# BULGA COAL COMPLEX

## Annual Environmental Management Report 2009

BULGA COAL

BELTANA
HIGHWALL MINING

xstrata
coal


| | |
|---|---|
| Name of Mine: | Bulga Coal Complex |
| Titles/Mining Leases: | ML 1547, ML 1494 |
| Mining Operations Plan Commencement Date: | 2007 (Bulga Surface Operations)<br>October 2007 (Beltana No.1 Mine) |
| Mining Operations Plan Completion Date: | 2012 (Bulga Surface Operations)<br>September 2014 (Beltana No.1 Mine) |
| AEMR Commencement Date: | 1 January 2009 |
| AEMR End Date: | 31 December 2009 |
| Name of Leaseholder: | Saxonvale Coal Pty Ltd |
| Name of Mine Operator: | Bulga Coal Management Pty Ltd |
| Reporting Officer: | Nigel Wood and Gary Cambourn |
| Title: | Operations Managers |
| Signature: | _____ |
| Date: | _____ |

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# 1. Introduction

Bulga Coal Complex is managed by Bulga Coal Management Pty Limited (BCM) on behalf of the Bulga Joint Venture (BJV). The Bulga Coal Complex is in the Upper Hunter Valley of New South Wales, approximately 12 km southwest of Singleton, 1 km north of Broke and 1.5 km east of Bulga (refer to **Figure 1-1**).

The Bulga Coal Complex is comprised of two existing coal mining operations, Bulga Open Cut Mine which incorporates the Bulga Coal Complex Coal Handling and Preparation Plant (CHPP) and Beltana Underground Mine (including Beltana No. 1 Mine and the Blakefield South Mine). The CHPP and the rail loading facility, located in the north-east corner of the Bulga Coal Complex (refer to **Figure 1-2**), service both operations; however, each operation is managed as a separate business unit.

During the 2009 reporting period, the total run-of-mine (ROM) coal production from the Bulga Coal Complex was approximately 14 million tonnes.

## 1.1 Structure of the Annual Environmental Management Report (AEMR)

The Bulga Coal Complex comprises an Open Cut Operation and an Underground Operation. These operations include:

- Bulga Coal Surface Operations (including CHPP).
- Beltana No. 1 Mine and Blakefield South Mine.

Throughout this AEMR, the Bulga Coal Surface Operations will be referred to as the 'Open Cut Operations'. The Beltana No. 1 Mine combined with Blakefield South project will be referred to as the 'Underground Operations'. Furthermore, the site as a whole will be referred to as the 'Bulga Coal Complex'.

The operational aspects of the Open Cut Operations and the Underground Operations are discussed in two separate sections (**Sections 2.0** and **3.0**). The environmental performance and community relations of the Bulga Coal Complex have been reported in Section 4.0 and Section 5.0 respectively. For a brief overview of the key performance indicators for both the Open Cut Operations and Underground Operations, refer to **Section 1.5**.

This AEMR has been prepared for the reporting period of 1 January 2009 to 31 December 2009 in accordance with the DII *Guidelines to the Mining, Rehabilitation and Environmental Management Process* (Version 3, 2006) and the relevant Bulga Coal Complex development consents.

## 1.2 Regulatory approvals

Bulga Coal Complex operations are regulated by a range of leases, licences and approvals. These leases, licences and approvals are summarised in **Appendix A**.

The extent of mining leases (MLs) and exploration licences (ELs) associated with the Bulga Coal Complex are illustrated in **Figure 1-3**.

### 1.2.1 Mining and exploration leases

During the reporting period a number of leases were renewed. An application to renew Authorisation 450 was submitted on 30 December 2008. Applications to renew Authorisation 447 and Exploration Licence 5277 were approved by DII during the reporting period. Details of the renewals are included in **Appendix A**.

An application to renew EL 5461 was also submitted on 19 April 2008, approval for the EL is pending.

### 1.2.2 Development consents

Bulga Coal Complex operates under three development consents (DA 41-03-99, DA 38-3-2005 and DA 376-8-2003), details of which are provided in **Appendix A**.

Condition 5 (Schedule 6) of the Underground Operations Consent (DA 376-8-2003), Condition 9.1(a) of the Open Cut Operations Consent (DA 41-03-99) and Condition 8 of the Open Cut Operations Consent specific to overburden waste emplacement (DA 38-3-2005), require a table showing a summary of compliance at each operation with the conditions of consent. These tables are provided in **Appendix B**.

A Section 75W application to modify DA 41-03-99 was submitted by the Open Cut Operations and approved by NSW Department of Planning (DoP) in November 2009. The modification aimed to increase the storage capacity of the approved CHPP Dam from 800 ML to 3,100 ML. The CHPP Dam is being constructed to enable the Bulga Coal complex to operate with less impact from in pit storm water run off and reduce the dependence on the Hunter River during dryer periods. Construction works on the CHPP Dam had not commenced during the reporting period.

Beltana submitted a Section 75W application to modify DA 376-8-2003 on 21 December 2009. The application seeks approval to:

- Uninstall and operation of up to 25 MW of gas fired reciprocating engine power generation units and associated infrastructure.
- Construction and operation of a pilot ventilation air methane (VAM) abatement system.

The purpose of the proposed infrastructure is to enable Beltana to reduce its greenhouse gas impacts. The proposed infrastructure has the potential to reduce the Beltana greenhouse gas impact by approximately 12%.

### 1.2.3 Environment Protection Licence

The Bulga Coal Complex operates under a single Environmental Protection Licence (EPL No.563). Monitoring is reported to the Department of Environment, Climate Change and Water (DECCW) as part of the Bulga Coal Complex EPL Annual Return. The environmental reporting and monitoring activities undertaken at the Bulga Coal Complex, in accordance with EPL No.563 are discussed in **Sections 4.4** (blasting), **4.5** (dust) and **4.6** (surface water).

### 1.2.4 Mining Operations Plan

In January 2009, DII approved a Mining Operations Plan (MOP) Amendment that was submitted by the Open Cut Operations in October 2008. The MOP Amendment allowed for the expansion of mine waste dumps in the south east corner of the mine lease to accept mine waste from the current Vaux Pit and also any waste from the expansion of the Vaux Pit to the north. This change in waste management provides for more

efficient haulage of material. The MOP Amendment also allowed for the creation of long term water storage into the future in the form of the CHPP water storage dam approved by the modification outlined above. The Vaux Pit is planned to be used to store up to 1,400 ML of mine water.

The Open Cut Operations submitted a Mining Operations Plan (MOP) Amendment to DII in December 2009. This MOP Amendment will allow for an increase in the dumping height in the Ramp 12 area. The changes proposed will enable the North and South Blakefield dump rehabilitation areas to be joined far earlier then the originally approved MOP. This will allow improved capture and discharge of clean runoff from completed rehabilitation areas and connection of rehabilitation with established vegetation corridors.

No amendments to the Underground Operations 2007 Mining Operations Plan (MOP) were made during the reporting period.

### 1.2.5 Density gauge licences

The Bulga Coal Complex operates eight density gauges that are registered and licenced with DECCW. An internal compliance audit undertaken during the reporting period identified that although the gauges were registered with DECCW, the licences had lapsed. Applications to renew the Complex's eight density gauge licences have been made to DECCW. Details of density gauge licences are provided in **Appendix A**.

### 1.2.6 Compliance audits

Development consent conditions for the Underground Operations (DA-376-8-2003) and Open Cut Operations (DA 41-03-99) specify that an independent compliance audit must be completed every three years, to ensure each operation is fulfilling their respective approval requirements. To satisfy these conditions, compliance audits were undertaken during the reporting period for both operations. The results of each audit identified that each operation generally showed a high level of compliance. There were however, a number of non-compliance issues for each operation. Details of these non-compliance issues are discussed in more detail in the independent audit reports provided in **Appendix C**. Also included in **Appendix C** are the submission letters to the NSW Department of Planning which includes the action proposed by Bulga Coal to address the identified non compliances.

The most significant issues identified were the need for the Open Cut operations to improve noise management and address the historical hydrocarbon management impacts and upgrade existing facilities.

### 1.2.7 Mine contacts

The contact details for the personnel responsible for environmental management and community relations of the Bulga Coal Complex are provided in **Table 1-1**.

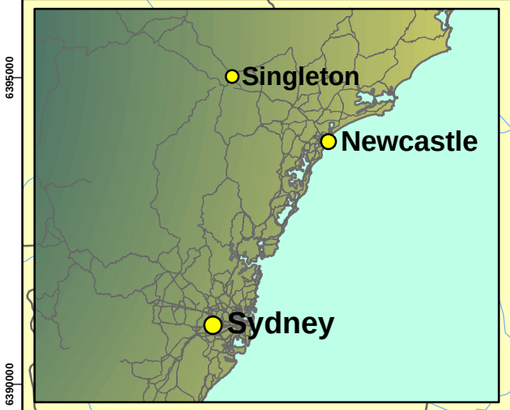
During the reporting period Ralph Northey (former Underground Operations Environment and Community Coordinator) was promoted to the new position of Bulga Coal Complex Environment and Community Manager. This position has been created to enhance the capacity of Bulga Coal to manage environment and community matters.

The previous Environment and Community Officer, Ned Stephenson, was promoted to the position of Environment and Community Coordinator for the Underground Operations.

Nathan Lane joined Beltana as the Environment and Community Officer in March 2010.

Mel Hawthorne and Steve Shoesmith continue in their respective roles as Environment and Community Superintendent and Environment and Community Officer for the Open Cut Operations.

# Figure 1-1 Locality Plan




Singleton
Mt Thorley
Bulga
Milbrodale
Broke
Bulga Coal Complex
Hunter River
Wallaby Scrub Rd
Golden Hwy
Mitchell Line Rd
Loders Creek
Parsons Creek
Putty Rd
Bulga Creek
Old Bulga Rd
Wollombi Brook
Milbrodale Rd
Cessnock Rd

305000 310000 315000 320000 325000 330000 335000
6395000 6390000 6385000 6380000 6375000 6370000

**Legend**
- Waterways
- Roads
- Railway Lines
- ML1547

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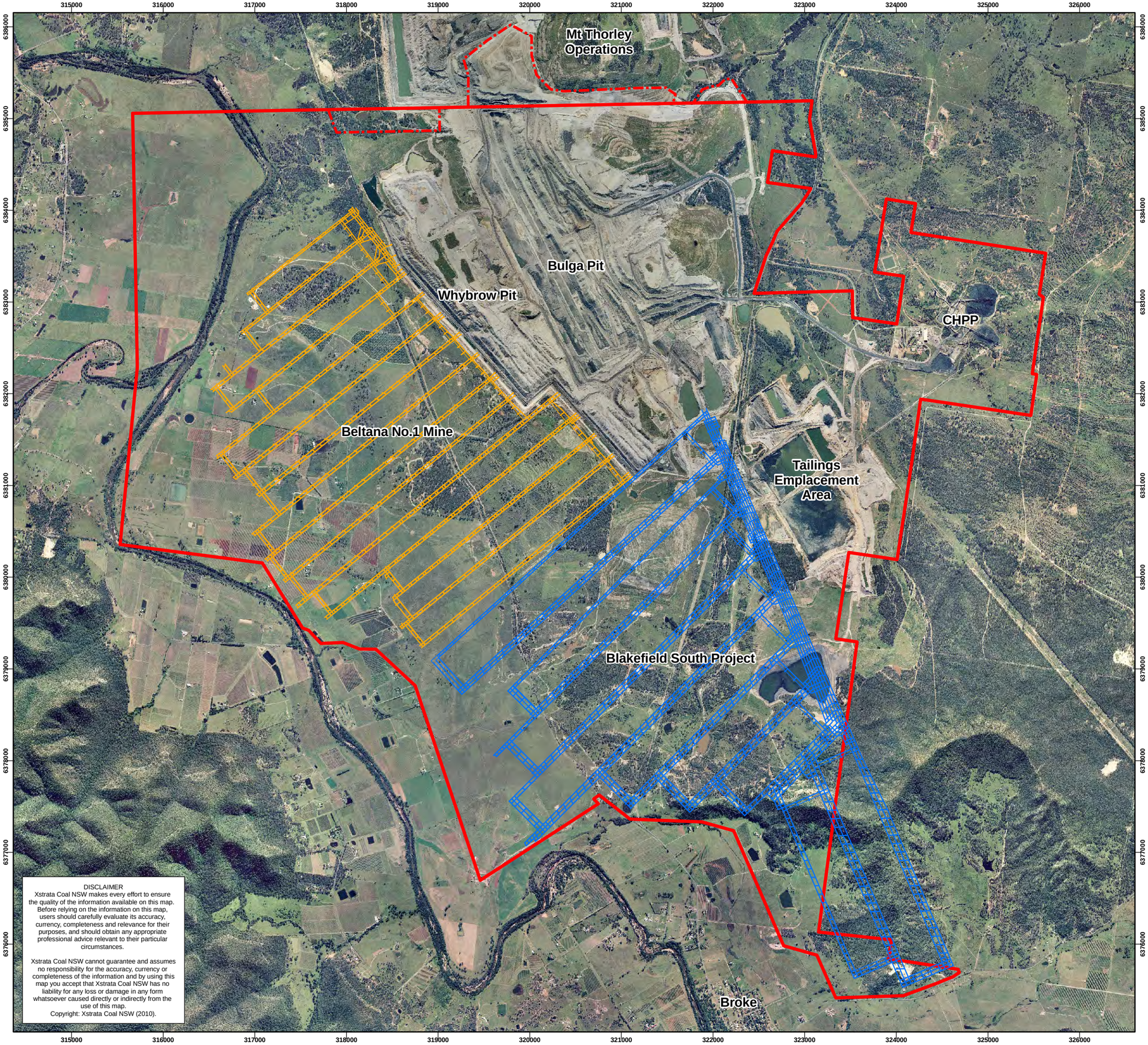
Projection: GDA 94 MGA 56

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# Figure 1-2
# Bulga Coal Complex
# Mining Operations

## Legend

- Blakefield South Project
- Beltana No.1 Mine
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

N
W E
S

0 500 1,000
m

1:40,000 @ A3

Projection: GDA 94 MGA 56

# Figure 1-3 Bulga Coal Complex Mining and Exploration Leases

Bulga

Milbrodale

Broke

Putty Rd

Charlton Rd

Broke Rd

Cessnock Rd

Milbrodale Rd

Mt Thorley Sub-Lease

Mt Thorley Sub-Lease

ML1547

EL 5277

AU 447

AU 450

ML 1494

Commonwealth Lease Application Area

EL 5461

## Legend

- Waterways
- Roads
- EL5461
- EL5277
- AU450
- AU447
- Mt Thorley Sub-Lease
- Commonwealth Lease Application Area
- ML1494
- ML1547

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1:50,000 @ A3

Projection: GDA 94 MGA 56

km

**Table 1-1 Environmental contacts for Bulga Coal Complex**

| Mine | Postal address | Contact | Position | Contact details | |
|---|---|---|---|---|---|
| Open Cut Operations | Bulga Coal Management Pty Limited<br>PMB 8<br>SINGLETON NSW 2330 | Nigel Wood | Operations Manager Bulga Surface Operations | Telephone:<br>Facsimile:<br>Email: | 02 6570 2418<br>02 6570 2476<br>nwood@xstratacoal.com.au |
| | | Ralph Northey | Bulga Coal Complex Environment and Community Manager | Telephone:<br>Facsimile:<br>Email: | 02 6570 4354<br>02 6570 4344<br>rnorthey@xstratacoal.com.au |
| | | Melinda Hawthorne | Environment and Community Superintendent | Telephone:<br>Facsimile:<br>Email: | 02 6570 2409<br>02 6570 2450<br>mhawthorne@xstratacoal.com.au |
| | | Stephen Shoesmith | Environment and Community Officer | Telephone:<br>Facsimile:<br>Email: | 02 6570 2529<br>02 6570 2450<br>sshoesmith@xstratacoal.com.au |
| Underground Operations | Beltana Highwall Mining Pty Limited<br>PMB 15<br>SINGLETON NSW 2330 | Gary Cambourn | Operations Manager Beltana Highwall Mine | Telephone:<br>Facsimile:<br>Email: | 02 6570 4372<br>02 6570 4344<br>gcambourn@xstratacoal.com.au |
| | | Ned Stephenson | Environment and Community Coordinator | Telephone:<br>Facsimile:<br>Email: | 02 6570 4366<br>02 6570 4344<br>nstephenson@xstratacoal.com.au |
| | | Nathan Lane | Environment and Community Officer | Telephone:<br>Facsimile:<br>Email: | 02 6570 4281<br>02 6570 4344<br>nlane@xstratacoal.com.au |

## 1.3 Actions required at previous AEMR review

The 2008 Annual Environmental Management Report (AEMR) for the Bulga Coal Complex was reviewed by DII (formerly NSW DPI (Minerals)) Regional Environmental Officer Michael Lloyd, including a site inspection in April 2009. The assessment concluded that the AEMR report was a thorough review of the environmental and subsidence performance of the mine complex. A single action was raised regarding erosion that had occurred in the water control structures on a spoil dump. During 2009 a detailed spoil characterisation programme was undertaken to address this concern, with further work planned for 2010. A copy of the response provided by DII is included in **Appendix C**.

## 1.4 Key performance indicators for Bulga Coal Complex

**Table 1-2** provides an overview of the key performance indicators for the Bulga Coal Complex during 2009.

**Table 1-2 2009 key performance indicators for the Bulga Coal Complex**

| KPI | Open Cut Operations | Underground Operations | Total Bulga Coal Complex |
|---|---|---|---|
| **Economic indicators** | | | |
| Coal ROM (Mt) | 9,101,266 | 4,904,111 | 14,005,377 |
| Employees | 272 | 306 | 578 |
| **Environmental indicators** | | | |
| Rehabilitated land area | 66 Ha | 25.5 Ha | 91.5 |
| Average depositional dust range (including onsite monitoring locations) | - | - | 1.0 to 4.9 $g/m^2$/month |
| Number of exceedances of TSP criteria | - | - | NIL |
| Number of exceedances of $PM_{10}$ criteria (short-term [24hr] goal of 50$\mu g/m^3$) | - | - | NIL |
| Number of exceedances of $PM_{10}$ criteria (cumulative criteria of 150$\mu g/m^3$) | - | - | NIL |
| Noise exceedances | 10 | - | 10 |
| Percentage of blasts exceeding criteria | 0.8% | - | 0.8% |
| **Social indicators** | | | |
| Complaints | 40 | NIL | 40 |

Note: '-' denotes Not Applicable.

# 2. Summary of Underground Operations

Underground operations at the Bulga Coal Complex comprise the Beltana No.1 Mine and the Blakefield South Project. The Beltana No.1 Mine consists of fourteen longwall panels and associated roadways within the lower Whybrow seam. The Blakefield South Project consists of nine longwall panels and associated roadways within the Blakefield seam. Presently, the development of headings and the construction of ventilation and gas drainage infrastructure are the primary activities at the Blakefield South Project. Longwall mining is expected to commence in the Blakefield seam in July 2010, and at that time the Blakefield South Project name will cease to be used and the area will simply be referred to as Beltana. Mining of the Whybrow seam will continue until October 2010, so there will be a period from July to October when the underground operations will have two longwalls operating. The layout of the respective areas is shown in **Figure 1-2**.

Activities undertaken during the reporting period included exploration drilling, gas drainage, construction, underground mining and rehabilitation. The extent of these activities is illustrated on **Figure 2-1** and discussed in the following sections.

## 2.1 Exploration

Exploration drilling during the 2009 reporting period focused on the definition of the Wollombi Brook alluvial boundary for the purposes of mine design. A summary of exploration drilling undertaken during 2009 is presented in **Table 2-1**.

**Table 2-1 Exploration drilling undertaken for Underground Operations**

| Lease/licence | Metres drilled (m) | Number of holes | Purpose |
|---|---|---|---|
| ML1547 | 121.5 | 11 | Definition of the alluvial boundary of Wollombi Brook adjacent to Beltana Longwall 13. |

**Note:** ML – Mining Lease.

## 2.2 Gas drainage

Pre-mining gas drainage infrastructure is constructed to extract gas from the underground workings, helping to create a safer work place. Methane is extracted from the coal seams and piped to an onsite flaring facility, where it is burned and converted to carbon dioxide. The conversion of coal seam methane gas to carbon dioxide gas substantially reduces the Underground Operation's greenhouse gas emissions. Coal seam water is also extracted from these gas drainage boreholes in preparation for underground mining.

Post-mining gas drainage wells are constructed to remove gas that will interfere with the retreating longwall face. The goaf methane wells are drilled and installed prior to mining, however gas extraction does not occur until the methane becomes mobilised in the goaf.

The Underground Operations commenced installing goaf wells during 2009 in preparation for the commencement of Longwall mining in the Blakefield seam. The first stage of the project involves the drilling and installation of eighteen wells into the proposed Blakefield South Longwall 1 panel. Only one of the proposed eighteen wells was completed during 2009. Drilling of a second well borehole commenced during 2009 but was not completed.

# Figure 2-1 Underground Operations Activities During 2009

Construction commenced on Wollombi Brook flood levee

Northern Drainage Line rehabilitation

Stage 1 of River Red Gum ecological community restoration

Cobcroft Road revegetation

Additional Blakefield South pit top facilities including; training room and longwall room constructed

Construction commenced on Fan Site No.2

Beltana Weather Station Constructed

Construction of Energen methane flaring facility completed

Construction of gas drainage hydrocarbon storage facility completed

**Legend**

- Exploration Drilling
- Vertical Gas Wells Drilled
- Goaf Wells Drilled
- Construction Activities
- Subsidence Repairs
- Rehabilitation Works
- 2009 Area Subject to Undermining
- ML1547

N W E S

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Projection: GDA 94 MGA 56



km

315000 316000 317000 318000 319000 320000 321000 322000 323000

6383000 6382000 6381000 6380000 6379000 6378000 6377000

Borehole drilling for all eighteen goaf drainage wells is scheduled to be completed during 2010. Details of the boreholes drilled for goaf drainage during the reporting period are provided in **Table 2-2**.

**Table 2-2 Goaf drainage boreholes drilled during 2009 for the Blakefield South project**

| Goaf drainage well | Date started | Date completed | Metres drilled |
|---|---|---|---|
| BLK 1 Q | 5/11/09 | 19/11/09 | 194 |
| BLK 1 H | 19/11/09 | Not completed | 130 |

Three new Energen flares became operational on 5th June, 2009. Each new flare has the capacity to flare up to one thousand litres of methane gas per second.

The installation of buried overland pipelines started in 2008 and continued during 2009. The overland pipes convey extracted water back into the mine water circuit and the gas to a central location where the methane content is flared.

A surface gas well (SW01), to assist with underground in-seam drilling in Blakefield South Longwall 1, was also drilled during 2009. The details of this borehole are provided in **Table 2-3**.

**Table 2-3 Surface well boreholes drilled for underground in-seam drilling for the Blakefield South project**

| SIS well | Date started | Date completed | Metres drilled |
|---|---|---|---|
| SW 01 | 11/05/09 | 26/05/09 | 130 |

The locations of wells drilled for gas drainage undertaken during 2009 are illustrated in **Figure 2-1**.

Underground in-seam gas drainage also took place during 2009. This involved the drilling of horizontal holes from underground directly into the Blakefield seam to accelerate the extraction of methane in areas where the surface pre-mining drainage had not reduced the coal gas seam content to an acceptable level for development mining. This activity was restricted to the Blakefield South LW1, and involved a total of 10 holes. Gas extracted from these underground in-seam holes was drawn to the surface via SW01.

## 2.3 Construction

Construction of the following surface infrastructure was undertaken for the Underground Operations during 2009:

- Gas drainage hydrocarbon storage facility.
- Three supplementary Energen methane flares.
- Blakefield South No. 2 ventilation shaft and fans (not completed).
- Blakefield South pit top facilities, including a training room and longwall room; Wollombi Brook Flood Levee (not completed).

The Gas Drainage Hydrocarbon Storage Facility constructed during the reporting period is located at the Gas Drainage Contractors Laydown Area, about 400m south of the Beltana Methane Flaring Facility. The location of the recently constructed hydrocarbon storage facility is shown in **Figure 2-1**.

This facility allows gas drainage contractors to refuel vehicles and machinery in a safe and environmentally responsible manner, minimising the need for portable fuel storages. **Plate 2-1** illustrates the completed hydrocarbon storage facility. This facility is temporary while drilling is undertaken for gas drainage in the Blakefield seam.


**Plate 2-1 The gas drainage hydrocarbon storage facility constructed during the reporting period**

The 3 new Energen methane flares (shown in **Plate 2-2**) add additional flaring capacity to the 5 existing LMS flares at the Underground Operations.

The location of the new Energen methane flaring facility is illustrated in **Figure 2-1**.


**Plate 2-2 The new Energen methane flaring facility installed at the Underground Operations during 2009**

Construction of the Wollombi Brook Flood Levee was started in 2009 across the Northern Drainage Line in the area immediately east of Beltana Longwall 14. The location is illustrated in **Figure 2-1**.

Construction of the levee is a requirement of the Underground Operations Development Consent (DA 376-8-2003). The Bulga Coal Continued Underground Operations EIS (2003) recommended a flood levee be constructed to minimise the risk of surface water ingress into the Beltana underground workings during a flood event, specifically Whybrow Longwalls 13 and14.

The design criteria, as specified in the Underground Operations Development Consent, states that the flood levee must be constructed to:

a) Remain stable under a 1 in a 100 year ARI flood event.

b) Not cause an increase in backwater stream heights in Wollombi Brook of greater than 20 mm upstream of the confluence of the unnamed watercourse and Wollombi Brook under conditions up to and including a 1 in a 100 year ARI event.

The unnamed watercourse in this instance is the watercourse internally referred to as the Northern Drainage Line The Wollombi Brook Flood Levee has been constructed in accordance with these criteria. **Plate 2-3** illustrates the Wollombi Brook Flood Levee, under construction in late 2009. The exposed levee banks will be rehabilitated with pasture seed early in 2010.

**Plate 2-3 The Wollombi Brook Flood Levee as commenced in December 2009**

The Blakefield South No 2 Ventilation Shaft and Fans will provide ventilation during the extraction of the Blakefield South Longwalls in the Blakefield Seam. The partially constructed ventilation fans are illustrated in **Plate 2-4** below.

**Plate 2-4 Blakefield South No 2 ventilation fans under construction**

## 2.4 Underground mining operations

Underground mining operations are undertaken using longwall retreat mining techniques. The longwall blocks at the Beltana No 1 Mine are approximately 262 m in width. Coal in each longwall panel is removed through the use of a shearer. The shearer moves along the longwall face shearing off coal and then loading it onto a conveyor. Large steel hydraulic roof supports are used to ensure the roof does not collapse. As the shearer progresses along the longwall and coal is extracted, the steel hydraulic roof supports move into the newly extracted area. The mined out area behind the steel hydraulic supports is known as the goaf. As roof supports are moved, the goaf collapses resulting in subsidence on the surface above the longwall panels. This process is continued until the longwall panel has been extracted back to the main access roadways.

There were no changes in mining methodology throughout the reporting period.

Development roadways for each longwall block at the Beltana No 1 Mine are constructed directly into the Lower Whybrow seam from the base of the highwall in the existing Whybrow Pit. Development headings are often referred to as first workings, as they are the first stage in the coal extraction process. The coal from the first workings is cut by a continuous miner. When the coal is removed, the roof is secured using roof bolts. As this process involves supported roofs there is negligible impacts on the surface.

The development of the Blakefield South mine continued during the reporting period. Access to the Blakefield seam is gained via a cross measure drift entry from the floor of the existing Whybrow box cut. Mining in the Blakefield seam will be undertaken using a combination of continuous mining and longwall retreat mining techniques.

The Blakefield seam ranges from 4.5 to 8 m in thickness within the Blakefield South longwall area, with the extraction thickness ranging from approximately 2.2 to 3.7 m, due to the operating range of the available longwall equipment.

The Underground Operations produced approximately 4.9 million tonnes of ROM coal and 3.2 million tonnes of product coal during the reporting period. The remaining portion of Longwall 11 and approximately 95% of Longwall 12 at the Beltana No 1 Mine were extracted during the reporting period. The extent of underground mining completed during 2009 is illustrated in **Figure 2-1**.

Surface facilities associated with the Beltana No 1 and Blakefield South Project include:

- administration building
- bathhouses
- stores and bulk oil store and fuel facilities
- emergency helipad
- ventilation fans and compressors
- gas drainage wells and mine dewatering bores
- gas flares
- pipelines
- internal access roads
- conveyors
- substation and switchyard
- fire depot and pumps
- water supply tanks, dams and sumps
- workshop.

A summary of the Underground Operations equipment fleet is provided in **Table 2-4**.

**Table 2-4 Mining equipment fleet for Underground Operations as at December 2009**

| Mining activity | Item | No. |
|---|---|---|
| Development | Joy 15SC Shuttle Cars | 2 |
| | Stamler Breaker Feeder | 5 |
| | Joy 10sc 32BC Shuttle Cars | 7 |
| | Joy 12cm 12 Continuous Miner | 7 |
| | PJ Berriman Mk 4.5 Man Transport | 6 |
| | Juganaut Load Haul Dump | 6 |
| | Wright 120G Underground Grader | 1 |
| Longwall | 1700 tonnes per hour (tph) conveyors | 2 |
| | DBT Electra 3000 Shearer (1990 kW Power) | 1 |

| Mining activity | Item | No. |
|---|---|---|
| | DBT Jumbotrack 2000 Haulage system | 1 |
| | Joy Roof supports (940 & 1150 tonne capacity), RS20 controls | 1 |
| | Joy BSL (twin 34 mm chain) | 2 |
| | PJ Berriman Mk 4.5 Man Transport | |
| | Eimco 130 Load Haul Dump | 4 |
| | Eimco 936 Load Haul Dump | 1 |
| | Bucyrus FBL55H Loader | 1 |
| Services | PJ Berriman Mk 4.5 Man Transport | 1 |
| | Juganaut Load Haul Dump | 2 |

A summary of coal production and waste from the Underground Operations ROM coal material production is provided in **Table 2-5**.

**Table 2-5 Production and waste summary for Underground Operations**

| Material | Last reporting period (2008) | This reporting period (2009) | Next reporting period (2010) (forecast) |
|---|---|---|---|
| ROM coal (tonnes) | 6,388,000 | 4,904,111 | 7,672,664 |
| Processing waste (tonnes) | 1,884,000 | 1,725,981 | 2,600,363 |
| Product coal (tonnes) | 4,504,000 | 3,178,130 | 5,072,301 |

Forecast production from Underground Operations (including Beltana No. 1 Mine and Blakefield South Project) for 2010 is 7.67 Mt ROM, 5.07 Mt product coal, at an average yield of 66%.

The processing waste shown in **Table 2-5** is washed from the ROM coal at the CHPP, which is located at the Open Cut Operations mine infrastructure area.

## 2.5 Coal handling and preparation

The CHPP is operated as a joint facility of the Underground and Open Cut Operations. Details of the CHPP are provided in **Section 3.4.2**.

The coal mined by the Underground Operations is transported via overland conveyor to the CHPP where it is processed.

The product handling facilities are managed by the Open Cut Operations. Details of product handling are provided in **Section 3.4.3**.

## 2.6 Waste management

Waste management at Bulga Coal Complex is undertaken in accordance with the Bulga Coal Complex Waste Management Plan, and includes mechanisms to:

- Comply with the conditions of development consent, environment protection licence and related waste management legislation.
- Identify all types and quantities of waste generated.
- Minimise waste generation and encourage and facilitate reuse and recycling of waste streams where possible.
- Undertake appropriate segregation, storage, transportation and disposal of waste generated on site.
- Effectively manage hydrocarbons, wastewater and sewage.
- Provide education and training programs to site personnel and contractors regarding waste minimisation measures and proper waste handling and disposal.

The Bulga Coal Complex utilises Thiess Service, under contract, to implement a total waste management system. The total waste management system includes the collection, storage, transport, recycling and disposal of all waste generated on site, with the exception of coal fines reject.

Each of the major types of waste produced at the Bulga Coal Complex, and the strategies to manage these, are discussed further below.

### 2.6.1 Coal rejects

Coarse and fine rejects are produced during the coal preparation process at the CHPP. Coarse rejects are currently placed in the Bulga Pit and incorporated into the rehabilitation works. Fine rejects are thickened in the CHPP and pumped to a tailings dam located in the Deep Pit. Additional paste thickened tailings are also co-disposed with the coarse rejects in the Bulga Pit.

The Deep Pit tailings dam is divided into the Northern Cell and Southern Cell. The tailings dam Southern Cell has reached capacity; the Northern Cell has approximately twelve months capacity. A conveyor separating the two tailings dam cells is proposed to be removed in 2010, which will permit combining the Northern and Southern Cell and increasing the capacity of the Deep Pit tailings dam. The life of tailings storage at the Bulga Coal Complex is approximately 20 years assuming half the tailings are co-disposed with the coarse reject and the dividing conveyor is removed in 2010. The locations of tailings storage facilities are illustrated in **Figure 1-2**.

### 2.6.2 Sewage treatment and disposal

Sewage generated by the Underground Operations is pumped to an extended aeration sewage treatment plant located at the Blakefield South pit top facilities. The treated waste water trickles through a buried pipe into the tailings dam Southern Cell.

### 2.6.3 Oil and grease containment and disposal

Bulga Coal Complex has ongoing contracts for the supply of oils and diesel.

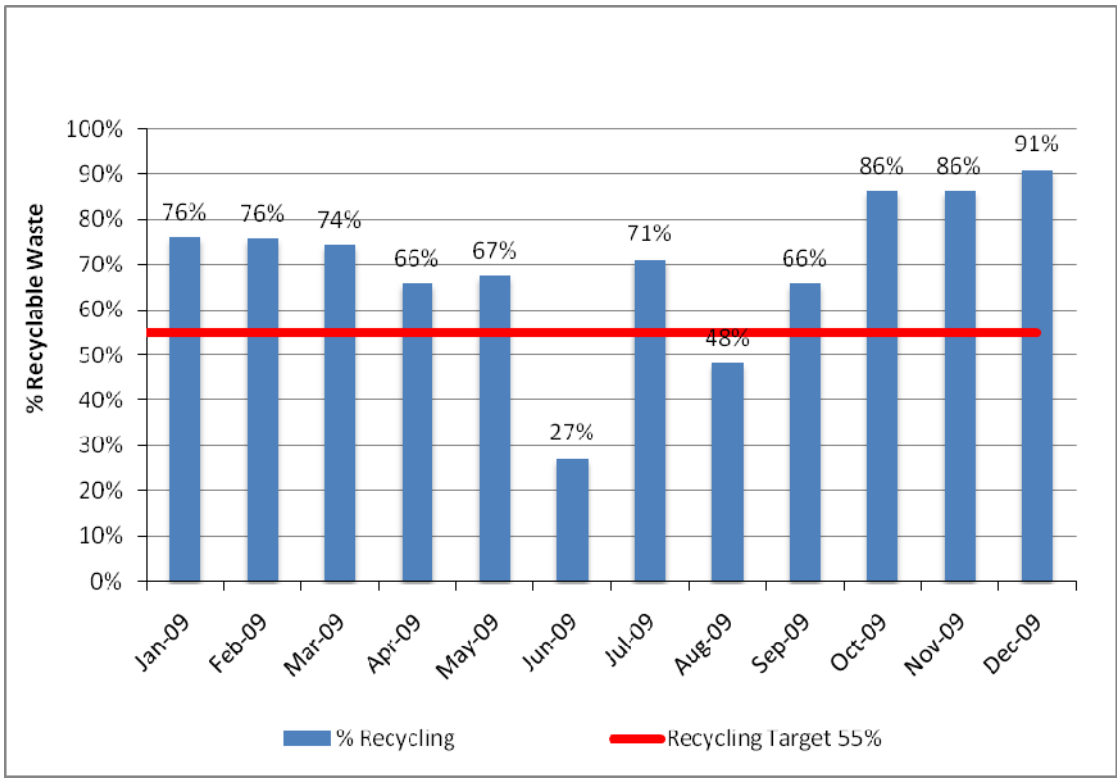
Removal of waste oil and grease from site for recycling is undertaken by Thiess Services.

The Underground Operations use bulk oil wherever possible to reduce the quantity of oil drums on-site. Oil for the underground is delivered in either 1000 litre pods or 20 litre drums and stacked inside bunded areas. Empty drums are returned to the surface and removed by Thiess Services. Waste solsenic oil at the Underground Operations is removed by Thiess Services for disposal at a licensed facility.

### 2.6.4 Rubbish disposal

All rubbish disposal is undertaken in accordance with the Waste Management Plan. Waste is removed by a licensed contractor and where appropriate, the waste is recycled. Wastes removed from site include batteries, tyres, scrap metal, domestic waste, fuel and oil filters, solvent, radiator coolant, wooden pallets and oily rags.

Where feasible, waste from the Underground Operations is recycled. The main materials to be recycled include steel, paper, plastics and batteries. During 2009, 68% of the volume of waste produced by the Underground Operations, which was removed from site, was recycled. **Figure 2-3** below illustrates the percentage of recyclable material that was recycled each month during 2009.




Source: Thiess Services, Beltana Monthly Cost Volume Report (December 2009).

**Figure 2-2 Waste recycling at the Underground Operations during 2009**

## 2.7 Hazardous materials management

Bulga Coal Complex operates a 'ChemAlert' system which is an online tool where personnel have access to Material Safety Data Sheets (MSDSs) for chemicals held at the Bulga Coal Complex. The Underground Operations implement a site specific hazardous materials management standard that provide guidelines for the purchase, handling, usage, storage, labelling and disposal of hazardous substances.

### 2.7.1 Explosives

Explosives for the Underground Operations are stored, transported and used in accordance with the *Occupational Health and Safety Act 2000*.

### 2.7.2 Fuel containment

The Underground Operations maintain a number of fuel storage facilities, including:

- An above ground diesel tank with a capacity of 55 kL, located at the Blakefield South surface facilities.
- An above ground diesel tank with capacity of 30 kL, located at the Gas Drainage Laydown Area.
- An above ground diesel tank with capacity of 40 kL, located at the Beltana surface facilities.
- Storage for 10 x 1 kL of bulk hydraulic oil, located at the Beltana underground surface facilities.

- Storage for 10 x 1 kL of bulk hydraulic oil, located at the Blakefield South surface facilities.
- Storage for 10 x 1 kL of various lubricants, located at the Beltana underground surface facilities.
- Storage for 10 x 1 kL of various lubricants, located at the Blakefield South surface facilities.
- Two self-bunded 20 kL above ground tanks for storage of solsenic oil and emulsion, located at the Beltana underground facilities. The tanks have a number of computerised alarms installed to detect leakage.

## 2.8 Rehabilitation

### 2.8.1 Buildings

No demolition of buildings was undertaken during 2009.

One house (no residents) and two farm sheds located on private property were undermined during 2009. Structural inspections were undertaken following subsidence and repairs were completed as necessary.

Repairs on the two farm sheds included realignment of doorways and replacement of distorted wall sheeting. Both sheds are structurally sounds and continue to be utilised for their original purpose. The undermined house did not require repair due to the limited impacts. All repairs were managed by the Mine Subsidence Board.

The locations of undermined buildings are illustrated in **Figure 4-17**, (**Section 4.11**).

### 2.8.2 Underground rehabilitation

**Table 2-6** presents a summary of the rehabilitation undertaken at the Underground Operations during the reporting period.

**Table 2-6 Summary of rehabilitation at the Underground Operations**

| | **Area (Ha)** | | |
|---|---|---|---|
| | **Last report (Dec 08)** | **To date (Dec 09)** | **At next report (estimated)** |
| A: MINE LEASE AREA | | | |
| A Mine Lease(s) Area | 4262 | 4262 | 4262 |
| B: DISTURBED AREAS | | | |
| B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads) | 98.5 | 116.6 | 129.5 |
| B2 Active Mining Area (excluding items B3 - B5 below) | Nil | Nil | Nil |
| B3 Waste emplacements (active/unshaped/in or out-of-pit) | Nil | Nil | Nil |
| B4 Tailings emplacements (active/unshaped/uncapped) | Nil | Nil | Nil |
| B5 Shaped waste emplacement (awaits final vegetation) | Nil | Nil | Nil |
| ALL DISTURBED AREAS | 98.5 | 116.6 | 129.5 |

| | | Area (Ha) Last report (Dec 08) | To date (Dec 09) | At next report (estimated) |
|---|---|---|---|---|
| C: | REHABILITATION PROGRESS | | | |
| C1 | Total annual rehabilitated area (except for maintenance) | 67 | 81.2 | 101.4 |
| D: | REHABILITATION ON SLOPES | | | |
| D1 | 10 to 18 degrees | Nil | Nil | Nil |
| D2 | Greater than 18 degrees | Nil | Nil | Nil |
| E: | SURFACE OF REHABILITATED/REVEGETATED LAND | | | |
| E1 | Pasture and grasses | 35 | 40.4 | 45.6 |
| E2 | Native forest/ecosystems | 32 | 40.8 | 55.8 |
| E3 | Plantations and crops | Nil | Nil | Nil |
| E4 | Other (include non-vegetative outcomes) | Nil | Nil | Nil |

Maintenance activities undertaken on the rehabilitated land are summarised in **Table 2-7**.

**Table 2-7 Maintenance activities on rehabilitated land at the Underground Operations**

| Nature of treatment | Area treated (Ha) 2009 | 2010 | Comment/control strategies/ treatment detail |
|---|---|---|---|
| Additional erosion control works (drains re-contouring, rock protection) | 4.2 | 5.5 | Contour drains and straw bale sediment control fences installed along northern drainage line as part of the Northern Drainage Line Rehabilitation Project. |
| Re-covering (further topsoil, subsoil sealing etc) | 2 | 2 | A number of different subsidence crack/sinkhole repair methods were trialled during 2009, these included;<br>PUR foam injection into rock cracks, followed by clay and topsoil compaction<br>Sand, clay and topsoil filling of cracks |
| Soil treatment (fertiliser, lime, gypsum etc.) | Nil | Nil | |
| Treatment/Management (grazing, cropping, slashing etc) | 15 | 15 | Slashing undertaken along Broke and Charlton Road verges and at the intersection of Broke and Charlton Road, near the old dairy.<br>10 Ha of millet/forage sorghum sown on Halkin Estate. |
| Re-seeding/Replanting (species density, season etc) | 14.2 | 15.8 | Seeding around goaf wells, Northern Drainage Line rehabilitation and the River Red Gum replanting. |
| Adversely Affected by Weeds (type and treatment) | 0 | 15 | 5Ha of prickly-pair infested paddock adjacent to Wollombi Brook is proposed to be sprayed in 2010. |
| Feral animal control (additional fencing, trapping, baiting etc) | - | - | Feral pig trapping program commenced in 2009 and will continue during 2010. |

## 2.8.3 Rehabilitation of disturbed land

Rehabilitation during the reporting period consisted of the repair of subsidence cracks and sinkholes, tree planting around completed gas drainage wells and a substantial tree seeding and tubestock planting program as part of the overall corridor development across the buffer lands.

During 2009, 18 Ha of land was disturbed to allow for the construction of gas wells and access tracks and associated infrastructure, and for the construction of the Wollombi Brook Flood Levee. Of the land disturbed, 2.3Ha was rehabilitated, which was principally the verges along internal roads and areas around gas wells. Revegetation of the flood levee will occur in 2010 at the completion of construction.

An additional 11.9Ha has been rehabilitated in target areas such as the Northern Drainage Line and as part of the River Red Gum Ecological Community Restoration Project.

Subsidence cracking and the associated repairs resulted in 2Ha of disturbed land during the reporting period. The entire surface disturbance caused by subsidence cracking was remediated.

The minimal disturbance method of repairing the subsidence cracks used during 2008 continued to be implemented in 2009. This method involved clay filling and topsoil coating each crack by wheelbarrow and shovel, or rolling small cracks with a 12 tonne vibrating sheep's-foot roller. **Plate 2-5** provides an example of manual subsidence repairs over Longwall 11. **Plate 2-6** provides an example of subsidence repairs using a vibrating sheep's-foot roller over Longwall 11.

**Plate 2-5 Subsidence repairs using wheelbarrow and shovel in the 'Atulya' olive grove over Longwall 11**


**Plate 2-6 Subsidence repairs using a vibrating sheeps foot roller in open grassland above Longwall 11**

A new subsidence repair method was trialled in 2009 to repair rock fractures along the Northern Drainage Line.

Cracks in sub-surface rock were excavated until the surface of the cracked rock was accessible for repair. The cracked rock was then injected with polyurethane resin (PUR) foam. Clay was then used to fill the excavated area and compacted. A 10-20cm layer of topsoil was finally placed over the clay.

This method of repair proved successful in areas where water-sealing of cracks was necessary to minimize gully erosion and surface water loss into the underlying subsided strata. An example of repairing fractured rock in the Northern Drainage Line using the PUR foam injection method is provided in **Plate 2-7** below.

**Plate 2-7 Polyurethane resin being used to seal cracking in sandstone along the Northern Drainage Line**

A number of the repaired cracks over Longwall 9 required follow-up repairs throughout the year however; generally the continued minimal disturbance approach to subsidence repairs has substantially reduced areas of surface disturbance.

The extent of subsidence repairs undertaken during the reporting period is illustrated in **Figure 2-3**.

The extent of revegetation and surface rehabilitation undertaken during the reporting period is illustrated in **Figure 2-1**.

Further discussion on the management of subsidence repairs is provided in **Section 4.10**.

As outlined in **Section 2.2.1**, all gas well sites are rehabilitated as construction works are completed. The seed mix provided in **Table 2-8** is used in the rehabilitation of the gas well sites, and other disturbed sites. Tubestock planting has also been used in areas where rapid establishment of visual screening is required. An example of visual screening of gas wells using tubestock planting is provided in **Plate 2-8**.

**Table 2-8 Underground Operations rehabilitation tree seed species**

| Species |
|---|
| *Acacia decurrens* (Green Wattle) |
| *Acacia falcata* (Sickle leaf wattle) |
| *Corymbia maculata* (Spotted Gum) |
| *Eucalyptus crebra* (Narrow Leaf Ironbark) |
| *Eucalyptus fibrosa* (Broad Leaf Ironbark) |

| **Species** |
| --- |
| *Eucalyptus moluccana* (Grey Box) |
| *Eucalyptus teretocornis* (Forest Red Gum) |
| *Calilitris endlicheri* (Black Cypress) |
| *Casuarina glauca* (Swamp Oak) |
| *Casuarina leuhmanni* (Bull Oak) |
| *Eucalyptus albens* (White Box) |
| *Leptospermum polygalifolium* |
| *Melaleuca stypheloidies* (Prickly Tea Tree) |
| *Bursaria spinulosa* (Bursaria) |

317000
318000
319000
320000
6383000
6382000
6381000

# Figure 2-3 Subsidence Repairs During 2009

**Legend**

- 2009 Subsidence Repairs
- Beltana No.1 Mine
- 2009 Area Subject to Undermining



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S

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Projection: GDA 94 MGA 56

**Plate 2-8 Tubestock planting providing visual screening around a vertical gas well near the intersection of Broke Road and Charlton Road**

Native tubestock and tree seed planted during 2007 and 2008 has now become well established around many of the gas wells and is providing effective visual screening. **Plate 2-9** shows an example of the establishment of visual screening vegetation around a vertical gas well adjacent to Charlton Road.

**Plate 2-9 Established vegetation providing visual screening around gas wells**

Surface to in-seam gas wells that are covered by decals of surrounding vegetation are now barely visible behind the well established native tree seed as shown in **Plate 2-10**.

**Plate 2-10 Photo decal and vegetation visual screening of a SIS gas well, viewed from the edge of Broke Road**

### 2.8.4 Rehabilitation

Two significant rehabilitation projects were undertaken in 2009; the River Red Gum Ecological Community Restoration Project and the Northern Drainage Line Rehabilitation Project.

The River Red Gum Ecological Community Restoration Project aims to re-establish the endangered River Red Gum Ecological Community on mine owned land. River Red Gum seed was source from the few remaining trees in the Broke area and propagated into tube stock. The first stage of this project involved planting 8.9Ha of mine owned alluvial flats adjacent to the Wollombi Brook. The plan agreed upon after consultation with ecologists and rehabilitation consultants is shown below in **Figure 2-4**. Over 2000 plants were hand-planted, of which 600 were River Red Gums. **Plate 2-11** demonstrates the manual planting in progress. To date the survival rate of this first stage has been over 95%. The second stage of this restoration project is planned for mid-2010, and will involve the establishment of another 3Ha of River Red Gum Ecological Community to the north as illustrated on **Figure 2-5**.

The Northern Drainage Line Rehabilitation Project aimed to stabilise a section of the Northern Drainage Line that had poor vegetative cover, and in doing so, to also extend the vegetation growing along the drainage in the north-west region of the mine lease area. The project involved tubestock planting, seeding, and erosion control structures to maintain soil stability and promote vegetation establishment. Stands of timber were intentionally placed throughout the area to provide habitat and act as sediment traps. **Plates 2-12, 2-13** and **2-14** illustrate area of the tubestock planting and timber stands installed as part of the Northern Drainage Line Restoration Project.

The complete extent of rehabilitation undertaken over the site during the reporting period is illustrated in **Figure 2-1**.

# Figure 2-4
# Stage 1
# River
# Red Gum
# Ecological
# Community
# Restoration

## Legend

- Creek Line: Casuarinas, E. camaldulensis and Callistemons
- Drainage Line: E. camaldulensis and E. tereticornis
- Pooling Zone: E. camaldulensis and a thick understorey of sedges and rushes
- Ridge Zone: A. costata, E. tereticornis and White Box
- General Zone: E.camaldulensis and Beltana general tree seed mix.

N
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0 50 100 m

1:3,000 @ A3

Projection: GDA 94 MGA 56

**Plate 2-11 The river red gum ecological community restoration project**

**Plate 2-12 Rehabilitation works on the Northern Drainage Line over Longwall 9 following December rainfall**

**Plate 2-13 A bare eroded slope along the Northern Drainage Line prior to rehabilitation**

**Plate 2-14 The same slope along the Northern Drainage Line 3 months after rehabilitation**

Additional revegetation works were undertaken during 2009 over an area of 3.8Ha on mine owned land adjacent to Cobcroft Rd. This area was ripped and seeded with native tree species. **Plate 2-15** provides an example of the ripped and seeded area. The works were undertaken in an area adjacent to remnant woodland to aid in the development of vegetation corridors. The extent of the Cobcroft Rd revegetation works are illustrated in **Figure 2-1**.

**Plate 2-15 Direct tree seeding in a paddock adjacent to Cobcroft Road**

The establishment of native vegetation corridors aligns with the objectives of the Bulga Underground Mine Operations Plan and the Bulga Coal Complex Flora and Fauna Management Plan.

### 2.8.5 Rehabilitation monitoring

Rehabilitation monitoring is undertaken by the Environmental Officer following significant rainfall. Areas are inspected for erosion, scour damage, slumping of surfaces and outbreaks of weeds.

### 2.8.6 Rehabilitation assessment

In addition to the monitoring undertaken by the Beltana Environmental Officer, rehabilitation contractors Global Soil Systems (GSS) undertake quarterly inspections of rehabilitation. The inspections are undertaken to monitor the success of the rehabilitation works completed by the Underground Operations and identify any maintenance requirements.

Some of the comments/maintenance requirements identified in the 2009 GSS quarterly rehabilitation reports are summarized below:

- Hot dry weather followed by periods of good rainfall provided excellent growing conditions during 2009.

- Favourable conditions allowed the direct seeding and tubestock planting undertaken in previous years to undergo significant growth and become well established. An example of this is the old air strip rehabilitation site, which has become well established with a thick cover of native trees (See **Plate 2-16** below).

- Favourable conditions also lead to increased weed cover around some of the rehabilitation sites. Native grasses sown on the old topsoil stockpile area and along a mine dewatering pipeline during late 2008 and early 2009 have failed; the areas are now overgrown with Galenia, Prickly Pear and a range of other weeds.

- Native birds have been sighted in some of the older rehabilitation sites, which are now providing good habit.

- Frost burn was noted on some of the tubestock rehabilitation around gas wells and the old dairy during winter. This did not affect survival rates significantly.

- Some of the failed tubestock around the old dairy will require re-planting with more resilient species during 2010.

- Southern Drainage Line rehabilitation project, undertaken during 2007 is now becoming well established.

The GSS reports highlighted the improvement in the condition of most rehabilitation sites as a result of favourable growing conditions throughout 2009. The reports also identified that the higher rainfall has also increased the coverage of weeds in some areas. Aside from the increased weed coverage and minor maintenance recommendations, no significant rehabilitation issues were identified. Generally, rehabilitation undertaken to date has been very successful.

**Plate 2-16 Rehabilitation works over the old airstrip (with the Southern Extension Waste dump in the distance)**

### 2.8.7 Decommissioning plans and schedule

All plans and schedules relating to the decommissioning of the Underground Operations are conceptual and are addressed in the MOP dated October 2007. The rehabilitation included in the MOP predominantly consists of repairing shallow depth of cover subsidence impacts, with the land being returned to a pre-mining land capability of Class IV and Class V.

The Bulga Open Cut Operations are responsible for the filling and rehabilitation of the Whybrow void once Underground Operations have been completed. However, the Underground Operations will be responsible for the sealing of adits and the removal of infrastructure.

If for unforeseen circumstances, mining prematurely ceased during the term of the MOP, the final rehabilitation plan will be developed to the satisfaction of DII in consultation with relevant stakeholders.

## 2.9 Underground activities proposed in the next AEMR period

All activities proposed in the next AEMR period are consistent with the 2007 MOP. In accordance with DII guidelines to the mining, rehabilitation and environmental management process (2006), three plans are submitted with the AEMR. These plans are provided in **Appendix P**.

The Underground Operation's objectives and targets for 2010 are provided in **Appendix D**.

**Figure 2-5** illustrates the mining, rehabilitation, infrastructure construction and drilling proposed for 2010.

It should be noted that the infrastructure proposed to be constructed on private property is subject to landholder consent that is yet to be confirmed.

During the next reporting period, the following works will be undertaken at the Beltana No.1 Mine:

- Mining the remainder of Beltana Longwalls 12 to 14.
- Rehabilitation of the subsidence impacts of Beltana Longwalls 12 to 14.
- Further rehabilitation and erosion control works along the Northern Drainage Line.
- Continuation of rehabilitation works around gas drainage facilities and pipelines.
- Rehabilitation of the Wollombi Brook Flood Levee.

During 2010, works relating to the Blakefield South Mine will include:

- The commencement of mining Blakefield South Longwall 1.
- Management of the subsidence impacts of Blakefield South Longwall 1.
- Continued installation of post-mining gas drainage facilities and pipelines.
- Continuation of rehabilitation works around gas drainage facilities and pipelines.
- Construction of a 4MW gas fired power station and methane abatement vocsidisers, pending development consent modification approval.

### 2.9.1 Exploration and gas drainage drilling

The following exploration drilling for the purposes of underground mine planning is proposed in 2010:

| Lease/licence | Metres drilled (m) | Number of holes | Purpose |
|---|---|---|---|
| ML1547 | 500 each | 9 | Underground Mine Planning |

The locations of proposed exploration drill holes are illustrated in **Figure 2-5**.

Additionally, 44 new gas drainage wells are scheduled to be drilled in 2010. The approximate locations of the proposed well sites are also shown on **Figure 2-5**.

# Figure 2-5 Underground Operations Activities Proposed 2010

Weed spraying and fencing in Conservation Area

Wollombi Brook Food Levee construction and rehabilitation

Borrow pit rehabilitation

Stage 2 of River Red Gum Ecological Community Restoration

Stage 2 of Northern Drainage Line Rehabilitation

Charlton Rd beautification

Fan Site No.2 construction

Commence construction of Methane Abatement Vocsidisers

Commence construction of Gas Fired Powerstation

Dewatering Bore

Installation of four piezometers in Wollombi Alluvials

## Legend

- Proposed Gas Wells
- Proposed Exploration Drilling
- Construction Activities
- Weed Spraying
- Proposed Undermining Area
- Proposed Rehabilitation
- ML1547



N
W E
S

0 500 1,000 m

1:35,000 @ A3

Projection: GDA 94 MGA 56

km

315000 316000 317000 318000 319000 320000 321000 322000 323000 324000 325000 326000

6384000 6383000 6382000 6381000 6380000 6379000 6378000 6377000 6376000

# 3. Summary of Open Cut Operations

## 3.1 Exploration

No exploration drilling was undertaken for the Open Cut Operations during the reporting period.

Open Cut Operations at the Bulga Coal Complex target the Redbank, Wambo, Whynot, Blakefield, Glen Munro and Woodlands Hill seams of the Whittingham coal measures. The Open Cut Operation has approval to extend the Bulga Pit to the south and west of the current location.

ROM coal is transported by dump truck via an overpass on Broke road to the ROM coal stockpile at the CHPP. Overburden extracted from the Open Cut Operation is currently placed in worked areas of the Bulga and Whybrow pits in two main areas the North and South Blakefield Dumps. The total projected remaining reserve is approximately 49 Mt providing for a further 8.5 years of open cut mining, within the current mine plan.

## 3.2 Construction

The Open Cut Operations received approval for the construction of a tyre changing facility and a washdown bay as part of a modification to the Development Consent in 2008. The tyre changing facility construction was completed in early 2009. The tyre changing facility includes storage and tyre change out facilities for the maintenance department. The new wash down bay facility commenced construction in 2009 but is not yet complete.

## 3.3 Land preparation

Land preparation ahead of open cut mining operations involves the construction of appropriate erosion and sediment control structures, the clearing of vegetation and stripping and stockpiling of topsoil.

Topsoil, grassland and fragmented woodland communities are cleared 100 m ahead of mining. Vegetation is bulldozed into windrows and stockpiled for future use within the rehabilitation process. Organic material is retained and incorporated into the topsoil stockpile. Topsoil stockpiles are generally kept to a height of 3 m or less, are set out in windrows to maximise surface exposure and biological activity and are located on level or gently sloping areas.

During 2009, land preparation was undertaken across a number of areas, including:

- Ramp 4 Area – 14.4 Ha.
- Crib Hut 3 Area – 9.3 Ha.
- North Blakefield power line – 4 Ha.

### 3.3.1 Open Cut mining operations

During 2009, the Open Cut Operations consisted of mining coal reserves from the Bulga and Southern Extension pits in the ML1547 lease area. Overburden removal during 2009 was undertaken with a dragline

assisted by a truck/shovel pre-strip fleet. Coal was mined by an excavator, front end loader and truck fleet. There were no changes in mining methodology during the 2009 reporting period.

The existing equipment fleet for the Open Cut Operations is shown in **Table 3-1**.

**Table 3-1 Mining equipment fleet for Open Cut Operations as at December 2009**

| Type | Model | Units |
|---|---|---|
| Dragline | P&H9020 | 1 |
| Shovels – Electric | P&H4100 | 1 |
| Shovels – Hydraulic | Hitachi EX8000 | 1 |
| | Hitachi EX5500 | 2* |
| | Hitachi 3500 | 1 |
| | Komatsu PC4000 | 1 |
| Haulage Trucks – Mine owned | Dresser 685E | 4 |
| | Dresser 830E | 7 |
| | Cat 793C XQ | 10 |
| | Cat 793D XQ | 10 |
| Haulage Trucks – Hired | Cat 789 | 12 |
| Front End Loaders | Komatsu WA 900 | 1 |
| | Komatsu WA 1200 | 1 |
| | Komatsu WA 500 | 1 |
| Dozers – Tracked, mine owned | Cat D11R | 11 |
| | Cat D10R | 1 |
| Dozers – Tracked, hired | Cat D10 | 1 |
| Dozers - Tyred | Cat 834H | 1 |
| Graders | Cat 16H | 1 |
| | Cat 16M | 1 |
| | Cat 24H | 1 |

* One shovel due to be commissioned in 2010.

A summary of coal production and waste material (overburden) production is provided in **Table 3-2**.

**Table 3-2 Production and waste summary for the Open Cut Operations**

| | Cumulative Production | | |
|---|---|---|---|
| | **Start of Reporting Period - January 2009** | **End of Reporting Period - December 2009** | **2010 (Forecast)** |
| Topsoil stripped ($m^3$) | 1,754,300 | 1,759,840 | 1,771,640 |
| Topsoil used/spread ($m^3$) | 863,100 | 868,640 | 880,440 |
| Waste rock ($m^3$) | 525,654,766 | 575,903,035 | 631,544,322 |
| ROM Coal (tonnes) | 122,607,645 | 131,708,911 | 140,000,237 |
| Processing waste (tonnes) (coal tailings and coarse reject) | 45,875,047 | 49,380,832 | 52,327,256 |
| Product Coal (tonnes) | 80,110,299 | 85,811,185 | 91,156,087 |

During the reporting period, ROM production from the Open Cut Operations totalled 9,101,266 tonnes, processing waste (incorporating coal tailings and coarse reject) totalled 3,505,785 tonnes and product coal totalled 5,700,886 tonnes. The total overburden moved during the 2009 reporting period was 124,584,234 tonnes.

The topsoil stripped during the reporting period totalled 5,540 cubic metres and was removed from a 27.7 ha area on the Ramp 4, Crib Hut 3 and North Blakefield dump.

During 2010, the Open Cut Operations are expected to produce 8.29 Mt of ROM coal, comprising 5.345 Mt of product coal at a yield of 64.5% and 2.946 Mt of reject.

Forecast overburden statistics for 2009 are provided in **Table 3-3**.

**Table 3-3 Forecast overburden statistics 2010**

| Overburden type | Forecast volume (tonnes) |
|---|---|
| Overburden | 55,641,287 |
| Reject | 2,946,424 |
| Total | 58,587,711 |

## 3.4 Coal handling and preparation

### 3.4.1 ROM coal

Coal mined by the Open Cut Operations is trucked to a receival hopper at the CHPP ROM stockpile site before being sized by a MMD sizer. The coal is either directly washed, or stacked out temporarily and reclaimed later by front-end loaders. The open cut ROM stockpile capacity is approximately 150,000 tonnes but storage is usually less than 20,000 tonnes. The open cut ROM coal stackout has an approximate capacity of 60,000 tonnes. The ROM stockpile capacity remained unchanged during the reporting period.

### 3.4.2 CHPP

The CHPP can produce two streams of product coal, semi-soft coking coal and thermal coal. The existing CHPP operates 24 hours per day, 7 days per week and has a capacity of 20 Mtpa. ROM coal is broken down to particles of less than 125 mm in a crusher; washed, screened, rinsed, and dewatered in the CHPP.

The total ROM (for the Open Cut Operations) coal processed in 2009 was 9,101,266 tonnes, producing 5,700,886 tonnes of product coal. It is expected that approximately 8,291,362 tonnes of ROM coal will be processed in 2010 producing approximately 5,344,902 tonnes of product coal from the Open Cut Operations.

### 3.4.3 Product handling

The product handling facilities remained unchanged during the reporting period. The product coal handling facilities consist of a dual product conveying systems from the CHPP out to the separate stockpiles and reclaiming facilities for coking coal and for thermal coal.

Clean coal is reclaimed from the product coal stockpiles and loaded into a 1500 tonne train loading bin. Trains are loaded from this bin at a rate of up to 3500 tph (Class 4 loading). Bulga Coal Complex can load on average 8 to 10 unit trains per day.

### 3.4.4 Tailings management

The Paste Thickener unit is continuing commissioning. During 2009, tailings were deposited in both the North and South Cell of the Deep Pit. In 2010 Deep Pit will reach current capacity until the overland conveyor is removed when the Beltana operation ceases mining.

Future works planned in 2010 for tailings management include the reuse of the Old Tailings Dam as an interim TSF. With this additional material, the Old Tailings Dam will be set up for decommissioning and rehabilitation once complete.

## 3.5 Waste management

Waste management is undertaken in partnership with the Underground Operations using Thiess Services. Details regarding waste management are outlined in **Section 2.6**.

### 3.5.1 Sewage treatment and disposal

There are two sewerage treatment plants located at the Open Cut Operations. One treatment unit is located at the Area Station; the second unit is located inside the rail loop at the CHPP. Effluent from the toilet blocks is transported to the Area Station sewage treatment plant for processing. The final effluent from both units is returned to the CHPP circuit water. Both units are maintained under a contract with CGF Services Pty Limited. The units are serviced and reported on fortnightly.

Any deactivated sludge is transported to Singleton Shire Council Treatment Works Depot.

### 3.5.2 Oil and grease containment and disposal

Removal of waste oil and grease from site for recycling is undertaken as part of the total waste management service by Thiess Services. All waste oil is drained from equipment either at the workshop or lube/service bay and stored in large bunded tanks. Oil changes in the pit are undertaken by draining the oil to the lube truck and then transported back for storage in the waste oil tanks.

Workshop waste water is processed through an oil water separator. Holding tanks across the site are serviced by a licensed contractor. Dirty oil is removed from site for recycling and/or disposal.

### 3.5.3 Rubbish disposal

Rubbish disposal is undertaken as part of the total waste management system by Thiess Services. Details of rubbish disposal are provided in **Section 2.6.4**.

## 3.6 Hazardous materials management

Bulga Coal Complex operates a ‘ChemAlert’ system which is an online tool where personnel have access to Material Safety Data Sheets (MSDSs) for chemicals held at the Bulga Coal Complex. The Open Cut Operations implement a site specific hazardous materials management standard that provide guidelines for the purchase, handling, usage, storage, labelling and disposal of hazardous substances.

### 3.6.1 Explosives

Explosives for the Bulga Coal Complex are stored in licensed explosive magazines in the appropriate location. The explosives magazines are equipped with lightning arrestors and are located on site, behind earthen bunds. The management of explosives storage, transport and use is conducted in accordance with the *Occupational Health and Safety Act 2000*.

### 3.6.2 Fuel containment

The Open Cut Operations maintain a number of fuel storage facilities, including:

- Eight 180kL above ground diesel storage tanks. The tanks are bunded within clay impervious bunding with clear water drainage grates and locked valves that lead to a triple interceptor fuel holding tank. The main fuel tanks are required to be ultrasonically inspected every ten years with the last inspection was completed during April 2005.
- Five In-pit fuel tanks that hold between 60,000L and 100,000L. The tanks are double skinned and are semi permanent installations that are moved as mining progresses.

## 3.7 Rehabilitation

### 3.7.1 Buildings

There were no building decommissioned during the reporting period. All mine related buildings will be decommissioned and removed from the site as part of the decommissioning and rehabilitation following completion of mining operations.

### 3.7.2 Rehabilitation statistics

During the reporting period, 66 ha of rehabilitation was completed. All areas rehabilitated during 2009 consisted of a combination of pasture seed and cover crop seeding. The areas where rehabilitation was undertaken during 2009 and the areas planned for rehabilitation during 2010 are illustrated in **Figure 3-1**.

A summary of the rehabilitation undertaken by the Open Cut Operations during the reporting period is provided in **Table 3-4**.

**Table 3-4 Summary of rehabilitation during 2009 for Open Cut Operations**

| | Area Affected (Ha) | | |
|---|---|---|---|
| | **Last report (Dec 08)** | **To date (Dec 09)** | **At next report (estimated)** |
| **A: MINE LEASE AREA** | | | |
| A1 Mine Lease(s) Area | 4269 | 4269 | 4269 |
| **B: DISTURBED AREAS** | | | |
| B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads) | 136 | 140 | 140 |
| B2 Active Mining Area (excluding items B3 – B5 below) | 385 | 385 | 385 |

| | Area Affected (Ha) | | |
|---|---|---|---|
| | **Last report (Dec 08)** | **To date (Dec 09)** | **At next report (estimated)** |
| B3 Waste emplacements (active/unshaped/in or out-of-pit) | 393 | 316.5 | 359.5 |
| B4 Tailings emplacements (active/unshaped/uncapped) | 119 | 119 | 119 |
| B5 Shaped waste emplacement (awaits final vegetation) | Nil | Nil | Nil |
| ALL DISTURBED AREAS | 1033 | 960.5 | 1003.5 |
| **C: REHABILITATION PROGRESS** | | | |
| C1 Total Rehabilitated area (except for maintenance) | 780 | 847 | 890 |
| **D: REHABILITATION ON SLOPES** | | | |
| D1 10 to 18 degrees | 55.2 | 69.2 | 69.2 |
| D2 Greater than 18 degrees | Nil | Nil | Nil |
| **E: SURFACE OF REHABILITATED LAND** | | | |
| E1 Pasture and grasses | 511.5 | 578 | 621 |
| E2 Native forest/ecosystems | 335 | 335 | 335 |
| E3 Plantations and crops | Nil | Nil | Nil |
| E4 Other (include non-vegetative outcomes) | Nil | Nil | Nil |

Notes: B4 Tailings Emplacements: the figure of 90 ha is calculated on the basis that the tailings dam will eventually be filled up to natural ground level, rather than at RL 55, as currently calculated. This gives an additional 10 ha of surface expression.

# Figure 3-1 Open Cut Operations Rehabilitation

Bulga Pit

Whybrow Pit

**Legend**

- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area
- 2009 Rehabilitation
- Proposed 2010 Rehabilitation

N
W E
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0 250 500 m

1:17,500 @ A3

Projection: GDA 94 MGA 56

Maintenance activities undertaken on the rehabilitated land are summarised in **Table 3-5.**

**Table 3-5 Maintenance activities on rehabilitated land for Open Cut Operations**

| Nature of treatment | Area treated (hectares) | | Comment/control strategies/ treatment detail |
|---|---|---|---|
| | 2009 | 2010 | |
| Additional erosion control works (drains re-contouring, rock protection) | 0 | 12 | No soil treatment was undertaken in 2009. |
| Re-covering (further topsoil, subsoil sealing etc) | N/A | N/A | N/A |
| Soil treatment (fertiliser, lime, gypsum etc) | 0 | 0 | No soil treatment was undertaken in 2009. |
| Treatment/management (grazing, cropping, slashing etc) | 0 | 43 | No grazing, cropping or slashing was undertaken in 2009. |
| Re-seeding/replanting (species density, season etc) | 0 | 43 | No Re-seeding/replanting was undertaken |
| Adversely affected by weeds (type and treatment) | 0 | 15 | No weed management activities was undertaken in 2009 |
| Feral animal control (additional fencing, trapping, baiting etc) | N/A | 30 | No weed management activities were undertaken in 2009. |

During the reporting period a detailed inspection program was undertaken to determine future maintenance requirements. This inspection was used to develop the 2010 Annual Rehabilitation Plan with specific budgeted allocation for Maintenance works.

## 3.7.3 Rehabilitation of disturbed land

### 3.7.3.1 Methodology

Rehabilitation is commenced as soon as practical following the completion of mining in any area. The rehabilitation strategy for the Open Cut Operations includes the following components:

- Overburden dumps are battered down to between 8-10° to facilitate ground preparation and seeding and to minimise erosion. Permission has been gained from the Inspectorate Division of the DPI to permit portions of the Blakefield South and the Blakefield North dumps to be profiled up to 14°.
- Contour drains and stock dams are installed along with toe drains and silt trap dams.
- Slope lengths are limited to between 50–70 m.
- Where topsoil is available, it is spread at a maximum of 150 mm thick over shaped overburden areas (usually gypsum is added after topsoil due to the high clay content in the topsoil).
- In areas allocated for tree lots, deep ripping occurs along contours over the entire area. For grass areas, the surface is ripped and rock-raked to remove any rocks at the surface.
- The ground is selectively treated with gypsum at the rate of 10 t/Ha, to combat the high clay content, preventing surface sealing and enabling water penetration into the overburden.
- The area is then seeded and fertilised.

- In the event that native tree species are being direct seeded in areas that have been spread with topsoil, the use of fertiliser is avoided to reduce the potential for weed infestation and subsequent competition for young germinants.

- Where possible, salvaged features such as logs and hollows are placed within the rehabilitation area to aid with habitat creation.

- A mixture of seasonal cover crop and various native tree and understorey species seed is directly sown by broadcasting. Local provenance species are sown where available. The tree species are directly seeded along with grass species. A list of the Open Cut Operations pasture, cover crop and tree species used in rehabilitation are outlined in **Table 3-6**, **Table 3-7** and **Table 3-8** respectively.

**Table 3-6 Open Cut Operations pasture seeding species**

| Species |
|---|
| Oats (autumn/winter) or Japanese Millet (spring/summer) |
| Couch |
| Lucerne |
| Seaton Park Cover |
| Wimmera Rye |
| Perennial Rye |
| Sephi Barrel Medic |
| Kikuyu |
| Phalaris |
| Rhodes Grass |

**Table 3-7 Open Cut Operations cover crop species**

| Species |
|---|
| Oats (autumn/winter) or Japanese Millet (spring/summer) |
| Tertilla Rye Grass |
| Rye Corn |
| Red Clover |

**Table 3-8 Open Cut Operations tree seeding species**

| Species |
|---|
| *Acacia buxifolia* |
| *Acacia decora* |
| *Acacia decurrens* |
| *Acacia falcata* |
| *Acacia implexa* |
| *Acacia mearnsii* |
| *Acacia salicina* |
| *Callistermon rigidus* |
| *Casuarina cunninghamiana* |
| *Corymbia maculata* |
| *Eucalyptus albens/moluccana* |
| *Eucalyptus camaldulensis* |
| *Eucalyptus crebra* |
| *Eucalyptus fibrosa* |

| Species |
|---|
| *Eucalyptus punctata* |
| *Eucalyptus sideroxylon* |
| *Eucalyptus tereticornis* |
| *Melaleuca styphelioides* |
| *Kunzea ambigua* |
| *Lomandra longifolia* |
| *Callistemon pinifolius* |
| *Daviesia ulicifolia* |
| *Hardenbergia violacea* |
| *Bursaria spinosa* |

**Plate 3-1** and **Plate 3-2** show some of the rehabilitation activities at the Open Cut Operation site and an example of a rehabilitated area.

**Plate 3-1 Early strike - Whybrow Spoils facing south**

**Plate 3-2 Perspective unshaped dump facing north to germinated area**

### 3.7.3.2 Geochemistry of overburden

There are four main soil types present throughout the Bulga Coal Complex. The results of overburden sampling undertaken during the reporting period are provided in **Table 3-9** below.

**Table 3-9 Overburden characteristics**

| Soil code | Organic C (%) | EC (dS/m) | pH | P (ppm) | K (ppm) | N (ppm) |
|---|---|---|---|---|---|---|
| BU2 | 0.6 | 0.30 | 9.61 | 120 | 232 | 1023 |
| BU3 | 0.5 | 0.45 | 9.47 | 50 | 429 | 915 |
| BU4 | 0.4 | 0.24 | 9.63 | 170 | 607 | 1062 |
| BU5 | 0.4 | 1.41 | 8.94 | 520 | 240 | 898 |

During 2009 Bulga Coal Complex engaged external consultants Parsons Brinkerhoff and Landloch to undertake a detailed spoil characterisation. The results presented in **Table 3-9** were a component of the initial spoil sampling. The results of these investigations are currently being finalised.

**Topsoil balance**

Land preparation is conducted in accordance with stripping plans and in situ soil conditions. Previous assessments have indicated that the Open Cut Operations have a significant topsoil deficit. As the lack of topsoil does not limit the establishment of trees, the shortage of topsoil at the site may not be critical to the overall success of future rehabilitation works.

The Open Cut Operations has 336,000 cubic metres of topsoil in various topsoil stockpile locations area around the site. This is well below the estimated topsoil requirement of approximately 680,000 cubic metres.

The Open Cut Operations have integrated the use of biosolids in place of topsoil to provide a suitable medium for plant growth on overburden. Biosolids are applied at a rate of 100 dry tonnes per hectare. Heavy application is undertaken if conditions permit. In some areas a thin layer of topsoil has been combined with biosolid application to improve long term vegetation results.

A summary of nutrient analysis undertaken is provided in **Table 3-10**.

**Table 3-10 Topsoil nutrient analysis**

| Soil Code | Organic C (%) | EC (dS/m) | pH | P (ppm) | K (ppm) | N (ppm) |
|---|---|---|---|---|---|---|
| BU1 | 0.7 | 0.16 | 6.85 | 50 | 38 | 197 |
| BU6 | 1.9 | 0.17 | 6.74 | 240 | 161 | 2319 |

The detailed spoil characterisation undertaken by Parsons Brinckerhoff and Landloch also included a detailed topsoil characterisation. The results of the initial topsoil sampling are presented in **Table 3-10**.

#### 3.7.3.3 Final landform

The final landform will be safe and stable, it will include a drainage pattern that is capable of conveying runoff, whilst minimising the risk of erosion and sedimentation. Drainage characteristics for the site have been developed in accordance with the Draft Guidelines for Designing Stable Drainage Lines on Rehabilitated Sites (DLWC, 1999). The system integrates surface storage during periods of high rainfall runoff and manages deep infiltration to levels which can be safely tolerated and at the same time reduce the size of the surface drainage system.

A detailed spoil characterisation program has been undertaken to assist with the assessment of landform stability under various conditions and treatments. The results from these investigations will be considered when designing the final landform. The final report for this assessment is currently being finalised.

**Rehabilitation monitoring**

Rehabilitation monitoring is undertaken by the Open Cut Operations following the completion of seeding. Monitoring is also undertaken following rainfall to identify any erosion and scour damage, slumping of surfaces, transport activities of topsoil, sedimentation in contour drains and any ‘pipe’ failure in drains. Routine inspections are also undertaken each month to monitor outbreaks of weeds and watering and replacement of tube stock. The results of the monitoring inspections are outlined below:

- South Blakefield Emplacement– rehabilitation is progressing well. Inspections revealed some evidence of erosion occurring along both batters and contour drains. Some weed infestation was monitored during the reporting period with Galenia being observed. There is a high percentage of ground cover and dominance of Rhodes grass.

- North Blakefield Emplacement– rehabilitation includes both pasture and tree species. The rehabilitation is producing some mixed results, including improvements from last year. Some evidence of bare patches and active erosion scours were observed. Some weeds were also observed during the reporting period including Galenia and Thistle, narrow leafed cotton bush and fireweed.

- MTO Emplacement – rehabilitation was completed during the previous reporting period with promising strike. Over the past 12 months over-storey and mid-storey species have been slow to develop; these species have increased their presence significantly in the last 3-4 months. Minimal erosion was observed, some slight weed infestation including Galenia and pear was observed. Overall rehabilitation is progressing well, however some minor final works are required to complete this rehabilitation.

- Southern Extension Emplacement – rehabilitation of this dump was finalised during the previous reporting period. There is some evidence of improved surface stability and a decreased score for weed infestation (Galenia). Erosion scours that appear to be active were monitored following rainfall, including a number of contour drain breaks and batter scouring.

## 3.7.4 Rehabilitation assessment

An annual inspection and assessment of the Open Cut Operations rehabilitation was undertaken by external consultants Umwelt.

The annual rehabilitation assessment made the following recommendations:

- repairing erosion (scours/pipes/contour bank failure)
- address dispersive soils and enhancement of growing medium
- undertake a selective weed control program
- improve the fertiliser maintenance program
- investigate dominance of Rhodes Grass and control options
- review species list for appropriateness and diversity of stratums.

These recommendations were incorporated into the 2010 Rehabilitation Plan.

## 3.7.5 Rehabilitation trials and research

### 3.7.5.1 Contour bank shaping trial

During the reporting period, the Open Cut Operations undertook a new trial relating to the modification of contour bank shapes. The trial was commenced in response to numerous breaks in contour banks. The contour bank shape and size have been modified to increase the slope percentage and widen the channel (horizontal section created between the contour bank and the emplacement slope) to accommodate increased water flow.

There were erratic results from this trial, with both stable and erodible contour banks observed. In undertaking this trail a number of additional variables that influence contour bank stability were observed, these include:

- Crest Shape – Ability of seed spreader to access all areas of the contour bank.
- Exit Grade – Maintaining the 0.5 – 1% grade along the entire length of the contour is critical. Some contours where scoured significantly where the grade increased upon entry to other water management structures.
- Upslope Grade – Increasing the size of the contour bank has caused an increased upslope grade.

### 3.7.5.2 Mine Closure Plan

A Conceptual Mine Closure Plan was developed for the Open Cut Operations in early 2007. All plans and schedules relating to the decommissioning of Bulga Coal Complex were updated during this process, including the 2006-2012 MOP.

The Conceptual Mine Closure Plan has been developed with the aim of providing assistance in making appropriate financial provisions for the eventual decommissioning of the Bulga Coal Complex. This will guarantee that at the completion of mining, the land can be returned to a stable and sustainable landform.

Mine closure at the Bulga Coal Complex includes a comprehensive planning process. The Conceptual Mine Closure Plan identifies the key objectives for mine closure at the Bulga Coal Complex. These objectives will ultimately be used in the development and design of the final Detailed Mine Closure Plan five years prior to closure. This closure plan will be updated in 2010.

## 3.8 Open Cut activities proposed in the next AEMR period

Mining operations during 2010 will be undertaken in the Bulga and Whybrow Pits. The areas to be mined during 2010 are illustrated on **Plan 4** in **Appendix Q**. All Open Cut activities proposed in the next AEMR period will be consistent with the MOP.

In accordance with the guidelines for AEMRs (DPI 2006), three plans are required for submission with the AEMR. These plans are to be current at the end date of the reporting period, of the same scale and with equivalent information to **Plan 3** Land Preparation, **Plan 4** Proposed Mining Activities and **Plan 5** Proposed Rehabilitation of the current MOP. These plans are included in **Appendix Q**.

Overburden emplacement will be predominantly in the former Ramp 12 area as per the recent amendment to the Mining Operations Plan.

During 2010, the Surface Operations will be constructing a 3,000ML CHPP Surge Dam. This dam will be integral in the ongoing water management plan for the Bulga Coal Complex for the life of the Operations.

The Open Cut Operations exploration program planned for 2009 was to consist of cored and open drilling, gas sampling and coal quality assessments and aimed at enhancing the current understanding of the geological, greenhouse and coal quality characteristics of the area. This program has been delayed until 2010.

As a result of community concern and subsequent noise investigations during 2009, the current mobile equipment fleet (both hire and owned) will be progressively replaced with sound attenuated equipment during 2010. In addition to this, to further reduce the operation's noise impact, a network of real-time noise monitoring units will be installed and operated, day and night dumping options will be implemented and noise bunds on elevated haul roads will installed during 2010. More information on the noise mitigation initiative is presented in **Section 4.5**.

During 2010 Bulga Surface Operations will also be pursuing a dust reduction program to improve dust management of hardstand areas around site.

Several rehabilitation activities are planned for 2010. These activities include; 43Ha of primary rehabilitation, visual mitigation works, disturbance reduction works, weed management (Galenia) and pasture improvement works.

As a requirement of the November 2009 Development Consent (DA41-03-99) Modification the Open Cut Operations are developing a revised Landscape Management Plan, incorporating the following components:

- Rehabilitation and Offset Management Plan.
- Final Void Management Plan.
- Mine Closure Plan.

The development of the revised Landscape Management Plan was commenced during 2009 and is scheduled to be completed by late 2010.

# 4. Community and environmental management

The Bulga Coal Complex undertakes a number of activities to communicate and consult with the community. The following sections provide a summary of community consultation and participation undertaken during the reporting period.

## 4.1 Environmental complaints

During the reporting period, forty community complaints were received in relation to the Open Cut Operations and zero complaints were received by the Underground Operations. Twenty-four of these complaints were made by the same complainant. The community complaints related to noise, dust and blast vibration/overpressure. A brief summary of the complaints and the actions taken in response to the complaints is provided in **Appendix E**.

Considerable investigations into the mines noise impact in response to community complaints resulted in Bulga Coal undertaking substantial actions to mitigate the impacts. These actions will be discussed further in **Section 4.5**.

## 4.2 Community liaison

### 4.2.1 Community Consultative Committee

A combined Community Consultative Committee (CCC) operates for the Underground and Open Cut Operations. Bulga Coal Complex hosted community consultative meetings on 20 May 2009 and 4 December 2009. The CCC meetings included representatives from the community, Singleton Shire Council, DII and the Bulga Coal Complex. Minutes of these meetings are distributed to each Community Consultative Committee member. Discussions held at CCC meetings typically cover a range of environmental and social aspects associated with the Bulga Coal Complex operations.

### 4.2.2 Other community participation

The Bulga Coal Complex was involved in a number of community events and sponsorships during the reporting period, these included:

- Community barbeques: The Bulga Coal Complex hosted a community barbeque for the residents of Bulga in April, attended by 32 residents. The aim of the community barbeque program is to inform the community about the mines activities and to strengthen relationships with the community.
- Broke Village Fair: The Bulga Coal Complex is a major sponsor of the Fair. Staff from the Open Cut and Underground Operations manned an information tent, where native trees and helium balloons were given away. Mine tours of the Open Cut Operations were also provided to fair patrons.
- Community morning tea: The Bulga Coal Complex hosted a morning tea for the residents of Broke in November, outlining the Xstrata supported ‘History of Broke’ research project. The morning tea was attended by 30 residents from the local community. The research project is ongoing and aims to produce a publication of the history of Broke which will be distributed to the local community.

- Broke Primary School mine tour: Students and staff from Broke Primary School were bussed through the Underground Operations Blakefield South Project and then onto the Mines Rescue Station in Singleton to experience working conditions of an underground mine in the virtual reality theatre. The tour coincided with the school's classroom lessons about coal mining.

**Plate 4-1 Residents of Broke attending the 'History of Broke' morning tea**

### 4.2.3 Donations

A number of donations to schools, community groups and charities were made by the Bulga Coal Complex during the reporting period, these included:

- Variety's Newcastle Bush Bash.
- Arrow Bone Marrow Research Canoe Classic.
- Singleton Disability Respite Services.
- Broke Public School swimming lessons and buses during December Swim School.
- Singleton Scouts.
- Broke P & C Association for school discos in May and November.
- Broke Community Christmas Concert.
- Movember.
- Wildlife Aid.
- We Help Ourselves (WHOS) Hunter Valley.

- Singleton Public Library Summer Reading Program.
- Adopt-a-Spot Clean Up, Broke Road.
- Witmore Enterprises Inc.

### 4.2.4 Sponsorships

The Bulga Coal Complex sponsored the following events held locally during the reporting period:

- Support of the Broke Fordwich Tourism Association including sponsorship of the *Little Bit of Italy Festival and Spirit of the Vine*.
- Singleton Beef and Land Management Junior Cattle Judging.
- Branxton Campdraft novice and junior categories.
- Art in the Vines.

## 4.3 Environmental risk identification

The Bulga Coal Complex has taken a proactive approach to management of environmental risk associated with its operations. Identification of environmental risk at the Bulga Coal Complex is undertaken via an internal risk assessment process. An aspects and impacts register is updated as changes to operations occur and used as a basis to develop a series of risk matrices in accordance with DII category requirements. Risk matrices developed for the Bulga Coal Complex are presented in **Appendix F**.

Internal risk assessments are undertaken using the Xstrata Risk Management system. The methodology used for the internal risk assessment is presented in **Table 4-1** (risk ranking table), **Table 4-2** (risk classification), **Table 4-3** (consequence table) and **Table 4-4** (probability table).

**Table 4-1 Risk ranking table**

| | | Probability (P) | | | | |
|---|---|---|---|---|---|---|
| Maximum Reasonable Consequence (MRC) | | A | B | C | D | E |
| | 1 | 1 | 2 | 4 | 7 | 11 |
| | 2 | 3 | 5 | 8 | 12 | 16 |
| | 3 | 6 | 9 | 13 | 17 | 20 |
| | 4 | 10 | 14 | 18 | 21 | 23 |
| | 5 | 15 | 19 | 22 | 24 | 25 |

**Table 4-2 Risk classification**

| | |
|---|---|
| 1 to 11 (Red) | **High** |
| 11 to 19 (Yellow) | **Medium** |
| 20 to 25 (Green) | **Low** |

**Table 4-3 Consequence table**

| Score | People | Property | Environment | Community |
|---|---|---|---|---|
| 1 Catastrophic impact | Multiple fatalities.<br>Major permanent negative health impacts on a large number of people. | Unplanned mine closure<br>>$10M | Disastrous environmental impact, with long-term effect, requiring major remediation, regulatory intervention or premature closure of the operation. | Public international condemnation.<br>Major breakdown of social order in affected community. |
| 2 Severe negative impact | Single fatality.<br>Severe irreversible disability or impairment (PDI). | Could cause major damage $1M - $10M | Serious environmental impact, with medium-term effect, requiring significant remediation or resulting in prosecution. | Loss of community's economic viability.<br>Significant damage to reputation of the operations. |
| 3 Major negative impact | Major injury to one or more persons.<br>Severe health impacts on a number of people. | Could cause major damage $100K - $1M | Moderate, reversible environmental impact with short-term effect, requiring moderate remediation, such as a reportable incident not likely to result in prosecution, e.g.: a minor water discharge. | Significant public criticism (e.g. community complaints).<br>NGO or Media 'taking up the issue'.<br>Major negative impact on economic viability. |
| 4 Negative impact | Significant reportable injury (MTI, or less than 5 days RWI or LTI).<br>Major impact on health of several people. | Could cause moderate damage $10K - $100K | Minor, reversible environmental impact, requiring minor remediation such as a non-reportable environmental incident e.g.: a minor oil spill. | Flare up of issues in affected communities.<br>Media criticism. |
| 5 Minor negative impact | Minor injury.<br>Slight negative impact on individual health. | Could cause minor damage.<br><$10K | Negligible, reversible environmental impact, requiring very minor or no remediation. | Slight negative impact on individuals in local community. |

**Table 4-4 Probability table**

| Code | Probability |
|---|---|
| A | Almost certain to happen (everyday/weekly event) |
| B | Likely to happen at some point (typically once a month) |
| C | Moderate: possible, heard of so it might happen (typically once a year) |
| D | Unlikely: not likely to happen (typically once every five years) |
| E | Rare: practically impossible (typically once every twenty five years) |

The purpose of the assessment is to identify how to reduce the risks associated with environmental hazards to a level ‘As Low as Reasonably Practical’ (ALARP).

The Open Cut Operations conducted a full review of the aspects and impacts for the mining operations in December 2009. The risk matrix provided in **Appendix F** was updated using this risk assessment. The update included changing the risk rating of noise impacts from mining operations from low to medium. There were a number of actions arising from this risk assessment process; however no additional aspects and impacts had their risk rating changed.

The Underground Operations conducted a review of the Underground Operations Aspects and Impacts Register in November 2009.The risk matrix provided in **Appendix F** for the Underground Operations was updated using this risk assessment. The only issue revised was the change in risk rating of the potential for flooding from a 1 in 100 year flood event. The construction of the Wollombi Brook Flood Levee has reduced the risk rating from high to medium.

There are no issues classified as high risks for either operation.

## 4.4 Meteorological monitoring

The Bulga Coal Complex undertakes on site meteorological monitoring, which is a requirement of the Underground and Open Cut Operations development consents.

**Figure 4-1** illustrates the location of the Open Cut Operations meteorological station in relation to mining operations.

A new meteorological station was installed in June 2009 at the Underground Operations, adjacent to the Beltana Methane Flaring Facility. The location of the recently construction meteorological station is provided in **Figure 4-1** The data from the Underground Operations meteorological station does not cover the entire reporting year and has subsequently not been included in this report. This station has not been constructed to replace the one at the Open Cut Operations; instead it is used to monitor for adverse conditions that may inhibit the methane flaring facility at the Underground Operations.

# Figure 4-1
# Bulga Coal Complex Air Quality and Meteorological Monitoring Sites

MTO-PM10
MTO-TSP1
MTO D9
MTO D3
H1(PM10)
D9
A3
N3
HVAS1
C1
D2
E2
N5
D10
D10 (PM10/TSP)
N4
F1
A1
Wollombi Brook
Bulga Met Station
C2
D3
E1
Chaffon Rd
D7
F2
N6
Dawtrey (PM10/TSP)
A2
B2
C3
Putty Rd
E3
L1
Broke Rd
F3
Beltana Met Station
B3
Sharrock 1
Beltana PM10
C4
D5
Cessnock Rd
C5
Redibar
Broke
Milbrodale Rd
D6

## Legend

- Depositional Dust Gauge
- High Volume Air Sampler
- Meteorological Station
- Roads
- Waterways
- Cadastre
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

N
W E
S

0 500 1,000 m

1:50,000 @ A3

Projection: GDA 94 MGA 56

A summary of data from the Open Cut Operations meteorological station including rainfall, solar radiation and temperature is provided in **Figure 4-2** and is discussed below.

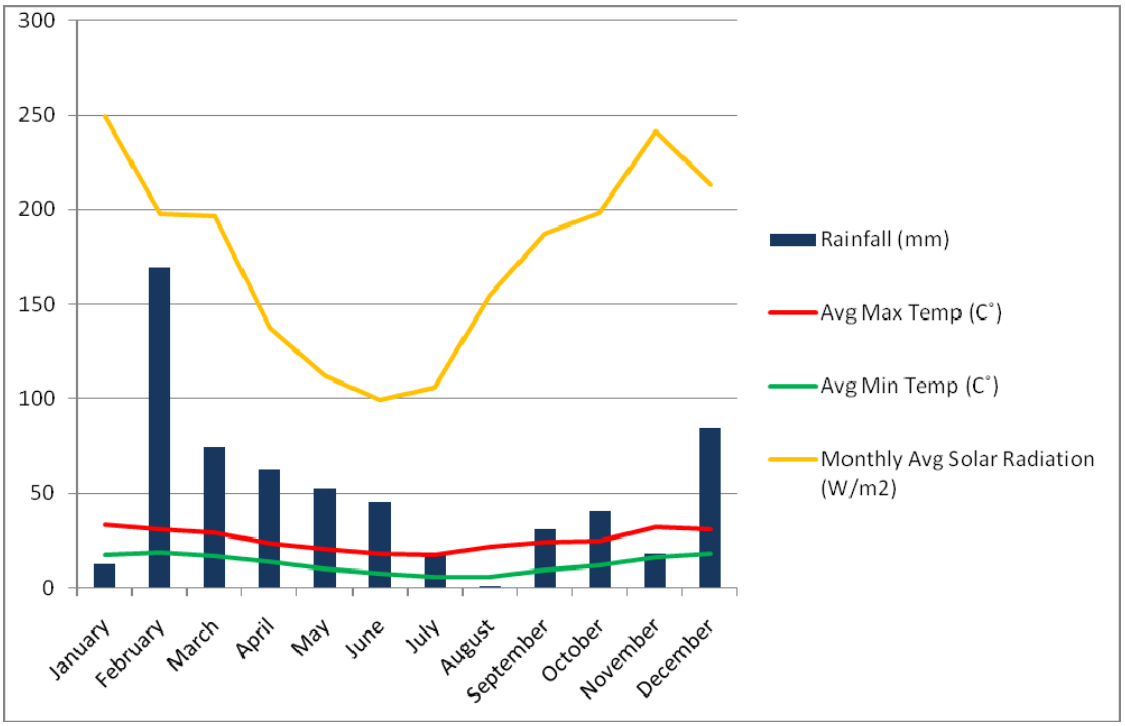



**Figure 4-2 Summary of recorded rainfall, temperature and solar radiation 2009**

### 4.4.1 Rainfall

Total rainfall recorded from January 2009 to December 2009 was 610 mm, compared to 641 mm during 2008 and 881 mm during 2007.

Rainfall was distributed evenly throughout the year, however late summer and autumn were the seasons that experienced the heaviest falls. February experienced 170mm of rainfall followed by 74 mm during March, 62 mm during April and 53 mm during May. There was also significant rainfall during December, when 84 mm fell.

The highest daily rainfall was 54 mm, recorded on 14 February 2009.

August was the driest month, recording only 1 mm of rainfall.

### 4.4.2 Temperature

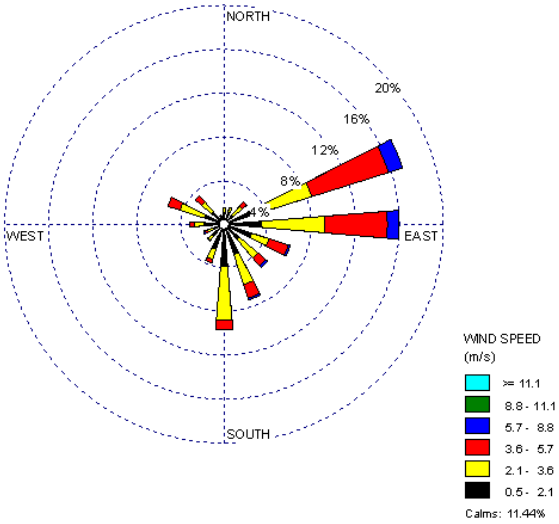
The temperature in 2009 was roughly consistent with standard seasonal patterns, and varied from a low of 0.1°C on 11 June to a maximum of 43.5°C on 11 November.

### 4.4.3 Solar radiation

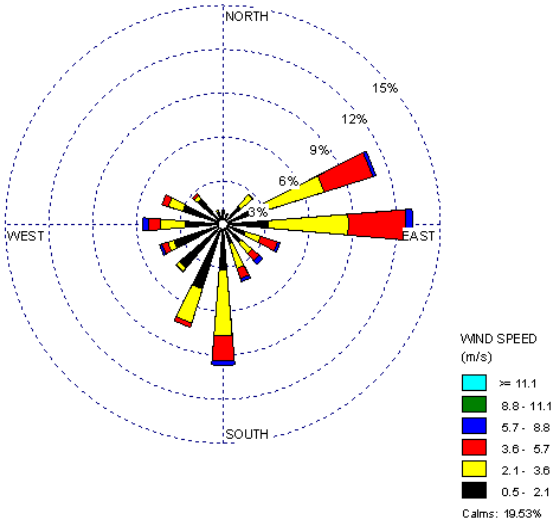
Solar radiation data from 2009 is consistent with normal seasonal patterns. The daily average rate of solar radiation ranged from a low of 25.9 W/m$^2$ on 29 June to a high of 356.7 W/m$^2$ on 12 December.

### 4.4.4 Wind speed and wind direction

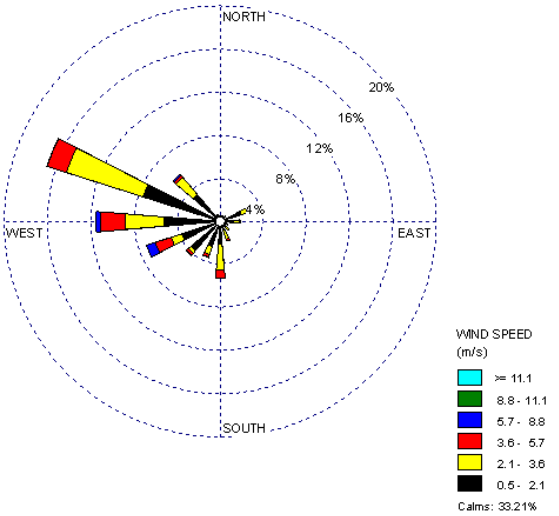
Wind speed and wind direction data taken from Bulga Coal Complex's meteorological station in 2009 were used by Global Acoustics to create monthly and seasonal wind roses. Seasonal wind roses are provided in **Figure 4-3**. Wind direction was highly variable throughout the year and the prevailing wind direction varied according to the season. In summer the predominant wind direction was easterly, in autumn it was southerly, in winter it was westerly and in spring it was an east north easterly.



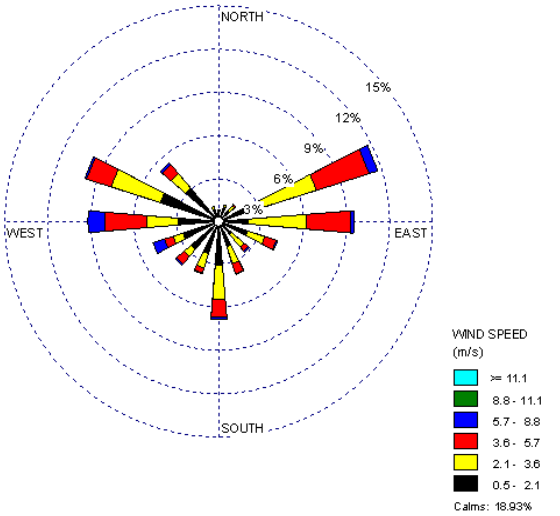

**Summer (January, February and December 2009)**




**Autumn (March – May 2009)**




**Winter (June – August 2009)**




**Spring (September – November 2009)**

**Figure 4-3 Bulga Coal Complex 2009 seasonal wind roses**

## 4.5 Noise

The development consent approval conditions for the Bulga Coal Complex include requirements to undertake quarterly noise monitoring on the mining lease and at key residential receivers surrounding the Bulga Coal Complex. Noise monitoring forms a key part of the environmental monitoring program for both the Open Cut and Underground Operations.

Quarterly noise surveys were undertaken by Global Acoustics during the reporting period for the Open Cut and Underground Operations.

All noise monitoring was undertaken in accordance with the DECCW's Industrial Noise Policy (INP) Guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'. Atmospheric data was collected concurrently to assist with data interpretation.

Global Acoustics conducted 72 hours of continuous noise monitoring and periods of attended monitoring during:

- Quarter 1 (Q1) – 5 January to 7 May 2009.
- Quarter 2 (Q2) – 26 May to 14 June 2009.
- Quarter 3 (Q3) – 6 August to 25 September 2009.
- Quarter 4 (Q4) – 20 October to 12 December 2009.

The results of noise monitoring for the Open Cut Operations are discussed in **Section 4.5.1** and in **Section 4.5.2** for the Underground Operations. The noise monitoring locations for the Bulga Coal Complex in relation to mining operations are illustrated in **Figure 4-4**.

### 4.5.1 Open Cut Operations

Noise criteria for Bulga Coal Complex Open Cut Operations are specified in the development consent (DA 41-3-99) Schedule 6, Condition 6.3.1. Specific noise criteria also apply to areas identified as 'areas of affectation' in the Open Cut EIS (ERM, 1999). These areas are defined as those that experience high noise levels under non-adverse conditions. The criteria included in DA 41-3-99 for the areas of affectation are provided in **Table 4-5**.

**Table 4-5 Noise assessment criteria**

| Time | Non-Adverse | Adverse |
|---|---|---|
| Day | 40 dB(A)$L_{A10}$ | 45 dB(A)$L_{A10}$ |
| Night | 35 dB(A)$L_{A10}$ | 40 dB(A)$L_{A10}$ |

The development consent approval conditions also specify that the Bulga Coal Complex must ensure that noise emissions from the Open Cut Operations do not exceed the noise limits as presented in **Table 4-6**, at the nominated residences during adverse weather conditions. Xstrata now owns both the Myers and Dawtrey properties and has private noise compensation agreements with both McInerney and Lewis which mean the noise criteria no longer apply.

**Table 4-6 Noise assessment criteria at specific residences (adverse weather conditions)**

| Residence | Bulga Open Cut Operations Limit dB(A)$L_{A10}$ | |
|---|---|---|
| | Day | Night |
| Myers | 43 | 37 |
| McInerney | 43 | 37 |
| Lewis | 43 | 39 |

Noise emissions from the Open Cut Operations are managed in accordance with the Open Cut Operations Noise Management Plan.

Concern about mine generated noise in the community prompted Bulga Coal Management Pty Limited to undertake a review of its mining operations in 2009. The review indicated that the noise criteria currently applicable to the operations are out-of-date and not in accordance with current industry best practice. Further, monitoring results have shown a trend towards increased mining related noise over the past two years. The increase in noise from the Bulga Coal Complex has predominantly been caused by an increase in the number of rear dump trucks utilised on site.

Once this issue was identified, an action plan was developed to rectify the issue and presented to Department of Planning. The action plan consisted of the following key aspects:

- Replacement of hire mining equipment with new sound attenuated equipment.
- Installation of a real-time noise monitoring network to enable the proactive management of noise impacts on the local community.
- Modifications to the operation in the form of implementing a day-time, night-time dumping strategy and constructing noise bunds on exposed haul road.
- The submission of an application to modify the Open Cut Development Consent to contemporise the noise criteria and include both Open Cut and Underground operations noise impacts under the one criteria.

The application to modify the Open Cut development to improved Bulga Complex noise management and the associated community consultation was undertaken in early 2010 and as such will not be addresses in detail in this AEMR.

#### 4.5.1.1 Open Cut Noise Monitoring Program

Night time attended noise monitoring is undertaken at five locations surrounding the Bulga Coal Complex (McInerney, Lewis/BCM Gate, Fordwich, Russell and Kennedy).The locations of night time attended monitoring sites are illustrated in **Figure 4-4**. The quarterly attended noise monitoring reports are included in **Appendix G**.

The duration of each noise measurement was 15 minutes. A measurement was taken at each site on four nights per quarter, for the duration of the reporting period.

The unattended continuous noise monitoring data has not been used to assess compliance with noise levels, as the contribution of the Open Cut Operations to recorded levels cannot be determined.

**Table 4-7 Average quarterly attended noise monitoring (night time)**

| Location | $L_{Aeq}$ (dB) | $L_{A10}$ (dB) | Calculated $L_{A10}$ (dB) | $L_{A90}$ (dB) |
|---|---|---|---|---|
| McInerney | 29-42 | 31-44 | 30-44 | 27-41 |
| Fordwich | 28-39 | 28-44 | 20-39 | 25-35 |
| Lewis/BCM Gate | 35-52 | 37-54 | 32-42 | 31-49 |
| Kennedy | 25-41 | 27-46 | 27-37 | 23-37 |
| Russell | 24-46 | 25-48 | 23-37 | 23-44 |

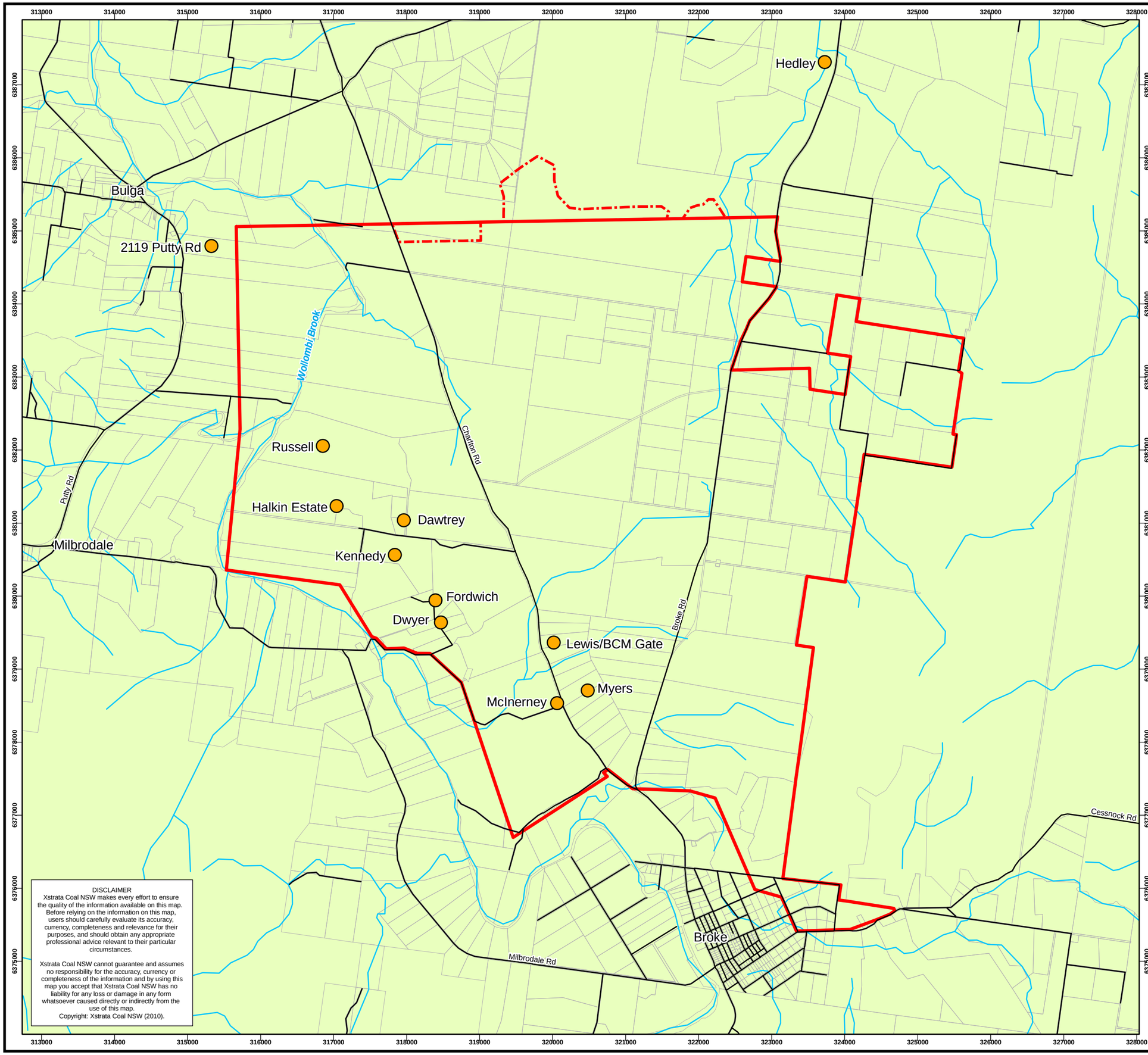
Measured levels at the McInerney site resulted in the negotiation of a private agreement with the landholder in recognition of the operations noise impact on the property.

During quarter one monitoring, excluding the McInerney receiver, the Kennedy receiver registered 37dB and was not considered a significant exceedance in line with Chapter 11 of the EPA 'Industrial Noise Policy'. Quarter two monitoring showed two exceedance events at the McInerney receiver, this resulted in the establishment of a private agreement as mentioned previously. Quarter three monitoring showed one exceedance outside of the Industrial Noise Policy Guidelines at the Fordwich receiver. Finally, quarter four monitoring showed no significant exceedance of the Industrial Noise Policy Guidelines.

### 4.5.2 Underground Operations

Noise criteria for the Underground Operations are specified in the development consent approval conditions (DA 376-8-2003) for continued Underground Operations. The criteria apply for specific residences and for sensitive receptors on privately owned land. The relevant noise criteria are presented in **Table 4-8**.

# Figure 4-4
# Bulga Coal Complex
# Noise Monitoring Sites




## Legend

- Noise Monitoring Sites
- Roads
- Waterways
- Cadastre
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

N
W E
S

0 500 1,000 m

1:50,000 @ A3

Projection: GDA 94 MGA 56

**Table 4-8 Noise assessment criteria**

| Property | Day/Evening/Night $L_{Aeq}$ (15 minute) | Night $L_{A1}$ (1 minute) |
|---|---|---|
| Property 20 Lewis | 37 | 47 |
| Property 11/12 – Hope (Now owned by Bulga Joint Venture) | | |
| All other residential or sensitive receptors | 35 | 47 |

Notes:

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

(b) Noise from the development is to be measured at 1 m from the dwelling façade to determine compliance with the LA1 (1 minute) noise limits in the above table.

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

• Wind speeds of up to 3 m/s at 10 m above the ground level; or

• Temperature inversion conditions of up to 3ºC/100 m, and wind speeds of up to 2m/s at 10 m above ground level.

The Noise Monitoring Program for the Underground Operations specifies that all surveys will include four nights of attended monitoring with a 15 minute period of attended monitoring undertaken at each site per night. This ensures a wide range of potential mining noise impacts are sampled, and accounts for variability in atmospheric conditions, which is a major influence in received noise levels offsite. The Noise Monitoring Program was developed in consultation with DECCW and to the approval of DII. The program includes eight monitoring locations, with additional sites added (as required) to assess the success of additional noise controls when implemented or to follow up issues raised by local residents. No additional sites were monitored during the reporting period.

Bulga Coal Complex has a private agreement with Lewis and McInerney which allows for noise levels of up to 60dB(A). Bulga Coal Complex now owns Hope/Halkin Estate, subsequently the noise impact assessment criteria are no longer applicable at this location.

#### 4.5.2.1 Underground Operations noise monitoring 2009

Attended noise monitoring was undertaken quarterly throughout the reporting period at each specified residential receiver. The locations of noise monitoring sites for the Underground Operations are provided in **Figure 4-4**.

Each monitoring event consisted of 15 minute measurements taken once per night at each site for four nights during each quarter. Daytime monitoring was not undertaken as mining operations are mostly inaudible by day compared to background noise. Evening monitoring was also not undertaken as atmospheric conditions during this period (which are a major influence on received noise levels at distant receptors) are similar to night. The full results for the Underground Operations attended noise monitoring are provided in **Appendix G**.

A summary of the attended noise monitoring results for 2009 is provided in **Table 4-9**.

**Table 4-9 Underground Operations 2009 attended noise monitoring results**

| Location | $L_{Aeq\ (15\ minute)}$ (dB)[1] (range of results for all monitoring) | $L_{A1\ (1\ minute)}$ (dB)[1] (range of results for all monitoring) | Underground Operations – Calculated $L_{Aeq\ (15\ minute)}$ (dB)[2] | Underground Operations – Calculated $L_{A1\ (1\ minute)}$ (dB)[2] |
|---|---|---|---|---|
| **McInerney** | 29-42 | 32-45 | Inaudible | Inaudible |
| **Lewis/BCM Gate** | 35-52 | 39-58 | Inaudible | Inaudible |
| **Kennedy** | 25-41 | 29-49 | Inaudible | Inaudible |
| **Halkin Estate** | 26-40 | 31-45 | Inaudible | Inaudible |
| **Russell** | 24-46 | 28-48 | Inaudible | Inaudible |
| **Bulga Village** | 33-41 | 37-44 | Inaudible | Inaudible |
| **Hedley** | 34-53 | 39-63 | Inaudible | Inaudible |
| **Fordwich** | 28-39 | 34-46 | Inaudible | Inaudible |

[1] Levels in these columns are not necessarily the result of Underground Operations.

[2] These are the calculated $L_{Aeq}$ and $L_{A1}$ of the Underground Operations in the absence of all other noise sources.

The results of the attended noise monitoring indicate that the Underground Operations were inaudible at all monitoring sites during each monitoring event undertaken in 2009.

## 4.6 Blasting

Blasting of overburden to expose and efficiently recover the underlying coal seams can impact on the local receptors. These impacts are most commonly experienced in the form of vibration, both through the air (overpressure) and through the earth (ground vibration). Other impacts include the generation of dust and fume.

Development approval consent and EPL conditions specify criteria for allowable levels of overpressure and ground vibration, experienced at private residences, heritage and other structures. Engineers design blasts to manage and minimise the risk of exceeding these limits and impacting upon sensitive receptors. The data recorded during each blast at blast monitors located in areas surrounding the mine are reviewed and reported against these criteria.

### 4.6.1 Blast criteria and control procedures

Blast criteria are prescribed in the Bulga Coal Complex EPL and in Condition 6.2e of the Open Cut Operations development consent (DA41-03-99). The development consent stipulates that the air blast overpressure level from blasting operations must not exceed 115dBL for more than 5 per cent of the total number of blasts during each reporting period and never exceed 120dBL when measured in the vicinity of any sensitive location (private residence without a current agreement).

Limits for ground vibration caused by blasting have also been specified in the EPL and development consent, and should not exceed a peak velocity of 5 mm/s for more than 5% of blasts and must never exceed 10mm/s at any time, when measured in the vicinity of any sensitive location (private residence without a current agreement).

The limit of 115dBL does not apply to the Lewis property, as the Lewis property has a private agreement with Bulga Coal Complex to allow overpressure up to 140dBL.

Blast emissions are managed in accordance with the Open Cut Operations Blast and Vibration Management Plan. Every blast is monitored at the non-mine owned residence most likely to be affected by the blast. Three residences have a permanent, remotely controlled blast monitor installed at or near the residence. The locations of blast monitors are provided in **Figure 4-5**.

### 4.6.2 Blast monitoring results 2009

There were 126 blasts during the reporting period. All blast monitoring results are included in **Appendix H**. The blast monitors had a 99.2% capture rate during the reporting period, with only one blast event failing to be captured on 15 June 2009. An investigation was conducted to determine the approximate overpressure and ground vibration levels of this blast based on charge size and distance to receptor. The investigation concluded that the blast was likely in compliance with the criteria. The calculated levels determined during the investigation have been incorporated into the 2009 blast monitoring results.

During 2009, there was one blast that exceeded the air blast overpressure threshold of 120dBL, recorded at the Hedley residence on 4 April 2009. The exceedance of 120dBL at the Hedley property was reported to DECCW via the Environment Hotline and subsequent written notification as per conditions in Environmental Protection Licence 563. The likely cause of the exceedance was a temperature inversion that was present at the time the blast was fired.

The number of blasts exceeding the threshold of 115dBL equates to 0.8% of the 126 blasts conducted during 2009. This level is within compliance with Condition 6.2(e) of the Open Cut Operations development consent (DA 41-03-99) which allows for 5% of blasts to exceed the 115dBL threshold.

The overpressure limit of 140dBL which applies to the Lewis property was not exceeded during the reporting period.

There were no exceedances of the 5 mm/sec criteria for vibration during the reporting period.

## 4.7 Air quality

Given the scale and the nature of mining activities at the Bulga Coal Complex and close proximity to the local community, the management of dust emissions is an important issue. This section presents the air quality (dust) criteria, monitoring program and results.

### 4.7.1 Air quality criteria

The Open Cut Operations development consent condition 6.1.2(c) requires that dust emissions from the Open Cut Operations do not exceed the DECCW air quality criteria at non-mine owned residences. The DECCW air quality criteria is provided in **Table 4-10**. It should be noted that the dust monitoring data includes dust generated from all sources received at the specific monitoring points including other mining operation, natural and man made (i.e. farming and road traffic). These external contributors to dust emissions and meteorology need to be taken into consideration when interpreting monitoring results.

# Figure 4-5
# Bulga Coal Complex
# Blast and Vibration Monitoring Sites

Hedley
Bulga
EWU2
EWU1
Wollombi Brook
Charlton Rd
Putty Rd
Dawtrey
Milbrodale
Lewis
Broke Rd
Broke
Milbrodale Rd

## Legend

- Blast Monitoring Site
- Early Warning Unit
- Roads
- Waterways
- Cadastre
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

N
W E
S

0 500 1,000 m

1:50,000 @ A3

Projection: GDA 94 MGA 56

**Table 4-10 Air quality criteria**

| Pollutant | Averaging period | Criterion |
|---|---|---|
| Deposited Dust* | Annual (maximum increase in deposited dust level) | 2 g/m$^2$/month |
| | Annual (total deposited dust level) | 4 g/m$^2$/month |
| Total suspended particulate (TSP) matter | Annual | 90 μg/m$^3$ |
| Particulate matter < 10μm (PM10) | 24-hour | 50 μg/m$^3$ |
| | Annual | 30 μg/m$^3$ |

* Dust is to be assessed as insoluble solids as defined by AS 3580.10.1-2003.

The criteria listed in **Table 4-10** also apply to the Underground Operations, as specified in Conditions 22 and 23 of the Underground Operations Development Consent.

## 4.7.2 Air quality monitoring

Bulga Coal Complex operates a comprehensive air quality monitoring system composed of 30 depositional dust gauges, 3 high volume air samplers for total suspended particulates (TSP) and 4 High Volume Air Samplers (HVAS) for particulate matter (PM10). Additionally Bulga Coal Complex shares monitoring data with Mount Thorley Operations who operate two dust gauges (MTOD3 and MTOD9) and two high volume air samplers for TSP and PM10 (MTO) which supplement the Bulga Coal Complex monitoring network. The locations of air quality monitoring sites for the Bulga Coal Complex are illustrated in **Figure 4-1**.

All monitoring is undertaken by qualified consultants in accordance with:

- AS 2724.3-1984 Ambient air – Particulate matter – Determination of total suspended particulates (TSP) – High volume sampler gravimetric method.
- AS 3580.10.1-2003 Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method.

The depositional dust gauges are sampled monthly to determine insoluble matter and ash content. Total Suspended Particulates (TSP) are measured by four HVAS. Five HVAS sample for $PM_{10}$ fine particulates. The HVAS record TSP and PM10 for a period of 24 hours every sixth day. All samples are analysed at a NATA approved laboratory.

## 4.7.3 Dust deposition monitoring

Dust deposition monitoring was undertaken throughout the reporting period at 32 sites located within and surrounding the Bulga Coal Complex. The location of depositional dust monitoring sites for the Bulga Coal Complex are illustrated in **Figure 4-1**.

Results of the dust deposition monitoring are analysed on a monthly basis for insoluble solids and these results are presented in **Appendix I** and graphically in **Figures 4-6a and 4-6b**. To determine compliance, the annual average dust deposition levels are compared to the criterion listed in **Table 4-10**.

Results recorded at the dust deposition gauges representative of sensitive receivers (gauges located on privately owned property) are included in **Appendix I** and presented graphically in **Figure 4-6b**. The results of all sensitive receivers dust deposition gauges complied with the criterion.

The results of the eleven dust deposition gauges (B2, C1, C2, C3, C4, D3, D5, E1, N4, MTO D3 and MTO D9) that are located on mine owned land and close to active mining operations are presented in **Appendix I** and **Figure 4-6b**. Due to their proximity to active mining areas, these gauges are not representative of sensitive receptors and are used solely for modelling and comparative purposes. Therefore, the criteria presented in **Table 4-10** above should not be applied to the results from these gauges. However, it should be noted that with the exception of gauges C1, C2 and MTO D9, the dust deposition results during the reporting period remained below the 4 g/m$^2$/month limit.

When compared with 2008 results, there was a general increase in the levels of deposited dust recorded during 2009 as shown on **Figures 4-6a** and **4-6b**. On further review it was identified that there was a very similar number of rain days in 2008 (100) and 2009 (104) and that the regional dust storm that impacted the majority of the east coast of Australia around the 23 September 2009 had significantly skewed the annual average results. In order to make a more relevant comparison of the 2008 and 2009 annual averages the 2009 October results (which included the dust from 23 September event) were replaced with the 2008 October results. The modified 2009 results (including 2008 October data) are also included in **Appendix I** and **Figures 4-6a** and **4-6b**. In general, the 2009 annual average (including the 2008 October data) was lower than the 2008 averages. This decrease is illustrated for both onsite and off-site gauges in **Figure 4-6a** and **Figure 4-6b** below.

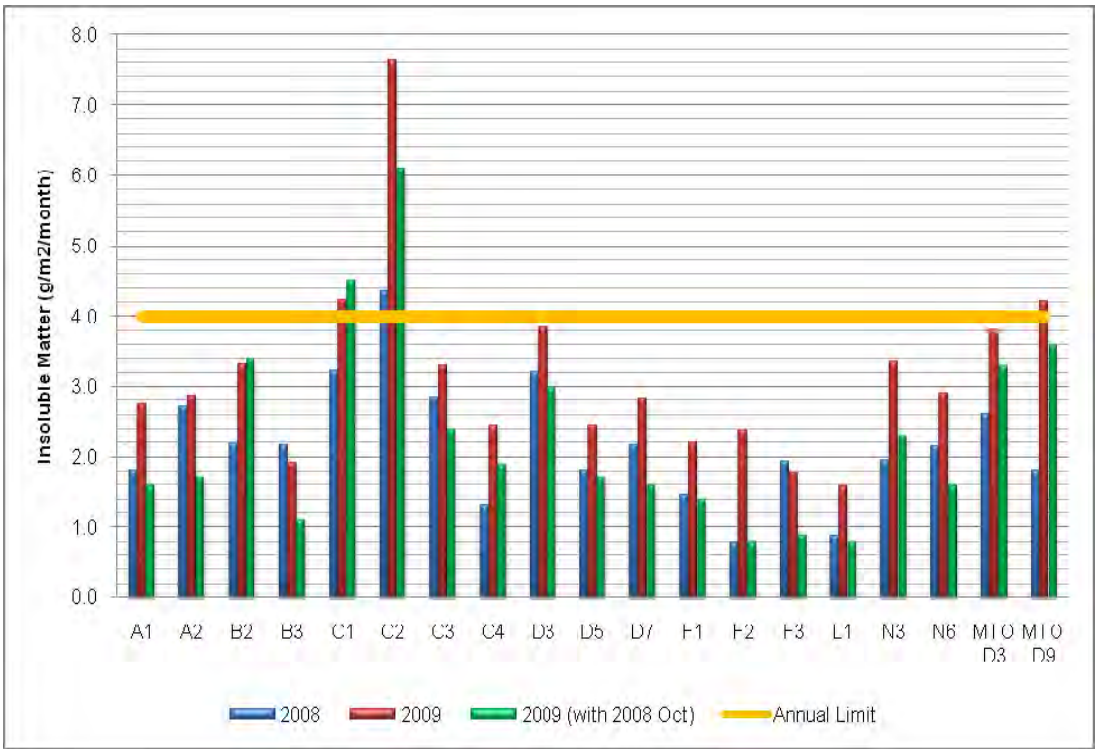



**Figure 4-6a Comparison of onsite (non-sensitive receptor) dust deposition gauges 2008-2009**

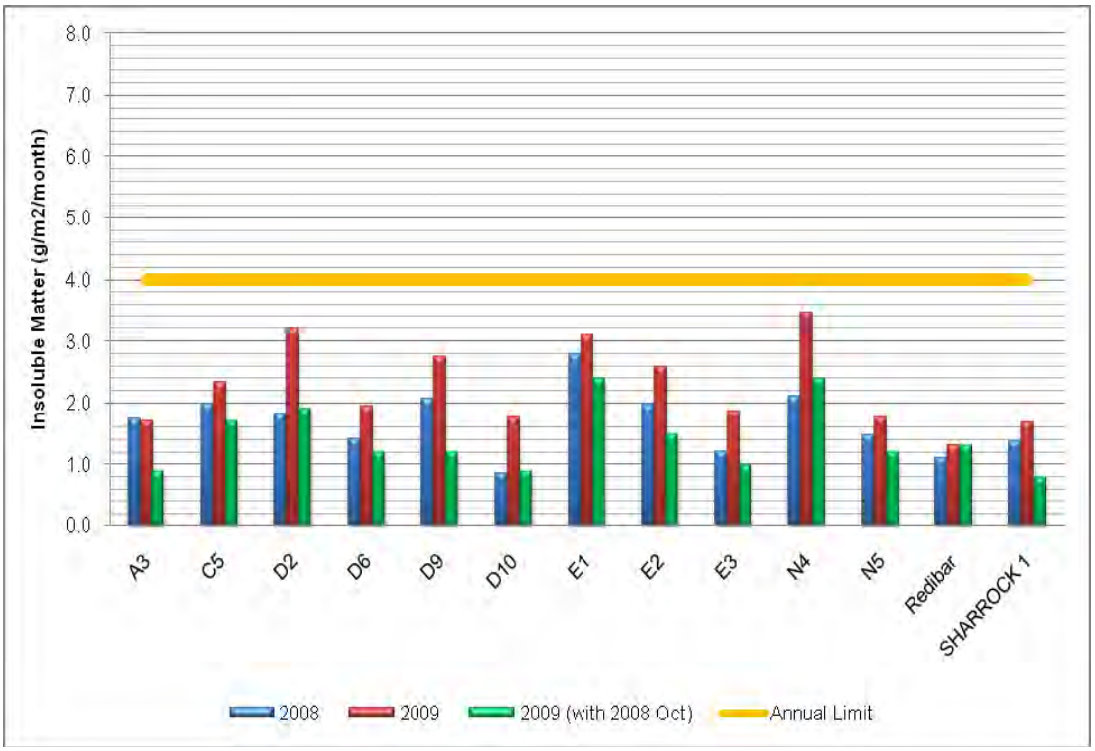



**Figure 4–6b Comparison of off-site (sensitive receptor) dust deposition gauges 2008-2009**

## 4.7.4 High volume air sampling

There are a total of nine high volume air samplers (four TSP and five $PM_{10}$) surrounding the Bulga Coal Complex. The locations of these HVAS are illustrated in **Figure 4-1**.

### 4.7.4.1 Total suspended particulate results

The TSP results for the samplers located at D10, Dawtrey, HVAS1 and MTO-TSP1 are presented in **Appendix I**. The results show that, with the exception of HVAS1, Bulga Coal Complex complied with the TSP annual average criteria of 90µg/m$^3$ at all samplers during 2009. Again it should be noted that the HVAS1 monitor is located in very close proximity to the mining operations on mine owned land and as such the criteria does not apply.

### 4.7.4.2 $PM_{10}$ results

Concentrations of $PM_{10}$ were sampled at the H1, Beltana, Dawtrey, D10 and MTO-PM10 high volume air samplers at 6 daily intervals during 2009 as required. The $PM_{10}$ monitoring results are presented in **Appendix I**.

The $PM_{10}$ results from Beltana, Dawtrey, D10 and MTO-PM10 high volume air samplers met the annual criteria (annual average of 33 µg/m$^3$) and only one exceedance on the short term criteria (MTO $PM_{10,}$ 8/12/09, 57µg/m$^3$). The H1 results (annual average of 33 µg/m$^3$) did not meet the annual criteria (30 µg/m$^3$ and on a number of occasions the short term criteria (50 µg/m$^3$). The exceedances are presented in **Table 4-11** and are discussed further below.

Unfortunately the H1 high volume dust monitor is located adjacent to a dirt road which is trafficked by the neighbouring mushroom compost business on a frequent basis. Investigations have not identified a suitable alternate location for this monitor with the northern neighbour not amenable to having it located on his property.

**Table 4-11 $PM_{10}$ results exceeding 24 Hour criterion of 50µg/m$^3$**

| Date | Monitor | Result (µg/m$^3$) |
|---|---|---|
| 6/1/09 | H1 | 69 |
| 24/1/09 | H1 | 57 |
| 19/3/09 | H1 | 56 |
| 25/3/09 | H1 | 101 |
| 12/5/09 | H1 | 66 |
| 4/8/09 | H1 | 55 |
| 16/8/09 | H1 | 66 |
| 28/8/09 | H1 | 67 |
| 21/10/09 | H1 | 71 |
| 20/11/09 | H1 | 80 |
| 8/12/09 | H1 | 55 |
| 8/12/09 | MTO $PM_{10}$ | 57 |

The cumulative 24 hour criterion for $PM_{10}$ (150µg/m$^3$) was not exceeded at any point during the reporting period.

Due to the large number of exceedances at the H1 monitoring site throughout the reporting period, the Bulga Coal Complex engaged an expert consultant PAE Holmes to review the dust monitoring data and determine the likely causes of these elevated results.

The PAE Holmes review concluded that only one of the eleven exceedances could be attributed solely to the Bulga Coal Complex, but that even this result was questionable due to the meteorological conditions on the day. The findings of the PAE Holmes report are summarised in **Table 4-12** below and the full report is provided in **Appendix J**.

**Table 4-12 Summary of PAE Holmes Air Quality Assessment Report**

| Date | H1 concentration above 50µg/m$^3$ | Is the dominant wind direction blowing across Bulga towards H1 | Percentage of winds blowing across Bulga towards H1 | Is it possible that emissions from Bulga contributed significantly to measured $PM_{10}$ concentration at H1? |
|---|---|---|---|---|
| 6/01/09 | 68 | No | ~5% | No |
| 24/01/09 | 57 | No | 10-15% | May have contributed a small percentage but unlikely to have been significant |
| 19/03/09 | 56 | No | <5% | No |
| 25/03/09 | 101 | No | 0% | No |
| 12/05/09 | 66 | Yes | 10-15% | Yes, but low/calm winds make it hard to be definitive |
| 4/08/09 | 55 | No | 10-15% | May have contributed a small percentage but unlikely to have been significant |
| 16/08/09 | 66 | No | ~15% | May have contributed a small percentage but unlikely to have been significant |
| 28/08/09 | 67 | No | ~10% | May have contributed a small percentage but unlikely to have been significant |
| 21/10/09 | 71 | No | ~15% | May have contributed a small percentage but unlikely to have been |

| Date | H1 concentration above 50µg/m$^3$ | Is the dominant wind direction blowing across Bulga towards H1 | Percentage of winds blowing across Bulga towards H1 | Is it possible that emissions from Bulga contributed significantly to measured $PM_{10}$ concentration at H1? |
|---|---|---|---|---|
| | | | | significant |
| 20/11/09 | 80 | No | <5% | No |
| 8/12/09 | 55 | No | <10% | No |

# Figure 4-7 Depositional Dust Isopleth Map

## Legend

- Mine Owned Dwellings
- Private Dwellings
- Depositional Dust Gauge
- Average Annual Depositional Dust (g/m2/month)
- ML1547

N3, N5, D10, F1, A1, N6, F2, D7, A2, B2, C3, L1, F3, B3, Sharrock 1, C4, C5, C1, D2, E2, N4, C2, D3, E1, D5, E3

3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 2.5, 1.5, 2

315000 316000 317000 318000 319000 320000 321000 322000 323000 324000 325000 326000

6385000 6384000 6383000 6382000 6381000 6380000 6379000 6378000 6377000 6376000

N

W E

S

0 0.5 1 km

1:35,000 @ A3

Projection: GDA 94 MGA 56

***Note: contouring algorithm = kriging***

#### 4.7.4.3 Trend analysis

Trends for the past five years of monitoring at D10-TSP, Dawtrey-TSP, and HVAS1-TSP (4 years only) are provided in **Figure 4-8a**. The results of TSP monitoring indicate a slight overall increase in the monitored results displayed for the D10-TSP and Dawtrey-TSP sites. The HVAS1-TSP site has undergone large fluctuations in dust levels over time and displays a general upward trend since the monitor was installed in 2006.


**Figure 4-8a Long term annual rolling averages for TSP**

The data trends for the past five years for H1 $PM_{10,}$ Beltana $PM_{10}$, Dawtrey $PM_{10}$ and D10 $PM_{10}$ are provided in **Figure 4-8b**. The figure highlights minimal inter-annual variability for most sites and that there is no overall increase or decrease in the results over the last five years.


**Figure 4-8b Long term annual rolling average for $PM_{10}$**

## 4.7.5 Ventilation monitoring

The Underground Operations development consent conditions specify that ventilation monitoring be undertaken within three months of commissioning a new shaft. The vent shaft is to be monitored for the parameters shown in **Table 4-13** below. All results are then submitted to DECCW. Although the Blakefield South Ventilation Shaft 1 was constructed in late 2008, it was not fully commissioned and sampled until 2009.

**Table 4-13 Ventilation monitoring parameters**

| Parameter | Units | Sampling method |
|---|---|---|
| Solid Particles | $mg/m^3$ | TM-15 |
| Odour | OU | OM-7 |
| Velocity | m/s | TM-2 |
| Volumetric flow rate | $m^3/s$ | TM-2 |
| Temperature | oC | TM-2 |
| Moisture | % | TM-22 |
| Dry gas density | $kg/m^3$ | TM-23 |
| Molecular weight of stack gases | g/g.mol | TM-23 |
| Carbon dioxide | 5 | TM-24 |
| Selection of sampling positions | - | TM-1 |

A further requirement of the consent is that a comparison be made between the sampling undertaken and the odour and dust ranges used in the dispersion modelling study in the Statement of Environmental Effects for the Bulga Underground - Southern Mining Area Modification - Section 96(2) Application to Modify Consent DA 376-8-2003. The results were as follows:

**Dust impacts**

The estimated TSP dust emission from underground ventilation air used in the 2007 SEE was 21,420kg/yr. The mass emission rate measured from the Blakefield South Ventilation Shaft 1 was 0.285g/s, which equates to 8,988kg/yr.

**Odour**

For air quality assessment purposes in the 2007 SEE an odour level of 170ou was assumed for the underground ventilation air. When an odour level of 170ou was used in the AUSPLUME dispersion model it was found that no residence was predicted to exceed the EPA assessment criterion of 7ou. The odour level measured from the Blakefield South Ventilation Shaft 1 was 79ou.

Therefore, the independent sampling of the Blakefield South Ventilation Shaft 1 was found to be compliant against both Condition 4.27 and Condition 4.28 of Underground Operation's development consent. The complete report by Stephenson Environmental Management Australia is provided in **Appendix K**.

## 4.8 Water management

### 4.8.1 Bulga Coal Complex overview

Water management for the Open Cut and Underground Operations is undertaken using a whole of complex approach. The water management controls implemented at Bulga Coal Complex aim to:

- Minimise the contamination of clean water runoff from catchment areas upslope of the operations.
- Securely contain mine water (groundwater and surface water which reports to open cut and underground mining areas), and other site water that comes into contact with areas disturbed by mining activities – including overburden emplacement areas, coal stockpiles and the coal handling and preparation plant area.
- Maximise reuse of mine water to preferentially meet on-site water consumption requirements, principally for use at the CHPP and dust suppression. Water from mine dewatering, tailings decant and run off from overburden/coarse rejects disposal areas are used preferentially to water sourced from the Hunter River.
- Provide secure access to make-up water to meet ongoing water supply requirements during periods when there is insufficient water available from the water management system.
- Manage disposal of excess water discharge to the Hunter River via the Hunter River Salinity Trading Scheme in the event that an excess water inventory exists on site beyond projected future requirements.

The water management system is illustrated as a schematic diagram in **Figure 4-9** (taken from Gilbert & Associates Site Water Balance). The major uses of water on site are in the CHPP, dust suppression and in Underground Operations.

Diversions have been constructed to divert runoff from non-disturbed areas around mining areas. Diversion bunds also collect runoff from rehabilitated overburden emplacement areas and are discharged around mine water storages to local drainages.

Fine coal tailings are thickened at the CHPP prior to being pumped to the Deep Pit North tailings storage facility.

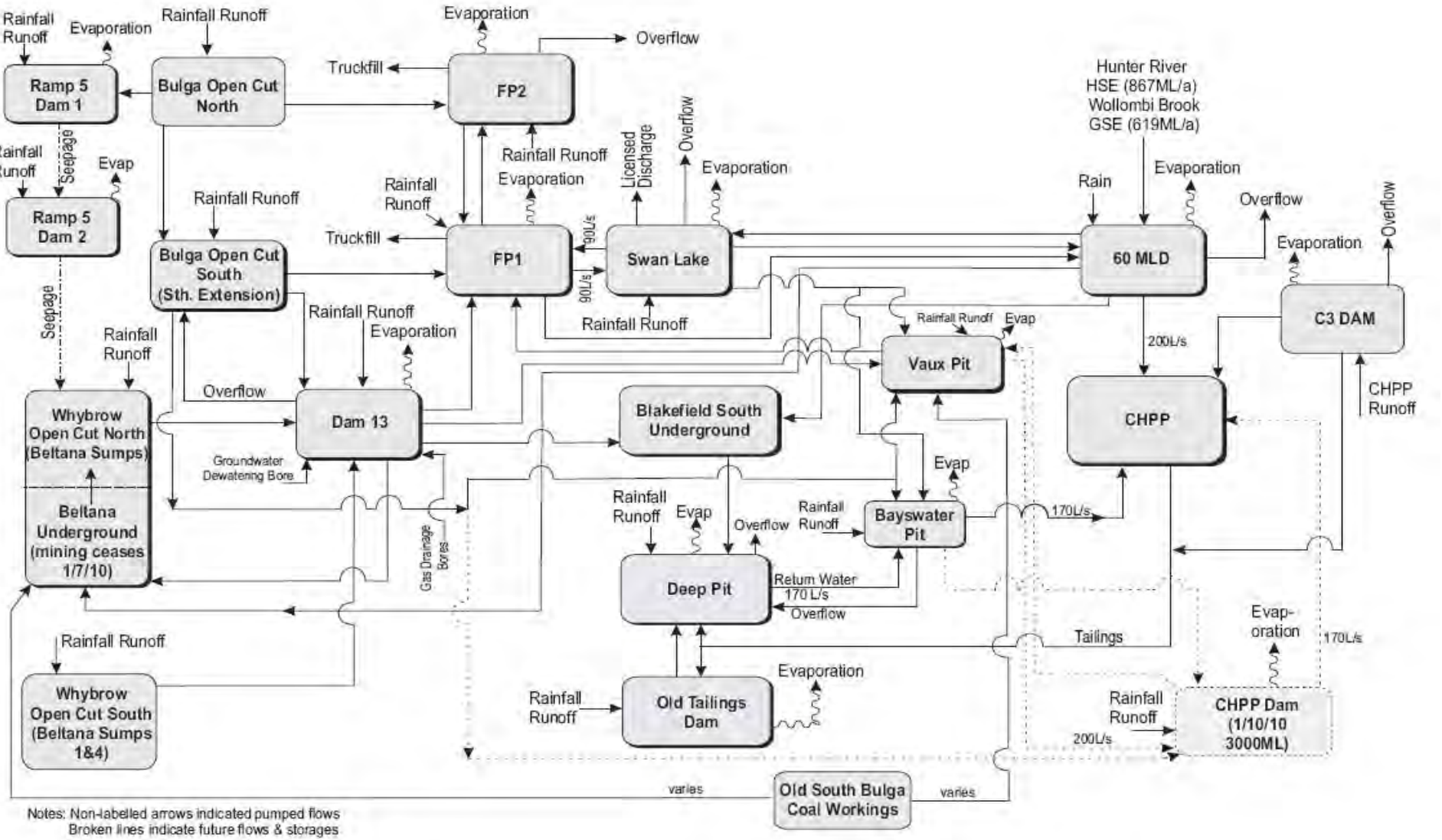



**Figure 4-9 Bulga Coal Complex site water management system**

### 4.8.2 Coal handling and preparation plant area and workshop water management

The CHPP utilises water to wash ROM coal to meet customer specifications. The CHPP produces paste thickened tailings and coarse rejects. As outlined above, the tailings are currently deposited at Deep Pit North. Coarse reject and paste are disposed of in the overburden emplacement areas as waste.

The total consumption of water in the CHPP during 2009 was 3,424 ML with 2,672 ML recovered from the resultant tailings ending up with a net consumption of 752 ML. The net consumption comprised of 747 ML sourced from raw water stored on site (intercepted rainfall run off) and 5 ML from the Hunter River. The 5 ML from the Hunter River was mistakenly imported.

**Table 4-14 Bulga Coal Complex 2009 CHPP water supply**

| Source | Water volume supplied (ML) |
|---|---|
| Tailings | 2,672 |
| Mine raw water (rainfall runoff ) | 747 |
| Hunter River extraction | 5 |
| Total | 3,424 |

### 4.8.3 Underground Operations water management

The raw water demand for the Underground Operations is primarily for dust suppression and electrical motor cooling purposes associated with the Beltana Longwalls and Blakefield South Development.

The 2009 Underground water balance is summarised in **Table 4-16**.

**Table 4-15 Underground Operations water supply and waste water production 2009**

| Source | Raw water supply (ML) | Underground consumption (ML) | Discharge to Open Cut (ML) |
|---|---|---|---|
| Groundwater Seepage to Underground Operation | 409 | 301 | 108 |
| Water Re-circulated from the Goaf | 226 | | |
| Hunter River | 0 | 0 | 0 |
| Captured Surface Water Run Off | 113 | | 113 |
| **Total** | **748** | **301** | **221** |

Of the 635 ML recovered from the Beltana Dewatering Bore, 409 ML was calculated to be groundwater inflow. The groundwater inflow equates to approximately 1.12 ML/day which is close to the Bulga Coal Continued Underground Operations EIS groundwater model predictions of 1.1ML/day for the corresponding year 7 period.

The installation of a water filter in the Beltana raw water supply system and modifications to the Blakefield South raw water supply circuit have negated the need to import water from the Hunter River. This has reduced the Hunter River water use from 190 ML during 2008 to nil during 2009.

### 4.8.4 Open Cut Operations water management

A large proportion of the water utilised by the Open Cut Operations is used for dust suppression on haul roads. The water for dust control is supplied from two 'quick fill' dams which are topped up from other water storages, including mine water from the Underground Operations. The volume of water used for dust suppression of surface haul roads in 2009 was approximately 590ML.

### 4.8.5 Bulga Coal Complex water balance

The Bulga Coal Complex has two water balance models to assist in the management of water onsite. The short term water balance model is primarily an operational management model which is used to review performance and to undertake short term projections (12 months) of the water requirements. The longer term water management planning model predicts water needs for the life of the mine. Major water transfers are monitored via a series of flow meters and water storage volumes are measured each week. The data is used in the water balance model to assist in making water management decisions.

Results of a water management review based on modelling and monitoring results for the 12 month period ending 31 December 2009 are presented in **Table 4-16** and **Table 4-17**.

**Table 4-16 Annual monitored water flows**

| Water management component | Pumped transfers | Inflow (ML) | Outflow (ML) | In Storage at end of year (ML) | Capacity (ML) |
|---|---|---|---|---|---|
| Bulga Open Cut | Pit Dewatering to Quick Fill Dam 1 | Not metered | Not metered | 848 | NA |
| Bulga CHPP (Consumption) | Supply from 60 ML Dam | 154 | Nil | | NA |
| Tailings Dams (North & South) | Tailings bleed, Supply to CHPP | 2,201 | 2,689 | 421 | 16,957 |
| Beltana Underground (consumption and supply) | Supply from 60 ML Dam, Dewatering to Dam 13 | 74 (O/C mine water) | 826 (UG dewatering and surface runoff) | NA | NA |
| 60 ML Dam (Hunter River supply point) | Inflows from Hunter River (minimal use in 2009) & Open Cut pit (not metered), Outflows to Swan Lake, Beltana, Open Cut & CHPP | 5 | 264 | 37 | 64 |
| Quickfill Dam 1 | Inflows from Swan Lake, outflow to Truckfill | 228* | 228* | 27 | 42.5 |
| Quickfill Dam 2 | Inflows from Swan Lake, outflow to Truckfill | 139* | 139* | 70 | 70.47 |
| Swan Lake | Inflows from Swan Lake, outflow to QF1/QF2 | Not metered | Not metered | 159 | 267.6 |
| Dam 13 | Inflows from Whybrow/Beltana underground, outflow to QF1 | 346 | Not metered | 97 | 98 |
| Potable Water – Bulga Open-Cut | | 32 | NA | NA | NA |
| Potable Water – Beltana & Blakefield South underground | | 10.7 | NA | NA | NA |

• NA – Not Applicable. - Estimated.

The overall site water balance is summarised in **Table 4-18**.

**Table 4-17 Bulga Coal Complex water balance**

| | Volume (ML) |
|---|---|
| **Water Inventory and Capacity** | |
| Total estimated water stored on site 1 January 2009 | 4,902 |
| Total estimated containment capacity at 1 January 2009 | 6,697 |
| Total estimated water stored on site 31 December 2009 | 5,344 |
| Total estimated containment capacity at 31 December 2009 | 6,697 |
| **Increase in water inventory** | **442** |
| **Inflows** | |
| Water extracted from Hunter River (monitored) | 5 |
| Rainfall and runoff intercepted from mine areas | 3,024 |
| Groundwater recovered from Open Cut Operations | 0 |
| Groundwater recovered from Underground Operations | 409 |
| **Total Inflows** | **3,438** |
| **Outflows** | |
| Evaporation | 1,073 |
| Discharge to Hunter River under HRSTS | 69 |
| Net 'Loss' to tailing disposal storage and product coal | 1,490 |
| Dust Suppression | 590 |
| **Total Outflows** | **3,222** |

## 4.9 Surface water

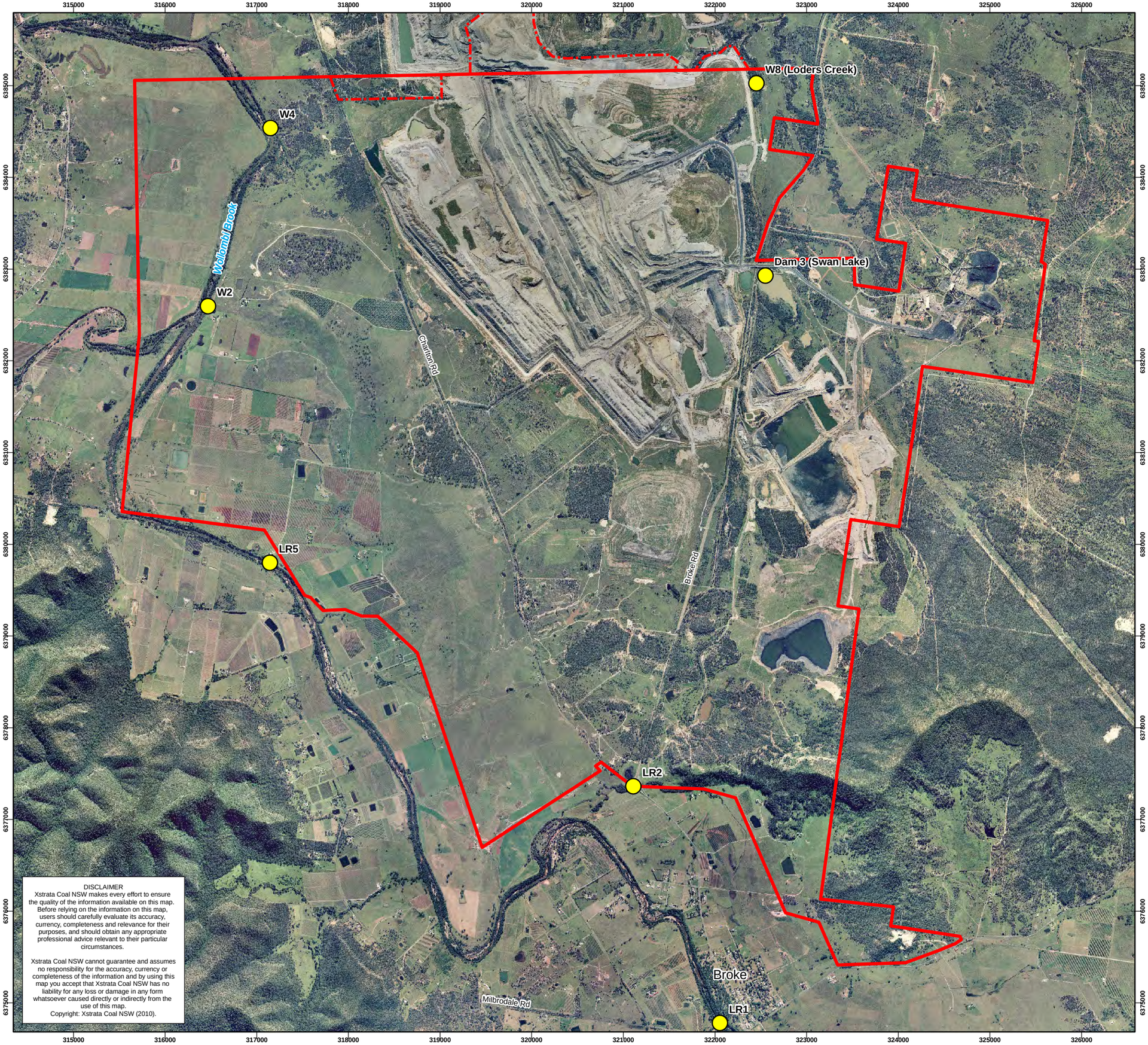
### 4.9.1 Overview

Surface water at the Bulga Coal Complex is managed in accordance with the Site Water Management Plan (SWMP) including monitoring and corrective action response plans. Changes to Development Consent (41-03-99) in November 2009 have prompted a review of the site water management plan in 2010.

Maintenance activities were undertaken on C3 dam and several sediment dams across the site. This primarily involved de-silting, improvements in pumping capacities, inflow channels and access.

### 4.9.2 Surface water monitoring results

Bulga Coal Complex undertakes surface water monitoring at 6 locations on a monthly basis for pH, electrical conductivity (EC) and total suspended solids (TSS). The locations of these monitoring points are illustrated in **Figure 4-10**. The results of surface water monitoring during the reporting period are provided below in **Figure 4-11**, **Figure 4-12** and **Figure 4-13** and in more detail in **Appendix L**.




# Figure 4-10
# Bulga Coal Complex Surface Water Monitoring Sites

## Legend

- Surface Water Monitoring Site
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

N
W E
S

0 500 1,000 m

1:40,000 @ A3

Projection: GDA 94 MGA 56

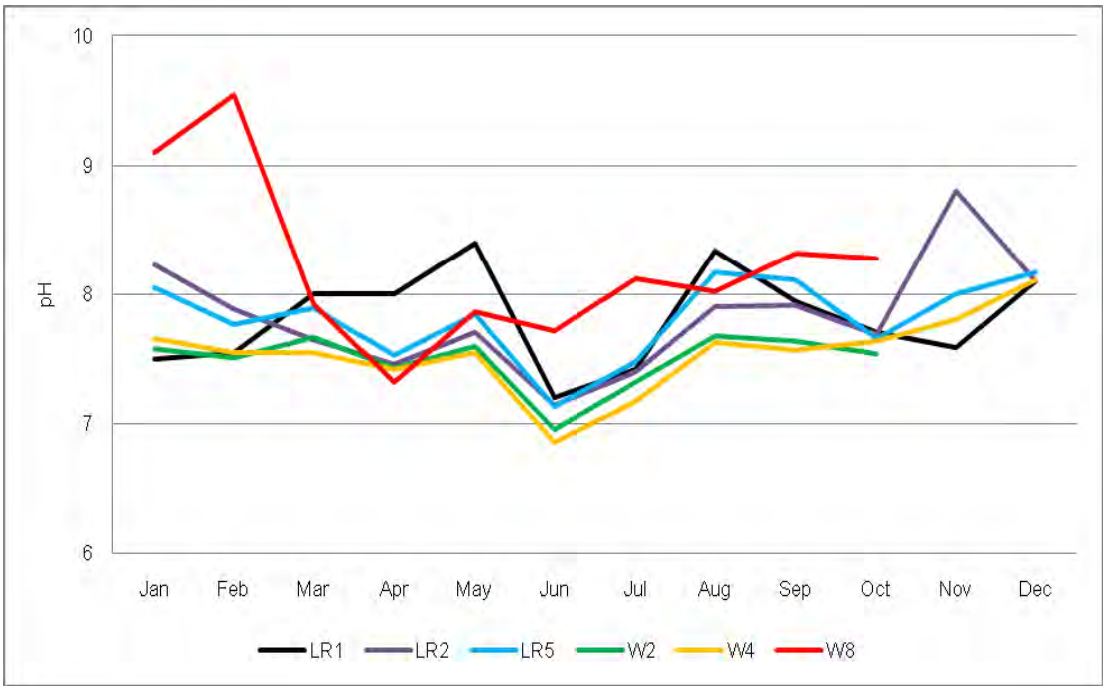



**Figure 4-11 Surface water pH results 2009**

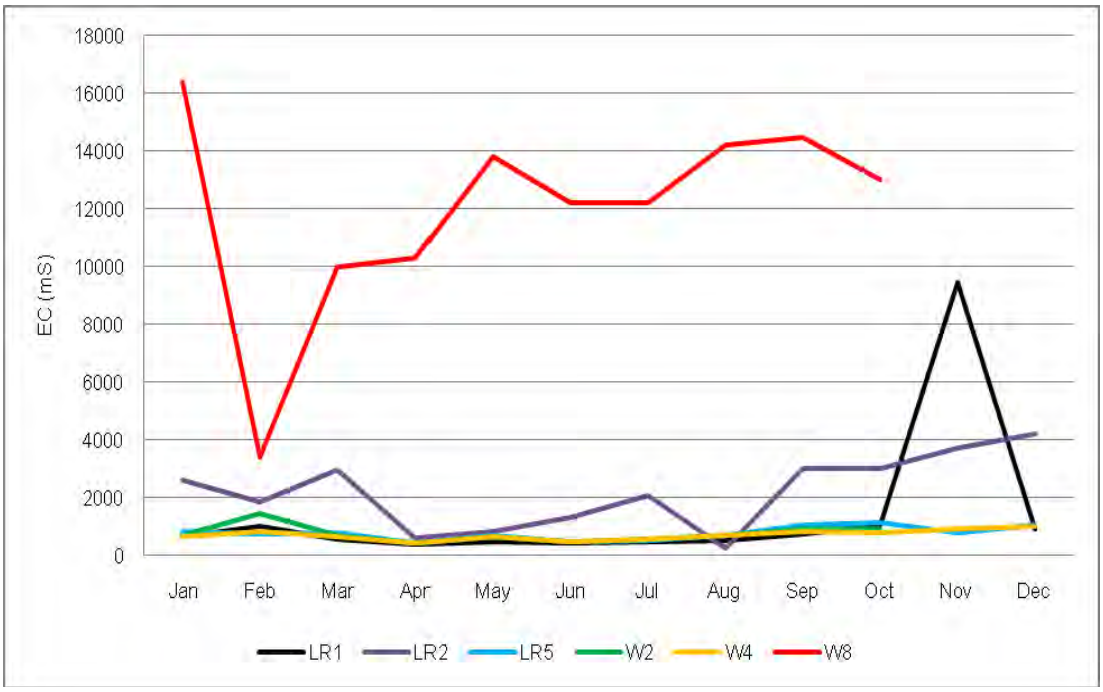



**Figure 4-12 Surface water electrical conductivity results 2009**

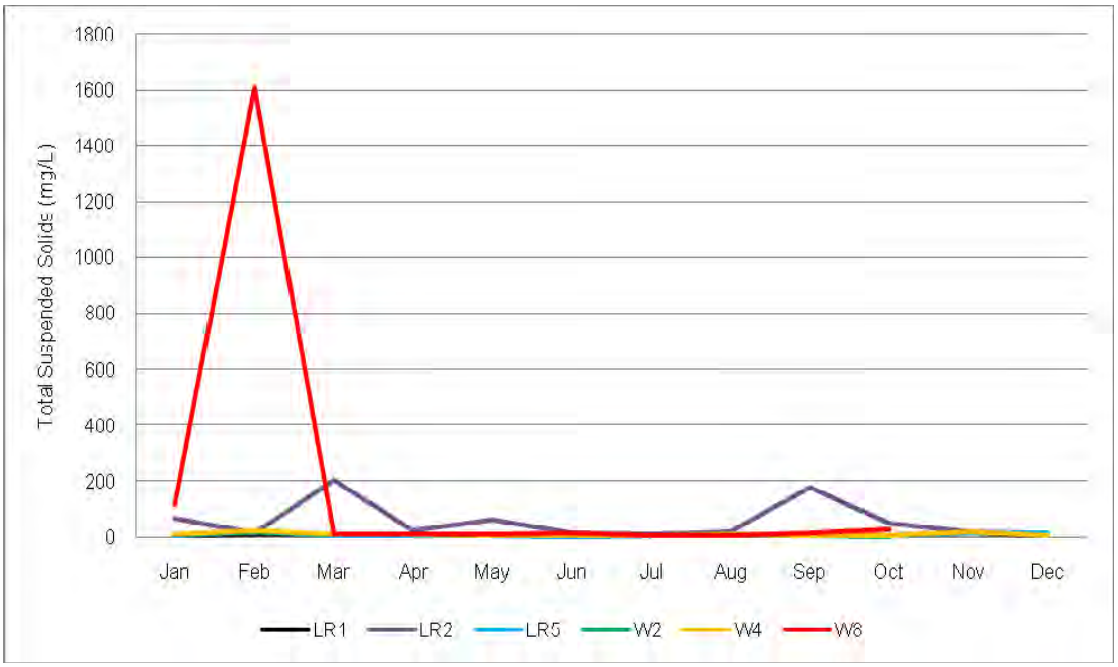



**Figure 4-13 Surface water total suspended solids results 2009**

The approved surface water monitoring sites are located on Wollombi Brook (W2, W4, LR1, LR5), Monkey Place Creek (LR2) and Loders Creek (W8). Monitoring sites LR1 and LR5 are representative of the surface water quality of Wollombi Brook upstream of the Bulga Coal Complex mining operations, while W4 is representative of surface water quality downstream of the mining operation. Monitoring site W8 is the Hunter River Salinity Trading Scheme licensed discharge point.

Generally the monitoring results recorded for all surface water sites remained relatively constant, with the exception of fluctuations in February and November. Monitoring results were within the range recorded during the previous reporting period.

Some elevated TSS results were recorded throughout the period and these results generally correlate with high rainfall events. Electrical Conductivity (EC) was also elevated at some sites throughout the reporting period. The W8 site samples were taken in an evaporative puddle for 75% of samples. In addition to these the February W8 sample was slowly flowing; and November and December sampling runs W8 was dry. The most marked increases were recorded at W2 in February and LR1 in November. A significant decrease in EC was experienced at W8 during February and this is most likely the result of heavy rainfall during that month.

Impacts of the Bulga Coal Complex on stream flow in the Wollombi Brook are determined by comparison of the NSW Office of Water's gauging station records, upstream and downstream of the site. The upstream site is the Wollombi Brook - Brickmans Bridge (Paynes Crossing) gauging station (20135), located approximately 20 km upstream of the Bulga Coal Complex. The downstream site is the Wollombi Brook - Bulga gauging station (210028), located approximately 5 km downstream from the Bulga Coal Complex. The gauging stations demonstrated a consistent level of stream flow between the two sites during 2009. There was no discernable impact from the Bulga Coal Complex on stream flow in the Wollombi Brook. A copy of the gauging station records at the upstream and downstream sites are provided in **Appendix L**.

### 4.9.3 Surface water discharge

Discharges are licensed at three separate locations on site, these being Dam 3 (Swan Lake), Fill Point 2 (Dam 9) and Dam 13. Discharges can occur from the dams simultaneously or from only one dam at a time. The EPL for the Bulga Coal Complex requires the discharge from the dams to be monitored at the dam locations. All discharge points are monitored for volume, pH, total suspended solids (TSS) and electrical conductivity (EC). The EPL requires that Bulga Coal Complex monitors for pH and TSS on all discharges. The EPL stipulates criteria for pH (6.5–9.5) and TSS (120 mg/L).

There was one discharge event from Dam 3 (Swan Lake) during the reporting period. The discharge occurred during April. The water released during the discharge event complied with all criteria stipulated by the EPL. The monitoring results for this discharge event are provided in **Appendix L**.

## 4.10 Groundwater

### 4.10.1 Groundwater monitoring program

Bulga Coal Complex monitors 46 piezometers every two months for depth to water. Groundwater from 44 piezometers is also monitored for pH and electrical conductivity (EC). Groundwater from thirteen of the piezometers are also sampled every six months and analysed for a range of analytes. These sites are located either within the alluvial aquifer associated with both Wollombi Brook and Monkey Place Creek, or the Wollombi Coal Measures. A number of these sites comprise dual piezometer completed to facilitate measurement and comparison of both the shallow and deep groundwater pressures. Shallow piezometers are completed at depths ranging from less than 10 m to more than 30 m while deep piezometers are located and sealed within a specific seam (e.g. Lower Whybrow).

The monitoring locations of all piezometers are shown on **Figure 4-14**, and **Table 4-19** shows a summary of the bi-monthly monitoring regime. **Table 4-20** shows a summary of the six monthly monitoring regime.

At a number of piezometer locations it is not possible to purge the water column within the piezometer, since standpipe size and depth to water generally preclude pumping. In addition, purging may lead to very long recovery periods in the deeper piezometers during which time, measurement of representative seam pressures would prove impossible. Samples are therefore often drawn by bailer from within or near the screened section of a piezometer in order to obtain a reasonably representative sample. Water quality parameters must therefore be viewed as indicative only and largely the result of diffusion and mixing processes between the screened intervals and the static water column. Abrupt changes in basic water quality parameters will be more indicative of changed storage or flow conditions within the piezometric column.

# Figure 4-14
# Bulga Coal Complex Groundwater Monitoring Sites

Mt Thorley Operations
Bulga Pit
Whybrow Pit
CHPP
Tailings Emplacement Area
Broke
Wollombi Brook
Charlton Rd
Broke Rd

WBR50A
V2
WBR181
WBR180
Larkin
WBR182
WBD65
WBR183
NPZ5-A
NPZ5-B
F1
WBD55
WBD55A
McG1
WBD62A
HofH
WBD160
WBD57
WBD57A
NPZ4-B
NPZ4-A
V1
WBR15
NPZ7-1
NPZ7-2A
NPZ7-2B
NPZ7-3A
NPZ7-3B
NPZ3-A
Dwyer
Fernance
NPZ3-B
F2
White 1
P9
S1
P1
P2
P4A
P4B
V3
P5A
P5B
GW10
P6A
P6B
GW9
P7A
P7B
GW8
GW7
GW3
P8
GW1
GW6

## Legend

- Groundwater Monitoring Site
- Beltana No.1 Mine
- Blakefield South Project
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

N
W E
S

0 500 1,000 m

1:40,000 @ A3

Projection: GDA 94 MGA 56

**Table 4-18 Summary of Bulga Coal Complex Bi-monthly Groundwater Monitoring Program**

| Bore ID | Bore depth (m) | Seam | Area | Parameters |
|---|---|---|---|---|
| GW1 | unknown | alluvial | Sales | water level, pH and EC |
| GW3 | 13.2 | alluvial | SBC | water level, pH and EC |
| GW6 | 13.3 | alluvial | SBC | water level, pH and EC |
| GW7 | 10 | alluvial | SBC | water level, pH and EC |
| GW8 | 16 | alluvial | SBC | water level, pH and EC |
| GW9 | 13 | alluvial | SBC | water level, pH and EC |
| GW10 | 16 | alluvial | SBC | water level, pH and EC |
| F1 | 17.4 | alluvial | Fordwich | water level |
| F2 | 14 | alluvial | Fordwich | water level |
| P2 | 21 | shallow coal measures | SBC | water level |
| P5A | <100 | shallow coal measures | SBC | water level |
| P5B | 186 | Lower Whybrow | SBC | water level |
| P6A | <100 | shallow coal measures | SBC | water level |
| P6B | >201 | Lower Whybrow | SBC | water level |
| P7A | 48 | shallow coal measures | SBC | water level |
| P7B | 244 | Lower Whybrow | SBC | water level |
| P8 | | Lower Whybrow | SBC | water level |
| V1 | <30 | alluvial | Beltana | water level |
| V2 | <30 | alluvial | Beltana | water level |
| V3 | <30 | alluvial | SBC | water level, pH and EC |
| WBR50A | 18 | alluvial | Beltana | water level, pH and EC |
| WBD50(N) | 65 | Lower Whybrow | Beltana | water level, pH and EC |
| WBD62A | 27 | Alcheringa | Beltana | water level, pH and EC |
| WBD160 | 18 | alluvial | Fordwich | water level, pH and EC |
| Fernance | unknown | sill-alluvial | Fordwich | water level, pH and EC |
| McG1 | unknown | regolith-sill | Fordwich | water level, pH and EC |
| White 1 | unknown | regolith-sill-alluvium | Fordwich | water level, pH and EC |
| WBR15 | 24 | regolith-sill | Fordwich | water level, pH and EC |
| Dwyer | <30 | alluvial | Fordwich | water level, pH and EC |
| Larkin | unknown | sandstone | Beltana | water level, pH and EC |
| S1 | unknown | unknown | unknown | water level, pH and EC |
| NPZ3-a | 18.43 | Alcheringa | Fordwich | water level, pH and EC |
| NPZ3-b | 51.38 | sandstone | Fordwich | water level, pH and EC |
| NPZ7-1 | 50 | Alcheringa | Fordwich | water level, pH and EC |
| NPZ7-2a | 10.04 | Alcheringa | Fordwich | water level, pH and EC |
| NPZ7-2b | 57.47 | sandstone | Fordwich | water level, pH and EC |
| NPZ7-3a | 17.7 | Alcheringa | Fordwich | water level, pH and EC |
| NPZ7-3b | 54.28 | sandstone | Fordwich | water level, pH and EC |
| NPZ5-a | 15.7 | Alcheringa | Fordwich | water level, pH and EC |
| NPZ5-b | 51.28 | sandstone | Fordwich | water level, pH and EC |
| NPZ4-a | 42.37 | Alcheringa | Fordwich | water level, pH and EC |

| Bore ID | Bore depth (m) | Seam | Area | Parameters |
|---|---|---|---|---|
| NPZ4-b | 63.33 | sandstone | Fordwich | water level, pH and EC |
| WBR180 | 46.0 | alluvial | Fordwich | water level |
| WBR181 | 9 | shallow coal measures | Fordwich | water level |
| WBR182 | 11.5 | alluvial | Fordwich | water level |
| WBR183 | 30.6 | shallow coal measures | Fordwich | water level |

A/B = separate piezometers at the same monitoring location.

**Table 4-19 Summary of Bulga Coal Complex Six-monthly Groundwater Monitoring Program**

| Bore ID | Bore depth (m) | Seam | Area | Parameters |
|---|---|---|---|---|
| F1 | 17.4 | alluvial | Fordwich | water level, depth to ground, depth to standpipe, pH, EC, TDS, chloride, calcium, sulphate, carbonate, bi-carbonate, hydroxide, sulphur, aluminium, iron – filterable, potassium, magnesium, sodium, silica, boron, copper, nickel, phosphors, zinc, manganese, chromium, strontium, arsenic, barium, mercury, lead, cadmium, cobalt, selenium. |
| P6A | <100 | shallow coal measures | SBC | |
| P6B | >201 | Lower Whybrow | SBC | |
| GW3 | 13.2 | alluvial | SBC | |
| GW8 | 16 | alluvial | SBC | |
| GW10 | 16 | alluvial | SBC | |
| McG1 | unknown | regolith-sill | Fordwich | |
| White 1 | unknown | regolith-sill-alluvium | Fordwich | |
| WBR15 | 24 | regolith-sill | Fordwich | |
| NPZ7-2a | 10.04 | Alcheringa | Fordwich | |
| NPZ7-3a | 17.7 | Alcheringa | Fordwich | |
| NPZ5-a | 15.7 | Alcheringa | Fordwich | |
| Larkin | unknown | Alluvial | Fordwich | |
| WBD160 | 18 | Alluvial | Fordwich | |
| WBR180 | 46.0 | shallow coal measure | Fordwich | water level |
| WBR181 | 9 | alluvial s | Fordwich | water level |
| WBR182 | 11.5 | alluvial | Fordwich | water level |
| WBR183 | 30.6 | shallow coal measures | Fordwich | water level |

## 4.10.2 Monitoring results

The following sections contain a brief description and interpretation of the groundwater monitoring data. Additional to this interpretation of the data an independent groundwater assessment for Longwall Panels 11 and 12 has been undertaken by Mackie Environmental Research (MER) (Dec 2009), a copy of which is included in **Appendix M**. It should be noted that the interpretation presented this AEMR and the MER (Dec 2009) report are in agreement.

The New South Wales Office of Water (NOW) have reviewed the MER (Dec 2009) report, the findings of which were included in a letter sent to the Underground Operations in March 2010. A copy of the NOW (Mar 2010) letter is also included in **Appendix M**. The NOW March 2010 letter requested the following be undertaken:

> *'Once mining is completed in the Lower Whybrow seam, further review of anticipated incidental groundwater take by means of mining operations will be required.*

*Better presentation of the water level data for piezometers (WBR 180 to WBR183, NPZ series piezometers, WBR171, F2, V2 and F1) and assessment of the longer term trends prior to the completion of mining Longwall 13.'*

It should be noted that as much as the AEMR presents and interpretation of the groundwater monitoring results to date a supplementary groundwater assessment will be commissioned to address the NOW requests.

#### 4.10.2.1 Broke area alluvial bores

**Figure 4-15** and **Figure 4-16** show the groundwater monitoring results for the Broke area alluvial and shallow (Wollombi) coal measure aquifers.

The hydrographs for the alluvial piezometers (GW1, GW3, GW6, GW7, GW8, GW9, GW10 and V3) and shallow coal measures piezometers (P2, P5A, P7A) exhibit trends consistent with the prevailing conditions and are largely a function of steam flow events.

pH readings continue to be stable while the fluctuations in EC are a result of the alluvial aquifer hydrochemistry responding to recharge events and in situ salinity.

There are no apparent impacts on water levels or water quality parameters from deep (Lower Whybrow) seam depressurisation.

#### 4.10.2.2 Northern area shallow alluvial piezometers

**Figure 4-17** shows the groundwater monitoring results for the Northern area alluvial piezometers.

The trends in the hydrographs in general reflect the prevailing condition and are largely a function of steam flow events in particular the responses of F2, V2 and WBR50A which show water levels returning to historical levels after the mid 2007 recharge event. Longer term trends for hydrographs for piezometers F1 and potentially V1 appear to show overall declines. Both F1 and V1 are located close to Wollombi Brook licensed surface water abstraction points which provide water for approximately 400 acres of vineyards.

The water quality data shows natural fluctuation with.

Further monitoring and investigation is required to determine if there is a measurable impact from coal seam dewatering/depressurisation on the alluvial aquifer water levels. Coal measures piezometers.

#### 4.10.2.3 SBC/Broke area Whybrow seam

**Figure 4-18** shows groundwater monitoring results for the South Bulga Coal (SBC) area deep piezometers located in the Lower Whybrow seam.

The Lower Whybrow piezometers P7B and P8 hydrographs do not appear to have shown any response to depressurization. P5B hydrograph appears to have shown a rise in hydrostatic pressure which may be in response to water being pumping into the South Bulga Underground. P6B water level data appears to show an overall decline.

The salinity on the sampled piezometers appeared to stabilise during 2008 except for P7B which appears to have been contaminated by surface waters.

Further investigation is required to determine the relationship between the SBC goaf water level and Whybrow seam water levels.

#### 4.10.2.4 Northern area Lower Whybrow seam

**Figure 4-19** shows the groundwater monitoring results for the Northern area Lower Whybrow seam piezometers. Both WBD50(n) and WBD65 hydrographs show a marked response to Whybrow Seam depressurisation as is expected.

#### 4.10.2.5 Northern area Alcheringa seam

**Figure 4-20** shows the groundwater monitoring results for the Northern area Alcheringa seam bores with only one WBD62 remaining serviceable.

Both WBD55A and WBD57A have been destroyed by subsidence impacts. As much as there is a noticeable increase in salinity WBD62A continues to show no impact from mine dewatering.

#### 4.10.2.6 Miscellaneous bores and wells

The groundwater monitoring results for other monitoring bores are shown in **Figure 4-21**. These mostly comprise shallow bores and wells that draw on the Wollombi Brook alluvial aquifer or a water bearing zone beneath the Fordwich Sill (most often the Alcheringa seam). All remaining piezometers show responses to the prevailing conditions. McG1 which is a hand dug well into the Fordwich Sill aquifer which appears to have sustained a gradula drop in water level over time with the December 09 water level being approximately 3.8 m below the Jan 03 water level. This McG1 hydrographic response is likely the result of regional depressurisation associated with Whybrow seam dewatering. The EC data shows a marked response to the June 07 recharge event and subsequent return to historic values. The pH data shows what is interpreted to be natural fluctuation.

#### 4.10.2.7 Beltana area NPZ piezometers

The NPZ series of piezometers were constructed to monitor the hydraulic gradients between the end of the longwall panels and the Wollombi Brook alluvial aquifer. The piezometers were constructed in nested pairs, one shallow to monitor the unconfined water level in the regolith-sill and one deeper to enable the determination of the hydraulic gradient (flow from the regolith-sill into the alluvial aquifer or into the underlying stratigraphy). The hydrographs for these piezometers are presented in **Figure 4-22**.

The hydrographic data shows that in general the hydraulic gradient is from the regolithic-sill into the underlying stratigraphy. The shallower piezometer hydrographs have not shown any observable impact from coal seam depressurisation. The hydrographs for deeper piezometers NPZ4B and NPZ5B show drops in pressure resulting from mine dewatering but have remained stable for a number of years. The data for NPZ3 since 2007 appears erroneous.

#### 4.10.2.8 LW 13 and 14 piezometers

In December 2008 piezometers WBR180 to WBR183 were drilled at the commencement end of Longwalls 13 and 14. The location of these piezometers is shown on **Figure 4-14**. The purpose of these piezometers is to monitor the water levels in the alluvial aquifer (WBR181 and WB182) and the underlying shallow coal seams (WBR180 and WB183). The water level data presented in **Figure 4-23** shows that there appears to be a noticeable drop in the shallow coal piezometers water levels for Piezometer WBR180 and to a lesser extent WBR183. It is interpreted that the drop of water (WBR180 and WBR183) is in response to coal seam depressurisation. There also appears to be a muted response in the alluvial aquifer piezometers (WBR182 and WBR182) to coal seam depressurisation. Further monitoring is required to determine if these responses are in fact attributable to coal seam depressurisation or just natural fluctuation in water levels.

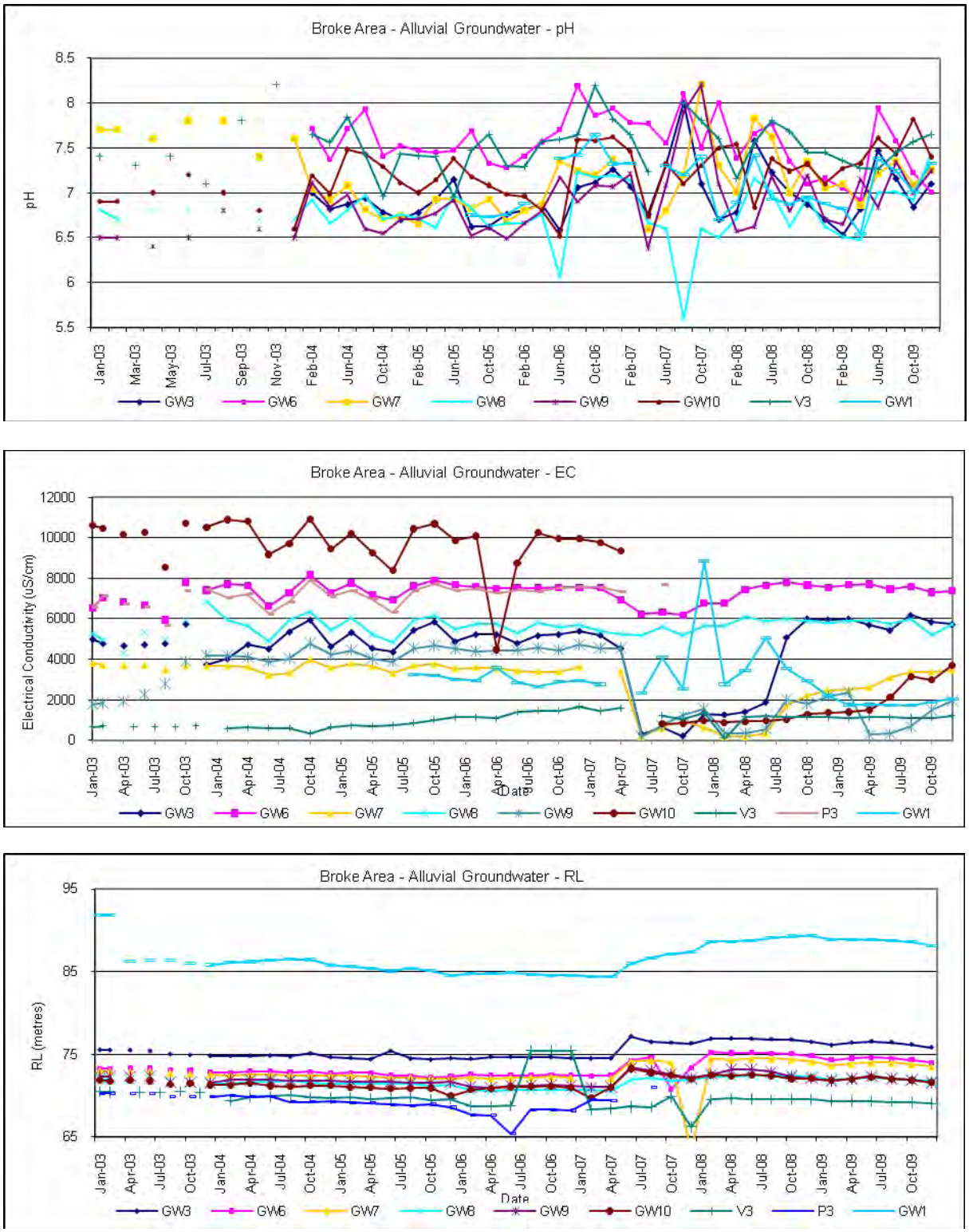



**Figure 4-15 Broke area alluvial groundwater groundwater hydrographs**

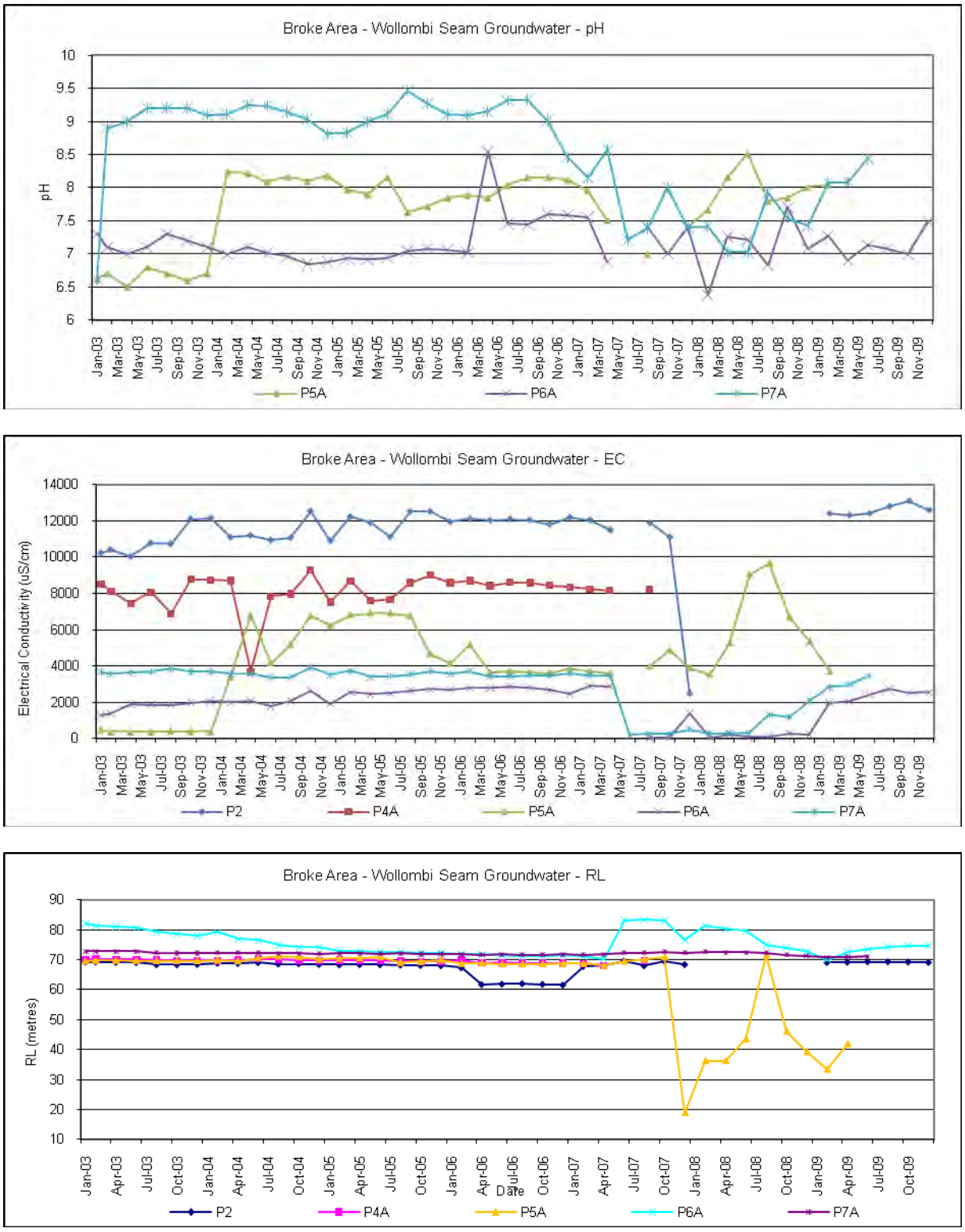



**Figure 4-16 Broke area Wollombi Seam groundwater hydrographs**

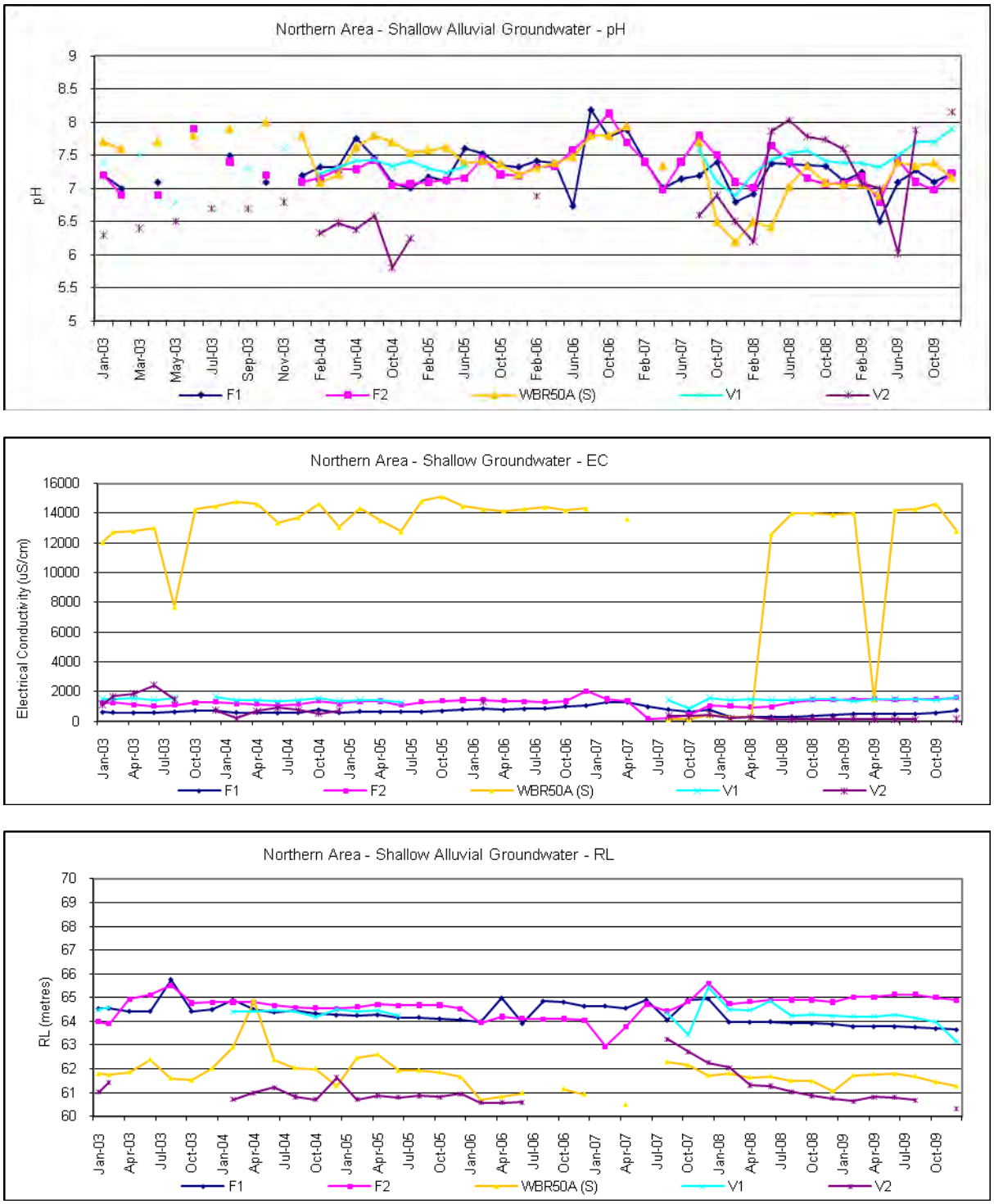



**Figure 4-17 Northern area shallow alluvial groundwater hydrographs**

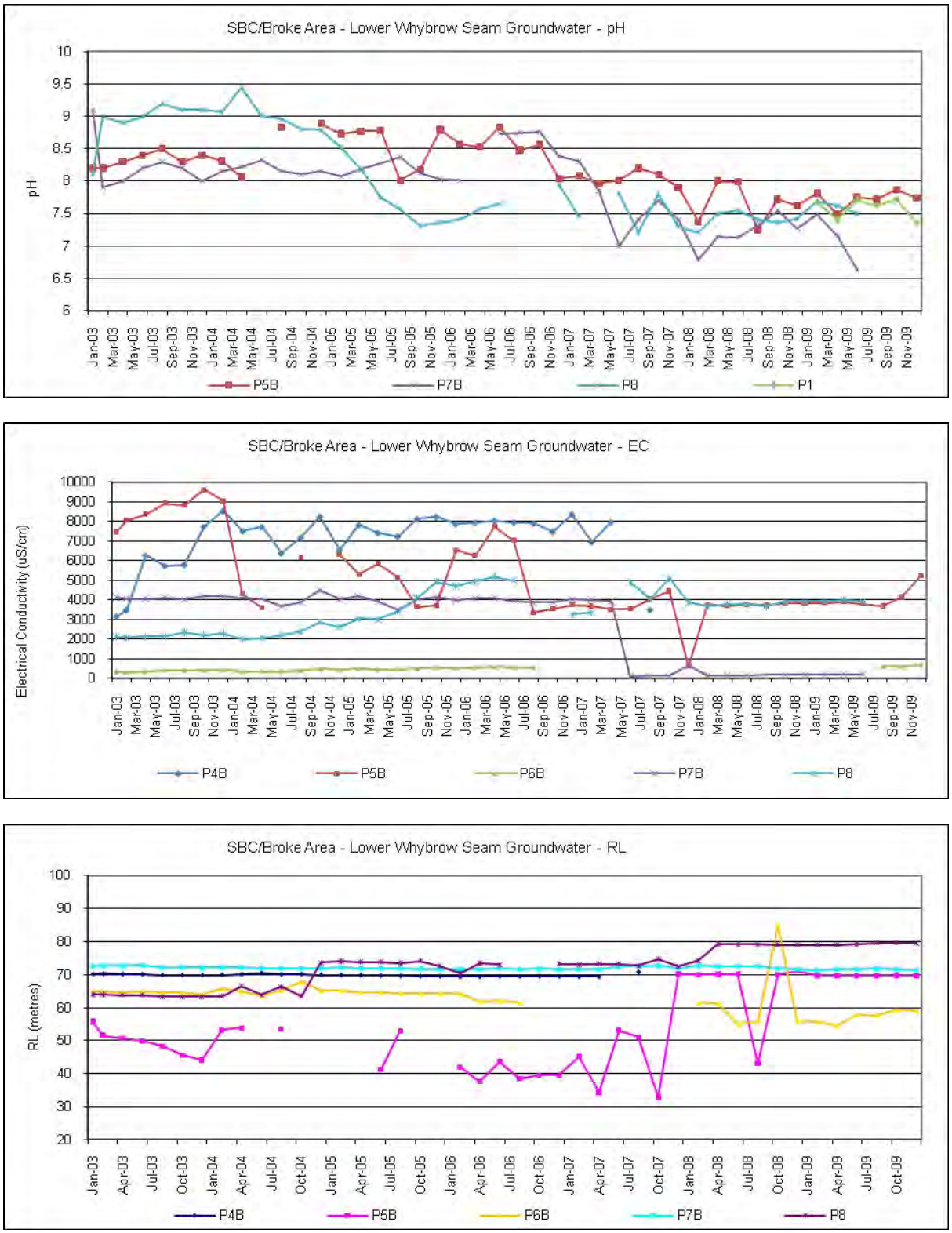



**Figure 4-18 SBC/Broke area lower Whybrow Seam groundwater hydrographs**

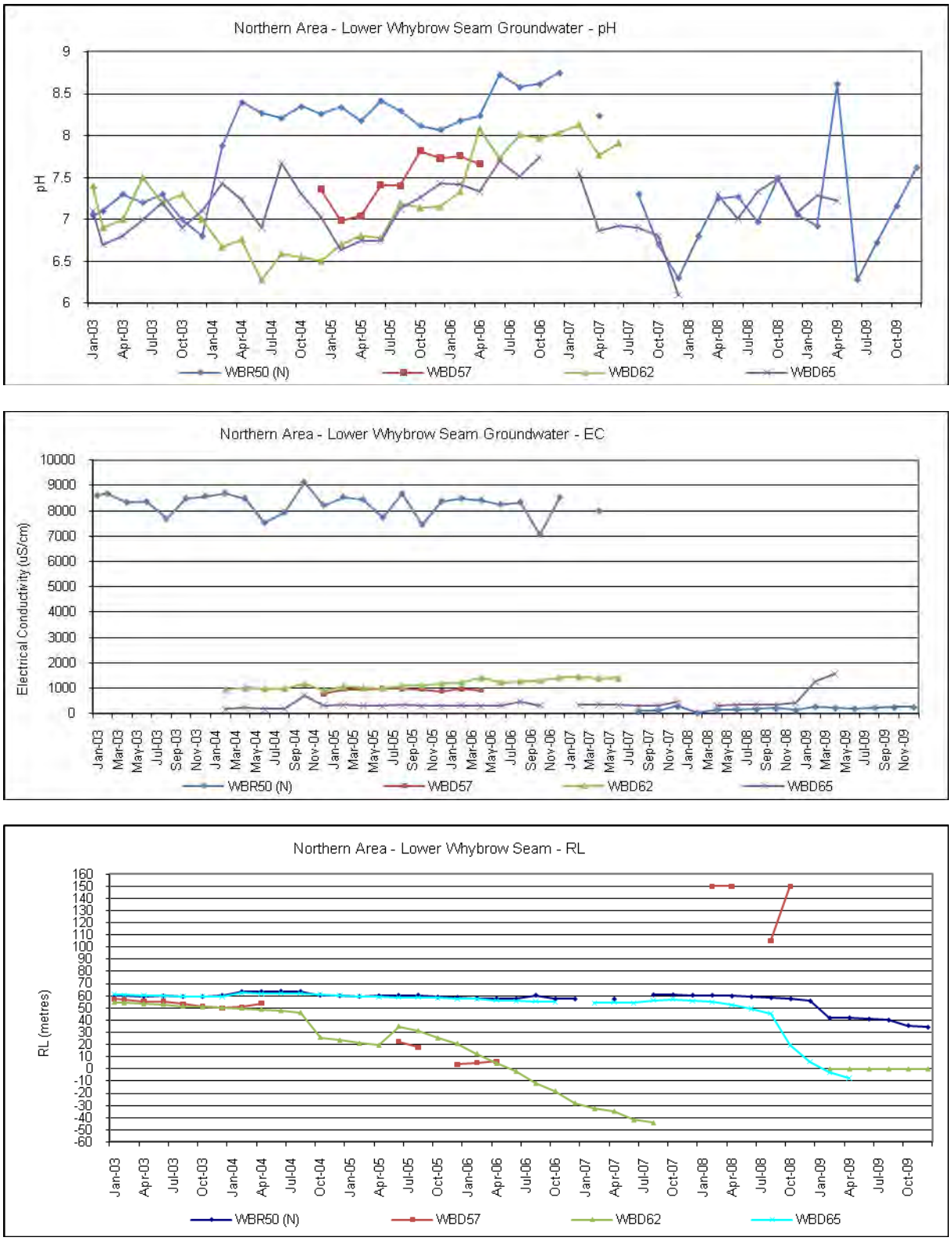
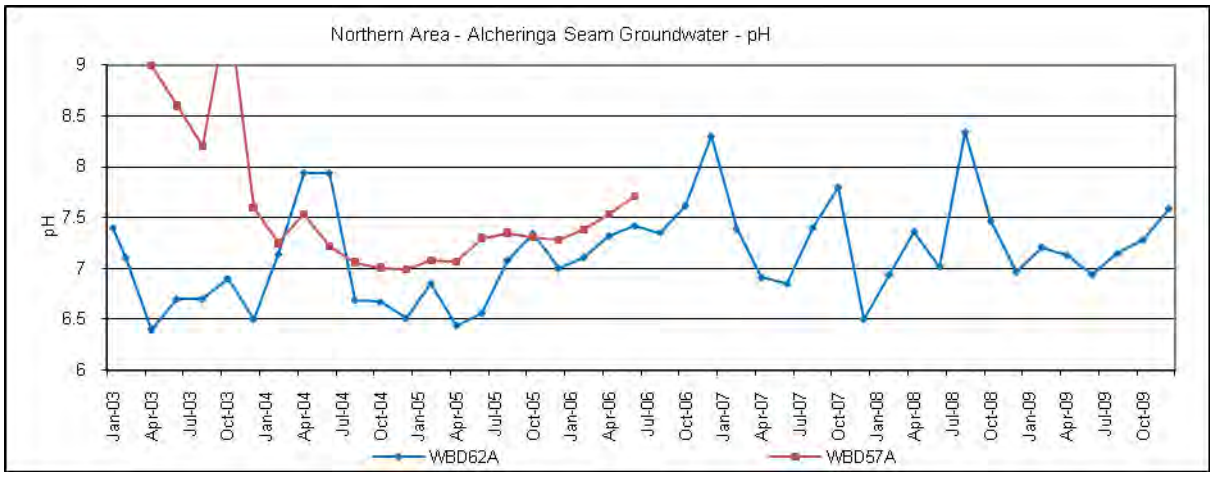
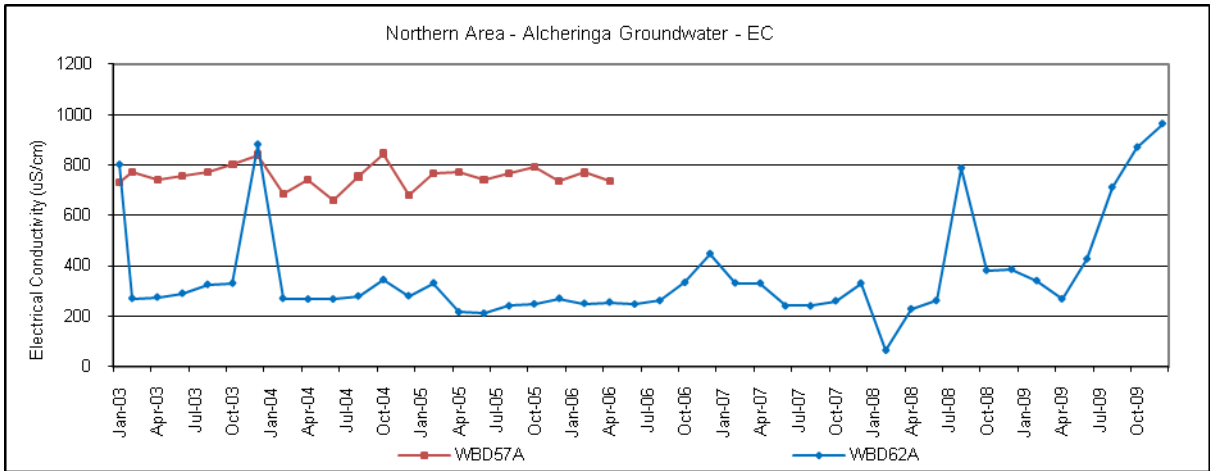



**Figure 4-19 Northern area lower Whybrow Seam groundwater hydrographs**



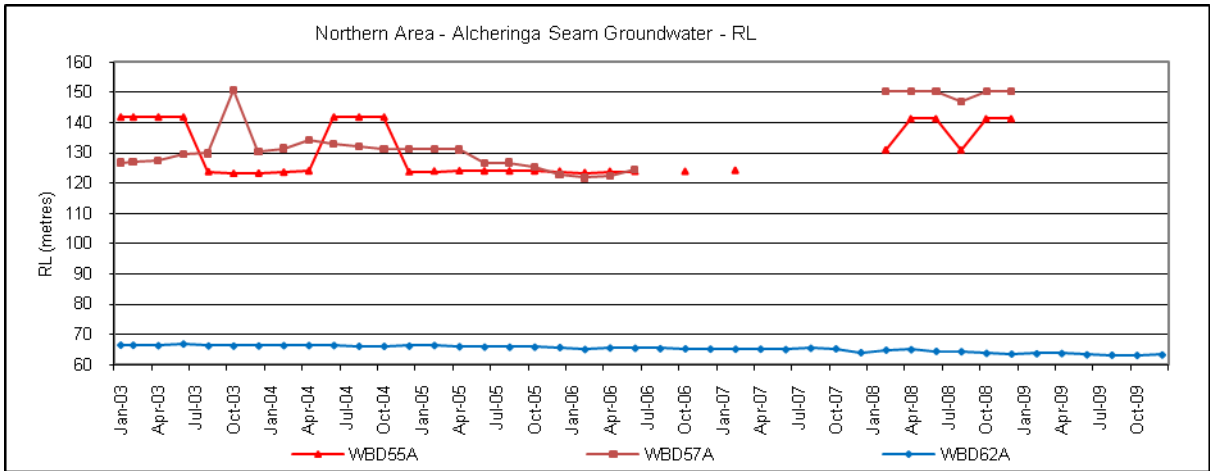




**Figure 4-20 Northern area Alcheringa Seam groundwater hydrographs**

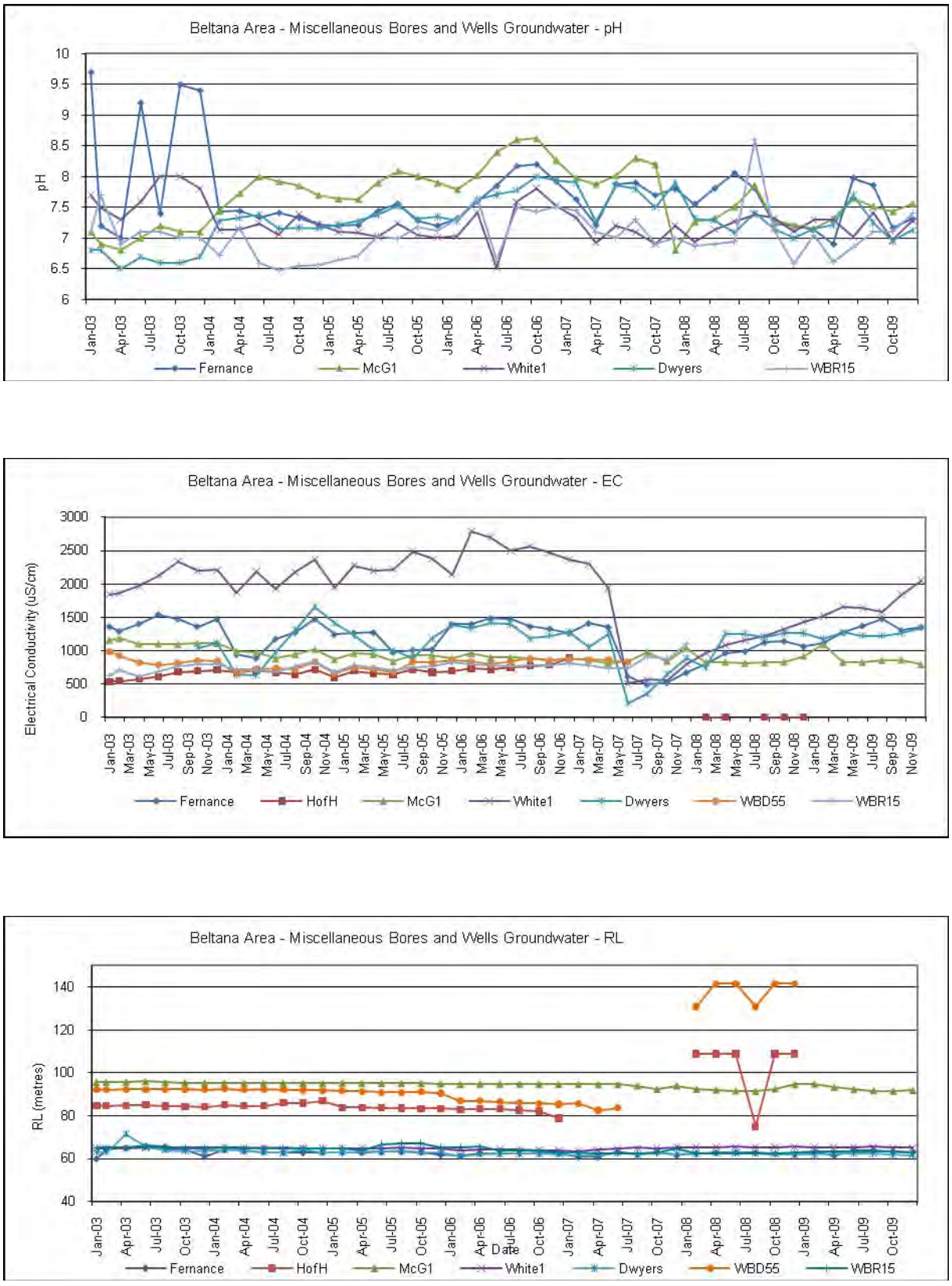
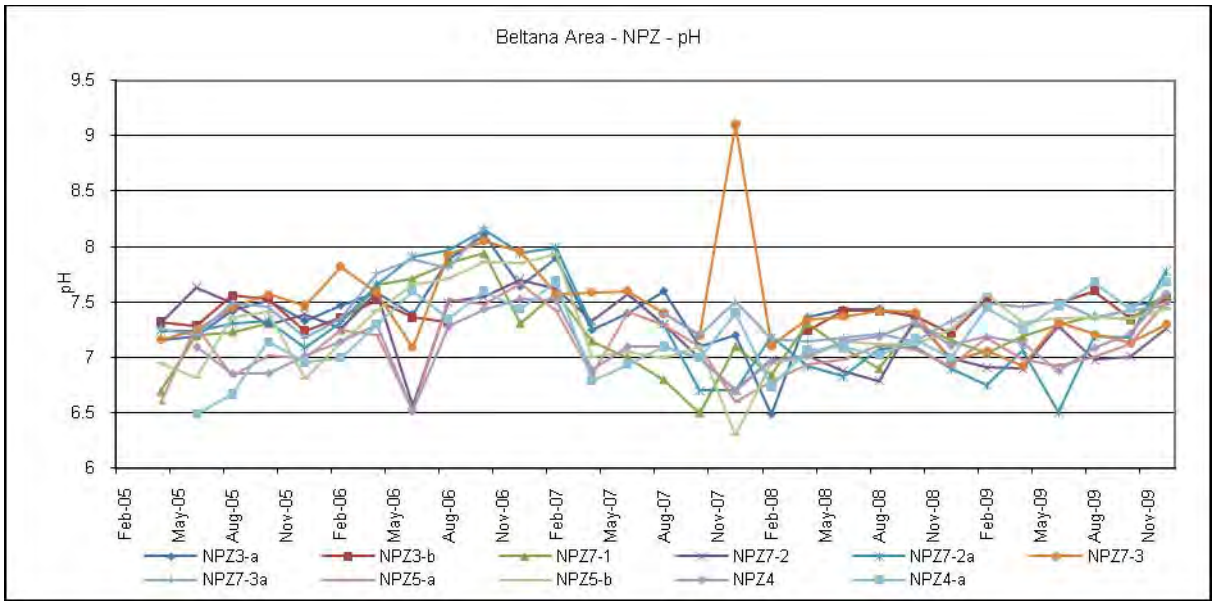
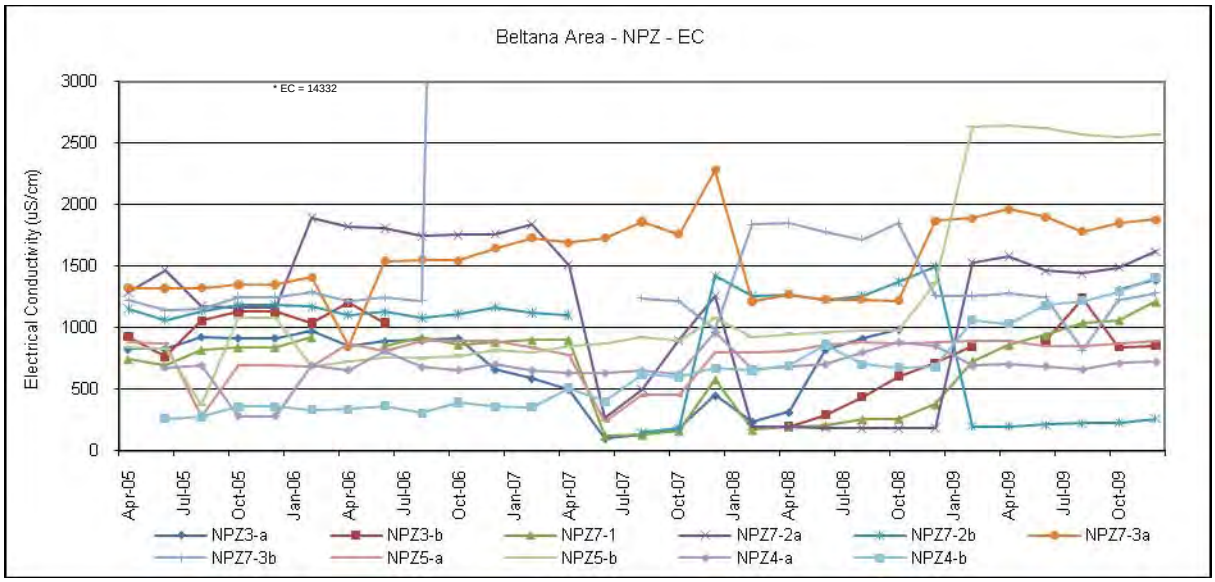



**Figure 4-21 Beltana area miscellaneous bores and wells groundwater hydrographs**



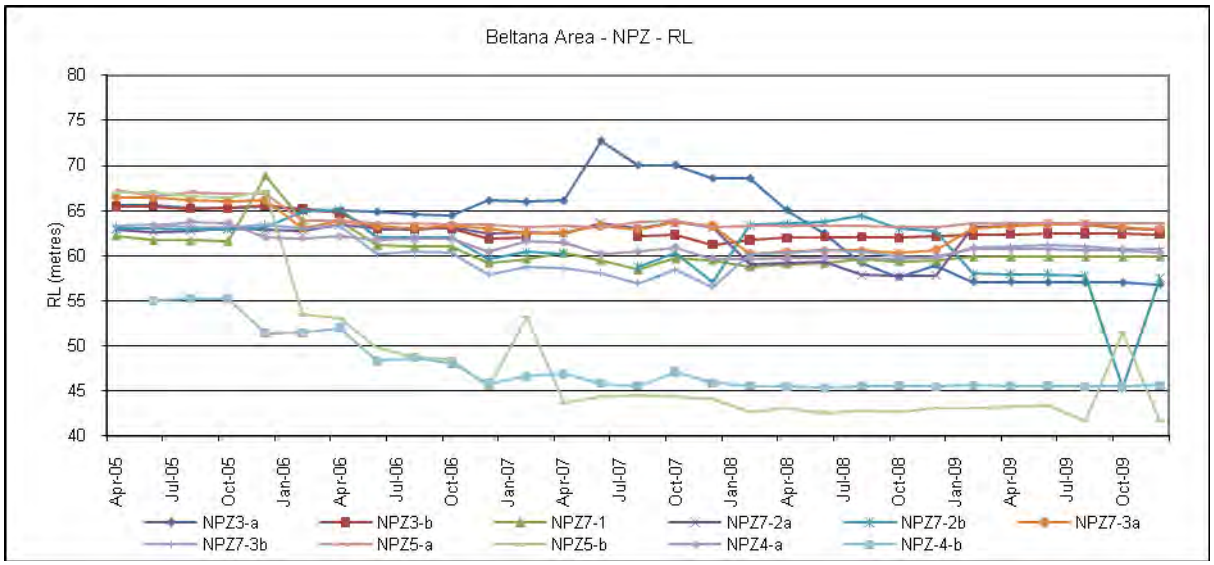
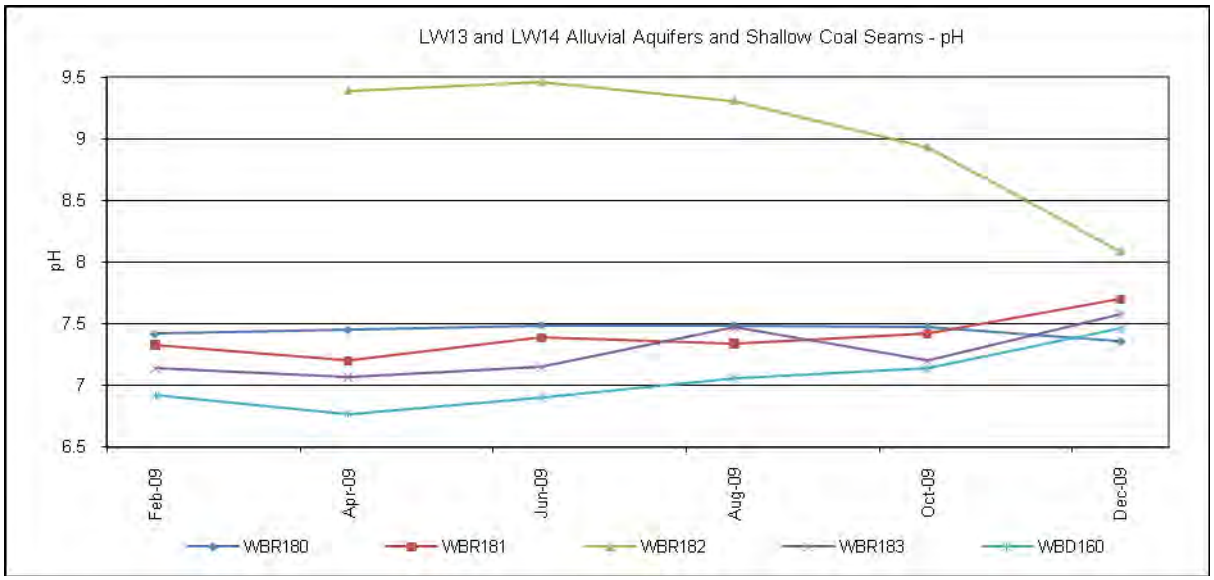
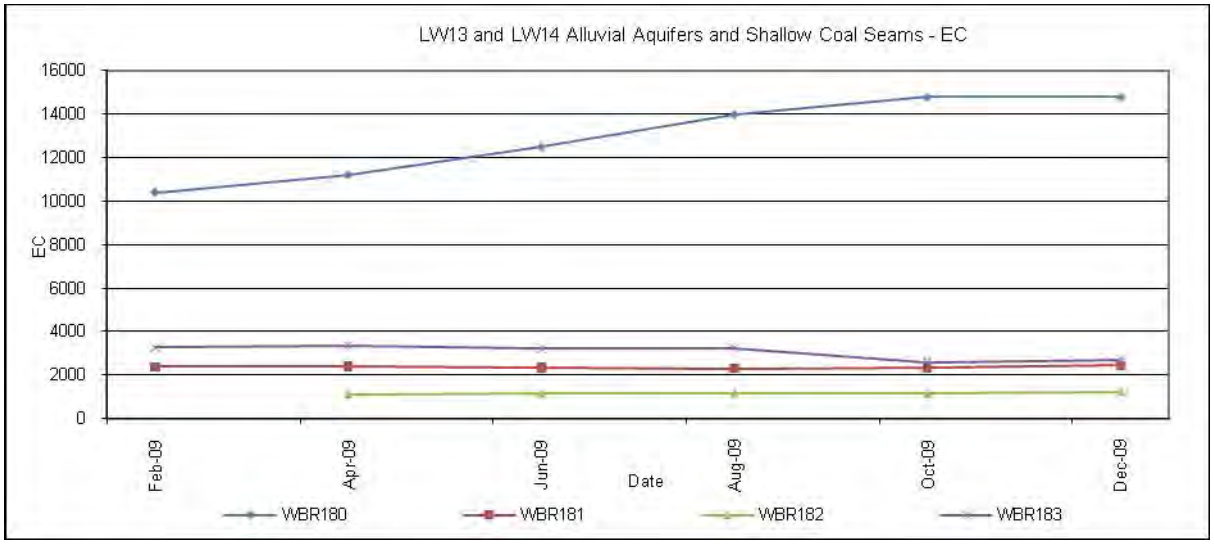




**Figure 4-22 Beltana area NPZ groundwater hydrographs**



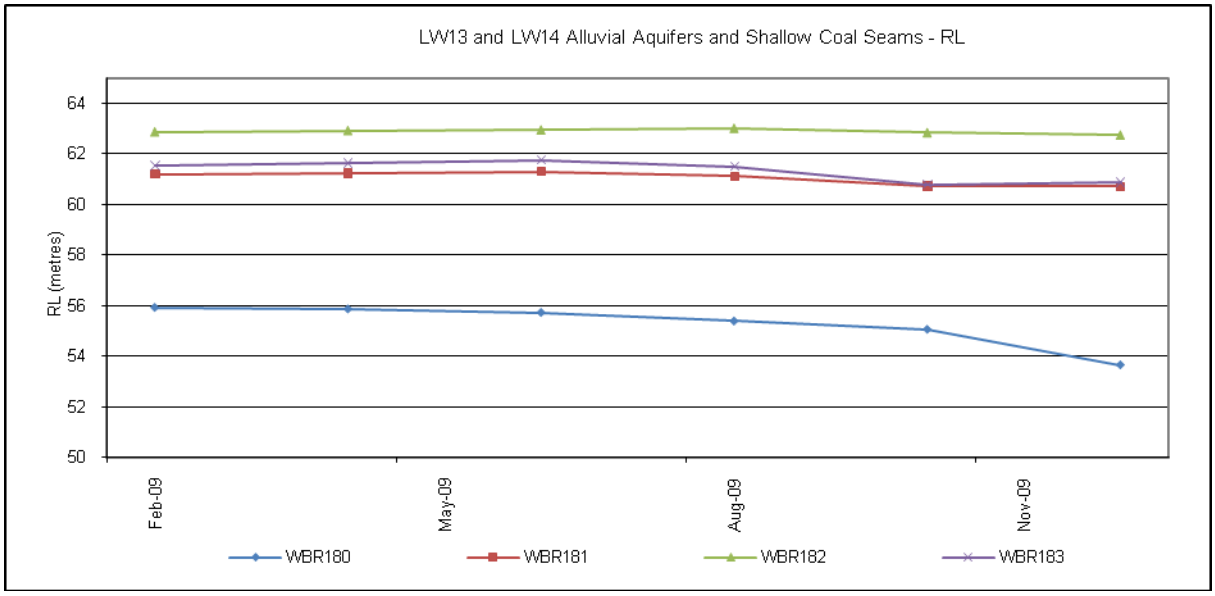




**Figure 4-23 Wollombi alluvials and shallow coal measures groundwater hydrographs**

#### 4.10.2.9 Groundwater sample chemical analyses

**Table 4-19** lists the piezometers which are sampled every six month and analysed for the major cations, anions and the suite of metals. **Appendix M** present the analyses conducted since 2003 including the ratios of the various cations and anions.

The analyses show that the dominant water type is the NaCl type, except for NPZ3A, NPZ4A, NPZ5A and WBR15, exhibiting water type that is predominantly Na $HCO_3$-Cl type water. Apart from the fluctuation in salinity previously described and minor fluctuations in analyte concentrations (ions and metals), the data does not show any sustained trends over time.

#### 4.10.2.10 Groundwater impact assessment trigger values

Included in the Bulga Coal Complex Site Water Management Plan are impact assessment trigger values which have been extrapolated from historical data. These trigger values are designed to prompt a review when the monitoring data falls outside the nominated range.

There have been no identifiable changes in water quality as the result of mining activities with the alluvial piezometers showing reductions in EC as a result of rainfall recharge and stream flow events.

Minor exceedances of water level triggers have been identified for piezometers PB6A, P7a, V3, GW8, McG1 and WBR15. The hydrographic responses for these piezometers have been reviewed in previous sections. The potential impacts on the alluvial aquifer will be critically reviewed in groundwater assessment mentioned in **Section 4.10.2**. Given the previous interpretations of the data, and results from the independent groundwater assessments it is believe that no further investigations are required.

#### 4.10.2.11 Underground water balance

The underground water balance components are presented in **Table 4-21**.

**Table 4-20 Components of underground mine water system**

| | | |
|---|---|---|
| **Water to Underground Operations** | = | Raw water pumped in (metered) |
| | + | Groundwater seepage (estimated in order to balance) |
| | + | Rainfall percolation (estimated from rainfall correlations) |
| **Water from underground** | = | Water pumped from dewatering bores (metered) |
| | + | Water pumped from portal (metered) |
| | + | Water added to ROM coal (as moisture content) |
| | + | Ventilation evaporative losses |
| | + | Change in goaf storage (storage calculated from measured water level) |

The current rate of groundwater seepage into the working is approximately 1.12 ML/day which is close to the predicted 1.1 ML/day as shown in **Table 4-21**. The rainfall recharge and its contribution to goaf storage has reduced the sensitivity of the water balance. Between approximately 150 to 200ML are currently stored in the goaf and act as a buffer to the inflow/outflow balance. The Independent groundwater assessments for Longwalls 11 and 12 concludes ‘Given the available data (water levels, pressures and water balance), leakage losses from the Wollombi Brook alluvial lands to the coal measures can be inferred but these losses are judged to be negligible at the present time. The independent groundwater assessment for Longwalls 11 and 12 is included in **Appendix M**.

**Table 4-21 Predictions and actual values groundwater seepage**

| Year | Predicted (ML/day) | Measured (ML/day) | Comment |
|---|---|---|---|
| 2003 | 0.65 | 0.25 | Monitoring strategy being developed |
| 2004 | 0.7 | 0.55 | Coal extraction rate higher than modelled. |
| 2005 | 0.8 | 0.75 | Coal extraction rate higher than modeled |
| 2006 | 0.85 | 0.84 | Coal extraction rate higher than modeled |
| 2007 | 0.9 | 0.8 | Water Balance complicated by rainfall recharge and water entering the mine portals |
| 2008 | 0.95 | 1 | Water Balance complicated by rainfall recharge and change in goaf storage |
| 2009 | 1.1 | 1.12 | |

### 4.10.3 Groundwater summary

The groundwater monitoring data shows that the responses to underground mining are generally consistent with the predictions in the BCCUO EIS 2003 groundwater predictions. Further monitoring and assessment is required to determine if there is a measurable response to coal seam depressurisation in the alluvial aquifer. As mentioned previously a supplementary groundwater assessment will be commissioned in response to NOW's requirements in particular the assessment of longer term trend in the alluvial piezometers hydrographs. The groundwater monitoring network is sufficient to enable a comprehensive evaluation of the mines impact on the regional hydrogeological setting.

## 4.11 Mine subsidence

During 2009, the Underground Operations completed the extraction of Longwall 11 and approximately 90% of Longwall 12. Depths of cover above the longwalls ranged from 55 m at the end of Longwall 12 to over 200m at the start of Longwall 11 (see **Figure 4-24**). The extracted thickness of coal ranged from 2.5 to 3.0 m.

A variety of subsidence related scenarios occurred during the reporting period, including undermining of the following:

- privately owned grazing land
- a mine-owned olive grove
- the Broke Fordwich PID
- a privately owned vacant house and two farm sheds
- power lines, telephone cables and fibre optic cables.

# Figure 4-24 Depth of Cover to Whybrow Seam

317000 318000 319000

6383000 6382000

LW 11

LW 12

## Legend

- 2009 Area Subject to Undermining
- Depth to Whybrow Seam

N W E S

0 100 200 m

1:7,500 @ A3

Projection: GDA 94 MGA 56

**Figure 4-25** illustrates the position of the infrastructure undermined during the reporting period in relation to the longwall panels.

The Underground Operations use a hands-on approach to manage the impacts of mine subsidence. The management strategies are based on risk management and developed in consultation with all relevant stakeholders. Where possible the risks are mitigated prior to mining, or where this is not practical, appropriate controls are put in place to monitor and manage the risks during subsidence.

A number of management plans and monitoring programs have been implemented to manage the impacts of subsidence. A summary of the impacts and management strategies adopted are outlined in the sections below.

### 4.11.1 Subsidence monitoring

Subsidence monitoring during 2009 was undertaken in accordance with the Beltana '*Longwall 4-14 Subsidence Monitoring Program'* and Longwalls 11 and 12 Survey Subsidence Monitoring Strategies, which were established as part of the Subsidence Management Plan development (SMP) process. The purpose of the monitoring is to provide a comparison between observed subsidence against the predictions made in the BCCUO EIS and SMP Applications. These comparisons can be used to assess whether the predictions and the management strategies in place are adequate.

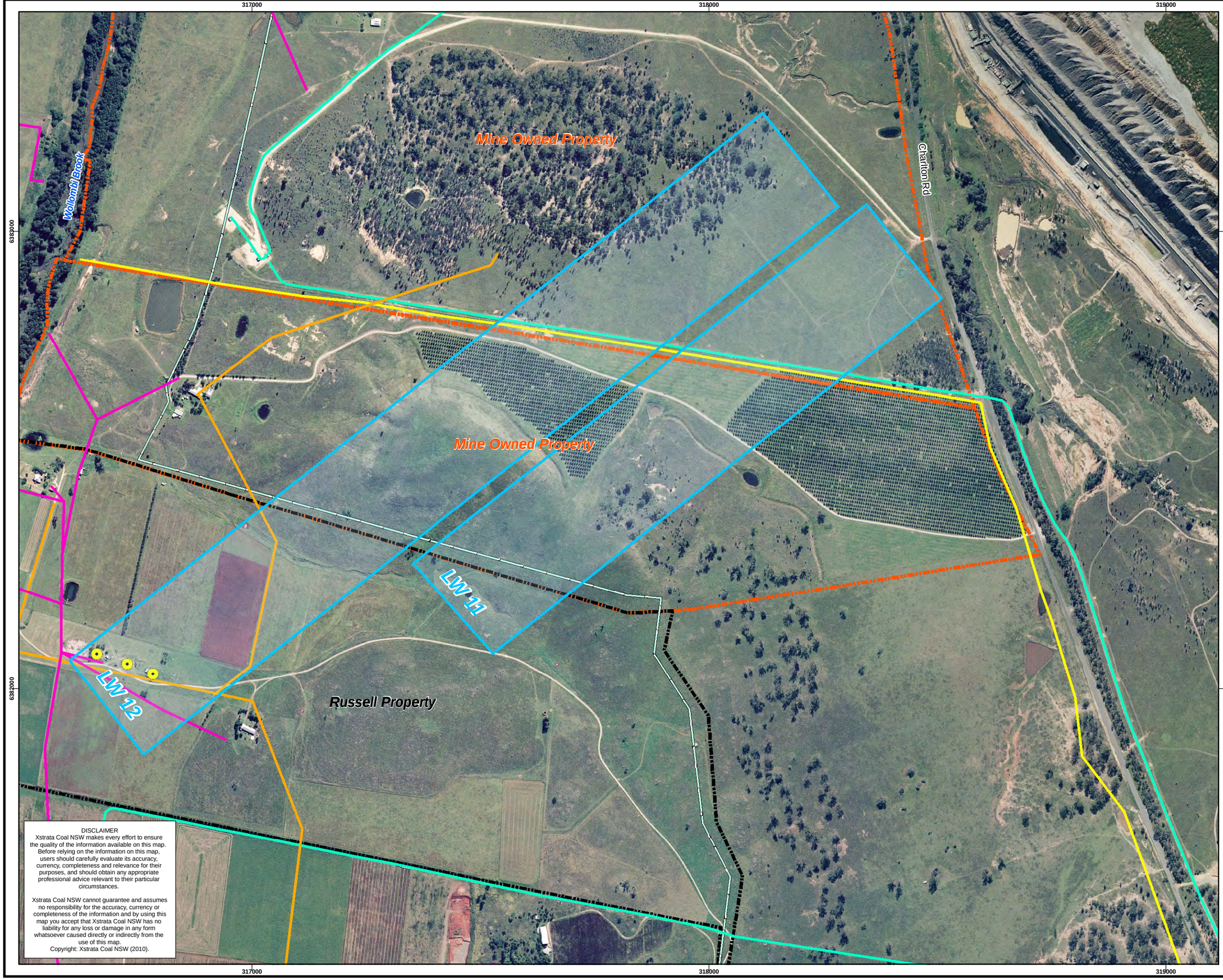
**Table 4-22** compares the results of the subsidence monitoring against the levels predicted. Survey data collected during 2009 was supplied to Mine Subsidence Engineering Consultants to evaluate the observed subsidence and provide expert opinion as to the accuracy of the predictions and adequacy of the management strategies in place. A copy of their report is contained in **Appendix N**, with a summary shown below in **Table 4-23**.

**Table 4-22 Observed and predicted subsidence, tilt and strain**

| Monitoring line | Longwall | Type | Maximum incremental subsidence (mm) | Maximum incremental tilt (mm/m) | Maximum incremental tensile strain (mm/m) | Maximum incremental compressive strain (mm/m) |
|---|---|---|---|---|---|---|
| Line 11A | 11 | Observed | 1894 | 26 | 6 | 10 |
| | | Predicted | 2100 | 22 | 4 | 4 |
| Line 11B | 11 | Observed | 1908 | 76 | 15 | 40 |
| | | Predicted | 1950 | 110 | >50 | >50 |
| Line 11-XLCR | 11 | Observed | 1820 | 58 | 16 | 12 |
| | | Predicted | 1950 | 65 | 50 | 35 |

**Figure 4-26** (taken from the MSEC report) illustrates the location of the subsidence monitoring lines used during 2009. These monitoring lines traverse the start and finish of Longwall 11, the middle and finish of Longwall 12.

# Figure 4-25
# Area Subject to Undermining

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## Legend

- Buildings Undermined
- Powerline
- Telephone Line
- Optic Fibre Cable
- Minewater Pipeline
- PID Pipeline
- Russell Property
- Mine Owned Property
- 2009 Area Subject to Undermining

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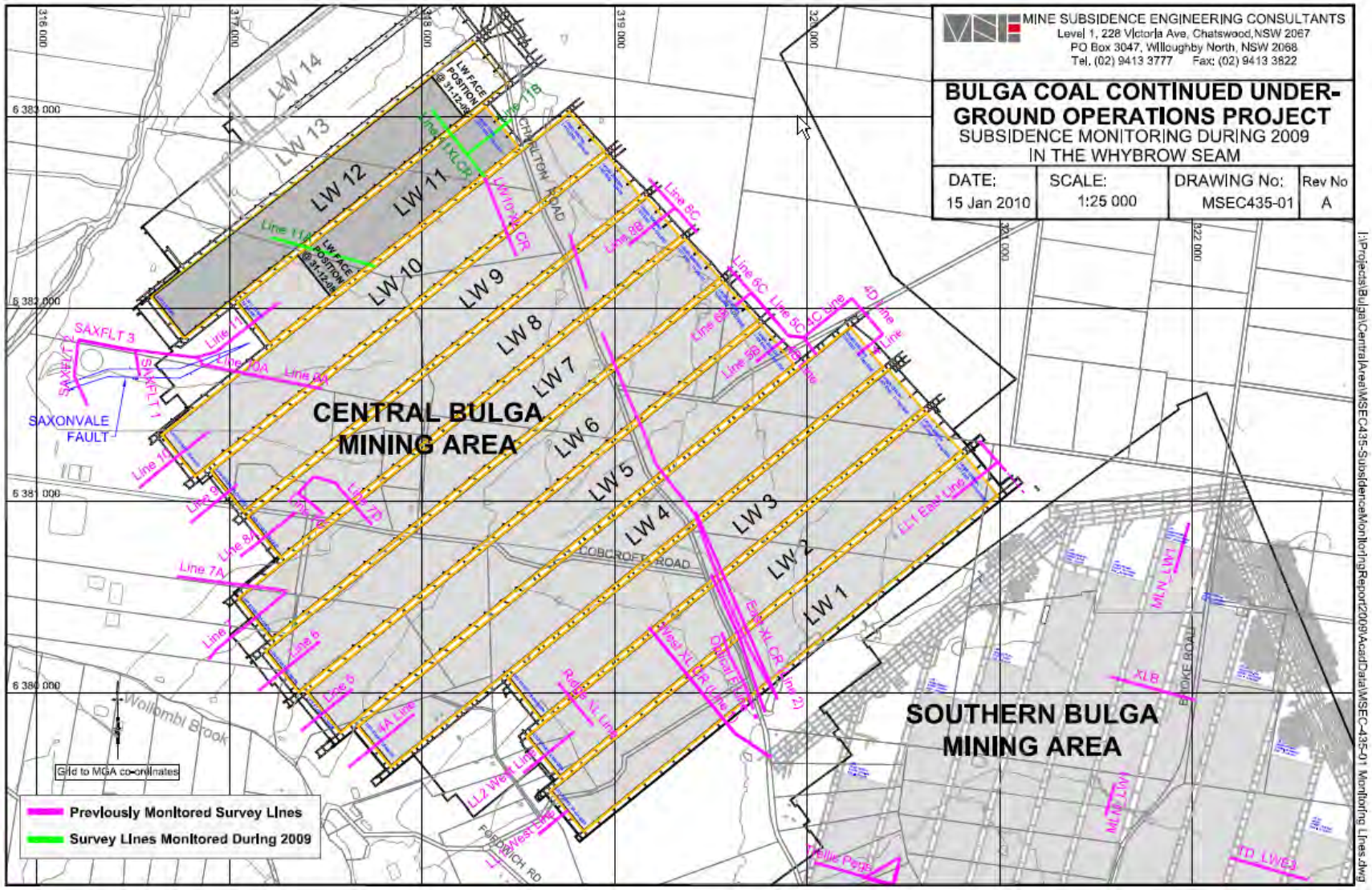


**Figure 4-26 Underground Operations subsidence monitoring lines**

#### 4.11.1.1 Comparison of observed and predicted subsidence monitoring data

**Subsidence profiles**

The observed subsidence profile for Longwall 11 showed good correlation with the predictions made in the BCCUO EIS and SMP Application. The observed maximum incremental subsidence was less than predicted on all occasions.

The development of subsidence on Longwall 11 continued to be consistent with that predicted in the SMP Application. Predicted and observed profiles compare more favourably in areas of a greater depth of cover. This observation is consistent with the comments provided in both the BCCUO EIS and SMP Application. At shallow depths of cover the overlying strata is expected to crack and dilate, causing the surface to subside in a 'blocky' manner, which produces more irregular subsidence, tilt and strain profiles.

**Angle of draw**

A survey monitoring line for measuring the angle of draw was not installed at the commencement end of Longwall 12 due to private land use constraints.

**Tilts and strains**

The figures in **Table 4-22** illustrate a reasonable comparison between predicted and observed tilt and strain profiles. The observed tilt and strain along Line 11A was slightly greater than predicted. Observed tilt was 18% greater than predicted, whilst observed strain was 50% greater than predicted. Tilt and strain along Line 11B and Line 11XLCR were less than predicted.

The observed strain profiles compare reasonably well with predicted levels, however, the discrepancies between predicted and observed profiles at individual points are much greater than those observed for subsidence and tilt. This result was expected due to the difficulty in predicting ground strains at particular points, particularly in shallow mining conditions. This was acknowledged in reports for the BCCUO EIS and SMP Applications.

#### 4.11.1.2 Independent audit of subsidence management

The Underground Operations development consent (DA 367-8-2003, Schedule 4, Condition 5) requires an independent audit of subsidence, surface water and groundwater impacts of the development prior to seeking approval from the DPI for a set of Longwall panels. **Appendix N** contains reports from independent audits conducted by Galvin and Associates and Aquaterra. These reports have been distributed to the members of the Interagency Subsidence Management Plan Review Committee.

The reports conclude that, in general, the impacts have been within the predicted ranges and not identified any significant issues.

**Summary**

In light of the above observations, the MSEC435 Subsidence Monitoring Report (MSEC 2009) concluded that no adjustments need to be made to the subsidence predictions or the Underground Operations management strategies in place.

**Other monitoring**

Monitoring of surface cracking was undertaken during and after mining in shallow depth of cover. Cracks and sinkholes were captured with a GPS camera and uploaded into the site Geographic Information System. The recorded locations of cracks and sinkholes were used to generate maps of affected areas for assisting with subsidence repairs.

Once repairs were undertaken, the recorded locations of repaired cracks and sinkholes were compared with the cracks and sinkholes capture with the GPS camera. This method helped to ensure all cracks and sinkholes were repaired.

## 4.11.2 Impacts on natural features

### 4.11.2.1 Land drainage

Portions of the 'Charlton' property and 'Atulya Olive Grove' were undermined during the reporting period without incidence. There was some minor surface cracking over the internal access road on the 'Atulya Olive Grove', which was repaired by wheelbarrow and shovel immediately. No re-positioning of culverts or re-grading of contour drains was necessary.

Follow up repairs along the Northern Drainage Line above Longwall 9 and 10 continued during the reporting period. A range of repair methods were used, the details of which are discussed in **Section 2.8.3**. Repairs along this drainage line have further improved water retention, which has helped support the establishment of vegetation in this area.

Impacts on natural features were consistent with the shallow depth of cover and were repaired in accordance with the Northern Drainage Line Management Action Plan, in a timely manner, with minimal disturbance.

As discussed in the 2008 AEMR, the decision was made not to reinstate the drainage line unless ponding was deemed to be unacceptable. To date no significant ponding issues have been identified. Should the ponding be deemed as unacceptable, the drainage will be reinstated by excavating the rise over each of the Beltana chain pillars.

## 4.11.3 Impacts on man-made features

### 4.11.3.1 Private residence

The Underground Operations subsided one residence and two farm sheds during the reporting period. These buildings are located on the privately owned 'Charlton' property. The locations of these buildings are illustrated in **Figure 4-25**.

The Mine Subsidence Board managed the subsidence impacts on these structures. Beltana assisted with temporary facilities for housing farm equipment whilst the sheds were undermined. The sheds sustained minor damage that required repair. Details of the repairs completed to the two farm sheds are provided in **Section 2.8.1**. Both sheds are back in use by the private landowner. The subsided residence was (and remains) vacant at the time of undermining. The house sustained minor damage that was not required to be repaired.

### 4.11.3.2 Stock water tanks

One stock water tank on the 'Charlton' private property sustained cracking and required replacement.

The Broke-Fordwich Private Irrigation District pipeline did not sustain damage from subsidence.

No dams were damaged by subsidence during the reporting period.

#### 4.11.3.3 Fence lines

Following undermining, fences within the 'The Groves', and 'Charlton' properties required re-tensioning. Ratchet strainers continue to be used because of the ease in loosening and tightening wires without the need to cut them as the longwall proceeds underneath.

### 4.11.4 Impacts on land use

The land use overlying Longwalls 11 and 12 includes cultivated land, mine owned olive groves, cattle grazing and de-stocked mine buffer land.

Surface cracking occurred amongst the olive trees; however this has had no measurable impact on the operation of the olive grove. There has been no loss of trees or noticeable change in vigour of the plants.

There was also minor surface cracking on cultivated land in the area of deep depth of cover. Many of the cracks in deep depth of cover closed of their own accord, or after rain.

Similarly, cattle-grazing has not been impacted by subsidence. The de-stocked buffer land continues to recover from the impacts of grazing with considerable natural regeneration, particularly trees. This zone of buffer land is also the area most prone to surface cracking because it coincides with the area of shallow depth of cover.

### 4.11.5 Impacts on public utilities

#### 4.11.5.1 Public roads

No public roads were undermined during the reporting period.

Despite not being undermined during 2009, monitoring of previously subsided sections of Charlton Road continued throughout the year.

No stepping or cracking on or beside Charlton Road was observed during the reporting period.

**Culverts**

Two culverts on a private internal road on the 'Atulya' olive grove were undermined during the reporting period. Monitoring of the culverts was undertaken whilst the road was being subsided. No visible damage was observed.

**Electricity**

The undermining of power poles over Longwall 11 caused the lowering of a power line by ground subsidence. An additional power pole was installed, prior to undermining, on the privately owned 'Charlton' property to accommodate this lowering. The new power pole was installed by Energy Australia and funded by the Underground Operations. There was a temporary loss of service whilst the new pole was being installed. No long term disturbance to local electricity supplies occurred as a result of subsidence.

**Telecommunications**

Copper cables and a major Inter Exchange Network (IEN) optical fibre cable are located within the underground mining area. All telecommunications cables are subject to pre, during and post subsidence monitoring by an experienced consultant in consultation with Telstra.

Longwalls 11 and 12 passed under the fibre optic and copper cable during the reporting period. The cables were prepared for subsidence during 2005; hence there were no significant impacts or interruptions to service during the reporting period.

## 4.12 Flora and fauna management

### 4.12.1 Overview

Bulga Coal Complex operates in accordance with a Flora and Fauna Management Plan developed to meet the requirements of both the Underground Operations and Open Cut Operations development consent conditions.

The key features of the plan relating to flora and fauna management of the site include:

- The inclusion of baseline data of the existing habitat on site.
- A detailed description of what measures would be implemented to satisfy the requirements of the consent.
- A detailed description of procedures to:
    - salvage and reuse material from the site
    - clear vegetation on site
    - control erosion and sediment flows
    - collect and propagate seeds from the local area
    - control weeds
    - control access to certain areas on site
    - manage any potential conflicts between flora and fauna and Aboriginal heritage
- A detailed flora and fauna monitoring program.

### 4.12.2 Flora and fauna monitoring results

In accordance with the Flora and Fauna Management Plan, an annual flora and fauna monitoring program was implemented at the Bulga Coal Complex. This program has been undertaken by Umwelt for the last seven years. The 2008 flora and fauna monitoring was unfortunately belatedly and undertaken in February 2009; as such it was not included in the 2008 AEMR. A copy of the Feb 2009 monitoring report is included in **Appendix O**. The 2009 period flora and monitoring report was undertaken in December 2009, a copy of this report is also included in **Appendix O**. The flora and fauna monitoring was undertaken at 12 sites during December 2009. Eleven of these sites were located in areas of remnant vegetation and one was located in a rehabilitated area**. Figure 4-27** displays the locations of these sites and **Table 4-23** lists their target vegetation communities. The results of this monitoring are presented in **Table 4-24** and **Table 4-25** below.

**Table 4-23 Monitoring sites and target vegetation communities**

| Site ID | Site name | Target vegetation community |
|---|---|---|
| **Warkworth Sands Woodland EEC** | | |
| BM1 | Warkworth Sands Woodland | Warkworth Sands Woodland |
| BM8 | Regenerating Warkworth Sands Woodland | Warkworth Sands Woodland |
| BM9 | Regenerating Warkworth Sands Woodland | Warkworth Sands Woodland |
| **Remnant Vegetation Sites (Analogue Sites)** | | |
| BM2 | Extension Area | Bulloak Forest Regeneration |
| BM3 | Nine Mile Creek | Swamp Oak Woodland |
| BM4 | Broke Road | Central Hunter Box-Ironbark Woodland |
| BM5 | South East Extension | Central Hunter Box-Ironbark Woodland |
| BM6 | Beltana | Central Hunter Box-Ironbark Woodland |
| BM7 | South Bulga | Central Hunter Box-Ironbark Woodland |
| BM10 | Charlton Road Remnant Vegetation | Central Hunter Box-Ironbark Woodland |
| **Rehabilitated Sites** | | |
| BM11 | 1991 Rehabilitation | Central Hunter Box-Ironbark Woodland |
| BM13 | 2003 Rehabilitation Site Bulga Coal | Unknown |

**Table 4-24 Comparison of flora monitoring results 2008-2009**

| Site ID | Native species | | Introduced species | |
|---|---|---|---|---|
| | 2008 | 2009 | 2008 | 2009 |
| BM1 | 18 | 14 | 1 | 2 |
| BM2 | 25 | 15 | 2 | 3 |
| BM3 | 27 | 10 | 8 | 6 |
| BM4 | 29 | 28 | 1 | 1 |
| BM5 | 28 | 27 | 3 | 4 |
| BM6 | 29 | 16 | 1 | 1 |
| BM7 | 29 | 15 | 2 | 2 |
| BM8 | 16 | 16 | 1 | 4 |
| BM9 | 16 | 13 | 1 | 2 |
| BM10 | 43 | 27 | 6 | 5 |
| BM11 | 6 | 3 | 3 | 0 |
| BM13 | 7 | 4 | 3 | 8 |

# Figure 4- 27
# Bulga Coal Complex Annual Flora and Fauna Monitoring Sites

Mt Thorley Operations
Bulga Pit
Whybrow Pit
CHPP
Tailings Emplacement Area
Wollombi Brook
Charlton Rd
Broke Rd
Broke

BM1a
BM1b
BM2
BM3
BM4
BM5
BM6
BM7
BM8
BM9
BM10
BM11
BM13

## Legend

- Vegetation Quadrats
- Flora and Fauna Transects
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

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As with previous fluctuations between years there are no clear causal factors for the differences between 2008 and 2009. It is likely to be a product of seasonal fluctuations and observer bias. The regular rainfall in 2009 may have contributed to the increase in exotic grasses at the BM13 site which is a rehabilitated overburden dump. In general there has been a significant recovery of native vegetation in the mine buffer land due to de-stocking.

**Table 4-25 Fauna monitoring results 2009**

| Site ID | Bird species recorded | Micro-bat species recorded |
|---|---|---|
| BM1 | 21 | 0 |
| BM2 | 15 | 8 |
| BM3 | 24 | 0 |
| BM4 | 25 | 4 |
| BM5 | 16 | 4 |
| BM6 | 21 | 5 |
| BM7 | 12 | 3 |
| BM8 | 18 | 0 |
| BM9 | 18 | 0 |
| BM10 | 13 | 9 |
| BM11 | 18 | 0 |
| BM13 | 11 | 0 |

A number of threatened bird and micro-bat species were recorded during the 2009 monitoring event, including the Speckled Warbler (*Chthonicola sagittata*), Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), eastern freetail-bat (*Mormopterus norfolkensis*) and little forest bat (*Vespadelus vulturnus*). A full list of species recorded can be found in **Appendix O**.

## 4.13 Noxious weed management

The *Noxious Weeds Act 1993* states that land occupiers have a responsibility for controlling noxious weeds. There are four major categories that weeds are grouped under in the *Noxious Weeds Act 1993*, where each grouping is dependent on the control strategy required for each weed species.

The four categories are:

- W1 - the local control authority must be notified and the weed must be suppressed continually and destroyed.
- W2 - the weed must be suppressed continually and destroyed.
- W3 - the weed must be prevented from spreading and its numbers and distribution reduced.
- W4 - actions specified in the declaration for the weed must be undertaken.

The following weeds have been discovered within Bulga Coal Complex and placed into one of the four categories:

- Galenia (W2).
- Scotch thistle (W2).

- Pampas grass (W2).
- Noogoora burr (W3).
- Blackberry (W3).
- Bathurst burr (W3).
- Green cestrum (W3).
- African boxthorn (W3).
- Lantana (W4).
- Tiger pear; (controlled under the *Prickly Pear Act 1987*).
- Prickly pear (controlled under the *Prickly Pear Act 1987*).

The Bulga Coal Complex Weed and Pest Management Plan was implemented during the reporting period. The Weed and Pest Management Plan is not required by the Underground or Open Cut Operations development consent conditions, but has been implemented to manage weeds and pests at a more detailed site level.

The Weed and Pest Management Plan provides:

- a baseline survey of the Bulga Coal Complex
- a review of management and control options
- an assessment to identify priority control areas
- an outline of monitoring needs, methods and reporting
- an annual work schedule for ongoing weed and pest management.

Specific weed management activities undertaken by the Underground and Open Cut Operations during the reporting period are outlined below.

The Underground Operations conducted targeted weed control during 2009 focusing on the River Red Gum Ecological Community Restoration Project. An isolated spraying program was undertaken to ensure weed competition did not affect tubestock and seedling survival rates.

Weed control at the Open Cut focused on three areas north and east of the Mine Infrastructure Area, covering an area of approximately 150 Ha. Weed spraying targeted the following species:

- African Boxthorn.
- Blackberry.
- Lantana.
- Prickly Pear.

## 4.14 Aboriginal heritage

The open cut and underground mining areas have been the subject of a number of archaeological investigations (Umwelt 2007, Umwelt 2003, Umwelt 2001, ERM 1999, Heffernan and Klaver 1997, Koettig 1991) that have identified numerous archaeological sites, as illustrated in **Figure 4-28**. A number of these sites have been the subject of sub-surface investigation and/or salvage activities conducted under relevant permits in accordance with the *National Parks and Wildlife Act 1974*.

Based on the findings of these investigations, a proposed Conservation Area, four conservation zones and the BMU1 conservation zone have been designated within the Bulga Coal Complex (refer to **Figure 4-28**). Works relating to Aboriginal cultural heritage undertaken during the reporting period within both the open cut and underground mining areas are described below.

### 4.14.1 Underground Operations

Completion of salvage activities associated with AHIP #2998 was undertaken during the reporting period. There was also ongoing consultation regarding several previous Aboriginal heritage activities undertaken during the reporting period.

#### 4.14.1.1 Remaining AHIP#2998 Salvage Activities at BCO10

AHIP #2998 was issued by DECC on 22 August 2008 in relation to salvage works to be conducted in an area to be impacted by subsidence and associated surface works including sites BCO10 (part); G2; G3; G4; G6; G7; G8; G9; Bulga 7; GIF-IF2; GIF-IF3 and GIF-IF4. The majority of these salvage works were conducted during the previous reporting period. The remaining salvage activity involved monitoring of topsoil removal in association with construction of the Wollombi Brook Flood Levee within the BCO10 site area.

Consultation regarding the scope of monitoring works was undertaken with the following relevant Aboriginal stakeholder groups:

- Aboriginal Native Title Consultants.
- Giwiirr Consultants.
- Ungooroo Cultural and Community Services.
- Hunter Valley Aboriginal Corporation.
- Mingga Consultants.
- Ungooroo Aboriginal Corporation.
- Wanaruah Local Aboriginal Land Council.
- Wattaka Wonnara CC Service.
- Wonnarua Culture Heritage.
- Wonn1 Contracting.
- Hunter Valley Cultural Consultants.
- Lower Wonnarua Tribal Consultancy.
- Muswellbrook Cultural Consultants.

- Upper Hunter Heritage Consultants.
- Upper Hunter Wonnarua Council Inc.
- Valley Culture.
- Wanaruah Custodians.
- Yarrawalk.
- Hunter Valley Cultural Surveying.

The monitoring works were undertaken on 14 October and 11-12 November 2009. The Aboriginal stakeholder groups who participated in the monitoring works are listed in **Table 4-27** below.

**Table 4-26 Aboriginal stakeholder representatives participating in monitoring**

| Date | Stakeholder group |
|---|---|
| 14 Oct 2009 | Aboriginal Native Title Consultants |
| | Wanaruah Local Aboriginal Land Council |
| | Yarrawalk |
| | Valley Culture |
| | Hunter Valley Cultural Consultants |
| | Mingga Consultants |
| | Upper Hunter Heritage Consultants |
| | Upper Hunter Wonnarua Council |
| | Giwiir Consultants |
| | Wattaka Wonnarua Cultural Consultants Service |
| | Ungooroo Aboriginal Corporation |
| 11-12 Nov 2009 | Aboriginal Native Title Consultants |
| | Giwiir Consultants |
| | Hunter Valley Aboriginal Corporation |
| | Mingga Consultants |
| | Ungooroo Aboriginal Corporation |
| | Wanaruah Local Aboriginal Land Council |
| | Wattaka Wonnarua Cultural Consultants Service |
| | Wonnarua Culture Heritage |
| | Wonn1 Contracting |
| | Lower Wonnarua Council |
| | Hunter Valley Cultural Consultants |
| | Muswellbrook Cultural Consultants |
| | Upper Hunter Heritage Consultants |
| | Valley Culture |
| | Yarrawalk |
| | Hunter Valley Cultural Surveying |
| | Cacatua Cultural Consultants |

Unfortunately, because of a lapse in communication between the contractor and the Underground Operations, the removal of topsoil commenced without stakeholder involvement. Work was stopped when this omission was realised, and recommenced when stakeholders were available to attend. However, after the first day of topsoil removal, a complaint was lodged with the Department of Environment, Climate Change and Water (DECCW), which led to a follow-up investigation by a DECCW archaeologist in late October. The result of the investigation was a warning letter from the DECCW regarding the non-compliance to the Aboriginal Heritage Impact permit #2998. A copy of the letter from DECCW is included in **Appendix P**. The Underground Operations corrective action to prevent a recurrence of this incident is to improve the internal Surface Disturbance Permit process.

The monitoring activities from the topsoil removal resulted in the recovery of approximately 546 artefacts. These artefacts will be analysed in conjunction with other artefacts salvaged under AHIP#2998 (as discussed in the previous reporting period). Following the completion of artefact recording and analysis, a report will be compiled for DECCW that provides the results of works completed under AHIP #2998.

#### 4.14.1.2 Update on previous Aboriginal Heritage activities

Rehabilitation works associated with the BMU1 grinding groove site required under AHIP#2766 are scheduled to be undertaken in the next reporting period and will be discussed in the subsequent AEMR.

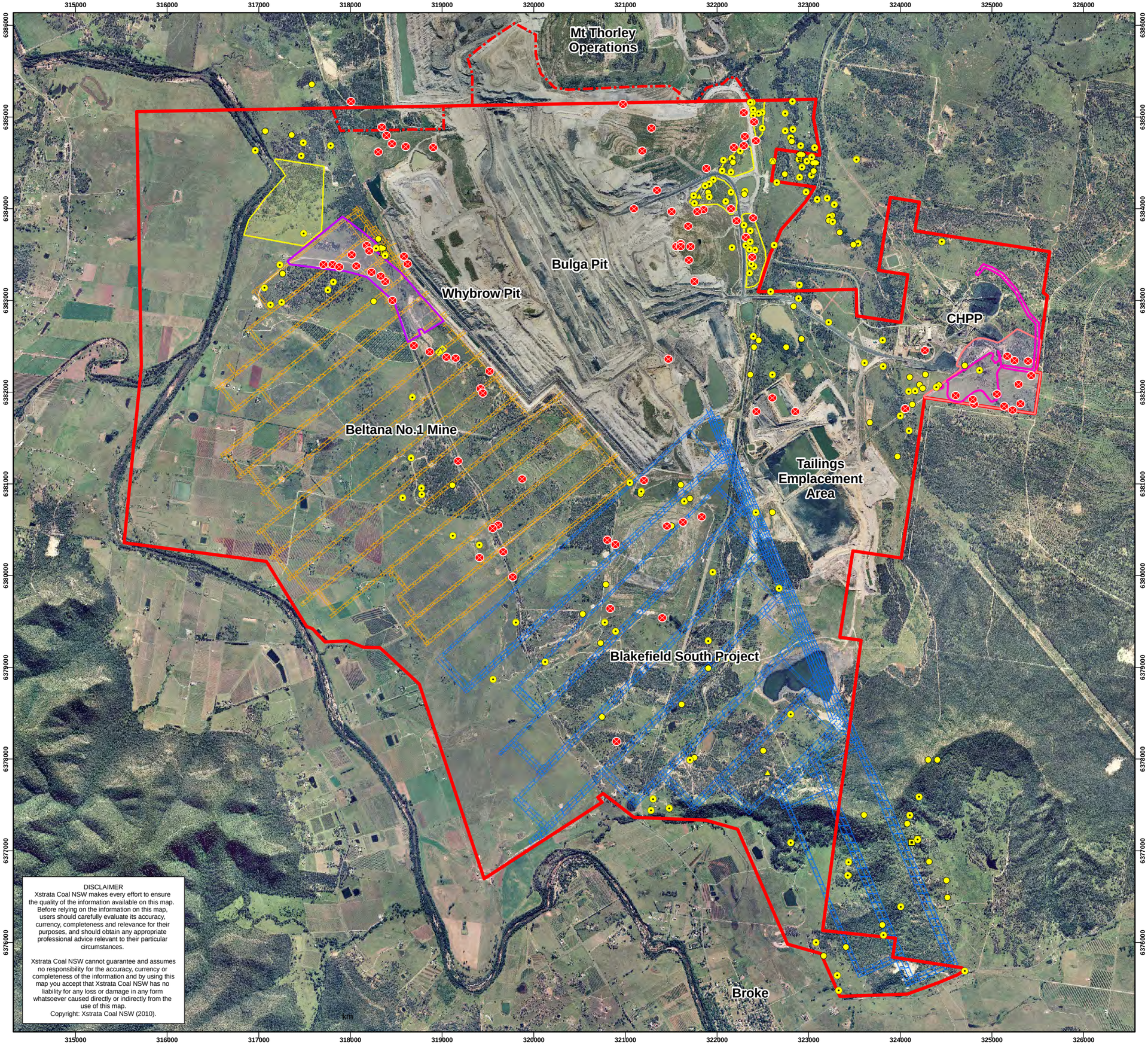
The draft Conservation Agreement and associated documents for the Beltana Conservation Area were reviewed in consultation with the relevant Aboriginal stakeholders during the previous reporting period. The location of the Beltana Conservation Area is illustrated in **Figure 4-28**. Consultation in relation to the Conservation Area was on-going during the reporting period and will continue throughout 2010, as will consultation regarding a proposed teaching/keeping place.

### 4.14.2 Open Cut Operations

Two Aboriginal archaeological salvages were undertaken during the reporting period at the Open Cut Operations. Both salvages covered an area in the eastern section of the open cut mining area, adjacent to the CHPP. The locations of these areas are illustrated in **Figure 4-28**. These salvages were undertaken in accordance with AHIP #3066 and #3212. The consultation process for these salvages was undertaken during the previous AEMR period and was reported in the 2008 AEMR.

The salvages covered the footprint of the approved 3,100ML CHPP dam, to be constructed and commissioned during 2010. The first salvage was a surface collection carried out under AIHP #3066 and was conducted during June and July 2009. Monitoring of topsoil removal was also conducted within an area selected by the Aboriginal stakeholders. A total of 116 surface artefacts and 5 sub-surface artefacts were recovered during this event.

# Figure 4- 28
# Bulga Coal Complex
# Aboriginal Heritage Sites

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## Legend

- Destroyed/Partially Destroyed
- Artefact Scatter
- Axe Grinding Groove
- Isolated Artefact
- Scarred Tree
- Shelter with Deposit
- Blakefield South Project
- Beltana No.1 Mine
- Conservation Areas
- AHIP#2998
- AHIP#3066
- AHIP#3212
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

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The second salvage, undertaken under AHIP#3212 during December 2009, involved surface collection of all remaining sites in the AHIP area. A total of 163 surface artefacts were collected during this event.

Both salvage projects were completed in consultation with the relevant Aboriginal stakeholders. Aboriginal stakeholders involved in the salvage activities under both permits are listed in **Table 4-27** and **Table 4-28** below.

**Table 4-27 Stakeholder groups involved in salvages under AHIP #3066**

| Date | Stakeholder group |
|---|---|
| 17/06/2009 | Aboriginal Native Title Consultants |
| | Upper Hunter Heritage Consultants |
| | Cacatua Culture Consultants |
| 18/06/2009 | Wattaka Wonnarua Cultural Consultants |
| | Giwirr Consultants |
| 23/06/2009 | Culturally Aware |
| | Yarrawalk |
| | Wanaruah Local Aboriginal Land Council |
| 30/06/2009 | Wonn1 Contracting |
| | Upper Hunter Heritage Consultants |
| | Ungooroo Cultural and Community Services |
| | Ungooroo Aboriginal Corporation |
| 1/07/2009 | Wanaruah Local Aboriginal Land Council |
| | Culturally Aware |
| | Yarrawalk |
| 2/07/2009 | Giwirr Consultants |
| | Wonn1 Contracting |
| | Hunter Valley Aboriginal Corporation |

**Table 4-28 Stakeholder groups involved in salvages under AHIP #3212**

| Date | Stakeholder group |
|---|---|
| 16/12/2009 | Upper Hunter Wonnarua Council |
| 16/12/2009 | Ungooroo Aboriginal Corporation |
| 16/12/2009 | Cacatua Culture Consultants |
| 16/12/2009 | Ungooroo Cultural and Community Services |
| 16/12/2009 | Wonn1 Contracting |
| 16/12/2009 | Culturally Aware |
| 16/12/2009 | Aboriginal Native Title Consultants |
| 16/12/2009 | Upper Hunter Heritage Consultants |
| 16/12/2009 | Hunter Valley Aboriginal Corporation |
| 16/12/2009 | Yarrawalk |
| 16/12/2009 | Giwirr Consultants |
| 16/12/2009 | Wattaka Wonnarua Cultural Consultants |
| 16/12/2009 | Wanaruah Local Aboriginal Land Council |

One incident regarding Aboriginal Heritage occurred during the reporting period, on 15 January 2009. The incident occurred as a result of an urgent management response to a large bushfire on adjacent land owned by the Department of Defence. In the process of re-grading an existing dormant fire trail for the purpose of asset protection, a number of archaeological sites were disturbed. Bulga Coal Complex reported the incident to DECCW and a subsequent meeting and site inspection were conducted involving relevant aboriginal groups. DECCW concluded that the circumstances leading to the incident were exceptional and that after the suggested actions were carried out, no further action regarding the incident would be required. A copy of the letter from DECCW is included in **Appendix P**.

## 4.15 European heritage

As a part of the BCCUO EIS (Umwelt, 2003a), a comprehensive assessment of European heritage values within the project area was undertaken. **Figure 4-29** illustrates the location of recorded European heritage sites within the Bulga Coal Complex. No additional European heritage items were found during the reporting period. If further items of European heritage are found during site preparation or the construction process, works within such areas will cease until appropriate permits or management processes are in place.

There were no impacts on items of European heritage at the Bulga Coal Complex during the reporting period.

## 4.16 Visual and stray light

### 4.16.1 Underground visual impacts management

The Underground Operations visual impacts are managed through implementation of the site's Visual Impact Management Procedure. Visual impacts management during the reporting period focused on establishing and maintaining visual screens around gas drainage and mine dewatering infrastructure.

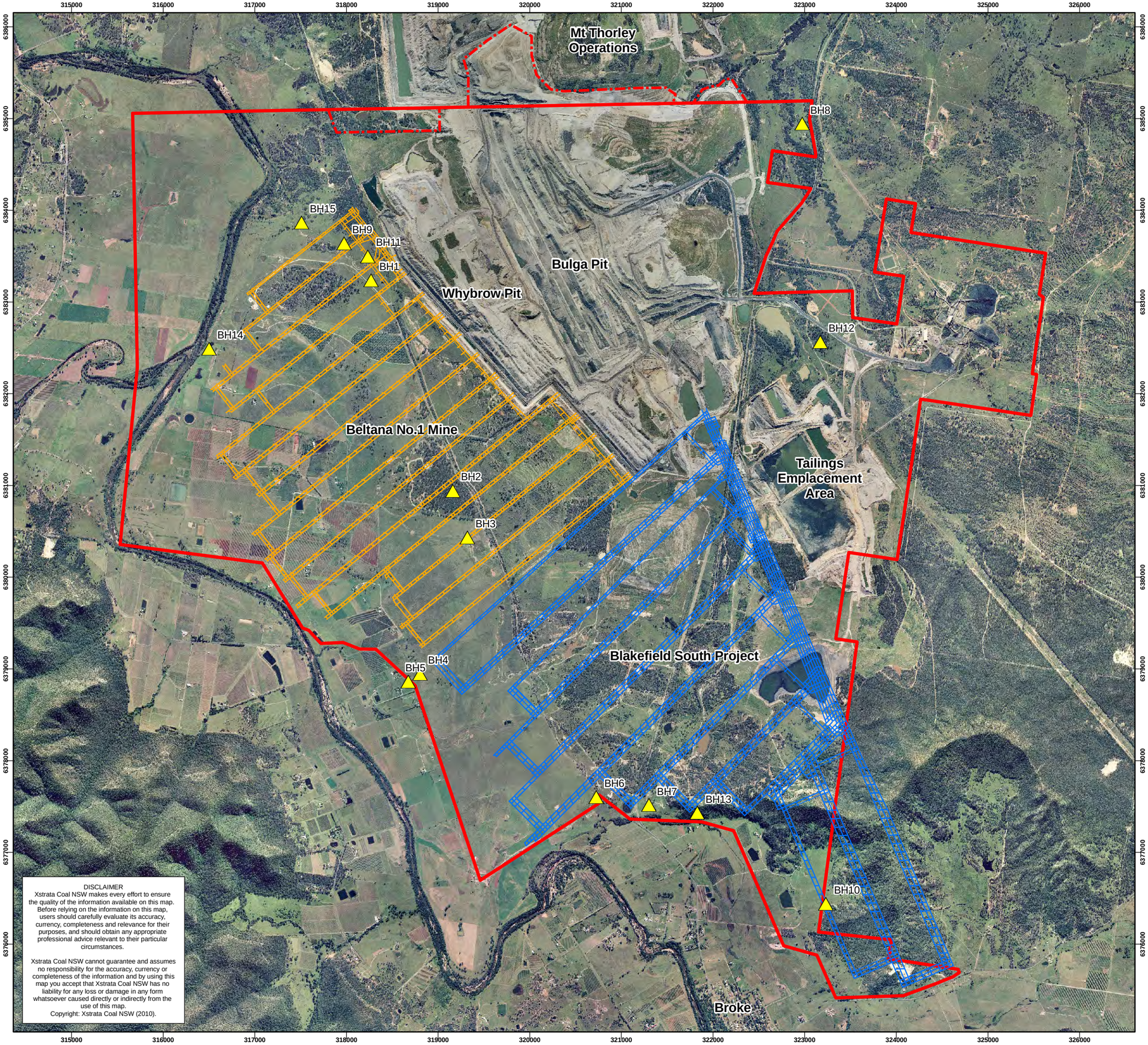
Visual screening works focus on the most publicly visible locations as a priority. The methodology for visual screening involves the implementation of different techniques based on the proximity of the infrastructure to public viewpoints.

Wire caging or Colourbond sheds are erected to enclose gas drainage wells located at a significant distance from public view points.

Photo decals or green small enclosures have been erected in areas within close proximity to public viewpoints.

These barriers are supplemented with endemic tree and shrub species to further decrease the visual impact of infrastructure. An example of this type of visual screen is provided in **Plate 4-2**.

# Figure 4-29
# Bulga Coal Complex
# European Heritage Sites




## Legend

- European Heritage Sites
- Beltana No.1 Mine
- Blakefield South Project
- Bulga Coal Complex and Mt Thorley Common DA Area
- Bulga Coal Complex Approved Mine Lease Area

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**Plate 4-2 Native vegetation and Colourbond cladding visual screening**

In addition to the visual screening of the gas drainage and mine dewatering infrastructure, the Underground Operations have endeavoured to keep the Bulga Coal Complex buffer land tidy, in particular the road verges and the area at the intersection of Broke and Charlton Roads. Details of the visual screening works and maintenance undertaken in these areas during the reporting period are provided in **Section 2.8.4**.

### 4.16.2 Open Cut visual amenity management

Visual impacts are managed by the Open Cut Operations through prompt rehabilitation, particularly in visually prominent areas. Visual impacts are also managed by using visual screens and bunds. During 2010 the Open Cut Operations will be pursuing an improvement program to reduce the visual impact of the operation.

### 4.16.3 Lighting

Lighting at the Bulga Coal Complex includes fixed lighting within infrastructure areas and equipment lighting on mobile equipment, conveyors, stockpiles, draglines and haul roads.

Fixed and mobile flood lighting is managed to:

- minimise direct light being emitted onto Broke or Charlton Roads
- prevent the light beam being directed towards any nearby dwellings
- minimise the illumination of areas not required for the safe operation and movement of equipment and personnel

- direct the light beam from the Open Cut Operations dragline upper boom section towards the area of interest through the use of lighting shields
- minimise illumination of the night sky.

Equipment lighting controls include:

- night-time inspections
- bunding
- the use of lighting shields
- the use of minimum wattage (where possible)
- directing of light toward the ground.

There was one community complaint regarding lighting during the reporting period. This complaint resulted in the Bulga Coal Complex purchasing and fitting louvres to all lighting plants in order to direct light onto work areas and shield sensitive receivers from stray light.

## 4.17 Spontaneous combustion

### 4.17.1 Underground Operations

#### 4.17.1.1 Management of spontaneous combustion

A Spontaneous Combustion Management Plan is currently implemented for the Underground Operations at Bulga Coal Complex. The Plan aims to provide a structured system for the management and control of spontaneous combustion and to establish a safe working environment. The Underground Operation monitors spontaneous combustion and has adopted control systems accordingly.

To manage a number of identified potential risks relating to spontaneous combustion a number of controls are implemented, they include:

- Awareness of spontaneous combustion on site and training of personnel to identify and report spontaneous combustion.
- Minimum standards for mine planning and design, which includes design for pillar stability and strata control, and mine geometry to exclude bleeder airways.
- Ventilation management. This includes minimum standards for ventilation change, control and appliance management, minimising pressure differentials and leakage, and balancing pressure differentials across longwall goafs.
- Systems for the purpose of monitoring the status of spontaneous combustion and to identify any potential increase in risk. This includes continuous gas monitoring of both mine airway and goaf atmospheres, minimum standards for monitoring, and analysis of sample results and trends.
- Alarm management.
- Response and recovery.

There were no changes to the management practices for spontaneous combustion during the reporting period.

#### 4.17.1.2 Spontaneous combustion incidents

No spontaneous combustion incidents occurred at the Underground Operations during the reporting period.

### 4.17.2 Open Cut Operations

The Open Cut Operations have had only rare occurrences of above ground spontaneous combustion due to a low sulphur content in extracted coal and good stockpile management that aims to keep the temperature of coal stockpiles low.

#### 4.17.2.1 Spontaneous combustion incidents

There were no major incidents of spontaneous combustion at the Open Cut Operations during the report period.

## 4.18 Bushfire

Bushfire risk at the Bulga Coal Complex is managed in accordance with the Bushfire Management Plan. The management plan includes procedures for bushfire suppression, prevention and classification/identification of high bushfire hazard zones. Fire management resources identified by the Bushfire Management Plan include:

- A mine rescue station accommodating a fully equipped and maintained fire engine.
- Three 185,000 litre water carts, available for use as water reservoirs if required. The carts have been fitted with the standardised Rural Fire Service equipment STORZ fittings.
- Helipad and road access points.
- Dams and maintained watering points.
- Emergency phones and fire extinguishers provided at vantage points within the surface facilities.
- Portable radios.
- Earthmoving equipment.
- Trained personnel with protective clothing.

There were no bushfire incidents at the Bulga Coal Complex during the reporting period. All existing fire breaks were maintained during the reporting period.

The Bulga Coal Complex continued to maintain existing fire breaks surrounding the CHPP and powerline easements during the reporting period.

## 4.19 Methane drainage and ventilation

The Underground Operations actively manage methane drainage through the implementation of the coal seam gas drainage project in preparation for the Blakefield South mining activities. The project aims to pre-drain the coal seam to provide a safer more efficient work environment. The drained methane is flared to lower greenhouse gas emissions resulting from the project. Details of the works undertaken for the project during the reporting period are provided in **Section 2.2**.

## 4.20 Hydrocarbon contamination

There were no significant hydrocarbon spillages recorded at the Bulga Coal Complex, which may have led to substantial contamination during the reporting period. Minor spills are managed and remediated in accordance with the site spill management procedures. Any soil removed as a result of minor spills is transported to the onsite bioremediation area.

A hydrocarbon contamination assessment for the Bulga Coal Complex was undertaken in December 2009 by an external consultant, Parsons Brinkerhoff. The assessment led to reporting the Open Cut Operations Area Station as a contaminated site in accordance with Schedule 2 of the *Contaminated Land Management Act 1997.* This legislation was enacted in December 2009.

Major infrastructure upgrade works are planned to commence in 2010 to improve all hydrocarbon management facilities at the Open Cut Operations. The works will be directed towards storage, use and treatment of runoff from hydrocarbon management facilities. Remedial Action Plans (RAPs) will be developed for key hydrocarbon management facilities onsite to address identified issues in the short term and for the Life of Mine (LOM). This issue was also identified in the Open Cut Operations external compliance audit, undertaken during the reporting period.

## 4.21 Public safety

All unauthorised entry to Bulga Coal Complex had been restricted by the installation of surrounding fences, and continuous security patrols.

All site visitors are directed to the main office to report and log on to the electronic visitors book (Onsite Track Easy). Visitors must provide details including their name, company, names of staff members they are visiting and their arrival time. They must also logout using the same system when leaving site.

Visitors are issued with a sticker and pass number which they must possess at all times on site, and return when departing site.

Mine safety and environmental management issues are explained to all contractors and employees working onsite prior to working within the mine area. During hazardous activities such as blasting, sentries are posted throughout the site to prevent unauthorised entry in to the blasting zone.

There were no incidents relating to public safety during the reporting period.

## 4.22 Vertebrate pest management

A Land Management Plan, developed and implemented by the Bulga Coal Complex includes the management of vermin, feral animals and noxious weeds.

Following a number of sighting of feral pigs on mine owned land, a feral pig eradication program was initiated by the Underground Operations in consultation with the local Livestock Health and Pest Authority. The program has shown only moderate success, with only one pig trapped during the reporting period. The program is scheduled to continue throughout 2010, or until pig sightings and visible land degradation caused by these vermin shows a noticeable decline. **Plate 4-3** shows the feral pig trapped during the reporting period.

**Plate 4-3 A feral pig trapped at the Bulga Coal Complex during the reporting period**

## 4.23 Greenhouse gas emissions

The Open Cut and Underground Operations record GHG emissions by utilising industry standard factors for diesel usage, explosives and fugitive emissions from stockpiles.

The Underground Operations directly measure greenhouse gas emissions from both ventilation and pre-mining gas drainage. The ventilation system comprises two fans at the Beltana No.1 Mine and two at the Blakefield South Mine. The fans pump surface air into the workings then return the air to the surface. The air extracted by the ventilation shafts is a mix of both atmospheric air and gases released from the underground exposed coal. Both carbon dioxide and methane are measured in the ventilation air.

The gas drawn from the pre-mining wells (as discussed in Sections 2.2 and 4.17) is nearly pure methane, with an average gas content of between 96% to 99% methane. At present, this methane is piped to the flaring facility for combustion. The expansion of the flaring facilities completed during 2009 has allowed the entire draw from the pre-mining gas wells to be combusted and emitted as carbon dioxide. Each new flare has the capacity to convert methane to carbon dioxide at a rate up to 1000L/s.

GHG emissions for the Bulga Coal Complex during the reporting period are summarised in **Table 4-30**. The emissions in this table have been estimated using the methods specified in DEWHA's *National Greenhouse*

*and Energy Reporting (Measurement) Determination 2008* and DEWHA's *AGO Factors and Methods Workbook 2006*.

**Table 4-29 Bulga Coal Complex greenhouse gas emissions for 2009**

| Emission source | Open Cut Operations emissions(t) | Underground Operations emissions (t) |
|---|---|---|
| $CO_2$ from diesel usage | 144,414 | 4,349 |
| $CO_2$ from explosives | 4,918 | 0.02 |
| $CO_2$ from ventilation air | Na | 22,382 |
| $CH_4$ emitted from Underground* | Na | 40,574 |
| $CH_4$ flared | Na | 30,971 |

*Methane emitted from underground includes both ventilation air and methane from underground in-seam gas drainage.

As mentioned in **Section 1.2.2** the purpose of the application to modify the Beltana development consent is specifically for the purpose of reducing the greenhouse gas impact. Constructing of 25 MW of gas fired power generation and VAM abatement unit has the potential to reduce the Beltana greenhouse gas impact by approximately 12%.

# 5. References

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# Appendix A

Summary of Approvals, Leases and Licences

# Appendix B

Development Consent Conditions
Summary Tables

# Appendix C

Compliance Audit Reports

# Appendix D

Objectives and Targets

# Appendix E

Community Complaints

# Appendix F

Environmental Risk Matrix

# Appendix G

Noise Monitoring Results

# Appendix H

Blast Monitoring Results

# Appendix I

Air Quality Monitoring Results

# Appendix J

PAE Holmes PM10 Assessment Report

# Appendix K

Stephenson Environmental
Ventilation Monitoring Report

# Appendix L

Surface Water Monitoring Results

# Appendix M

Groundwater Monitoring Results
and Assessment Reports

# Appendix N

Subsidence Monitoring and Auditing Reports

# Appendix O

Umwelt Ecological Monitoring Report

# Appendix P

DECCW Aboriginal Heritage Incident Consultations

# Appendix Q

Statutory Mine Plans