and ethnography of the Cullen Bullen region;
- Indigenous community consultation, including the Bathurst Local Aboriginal Land Council (BLALC); Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and North East Wiradjuri Native Title Party (NEWNT);
- Pedestrian field survey to identify and record all cultural heritage sites and relics within a c. 250 ha area incorporating the Baal Bone longwalls 29-31 SMP area (bounded by red– Figure 3);
- Assessments of significance of the recorded sites and the formulation of appropriate management strategies; and
- Completion of documentary evidence (e.g. DEC Site Cards) for any sites/relics located during the survey for the notification of the relevant authorities.

Figure 7: Locality map (Source: International Environmental Consultants).

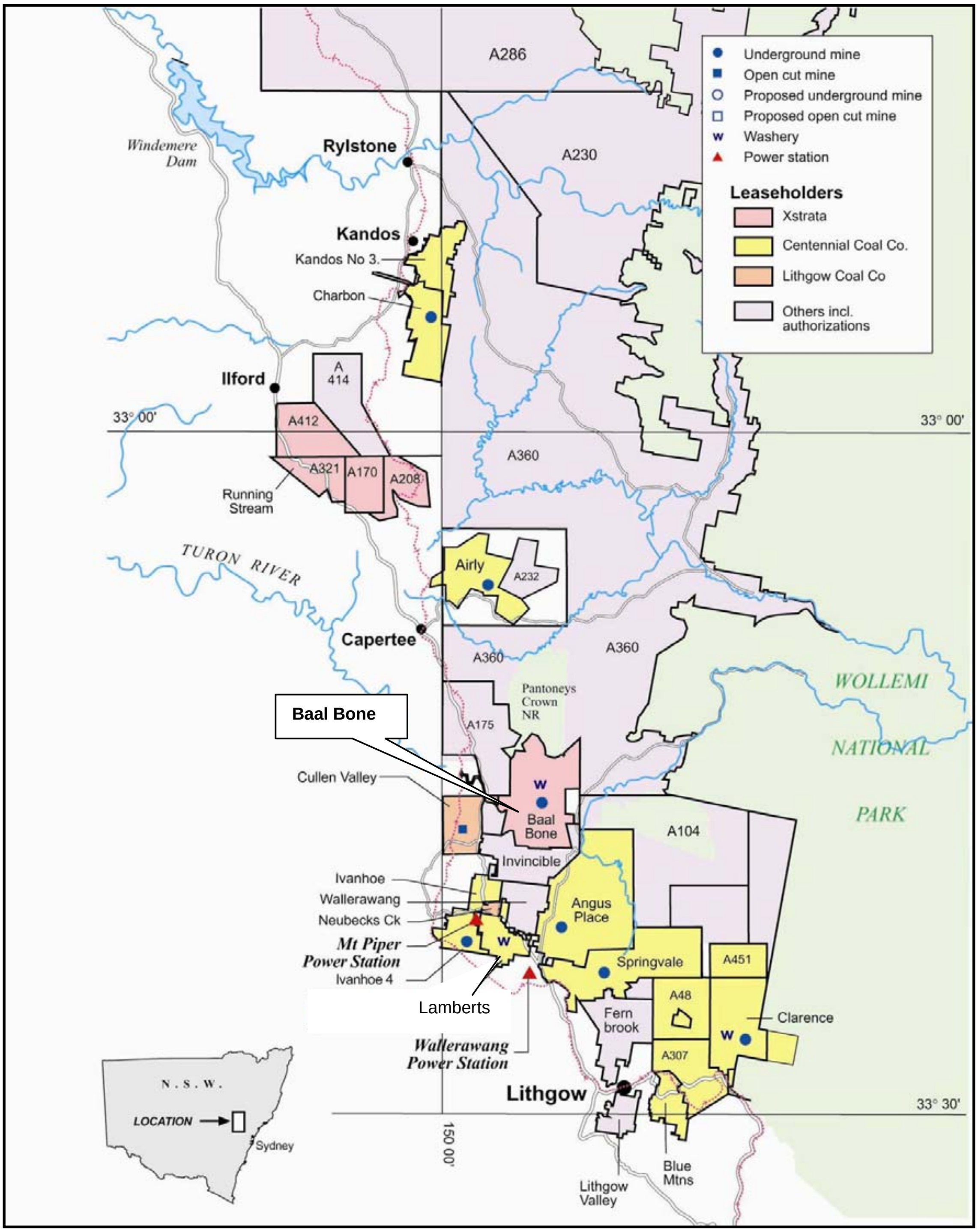


Figure 8: Project site detailing the proposed SMP area (pink hatched) while the black hatched portion shows the existing underground mining operations (Source: Xstrata Coal).

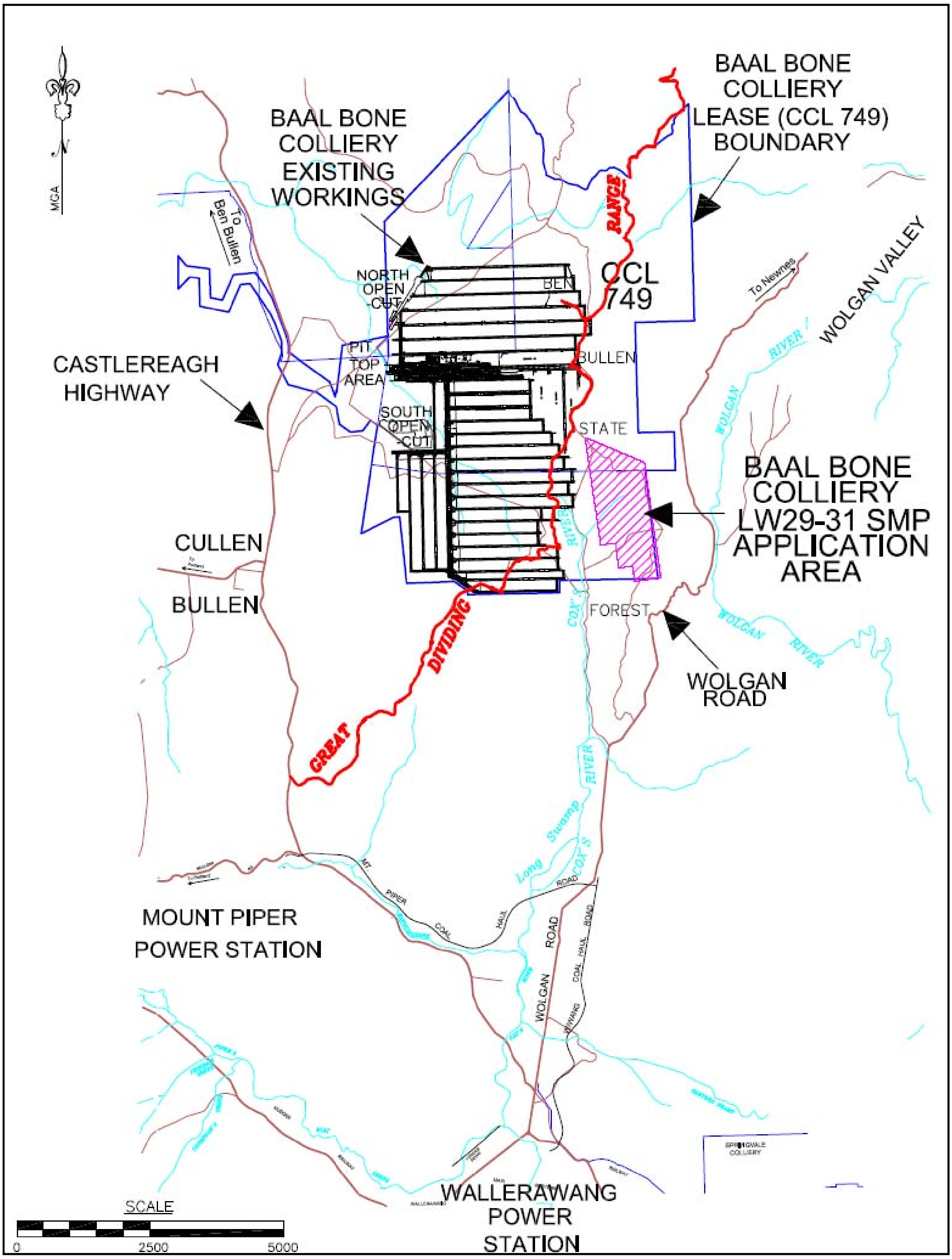
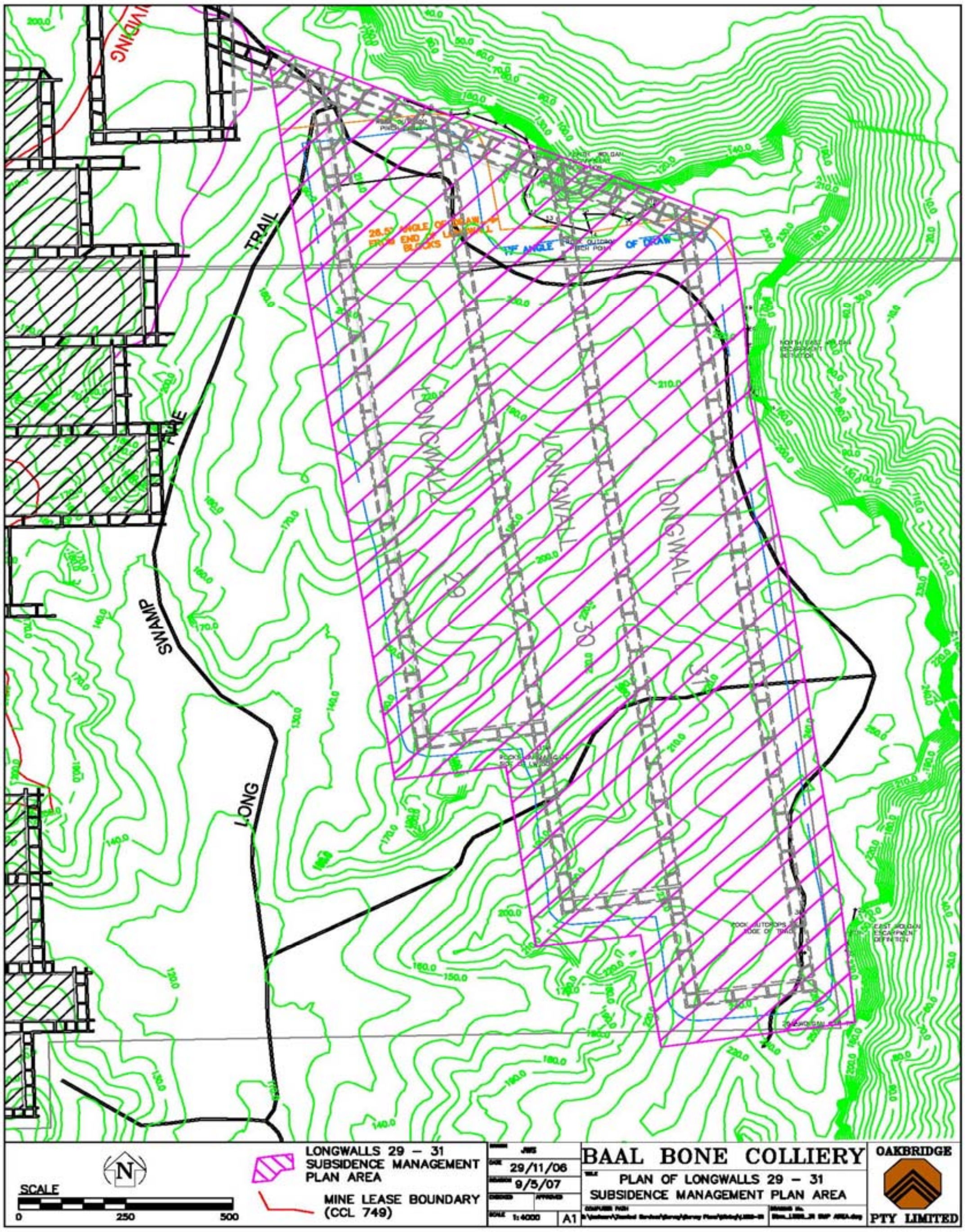


Figure 9: Detailed plan of proposed longwall panels 29-31 and SMP area (pink hatched) Source: Xstrata Coal).



1.2 Proposed Works

Baal Bone Colliery is owned and operated by Wallerawang Collieries Limited. They are seeking to obtain approval to begin mining operations within three new longwall panels that cover a surface area of approximately 250 ha (29-31, Figure 3). The potential for subsidence over longwall panels instigates the requirement for an SMP. Other surface infrastructure required to facilitate longwall mining includes a ventilation shaft, the approval for which will form part of a separate application process.

1.3 Project Constraints and Limitations

Survey was limited to the pink bounded area in Figure 3, being that delineated as requiring an SMP. All corners of the study area were provided to OzArk (by Mr Tony King of Baal Bone Colliery) as GPS co-ordinates and were delineated on site maps provided to OzArk EHM. At a couple of locations along the northern boundaries of the study area, the very edge of the steep sandstone escarpment that overlooks the Wolgan Valley to the east (Plates 1 and 2) lies just within the SMP area (although at the greatest line of draw). It was not possible to assess these sheer sandstone faces and it is considered unlikely that caves will be found in these two discrete areas, primarily because of their inaccessibility and distance from water. Overall, ground surface visibility across the majority of the study area was poor which limited the detection of occupation site evidence.

1.4 Report Authorship

This investigation was undertaken by Dr Jodie Benton and Phillip Cameron (OzArk Environmental & Heritage Management P/L), accompanied by Richard Peters, representative of the Bathurst Local Aboriginal Land Council and Wendy Lewis representing the Warrabinga Native Title Claimants Aboriginal Corporation. This report was written by Dr Jodie Benton.

2. ABORIGINAL COMMUNITY INVOLVEMENT

Aboriginal community consultation for the project has been undertaken using the DEC's "Interim Community Consultation Requirements for Applicants" which became effective on the 1st January 2005. An advertisement was placed in the local print media seeking expressions of interest from Indigenous groups and organisations in the Cullen Bullen area to participate in the heritage assessment process. Letters were sent to local and state government agencies seeking knowledge of any Indigenous stakeholder groups, as well as being sent out to groups already known to OzArk, including Bathurst Local Aboriginal Land Council (BLALC), North East Wiradjuri Native Title Party (NEWNTP), Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and Gundungurra Tribal Aboriginal Corporation (GTAC).

Responses received include letters from NEWNTP and WNTAC expressing interest in being part of the consultation process, and a phone call from BLALC expressing their interest as well. Response from GTAC indicates that this group has recently spit into two – one remaining with the same name, the other becoming the Gundungurra Aboriginal Heritage Association (GAHA). The latter group responded that they felt the location of the current proposal was outside their area and no response was received from GTAC[1].

Field assessment for this project included provision of two positions for Aboriginal community representatives, who were chosen from those who expressed interest. Choice of possible participants was based on several factors including experience with and local knowledge of Indigenous heritage places / sites in the Cullen Bullen area, provision of relevant Workers Compensation insurance documents and breadth of representation in relation to group membership. Using these factors, Richard Peters of the BLALC and Wendy Lewis of the WNTCAC were offered the two field survey positions and both attended the three day survey of the Baal Bone SMP study area. All groups who have expressed interest in being part of the consultation process will be kept informed of the results of the survey and forwarded a draft copy of the report for their review.

A full record of all Aboriginal community consultation can be found in Appendix 3, while letters from these groups can be found in Appendix 2.

2.1 Native Title

Search of the National Native Title Tribunal website undertaken prior to survey originally indicated that the study area was outside any Native Title claim boundaries. It was only upon closer inspection of these boundaries, after communication to Proponent from the Department of Planning regarding a nearby matter, that it became clear that the proposed longwalls are in fact located within the northern boundaries of the Native Title Claim NC97/7, Gundungurra Tribal Council Aboriginal Corporation #6. As there is an existing mining lease held over the proposed mining lease area Native Title does not present an issue with respect to the Subsidence Management Plan application.

[1] A representative of GAHA, Sharyn Halls, did not that think that GTAC was functioning normally since the split.

3. THE STUDY AREA

The study area for the current heritage assessment comprises c. 250 ha situated within Blaxland Shire, County of Cook and Parish of Cox. The study area lies wholly within the Lithgow City Council local government area (LGA) area, and is governed by the Local Environmental Plan (LEP) of 1994 on land zoned 1(f) forestry. In this zone mining activities are permissible with consent (in this case, the Minister for Planning). The study area is primarily within the Ben Bullen State Forest, although the northern and easternmost edges appear, according to the Cullen Bullen 1:25k topographic map 8931-3N, to lie within Wolgan State Forest.

3.1 Topography, Hydrology and Climate

According to the DEC website (2005), the study area lies within the South Eastern Highlands Bioregion which covers the dissected ranges and plateau of the Great Dividing Range.

The subject land comprises several southwest oriented spurs and valleys ranging in elevation from 980 to 1040 m, bounded to the north and east by the steep northeast facing escarpment and to the south by the Coxs River headwaters, being Long Swamp. In terms of hydrology, several drainage headwaters are present within the study area, all draining primarily southwest into the Coxs River catchment.

Cullen Bullen, the nearest residential area (c. 1 km from Baal Bone Colliery) has a mild climate with a wet, late summer (average temperature is 16.5^{o} C with a maximum of 35.1^{o}) and cold, dry winters (average temperature 5.1^{o} C with a minimum of -9.4^{o}). Summer is the pronounced wet season, particularly from January to March, often accompanied by high intensity storms. Only intermittent rains are received during winter (Australian Bureau of Meteorology 2006).

3.2 Geology

The South Eastern Highlands Bioregion comprises part of the Lachlan fold belt that runs through the eastern states as a complex series of metamorphosed Ordovician to Devonian sandstones, shales and volcanic rocks intruded by numerous granite bodies and deformed by four episodes of folding, faulting and uplift. The general structural trend in this bioregion is north-south and the topography strongly reflects this.

More specifically, the study area is situated near the edge of the Permo-Triassic Sydney Basin, in an area known as the Western Coalfields. This is comprised of an extensive plateau of erosion resistant Triassic sandstone dissected by steep-sided valleys. There is a remnant surface layer of weathered sandstone and shales of the Narrabeen Group overlying a complex stratigraphic sequence including the Lidsdale and Lithgow Seams, which are both sub-groups of the Illawarra Coal Measures (Appleton 2004: 12).

3.3 Vegetation and Fauna

Vegetation is dominated by the community referred to as Hill Woodland, comprising Broad-leaved Peppermint (*Eucalyptus dives*), Brittle Gum (*E. mannifera* ssp. *mannifera*), Red Stringybark (*E. macrorhynca*) and Western Scribbly Gum (*E. rossii*), on the mid-upper hill slopes. There is a shrub layer of low to medium density and a ground layer vegetation of medium to high density.

Prior to European occupation the general area would have provided a rich resource base for animals including gliders, possums, macropods and bandicoots and a large variety of reptiles and amphibians. The wetlands and permanent creeks within close proximity of the study area would have undergone inundation and seasonal movements of fauna would have supported a greater diversity and number of species, predominantly birds but including other species such as: swamp wallabies, grey kangaroos, rock wallabies, swamp rats, frogs and tortoise, as well as predator species such as the red bellied black snake and carpet python. A myriad of different migratory bird species would have also utilised these swamp areas (i.e. Long Swamp) and the flowering eucalypts present on site would have attracted nectar and insect feeding birds, including parrots and honey eaters and also a large number of species of bats.

3.4 Existing Levels of Disturbance

Disturbance over the Baal Bone study area is relatively minimal. Treed hills remain vegetated despite being subject to varying intensities of selective logging, the construction of vehicle access tracks and limited mineral exploration. Some spurs have suffered almost complete removal of old growth trees (Plate 6), while other areas appear to have scattered remnant mature eucalypts amongst the regrowth (Plate 7).

4. Ethnohistoric Sources of Past Aboriginal Culture

According to Tindale (1974), the current study area falls within the eastern limits of the lands occupied by the Wiradjuri tribe. However, due to the location of this area at the western base of the mountains it has often been referred to as zone of interaction between the Wiradjuri, the Dharug to the east and the Gundungurra to the south (Bowdler 1984).

Few archival sources are available which give any great detail regarding local Aboriginal culture at the time of contact or even soon after. The Lithgow area seems to have undergone little study by professional or amateur ethnologists and anthropologists despite its close proximity to Sydney.

A resident of nearby Lidsdale, Fay Hasler, has written notes based on oral histories of people in the area (reproduced in part in Kelton 2002a: 12-13), which are held by the Lithgow and District Family Historical Society. The salient points derived from these notes are as follows:

- A large Aboriginal settlement is described as being located at Pipers Flat, with the burial ground being located at Lidsdale;
- The Pipers Flat Aborigines would regularly travel to Richmond to fight the local Aboriginals and bring back women to combat in-breeding;
- The tribes occupying the valleys in the area were wiped out by disease including measles and small pox; and
- Stories of massacres of Aborigines by soldiers at Capertee and settlers at Marrangaroo were often spoken about by the elders, together with the poisoning of flour which killed women, children and men.

Interviews with Fay Hasler during March and May 1999 (Gay 1999) indicate that the burial ground at Lidsdale was located on the river flats either side of the current Coxs River alignment. It is noted that the colliery railway line was constructed through this area in the 1920's and further disturbance would have affected this area during the Coxs River realignment in the 1950's (Gay 1999: 15).

Gay (1999: 16) also notes an historical reference to the burial of an Aboriginal Elder in the Wallerawang area. King Myall (Mylles) had worked for James Walker who had been granted land in the Wallerawang and Lidsdale districts during the 1820's. The burial site of King Myall was drawn and published in the Sydney Illustrated News in October 1880, showing a burial mound and carved trees. This may be part of the burial ground referred to by Fay Hasler (Gay 1999: 16).

5. Archaeological Context

5.1 Regional Context

Current understanding of the types of sites present or likely to be present, within the Coxs River valley and surrounding hill country remains sketchy. Data from excavated sites combined with information derived from surveys, points to a variable use of the valley, with some sites indicating ephemeral, casual or limited use, while other sites show more intensive or repeated use.

Sites and studies within a c. 10 km radius of the current project area will be considered in the following section (5.2 Local Context), while those from the general Coxs River valley and surrounds will be briefly reviewed here.

In the mid 1960's, McCarthy excavated a series of sites to the north of the current survey area, in the Capertee Valley, identifying an early stone tool industry that predated what was then called the Australian Small Tool Tradition. He named this industry the Capertian and described it as consisting of non-specialised flake and core scrapers, also known as the Core Tool and Scraper Tradition (Mulvaney and Kamminga 1999: 44).

Development driven survey in the Coxs River area (south of the current study area) such as that undertaken by Rich (1988) and Silcox (1988) provided further evidence for a site occupation pattern previously postulated by Rich, indicating that open sites are most frequent on elevated ground close to permanent water, such as the Coxs River. Again quartz was seen as the dominant raw material, in contrast to sites on the Newnes Plateau, which appear to have mudstone and chert dominated assemblages. The limited presence of cortex on some of the quartz artefacts led Rich to argue that artefacts may have been carried to these locations after primary/initial flaking elsewhere. The general quality of the quartz was reported as high, with few fracture plains.

In 1992 a survey for the Springvale Colliery and conveyor (Rich and Gorman) recorded 35 sites situated in the Coxs River Valley. Site 2, located on the southern bank of Pipers Flat Creek, consisted of over 100 artefacts within a 200 x 40 m area. Two quartz knapping floors with artefact densities of over 25/m^2 were identified at Site 2 as were a smaller number of indurated mudstone artefacts. Site 9, located c. 700 m west of Duncan street, on elevated terrain above and on the west side of the Coxs River, was comprised of 26 artefacts, primarily quartz, with a maximum artefact density of 6/m^2. As a result of this study, Rich argues that the larger sites within her study area lie closest to the Coxs River and Pipers Flat Creek (Rich & Gorman 1992: 73).

Also in 1992, Haglund & Brayshaw undertook survey for the proposed Lamberts Gully open cut mine at Western Main Colliery (Haglund & Brayshaw 1992a). Six (6) Aboriginal sites were recorded as a result of this survey, predominantly located at the southern end of Lamberts Creek. Later that year test excavations were carried out at two PADs, one having been recorded during their Lamberts Gully survey (POS A), and the second being a PAD recorded by Rich and Gorman in 1992 (POS2). The latter site came to be known as Lamberts Creek 6 (#45-6-2355) and while POSA came to be known as Lamberts Creek 7 (#45-6-2354). Test excavation of these locations revealed them to be open sites although of a "one-off" nature, likely to date within the last 3,000 yrs due to the presence of a backed blade and bipolar knapping technology (Brayshaw 1993: 8).

Again in 1992, Brayshaw & Haglund surveyed an easement linking Mt Piper Power Station with Angus Place Colliery (Haglund & Brayshaw 1992b). This study recorded two open camp sites and one isolated find. During his 2002 study for the Boulder project, Kelton attempted to relocate these sites and was unsuccessful, concluding that site # 45-2-0217 must have been destroyed during the construction of the transmission line easement immediately south of the haul road (Kelton 2002: 32). Site # 45-2-0216, however, although not relocated by Kelton, was subsequently relocated by OzArk EHM during their 2004 survey in the face of the proposed Neubecks Open Cut Coal Mine (OzArk 2004).

Brayshaw (1993) undertook further survey for the Western Main colliery, although this extension was to the north of the previous study, being close to the Castlereagh Hwy. Three sites were recorded in this survey, all open camp sites, as the study area was situated within the Neubecks creek valley rather than in the more hilly country to the south. Brayshaw notes that the open sites identified were relatively small and sparse and were situated in positions elevated above swampy areas and creeks.

Lyell Dam, situated in the Coxs River catchment approximately 15 kms south of the current study area, was formed by damming the Coxs River. Three open sites located on the slopes of spurs overlooking the Coxs River floodplain were investigated here in 1994, prior to raising the water level in the lake. All three sites were situated c. 400 m from the river margin (Gay 1999: 14).

At open site Lyell Dam 3 (LD3) a quartz block fractured knapping floor was found. Although the assemblage was dominated by quartz, other raw materials such as indurated mudstone (silicified tuff) and stone of volcanic origin was also present. In terms of surface manifestations of this site, the highest artefact density recorded was $3/m^2$, with most sample areas showing lower densities (Barton & McDonald 1995: 25). The excavated assemblage, however, was far larger, with estimated thousands of artefacts present at this location. Barton & McDonald (1995: 35) interpreted this site as being repeatedly occupied by people carrying out the same range of tasks.

Conclusions of the Lyell Dam site investigation project can be summarised as follows (from Barton & McDonald 1995: 67 as summarised in Gay 1999: 15):

- Cobbles of igneous, metamorphic and sedimentary rocks were procured locally, primarily from the bed of the Coxs River;
- Quartz was locally available and the ease with which it was procured eliminated the need to flake using the bipolar technique;
- Quartz was used to create medium sized flakes and some smaller retouched tools;
- Volcanic stone was used to create large or heavy tools; and
- All three sites were interpreted as representing repeated short-term occupation areas that focussed on acquiring resources such as specific plants or animals endemic to the swampy margins of the Coxs River.

As may be expected, research into the known archaeological sites in the region surrounding the current study area has shown that the majority of sites are located on landforms close to water sources. Most sites were small, containing low densities of artefacts, with only one large site present, being LD 3 situated in the Lyell Dam area. Quartz dominates the artefact assemblages that are characterised by the Core and Flake tradition (Gay 1999: 15).

In 1998 Mills undertook survey of the proposed Ivanhoe Stage 4 project c. 7 km southwest of the current study area. The survey identified six (6) open sites, two (2) isolated artefacts and eight (8) other areas of potential archaeological deposit. Mills concluded that the presence of high quality milky white quartz flakes and debitage at all sites recorded in the survey area may indicate that it was a procurement place for the raw material however, no source was located.

A survey undertaken by Gay in 1999 indicated the possibility of an Aboriginal burial area being located close to the road alignment between Duncan Street and the coal conveyor at Lidsdale. Oral history from a local informant provided primary data for the location of the burial ground and test excavations of this general area were undertaken in 1993 (McIntyre as reported in Gay 1999: 17). During this work two areas were tested, and although no skeletal remains were uncovered, a minor open site was identified on the west side of the railway line (AHIMS # 45-1-237), where stone tools were said to have been manufactured or repaired.

McIntyre concluded that the reported burial ground may have been destroyed during the Coxs River deviation works in the 1950's, although there is still the possibility that skeletal material may occur east of the railway and river. She further notes that the presence of artefacts within the level ground adjacent to the river indicates the potential this landscape unit has for the occurrence of Aboriginal sites (McIntyre as reported in Gay 1999: 16-17).

In 1999 and 2000, Kelton undertook surveys in the Wallerawang and Marrangaroo areas respectively. Of the seventeen sites recorded at Marrangaroo, the majority were rock shelter sites, as most of the study area was within the sandstone escarpment. Kelton notes that the location and nature of sites recorded conforms to the previously developed site prediction and distribution models outlined above (Kelton 2000: 101).

An area covering almost 300 ha was surveyed for the proposed Cullen Valley open cut mine extension, northwest of the town of Cullen Bullen (and c. 8 kms west of the current study area) by Kelton in 2002. The landforms encountered included exposed sandstone formations, although few alluvial valleys. One open camp site comprising 9 stone artefacts primarily of chert and one rock shelter with no artefacts and some charcoal were recorded as a result of this assessment (Kelton 2002b).

To the southeast of Invincible mine and just outside (southwest) the 10 x 10 km area surrounding the current Baal Bone study area, Kelton (2002a) undertook survey of a c. 50 ha area for the proposed Boulder Road coal mine, which has now been incorporated into the proposal for the Neubecks Open Cut Coal Mine. During this survey, Kelton identified one isolated find (BP-IF1 - # 45-1-2582), apparently situated on a high flat spur overlooking the tributary into Neubecks Creek, and one open camp site (BP-OS1 - # 45-1-2581) containing seven recorded artefacts in a disturbed context next to the transmission line easement immediately east of the Castlereagh Hwy.

In 2003 further survey was undertaken (Appleton 2004) in the face of proposed coal mining at Pine Dale Coal Mine, immediately north of Enhance Place coal mine, c. 8 kms SSW of the current study area. This study recorded one isolated find – WC1A (a silicified metasedimentary flake).

In 1999 and 2000, two surveys by Gay were undertaken in the face of the proposed Castlereagh Highway deviation at Lidsdale. One open site and two PADs were identified and test excavation of the latter two was recommended. Subsequently, large scale test and salvage excavations were carried out at these sites, located on a crest above the Coxs River (OzArk 2004a). Part of the site revealed deep soils with evidence for cultural stratification. Sediment samples were dated using the OSL technique providing determinations of 7, 400 ±700 BP at 30 cm depth and 13, 500 ±1, 000 BP at 45 cm depth. While these sediment samples may not directly date the lithic assemblage, they do give an indication of potential age range, particularly the presence of a pre-Bondaian assemblage in the deepest spits. This interpretation is supported by an absence of Bondaian technical features within the lithic assemblage from spits 3 and 4.

The assemblage from the lower spits lacked backed artefacts and evidence of asymmetric alternating flaking and no flakes with faceted platforms were recovered. This Pre-Bondaian assemblage is dominated by quartz, and has higher frequencies of quartzite and igneous artefacts than the more recent assemblage and average artefact weight is higher than in the upper spits. The assemblage from spits 1 and 2 both include backed artefacts, some cores show asymmetric alternating platforms and some flakes have faceted platforms. Both upper spit assemblages are dominated by quartz, but siliceous tuff / FGS is more frequent in spit 1 than in spit 2. A few bipolar artefacts occur in spit 2. A piece of utilised pigment was also found in spit 2. Average artefact weight is lowest in spit 1 (Table 2).

Table 6: Summary of the assemblage from Lidsdale open site, Area I.

Age BP	Spits	Total artefacts	% Quartz	% S.Tuff	Mean weight Quartz	Mean weight S.Tuff	% Backed artefacts	% Cores	% Bipolar artefacts
	1	559	*71.4*	*26.1*	1.2g	1.2g	*2.1*	*0.6*	
7,400±700 before 2000AD (K-0032) (ANU_{OD}1591)	2	642	*84.6*	*12.8*	1.6g	2.4g	*1.9*	*1.1*	*0.6*
13,500±1000 before 2000AD (K-0033) (ANU_{OD}1592)	3+4	284	*79.9*	*11.6*	2.9g	3.9g		*1.4*	

(Assemblage data from White 2004; sediments dated using OSL, reported in OzArk CHM 2004a)

OzArk (2004b) undertook survey for the proposed Neubecks open cut coal mine. This survey was carried out over the Neubecks valley, on the property between Pinedale and Boulder, c. 5 kms south of the current study area. The Indigenous heritage component of the study recorded five (5) Indigenous sites. Two were open camp sites with Potential Archaeological Deposit – PAD, a further two were small open camp sites and the last is an isolated find. Both open camp sites with PAD were recorded on knolls / elevated spurs while the remaining sites were located on the colluvial / alluvial terraces adjacent to Neubecks Creek.

OzArk (2005a & b) undertook a survey within ML 1448 Lamberts Gully and recorded one open camp site with potential archaeological deposit (SVW-OS1 with PAD). This site was located adjacent to an ephemeral drainage line on flat ground at the base of the surrounding hills. Previous studies undertaken within the same study area (Rich and Gorman 1992, Rich 1993a and 1993b and Brayshaw 1993) identified eight Aboriginal sites. Of these three Aboriginal open camp sites # 45-1-0218, # 45-1-0208 and an isolated find IF2 (not registered on the DEC AHIMS) remain intact within ML 1448. Two of the sites (open camp site # 45-1-0208 and IF2) were not relocatable.

OzArk (2005c) undertook archaeological assessment over the North Ivanhoe rehabilitation project which is located on the western side of the Castlereagh Highway, c. 6-7 kms southwest of the current study area. The survey assessed 23 ha of land over the site of the proposed Ivanhoe North Rehabilitation Project and recorded no Indigenous sites. The degree of slope was assessed as generally unsuitable for camping locations and would have more likely been used for resource gathering.

5.2 Local Context

A search of the DEC AHIMS database (search date 7.12.06) shows the presence of 25 recorded sites within a 10 x 10 km square area centred on the current study area (Zone 56: 225000-235000E / 6307000-6317000N). Table 3 provides a breakdown of site types. The most frequent site types recorded in the vicinity of the current study area are rockshelters, comprising 80% of all site types. These may have occupation deposits (52%) or art (20%) and in two instances, caves had both art and deposit (8%). Obviously the escarpment country in which the current Baal Bone study area is located (albeit on the western perimeter of this landscape) provides the requisite geological landforms for habitable rockshelters.

Again the relatively small percentage of open campsites (16%) reflects the overriding topography of the searched area. The recorded camp sites are all located next to drainage features, one next to Ben Bullen Creek and the other three adjacent to more ephemeral waterways that drain into Jews

Creek. The only isolated find is recorded south of the current study area, very close to Blackfellows Hand Rock.

Table 7: Number, type and percentage frequency of sites within a 10 x 10 km^2 including centred on the Baal Bone study area.

Site Type	Total	%Frequency
Shelter with Deposit	13	*52*
Shelter with Art	5	*20*
Shelter with Art & Deposit	2	*8*
Open Camp Site	4	*16*
Isolated Finds	1	*4*
Totals	***25***	***100***

With reference to surveys undertaken in within a c. 5 km radius of the current study area, the most relevant are three assessments undertaken for Baal Bone Colliery by Haglund in 1990 and Kohen in 1992 and 1996. It has only been possible to source one of these reports (Kohen 1996), although review of the AHIMS search data for the area sees three (3) sites recorded on the Baal Bone lease by Brayshaw and Haglund in 1990. These comprise the open campsites mentioned above, that are situated on the headwater tributaries draining northwest into Jews Creek[2]. The subsequent study by Kohen in 1992 recorded one Indigenous site, being the open camp site on Ben Bullen Creek which was comprised of 47 stone artefacts (Kohen 1996: 12).

During Kohen's 1996 survey of the northern extension to the Baal Bone underground mining activities (shown in Figure 3 as the northernmost longwalls), he notes that a single site had been previously recorded within his study area, being a rock shelter recorded by Ian Brown for NPWS in 1984 (DEC # 45-1-0097). The site is described as an overhang situated along a track under which a chert scraper was recorded.

Outside the current study area c. 1 km to the west, was the location of Kohen's 1994 study, which involved the excavation of two rockshelters at Gardiners Gap. Further attempts will be made to source these reports, which are not held by the current owners of Baal Bone, Xstrata Coal.

McIntyre's work in the Kariwara Project Area (1990) included a large area encompassing the Newnes Plateau and part of the AHIMS search area for the current project. A total of 42 sites, predominantly rockshelters (n=41) along the escarpment were recorded, including many of the 'shelter sites within documented in Table 3. McIntyre's work specifically targeted potential impacts from the effects of long wall mining on this landform and its associated Indigenous sites. Three major site complexes were identified as a result of her work, at Mt Horne, the upper reaches of the Wolgan River and Black Fellows Hands site. From this study McIntyre postulated the following hypotheses:

1. That major site complexes were most likely to be situated at the top of open gullies where access from the ridge tops to major creeks and rivers where resources were concentrated. These complexes may also be located on the plateau where localised resources and good vantage points coincided;

2. Large, open camp sites were also located along the western flank of the plateau where streams entered the Coxs River Valley; and

3. Smaller open camp sites representing sporadic visits were found at the end of long ridges.

[2] It is noted in Kohen (1996: 12) that one of the three open sites recorded by Brayshaw and Haglund in 1990 (Baal Bone 3, DEC # 45-1-0120) had a consent to destroy permit issued for it in 1993.

In 1996 a survey was undertaken c. 3 kms to the northwest of the current project, reported as being for the Feldmast Coal Project (Mills 1996). This survey covered a large area immediately north of Cullen Bullen, part of which lies outside the 10 km^2 area searched for the current project (hence the sites recorded did not come up in the search results although survey area did overlap with the searched area). Three sites were recorded as a result of this study, an open camp site and isolated find were recorded on Western Springs Creek and Cullen Creek respectively, while a grinding groove site was recorded at an area of exposed sandstone adjacent to the headwaters if unnamed creek.

Silcox (1997) undertook archaeological survey within the Invincible mining lease area (immediately south of Baal Bone Colliery) for the original Invincible ML 68 open cut coal mine and haulage road. No sites were detected within the study area.

Also in 1997, Hunt is recorded as having undertaken archaeological investigations in the vicinity of Black Fellows Hand site. Five of the shelter sites revealed in the AHIMS site search relate to this project, although no original report for this study has been located.

In February 2006 OzArk undertook assessment of the former ML 68 (Invincible) open cut coal mine which occurs at the margin of the current 10 x 10 km search area. Approximately 10 ha of the Ben Bullen State Forest was assessed as a result of the coal extraction proposal Survey of this area recorded no Indigenous sites within the proposed impact footprint and haulage road.

5.3 Predictive Model for Site Location

Predictive modelling aims to establish a theoretical model for site location / distribution within a given area. This model provides a comparative situation against which the results of the investigation can be discussed, taking into account the affects of post formation processes, such as visibility, land use etc.

Proximity to a permanent water supply is generally considered the primary factor determining the location of Aboriginal camp sites. In the Sydney region, stream ordering has been used to predict the potential for site occurrence, and further to indicate the possible nature of these sites in terms of their complexity. Results of an integrated series of studies including a serious excavation component (Jo McDonald CHM 1997), suggests a high correlation between the permanence of a water source and the permanence and/or complexity of the areas' Aboriginal occupation. This was further reflected in the lithic assemblages from sites close to permanent water, which suggested that a greater range of activities were represented (e.g. tool use, manufacture and maintenance, food processing and quarrying). Sites near ephemeral water sources had evidence for one-off occupation (e.g. isolated knapping floors or tool discard), and creek junctions were also proven to be foci for site activity.

More closely related to the current study area, are some extrapolations concerning site nature and distribution in the Cox's River Valley and surrounding escarpment country, as summarises above in the Regional and Local Context for the current project. Based on these results and the using the concept of stream ordering, the following general predictions can be made regarding the nature of sites and their location in the current study area:

- On major creeklines and rivers archaeological evidence will tend to indicate more permanent or repeated occupation. Sites may be complex, with a range of lithic activities represented, and may even be stratified. Proximity to resource rich zones also indicates a higher likelihood of the presence of complex occupation sites.
    - ➢ From review of the topographic data relating to the current study area, the waterways all appear to be quite ephemeral and the gullies seem to have significant slope. If this proves to the case, large open camps sites may not be frequent in the current study area.

- Further from permanent water, sites are likely to be smaller, less complex and more likely to be the result of one-off occupation episodes.
  - The current study area appears to fall into this category, consequently small sites may be located on appropriate elevated, well drained areas near ephemeral water.
- In escarpment country or upper hillslopes where appropriate, habitable sandstone overhangs and caves are present, occupation sites are likely and their size will be determined by the extent of available space in the shelters.
  - The current study area comprises significant high country. The nature and quality of the sandstone is as yet, however, unknown, although personal communication from a Baal Bone Colliery representative indicates it may be friable. Depending on the condition and aspect of available overhangs, rock shelter sites with or without art and/or deposits may be recorded.

From the known sites outlined previously in Section 5.2, and the landform potential as detailed above, it is possible to say that the most likely sites to be encountered in the Baal Bone study area are:

- Rock shelter sites may occur wherever there are suitable overhangs / caves. The quality and extent of such features will determine the nature and type of potential occupation;
- Open camp sites (on elevated terraces and low spurs close to water). Due to the ephemeral nature of the water courses within the study area and the significant slope of the landform, such sites may be unlikely, but if present may be the result of one-off occupation episodes;
- Scarred trees (frequently close to creeks and rivers but also found further afield). Few mature trees of an age to bear cultural scars are likely to remain in the study area (due to logging), although some remnant individuals may be present;
- Grinding grooves may occur where exposed sandstone is evident;
- Natural mythological or cultural / ceremonial sites may occur anywhere, although are less likely on significant slopes;
- Isolated finds may occur anywhere, especially in disturbed locations near water sources or in areas close to ephemeral water – i.e. headwaters.

For the purposes of the current study site type definitions can be found in Appendix 4.

6. Survey Methodology

The Baal Bone SMP study area was traversed using both pedestrian transects and through driving all available vehicle tracks. There was essentially no ground surface visibility at all off the vehicle tracks. Nonetheless, several long transects through the undifferentiated slopes of the spurs that comprise the study area were assessed by all four surveyors. It was attempted to located and assess all areas of significant outcropping sandstone suitable for the presence of overhangs and / or rockshelters, as well as all areas that were relatively flat (suitable for camping) or within close proximity of a waterway.

Specific pedestrian survey through the bush was undertaken along the transects delineated in red on Figure 4, while locations of extensive spot checks are shown as blue areas bounded by red. The location of the two recorded sites is also shown on Figure 4.

7. Survey Results

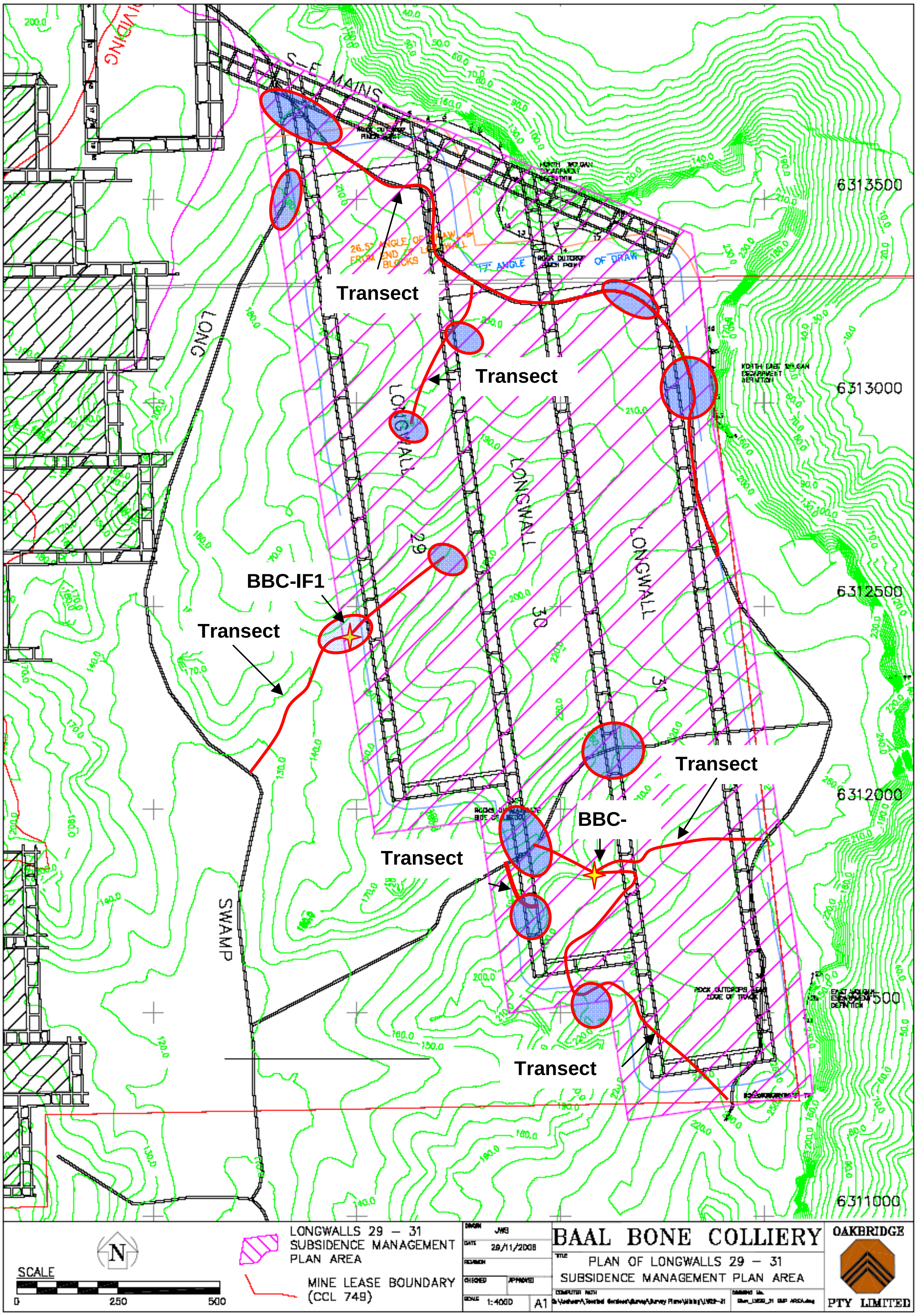
The current study recorded one (1) Indigenous site, an isolated find (BBC-IF1) and one (1) rock shelter site (BBC-RS1) that exhibited no surface evidence of Aboriginal occupation. Details regarding these sites are as follows:

BBC-IF1 ***Cullen Bullen 1:25K*** ***GDA*** ***229984 E 6312407N***

This isolated find was located along an unmarked logging access track that extends from Long Swamp Track to the northeast, up a drainage gully (shown as Transect 5 on Figure 4). The isolated find is a small, exhausted grey chert core, measuring 3.1 x 1.9 x 1.8 cm (Plate 8). It was recorded adjacent to the alluvial bed of the unnamed waterway that flows from the top of the gully southwest into Long Swamp (Plate 9). Due to the alluvial nature of the deposits in which the artefact was located, the original source of the artefact is unknown. It may have travelled along the bed of the creek during high flow events, or have moved downslope from the spurs on either side of the creek. Despite extensive searching in the immediate area, no further definitive artefact could be located, although two possible quartz flakes were also photographed (Plate 8). The predominance of small quartz cobbles in the alluvial creek bed and the position of the 'flakes' on the vehicle track causes there to be a high likelihood that these possible flakes may in fact be broken quartz pebbles, fractured as a result of vehicle impacts.

The lack of definitive context for the chert core, combined with the lack of further artefacts or the presence of a defined landform that could be described as having potential for intact sites, leaves the probable interpretation of this artefact as being an isolated drop artefact, left behind as individuals passed through this landscape either on route to the Wolgan Valley or Long Swamp.

Figure 10: Plan of the SMP study area showing transects surveyed (source: Xstrata Coal).



BBC-RS1 ***Cullen Bullen 1:25K*** ***GDA*** ***230548E 6311839N***

Within the confines of a steep gully draining to the northwest, an area of outcropping sandstone was traversed which possessed a sandstone overhang assessed as being suitable for human habitation (Plates 10-12, Figure 4). Although only one portion of the sandstone possessed a significant area of overhang, the remainder of the gully was very enclosed providing a quiet, protected location with a selection of edible plants, including saw sedges (*Gahnia),* long-leaf matt-rush (*Lomandra longifolia*), flax lilies (*Dianella Sp.*) fishbone fern (*Blechnum nudum*) and kangaroo grass (*Themeda australis*). The almost U-shaped area faces the west northwest in the direction of the water flow, although the creek was dry when surveyed and is likely to be dry periodically.

The primary area of sandstone overhang had collapsed onto the floor of the rock shelter (Plates 10-12), obscuring the accumulated deposits from inspection and sterilising a portion of them from investigation. It is not possible to determine when this collapse may have occurred, but the potential that human habitation remains pre-existed the collapse cannot be ruled out and hence the fallen stone could bury archaeological evidence. It is nonetheless noteworthy that extensive searching in the area did not locate any direct evidence of human habitation (either deposit or art), although the area was significantly overgrown.

A second potentially habitable rock shelter site was also noted on the southwest border of the study area, although its location places it outside the area delineated as requiring an SMP.

8. Discussion

8.1 Aboriginal Site Distribution

The current Baal Bone SMP study area is comprised of three major landform units:

- Ephemeral, gully drainage lines (none named);
- Hill slopes; and
- Ridge crests.

The aerial photograph in **Figure 5** shows these features clearly, as well as indicating that entire study area forms an upland, sloping plateau that falls off steeply to the east and north into the Wolgan Valley, while sloping down to the southwest, draining into Long Swamp. The location of the isolated find (BBC-IF1) is seen to be within one of the two major southwest draining gullies while the rock shelter site is located in a more ephemeral gully.

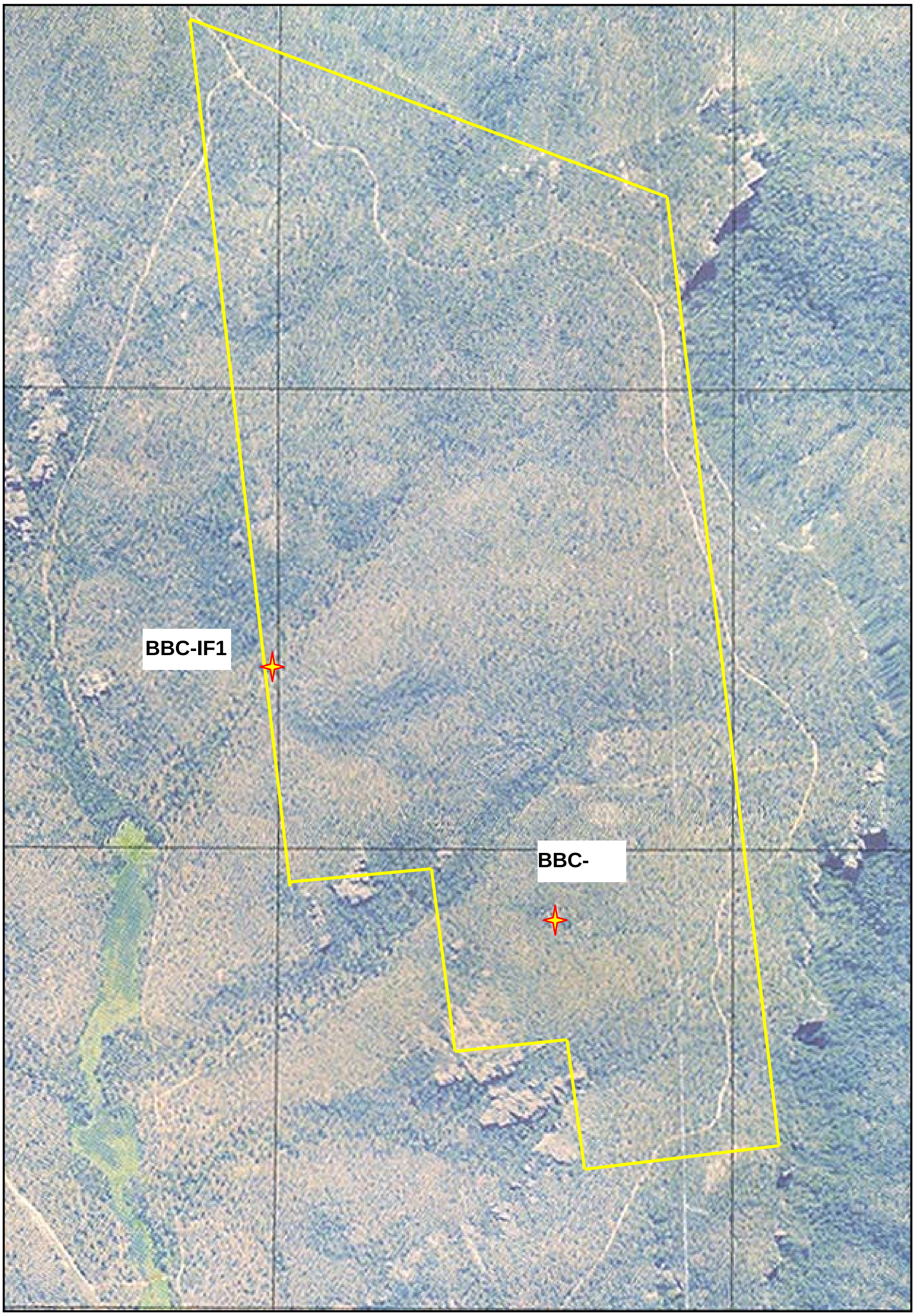
The lack of sites recorded during the current survey is thought to be the result of two primary interrelating factors:

1. That the landforms within the study area have an overall low sensitivity for the presence of Indigenous sites due to the distance from permanent water and the general sloping nature of the land. The Wolgan Valley to the east and Long Swamp to the west both provide rich, permanent resource areas which would have been favoured over the undifferentiated, wooded slopes of the current study area.

2. The almost complete lack of ground surface visibility impeded the detection of occupation sites over the current study area. This factor is exacerbated by the removal of the majority of old growth trees of an age to have been scarred.

In summary, the overall lack of sites was predicted (Section 5.3) due to the assessed nature of the landforms, although poor visibility is certainly likely to have exaggerated this result.

Figure 11: Aerial photograph of the study area with SMP area superimposed in yellow and recorded sites (Source 1:25k 8931-3N).



8.2 Aboriginal Site Assessment

The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance as well as the likely impacts of any proposed developments. Scientific, cultural and public significance are currently identified as baseline elements of this assessment, and it is through the combination of these elements that the overall cultural heritage values of a site, place or area are resolved.

Cultural significance

This area of assessment concerns the importance of a site or feature to the relevant cultural group - in this case the Aboriginal community. Aspects of cultural significance include assessment of sites, items, and landscapes that are traditionally significant or that have contemporary importance to the Aboriginal community. This importance involves both traditional links with specific areas as well as an overall concern by Aboriginal people for their sites generally and the continued protection of these. This type of significance may not be in accord with interpretations made by the archaeologist - a site may have low scientific significance but high Aboriginal significance (or *vice versa*).

The significance of sites BBC-IF1 and BBC-RS1 to the local **Aboriginal community** was addressed in an on-site meeting with Richard Peters of BLALC and Wendy Lewis of the WNTCAC (see Sections 2, 8.3 and Appendices 2 and 3).

Scientific significance

Assessing a site in this context involves placing it into a broader regional framework, as well as assessing the site's individual merits in view of current archaeological discourse. This type of significance relates to the ability of a site to answer current research questions and is also based on a site's condition (integrity), content and representativeness.

The overriding aim of cultural heritage management is to preserve a representative sample of the archaeological resource. This will ensure that future research within the discipline can be based on a valid sample of the past. Establishing whether or not a site can contribute to current research also involves defining 'research potential' and 'representativeness' (Bowdler 1984). Questions regularly asked when determining significance are: can this site contribute information that no other site can? Is this site representative of other sites in the region?

The scientific significance of <u>isolated finds</u> tends to be limited unless the artefact is in some way rare (contextually) in terms of artefact type or raw material.

<u>Rockshelters</u>: It is impossible to determine the significance of rockshelters in which no archaeological material has been discovered as there is no site material or soil data to assess. If a site is assessed as having adequate potential, test excavation may be recommended for sites to investigate the presence, extent, nature and integrity of any possible site material such that their significance can be assessed and appropriate management recommendations devised.

Public significance

Sites that have public significance do so because they can educate people about the past. By reducing ignorance about why sites are important to the Aboriginal and scientific community, important sites can be protected from ignorant or inadvertent destruction. Educating the public to understand the need for site preservation should increase the likelihood of maintaining an archaeological resource into the future. For a site to have high public significance it should contain easily identifiable and interpretable elements, and be relatively easily accessed.

Most open artefact scatters and isolated finds, when *in-situ*, are usually extremely difficult for the lay person to appreciate unless the artefact(s) is/are in someway very unusual or numerous. Rockshelter sites may be easier for the layperson to appreciate as long as they are relatively accessible and display obvious signs of human occupation (i.e. hearths or rock art).

8.3 Assessed significance of the recorded sites in the Baal Bone SMP study area.

Cultural

Conversations were held on-site with representatives of Bathurst LALC and WNTCAC regarding the cultural significance of the recorded sites. The isolated find (BBC-IF1) was assessed as having **moderate cultural significance** to the local Aboriginal people. Neither of the Aboriginal community representatives thought the artefact was *in situ*, and it was assessed as most likely to have a been a ‘drop’ artefact, left as someone moved through the landscape rather than as an indicator of an occupation site. Due to the lack of occupation evidence present at BBC-RS1, a determination of significance is challenging.

Written feedback from the BLALC (Appendix 2) has indicated no specific assessment of cultural significance of the finds. To date there has been no written feedback from WNTCAC.

Scientific

As discussed in Section 8.1, the sites discovered during the survey generally conform to the settlement pattern that has already been established throughout the broader region. Due to the lack of suitable landforms, little evidence of human occupation was recorded over the study area, and more suitable resource-rich locations were identified nearby. It is considered that these other areas (the Wolgan Valley and Long Swamp) are likely to have been the foci of Indigenous activity / occupation in the area.

BBC-IF1

This artefact is considered to be of Aboriginal origin. The likelihood of there being associated artefacts or intact, sub-surface deposits is considered to be very low and the site is assessed as having **low scientific significance.**

BBC-RS1

No direct evidence of Aboriginal occupation of this rockshelter was recorded and a significance degree of collapse had occurred in the main portion of the shelter (Plate 10). The presence of edible plant foods, the protected aspect and proximity to the ephemeral waterway are all provide favourable conditions for human habitation (Plates 10-12).

Assessment of the scientific significance of this rockshelter is challenging due to the lack of surface information available. At minimum we can assess that there no significant rock art is present and that the shelter does not appear to have been inhabited by humans recently, due to the extensive roof collapse. There is still, however, some potential that the collapse overlies evidence of prior human habitation, and this evidence may continue to the currently overgrown drip line of the shelter and hence be accessible through test excavation.

As a preliminary indication, the shelter may be assessed being of **moderate scientific significance**.

Public

This sites recorded during the current survey are not located within easily accessible areas and nor is the stone artefact easily identifiable by the lay person as being Aboriginal in origin. Consequently the sites located as a result of this study are said to have overall **low-moderate public significance**.

8.4 Likely Impacts of proposed longwalls 29-31 under the Ben Bullen State Forest.

8.4.1 General introduction - Aboriginal sites and the potential effects of mine subsidence

The primary surface impact from underground mining, other than construction of the requisite surface infrastructure, is the potential surface subsidence resulting from coal seam extraction. Such subsidence often takes the form of a trough or a series of parallel troughs in the ground surface directly above areas where full seam extraction has occurred. Open sites may be impacted causing disruption to the archaeological deposits or indirect impacts such as altered hydrology may cause erosion patterns to change. The possible collapse of cliffs in sandstone escarpment country also has the potential to impact rock shelter sites (Byrne et al 1997) or grinding groove sites (Kuskie 2006: 12).

The type and extent of subsidence is variable and challenging to predict, although there have been significant advances in computer generated modelling of potential subsidence based on data including the depth of the coal seam from the surface, the thickness of the coal seam, the orientation of the longwalls, the depth and nature of the intervening deposits and the methods of coal extraction. Typically, the largest vertical movements occur in areas of total extraction, while vertical movements diminish outside the edge of the mined area, becoming more likely to be horizontal movements along the line of draw. According to Byrne (1997: 2), it is the horizontal movements that are most likely to impact sandstone formations and these are amplified in areas of significant surface slope.

With respect of potential impacts to rockshelter sites in sandstone landforms, the most common occurrence is the that rock falls may destroy rock art present on the walls of shelters of may sterilise potential occupation deposits through the collapse of the shelter roof. Unless major rockfalls occur, the effect on a deposit may not be substantial, although it does reduce the visual integrity of a site and hence aspects of its heritage significance. Cracking as a result of subsidence may also impact rockshelter sites through making them unsafe and thus unable to be visited by members of the Aboriginal community or investigated scientifically (Kuskie 2006: 12).

8.4.2 Impacts on recorded sites within the Baal Bone SMP area

Overall, there is likely to be subsidence impacts across the extent of the SMP area, although details a regarding the exact nature or intensity of these potential impacts is currently unknown. Likely impacts of subsidence to the isolated find BBC-IF1 are inconsequential as this artefact may not even remain in its recorded location after the next flood event, and has been assessed as having low significance.

Impacts to the recorded rockshelter BBC-RS1 are, however, uncertain. This site is above longwall 30, near its southern end and close to the border with longwall 31. Without predictive subsidence plans, it is challenging to forecast what the impacts to this rockshelter are likely to be. In this regard it is also pertinent to note that deposits within rockshelter BBC-RS1 are already partially sterilised through previous roof collapse (Plates 10-12).

Consequently, our approach is to offer two options for the management of the shelter, one based on the likelihood that the rockshelter will not be significantly impacted and one on the assumption that it will be extensively disturbed becoming effectively non-existent as a rockshelter . These management options are described below in Section 8.5

8.5 Management Options

Appropriate management of cultural heritage items is primarily determined on the basis of their assessed significance as well as the likely impacts of the proposed development. Sections 8.3 & 8.4 described respectively the significance/potential of the recorded sites and the likely impacts of the development as known to date. The following management options are general principles, in terms of best practice and desired outcomes, rather than mitigative measures against individual site disturbance.

1. Avoid impact by altering the development proposal or in this case by avoiding the potential subsidence impacts of the proposed longwall mining operation to rock shelter BBC-RS1 identified during the current study. This may not be required if the subsidence prediction plan shows this area to be only minimally affected b subsidence, however, if the area is to be extensively disturbed, there may be options to alter the longwall layout to reduce subsidence impacts in this area.

2. If impact is unavoidable then a then a Section 90 (Consent to Destroy) or Section 87(1)[3] permit to test excavate may be applied for from the NSW DEC. In the current situation, the latter permit would be required to undertake limited testing to determine whether in fact any archaeological deposits are present within the BBC-RS1 area. Approval of the application will depend on many factors including the sites' assessed significance. Sites of moderate to high significance and/or potential may require either test or salvage excavation, or more detailed recording, as part of the conditions of a Section 90 being granted. Sites of low significance may have a Section 90 or 87(1) approved with no further archaeological assessment being required, or with an approved monitoring programme. Once granted, the local Aboriginal communities may wish to collect or relocate artefacts, whether temporarily or permanently, if necessary[4].

In relation to the current project, the landscape impacts are indirect through potential subsidence effects. Hence the predicted nature of the subsidence across the current study area has a significant bearing on the degree of impact and consequently the fate of rockshelter BBC-RS1. As noted above, the rockshelter bears no surface evidence of Indigenous occupation, although the presence of such evidence in the shelter deposits and environs cannot be ruled out. As a result, if subsidence prediction models show the area of BBC-RS1 to be likely to suffer considerable subsidence impacts, then a programme of limited testing should be undertaken at BBC-RS1 to determine whether Indigenous occupation deposits are present.

8.6 Relevant Legislation

Base line principles for the conservation of heritage places and relics can be found in the Burra Charter[5], which recognizes that there are places worth keeping because they can enrich our lives on many levels. The significance of such places may be embodied in fabric (physical material), environmental setting, contents, use or its meaning to people, and should be assessed through methodical data collection. Since its adoption in 1979, The Burra Charter has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local

[3] The developer must to apply to the Director-General of NSW DEC to obtain a Section 90 certificate or engage an archaeologist on their behalf to obtain a Section 87(1) permit, before any impact to the site/object is affected. This process usually takes at least eight weeks.

[4] The fate of all artefacts remains within the statutory control of the NSW DEC. A care and control permit may be issued to local Aboriginal groups or, with Aboriginal community consent, to other parties, for educational or display purposes.

[5] The Burra Charter defines the basic principles and procedures to be followed in the conservation of all kinds of places such as monuments, buildings, Aboriginal sites, roads, archaeological sites, whole districts or even regions. It was first adopted in 1979, based on the Australian ICOMOS (International Council on Monuments and Sites) review (1977) of the 1966 Venice Charter (Australian ICOMOS Inc. 1998).

government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The Burra Charter generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a State level.

A number of Acts of parliament provide for the protection of Aboriginal heritage at various levels of government[6]. The three most important statutes in New South Wales are the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act), amended by the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* (EP&AAAct)
- *National Parks and Wildlife Act 1974 (*NPW Act*)*
- *Heritage Act 1977 (*H Act*)*

While at Commonwealth level, the following statutes are relevant:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) amended by the *Environment and Heritage Legislation Amendment Act (no. 1) 2003,* the *Australian Heritage Act 2003 (*AHC Act*)* and the *Australian Heritage Council (Consequential and Transitional Provisions) Act 2004 (*AHC (CT) Act*).*

State legislation

The EP&A Act 2005 is founded on the *Environmental Planning and Assessment* Act 1979 that requires environmental impacts, including cultural heritage, are considered at a land-use planning and decision making level.

Under this Act Aboriginal heritage is protected in three different ways:

4. Through planning instruments such as Regional Environmental Plans (REPs) and Local Environmental Plans (LEPs). Such plans outline permissible land use as well as identifying potential constraints. Section 112 (1) of the EP & A Act delineates that no approval for either prescribed developments or developments likely significantly affect the environment, may be granted without prior appropriate environmental impact assessment.
5. Section 90 of the Act (Part 4, Division 5) lists impacts to the environmental resource, including cultural heritage, which must be considered before development approval is granted.
6. All State Government agencies acting as determining authorities on environmental issues must consider a range of community and cultural factors, including Aboriginal heritage, in their decision-making process. The factors to be considered in such assessments are set out in the EP & A Regulations (1980), Part VII.

The *National Parks and Wildlife Act 1974* (as amended; particularly sections 83-91A) provides statutory protection for all Aboriginal relics and places, regardless of significance, land tenure or whether they have been previously recorded in the DEC AHIMS. Areas may be gazetted as

[6] NSW Heritage Office 1998: Living with Aboriginal Culture, p. 3

Aboriginal 'places' when the Minister is satisfied that sufficient evidence exists to demonstrate that the area is or was of special significance to Aboriginal people.

Under Section 90 of this Act it is an offence to knowingly damage, deface or cause or permit the destruction of an Aboriginal relic or place without the prior written consent of the Director-General of the NSW DEC. Prosecution for such offences may include the imposition of financial penalties and/or imprisonment. Reporting the discovery of previously unknown Aboriginal sites to the Director-General of the DEC within a reasonable time of discovery is also obligatory under Section 91 of the Act.

The *Heritage Act 1977* (amended 1999) protects the State's natural and cultural heritage and contains measures to protect archaeological remains. Generally, Aboriginal sites are protected by the NPW Act, but if certain sites are deemed as having great significance, they can be further protected by a heritage order, issued by the Minister, on the advice of the Heritage Council.

Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* protects the environment, particularly matters of National Environmental Significance. It streamlines national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places. Under the EPBC Act, definitions of the "environment" include the following:

Ecosystems and their constituent parts, including people and their communities;

Natural and physical resources;

The qualities and characteristics of locations, places and areas;

Heritage values of places and

The social, economic and cultural aspects of a thing mentioned in the above points.

There are seven matters of National Environmental Significance under the EPBC Act:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (Ramsar Wetlands);
- listed threatened species and ecological communities;
- listed migratory species;
- the Commonwealth marine area; and
- nuclear actions, including uranium mining.

The EPBC Act provides that any action assessed as likely to have a significant affect on these listed matters of national environmental significance is to be known as a *controlled action*, *and* may only proceed with the Minister of the Environment's approval.

In January 2004 changes to the protection of national heritage came into affect through amendments to the EPBC Act and through the passing of the AHC Act and the AHC (CT) Act. The first was covered above; where National Heritage places joined the previous six listed Matters of National Environmental Significance.

The AHC Act provided for the establishment of the Australian Heritage Council (AHC), an independent advisory body to the Commonwealth Minster for the Environment and Heritage. This body replaces the earlier Australian Heritage Commission, established in 1975 under the *Australian Heritage Commission Act 1975 (*AHC Act 1975*).* The register of heritage places set up under the

AHC Act 1975, known as the Register of the National Estate (RNE), is retained under the new AHC Act, but it is noteworthy that this list provides no specific legislative protection, although listing on the RNE recognises the heritage values of such places.

The AHC (CT) Act repeals the AHC Act 1975 and provided amendment to various Acts, allowing a transitional period for the establishment of the National Heritage List (NHL) and the Commonwealth Heritage List (CHL).

9. RECOMMENDATIONS

Under Section 91 of the NP & W Act (1974 as amended) the Director-General of the NSW DEC must be notified of the location of all Aboriginal sites recorded under any auspices. As a professional in the field of cultural heritage management it is the responsibility of OzArk EHM to ensure this process is undertaken.

To this end it is noted that DEC Site Cards for the sites recorded during the current survey of the Baal Bone longwalls in Ben Bullen State Forest have been lodged with the DEC head office in Hurstville. The following recommendations are made on the basis of:

- Legal requirements under the terms of the *National Parks and Wildlife Act of 1974* (as amended) whereby it is illegal to damage, deface or destroy an Aboriginal relic/object without the prior written consent of the Director, DEC;
- The findings of the current investigations undertaken within the study area; and
- The interests of the Bathurst Local Aboriginal Land Council (BLALC), North East Wiradjuri Native Title Party (NEWNTP) and Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC).

It is recommended that:

1) One isolated find, BBC-IF1 was recorded in the current Baal Bone SMP study area. It has been assessed as being a one-off drop artefact of overall low significance. No further archaeological assessment in relation to this site is considered necessary.

2) One rockshelter with no surface evidence of Indigenous occupation was also recorded, BBC-RS1. Management of this rockshelter should be formulated with respect to the predicted affects of subsidence on the location of the rockshelter, once these have been modelled. Hence, there are two options for BBC-RS1, as follows:

    a. If subsidence predictions indicate that the location of BBS-RS1 will be only minimally impacted by potential subsidence, then no further archaeological assessment of this location is considered necessary.

    b. If, however, subsidence predictions indicate that this location is likely to suffer extensive disturbance and plans of the underlying longwalls cannot be altered to alleviate this, then a programme of limited sub-surface test excavation within the rockshelter and its immediate environs is recommended to determine the presence or absence of Indigenous occupation evidence. The resultant information will allow an informed assessment of the scientific and cultural significance of the rockshelter thus enabling the formulation of appropriate management recommendations. The Proponent would be required to engage a suitably qualified archaeologist to prepare a Section 87(1) permit application and research design for lodgement with the Director-General of the NSW DEC. Concomitant Aboriginal community liaison would also be required. Processing time for permit applications with the DEC is a minimum of 8 weeks.

3) No other Indigenous sites were recorded as a result of the current assessment. Overall the Baal Bone SMP study area was assessed as having low archaeological sensitivity due to the generally sloping nature of the landforms and the distance from permanent water sources. This assessment is supported by the nearby presence of Long Swamp to the west and the Wolgan Valley to the east, of which both locations would have provided plentiful resources and appropriate occupation sites.

4) There are no further constraints on the grounds of Indigenous heritage to the proposed Baal Bone Colliery underground mining project comprising longwalls 29-31 under the Ben Bullen State Forest, NSW.

5) One copy of this report should be sent to:

Gundungurra Tribal Council Aboriginal Corporation

PO Box 419

Katoomba 2780

Members - Bathurst Local Aboriginal Land Council

c/o Mr Warwick Peckham, Coordinator

PO Box 1500

Bathurst NSW 2795

Members - Warrabinga Native Title Claimants Aboriginal Corporation

c/o Ms Wendy Lewis, Cultural Heritage Liaison Officer

PO Box 771

PICTON NSW 2574

Members – North East Wiradjuri Native Title Party

c/o Ms Lyn Syme, Secretary

17 Main St

ULAN NSW 2850

6) Two copies of this report should be sent to:

Manager, Aboriginal Heritage Unit

Cultural Heritage Division,

NSW DEC

PO Box 1967

HURSTVILLE NSW 2220

10. REFERENCES

Australian ICOMOS Inc. 1998 Understanding the Burra Charter: A guide to the principles of heritage conservation in Australia. Brochure produced for Australia ICOMOS.

Appleton, J. 2004 Aboriginal Heritage Assessment Pine Dale Coal Mine Proposal. Report to R.W. Corkery & Co.

Barton, H. and McDonald, J. 1995 Archaeological investigation of sites affected by augmentation works at Lyell Dam, near Lithgow, NSW. Salvage and test excavation report. Report prepared for Pacific Power.

Bembrick, C.S. 1980 "Geology of the Blue Mountains, Western Sydney Basin" pp.134-161. (In) C. Herbert and R. Helby (Eds) *A guide to the Sydney Basin* Geological Survey of New South Wales, Department of Mineral Resources, Sydney.

Bureau of Meteorology 2006 www.bom.gov.au

Bowdler, S. 1983 *Aboriginal sites on the Crown timber lands of NSW*. Report to the Forestry Commission of NSW.

Brayshaw, H and Haglund, L. 1992a Western Main Colliery Proposed Open Cut Western Blue Mountains, NSW. Report to Novacoal Australia Pty Ltd.

Brayshaw, H and Haglund, L. 1992b Lamberts Creek - Western Main Colliery Archaeological investigation of two potential open sites. Report to Novacoal Australia Pty Ltd.

Brayshaw, H. 1993 Western Main Colliery Proposed Open Cut Extension. Archaeological Survey for Aboriginal Sites. Report to Novacoal Australia Pty Ltd.

Byrne, D. 1997 (NPWS) Aboriginal Cultural heritage Standards & Guidelines Kit. Aboriginal Heritage Division.

Gay, L. 1999 Proposed Realignment of the Castlereagh Highway, Lidsdale, NSW: Indigenous Heritage Assessment. Report to the RTA.

Gay, L. 2000 Proposed Realignment of the Castlereagh Highway, Lidsdale, NSW: Supplementary Report on the Indigenous Heritage Assessment. Report to the RTA.

Haglund, L. 1982 *Archaeological Investigation east of Portland*. Report to Blue Circle Southern Cement Limited.

Jo McDonald CHM 1997 Interim Heritage Management report: ADI Site St Marys. Volume 1. Report to Lend Lease.

Kelton, J 1999 An Archaeological survey of the proposed silicon plant at Wallerawang, near Lithgow, Central tablelands of NSW. Report to R.W. Corkery, Orange.

Kelton, J 2000 An Aboriginal Archaeological study of the Marrangaroo Department of Defence site, Lithgow, NSW. Report to Dames and Moore Pty Ltd, North Sydney.

Kelton, J. 2002a An Aboriginal Archaeological Study & Non-Indigenous Heritage Overview of the Proposed Boulder Road Coal Mine, Near Cullen Bullen. A report to International Environmental Consultants P/L.

Kelton, J. 2002b An Aboriginal Archaeological Survey & Non-Indigenous Heritage Overview of the Proposed Extension to Cullen Valley Mine. A report to Lithgow Coal Company.

Kohen, J. 1992 Archaeological Survey of the Proposed Open Cut extensions to the Baal Bone Colliery. Report to Coalex.

Kohen, J. 1992 Excavation of two Aboriginal rockshelter sites at Gardiners Gap, near Baal Bone Colliery.

Kohen, J. 1996 Archaeological Survey of the Proposed Northern extension to the Baal Bone Colliery. Report to Wallerawang Colliers P/L.

Kuskie, P. (South East Archaeology) 2006 Abel Underground Mine: Part 3A Project Application – Aboriginal Heritage. Report to Donaldson Coal P/L.

Lembit, R. 2002 *Boulder Flora Assessment.* A Report to International Environmental Consultants.

Mills, R. 1996 An Archaeological Survey for the Proposed Feldmast Coal Project Cullen Bullen, NSW. Report to International Environmental Consultants.

Mills, R. 1998 An Archaeological survey for the Proposed Stage 4 of Ivanhoe Mine, Portland. Report to International Environmental Consultants.

McIntyre, S. 1990 Archaeological survey of the proposed Kariwara Longwall Coal Mine. Prepared by the Electricity Commission of NSW.

McIntyre, S. 1993 Springvale coal project – Aboriginal burial site. Report prepared for Clutha Limited and Samsung (Australia) Pty Ltd).

Mulvaney J. and Kamminga, J 1999 *Prehistory of Australia*. Allen and Unwin: Sydney.

OzArk EHM 2004a Salvage Excavations at Site L2 – # 45-1-2573 & 2574, within the Proposed Corridor the New Castlereagh Highway 86, Lidsdale, NSW. July 2004. Report to the NSW Roads and Traffic Authority, Parkes.

OzArk EHM 2004b Archaeological Assessment for the proposed Neubecks Creek Open Cut Coal Mine. Report to International Environmental Consultants.

OzArk EHM 2005a Archaeological and Ecological Assessment Open Cut Coal Mine Expansion Mining Lease 1448, Lamberts Gully, NSW. Report to International Environmental Consultants.

OzArk EHM 2005b Addendum to Archaeological and Ecological Assessment Open Cut Coal Mine Expansion Mining Lease 1448, Lamberts Gully, NSW. Report to International Environmental Consultants.

OzArk EHM 2005c Archaeological Assessment - Nth Ivanhoe Rehabilitation Project. Report to Centennial Coal Pty. Ltd.

OzArk EHM 2006 Indigenous heritage desktop review: Proposed Subsidence Management Plan over three new longwalls (29-31) in the Ben Bullen State Forest. Report to Xstrata Coal Pty Ltd, Baal Bone Colliery.

Rich (= White), E. 1988 Proposed prison at Marrangaroo Creek near Lithgow, NSW: archaeological survey for Aboriginal sites. Report prepared by Brayshaw McDonald Pty Ltd for the Public Works Department of NSW.

Rich (= White), E. & Gorman, A 1992 Proposed Springvale Colliery and Conveyor, Wallerawang: Archaeological Survey for Aboriginal Sites. Report prepared for Sinclair Knight.

Rich (= White), E. 1993a Springvale Coal Project, Wallerawang, NSW: Archaeological inspection of Aboriginal sites affected by construction works. Report prepared for Howie Herring and Forsyth Pty Ltd.

Rich (= White), E. 1993b Additional Archaeological Survey for the Proposed Springvale Colliery and Conveyor, Wallerawang: Archaeological Survey for Aboriginal Sites. Report prepared for Howie Herring and Forsyth Pty Ltd.

Silcox, R. 1988 AnArchaeological Survey of a proposed deviation on State Hwy No. 5 near Lithgow. Report to DMR.

Tindale, A. 1974 *Aboriginal Tribes of Australia.* University of California Press.

URS, 2003 "Neubecks" Landuse Study and Open Cut Coal Mine Concept Design. Report to Centennial Coal.

Appendix 1 – Plates

Plate 3: General view of a standard portion of the study area along Transect 1. Note the complete lack of ground surface

Plate 4: General view of a standard portion of the study area along Transect 5. Note the complete lack of ground surface

Plate 5: General view of the main access track that traverses the study area. This was the only real area of ground surface

Plate 6: View of a portion of the study now devoid of all old growth as a result of continued logging.


METRIC 1
2
3


METRIC 1


METRIC 1

Plate 9: Location of isolated find BBC-IF1 – next to the log which is located on beyond the ephemeral waterway.

Plate 10: View directly into rockshelter BBC-RS1. Note the scale and extent of the overhang and the collapsed portion of

Plate 11: View southeast along the drip line of the rockshelter BBC-RS1 towards further outcropping sandstone that

Plate 12: View northwest along the drip line of the rockshelter BBC-RS1. The area closest to this end of the shelter had

Appendix 2 – Aboriginal Community Correspondence

13 Dec 06 11:53a Lyn Syme 0246830566 p.4

WARRABINGA

Native Title Claimants Aboriginal Corporation
PO Box 771
Picton NSW 2574
MOBILE: 0409 966 371 or 0409 966 163
FAX: 02 4677 0454

12th December, 2006

Kylie Sutherland
Ozark
PO Box 2069
DUBBO. NSW 2830

Dear Kylie

Re: Expression of Interest
Aboriginal Cultural & Heritage Interests
***Proposed* extensions to Baal Bone Colliery at Cullen Bullen**

I write to advise you of this organisation's interest in any work you may be undertaking in NSW in relation to Native Title and Aboriginal cultural heritage issues.

Membership of our organisation is open to adult Aboriginal persons who are descendants of Dabee, Mudgee, Capertee, Coxes River, Goulburn River, Cudgegong River, Gulgong, Cassilis, Bylong, Lithgow, Abercrombie, Jenolan and Wombeyan Caves and Wollimi and Oberon Clans.

Warrabinga Native Title Claimants Aboriginal Corporation was established to represent the interests of a large number of individual Aboriginal clan groups in the areas outlined above.

Broadly our organisation has members with native title interests over the lands and waters associated with the Cox's River, Goulburn River and the Cudgegong River and other waterways within these boundaries .

Our organisation consists of a number of members with knowledge essential to completing Aboriginal cultural heritage assessments and our executive committee make determinations for the most suitably qualified individual(s) for any field work.

Warrabinga is *fully insured for both Public Liability and Workers* Compensation (Certificates of currency are available upon request, should they be required for any work).

An important point is that under the amended National Parks legislation all sites are protected regardless of whether they have been previously identified or not.

13 Dec 06 11:53a Lyn Syme 0246830566 p.7

WARRABINGA

Jative Title Claimants Aboriginal Corporation

'O Box 771
'icton NSW 2574
MOBILE: 0409 966 371 or 0409 966 163
'AX: 02 4677 0454

We would therefore request that you maintain contact with us, consult with us and we can provide expertise services under contract should you require such services.

Professional Fees:

Our organisation has previously worked in association with other Environmental Consultants on other projects within our area of interest.

What we would require from you:

Definitive survey dates 10 days prior to commencement of work.

Should you have any further queries relating to Warrabinga or require more specific information please feel free to contact me on the above numbers.

Yours in Indigenous spirit,

W. Lewis

Wendy Lewis
Cultural Heritage Liaison Officer

2

NORTH EAST WIRADJURI NATIVE TITLE PARTY

C/- Lyn Syme
17 Main St., Ulan. 2850

0263734875
0425332434
lsyme@aapt.net.au

12th December, 2006

Kylie Sutherland
OzArk
PO Box 2069
DUBBO. NSW. 2830

Dear Kylie,

Expression of Interest
Aboriginal Cultural Heritage Assessment
Proposed Extensions to Baal Bone Colliery at Cullen Bullen

On behalf of the NE Wiradjuri Native Title Party I wish to register our interest in the Aboriginal Cultural Heritage Assessment for the above Aboriginal Cultural Heritage Assessment.

I can be contacted on the above phone nos. should you require any further information.

Yours in Indigenous Spirit

Lyn Syme
Secretary.

BATHURST
LOCAL ABORIGINAL LAND COUNCIL

149 Russell Street
Bathurst NSW 2795

PO Box 1500
Bathurst NSW 2795

Phone: 02 6332 6835
Fax: 02 6332 3623

LONGWALL 29 - 31

Three separate surveys were conducted for Baal Bone Colliery on over a three-day period 27th, 28th and 29th of December 2006 for the proposed airshaft bore hole, power transmission line and longwalls 29-31. The survey areas are located within the Ben Bullen State Forest east of Lithgow NSW. This is an extension survey to a pervious survey conducted on Monday the 17th September 2006 with Phillip Cameron from Ozark Environmental & Heritage Management.

Survey One – Proposed Air Shaft Bore Hole

The proposed airshaft bore hole site is located on Long Swamp Road. The area surveyed covered approximately 200 x 200 meters. This area has been severely disturbed, consisting of sandy soil covered with heavy ground growth creating nil visibility. Clearing of this survey area will be required for the installation of the airshaft bore hole.

Survey Two – Power Transmission Line

The power line will be installed adjacent to the existing bush track for 700 meters, after that distance it will veer northwest into the bush land. This bush land is comprised of an extremely rough terrain and covered in dense ground cover such as leaves, fallen trees, branches and other forest matter thus creating nil visibility difficult access.

Two shelters were located within the survey area. These shelters displayed *no evidence of* aboriginal occupancy and will not be impacted on by the installation of the power line. No evidence of Aboriginal activity, artefacts, shelters or scared trees was recorded or discovered during either survey.

Survey Three – Longwalls 29 - 31

Two shelters were located within the Longwalls survey area. These shelters *displayed no* evidence of aboriginal occupancy however one isolated artefact was located. This artefact was rerecorded and replaced in the same region. Visibility was extremely poor due to thick undergrowth and bush litter. The area provided no potential for Aboriginal occupation.

The Bathurst Local Aboriginal Land Council has no objections to the commencement of the proposed Air Shaft bore hole, power transmission line and longwalls installation commencing *within the surveyed areas.*

Present at this were surveys:

Jodie Benton	Archaeologist	Ozark Environmental & Heritage Management
Phillip Cameron	Ecologist	Ozark Environmental & Heritage Management
Wendy Lewis	Representative	Warrabinga Aboriginal Council
Richard Peters	Sites Officer	Bathurst Local Aboriginal Land Council

Richard J. Peters

RICHARD J PETERS
SITES OFFICER
3 January 2007

02 May 07 11:22a Tharawal LALC 0246831375 p.1

Phone 68822118

WARRABINGA

Native Title Claimants Aboriginal Corporation

~~535~~ 525 Pheasants Nest Road
Pheasants Nest, NSW 2574
PH: 02-46841341
MOB: 0409966163 EMAIL: lewis~~barton@bigpond.com~~.au tharawallalc@bigpond.com.au
FAX: 02-~~46843454~~ 0246831375

Baalbone Long Wall Panel 29-31 ~~a Ventilation Shaft~~.

Ground Cover absolutely no visability very heavy leave & bark coverage

I attended 28,29,30/12/2006.

Cores Swamp area & National Trial area to LHS of Wolgan Rd.

The artefact found in 1 Valley Creek area "rare".

I have strong feelings that the large overhang at "Pagoda Outcrop Western side was a living area and the presence of food source and medicinal plants would be indicative of this.

Monitoring of subsidence of the area is important and its close ness to "Blackfellows Hands" in state forest which is extremely important area.

I would support further examination or an excavation in this area to record if there is any likelihood of damage.

The "Pagoda" Rocks are important as land marks to negotiate the area in traditional walking tracks.

Yours in Indigenous Unity

Wendy Ann Lewis

2/5/2007

Warrabinga NTCAC.

68820630 02/05/2007 10:02 RECEIVED FROM: 0246831375 #0082-001

Appendix 3 – Log of Aboriginal Community Consultation

Preparation for Field Investigation and Community Consultation Log

Proposed Extensions to Baal Bone Colliery

Pre field assessment					
place advert in Lithgow Mercury 7.12.06					
expressions of interest close 21.12.06					
Order site search 4.12.06					
Map ordered					
ACTION	**Person Contacted**	**Date**	**Method**	**OzArk**	**Comment**
Letters seeking expressions of interest and stakeholder details sent to:					
Native Title	Steve Ryan	5.12.06	email letter	KAS	Replied 6.12.06 that Traditional Owners - NE Wiradjuri (L Syme) should be contacted
Lithgow Council	General Manager	5.12.06	letter	KAS	
DEC	C Hampson	5.12.06	email letter	KAS	
NE Wiradjuri	members (L Syme)	5.12.06	fax letter	KAS	
Warrabinga	members (W Lewis)	5.12.06	fax letter	KAS	
BLALC	members (W Peckham)	5.12.06	fax letter	KAS	
Gundungurra Tribal Council Aboriginal Corporation	members	11.12.06	letter	KAS	
Community Consultation					
Gundungurra Aboriginal Heritage Association Inc.	Sharyn Halls (Sec)	11.12.06	phone	KAS	Called to ascertain if they had been contacted by Xstrata re consultation for proposed extensions at Baal Bone Colliery at Cullen Bullen. They have not been included in this process to date. She confirmed that Cullen Bullen is not in Gundungurra territory.

Bathurst LALC	Rick Peters	15.12.06	phone	PJC	Will be able to attend field survey 28th-30th Dec 06
NE Wiradjuri	Lyn Syme	13.12.06	fax	KAS	expressed interest to be included in the consultation process
Warrabinga	Wendy Lewis	13.12.06	Fax	KAS	expressed interest to be included in the consultation process
ACTION	**Person Contacted**	**Date**	**Method**	**OzArk**	**Comment**
Lithgow City Council				PJC	Called OzArk to advise of GLATSIC Indigenous body which operates in Lithgow
GLATSIC		18.12.06	phone	KAS	called to establish what core business is, no answer
Bathurst LALC	Toni-lee	18.12.06	phone	KAS	Called to confirm field work for Rick Peters and she faxed current insurances straight back.
NE Wiradjuri	Lyn Syme	18.12.06	phone	KAS	Spoke to Lyn who demanded NE Wiradjuri and Warrabinga both attend the three days of field assessment. Also informed that she has no insurances for NEW.
NE Wiradjuri traditional owner	Sharyn Riley	18.12.06	phone	KAS	Expressed interest to be included in the consultation process, she will forward contact details by fax to facilitate this process.
Warrabinga	Wendy Lewis	19.12.06	phone	KAS/JB	Spoke to Wendy who demanded NE Wiradjuri and Warrabinga both attend the three days of field assessment.
Xstrata	Tony King	19.12.06	phone	JB	Called to update on current community position and discuss how to manage community issues and to re confirm number of community placements 2 and field assessment dates 27-29 Dec.
Native Title Service		19.12.06	phone	PJC	Called to establish if a native title claim can be lodged over an existing mining lease or a Part 3A extension.
Xstrata	Tony King	20.12.06	phone	JB	Discussed Xstrata policy for engagement of community groups

Warrabinga	Wendy Lewis	20.12.06	phone	KAS	faxed through interim guidelines to Wendy on request, also fax of engagement for field assessment
NE Wiradjuri traditional owner	Lyn Syme	20.12.06	fax/email	KAS	faxed/email letter of engagement for field assessment
BLALC	Toni-lee	20.12.06	fax	KAS	faxed letter of engagement for field assessment
BLALC	Rick Peters	2.1.06	fax	KAS	Received report on site visit from Rick Peters, BLALC representative for field assessment.
Warrabinga	Wendy Lewis	8.2.07	phone	KAS	A call was made to Wendy to ask for her letter of participation for the project. A message was left as she was in a meeting.
ACTION	**Person Contacted**	**Date**	**Method**	**OzArk**	**Comment**
Warrabinga	Wendy Lewis	April 07	Phone	KAS	Wendy Lewis was called at Warribinga on three occasions during April and a request was made for her letter of participation/report for the field assessment for this job.
Warrabinga	Wendy Lewis	2.5.07l	Fax/Phone	KAS/JB	Spoke to Wendy as she faxed through hand written letter of participation for the field assessment.

Appendix 4 – Site Type Definitions

Rockshelter sites (with art and/or deposit)

Rockshelter sites can only occur where this is suitable topographic and geological factors present, forming overhangs or caves in the eroding bedrock. The size (both horizontal and vertical dimensions) of the space available, the aspect of the opening and the proximity to resources will determine the length and intensity of human occupation. Art in the form paintings may be found in caves, but often suffer considerably from erosion of the sandstone.

Open camp sites

Often called stone artefact scatters, these sites (for the purposes of the DEC AHIMS database) were in the past defined by the presence of two or more stone artefacts located within 50 m of one another. Current guidelines, however, delineate no hard and fast determinations, more loosely describing these camp sites as places exhibiting evidence of past human activity. This can be, and is most frequently, in the form of stone artefacts, but may also include other evidence such as hearths or midden material. Such sites provide evidence for the range of activities that may have been undertaken at a particular place, including the production of stone tools and the preparation of food including the butchering of animals or grinding of seeds. However, the distinction between a single, isolated artefact versus a place where numerous artefacts have been recorded together provides a necessary division in terms of the possible information that a site can reveal about past activities. Further information recorded about open sites includes assessments of the sites' integrity (how intact the site is) and subsequently whether sub-surface deposits are thought to be present.

Isolated Finds

An artefact, usually of stone, but possibly of other materials, that is located but has no relationship to other identifiable archaeological features.

Axe Grinding Grooves

Aboriginal axe heads were usually made from very hard igneous rock, which was first flaked roughly to the appropriate shape and then pecked or ground to an even surface. To keep the edges of these axes sharp, they were ground on the surface of a relatively softer stone (usually sandstone). As the axe is rubbed repeatedly in the same location, a groove forms to fit the shape of the axe. This groove has a roughly elliptical shape and a smooth, regular surface along its base. Arrowheads may also have been sharpened in grooves, which generally appear narrower and deeper.

Grinding groove sites are most often located on the floodplains of rivers and creeks, although they can be in elevated positions above water as well. Sometimes, sandstone flats near water may exhibit hundreds of such grooves, and it is thought that once an axe blank has its edge ground in a groove, then it can only be sharpened in the same groove. Hence, if the owner of the axe is away from its place of origin, then a new groove has to be created for the sharpening of that particular axe head[9]. Grooves are also frequently recorded in smaller groups, especially along more ephemeral water courses.

Scarred Trees

This site type results from the deliberate removal of bark (and sometimes wood) from trees, for the purpose of obtaining raw material for the manufacture of various items of material culture – i.e.

[9] As read at the Terramungamine Reserve grinding groove interpretation sign.

shields, coolamons, shelters, canoes, and cradles. They may also result from foraging and hunting - for instance, toe holes cut in trees to allow access to upper branches and hollows, and axe marks around natural hollows for the extraction of small tree-living fauna (such as possums or birds) or honey.

The identification and interpretation of a scar as being Aboriginal in origin can often be difficult, as bark can be removed from trees by a variety of means e.g. animal and bird foraging, the natural breaking off of tree limbs, lightning strikes to the tree, the result of machinery damage to trunks and the removal of bark by Europeans to define land boundaries. To assist archaeologists in the accurate identification of Aboriginal scarred trees, the DEC Western region provides a set of criteria against which each scar must be assessed.

These diagnostic criteria are as follows:

1. *The scar must not touch the ground* - (scars resulting from fire, fungal attack or lightning nearly always reach the ground). Such a termination does not necessarily preclude an Aboriginal origin. Ethno-historic accounts of canoe manufacture occasionally demonstrate scarring to ground level. If the scar does run to the ground, the sides must be relatively parallel (i.e. not triangular). It must be noted that discussion with Native Title from other areas suggests that scars may indeed extend to the ground, especially when the bark is planned for use in a shelter. This information is derived from oral histories recorded in Dubbo and observations from further afield;

2. *The ends of the scar should be squared off or evenly tapered* - Different shapes at the top and bottom (e.g. pointed at top, squared at bottom; round at top, flaring at bottom) are suggestive of natural processes (e.g. branch loss);

3. *The sides of the scar should be parallel or symmetrical* - Few natural scars are likely to have these properties, with the possible exception of fire scars which may be symmetrical but are usually wider at their base. Modern surveyors' marks are typically triangular, and often adzed. These also (regardless of shape) usually have a number carved in the wood, within the scar;

4. *The length of the scar must be on the same axis as the tree and not oblique or slanting across the tree or the branch* - Scars which are natural in origin tend to have irregular outlines, sometimes have irregular regrowth and may occur against the axis of the tree.

5. *The tree should be reasonably old – i.e. over 100 years* - The tree upon which the scar is found should be old enough (i.e. of sufficient age) to have been used by Aboriginal people in (at least) a semi-traditional manner. This means the tree should be at least c. 100 years old. The age of the scar should also be reflected in the thickness of the regrowth. Young scars (e.g. some natural scars caused by branches falling or birds or horses gnawing, have characteristically thin regrowth);

6. *There must be no obvious natural or other artificial cause* such as a branch rip, lightening strike, cockatoo chewed bark or healed bark tears from machinery damage or car impact – Any signs that the scar may not be Aboriginal should be carefully assessed; and,

7. *The tree must not be an introduced species* – For obvious reasons, the tree upon which the scar is found should be endemic to the region, i.e. this excludes historic (exotic) plantings.

Also helpful in scarred tree identification, but not within the DEC criteria are the following points:

8. *Axe or adze marks* - A scar with cut marks on the original wood is likely to be anthropogenic in nature (i.e. as a result of human actions). The location and shape/size may lend support to the scar's origin. For example stone axe marks would indicate an Aboriginal origin, while

steel axe marks post-date the arrival of Europeans. These of course could still have been made by an Aboriginal person in the post-contact era; and,

9. *The presence of epicormal growth* – Many scars of Aboriginal origin tend to have an epicormal shoot originating at the base of the scar. This is a new branch shooting from the point of damage and is part of the trees self preservation mechanism.

As noted in the DEC criteria, any tree that does not fit these rules cannot be accepted as likely to be of Aboriginal origin. This may mean that a few authentic scars are omitted from the Aboriginal Sites register, but it is the only means to establish consistency in identification.

However, even when applied, the above criteria cannot always provide a definitive classification, and a natural origin for the scar cannot be ruled out. For this reason interpretations of Aboriginal origin are qualified by the recorders degree of certainty. The following categories are used:

- DEFINITE ABORIGINAL SCAR

This is a scar which conforms to all of the criteria stated above and/or has in addition a feature or characteristic that provides definitive identification, such as diagnostic axe or adze marks, or a historical identification. All conceivably natural causes of the scar can be reliably discounted.

- ABORIGINAL SCAR

This is a scar which conforms to most of the criteria, and where an Aboriginal origin is considered to be the most likely. Despite this, a natural origin cannot be completely ruled out.

- POSSIBLE ABORIGINAL SCAR

This is a scar which conforms to most of the criteria but where an Aboriginal origin would appear unlikely.

For the purposes of the current study, on the advice of Allan Hutchins (DEC Western Region), only scars of the first two categories have been recorded as sites to be entered into the DEC ASR. As a general rule, the “Aboriginal scar” and “Probable Aboriginal scar” categories have been collapsed into one, called “Aboriginal scar”.

<u>Natural Mythological or Cultural / Ceremonial sites</u>

Natural mythological sites can be any natural feature and like a cultural / spiritual are not detectable without the traditional knowledge of specific areas. Lindsey Moran from the BLALC is a keeper of such knowledge and was present in an effort to establish the presence of any such site type.

<u>Burials</u>

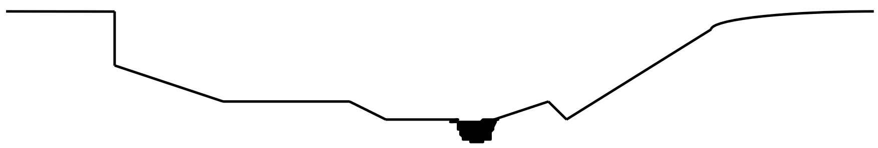
Human skeletal remains can occur as either single individual burials or as cemeteries containing multiple individuals. Several have been found in the local region (Section 5.2). Individuals may be buried either in a standing or sitting position, often oriented to the east and sometimes marked by carved trees.

Appendix 5 – DEC Site Cards

New Recording ☒ Additional information ☐

SITE IDENTIFICATION					
Site name	***BBC-IF1***			**NPWS Site Number**	
Owner/manager	Xstrata Coal				
Owner Address	*Baal Bone Colliery, Cullen Bullen*				
LOCATION					
Location	*Proposed site for long wall mining at Baal Bone Colliery, Cullen Bullen*				
How to get to the site	Turn off the Great Western Highway just west of Cullen Bullen at mine entrance				
1:250,000 map name	Cullen Bullen 8931-3-N			**NPWS map code**	
AMG Zone	56	**AMG Easting**	229862E	**AMG Northing**	6312228 N
Method for grid reference	Hand-held GPS	**Map scale (if method = map)**	1:50 k	**Map name**	Cullen Bullen 8931-3-N
NPWS District Name (see map)				**NPWS Zone (see map)**	***Northwest***
Portion no.				**Parish**	***Cullen Bullen***
SITE DESCRIPTION					
Site type(s)	Isolated Find			**Site type code (NPWS use only)**	
Description of site and contents CHECKLIST: eg. length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock. DEPOSIT: colour, texture, estimated depth, stratigraphy, contents- shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types. ART: area of decorated surface, motifs, colours, wet,/dry pigment, engraving technique, no. of figures, sizes, patination. BURIALS: number & condition of bone, position, age, sex, associated artefacts. TREES: number, alive, dead. likely age, scar shape, position, size, patterns, axe marks, regrowth. QUARRIES: rock type,	This isolated find was located along an unmarked logging access track that extends from Long Swamp Track to the northeast, up a drainage gully. The isolated find is a small, exhausted grey chert core, measuring 3.1 x 1.9 x 1.8 cm . It was recorded adjacent to the alluvial bed of the unnamed waterway that flows from the top of the gully southwest into Long Swamp. Due to the alluvial nature of the deposits in which the artefact was located, the original source of the artefact is unknown. It may have travelled along the bed of the creek during high flow events, or have moved downslope from the spurs on either side of the creek. Despite extensive searching in the immediate area, no further definitive artefact could be located, although two possible quartz flakes were also photographed. The predominance of small quartz cobbles in the alluvial creek bed and the position of the 'flakes' on the vehicle track causes there to be a high likelihood that these possible flakes may in fact be broken quartz pebbles, fractured as a result of vehicle impacts. The lack of definitive context for the chert core, combined with the lack of further artefacts or the presence of a defined landform that could be described as having potential for intact sites, leaves the probable interpretation of this artefact as being an isolated drop artefact, left behind as individuals passed through this landscape either on route to the Wolgan Valley or Long Swamp. **Attach photographs and sketches, eg. plan & section of shelter.** **Do NOT dig, disturb or damage site or contents.**				

debris, recognisable artefacts, percentage quarried	

SITE ENVIRONMENT					
Land form	***Creek bed Soil mantled slope***	**Aspect**		**Slope**	flat
Mark position of the site					
Local rock type	***Sandstone***	**Land use/effect**	***State Forest***		
Distance from drinking water	***5m***	**Source**	***Unnamed drainage line***		
Resource zone (eg. estuarine, river, forest)	woodland	**Vegetation**	***Cleared***		
Edible plants		**Faunal resources** (include shellfish)			
Other exploitable resources (eg. ochre)					
Are there other sites in the locality	yes	**Are they in the Sites Register**	No	**Other site types include**	1 open site. Site cards will be submitted with this site card.

SITE MANAGEMENT			
Site condition			
Management recommendations			
Have artefacts been removed from site	No	**When**	
By whom		**Deposited at**	
Consent applied for	☐	**Consent issued**	☐
Date of issue		**Consent number**	

SITE INSPECTION AND RECORDING			
Reason for investigation	Proposed longwall mining operations site		
Were local Aborigines contacted or present for the recording	☐Not contacted ☒Contacted and present ☐Contacted but not present	**Names and addresses**	Rick Peterson Bathurst LALC PO Box 1500 Bathurst, 2795 Wendy Lewis Warrabinga PO Box 771, Picton, 2574
Is the site important to local Aborigines			
Verbal/written reference sources	OzArk EHM, Jan 2007, Indigenous Heritage Desk Top Review for Proposed Subsidence Management Plan over three New Long Walls (29-31), Ben Bullen State forest, Cullen Bullen, NSW. OzArk EHM, May 2007, Indigenous Heritage Assessment for Proposed Subsidence Management Plan over three New Long Walls (29-31), Ben Bullen State forest, Cullen Bullen, NSW.	**ASR report number(s) (or title)**	C- C-

Photographs taken	Yes	**No. of Photos attached**	
Site recorded by	Jodie Benton & Phil Cameron	**Date of recording**	27 December 2006
Address/institution			

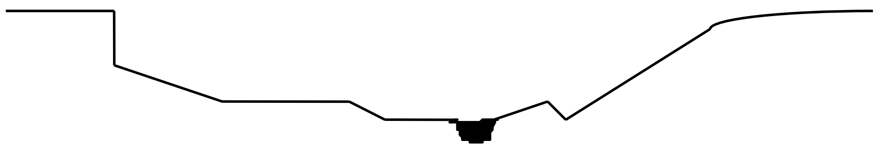
New Recording ☒ Additional information ☐

Site name	*BBC-RS1*	**NPWS Site Number**	
Owner/manager	Xstrata – Baal Bone Colliery		
Owner Address	Baal Bone Colliery, Cullen Bullen NSW.		

Location	*Proposed site of long wall mining in steep gully at Baal Bone Colliery*				
How to get to the site	Great Western Highway west of Cullen Bullen at entrance to Baal Bone Colliery				
1:250,000 map name	*Cullen Bullen*			**NPWS map code**	
AMG Zone	56	**AMG Easting**	230426E	**AMG Northing**	6311660N
Method for grid reference	Hand-held GPS	**Map scale (if method = map)**	1:50 k	**Map name**	Cullen Bullen 8931-3-N
NPWS District Name (see map)				**NPWS Zone (see map)**	Northwest
Portion no.				**Parish**	Cullen Bullen

Site type(s)	Rock Shelter	**Site type code (NPWS use only)**	
Description of site and contents CHECKLIST: eg. length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock. DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types. ART: area of decorated surface, motifs, colours, wet,/dry pigment, engraving technique, no. of figures, sizes, patination.	Within the confines of a steep gully draining to the northwest, an area of outcropping sandstone was traversed which possessed a sandstone overhang assessed as being suitable for human habitation. Although only one portion of the sandstone possessed a significant area of overhang, the remainder of the gully was very enclosed providing a quiet, protected location with a selection of edible plants, including saw sedges (*Gahnia),* long-leaf matt-rush (*Lomandra longifolia*), flax lilies (*Dianella Sp.*) fishbone fern (*Blechnum nudum*) and kangaroo grass (*Themeda australis*). The almost U-shaped area faces the west northwest in the direction of the water flow, although the creek was dry when surveyed and is likely to be dry periodically. The primary area of sandstone overhang had collapsed onto the floor of the rock shelter, obscuring the accumulated deposits from inspection and sterilising a portion of them from investigation. It is not possible to determine when this collapse may have occurred, but the potential that human habitation remains pre-existed the collapse cannot be ruled out and hence the fallen stone could bury archaeological evidence. It is nonetheless noteworthy that extensive searching in the area did not locate any direct evidence of human habitation (either deposit or art), although the area was significantly overgrown. A second potentially habitable rockshelter site was also noted on the southwest border of the study area, although its location places it outside the area delineated as requiring an SMP.		

BURIALS: number & condition of bone, position, age, sex, associated artefacts. TREES: number, alive, dead. likely age, scar shape, position, size, patterns, axe marks, regrowth. QUARRIES: rock type, debris, recognisable artefacts, percentage quarried	**Attach photographs and sketches, eg. plan & section of shelter.** **Do NOT dig, disturb or damage site or contents.**

Land form	***Steep slope***	**Aspect**		**Slope**	steep
Mark position of the site					

Local rock type	***Sandstone***	**Land use/effect**	***State Forest***
Distance from drinking water		**Source**	
Resource zone (eg. estuarine, river, forest)	***Forest***	**Vegetation**	
Edible plants		**Faunal resources** (include shellfish)	
Other exploitable resources (eg. ochre)			

Are there other sites in the locality	yes	**Are they in the Sites Register**	No	**Other site types include**	1 open site. Site cards will be submitted with this site card.

Site condition	Disturbed, rock fall evident	
Management recommendations	Avoid impact, if impacts are unavoidable then apply for a section 90 to excavate.	

Have artefacts been removed from site	No	**When**	
By whom		**Deposited at**	
Consent applied for	☐	**Consent issued**	☐
Date of issue		**Consent number**	

Reason for investigation	Proposed long wall mining site		
Were local Aborigines contacted or present for the recording	☐Not contacted ☒Contacted and present ☐Contacted but not present	**Names and addresses**	Rick Peterson Bathurst LALC PO Box 1500 Bathurst, 2795 Wendy Lewis Warrabinga PO Box 771, Picton, 2574
Is the site important to local Aborigines			
Verbal/written reference sources	OzArk EHM, Jan 2007, Indigenous Heritage Desk Top Review for Proposed Subsidence Management Plan over three New Long Walls (29-31), Ben Bullen State forest, Cullen Bullen, NSW. OzArk EHM, May 2007, Indigenous Heritage Assessment for Proposed Subsidence Management	**ASR report number(s) (or title)**	C- C-

	Plan over three New Long Walls (29-31), Ben Bullen State forest, Cullen Bullen, NSW.		
Photographs taken	Yes	**No. of Photos attached**	
Site recorded by	Jodie Benton & Phil Cameron	**Date of recording**	27 Dec 2006
Address/institution			

Appendix 2

31st December 2007

To: Tony King
Xstrata Coal
Baal Bone Colliery
PO Box 13
Lithgow NSW 2790

Re: ADDENDUM to “Indigenous heritage assessment for Subsidence Management Plan over three proposed Longwalls (29-31), Baal Bone Colliery , Ben Bullen State Forest, Cullen Bullen, NSW” May 2007.

Background

In May 2007, the Indigenous heritage assessment report required for the preparation of the overall Subsidence Management Plan (SMP) for proposed longwalls 29-31 was finalised by OzArk EHM (OzArk 2007). It has recently become apparent to OzArk that there were some issues with the site search received for the project (7.12.06) and that several sites that should have been mentioned in greater detail under the heading of “ Local Context”, were in fact omitted.

It is the subject of this brief addendum letter report to address this issue. We would like to take this opportunity to formally apologise for the omission and ask that this addendum be appended to the OzArk May 2007 report.

It is important to note that although the sites to be discussed in this addendum report are close to the SMP area, none actually fall within in it and hence the recommendations for the Indigenous heritage report do not require alteration.

This addendum provides a rewrite of the section entitled **Local Context,** found in the original report on page 12.

5.3 Local Context

A search of the DEC AHIMS database (search date 7.12.06) shows the presence of 25 recorded sites within a 10 x 10 km square area centred on the current study area (Zone 56: 225000-235000E / 6307000-6317000N). Table 1[1] provides a breakdown of site types. The most frequent site types recorded in the vicinity of the current study area are rockshelters, comprising 80% of all site types. These may have occupation deposits (52%) or art (20%) and in two instances, caves had both art and deposit (8%). Obviously the escarpment country in which the current Baal Bone study area is located (albeit on the western perimeter of this landscape) provides the requisite geological landforms for habitable rockshelters.

Again the relatively small percentage of open campsites (16%) reflects the overriding topography of the searched area. The recorded camp sites are all located next to drainage features, one next to Ben Bullen Creek and the other three adjacent to more ephemeral waterways that drain into Jews Creek. The only isolated find is recorded south of the current study area, very close to Blackfellows Hand Rock.

[1] This is Table 3 in the original report.

Table 8: Number, type and percentage frequency of sites within a 10 x 10 km^2 including centred on the Baal Bone study area.

Site Type	Total	%Frequency
Shelter with Deposit	13	*52*
Shelter with Art	5	*20*
Shelter with Art & Deposit	2	*8*
Open Camp Site	4	*16*
Isolated Finds	1	*4*
Totals	***25***	***100***

With reference to surveys undertaken in within a c. 5 km radius of the current study area, the most relevant comprise a series of assessments undertaken for Baal Bone Colliery by Haglund in 1990 and Kohen in 1992a and b, 1994, 1995 and 1996. An earlier survey was undertaken in 1989 by Godwin, however, no associated report was generated. During this survey, Godwin[2], recorded rock shelter sites # 45-1-0123, # 45-1-0124, # 45-1-0125 and # 45-1-0126 during survey for proposed underground mining activities. Despite the lack of report, data obtained from the site cards does provide limited information about these sites, as do subsequent investigative reports (Kohen 1992b, 1994). Figures 3 – 5 provide the location of these sites.

Site 45-1-0123, located c. 1 km west of the SMP area, is a large shelter with artefacts exposed along the drip line, that was the subject of an investigation related to longwall mining impacts in 1992 (Kohen 1992b). As a result of this study it was considered appropriate for sites 45-1-0123 and 0126 to be the subject of an archaeological monitoring programme with regards to potential subsidence impacts. Prior to such a programme, the sites were deemed as requiring test excavation (Kohen 1992b: 19). Test excavations were undertaken at both these sites in 1994 (Kohen 1994: 15). Two 1 x 1 m test excavation squares were dug at site # 45-1-0123, in 5 cm spits[3] to a depth of 20 cm, revealing an ashy layer of yellowy sand. 240 flaked stone artefacts were retrieved from the two squares, which can be extrapolated to 660 artefacts per cubic metre of deposit, a density suggested as being very low[4] (Kohen 1994: 32). Quartz was the most prominent raw material with bipolar cores comprising 68% of all cores. Artefacts were identified as being related to the Australian Small Tool Tradition dating to less than 4,000 years ago (Kohen 1994: 33). It is noteworthy that the rear of this shelter was described as showing evidence of a number of rockfalls, prior to underground mining activities occurring.

Site 45-1-0124, is located 80 m west of Long Swamp Road and is hence about 200 m west of the SMP boundary. This rockshelter site is described as small overhang shelter comprising a 10 x 1.5 m protected area and bearing evidence of one red ochre motif, of indeterminate morphology, c. 30 cm in height. Although no occupation is noted here, a single artefact was recorded in a small shelter 20 m to the south. It is noteworthy that this site was relocated in December 2007 and is in exactly the same condition as it was when first recorded, even to the relocation of the single recorded artefact. The GPS generated coordinates for this site are as follows: AGD 229421 E / 6312794 N and the site is situated at 1003 m AHD in elevation.

Site 45-1-0125 is described as being an enormous shelter comprising a 25 x 4 m protected area and being c. 15-20 m high. The area suitable for occupation is c. 10 m long and artefacts of chert, quartz

[2] Who was then working for the NSW National Parks and Wildlife Service.

[3] Artificial layers of deposit.

[4] For example, compared to Shaws Creek KII on the eastern side of the Blue Mountains, which revealed artefact densities of between 10,000 and 15,000 per cubic metre (Kohen 1994: 32).

and silcrete were recorded, together with a sandstone grinding slab fragment at the western end. Again the shelter is noted as bearing a significant amount of roof fall within the shelter, a factor interpreted as indicating the overall instability of the area and the potential for collapse of the shelter if mining further destabilises the area was noted. This site is in close proximity to the southern edge of the SMP area (Figures 3 - 5) and was relocated in December 2007 to check its GPS co-ordinates and ensure that it is outside the SMP area. The coordinates provided on the AHIMS were fairly general[5] (pre GPS era), but physical description of the site and its location enabled it to be found. A few stone artefacts were visible from the surface, but overall the quantity of artefacts recorded in 1986 was not relocated. The new GPS generated coordinates for this site are as follows: AGD 230336 E / 6311302 N and the site is at 1017 m AHD in elevation. Figures 6 provide images of this rockshelter.

McIntyre's work in the Kariwara Project Area (McIntyre and Donlon 1990) included a large area encompassing the Newnes Plateau and part of the AHIMS search area for the current project. A total of 42 sites, predominantly rockshelters (n=41) along the escarpment were recorded, including many of the shelter sites documented in Table 3. McIntyre's work specifically targeted potential impacts from the effects of long wall mining on this landform and its associated Indigenous sites. Three major site complexes were identified as a result of her work, at Mt Horne, the upper reaches of the Wolgan River and Black Fellows Hands site. From this study McIntyre postulated the following hypotheses:

1. That major site complexes were most likely to be situated at the top of open gullies where access from the ridge tops to major creeks and rivers where resources were concentrated. These complexes may also be located on the plateau where localised resources and good vantage points coincided;

2. Large, open camp sites were also located along the western flank of the plateau where streams entered the Coxs River Valley; and

3. Smaller open camp sites representing sporadic visits were found at the end of long ridges.

The closest of McIntyre's sites to the current SMP area, located to the south, is site # 45-1-0155. It is described as sandstone shelter, comprising an 8.7 x 4.5 x 3 m protected area, located just below the top of a ridge, at the base of pagoda formation. Dense charcoal was recorded in the back of the shelter and artefacts were described as plentiful, particularly those of quartz (McIntyre and Donlon 1990: Sect 31.0). The deposits were described as being of depth, potentially suitable for test excavation, although due to the quantity of material on the surface, excavation was not considered necessary. Grinding stone fragments with residue as well as a grey chert stone artefact were collected for residue analysis.

Three (3) open sites were recorded on the Baal Bone lease by Brayshaw and Haglund in 1990. These comprise the open campsites mentioned above, that are situated on the headwater tributaries draining northwest into Jews Creek[6]. The subsequent study by Kohen in 1992 recorded one Indigenous site, being the open camp site on Ben Bullen Creek which was comprised of 47 stone artefacts (Kohen 1996: 12).

During Kohen's 1996 survey of the northern extension to the Baal Bone underground mining activities (shown in Figure 3 as the northernmost longwalls), he notes that a single site had been previously recorded within his study area, being a rock shelter recorded by Ian Brown for NPWS in 1984 (DEC #

[5] GPS coordinates for this site on AHIMS are as follows: 230400E and 6311400N.

[6] It is noted in Kohen (1996: 12) that one of the three open sites recorded by Brayshaw and Haglund in 1990 (Baal Bone 3, DEC # 45-1-0120) had a consent to destroy permit issued for it in 1993.

45-1-0097). The site is described as an overhang situated along a track under which a chert scraper was recorded.

In 1996 a survey was undertaken c. 3 kms to the northwest of the current project, reported as being for the Feldmast Coal Project (Mills 1996). This survey covered a large area immediately north of Cullen Bullen, part of which lies outside the 10 km^2 area searched for the current project (hence the sites recorded did not come up in the search results although survey area did overlap with the searched area). Three sites were recorded as a result of this study, an open camp site and isolated find were recorded on Western Springs Creek and Cullen Creek respectively, while a grinding groove site was recorded at an area of exposed sandstone adjacent to the headwaters if unnamed creek.

Silcox (1997) undertook archaeological survey within the Invincible mining lease area (immediately south of Baal Bone Colliery) for the original Invincible ML 68 open cut coal mine and haulage road. No sites were detected within the study area.

Also in 1997, Hunt is recorded as having undertaken archaeological investigations in the vicinity of Black Fellows Hand site. Five of the shelter sites revealed in the AHIMS site search relate to this project, although no original report for this study has been located.

In February 2006 OzArk undertook assessment of the former ML 68 (Invincible) open cut coal mine which occurs at the margin of the current 10 x 10 km search area. Approximately 10 ha of the Ben Bullen State Forest was assessed as a result of the coal extraction proposal Survey of this area recorded no Indigenous sites within the proposed impact footprint and haulage road.

Figure 12: Locality map (Source: International Environmental Consultants).

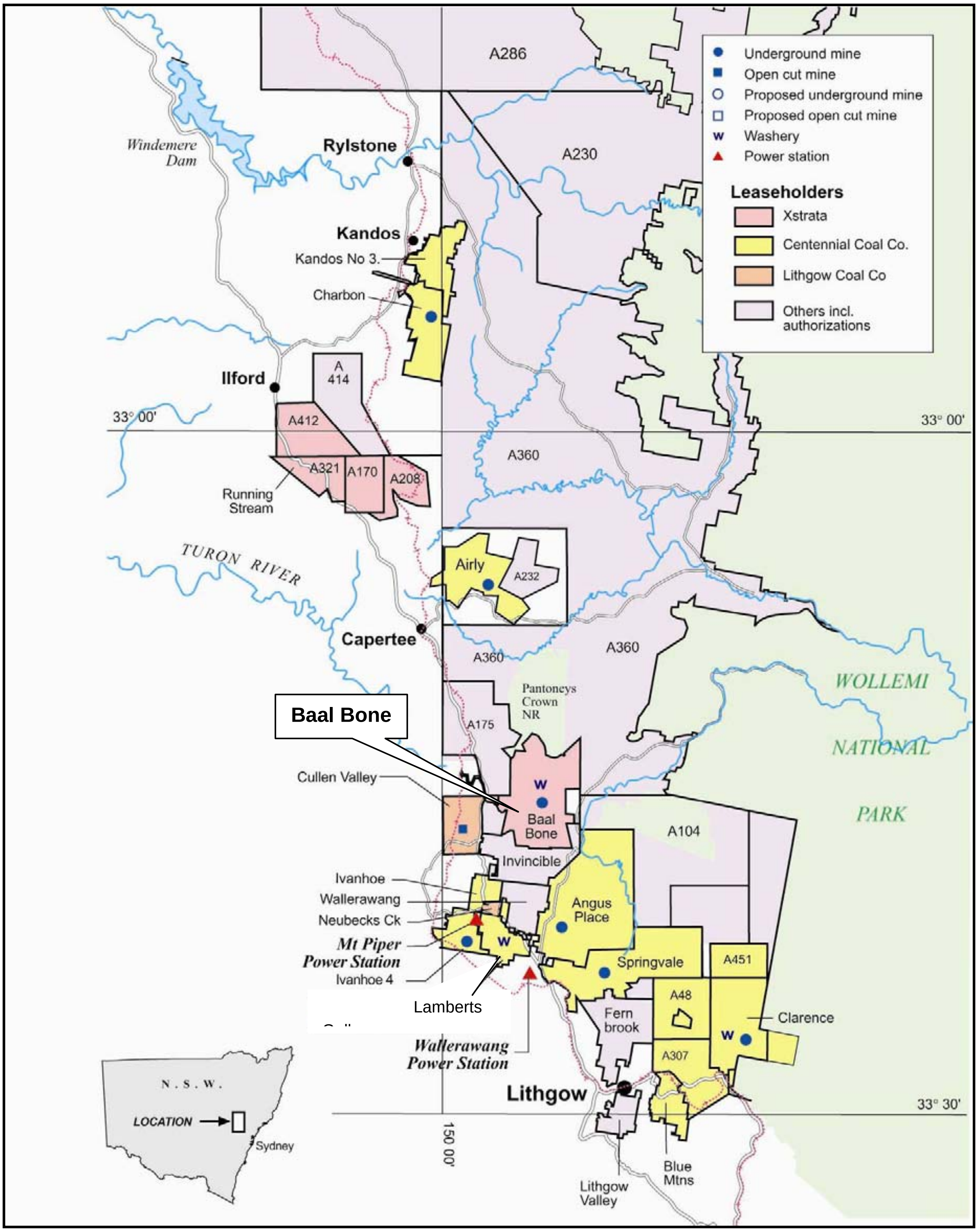


Figure 13: Project site detailing the proposed SMP area (pink hatched) while the black hatched portion shows the existing underground mining operations (Source: Xstrata Coal).

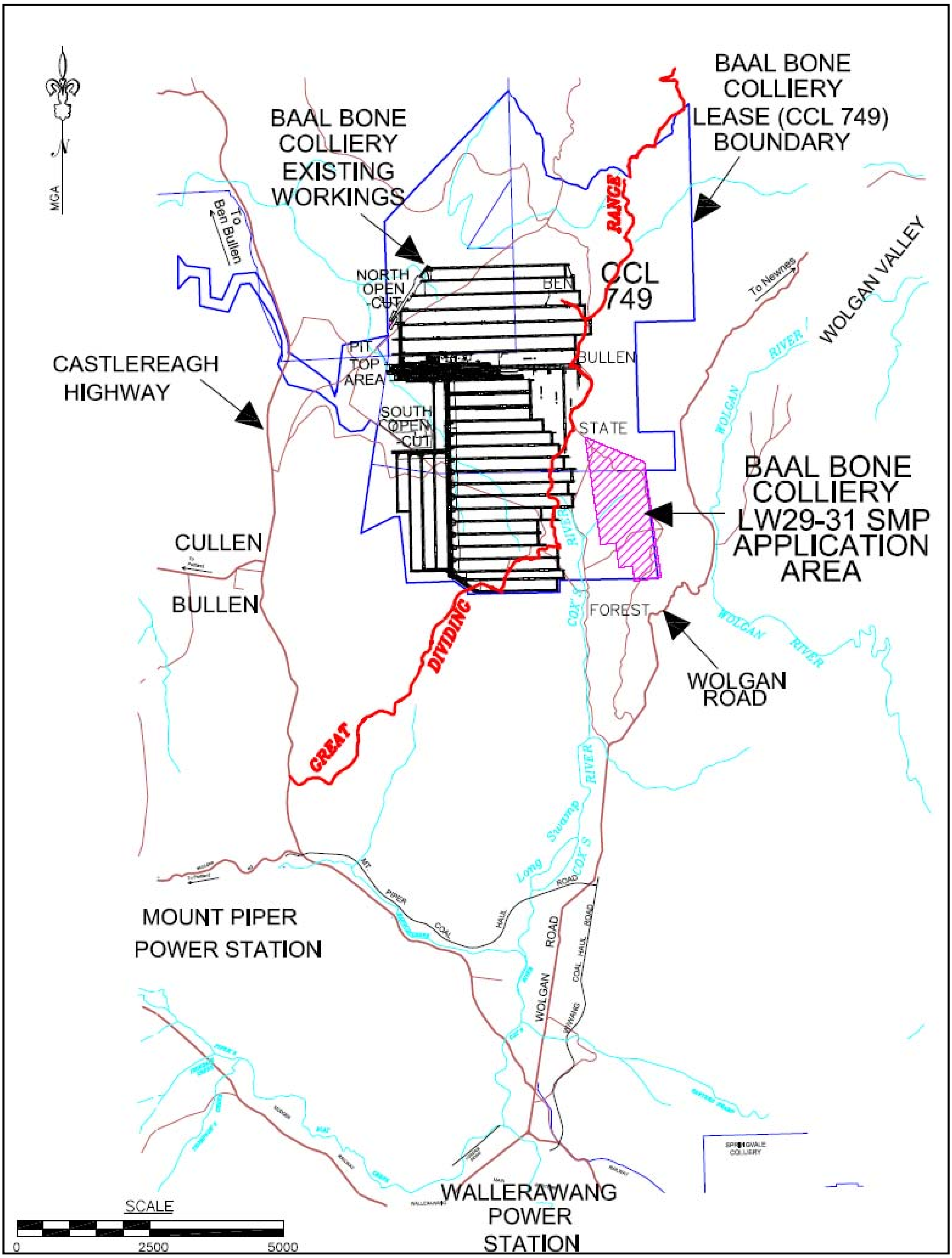


Figure 14: Map showing Long Swamp Rd and the locations of the sites in its vicinity. The pink dot sites have been added to the map as they were recorded during initial SMP investigations (Source Forests NSW).

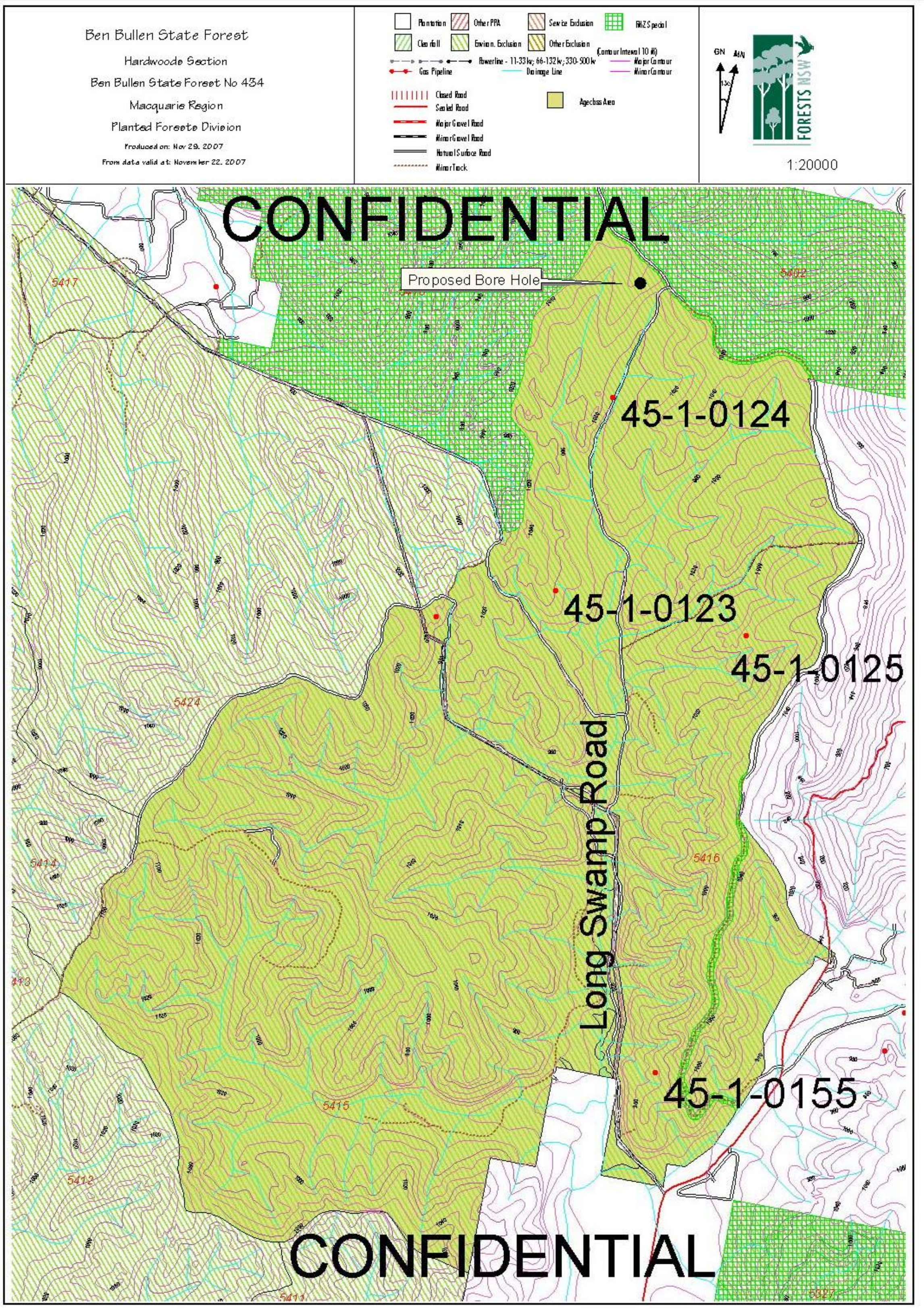


Figure 15: Location of sites in relation to SMP area.

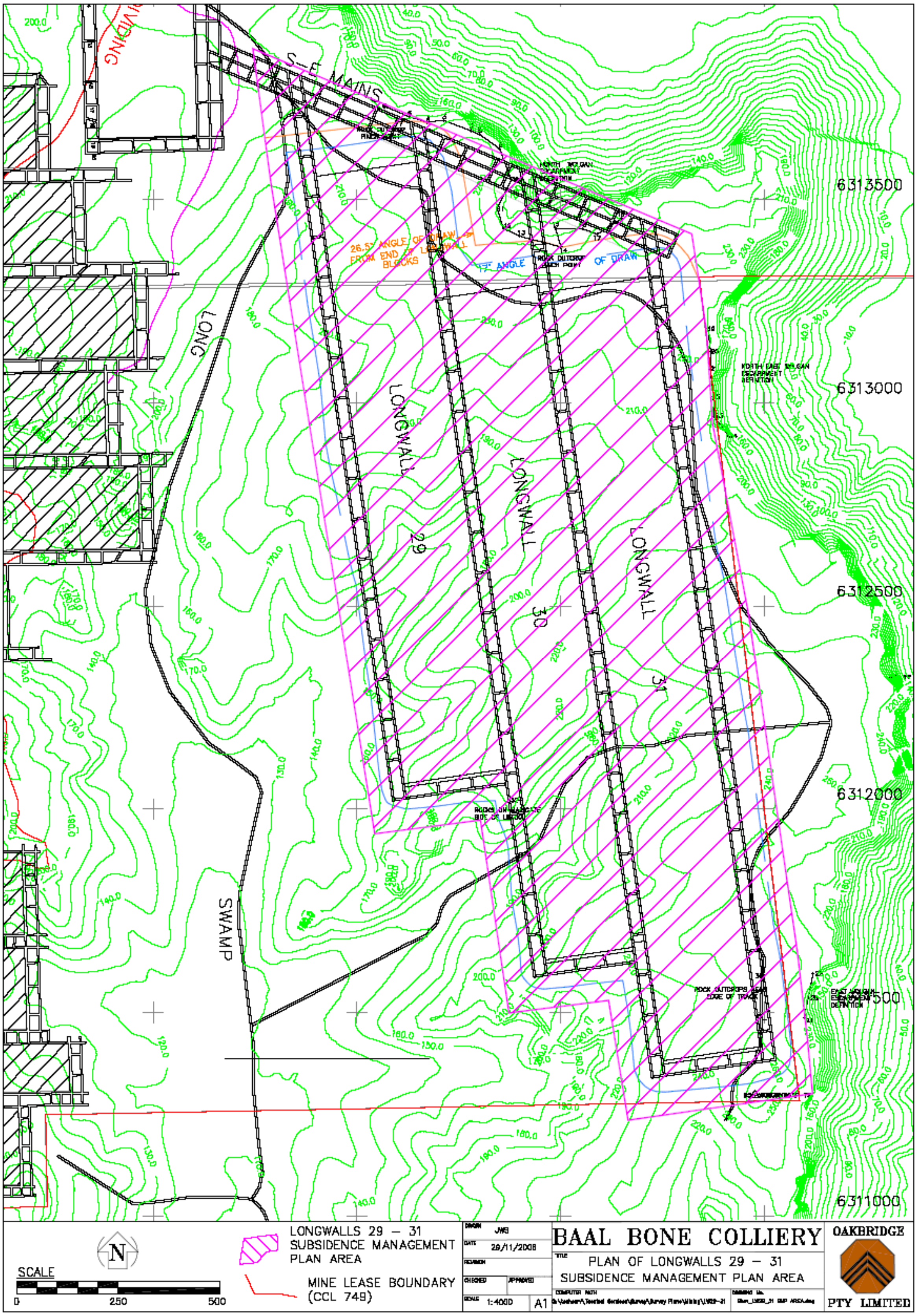
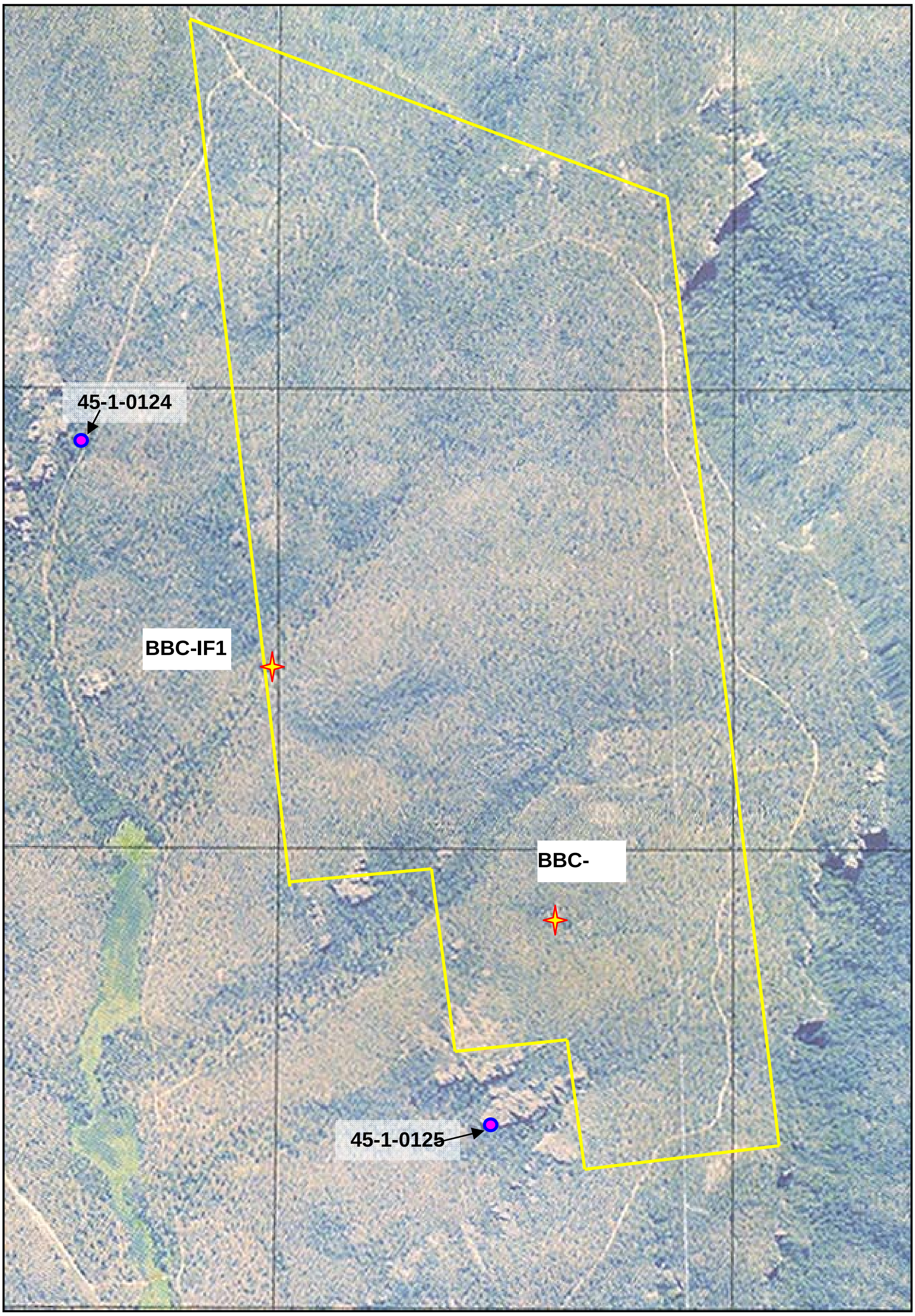


Figure 16: Aerial photograph showing location of the previously recorded sites in the vicinity of the SMP area.



Recommendations and mitigative measures

None of the sites mentioned in this addendum are located within the boundaries of the SMP area as delineated on Figures 4 and 5. The closest rockshelter site is # 45-1-0125, located south of the SMP area, within the pagoda formations that were avoided during longwall planning. This is best seen in the aerial photograph on Figure 5.

No specific mitigative measures are required for any of the sites mentioned in this addendum. As noted in the Recommendations of the SMP assessment, however, modelling of subsidence impacts may indicate the need for rockshelter site BBC-RS1 (# 45-1-2665) to be assessed again, possibly with a test excavation component. If this is the case, then rockshelter site # 45-1-0125 should also be visited, simply to monitor if there have been changes to its physical appearance. As it is not within the SMP area, test excavations of this shelter are not currently recommended, although subsidence modelling in the future may change this.

References

OzArk EHM 2006 Indigenous Heritage Desktop Review - Subsidence Management Plan over three new longwalls (29-31), Ben Bullen State forest, Cullen Bullen, NSW. Report to Xstrata Coal.

OzArk EHM 2007 Indigenous Heritage Assessment for Subsidence Management Plan over three proposed longwall panels (29-31), Baal Bone Colliery, Ben Bullen State forest, Cullen Bullen, NSW. Report to Xstrata Coal.

Kohen, J. 1992a Archaeological survey of the proposed open cut extension to the Baal Bone Colliery. Report to Coalex P/L.

Kohen, J. 1992b The impact of longwall mining on Aboriginal sites: The southeast extension to the Baal Bone Colliery. Report to Coalex P/L.

Kohen, J. 1994 Excavation of two rock shelter sites at Gardiners Gap near Baal Bone Colliery. Report to Baal Bone Colliery.

Kohen, J. 1996 Archaeological survey of the proposed northern extension to the Baal Bone Colliery. Report to Wallerawang Collieries.

Kohen, J. 2000 Archaeological survey of the Baal Bone Colliery Mie dewatering facility and pipeline proposal (Longwall 1 and 19). Report to Report to Wallerawang Collieries.

McIntyre, S. and Donlon, D. 1990 Archaeological Survey of the Proposed Kariwara Longwall Coal Mine, Report to the Electricity Commission of NSW.

Appendix 3

Abridged report (Ozark 2007b)

As no Aboriginal sites were recorded as a result of this assessment, only an abridged version of the report follows.

Indigenous Heritage Assessment

For a proposed 1.7 km, 11Kv Powerline Corridor & Ventilation Fan compound

Baal Bone Colliery - Ben Bullen State Forest, 4 km northeast of Cullen Bullen, NSW.

Executive Summary

This study was commissioned by Umwelt Australia on behalf of Baal Bone Colliery (operated by The Wallerawang Collieries Pty Limited). It details the results of an Indigenous heritage assessment undertaken for the construction of an 11kV powerline corridor and ventilation shaft compound in the Ben Bullen State Forest, near Cullen Bullen, NSW (Figures 1-3).

No Indigenous sites were recorded as a result of the current assessment. Overall the Baal Bone study area was assessed as having low archaeological sensitivity due to the generally sloping nature of the landforms or the distance from permanent water sources. This assessment is supported by the nearby presence of Long Swamp to the south, the Wolgan Valley to the east and Jews Creek to the north, all of which would have provided plentiful resources and appropriate occupation site locations.

Consequently, there are no constraints to the proposed construction of the 11kV powerlines and ventilation shaft compound in the Ben Bullen State Forest on the grounds of Indigenous heritage.

Should any ‘relics’ or other Aboriginal sites be identified anywhere in the study area during the course of construction, work in that area should cease and the DECC and the respective Aboriginal community organisation or LALC be contacted to discuss how to proceed.

Project Scope

The consultant was briefed to undertake survey and assessment for Indigenous heritage issues relevant to the construction of a proposed 11kV powerline corridor and ventilation shaft compound in the Ben Bullen State Forest.

The current assessment included the following aspects:

- A search of the NSW DEC Aboriginal Heritage Information Management System (AHIMS) for any previously recorded sites, a search of NSW State Heritage Register and Inventory; the Australian Heritage Database, the Register of the National Estate; and the Lithgow Council LEP;

- A review of relevant literature including previous consulting reports, academic theses, articles or published works on the archaeology and ethnography of the Cullen Bullen area;

- Indigenous community consultation, including the Bathurst Local Aboriginal Land Council (BLALC); Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and North East Wiradjuri Native Title Party (NEWNTP);

- Pedestrian field survey to identify and record all cultural heritage sites and relics along the 1.7 kilometre x 50 metre wide corridor and 200 x 200 metre area proposed for the ventilation shaft compound;

- Assessments of significance of any recorded sites and the formulation of appropriate management strategies; and

- Completion of documentary evidence (e.g. DEC Site Cards) for any sites/relics located during the survey for the notification of the relevant authorities.

Figure 17: Locality map (Source: Umwelt).

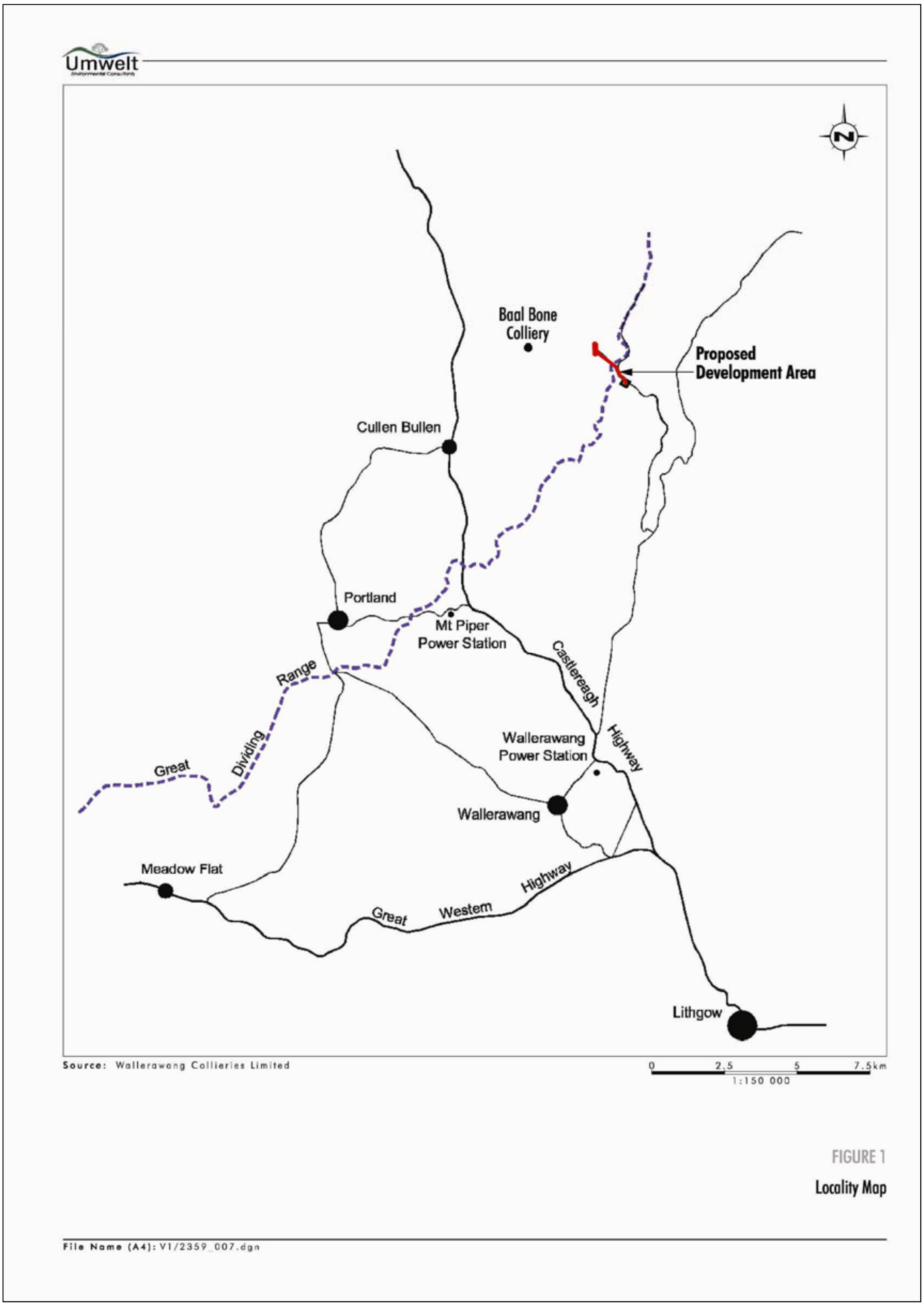


Figure 18: Map showing the location of the proposed corridor and ventilation shaft compound, delineated in blue (Source: Xstrata Coal) The red line indicates the subsidence management plan area.

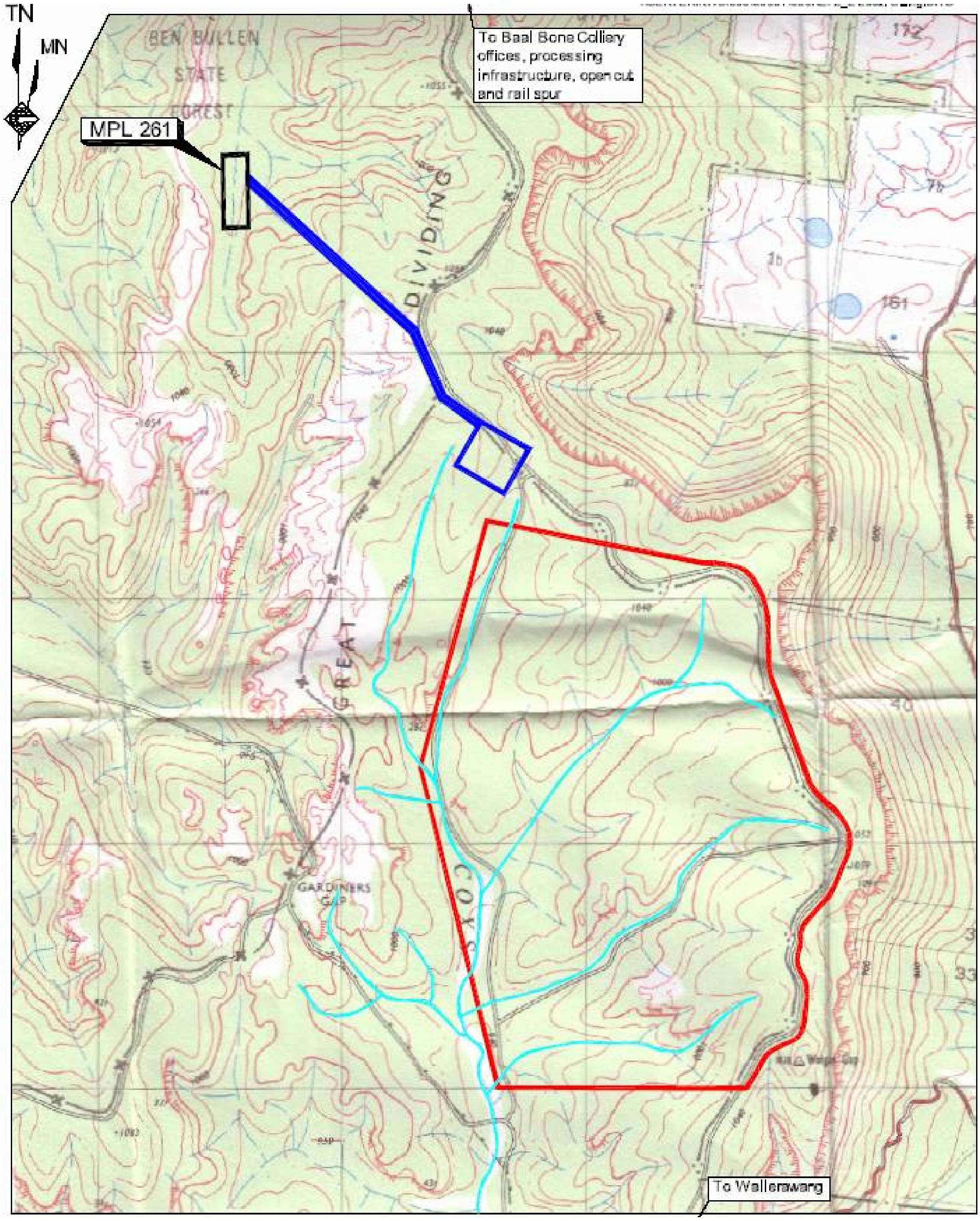
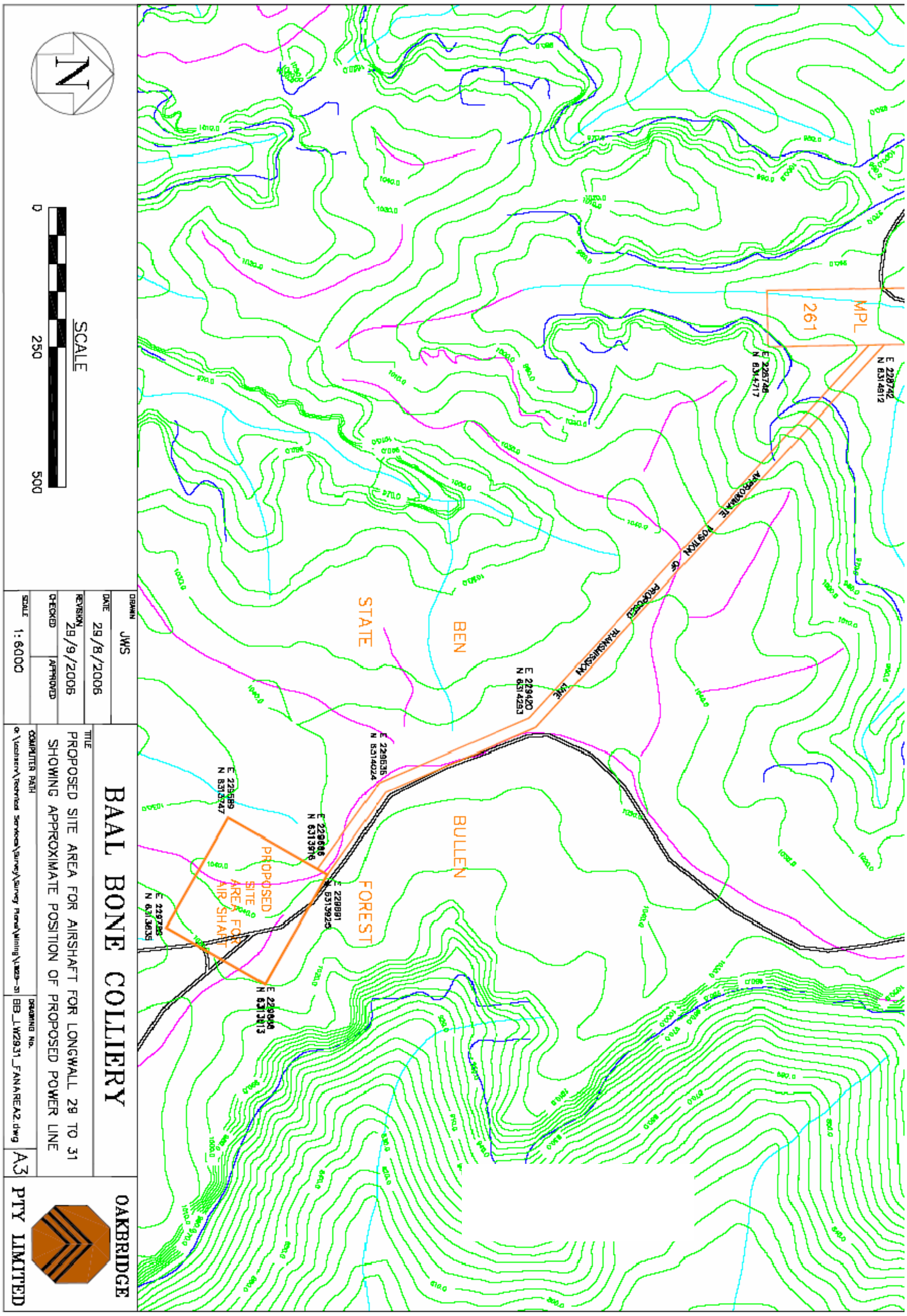


Figure 19: Detailed plan of proposed corridor and ventilation shaft compound (orange) (Source: Xstrata Coal).



Proposed Works

Baal Bone Colliery wishes to extend their underground mining area. Predicted air flows into the new resource extraction area will be insufficient for the needs of the miners and as such a new air vent will be required. The electricity to power the fan will be sourced from an existing dewatering borehole circa (c.) 1.7 km to the west. A powerline in the form of an aerial bundle cable will be required to connect the proposed compound to the existing dewatering borehole power supply (Figure 3). Some underground cabling may also be utilised in areas with existing ground surface disturbance such as adjacent to access roads. The proposed air vent will be drilled from the underground mining area and as such will have less surface impacts than are normally associated with surface drill rigs. Although only 50 x 50 m is required for the compound 200 x 200 m area was assessed similarly, 50 m width for the corridor was assessed giving the Proponent flexibility in planning.

Project Constraints and Limitations

Survey was limited to the area delineated in orange in Figure 3. Overall, ground surface visibility across the majority of the study area was poor.

Report Authorship

This investigation was undertaken by Dr Jodie Benton and Phillip Cameron (OzArk Environmental & Heritage Management Pty Ltd), accompanied by Richard Peters, representative of the Bathurst Local Aboriginal Land Council and Wendy Lewis representing the Warrabinga Native Title Claimants Aboriginal Corporation. This report was written by Dr Jodie Benton.

Aboriginal Community Involvement

Aboriginal community consultation for the project was undertaken using the DEC's "Interim Community Consultation Requirements for Applicants" which became effective on the 1st January 2005. An advertisement was placed in the local print media seeking expressions of interest from Indigenous groups and organisations in the Cullen Bullen area to participate in the heritage assessment process. Letters were sent to local and state government agencies seeking knowledge of any Indigenous stakeholder groups, as well as being sent out to groups already known to OzArk, including Bathurst Local Aboriginal Land Council (BLALC), North East Wiradjuri Native Title Party (NEWNTP), Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC) and Gundungurra Tribal Aboriginal Corporation (GTAC).

Responses received include letters from NEWNTP and WNTAC expressing interest in being part of the consultation process, and a phone call from BLALC expressing their interest as well. Response from GTAC indicates that this group has recently spit into two – one remaining with the same name, the other becoming the Gundungurra Aboriginal Heritage Association (GAHA). The latter group responded that they felt the location of the current proposal was outside their area and no response was received from GTAC[1].

Field assessment for this project included provision of two positions for Aboriginal community representatives, who were chosen from those who expressed interest. Choice of possible participants was based on several factors including experience with and local knowledge of Indigenous heritage

[1] A representative of GAHA, Sharyn Halls, did not that think that GTAC was functioning normally since the split.

places / sites in the Cullen Bullen area, provision of relevant Workers Compensation insurance documents and breadth of representation in relation to group membership. Using these factors, Richard Peters of the BLALC and Wendy Lewis of the WNTCAC were offered the two field survey positions and both attended the survey of the Baal Bone powerline corridor and ventilation shaft compound study area. All groups who have expressed interest in being part of the consultation process will be kept informed of the results of the survey and forwarded a draft copy of the report for their review.

THE STUDY AREA

The current study area is located entirely within the Ben Bullen State Forest and is managed by the Department of Primary Industries - Forests NSW (DPI-FNSW). The study area comprises two separate portions of land. The first, a 200 x 200 metre area, has been earmarked for a ventilation facility whilst the second is for a proposed powerline corridor. An area of 1.7 km x 50 metres was assessed for the corridor. The construction of the aerial bundle cable will require minimal vegetation and ground surface disturbance and the route will be identified within this corridor in order to avoid large trees and rock exposures.

The subject land is located wholly within the Greater Lithgow Local Government Area (LGA) and is governed by the Greater Lithgow Local Environmental Plan (LEP) of 1994. It is situated within Blaxland Shire, County of Cook and Parish of Cox. The land is zoned 1(f) forestry. The LEP adopts the Environmental Planning and Assessment Model Provisions and therefore the proposed development falls within the ambit of clause 35 Schedule 1 of the Model Provisions. The proposed development therefore does not require development consent under Part 4 of the EP&A Act.

Survey Results

The current study recorded no Indigenous sites.

Discussion

8.1 Aboriginal Site Distribution

The Baal Bone powerline corridor and vent fan compound study area is comprised of three major landform units:

- Ephemeral, gully drainage line (not named);
- Sandstone escarpment / hill slopes;
- Ridge crests.

The lack of sites recorded during the current survey is thought to be the result of two primary interrelating factors:

1. That the landforms within the study area have an overall low sensitivity for the presence of Indigenous sites due to the distance from permanent water and the general sloping nature of the land. The Wolgan Valley to the east, Long Swamp to the south and the Jews Creek valley to the north would have provided rich, permanent resource areas which would have been favoured over the undifferentiated, wooded slopes of the current study area.

2. The almost complete lack of ground surface visibility impeded the detection of occupation sites over the current study area. This factor is exacerbated by the removal of the majority of old growth trees of an age to have been scarred.

In summary, the overall lack of sites was predicted (Section 5.3) due to the assessed nature of the landforms, although poor visibility may have exaggerated this result.

Aboriginal Site Assessment

The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance as well as the likely impacts of any proposed developments. Scientific, cultural and public significance are currently identified as baseline elements of this assessment, and it is through the combination of these elements that the overall cultural heritage values of a site, place or area are resolved.

As no sites were recorded as a result of the current assessment, the remainder of this section has been omitted.

Likely impacts of the proposed powerline corridor and ventilation shaft compound in the Ben Bullen State Forest.

As no sites of Indigenous heritage significance were recorded within the current study area, there will be no impacts to cultural heritage.

RECOMMENDATIONS

Under Section 91 of the NP & W Act (1974 as amended) the Director-General of the NSW DEC must be notified of the location of all Aboriginal sites recorded under any auspices. As a professional in the field of cultural heritage management it is the responsibility of OzArk EHM to ensure this process is undertaken.

To this end it is noted that no sites were recorded as a result of the current assessment.

The following recommendations are made on the basis of:

- Legal requirements under the terms of the *National Parks and Wildlife Act of 1974* (as amended) whereby it is illegal to damage, deface or destroy an Aboriginal relic/object without the prior written consent of the Director, DEC;
- The findings of the current investigations undertaken within the study area; and
- The interests of the Bathurst Local Aboriginal Land Council (BLALC), North East Wiradjuri Native Title Party (NEWNTP) and Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC).

It is recommended that:

1) No Indigenous sites were recorded as a result of the current assessment. Overall the Baal Bone study area was assessed as having low archaeological sensitivity due to the generally sloping nature of the landforms and the distance from permanent water sources. This assessment is supported by the nearby presence of Long Swamp to the south, the Wolgan Valley to the east

and Jews Creek to the north, all of which would have provided plentiful resources and appropriate occupation site locations. These locations are likely to have been utilised in preference to the Baal Bone study area.

2) Consequently, there are no constraints on the grounds of Indigenous heritage to the proposed Baal Bone Colliery construction of the 11kV powerline and ventilation shaft compound in the Ben Bullen State Forest, NSW.

3) Should any 'relics' or other Aboriginal sites be identified anywhere in the study area during the course of construction, work in that area should cease and the DECC and the respective Aboriginal community organisation or LALC be contacted to discuss how to proceed.

Plates

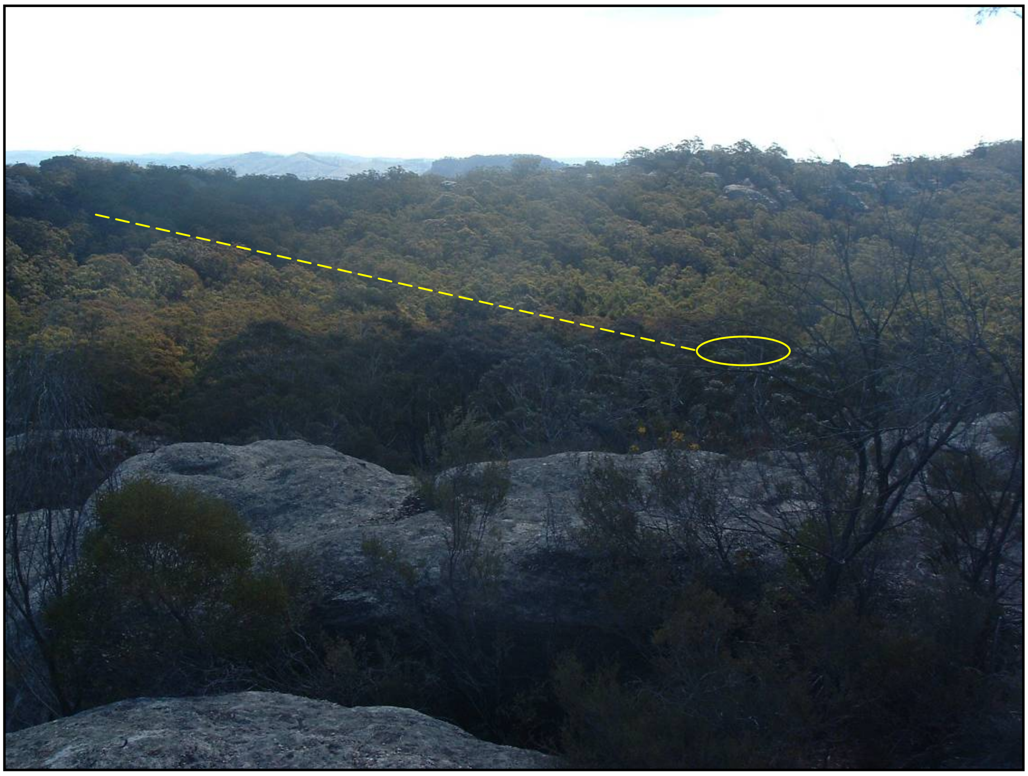


Plate 1: View west from the top of the escarpment along the proposed easement route showing the location of the existing dewatering borehole in the valley below. The proposed easement is likely to span from this point to the existing infrastructure**.**

Plate 2: View of a typical woodland habitat in the general vicinity of the proposed ventilation shaft compound.

Plate 3: View east from the existing dewatering borehole towards the drainage feature to be spanned by the easement.

Aboriginal Community Correspondence

13 Dec 06 11:53a Lyn Syme 0246830566 p.4

WARRABINGA

Native Title Claimants Aboriginal Corporation
PO Box 771
Picton NSW 2574
MOBILE: 0409 966 371 or 0409 966 163
FAX: 02 4677 0454

12th December, 2006

Kylie Sutherland
Ozark
PO Box 2069
DUBBO. NSW 2830

Dear Kylie

Re: Expression of Interest
Aboriginal Cultural & Heritage Interests
Proposed extensions to Baal Bone Colliery at Cullen Bullen

I write to advise you of this organisation's interest in any work you may be undertaking in NSW in relation to Native Title and Aboriginal cultural heritage issues.

Membership of our organisation is open to adult Aboriginal persons who are descendants of Dabee, Mudgee, Capertee, Coxes River, Goulburn River, Cudgegong River, Gulgong, Cassilis, Bylong, Lithgow, Abercrombie, Jenolan and Wombeyan Caves and Wollimi and Oberon Clans.

Warrabinga Native Title Claimants Aboriginal Corporation was established to represent the interests of a large number of individual Aboriginal clan groups in the areas outlined above.

Broadly our organisation has members with native title interests over the lands and waters associated with the Cox's River, Goulburn River and the Cudgegong River and other waterways within these boundaries .

Our organisation consists of a number of members with knowledge essential to completing Aboriginal cultural heritage assessments and our executive committee make determinations for the most suitably qualified individual(s) for any field work.

Warrabinga is fully insured for both Public Liability and Workers Compensation (Certificates of currency are available upon request, should they be required for any work).

An important point is that under the amended National Parks legislation all sites are protected regardless of whether they have been previously identified or not.

13 Dec 06 11:53a Lyn Syme 0246830566 p.7

WARRABINGA

Jative Title Claimants Aboriginal Corporation

'O Box 771
'icton NSW 2574
IOBILE: 0409 966 371 or 0409 966 163
'AX: 02 4677 0454

We would therefore request that you maintain contact with us, consult with us and we can provide expertise services under contract should you require such services.

Professional Fees:

Our organisation has previously worked in association with other Environmental Consultants on other projects within our area of interest.

What we would require from you:

Definitive survey dates 10 days prior to commencement of work.

Should you have any further queries relating to Warrabinga or require more specific information please feel free to contact me on the above numbers.

Yours in Indigenous spirit,

W. Lewis per

Wendy Lewis
Cultural Heritage Liaison Officer

2

3 Dec 06 11:53a Lyn Syme 0246830566 p.3

NORTH EAST WIRADJURI NATIVE TITLE PARTY

C/- Lyn Syme
17 Main St., Ulan. 2850

0263734875
0425332434
lsyme@aapt.net.au

12th December, 2006

Kylie Sutherland
OzArk
PO Box 2069
DUBBO. NSW. 2830

Dear Kylie,

Expression of Interest
Aboriginal Cultural Heritage Assessment
Proposed Extensions to Baal Bone Colliery at Cullen Bullen

On behalf of the NE Wiradjuri Native Title Party I wish to register our interest in the Aboriginal Cultural Heritage Assessment for the above Aboriginal Cultural Heritage Assessment.

I can be contacted on the above phone nos. should you require any further information.

Yours in Indigenous Spirit

Lyn Syme
Secretary.

BATHURST
LOCAL ABORIGINAL LAND COUNCIL

149 Russell Street
Bathurst NSW 2795

PO Box 1500
Bathurst NSW 2795

Phone: 02 6332 6835
Fax: 02 6332 3623

LONGWALL 29 - 31

Three separate surveys were conducted for Baal Bone Colliery on over a three-day period 27th, 28th and 29th of December 2006 for the proposed airshaft bore hole, power transmission line and longwalls 29-31. The survey areas are located within the Ben Bullen State Forest east of Lithgow NSW. This is an extension survey to a pervious survey conducted on Monday the 17th September 2006 with Phillip Cameron from Ozark Environmental & Heritage Management.

Survey One – Proposed Air Shaft Bore Hole

The proposed airshaft bore hole site is located on Long Swamp Road. The area surveyed covered approximately 200 x 200 meters. This area has been severely disturbed, consisting of sandy soil covered with heavy ground growth creating nil visibility. Clearing of this survey area will be required for the installation of the airshaft bore hole.

Survey Two – Power Transmission Line

The power line will be installed adjacent to the existing bush track for 700 meters, after that distance it will veer northwest into the bush land. This bush land is comprised of an extremely rough terrain and covered in dense ground cover such as leaves, fallen trees, branches and other forest matter thus creating nil visibility difficult access.

Two shelters were located within the survey area. These shelters displayed *no evidence of* aboriginal occupancy and will not be impacted on by the installation of the power line. No evidence of Aboriginal activity, artefacts, shelters or scared trees was recorded or discovered during either survey.

Survey Three – Longwalls 29 - 31

Two shelters were located within the Longwalls survey area. These shelters *displayed no* evidence of aboriginal occupancy however one isolated artefact was located. This artefact was rerecorded and replaced in the same region. Visibility was extremely poor due to thick undergrowth and bush litter. The area provided no potential for Aboriginal occupation.

The Bathurst Local Aboriginal Land Council has no objections to the commencement of the proposed Air Shaft bore hole, power transmission line and longwalls installation commencing *within the surveyed areas.*

Present at this were surveys:

Jodie Benton	Archaeologist	Ozark Environmental *& Heritage Management*
Phillip Cameron	Ecologist	Ozark Environmental & Heritage Management
Wendy Lewis	Representative	Warrabinga Aboriginal Council
Richard Peters	Sites Officer	Bathurst Local Aboriginal Land Council

Richard J. Peters

RICHARD J PETERS
SITES OFFICER
3 January 2007

02 May 07 11:22a Tharawal LALC 0246831375 p.2

WARRABINGA

Native Title Claimants Aboriginal Corporation

535 Pheasants Nest Road
Pheasants Nest, NSW 2574
PH: 02-46841341
MOB: 0409966163 EMAIL: lewisbarton@bigpond.com.au
FAX: 02-46843454

Baalbon Ventilation Shaft Compound.
28 29 30/12/2006 & Electrical Line.
No sites found.
No. areas of archaelogical sensitivity
Yours in Indigenous Unity
Wendy Ann Lewis
WARRABINGA NTCAC.
2/5/2007

68820630 02/05/2007 10:02 RECEIVED FROM: 0246831375 #0082-002

Continued Operations at Baal Bone Colliery - Environmental Assessment Publications

Volume 1
Main Report

Volume 2
Appendix A-I

Appendix A
Director-General's Environmental Assessment Requirements and Agency Consultation
Appendix B
Stakeholder Newsletter
Appendix C
Subsidence Impact Assessment Reports
Appendix D
Subsidence Risk Assessment
Appendix E
Noise Impact Assessment
Appendix F
Mine Water Balance
Appendix G
Hydrogeological Assessment
Appendix H
Tailings Capacity Assessment
Appendix I
Road Assessment

Volume 3
Appendix J-N

Appendix J
Air Quality Impact Assessment
Appendix K
Greenhouse Gas Assessment
Appendix L
Flora Assessment
Appendix M
Fauna Assessment
Appendix N
Indigenous Heritage Assessment