

Clarence Colliery



Centennial Coal

Annual Environmental Management Report

2013

Clarence Colliery following the State Mine Bushfire (2013)

Name of mine	Clarence Colliery		
Titles/Mining Leases	CCL705, ML1353, ML1354 & ML1583		
MOP Commencement Date	01/01/2007	MOP Completion Date	31/12/2013
AEMR Commencement Date	01/01/2013	AEMR End Date	31/12/2013
Name of Leaseholder	Coalex Pty Ltd & Clarence Coal Investments Pty Ltd		
Name of mine operator (if different)	Clarence Colliery Pty Ltd		
Reporting Officer	Gregory Shields		
Title	Mine Manager		
Signature		
Date			

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1. Introduction

Clarence Colliery Pty Ltd (Clarence Colliery) is an underground coal mining operation located within the NSW Western Coalfields (**Appendix 1**). Clarence Colliery is a wholly owned subsidiary of Centennial Coal Company Limited (which is a wholly owned subsidiary of Banpu Public Company) and has been appointed as the management entity for the Clarence Joint Venture. Centennial Coal Company Limited has an 85% share in the Clarence Joint Venture comprised of a number of wholly owned subsidiaries including Coalex Pty Ltd (51% share), Clarence Coal Investments Pty Ltd (29% share) and Centennial Clarence Pty Ltd (5% share). The remaining 15% share in the Clarence Joint Venture is held by SK Networks Resources Australia Pty Ltd.

Operations at Clarence Colliery commenced in 1979. Coal is extracted from the Katoomba coal seam using bord and pillar partial extraction methods supplying coal to both domestic and export markets. Clarence Colliery is located approximately 15 kilometres east of Lithgow, to the north of Chifley Road (continuation of the Bells Line of Road) and the Main Western Rail Line. Newnes Junction village is located approximately 900 metres to the south-east of the site and contains a small number of residential dwellings. Clarence Village is also located approximately 1.5 kilometres to the south-west of the site.

A number of extractive industries are also located in close proximity to Clarence Colliery including the Hanson Quarry located immediately to the west and the disused Rocla Quarry located to the south-east of the site respectively. The Newnes Kaolin Project is an approved quarry, which is proposed to be established to the south-east of the site.

Land to the east of the site is protected under the Blue Mountains National Park, one of the eight protected areas making up the World Heritage Listed Greater Blue Mountains Area (UNESCO 2013). The Newnes State Forest is located to the north and west of Clarence Colliery. Clarence Colliery is located within the Hawkesbury-Nepean Catchment and discharges water to the Wollangambe River which eventually drains to the Colo River.

The principal components of the existing operations include:

- An underground coal mine with maximum production levels of three million tonnes per annum (Mtpa).
- Associated pit top area containing surface infrastructure including:

- Mine administration and bath house building;
- Store and workshop building;
- Water treatment plant;
- Rail loop and load out facilities;
- Conveyor systems to transfer coal from the underground mine to the pit top facilities including the load out on the rail loop;
- Run-of-Mine stockpile area;
- Ventilation facility;
- Washed coal stockpile area;
- Coal Handling and Preparation Plant (CHPP);
- Four partially rehabilitated existing Reject Emplacement Areas (REA);
- Various water management structures include storage and leachate dams and irrigation area which forms part of the water management on site;
- Sewage treatment plant; and
- A downcast ventilation shaft located on the Newnes Plateau.

Environmental aspects of the Clarence Operation are managed in accordance with legislation, lease, licence and approval conditions with reference to the Clarence Colliery Environmental Management System (EMS). In accordance with Clarence EMS, Clarence has adopted the Centennial Coal Environment and Community Policy, included in **Appendix 9**.

This Annual Environmental Management Report (AEMR) has been prepared to meet the reporting requirements of the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS), NSW Department of Planning and Infrastructure (DP&I), NSW Office of Water (NoW) and other such regulatory bodies. This AEMR has been prepared in accordance with the Guidelines to Mining, Rehabilitation and Environmental Management Process (2006) published by DTIRIS.

1.1 Consents, Leases and Licences

Mining at Clarence is undertaken within Consolidated Coal Lease 705 (CCL705), Mining Lease 1353 (ML1353), Mining Lease 1354 (ML1354) and Mining Lease 1583 (ML1583) issued by the DTIRIS. Mining during 2013 occurred within CCL705 and ML1583 (**Appendix 1**).

Clarence Colliery currently operates under three separate development consents. Approval to commence mining was originally granted in 1976 by the Blaxland Shire Council, now known as Lithgow City Council (LCC) for

the construction of surface facilities. The approval area partially encompassed CCL705. This consent was then modified in 1993 by Greater Lithgow County Council (now Lithgow City Council) to amend the REAs proposed in the original consent and expand the mining area to include all of CCL705.

Development consent for an extension of underground coal mining to the north (encompassing ML1353 and ML1354) and the consequent extension of surface reject disposal areas, water management and ancillary structures within the Clarence Colliery pit top was granted by Greater Lithgow County Council in 1994.

In 2005, Clarence received approval from the Department of Infrastructure, Planning and Natural Resources (now the Department of Planning and Infrastructure) to expand the operations into a new mining lease (ML1583) which consisted of the conversion of a number of tenements into the new mining lease. The development application number for this consent is 'DA 504-00'.

Centennial lodged a development application (DA) with Lithgow City Council in October 2000 for the proposed lease extension of Clarence Colliery. This DA was for the conversion of coal authorisations EL5072, ALA5, ALA8 and ALA307 to mining leases for the purpose of coal extraction using the

existing mining system and pit top facilities. The development application (DA 504-00) was approved by the Minister for Planning on the 19th December 2005. A copy of Clarence Development Consent is attached in **Appendix 10**.

During the reporting period Clarence submitted a Section 75W modification to DA 504.00 for the construction of an additional REA.

Clarence operates in accordance with Environmental Protection Licence (EPL) 726 issued by the Office of Environment and Heritage (OEH). A copy of EPL 726 is attached in **Appendix 11**.

Clarence first Mining Operations Plan (MOP) covered the period 2001-2006. Clarence's current MOP 2007-2013 was approved in February 2007. In November 2010 Clarence requested an amendment of the MOP for the development of REA IV and V, update of mine contact details, proposed land preparation and construction and future water management, use of mining equipment and rehabilitation.

A new Draft MOP for the period covering 2014-202 has been submitted to DTIRIS following the expiry of the current MOP on December 31, 2013. While the new MOP is in consultation Clarence will continue to operate under its existing approved MOP.

All licences, consents and approvals held by Clarence Colliery are listed in **Table 1**.

Table 1. Clarence Colliery Licences, Consents and Approvals

Licence/Approval/Consent	Approval/Number	Approval Authority	Date Granted-Expiry/Renewal Date
Development Consents			
Original Development Consent	IRM.GE.76	Blaxland Shire Council	Approved 15/06/1976
Development Consent Modification	IRM.GE.76	Lithgow City Council	Approved 21/07/1993
Development Consent	174/93	Lithgow City Council	Approved 15/02/1994
Development Consent	DA504-00	Department of Planning & Infrastructure	19/12/2005-31/12/2026
Licences			
Environmental Protection Licence	EPL726	Environment Protection Authority	02/07/2013-Renewed Annually 1 st of January
Radiation (density gauge) Licence	RR739	Environment Protection Authority	2013-18/05/2015
Radiation (density gauge) Licence	RR740	Environment Protection Authority	2013-18/05/2015
Radiation (density gauge) Licence	RR1120	Environment Protection Authority	2013-18/05/2015
Radiation (density gauge) Licence	RR1121	Environment Protection Authority	2013-18/05/2015
Radiation (density gauge) Licence	RR1122	Environment Protection Authority	2013-18/05/2015

Radiation Licence	RL31190	Department of Environment and Heritage	2013-18/05/2014
Dangerous Goods Licence	NDG020999	WorkCover Authority NSW	03/04/2013-05/03/2014
Bore Licence	10BL156676	NSW Office of Water	12/05/1995-Perpetuity
Bore Licence	10BL161963	NSW Office of Water	13/08/2003-Perpetuity
Bore Licence Leachate Transfer	10BL604765	NSW Office of Water	12/12/2012-11/12/2017
Bore Licence CLRP1	10BL161964	NSW Office of Water	13/08/2003-Perpetuity
Bore Licence CLRP2	10BL161965	NSW Office of Water	13/08/2003-Perpetuity
Bore Licence CLRP3	10BL602213	NSW Office of Water	10/12/2007-Perpetuity
Bore Licence CLRP4	10BL161962	NSW Office of Water	30/08/2003-Perpetuity
Bore Licence CLRP5, CLRP7, CLRP10	10BL602211	NSW Office of Water	10/12/2007-Perpetuity
Bore Licence CLRP6	10BL602212	NSW Office of Water	10/12/2007-Perpetuity
Bore Licence CLRP 12	10BL604063	NSW Office of Water	07/07/2010-Perpetuity
Bore Licence CLRP 11, 13, 14	10BL604099	NSW Office of Water	05/07/2010-Perpetuity
Bore Licence CLRP 15, 16	10BL604098	NSW Office of Water	05/07/2010-Perpetuity
Bore Licence CLRP 17, 20	10BL605316	NSW Office of Water	30/01/2013-Perpetuity
Bore Licence CC114	10BL602819	NSW Office of Water	09/03/2009-Perpetuity
Bore Licence CC115	10BL602820	NSW Office of Water	09/03/2009-Perpetuity
Bore Licence HV1, HV2, HVU1, HVU2	10BL603337	NSW Office of Water	07/09/2009-Perpetuity
Bore Licence	10BL605494	NSW Office of Water	12/12/2013-Perpetuity
Bore Licence 79 cut through mine dewatering	10BL165054	NSW Office of Water	22/09/2006-21/09/2011 (application in progress)
Bore Licence 82 cut through mine dewatering	10BL165053	NSW Office of Water	22/09/2006-21/09/2011 (application in progress)
Surface Licence Main Dam	10SL039344	NSW Office of Water	26/01/2008-25/01/2013
Surface Authority Town Water Supply	10SA001409	NSW Office of Water	30/09/2007-30/09/2017
Exploration Licence	EL5072	Department of Primary Industries	08/05/2006-11/11/2010
Authorisations			
Authorisation 307	A307	Department of Primary Industries	05/02/2010-24/08/2014
Authorisation A416	A416	Department of Primary Industries	29/03/2010-24/08/2014
Authorisation A451	A451	Department of Primary Industries	05/02/2010-24/08/2014
Project Approval			
Reject Emplacement Area II	Section 126	Department of Primary Industries	Approved 19/06/1992
Reject Emplacement Area III	Section 126	Department of Primary Industries	Approved 07/10/1993
Reject Emplacement Area IV	Section 100	Department of Primary Industries	28/03/2011-01/07/2015
Reject Emplacement Area Iva extension	Section 100	Department of Primary Industries	18/09/2013-01/09/2017
Leases			

Consolidated Coal Lease	CCL705	Department of Trade and Investment, Regional Infrastructure and Services	20/12/2006-20/12/2027
Mining Lease	ML1353	Department of Trade and Investment, Regional Infrastructure and Services	21/07/1994-21/07/2015
Mining Lease	1354	Department of Trade and Investment, Regional Infrastructure and Services	21/07/1994-21/07/2015
Mining Lease	1583	Department of Trade and Investment, Regional Infrastructure and Services	09/07/2006-09/07/2027
Mining Operations Plan			
Mining Operations Plan	N/A	Department of Trade and Investment, Regional Infrastructure and Services	01/01/2007-31/12/2013 (2014-2020 MOP in Consultation with DTIRIS)
Subsidence Management Plans			
Subsidence Management Plan	700 Area	Department of Trade and Investment, Regional Infrastructure and Services	08/05/2009-01/05/2014
Subsidence Management Plan	700 West Area	Department of Trade and Investment, Regional Infrastructure and Services	18/06/12-01/06/2017 or to expiry/cancellation of ML1583
Subsidence Management Plan	Eastern Area	Department of Trade and Investment, Regional Infrastructure and Services	10/2005-01/06/2013 or to expiry of CCL705 or ML1353
Subsidence Management Plan	CCL705 Outbye Areas	Department of Trade and Investment, Regional Infrastructure and Services	08/05/2009-01/05/2014
Subsidence Management Plan	CCL705 Outbye Areas (Panels 302, 305, 306, 307, 400, 403 and 406)	Department of Trade and Investment, Regional Infrastructure and Services	08/05/2009-01/05/2014
Subsidence Management Plan	CCL705 Outbye Areas (Panels 314 & 316)	Department of Trade and Investment, Regional Infrastructure and Services	19/02/2010-01/02/2015 or to expiry/cancellation of CCL705
Subsidence Management Plan	CCL705 Outbye Areas (Panel 402 Only)	Department of Trade and Investment, Regional Infrastructure and Services	27/03/2009-01/01/2010 or to expiry/cancellation of CCL705
Subsidence Management Plan	CCL705 Outbye Areas (Panel 602 Only)	Department of Trade and Investment, Regional Infrastructure and Services	30/01/2009-01/01/2010 or to expiry/cancellation of CCL705
Access Agreement			
Access Agreement	Q648-100	State Rail Authority	10/07/1981-Life of Loop
Occupation Permit			
Occupation Permit		Forests NSW	Renewed Annually

1.2 Mine Contacts

Table 2. Contact Details for Key Mine Personnel

Name	Title	Phone
Gregory Shields	Mine Manager	02 6353 8033
Jesse Percival	Environment and Community Coordinator	02 6353 8039
Enquiries and Complaints Line	Daytime Contact Afterhours Contact	02 6353 8039 02 6353 8010

1.3 Actions Required at Previous AEMR Review

A summary of actions identified at the 2012 AEMR review meeting on the 27th August 2013 and feedback from the DTIRIS and DP&I on 5th July 2013 (**Table 3**).

Table 3. Actions Required at Previous AEMR Review

Action Required	Where dealt with in this AEMR
Reporting parameters must include a comparison of complaints received during the past year with complaints received in previous years.	Section 4.1.
An air quality assessment is scheduled to be completed in the first quarter of 2013, as previously requested by the Department during the 2011 Annual Report review.	Section 3.3.5.
A new Mining Operations Plan to be developed during the 2013 reporting period covering the period 2014-2020.	Section 1.1.
An action plan to address soil and groundwater contamination risks identified in a targeted Phase 2 Environmental Site Assessment to be developed in the 2013 reporting period.	Section 3.16.2.

2. Operations During the Reporting Period

2.1 Exploration

In 2012 Clarence undertook the approval process for a four hole exploration program within the '800 Area' on the Newnes Plateau. The exploration drilling program began in Quarter 2, 2013 which included three partly-cored drill holes (due to financial constraints) to explore and further define coal resources of the exploration area. The boreholes were located along existing and overgrown fire trails and vehicle access tracks on the Newnes Plateau. A Review of Environmental Factors (REF) was prepared which considered the environmental impacts of the exploration program and the mitigation measures that would be employed. A copy of the REF is available on Resources & Energy Website at the following address:

<http://www.resources.nsw.gov.au/environment/ref/2012>

Approval from the DTIRIS was received on the 17th of December 2012. The issuing of monitoring bore licences from NoW was a signed occupation permit with the Landholder Forests NSW in early 2013. At the completion of each borehole drilling, the borehole was geo-physically logged by a specialist contractor. The logging operation approximately took one day with the drill rig remaining on site during the process. Upon completion of the exploration activities, CLRP20 was rehabbed and sealed in accordance with the DTIRIS guideline '*EDG01 Environmental Management Guideline for Industry - Borehole Sealing Requirements on Land: Coal Exploration*' (Department of Mineral Resources 1997) and CLRP17 and CLRP 19 were rehabbed and monuments were fitted for piezometers. A summary of rehabilitation progress for previous Clarence drilling activities is included in **Table 4** and the location of existing boreholes is shown in **Appendix 4**.

2.2 Land Preparation

Land preparation for Reject Emplacement Area (REA) IVa was completed during the reporting period. The total area cleared was approximately 0.9 hectare. Cleared vegetation and stripped topsoil and subsoil was directly applied on the completed benches of REA IV for progressive rehabilitation. Rehabilitation activities are discussed in **Section 5**.

2.3 Construction

REV IVa was constructed during the reporting period as an extension of REA IV located adjacent to the access road and rail loop to the south-east of the stockpile areas.

2.4 Mining

During 2013, the following mining activities took place:

- Extraction within 700 panel commenced on 27 November 2013 and continued into until the end of the reporting period.
- Development commenced in 701 panel from 2nd April 2013 and finished 27th June 2013.
- Development continued in 706 panel from the 2012 reporting period and finished 5th December 2013.
- Development continued in 716 panel from the 2012 reporting period and finished 25th July 2013.
- Extraction within 716 panel commenced on 26th July 2013 and finished 27th September 2013.
- Development continued in 801 panel from the 2012 reporting period and finished 9th August 2013.
- Development commenced in 801S panel from 12th August 2013 and continued until the end of the reporting period.
- Development commenced in 803 panel from 30th April 2013 and finished 8th November 2013.
- Development commenced in 810 panel from 11th November 2013 and continued until the end of the reporting period.
- Development continued in 901 panel from the 2012 reporting period and finished 19th April 2013.
- Development commenced in 902 panel from 9th December 2013 and continued until the end of the reporting period.
- Development commenced in 904 panel from 1st October 2013 and continued until the end of the reporting period.

The 2013 mine plan with progress of development and extraction is included in **Appendix 2** and proposed 2014 mine plan is included in **Appendix 3**.

Table 4. Drilling Activities and Rehabilitation Progress

Borehole Number	License Number	Drilling Date	Drilling Site Rehabilitation Progress	Borehole Sealing Rehabilitation Progress
CLRP1	10BL161964	Aug-04	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP2	10BL161965	Aug-04	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP3	10BL602213	Dec-06	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP4/MBN01	10BL161962	Aug-03	Complete	Standpipe Single Data Logger
CLRP5	10BL602211	May-08	Complete	Standpipe Single Data Logger
CLRP6	10BL602212	May-08	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP7	10BL602211	Apr-08	Complete	Standpipe Single Data Logger
CLRP9	N/A	May-08	Complete	Sealed
CLRP10	10BL602211	May-08	Complete	Standpipe Single Data Logger
CLRP11	10BL604099	Sep-10	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP12	10BL604063	Aug-10	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP13	10BL604099	Sep-10	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP14	10BL604099	Sep-10	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP15a	10BL604098	Oct-10	Complete	Standpipe Single Data Logger
CLRP15	10BL604098	Oct-10	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP16	10BL604098	Oct-10	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP17	10BL605316	Aug-13	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP19	10BL605316	Jul-13	Complete	Multi Level Vibrating Wire Piezometer Grouted
CLRP20	10BL605316	Jul-13	Complete	Multi Level Vibrating Wire Piezometer Grouted
CC111	N/A	Aug-08	Complete	Sealed
CC112	N/A	Aug-08	Complete	Sealed
CC113	N/A	Oct-07	Complete	Standpipe Single Data Logger
CC114	10BL602819	Apr-09	Complete	Multi Level Vibrating Wire Piezometer Grouted
CC115	10BL602820	Apr-09	Complete	Multi Level Vibrating Wire Piezometer Grouted
Happy Valley Upper Swamp 1	10BL603337	Dec-10	Complete- Minimal disturbance	Standpipe Single Data Logger
Happy Valley Upper Swamp 2	10BL603337	Dec-10	Complete- Minimal disturbance	Standpipe Single Data Logger
Happy Valley Swamp 1	10BL603337	Dec-10	Complete- Minimal disturbance	Standpipe Single Data Logger
Happy Valley Swamp 2	10BL603337	Dec-10	Complete- Minimal disturbance	Standpipe Single Data Logger

Table 5. Coal Production (Run of Mine) 1999-2013

Year	Coal Production (Run of Mine) Tonnes
2013	2,360,066
2012	2,017,674
2011	2,006,738
2010	1,829,454
2009	1,978,214
2008	1,829,551
2007	1,474,944
2006	1,604,397
2005	1,626,414
2004	1,729,167
2003	1,529,667
2002	1,129,550
2001	1,384,162
2000	1,092,525
1999	920,680

Table 6. Production and Waste Summary

	Cumulative Production (tonnes)		
	Start of Reporting Period	At end of Reporting Period	End of next reporting (estimated)
Topsoil Stripped	1 200	900	0
Topsoil Used/Spread	900	3000	0
Waste Rock	0	0	0
ROM	2 017 674	2,360,066	2,604,325
Processing Waste	192 324	280,676	156,259
Product Domestic	103 596	153,652	200,000
Product International	1 825 264	1,816,772	2,375,000

2.5 Mineral Processing

The CHPP is designed to operate at 650 tonnes per hour (tph). Product less than 50mm sizing is pushed into underground reclaim tunnels via a dozer. A medium is added to the water which aids the separation of the heavier material from the coal. Coal is screened to separate less than 0.05mm coal fines which report to the thickener and product coal is sent to the product stockpile. The fine material is pumped from the thickener to belt filter presses which were installed in 2009. The filter

press compresses slurry into a cake and water is returned to the plant. The filter cake is transported to the product stockpile.

The washed coal is added to an export stockpile or sized in a screening plant into 50mm minus to plus 25mm, 25mm minus to plus 15mm or 15mm minus. Screened material is stockpiled and loaded for domestic sale via road haulage.

Coarse reject from the plant is transported via a belt from the CHPP to a reject bin and trucked to the reject emplacement area.

2.6 Waste Management

Waste is managed in accordance with Clarence Waste Management Plan. Waste management practices are based on the Waste Management Hierarchy whereby waste is minimised in the first instance, reused/recycled in the second instance and disposed of as a last resort.

Waste is segregated into the following different streams for management and recycling and/or disposal:

- General Waste;
- Paper and Cardboard Recycling;
- Scrap metal;
- Packaged Oily Waste;
- Liquid Oily Waste;
- Diesel Particulate Filters; and
- Other special hazardous wastes.

Clarence reviewed its Waste Management Plan in 2012 and updated the plan to include waste performance targets. Clarence has set the following targets to ensure continual improvement in site waste minimisation and management:

- 5% reduction in total waste volumes on a comparative year basis. Total waste volumes will be calculated on a kg of waste per ROM tonne produced; and
- 10% improvement in recycling rates on a comparative year basis. Recycling rates will be calculated as a percentage of total waste material.

During the reporting period Clarence did not meet the 5% reduction in total waste target. This is due to a large amount of waste produced from the State Mine Bushfire which proceeded through the site on the 17th of October 2013. However, Clarence exceeded the 10% improvement in recycling rates by 13% during 2013.

Waste targets will be reviewed and modified as required to assist in improving waste minimisation and management procedures. Total waste and percentage of material recycled during the reporting period is presented in **Figure 1**.

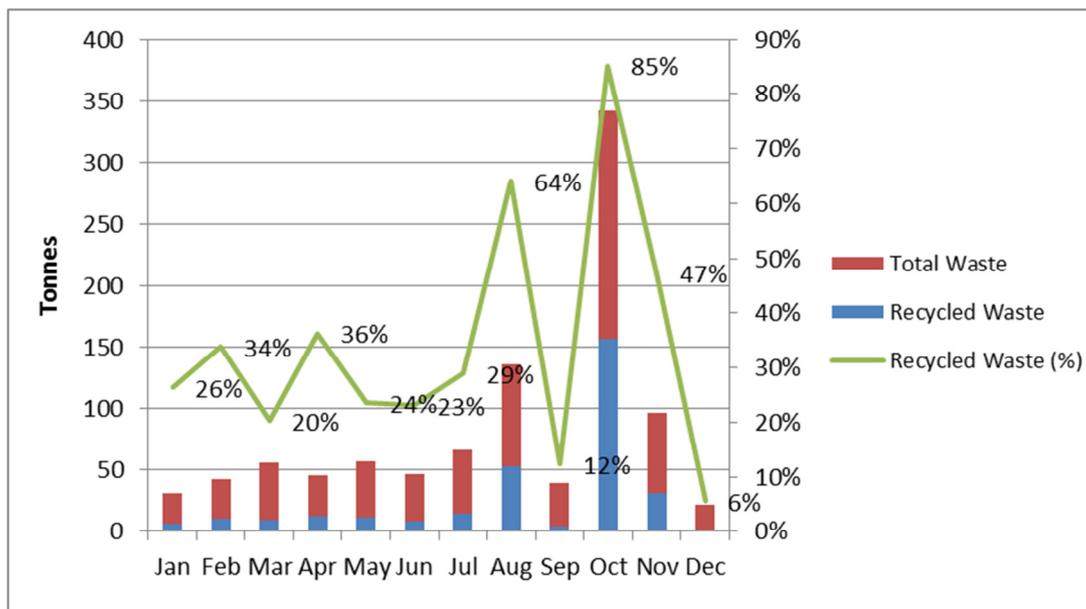


Figure 1. Total Waste and Recycling 2013

2.6.1 Reject Management

Reject material from the CHPP is produced when ‘washing’ coal to reduce ash content. Washing coal removes impurities in the coal (e.g. sedimentary rock, clay, high-ash coal) to meet desired ash content in the final product. Washing is undertaken as required to meet market specifications.

During the reporting period all reject material was placed on Reject Emplacement Area (REA) IV and IVa.

Fines were put through the belt press filters and then were placed on the final product stockpile. During thickener maintenance periods the fines were placed in REA III settling ponds.

2.6.2 Sewage Treatment

A package sewage treatment plant is connected to a holding tank that receives raw sewage from the administration and CHPP buildings. Treated effluent is discharged to a twin pond system for maturation, from where it is then pumped to a spray irrigation area between the coal stockpiles and the rail-loading loop. An average of 36kl is applied to the irrigation area each day. The sewerage treatment plant is currently being upgraded to improve performance and quality of treated effluent through additional filtration and maturation. The upgrade is expected to be completed in Quarter 2, 2014.

Irrigation of treated effluent currently occurs on the proposed REA VI site, requiring selected irrigation sprinklers to be removed pending the approval of the construction of REA VI. Clarence Colliery commissioned consultants to determine alternate areas which treated effluent could be applied. Areas identified based on catchment mapping and soil testing included rehabilitated areas on REA II and REA III.

2.6.3 Oil and Grease Containment and Disposal

Clarence Colliery utilises oil and grease handling and recovery systems for oil evacuation at workshops to waste oil tanks which are emptied by a licensed contractor. The handling and recovery systems prevent the entry of waste oil into the water system. There were no changes to oil and grease handling during the reporting period.

Clarence collects liquid waste oil, oily rags and oil filters from the workshop and CHPP for recycling and disposal. Total quantities of packaged and liquid oily waste recycling in 2013 are presented in **Figure 2** and **Figure 3**. All oily waste was tracked in accordance with *Protection of the Environment Operation (Waste) Regulation*.

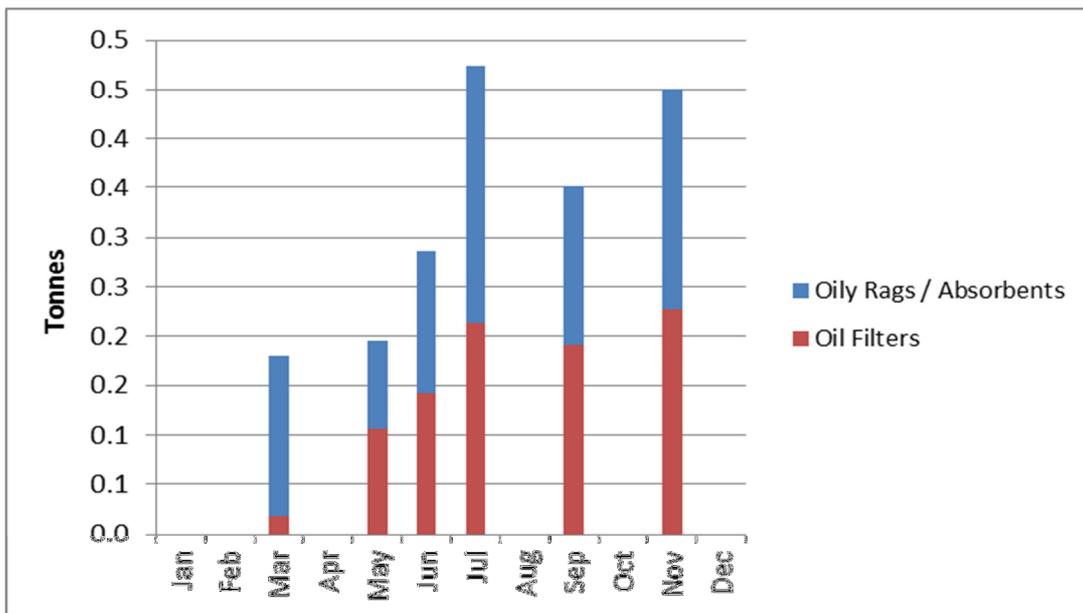


Figure 2. Packaged Oily Waste Recycling 2013

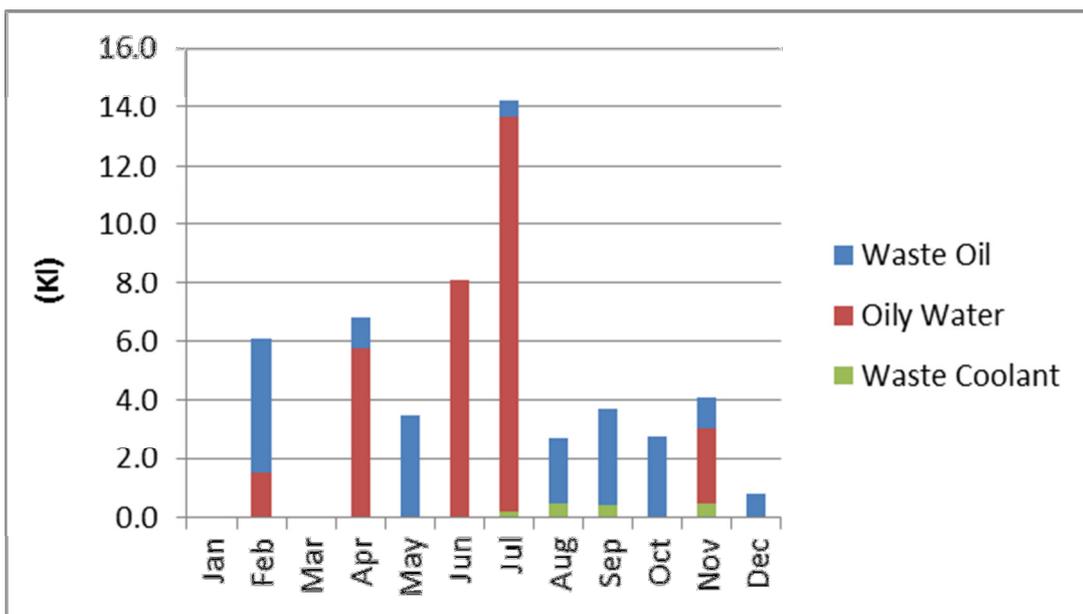


Figure 3. Liquid Oily Waste Recycling 2013

2.7 Product Stockpiles

Coal is delivered from the underground workings via a conveyor belt system, through sizing plant and then feeds onto the ROM stockpile. The ROM stockpile area has a capacity of 300,000 tonnes. The eastern half of the ROM stockpile area contains an automatic understack coal reclaim system that can extract ROM coal from the stockpile and direct it to the train-loading bin. The western half of the ROM stockpile has an understack

coal reclaim system which supplies coal to the CHPP as required. The washed/final product stockpile has a capacity of approximately 300,000 tonnes. This area is used for washed product and is also used for screened coal stockpiles. There were no changes to the management of product stockpiles during the reporting period.

2.8 Water Management

Water Management at Clarence is managed in accordance with a Water Management Plan approved by DP&I. A schematic showing water flows around the Clarence site is attached in **Appendix 8**.

Clarence reviewed the Water Management Plan during the previous reporting periods. The review included updating the Plan in accordance with applications and approval conditions of the Outbye and 700 Area SMP's. Following consultation with regulatory bodies, DP&I approved the Water Management Plan on 25th June 2012.

Clarence undertook specific changes to the water management system during the reporting period supporting continuous improvement. Changes made to the water management in 2012 are described throughout Section 2.8 below.

Clarence supplies water to the LCC through the water transfer scheme outlined in Section 2.8.6. Clarence continued to work with LCC during the reporting period.

2.8.1 Water Management Strategy Team

During the previous reporting period Clarence continued its Water Strategy Team established in 2012 to improve the Clarence Water Management System through a whole of mine approach. The team included representatives from all departments and met on a monthly basis to identify, assess and schedule improvement projects. Significant improvements to the water management system were completed including:

- Continued monitoring of the quality and quantity of underground water and improved water accounting;
- Continued monitoring of the quality and quantity of surface water and improved water accounting;
- Optimisation and upgrades to the Clarence Mine Water Treatment Plant;
- Improved monitoring systems at the Clarence Mine Water Treatment Plant to prevent licence exceedences;
- Planning and design of Leachate Dam No. 2 upgrade to 10.3 ML;
- Design, planning and delivery of the Primary Arrestor Slurry Pump; and
- Design and commissioning of the CHPP Recycling System.

Water Strategy Team Meetings will continue during the 2014 reporting period with focus on the following:

- Commissioning of Primary Arrestor Slurry Pump;

- Construction of Leachate No. 2 Dam upgrade;
- Ongoing monitoring of surface and underground water quality and quantity;
- Continued improvements and optimisation of the Mine Water Treatment Plant; and
- Improvements to underground water delivery.

2.8.2 Water Supply and Use

Clarence is not connected to the Lithgow township potable water system. Water on site is captured in rain water tanks or treated mine water. Primary contact water is sourced from a number of treated water tanks located on the site. The approximate consumption of bathroom water was 13.5ML.

Site water usage and transferred is measured on a daily basis and the site water balance calibrated monthly. The consumption of process water (inclusive of water used in the mine, CHPP, WTP process water and for dust suppression) was 598ML in 2013. A breakdown of the total process water used in 2013 is outlined below in **Table 7**. Clarence has achieved significant water savings in 2013 through the commissioning of the CHPP recycling project. This is discussed further in **Section 3.19.4**.

Table 7. Process Water Supply 2013

Area	Supply 2013 (ML)
Underground	135
CHPP	334
Other Surface (Pit Top, administration)	129
TOTAL	598

2.8.3 Groundwater Management

Clarence is licensed to dewater the mine for safety reasons under dewatering licences issued by the NSW Office of Water (NoW). The underground workings are dewatered via two boreholes on the northern extent of the surface infrastructure. Water is transported from the dewatering boreholes by an overland pipeline for each borehole to the water treatment plant for treatment and release off site through Licensed Discharge Point 2.

The partial extraction technique used at Clarence ensures that impacts on the surrounding groundwater resources are minimised in accordance with Schedule 3, Condition 6, 9, 10 and 11 of DA 504-00, Clarence has developed a Groundwater Monitoring Program and Response Plan. This

Plan forms part of the Site Water Management Plan and was developed in consultation with regulatory bodies including Lithgow City Council, Sydney Catchment Authority, Office of Environment and Heritage and the Department of Planning and Infrastructure and has been approved by the Department of Planning.

The objectives of this monitoring program are to monitor and manage any potential impacts resulting from operations at Clarence on both groundwater baseflows and surface water flows in water bodies above the mine. These flows are critical to the protection of upland swamps and wetlands and supply a source of bore water to the residents of Clarence Village. The program gathers baseline groundwater levels and quality data, develop groundwater impact assessment criteria, monitor the volume and quality of groundwater seeping into the underground mine workings and monitor regional groundwater levels in a number of geologic formations at the mine as follows:

- I. Banks Wall Sandstone;
- II. Burra-Moko Head Sandstone;
- III. Caley Formation; and
- IV. Katoomba Coal Seam.

Groundwater is also managed and monitored through the SMP process which includes risk assessment, performance monitoring and mitigation of residual risks.

2.8.4 Surface Water Management

Clarence surface water is managed in accordance with the site Water Management Plan (WMP) under DA 504-00.

The WMP has been developed to meet the requirements of Development Consent DA504-00, specifically Conditions 5 to 11 of Schedule 3. The WMP describes the systems in place to manage surface and underground water associated with the mining activities at Clarence Colliery.

The principle objectives of the WMP include:

- Separation of clean, dirty and leachate water
- Capture and treatment of dirty and leachate water to ensure compliance with Clarence's Environmental Protection Licence
- Appropriate sediment control are maintained

The WMP also describes the monitoring program to measure the performance of the water management system and applies to all operations at Clarence Colliery.

Run-off is collected within various dirty water and clean water management structures. A schematic of surface water is provided in **Appendix 8**.

All surface water runoff (excluding reject emplacement areas) is collected in the Polishing Lagoon prior to release off site through Licensed Discharge Point 2. Dirty water is settled in a series of structures including the Grit Trap, Primary Arrestor and "B" Thickener prior to release to the Polishing Lagoon.

Runoff and leachate water from reject emplacement areas is collected in either Leachate No.1 Dam or Leachate No.2 Dam. Leachate water is transferred to the underground water storage for mixing with underground mine water.

All water in the underground water storage (collected from mine water make and leachate water) is pumped through the 79 c/t and 82 c/t dewatering pumps to the Water Treatment Plant where the water is treated before being discharged through Licensed Discharge Point 2. The Water Treatment Plant was designed specifically to remove manganese and iron from raw water. Details on the Water Treatment Plant are provided in **Section 2.8.5**.

2.8.4.1 Leachate

Leachate water originates from REA's I, II, III and IV. The leachate water is collected in open drainage lines at the toe of REA I, II, III and IV. Water is transferred from the open drainage lines to Leachate Dam No. 1 and Leachate Dam No. 2. Water from each leachate dam is transferred via a pipeline to the Leachate Borehole.

The Leachate Borehole is gravity fed receiving water from Leachate Dam No. 1 and Leachate Dam No. 2. The water mixes underground in the 79 c/t and 82 c/t water storage area. The water is mixed to provide consistent water chemistry for treatment at the water treatment plant on the surface.

Water is pumped to the surface via the 79 c/t and 82 c/t dewatering boreholes. The water is treated at the water treatment plant described in **Section 2.8.5**. After the water is treated it is released through LD2.

Whilst Leachate Dam No.1 and Leachate Dam No.2 are operated to be zero discharge under normal conditions, during high rainfall events these dams may discharge through Licensed Discharge Point 3 and 4 respectively. During the reporting period Licensed Discharge Point 4 did not discharge and Licensed Discharge Point 3 discharged on one occasion following a high rainfall event.

2.8.4.2 Main Dam

The Main Dam is a storage dam located on the Wollangambe River and has a maximum holding capacity of approximately 70ML.

Licensed Discharge Point 2 flows into the Main Dam. The dam is used as a source of water for underground operations, fire water, process water for the CHPP and water treatment plant and it supplements Lithgow's water supply (described in **Section 2.8.6**).

2.8.4.3 Stored Water

The stored water at the beginning and end of the reporting period are presented in

Table 8. It should be noted that these values are estimates only.

2.8.5 Clarence Colliery Water Treatment Plant

The Clarence water treatment plant treats the mine water through aeration, chemical dosing and dissolved air flotation (DAF).

The treatment plant operates primarily to reduce filterable manganese and iron levels in the water. Levels of manganese and iron are not process additives but are found naturally occurring in local groundwater and streams.

After recovery from the underground mine workings, raw mine water (along with leachate water) is directed into an aeration tank where lime and potassium permanganate are added

immediately prior to aeration to raise the pH of the water and oxidise dissolved metals. This has the effect of precipitating iron and manganese. A surfactant and polymer are added for the coagulation/flocculation process on the way to the flocculation tank.

Water leaves the flocculation tank and enters the DAF tank. As the water enters the DAF tank, the flocculants are carried to the surface by small bubbles of air and forms a sludge blanket. The sludge blanket is automatically swept into a sludge tank/hopper that is located internally within the DAF. Sludge is then pumped to a drying pond within the Reject Emplacement Area. The treated water is then adjusted for pH with sulphuric acid and released off site through LD2.

Continued capital upgrades occurred during the reporting period including:

- Replacement of Permanganate Dosing Pumps;
- Replacement of Recycle Pumps; and
- Optimisation of the Recycle and Saturation System to increase flotation of precipitated Iron and Manganese.
- Improved Maintenance Systems

Table 8. Stored Water

	Volumes held (cubic metres)		
	Start of Reporting Period	At end of Reporting Period	Storage Capacity
Clean Water	n/a	n/a	n/a
Polishing Lagoon	16.7	16.7	16.7
Main Dam	70.0	70.0	70.0
Processed Water Tank (1)	3.5	1.5	4.5
Dirty Water	n/a	n/a	n/a
Grit Trap	1.0	0.5	1.0
Settling Pond	3.2	3.2	3.2
Leachate Dam 1	3.0	1.0	3.0
Leachate Dam 2	1.0	<0.5	3.0
Primary Arrestor	1.5	<0.5	3.0
A Thickener	1.8	1.8	1.8
B Thickener	1.8	1.8	1.8

2.8.6 Clarence Water Transfer Scheme

Clarence has an agreement with Lithgow City Council (LCC) to provide water from the Main Dam to supplement Lithgow's water supply. LCC pump water from the Main Dam at Clarence to a designated LCC tank following provision of water for the Colliery. LCC manage the pumping of water from the tank to settlement ponds on the Newnes Plateau which transfer water into the Lithgow No. 2 Dam (Farmers Creek Dam) under a Surface Authority held by LCC.

LCC is working to upgrade the water transfer scheme in accordance with terms of an agreement with the Federal Government. LCC started the upgrade during the reporting period, assisted by Clarence Colliery. The upgrade is scheduled to be completed during quarter 2 of 2014.

2.9 Hazardous Material Management

The Dangerous Goods Licence 35/020999 was renewed on 15th March 2013. The licence covered two above ground self-bunded diesel tanks and an above ground sulfuric acid tank. Clarence Colliery has implemented a Dangerous Goods and Hazardous Substances Management Plan. The primary objectives of this management plan include but are not limited to:

- Application of a suitable risk management process to identify hazards/risks and establish the appropriate controls;
- Establishing standards, procedures and the appropriate information and communication protocols;
- Ensuring as far as reasonably practicable that person(s) are sufficiently aware of their authority and responsibility;
- Providing means for induction and ongoing training for matters related to this management plan;
- Establishing a structured process for the identification, monitoring, assessment and control of changes associated to this management plan;
- Providing an effective measurement and monitoring process of the control measures including determination of compliance through audit and review; and
- Comply with the provisions of the operations Health and Safety Management System and relevant legislation, as a minimum.

This Hazardous Substances and Dangerous Goods Management Plan provides practical guidance for the purchase, storage, use, handling and disposal of Hazardous Substances at Clarence Colliery.

A Dangerous Goods Audit was undertaken at Clarence Colliery in November 2013. The audit included an inspection of all dangerous and hazardous goods held on site. The areas inspected included:

- The Main Store and Workshop;
- Surface Yard;
- Washery Store;
- Dozer Shed;
- Water Treatment Plant;
- Coal Handling and Preparation Plant;
- Surface Conveyor;
- Bathhouse; and
- Administration Building.

All materials were listed and Material and Safety Data Sheets (MSDS) were updated accordingly as hardcopies and electronically on the Chemgold3 Program (Chemwatch). Chemwatch is a chemical register providing access to original and customized MSDSs. All MSDS's in the database are maintained and updated every five years.

2.10 Other Infrastructure Management

2.10.1 Facility Alterations

There were no facility alterations during the reporting period.

2.10.2 Transport Alterations

There have been no changes to the product transport system during the reporting period.

2.10.3 Changes in Mining Equipment or Method

There were no changes in mining equipment or method during the reporting period.

2.10.4 State Mine Bushfire Infrastructure Replacement

The State Mine Bushfire proceeded through Clarence Colliery on the 17th October 2013. This caused damage to Clarence colliery infrastructure including:

- Sewerage Treatment Plant;
- Dewatering bore pipeline;
- Water Treatment Plant recycling system;
- Dust monitoring infrastructure; and
- LDP2 Flow monitoring infrastructure.

This infrastructure was replaced during the reporting period and is now operational.

3. Environmental Management and Performance

This section summarises environmental management throughout the 2013 reporting period at Clarence Colliery. A plan of environmental monitoring locations is located in **Appendix 1**.

3.1 Environment Protection Licence

Clarence is licenced by the EPA under the *Protection of the Environment Operations Act 1997* with EPL 726. The licence was reviewed during the reporting period and a variation issued. The variation included the addition of air and noise quality criteria consistent with approval conditions in Clarence's Development Approval 504.00. A Pollution Reduction Program (PRP) was also added which stipulated sediment basins achieve 'Type D' specification. A copy of the latest licence can be found in **Appendix 11**.

Clarence is required to complete an Annual Return detailing compliance against EPL 726 conditions for the reporting period.

3.2 Meteorological Data

Meteorological data is obtained from the Clarence Colliery meteorological station. The station was installed in accordance with *Approved Methods for Sampling of Air Pollutants in New South Wales (DECCW 2007)* during 2010 and was serviced and calibrated in 2012. Clarence notified the OEH and the DP&I in September 2010 of the installation. The meteorological station is calibrated every six months. Climate data is presented below.

3.2.1 Temperature

The temperatures throughout the year covered a range from a minimum average of 7.1°C in the month of June and July to a maximum average of 19.6°C in January (**Table 9**).

3.2.2 Rainfall

The monthly rainfall fluctuates throughout the year, with the highest rainfall occurring in February and the minimum occurring in July. Total annual rainfall for 2013 was 892.8mm compared with 1019 mm in 2012 (**Table 10**).

Table 9. Average Temperature

Month	Average Temperature (°C)
January	19.6
February	16.3
March	15.5
April	12.3
May	9.1
June	7.1
July	7.1
August	7.7
September	12.3
October	13.7
November	14.3
December	18.0

Table 10. Rainfall Recorded at Clarence

Month	Rainfall (mm) Clarence Meteorological Station
January	132.2
February	235.8
March	62.0
April	45.2
May	23.6
June	119.2
July	17.6
August	22.2
September	48.0
October	22.8
November	122.6
December	41.6
Total	892.8

3.2.3 Wind Speed and Direction

The wind direction during 2013 was predominantly south-westerly. Average wind speed was 6km/h. The maximum wind speed at Clarence was 19km/h in March. Wind speed data is presented in Figure 4.

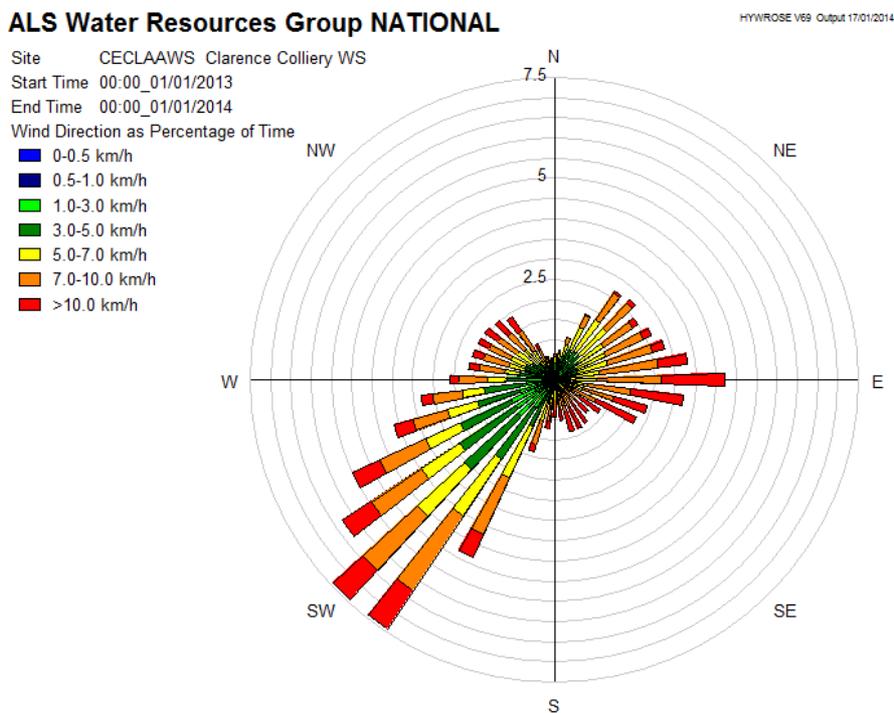


Figure 4. Yearly Windrose Plot 2013

3.3 Air Quality

Air quality in the locality surrounding Clarence Colliery is influenced by emissions generated by a range of sources including the existing operations, nearby extractive industries, vehicular traffic and regional emissions from more distant sources.

The primary components of Clarence Colliery which contribute air emissions include surface infrastructure such as the bathhouse and administration buildings, Water Treatment Plant, store warehouse, diesel refuelling station and storage shed, machinery washdown bay and workshop, equipment and materials storage areas.

On-site dust monitoring is undertaken at three locations around the periphery of the mine and a weather station is located near the administration building.

Deposited matter is measured monthly at the three locations using standing dust deposition gauges and records average dust deposition rates. This includes the contribution from Clarence Colliery together with background dust levels from surrounding extractive industries and regional sources.

Clarence Development Consent (DA 504-00) details the air quality criteria that are to be met

by operational activities at Clarence Colliery. Clarence Environmental Air Quality Monitoring Program outlines how this is to be achieved by the operation.

Depositional dust gauges are collected on a monthly basis. Samples are analysed for insoluble solids with results reported in grams per square metre per month (g/m²/month). The depositional dust limit stated in the Development Consent is 4g/m²/month on an annual average basis. This criterion is also outlined in the Environmental Air Quality Monitoring Program.

Monitoring for PM₁₀ (Particulate Matter less than 10 micrometres in size) and TSP (Total Suspended Particulates) was also undertaken during the reporting period.

Clarence Colliery operates in accordance with an Air Quality Management Plan which includes the use of a number of emission controls to minimise the impact of the operations on nearby sensitive receivers. This includes the use of water sprays within the coal handling areas, product stockpiles, reject emplacements and haul roads.

A review of the Air Quality Management Plan occurs in the first quarter of each year during the preparation of the Clarence Colliery AEMR

and the Annual Return for Environment Protection Licence No.726.

In 2012 Clarence conducted a site specific Best Management Practice (BMP) particulate determination to identify the most practicable means to reduce particle emissions from the premises. A variation was applied to EPL 726 during December 2011 to include a Pollution Reduction Program (PRP) which outlined the requirement to complete a BMP. Results and Recommendations of the Dust BMP are discussed in Section 3.3.4.

3.3.1 Dust Performance Against Environmental Impact Statement Prediction

The Environmental Impact Statement (2000) concluded that the proposed development would have no additional impact on air quality. No impact has been observed from the operation of Clarence Colliery.

Annual average insoluble solids were below 4g/m²/month for all depositional dust gauges during 2013. Monitoring for TSP and PM₁₀ also showed results well below the Development Consent criteria during 2013.

3.3.2 Review of Dust Monitoring Results

Air Quality is monitored at three locations around the perimeter of the site. The location of the monitoring sites is shown in **Appendix 4**. The locations of the air quality monitoring sites are:

1. Adjacent to the nearest residence, south of the Pit Top (TSP, PM10 and depositional Dust Gauge (DG) 1);

2. To the north of the Pit Top (DG2); and
3. On the entrance road to the south-west of the Pit Top (DG3).

DG3 is located further south-west along the entrance road, closer to Clarence village. Clarence Colliery has also commenced negotiations to relocate DG3 to private property within Clarence village itself to measure any dust impacts on nearby residences. Once the final location is agreed, the Environmental Air Quality Monitoring Program will be revised accordingly.

3.3.2.1 Dust Depositional Gauges 1, 2 and 3

Dust monitoring data indicated that monthly dust deposition results for 2013 ranged from below the detection limit to 0.1 g/m²/month at DG 2 to 3.3 g/m²/month at DG 1. No data was recorded for DG 2 in October due to the State Mine Bushfire which proceeded through Clarence Colliery on the 17th October 2013. Depositional dust gauge results for 2013 are shown in **Figure 5**.

The annual average insoluble solids for 2013 was 1.2 g/m²/month at DG 1, 0.7 g/m²/month at DG 2 and 1.3 g/m²/month at DG 3. The results are all below the annual average air quality criteria of 4 g/m²/month. The location of the dust gauges are identified as dust monitoring sites (DM1, DM2 and DM3) on the Clarence Colliery Pit Top Monitoring Locations figure, located in the document titled Environmental Monitoring Program.

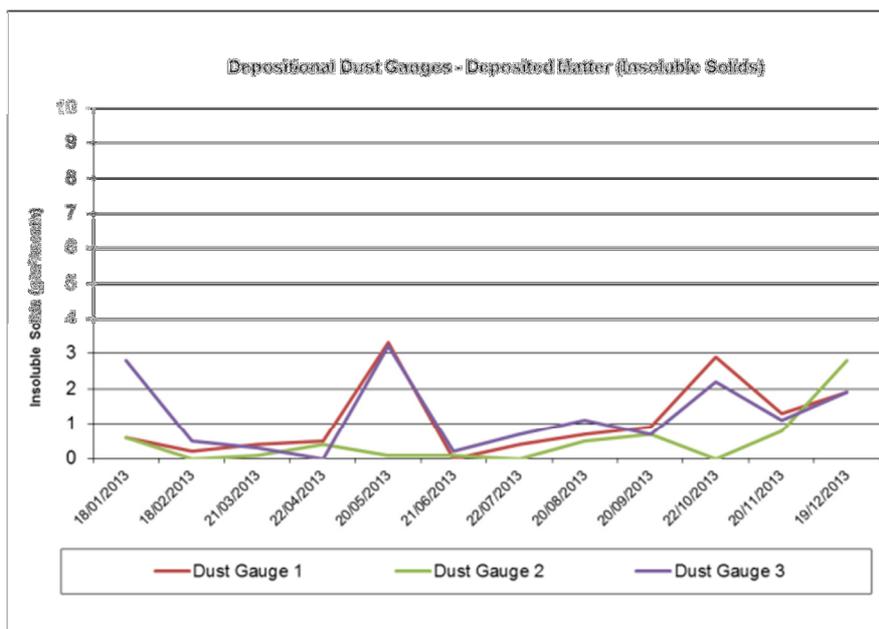


Figure 5. Depositional Dust Gauges 1, 2 and 3

3.3.2.2 TSP/PM₁₀

Monitoring for PM₁₀ (Particulate Matter less than 10 micrometres in size) and TSP (Total Suspended Particulates) occurred during the reporting period as required under the Clarence Development Consent and the Environmental Air Quality Monitoring Program. No exceedances were recorded during the reporting period for measured maximum 24 hour average PM₁₀ concentrations (criteria limit of 50 µg/m³) or the average annual TSP (90 µg/m³). The location of the TSP and PM₁₀ monitoring site is identified on the Clarence Colliery Pit Top Monitoring Locations figure, located in the document titled Environmental Monitoring Program under the Management Plans section of the Clarence Colliery area of the Centennial website. TSP and PM₁₀ monitoring is required to take place two times per year with each sample taken on every 6th day for a period of a month.

The results of the monitoring program are displayed in **Figure 8**, **Figure 9**, **Figure 10** and **Figure 11**.

3.3.3 Control Measures

Surface conveyors are enclosed to prevent dust generation on route to the main stockpile at the Coal Handling Preparation Plant (CHPP). Water sprays are installed at transfer points between surface conveyor belts to minimise the dust generated. Sprinklers are positioned on gantries above the main stockpile and are used if conditions are windy to suppress dust on stockpile areas.

Dust generation around the CHPP is managed using a water cart and fixed sprinklers (**Figure 6**). Throughout the reporting period the fixed sprinkler system on the truck access road was upgraded with the installation of an additional 15 sprinklers, this control strategy has proved to be adequate to manage dust emissions (**Figure 7**).

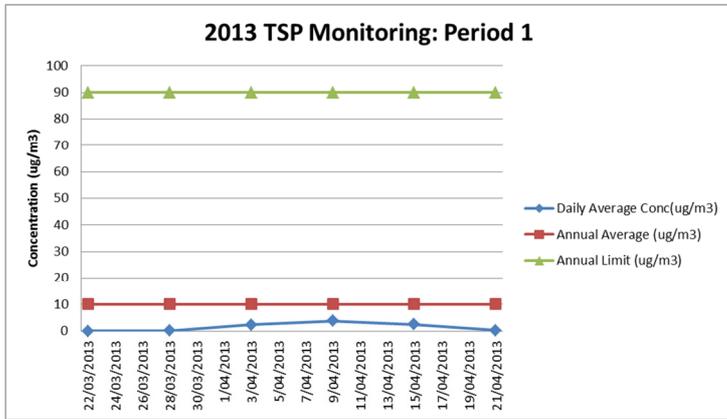
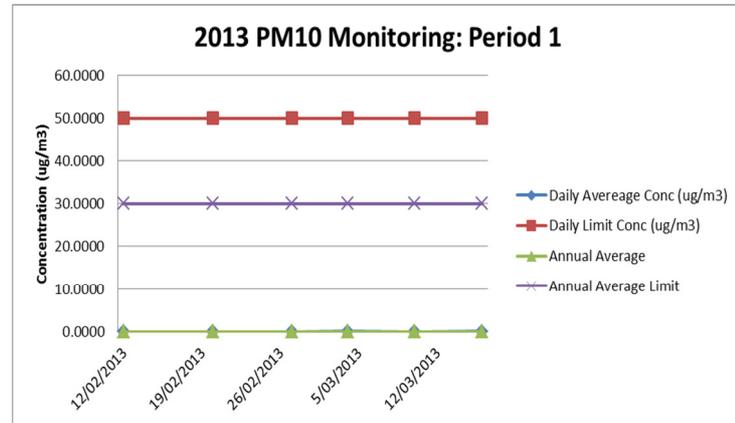
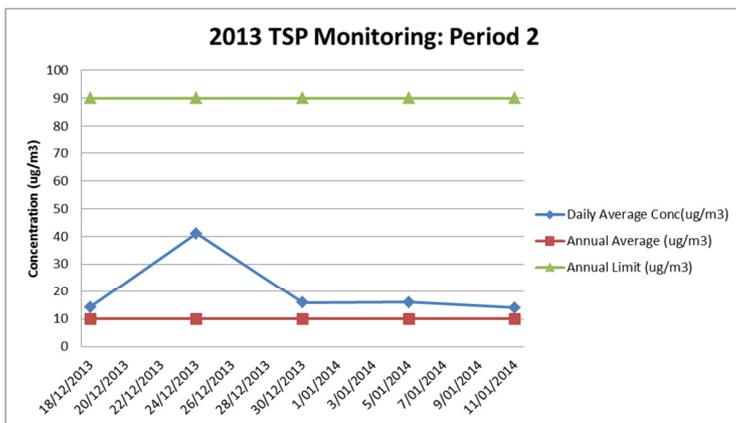
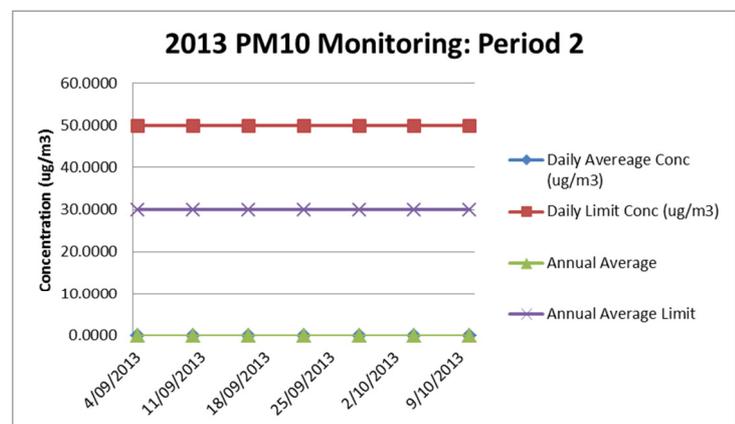
Dust generation from the Pit Top areas was considered a medium environmental risk, particularly during dry and windy days. A road sweeper from Lithgow City Council is utilised to sweep the pit top monthly reducing the volume of material potentially available to be mobilised to form airborne dust. All trucks transporting coal from Clarence Colliery are required to have covers.



Figure 6. REA Haul Road Sprinklers and Water Cart in Use at REA IV



Figure 7. Upgraded Sprinkler System on Truck Access Road


Figure 8. TSP Monitoring 2013 (1st period)

Figure 10. PM10 Monitoring 2013 (1st Period)

Figure 9. TSP Monitoring 2013 (2nd Period)

Figure 11. PM10 Monitoring 2013 (2nd Period)

3.3.4 Dust BMP Particulate Determination

In 2011, the EPA required through a Pollution Reduction Program, that Clarence Colliery provide a report which examines in detail the potential measures which could be employed to further reduce particulate emissions from the mine. This is part of a larger program which aims to reduce particulate emissions from the coal mining industry as a whole in NSW.

Clarence completed the Dust Best Practice Particulate Determination and submitted to the EPA on the 28th September 2012. In accordance with the commitments made in the BMP, Clarence Colliery completed the following actions during the reporting period:

- Commenced watering of stockpile pads (no chemical suppressants);
- Assessed stockpile and reject dust propensity; and
- Implemented REA III dust mitigation measures including the installation of water delivery infrastructure to be used as required and investigated potential rehabilitation options.

3.3.5 Air Quality Impact Assessment

In response to a comment raised by the DP&I regarding the validity of historic site air quality data during the 2011 AEMR review Clarence completed an Air Quality Impact Assessment in 2013 to update the current Air Quality Model and also determine impacts (if any) of the proposed new Reject Emplacement Area.

Dispersion modelling was conducted for the identified sources at contributing operations for particulates (TSP, PM10 and PM2.5) and odour.

In order to assess the background air quality of the region a number of other mining operations with the potential to have a cumulative impact on the local airshed were identified. A dispersion modelling exercise was performed to determine suitable background levels of pollutants in order to assess the cumulative impacts.

It was concluded from the dispersion modelling exercise that concentrations of TSP, PM2.5, and annual average PM10 were unlikely to exceed the relevant criterion at any of the identified sensitive receptors.

The maximum cumulative 24-hour average PM10 concentrations are predicted to be below the criterion of 50 µg/m³ at all identified sensitive receptor locations during construction of the proposed REA and operation of Clarence Colliery. The maximum cumulative impacts with respect to Newnes Kaolin Project were concluded to be exceeding the project

criterion, during stage 5 of the Newnes Kaolin Project and operations at the Clarence Colliery. However considering the day of maximum increment due to construction of the proposed REA or operations of Clarence Colliery, it was concluded that the exceedance of the criteria was likely to occur due to high background concentrations. This scenario however is considered unlikely.

The 99th percentile odour concentrations were predicted to be below the relevant criterion at all the identified sensitive receptors during Project operations.

3.4 Erosion and Sediment Management

The Erosion and Sediment Control Plan was approved by the Department of Planning in November 2007. It forms part of the site Water Management Plan and is reviewed every 12 months. The Water Management Plan has been updated and subsequently approved by DP&I following consultation with relevant government agencies. The Water Management Plan identifies all activities that could cause erosion and describes the location, function and capacity of erosion and sediment control measures. An addition to the Water Management Plan was a plan identifying clean water, dirty water and leachate water drainage lines on the Pit Top created from field investigations conducted during the reporting period.

There are three areas of potential soil erosion and sediment transport within the Clarence Colliery lease area:

- Pit Top Surface Facilities (e.g. stockpile areas, conveyor belts, lay down areas, Reject Emplacement Area);
- Underground Workings; and
- Surface areas potentially affected by subsidence (areas above mine workings).

The greatest potential for erosion and sediment transport from disturbed areas comes from coal distribution and stockpiling.

The soils at Clarence have a moderate to high erosion potential due to their sandy nature and occurrence on moderate to steep slopes. Several types of erosion control measures have been implemented on the site with the aim of preventing soil erosion and the entry of sediments into the surrounding water bodies. The existing surface water management system includes a series of clean water diversion channels, sediment control structures and water treatment facilities. Erosion control measures are described below.

3.4.1 Drainage Channels

Drains are constructed with either a parabolic or trapezoidal cross section to minimise erosion. Where possible, channels have been constructed with an adjacent earth bank or in some cases have been completely concrete lined.

Flow channels in soil materials are limited to 0.5% gradient and where steeper gradients are unavoidable, concrete weirs, gabion weirs, concrete pipes and run-off control channels are installed to control the water flow.

All channels are inspected monthly during the environmental inspection. Maintenance is then initiated as required to repair damage caused by scour, sediment deposition or channel obstruction.

A clean water by-pass channel allows water from upstream of the site to pass through without coming into contact with disturbed areas. This reduces the quantity of water that has potential to cause erosion and require treatment.

All water emanating from disturbed areas flow through collection pipes/drains/channels to a number of sediment control structures.

3.4.2 Sediment Basins

Several sediment basins have been constructed within the dirty water system. The sediment control basins have been designed and located to contain dirty water from disturbed areas on site. The primary purpose of these basins is to contain sediment from normal rainfall events as well as reduce flow velocity during high rainfall events.

There are several sediment control structures on site. These include:

- Conveyor Sediment Traps;
- Pit top grit trap;
- Primary separator and B Thickener;
- Polishing Lagoon;
- Leachate Dams; and
- Underground Settling Ponds.

These structures are regularly maintained and cleaned out once the capacity has reduced by approximately thirty percent. The structures are inspected after major rainfall events and any erosion of the spillway is remediated.

Construction works on Leachate Dam No.2 upgrade commenced within the reporting period. The existing dam storage was approximately 3ML. The new dam is designed to hold approximately 10ML for leachate and stormwater runoff retention purposes and a 1:50 Annual Exceedance Probability (AEP) event. The upgrade is scheduled to finish mid February 2014.

3.4.3 Maintenance

The Grit Trap and Primary Separator are checked for sediment on a twice weekly basis or following rainfall. All other sediment control structures and drainage lines are checked monthly or following rainfall.

Sediment control structures are cleaned out when their capacity is reduced by 30% including the pit top grit trap and primary arrestor. Material is placed in the REA as either waste or where coal content is sufficiently high mixed with product.

Channels are inspected on a monthly basis for blockage, scour, sediment deposition or channel obstruction. Repairs are initiated as required.

For potential subsidence areas, regular inspections are made of the overlying topography prior to, during and after an area has been mined to identify any areas of surface cracking. In the highly unlikely event that surface cracks are found that may pose an erosion risk, works will be undertaken to fill the cracked areas and prevent soil erosion. This will be particularly important in areas with soils that have high water erosion potential.

3.5 Surface Water Quality

The Water Management Plan required under DA 504-00 was prepared in consultation with relevant government agencies and originally approved by the then Department of Planning on the 25th July 2007. The latest version was submitted to the regulators for review in September 2013. No comments have been received on this reviewed document. Clarence will request the Department of Planning and Infrastructure approve the updated plan in the 2014 reporting period.

The Environmental Impact Statement (2000) identified the process of water extraction from the underground treatment in the water treatment plant and discharge through LD2 as the main potential impact.

3.5.1 Monitoring and Performance Criteria

Clarence monitors surface water discharge from its licenced discharge points according to the conditions set out in Environmental protection Licence (EPL) 726. The criteria for discharge water quality are outlined in **Table 11**. A copy of EPL 726 is available in **Appendix 11**.

3.5.2 Results

The 2013 LD2 results for pH, Total Suspended Solids, Oil and Grease, Filterable Manganese, Total Arsenic, Total Boron, Total Cadmium, Total Chloride, Total Chromium VI, Total Copper, Filterable Iron, Total Fluoride, Total Lead, Total Mercury, Total Selenium, Total,

Silver, Total Sulfate and Total Zinc required to be monitored by EPL 726 are provided in the following graphs.

* Note that all results less than the detection limit are shown as zero in the graphs.

Table 11. EPL Licence Limit Parameters

Parameter	EPA Licence Limit
pH	6.5-8.5
Total Suspended Solids (mg/L)	30
Oil and Grease (mg/L)	10
Arsenic (mg/L)	0.01
Boron (mg/L)	0.1
Cadmium (mg/L)	0.001
Chloride (mg/L)	25
Chromium VI (mg/L)	0.01
Copper (mg/L)	0.02
Filterable Iron (mg/L)	0.3
Filterable Manganese (mg/L)	0.5
Fluoride (mg/L)	1
Lead (mg/L)	0.005
Mercury (mg/L)	0.001
Selenium (mg/L)	0.01
Silver (mg/L)	0.001
Sulfate (mg/L)	250
Zinc (mg/L)	2.5

3.4.2.2 pH LD2

pH results at LD2 during the reporting period were generally within the 6.5 - 8.5 EPA licence limit except for one exceedence of 6.44 pH on 5 March 2013 (**Figure 12**). It is noted that the accuracy of a correctly calibrated pH probe used is plus/minus pH 0.07. Clarence Water treatment plant did not correctly adjust the pH on discharge. A sample was taken downstream at the Clarence Colliery Main Dam on the 5th of March 2013 to determine any environmental impact to downstream waters. The result of pH 6.67 was complaint with EPL 726 concentration limits and indicated no impact as a result of the discharge event. The pH control was reviewed and adjusted on discharge.

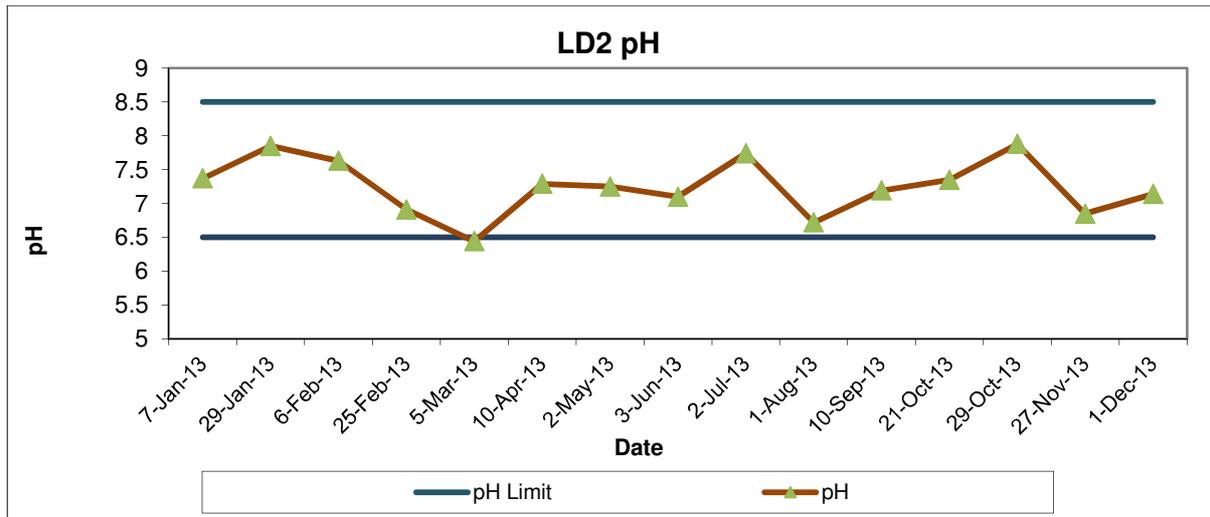


Figure 12. pH 2013 Monitoring Results for LD2

3.4.2.3 Total Suspended Solids LD2

Total Suspended Solids (TSS) results for LD2 during the reporting period were below the 30 mg/L licence limit (Figure 13).

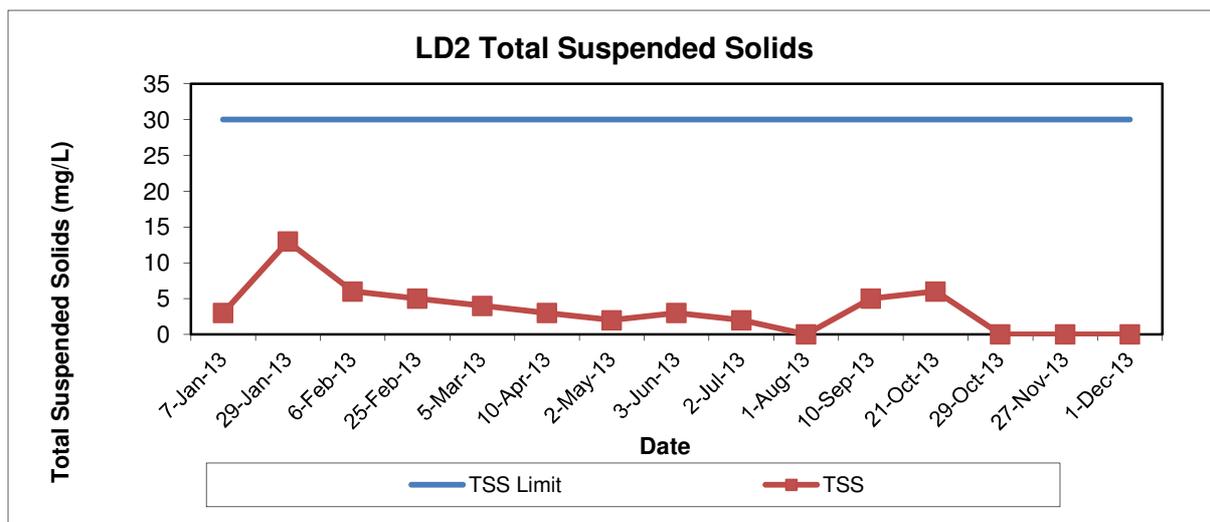


Figure 13. TSS 2013 Monitoring Results for LD2

3.4.2.4 Oil and Grease LD2

Oil and Grease results for discharged water sampled at LD2 during the reporting period were below the prescribed limit (10mg/L) in EPL 726 (Figure 14).

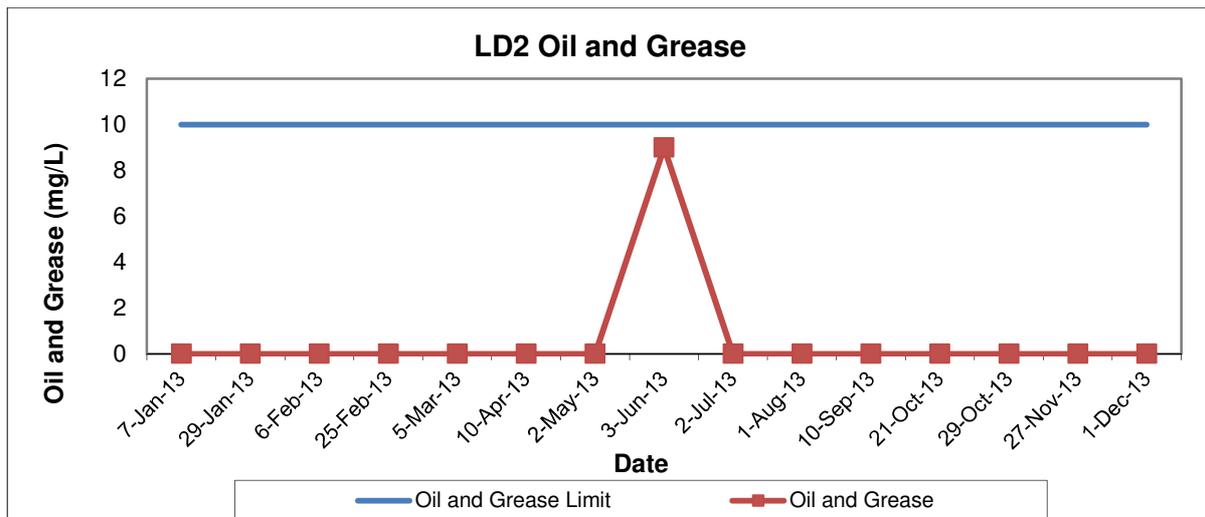


Figure 14. Oil and Grease 2013 Monitoring Results for LD2

3.4.2.5 Filterable Manganese LD2

Filterable manganese results were generally within the licence limit during the reporting period except one exceedance (Figure 15). The exceedance was a result of the State Mine Bushfire which proceeded through Clarence Colliery Mine Site on 17 October 2013. A sample was taken at LD2 on 21 October 2013 following safe access to the Clarence Mine site following the fire for due diligence purposes. A concentration of 0.593 mg/L was recorded above the EPL 726 licence limit of 0.5 mg/L. An incident investigation concluded the following contributing factors which resulted in the licence exceedance at LD2:

- Loss of power and transfer pipelines to the Clarence Mine Water Treatment Plant;
- Loss of power and water transfer pipelines to Clarence surface water treatment facilities; and
- Use of Run of Mine and Product water sprays before, during and after the fire increasing run-off from coal stockpile areas.

A sample was also taken downstream at the Clarence Colliery Main Dam on 21 October 2013 to determine any environmental impact to downstream waters. These results were compliant with EPL 726 concentration limits and indicated no impact as a result of the discharge event.

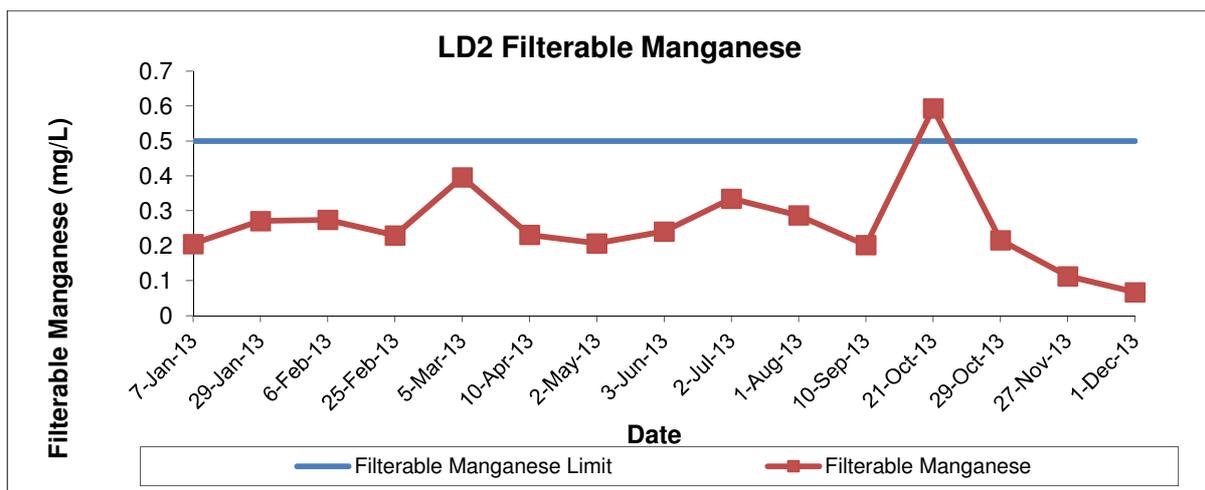


Figure 15. Filterable Manganese 2013 Monitoring Results for LD2

3.4.2.6 Total Arsenic LD2

Total Arsenic results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.01mg/L) and below the detection limit (0.001mg/L) on all occasions (Figure 16).

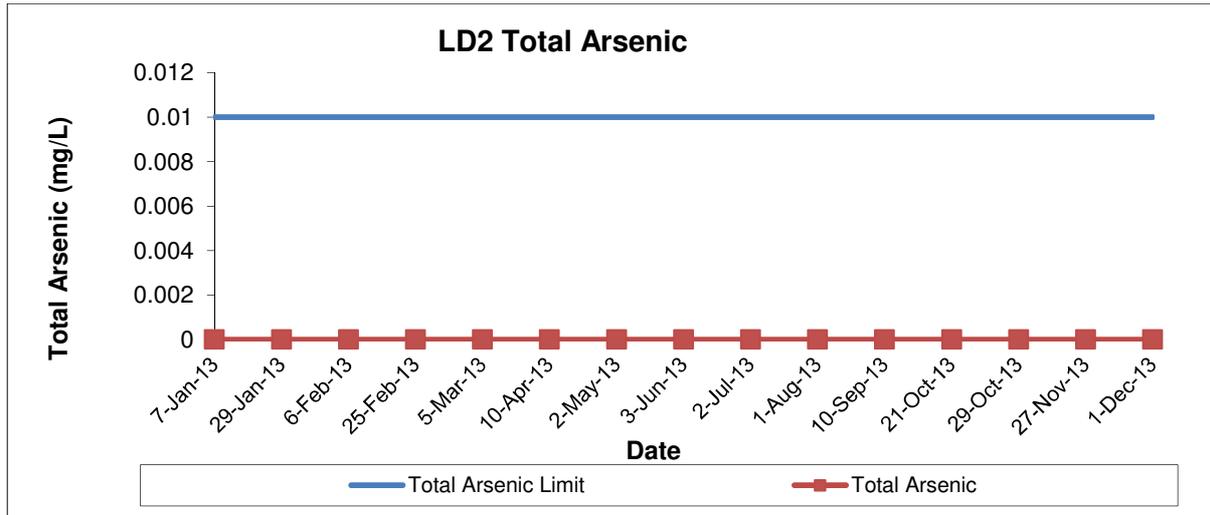


Figure 16. Total Arsenic 2013 Monitoring Results for LD2

3.4.2.7 Total Boron LD2

Total Boron results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.1mg/L) and below the detection limit (0.05mg/L) on all occasions (Figure 17).

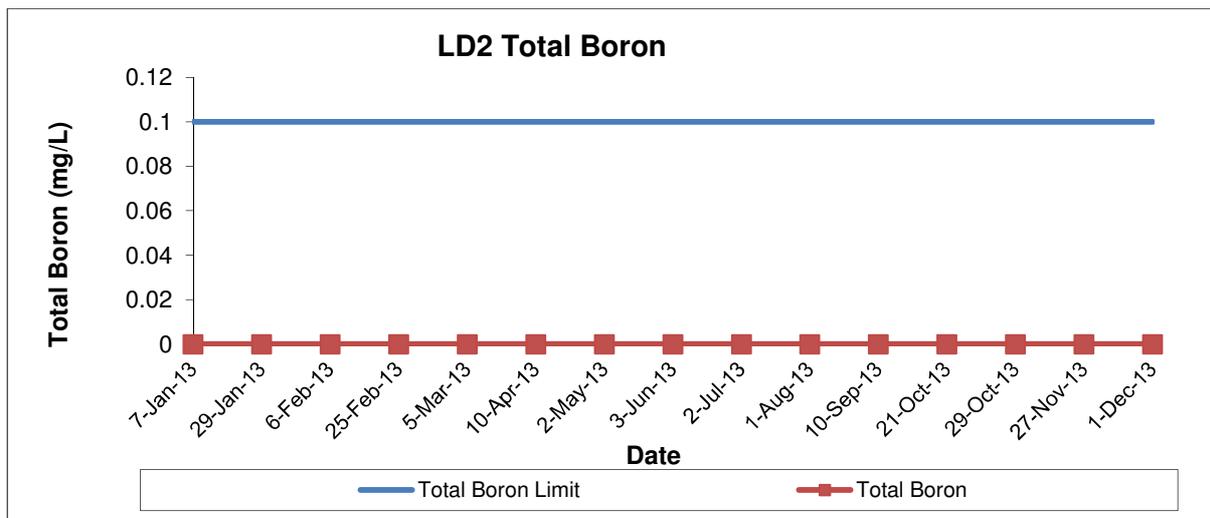


Figure 17. Total Boron 2013 Monitoring Results for LD2

3.4.2.8 Total Cadmium LD2

Total Cadmium results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.001mg/L) on all occasions with the highest result being 0.0001mg/L on the 21 October 2013 (Figure 18).

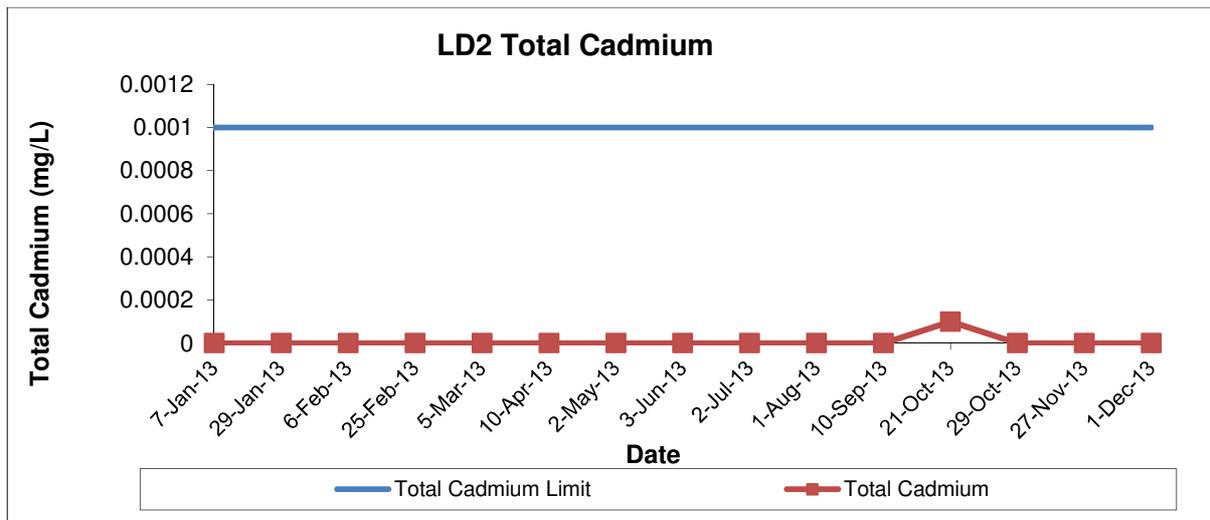


Figure 18. Total Cadmium 2013 Monitoring Results for LD2

3.4.2.9 Total Chloride LD2

Total Chloride results for discharged water sampled at LD2 during the reporting period were below the licence limit (25mg/L) on all occasions with the highest result being 8 mg/L on 21 October 2013 (Figure 19).

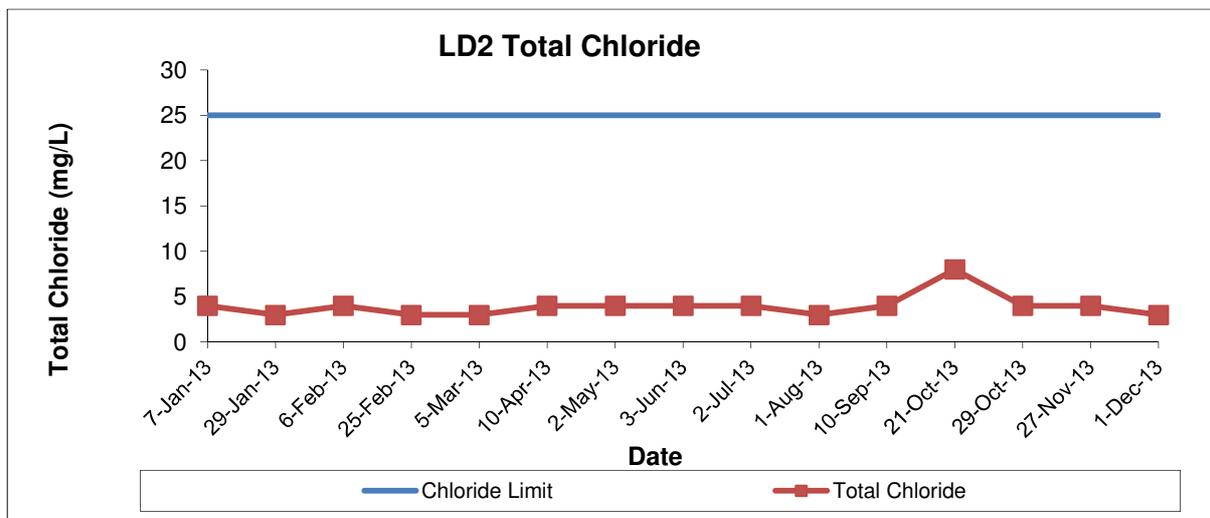


Figure 19. Total Chloride 2013 Monitoring Results for LD2

3.4.2.10 Total Chromium (hexavalent) LD2

Total Chromium (hexavalent) also referred to as Total Chromium (VI), results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.01mg/L) and below the detection limit (0.01mg/L) on all occasions (Figure 20).

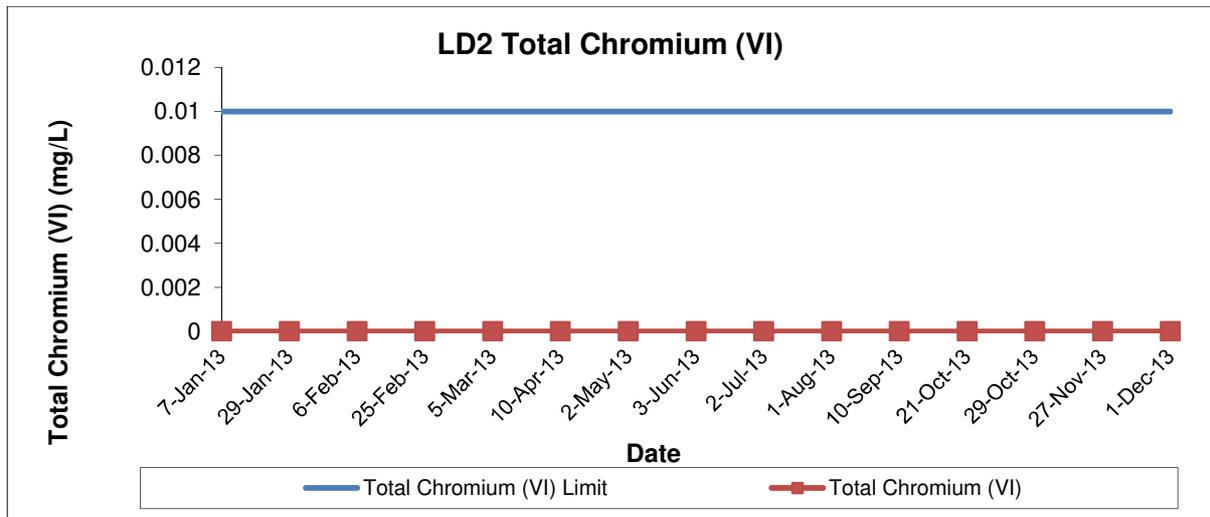


Figure 20. Total Chromium (VI) 2013 Monitoring Results for LD2

3.4.2.11 Total Copper LD2

Total Copper results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.02mg/L) on all occasions with the highest reading of 0.003mg/L recorded on 29 October 2013 (Figure 21).

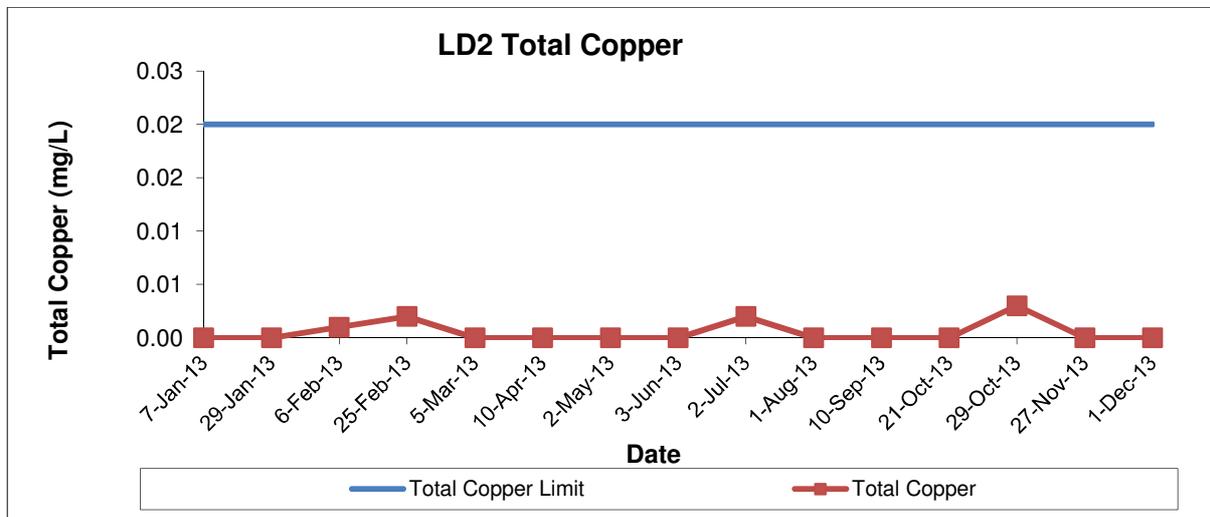


Figure 21. Total Copper 2013 Monitoring Results for LD2

3.4.2.12 Filterable Iron LD2

Filterable Iron results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.3mg/L) on all occasions with the highest reading being 0.17 mg/L on 10 April 2013 (Figure 22).

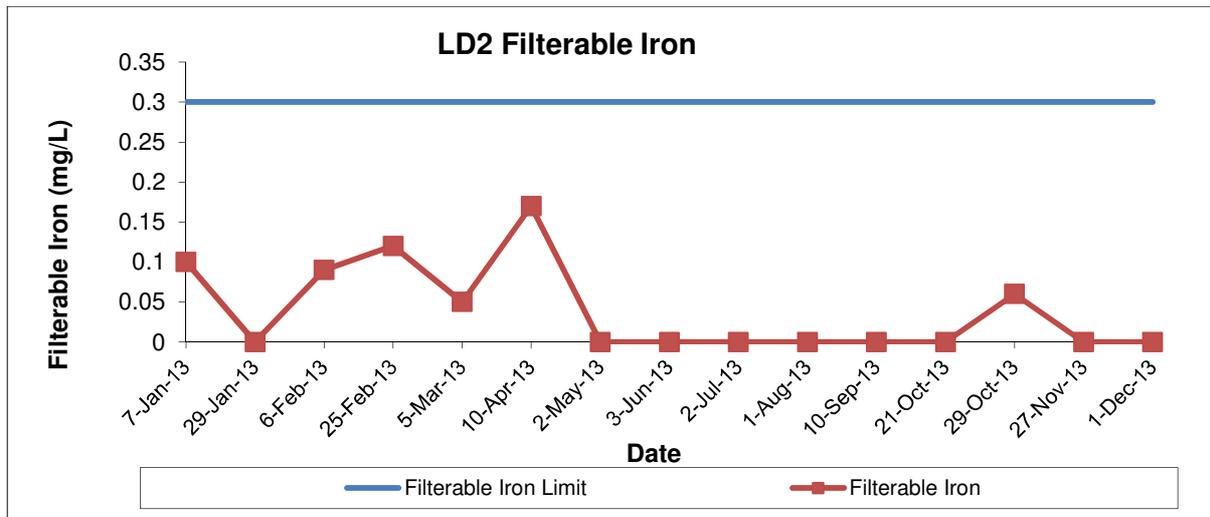


Figure 22. Filterable Iron 2013 Monitoring Results for LD2

3.4.2.13 Total Fluoride LD2

Total Fluoride results for discharged water sampled at LD2 during the reporting period were the below licence limit (1mg/L) on all occasions with the highest reading being 0.1 mg/L on 25 February and 21 October 2013 (Figure 23).

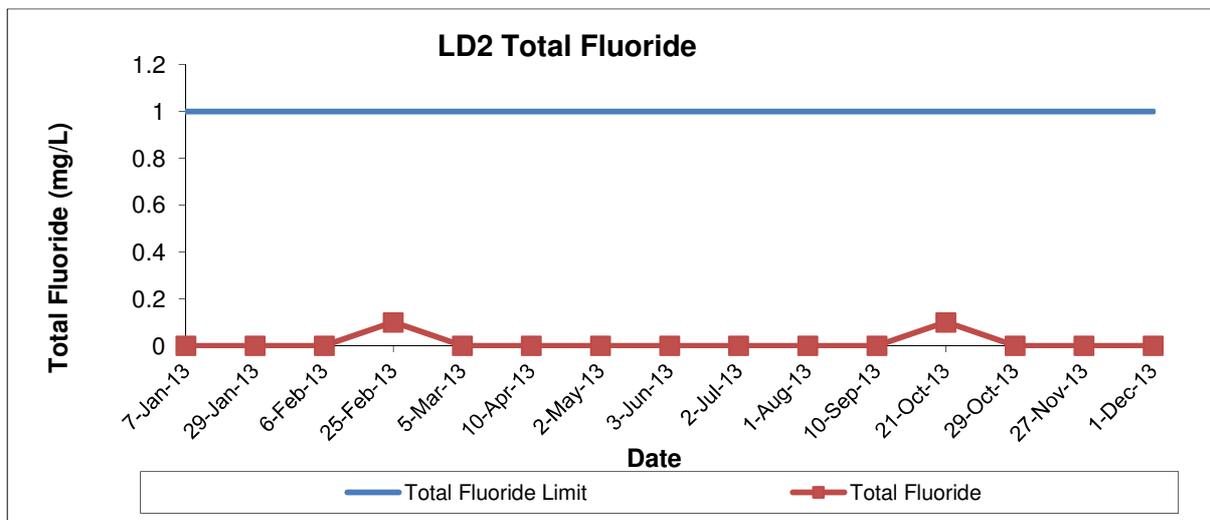


Figure 23. Total Fluoride 2013 Monitoring Results for LD2

3.4.2.14 Total Lead LD2

Total Lead results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.005mg/L) and below the detection limit (<0.001mg/L) on all occasions (Figure 24).

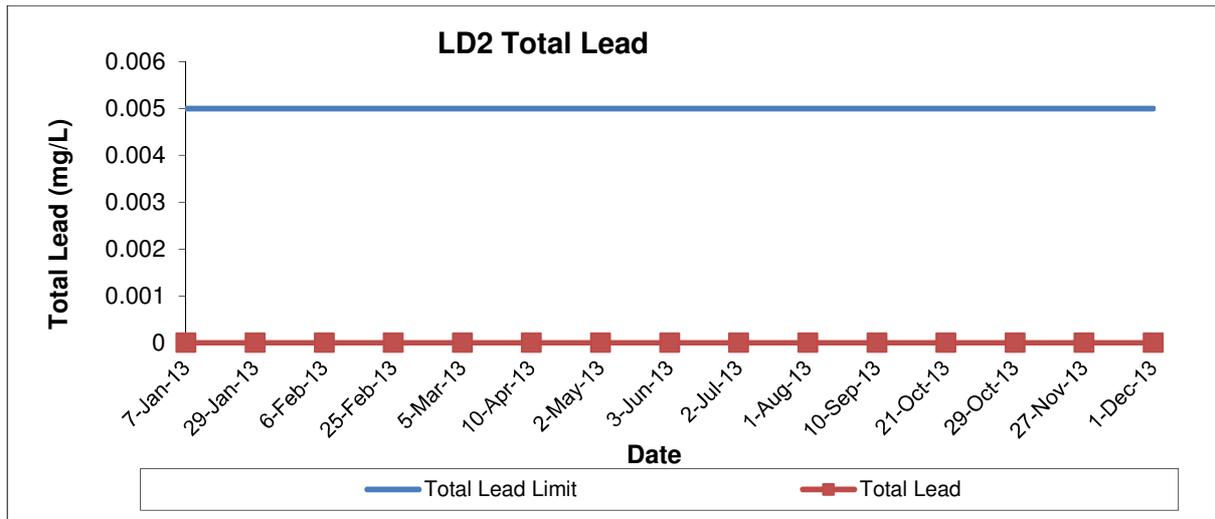


Figure 24. Total Lead 2013 Monitoring Results for LD2

3.4.2.15 Total Mercury LD2

Total Mercury results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.001mg/L) and below the detection limit (0.0001mg/L) on all occasions (**Figure 25**).

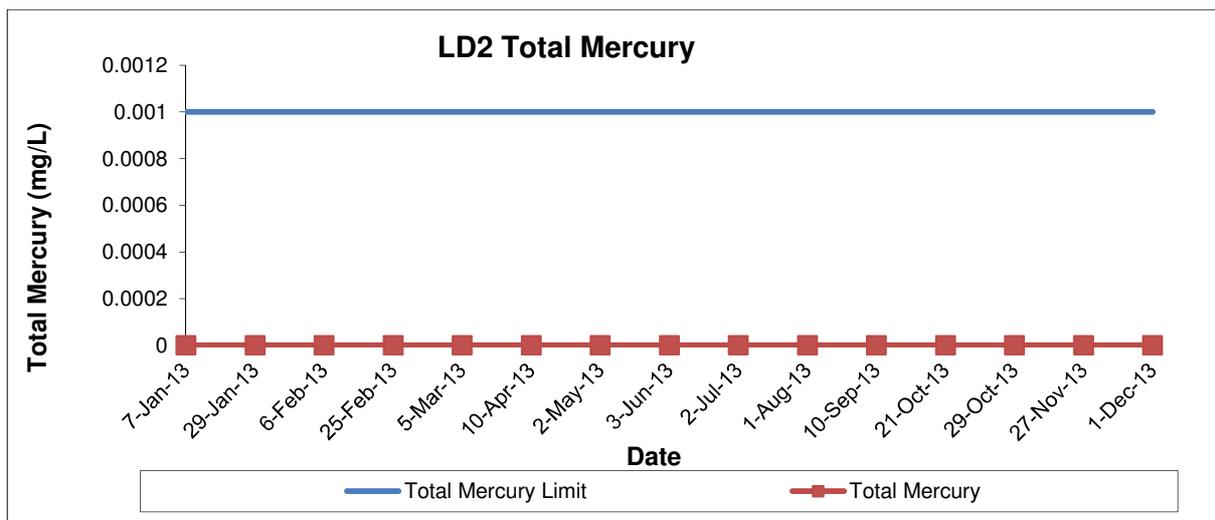


Figure 25. Total Mercury 2013 Monitoring Results for LD2

3.4.2.16 Total Selenium LD2

Total Selenium results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.01mg/L) and below the detection limit (0.01mg/L) on all occasions (**Figure 26**).

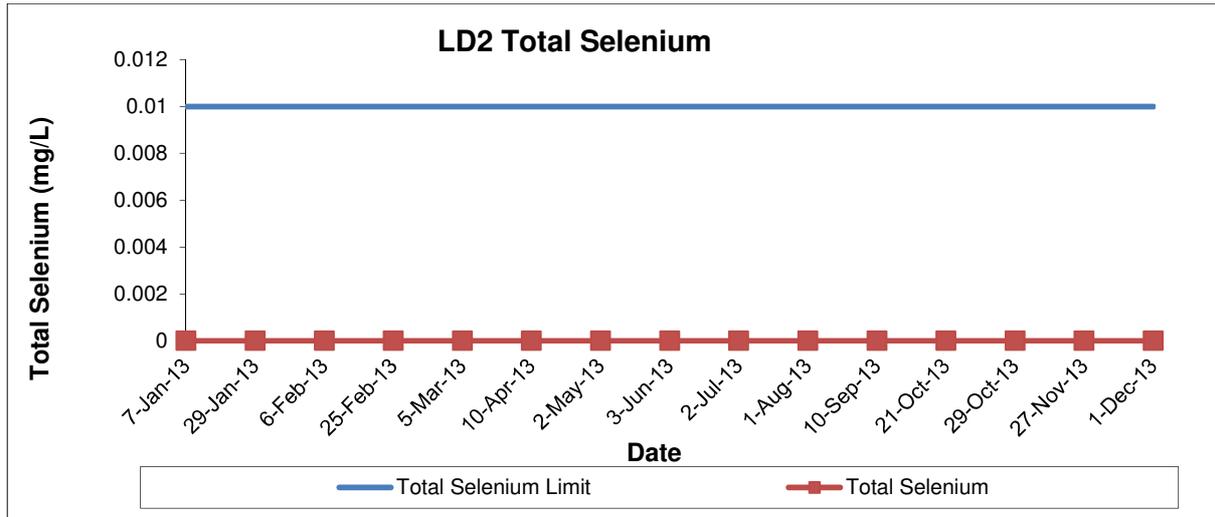


Figure 26. Total Selenium 2013 Monitoring Results for LD2

3.4.2.17 Total Silver LD2

Total Silver results for discharged water sampled at LD2 during the reporting period were below the licence limit (0.001mg/L) and below the detection limit (0.001mg/L) on all occasions (Figure 27).

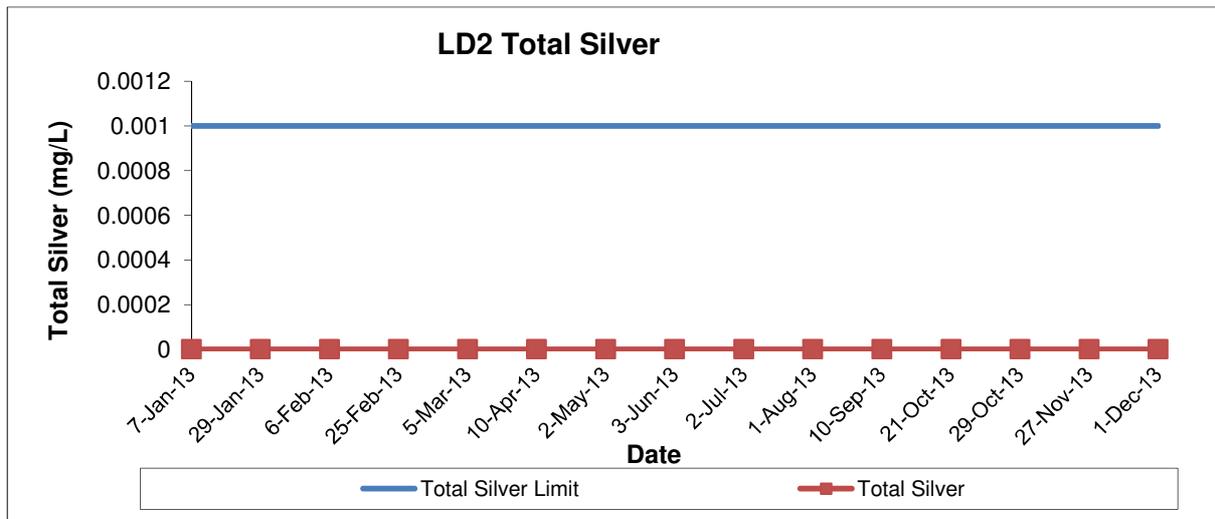


Figure 27. Total Silver 2013 Monitoring Results for LD2

3.4.2.18 Total Sulfate LD2

Total Sulfate results for discharged water sampled at LD2 during the reporting period were below the licence limit (250mg/L) on all occasions with the highest result being 222 mg/L on 5 March 2013 (Figure 28).

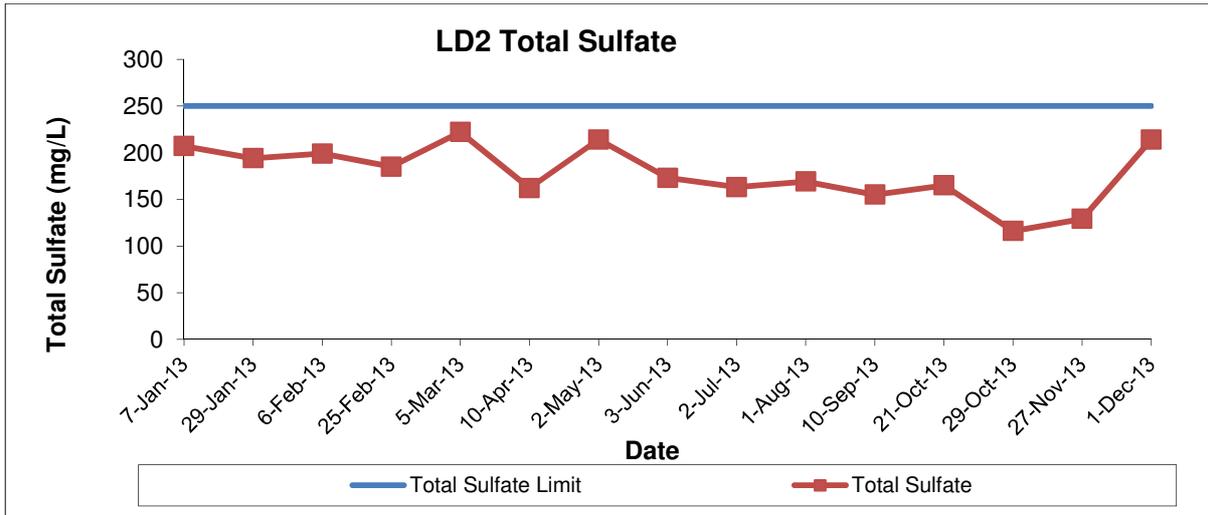


Figure 28. Total Sulfate 2013 Monitoring Results for LD2

3.4.2.19 Total Zinc LD2

Total Zinc results for discharged water sampled at LD2 during the reporting period were below the licence limit (2.5mg/L) on all occasions with the highest result being 0.561 mg/L on 21 October 2013 (Figure 29).

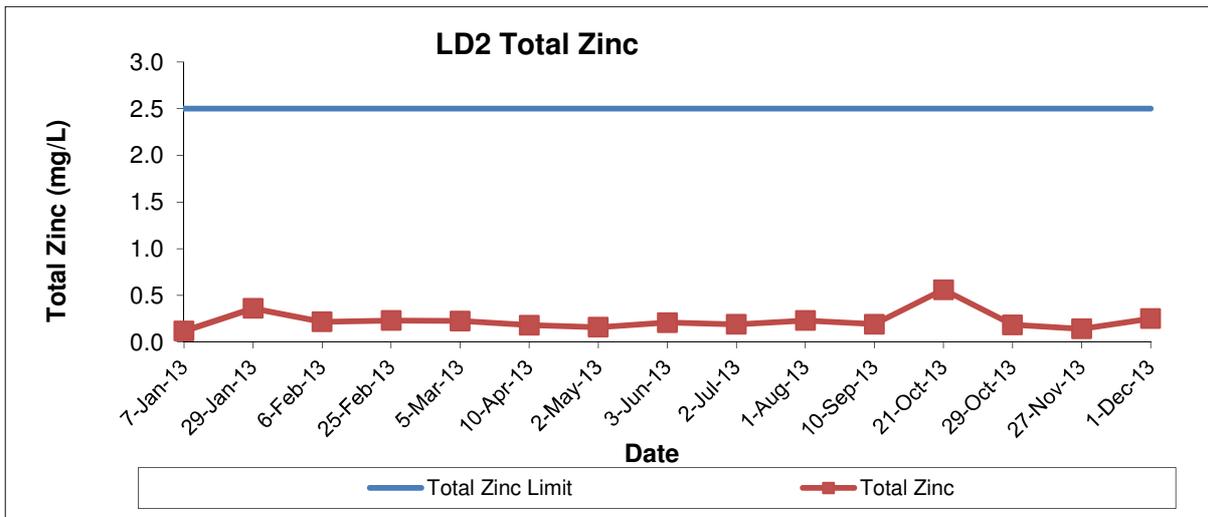


Figure 29. Total Zinc 2013 Monitoring Results for LD2

3.4.2.20 LD3

LD3 provides emergency discharge during periods of sustained heavy rainfall. There was a planned emergency discharge at LD3 after a flooding rainfall event in which 131.8 mm was recorded within a 30 hour period.

At LD3 there were exceedences of EPL 726 concentration limits for pH, Cadmium, Copper, Iron (filtered), Manganese (filtered), Lead, Sulfate and Zinc (Table 12). An estimated 0.217 ML was discharged during this event. The total volume discharged was minimized through the use of diesel pumps before the

rainfall event to provide freeboard and during the rainfall event to aid in the transfer of water for treatment in the Clarence Water Treatment Plant. LD3 discharges into the Clarence Main Dam which has a capacity of 70ML. The Main Dam also receives treated mine water from LD2 as well as natural upstream flows. The Main Dam was sampled following the discharge event at LD3. The results indicated no downstream impact as a result of the discharge event at LD3.

Table 12. LD3 Results for 25th February 2013

Parameter	Result	EPA Licence Limit
pH	3.57	6.5-8.5
Total Suspended Solids (mg/L)	28	30
Oil and Grease (mg/L)	<5	10
Arsenic (mg/L)	<0.001	0.01
Boron (mg/L)	<0.05	0.1
Cadmium (mg/L)	0.0051	0.001
Chloride (mg/L)	2	25
Chromium VI (mg/L)	<0.01	0.01
Copper (mg/L)	0.104	0.02
Filterable Iron (mg/L)	7.15	0.3
Filterable Manganese (mg/L)	4.6	0.5
Fluoride (mg/L)	0.2	1
Lead (mg/L)	0.024	0.005
Mercury (mg/L)	<0.0001	0.001
Selenium (mg/L)	0.01	0.01
Silver (mg/L)	<0.001	0.001
Sulfate (mg/L)	254	250
Zinc (mg/L)	7.92	2.5

3.4.2.21 LD4

LD4 is the overflow for Leachate Dam No.2. Leachate Dam No.2 did not overflow during 2013 and consequently there are no results for LD4.

3.5 Ground Water Quality

Groundwater monitoring is undertaken in accordance with Clarence Water Management Plan, Environmental Monitoring Program and Subsidence Management Approvals.

Currently measured groundwater monitoring sites are outlined in

Table 13.

In August 2004, nested piezometer sites CLRP1 and CLRP2 were installed as baseline monitoring for the Eastern Area SMP. CLRP3 was then installed as an additional site in January 2006. CLRP1, CLRP2 and CLRP3 have been used to measure background groundwater levels and the subsequent impact from mining over a number of years.

CLRP4, CLRP5 CLRP6 CLRP7 CLRP10 and CC113 were installed to measure any potential impact from mining within the 700 Area. The first panel in the 700 Area (702 panel) completed extraction in early December 2009. CLRP8 was an existing borehole located in the Clarence Township. Clarence Colliery installed a piezometer in the bore to measure potential impacts on the water supply for the Clarence village.

CC114 and CC115 were installed to collect background data for the 800 Area SMP application. These piezometers have not been undermined but do provide data with the potential to detect groundwater related impacts beyond the mining area.

Shallow piezometers were installed in Happy Valley Swamp (HV1 and HV2) and Happy Valley Upper Swamp (HVU1 and HVU2) in December 2009. The two piezometers in each Swamp directly measure any impact on groundwater baseflows from undermining each swamp.

CLRP11, CLRP12 and CLRP13 were installed to collect further baseline data for the 700 West/800 Area SMP Application. Again, these piezometers have not been undermined but do provide data with the potential to detect groundwater related impacts beyond the mining area.

CLRP15 and CLRP16 are located either side of the Lithgow No.2 Dam and are used to monitor potential impact on the dam from mining (including the currently approved first workings) within the Dam Notification Area.

CLRP17, CLRP19 and CLRP20 were installed in 2013 to collect background data for the 800 Area SMP application. Within a few weeks of installation they were damaged by fire, along with CLRP14, CC115 and CLRP11. These remain out of service but some, if not all, will be restored in the shorter term. The location of all piezometers is presented in **Appendix 5**.

Table 13. Groundwater Monitoring Piezometers Summary

Piezometer	Installed	Area
CLRP1	2004	Eastern Area SMP, within 330 Area
CLRP2	2004	Eastern Area SMP, above 611E panel
CLRP3	2006	Eastern Area SMP, above 612 panel
CLRP4	2008	South of mining areas
CLRP5	2008	700 Area SMP, north of 700 area panels
CLRP6	2008	700 Area SMP, above 702/704 panels
CLRP7	2008	700 Area SMP, south of 700 area panels
CLRP10	2008	700 Area SMP, above 706 panel
CC113	2008	700 Area SMP, south of 700 area panels
CLRP8	2009	Clarence Township
CC114	2009	800 Area SMP Application Area
CC115	2009	800 Area SMP Application Area
HV1	2009	Happy Valley Swamp (700 Area SMP)
HV2	2009	Happy Valley Swamp (700 Area SMP)
HVU1	2009	Happy Valley Upper Swamp (700 Area SMP)
HVU2	2009	Happy Valley Upper Swamp (700 Area SMP)
CLRP11	2010	700 West SMP Area
CLRP12	2010	700 West SMP Area
CLRP13	2010	800 Area SMP Application Area
CLRP14	2011	800 Area SMP Application Area
CLRP15	2011	Lithgow No.2 Dam
CLRP16	2011	Lithgow No.2 Dam
CLRP17	2013	800 Area SMP Application Area
CLRP19	2013	800 Area SMP Application Area
CLRP20	2013	800 Area SMP Application Area

3.5.1 Open Hole Piezometers

Open hole piezometers include CLR4, CLRP5, CLRP7, CLRP8, CLRP10 and CC113. All groundwater levels (except CLRP4) in the open hole piezometers installed in the Clarence Aquifer showed slow, generally very consistent, rises in groundwater level during the period. CLRP4 continued to show a flat trend. CC113 is no longer collected as Clarence was unable to negotiate an access agreement with the landowner.

Groundwater levels in all of these holes stand generally at historically high levels in the data record extending back to 2008, related to the generally wetter conditions between late 2010 and early 2012. There is no evidence of any mining-related impacts on any of these piezometers, based on the continuing uniform responses of the piezometers.

Monitoring results for piezometric height at CLRP4, CLRP5, CLRP6, CLRP7, CLRP8, CLRP10 and CC113 is presented in **Figure 30**.

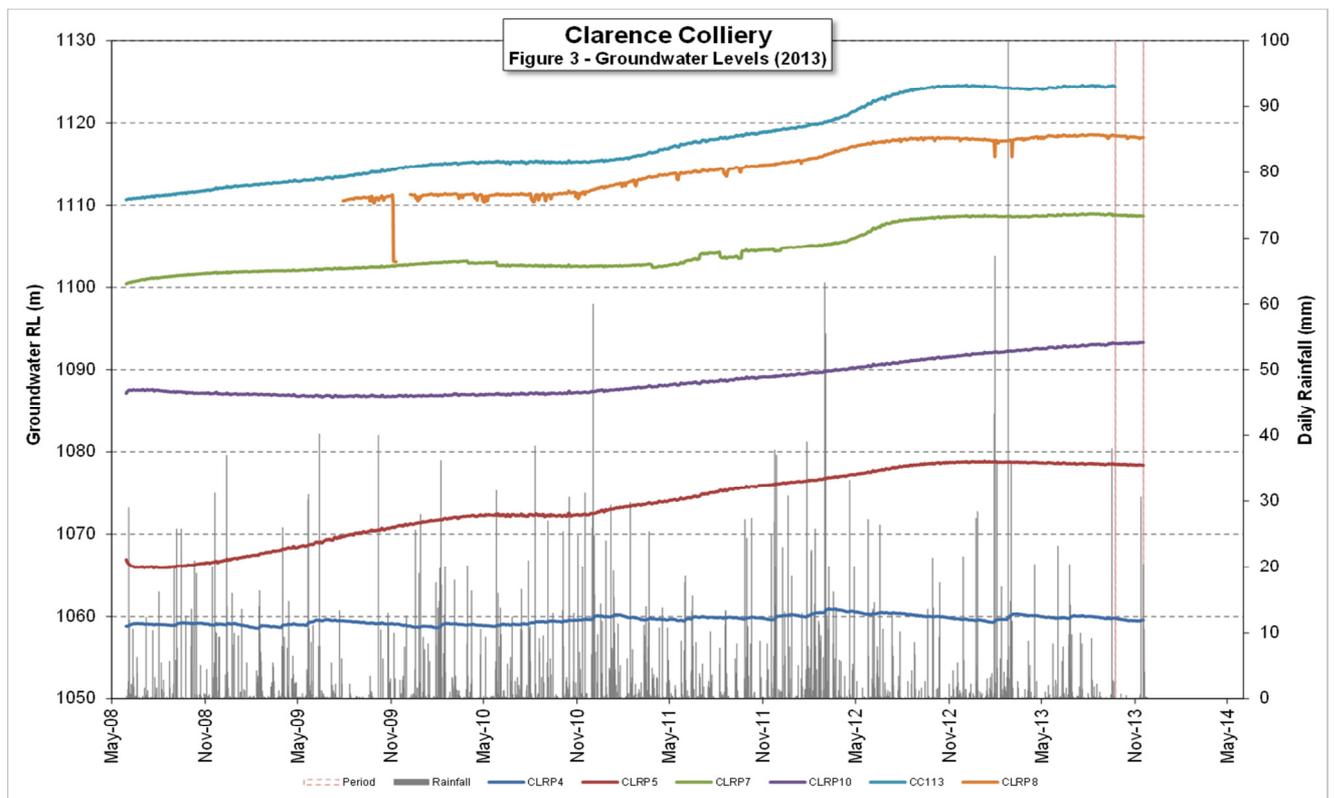


Figure 30. CLRP4, CLRP5, CLRP6, CLRP7, CLRP8, CLRP10 and CC113 Piezometric Height

3.5.2 Multi-Level Piezometers

3.5.2.1 CLRP1

As noted previously, pillar removal was carried out in Panel 330 immediately to the north of this bore in late 2004. This resulted in a significant depressurisation of the Katoomba seam, as measured by piezometer 1. In December 2013, first workings in panel 803 were developed over 10km to the east. There was no evidence of any permanent mining-related impacts in the three piezometers higher up in the bore (including the two in the Banks Wall Sandstone), although piezometer 2 just above the roof of the seam did show partial depressurisation followed by near-complete recovery. Since that time there have been no further indications from the data recorded to the present of any mining-related impacts.

Monitoring results for piezometric height at CLRP1 is presented in **Figure 31**.

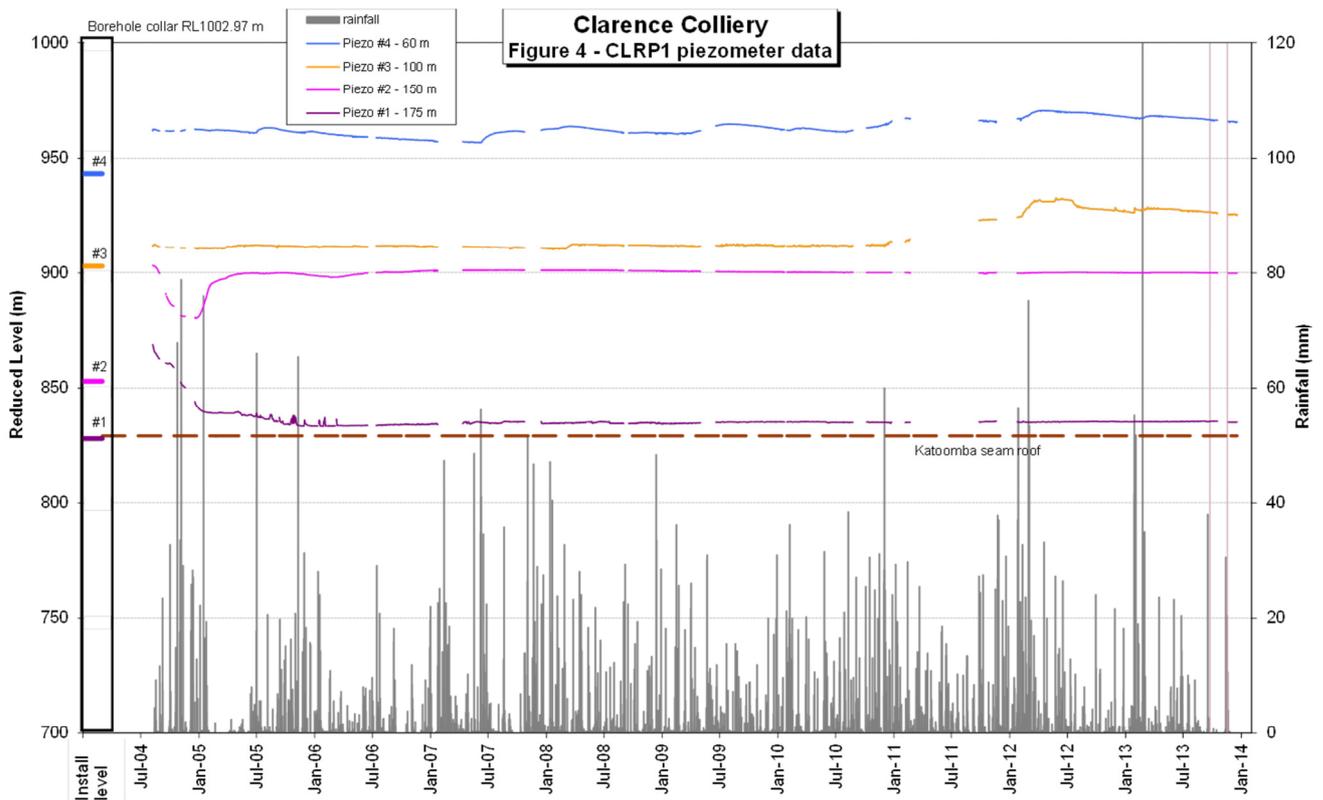


Figure 31. CLRP1 Piezometric Height

3.5.2.2 CLRP2

Total depressurisation occurred in piezometer 1 in the coal seam in August 2007 after mining below the borehole, as expected. The other three piezometers showed no impact from mining at the time and continued to show no impact from mining.

The data does not indicate any adverse impact on the near-surface aquifers. If there was any serious, adverse impact, then the plot of the piezometric pressures would show a rapid decline.

Monitoring results for piezometric height at CLRP2 is presented in **Figure 32**.

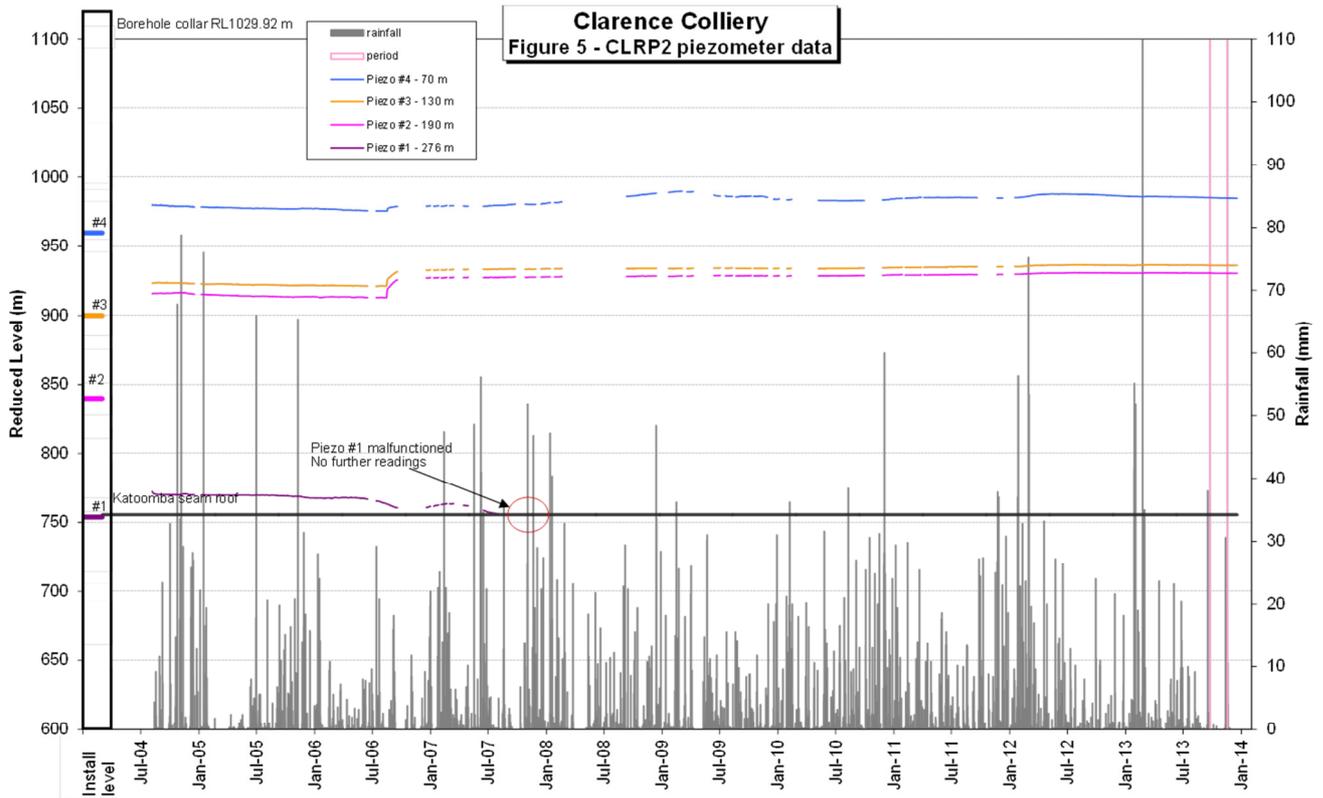


Figure 32. CLRP2 Piezometric Height

3.5.2.3 CLRP3

borehole was undermined shortly after it was installed in 2006, with no mining-related impacts evident in the data up to the present.

Monitoring results for piezometric height at CLRP3 is presented in **Figure 33**.

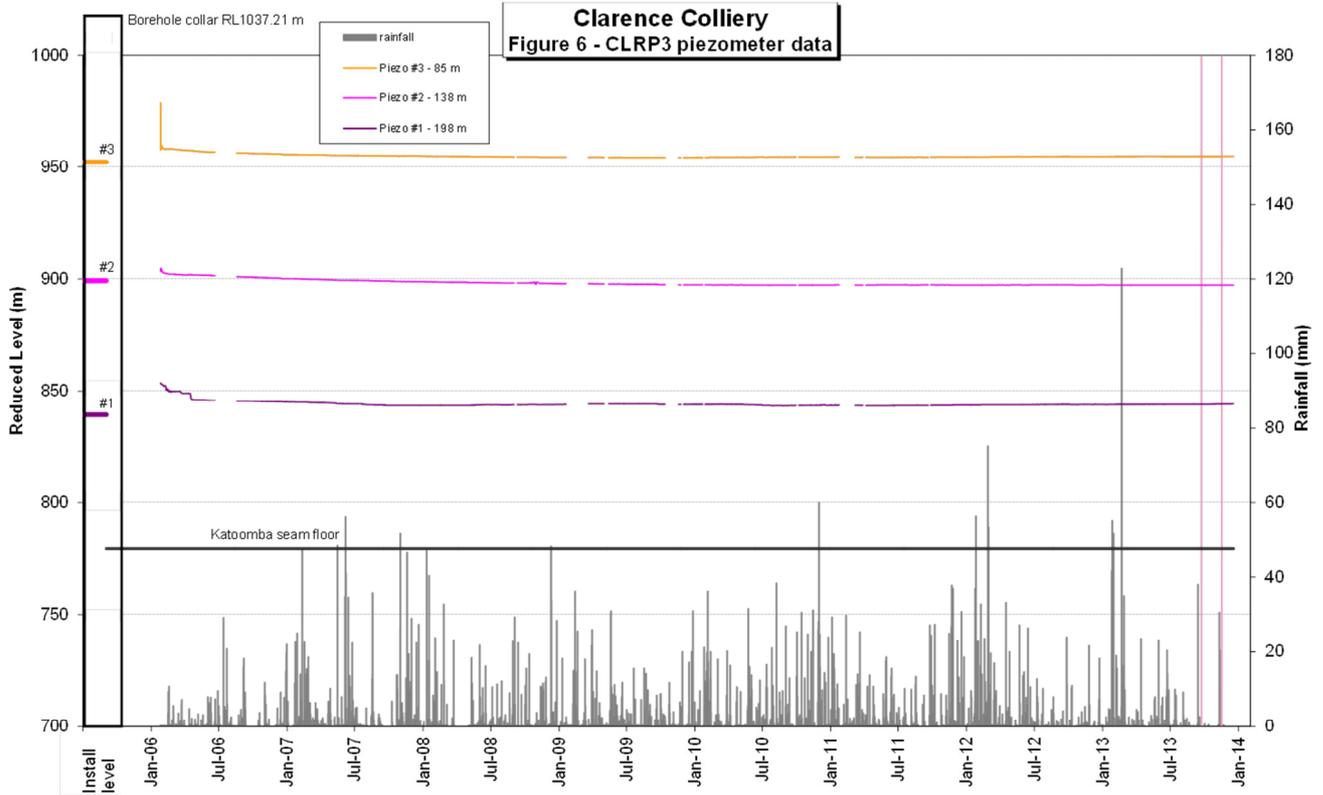


Figure 33. CLRP3 Piezometric Height

3.5.2.4 CLRP6

Partial extraction occurred in Panel 702 in September 2009 directly beneath this borehole, and the adjacent Panel 704 was partially extracted in December 2009. First workings in Panel 706, 250 m to the west, were driven during February 2012. There is no evidence from the data of any adverse mining-related impacts on the strata containing the two functional piezometers during any of the mining.

Monitoring results for piezometric height at CLRP6 is presented in **Figure 34**.

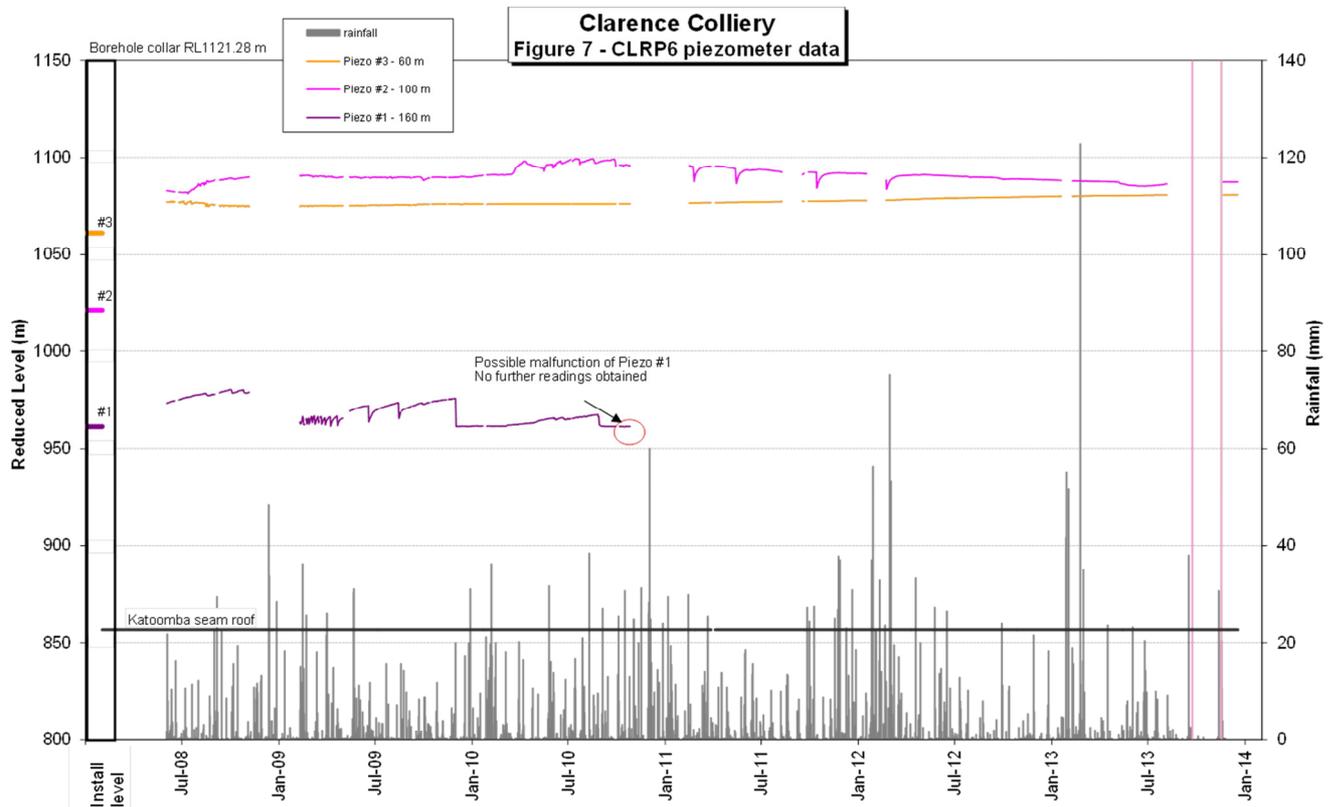


Figure 34. CLRP6 Piezometric Height

3.5.2.5 CC114

In December 2013, first workings in panel 803 were developed over 10km to the east. There is no indication of mining impact in the data.

Monitoring results for Piezometric height at CC114 is presented in **Figure 35**.

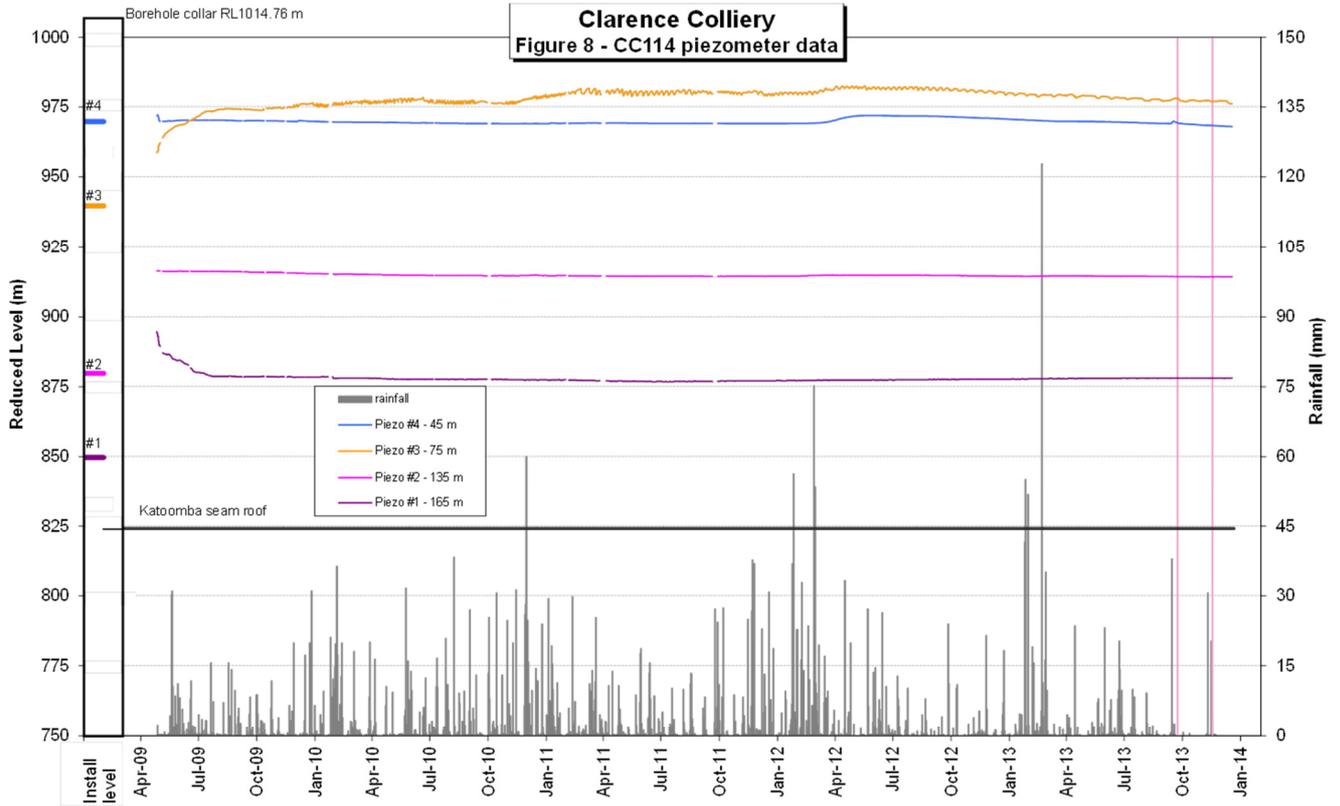


Figure 35. CC114 Piezometric Height

3.5.2.6 CC115

First workings were mined in Panel 810 during November – December 2013, 600 – 1000 m west-northwest of CC115. With the exception of piezometer 1 (results showing instrument malfunction), there are no indications of any abnormal effects in the available data, indicated by the consistent trends in these records.

Monitoring results for Piezometric height at CC115 is presented in **Figure 36**.

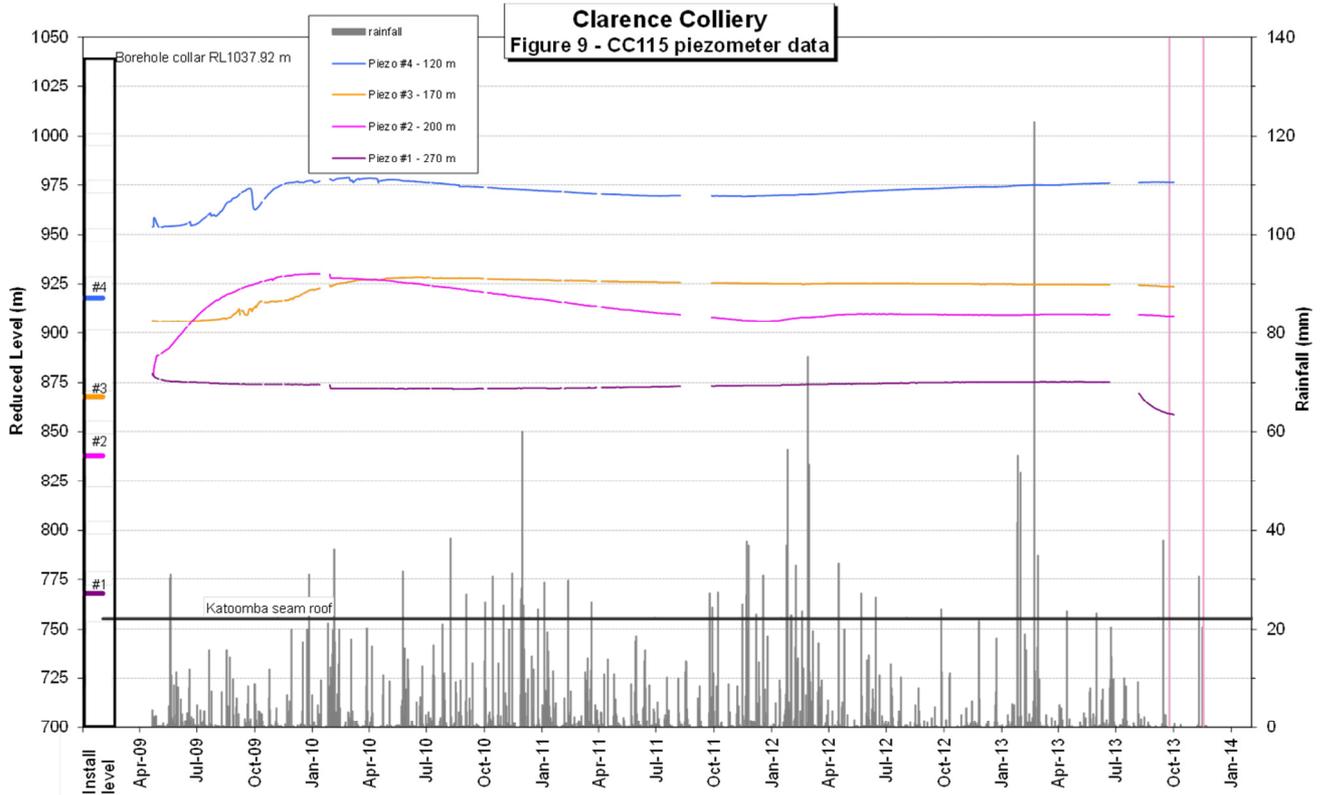


Figure 36. CC115 Piezometric Height

3.5.2.7 CLRP11

Pillar extraction previously occurred in Panel 716, c. 700 m east of CLRP11. None of the data indicate any mining impact.

Monitoring results for Piezometric height at CLRP11 is presented in **Figure 37**.

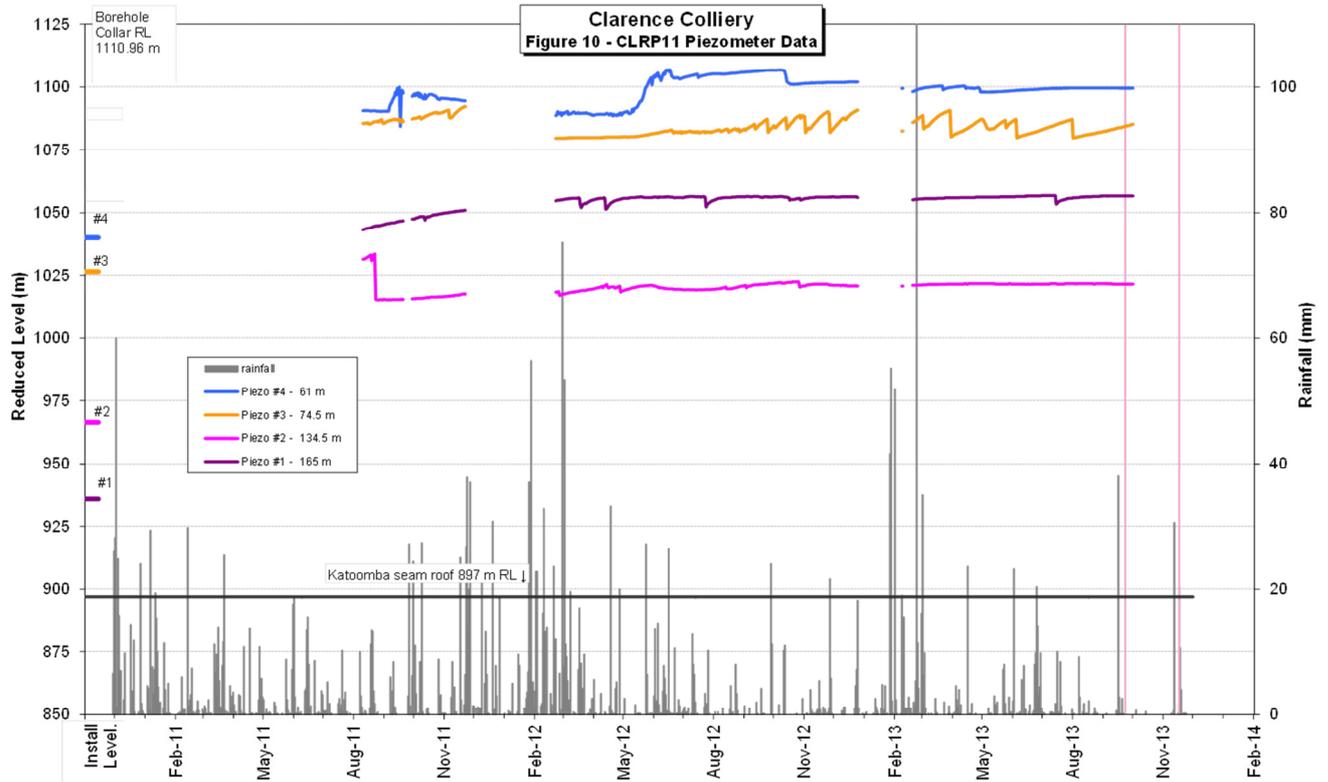


Figure 37. CLRP11 Piezometric Height

3.5.2.8 CLRP12

First workings and pillar extraction occurred in Panel 716 during July – August 2013, over 800 m to the east-southeast of CLRP12. Given the unreliable nature of most of the data, it is hard to identify any mining impact. However, pressure trends in the uppermost piezometer are unchanged, and it is clear that mining is having no impact on the near-surface unconfined aquifer. Monitoring results for Piezometric height at CLRP12 is presented in **Figure 38**.

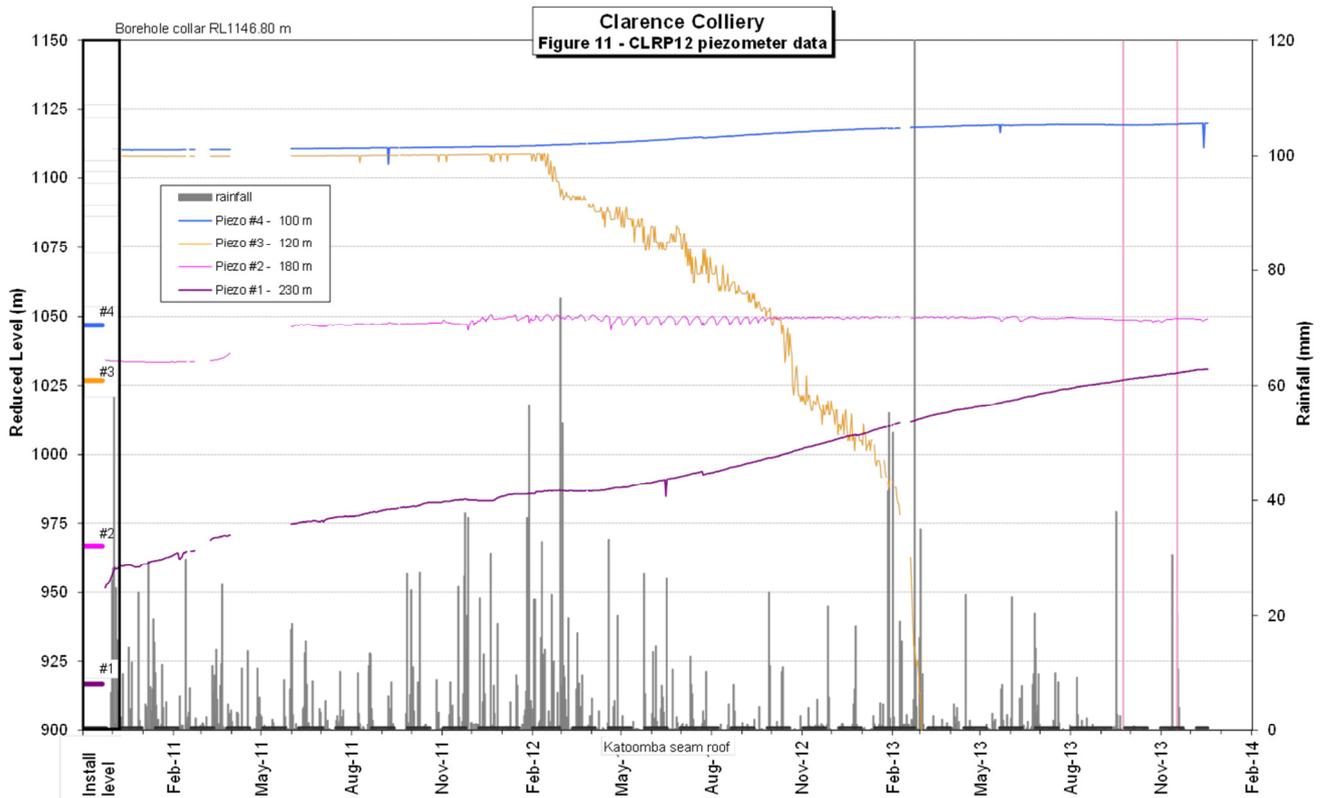


Figure 38. CLRP12 Piezometric Height

3.5.2.9 CLRP14

First workings in Panel 801 passed beneath this site in September 2012. First workings in panel 803 were undertaken over 700 m south of the borehole in December 2013. The data record shows no impact from this mining.

Monitoring results for Piezometric height at CLRP14 is presented in **Figure 39**.

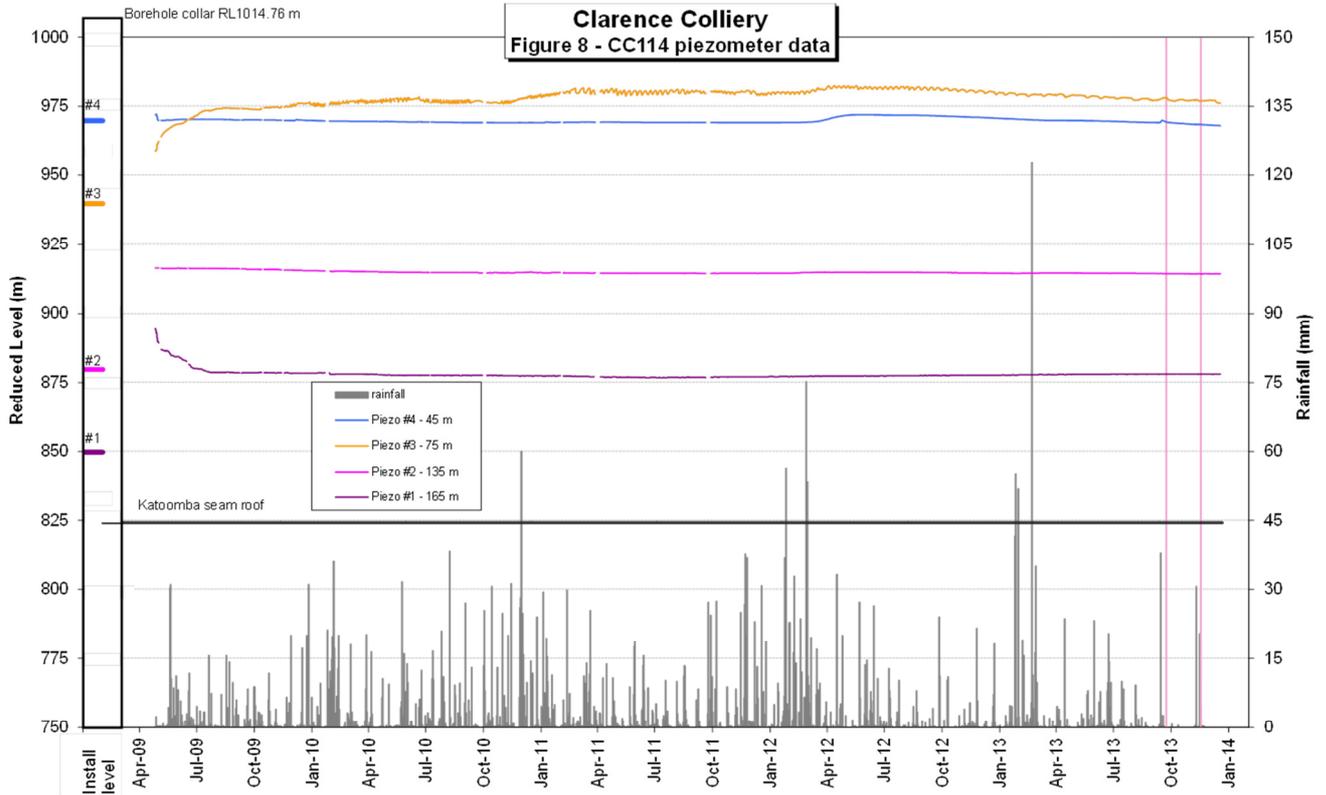


Figure 39. CLRP14 Piezometric Height

3.5.2.10 CLRP15

First workings in 707 panel were about 250 m east of the borehole at the end of July 2012, and partial extraction was completed in August 2012. Pillar extraction in panel 716 approached to within c. 750 m during August – September 2013. Pillar extraction in 700 Panel occurred over 500 m the east during December 2013. The level trends and evidence of flow towards the reservoir indicate that there is no recognisable impact from mining.

Monitoring results for piezometric height at CLRP15 is presented in **Figure 40**.

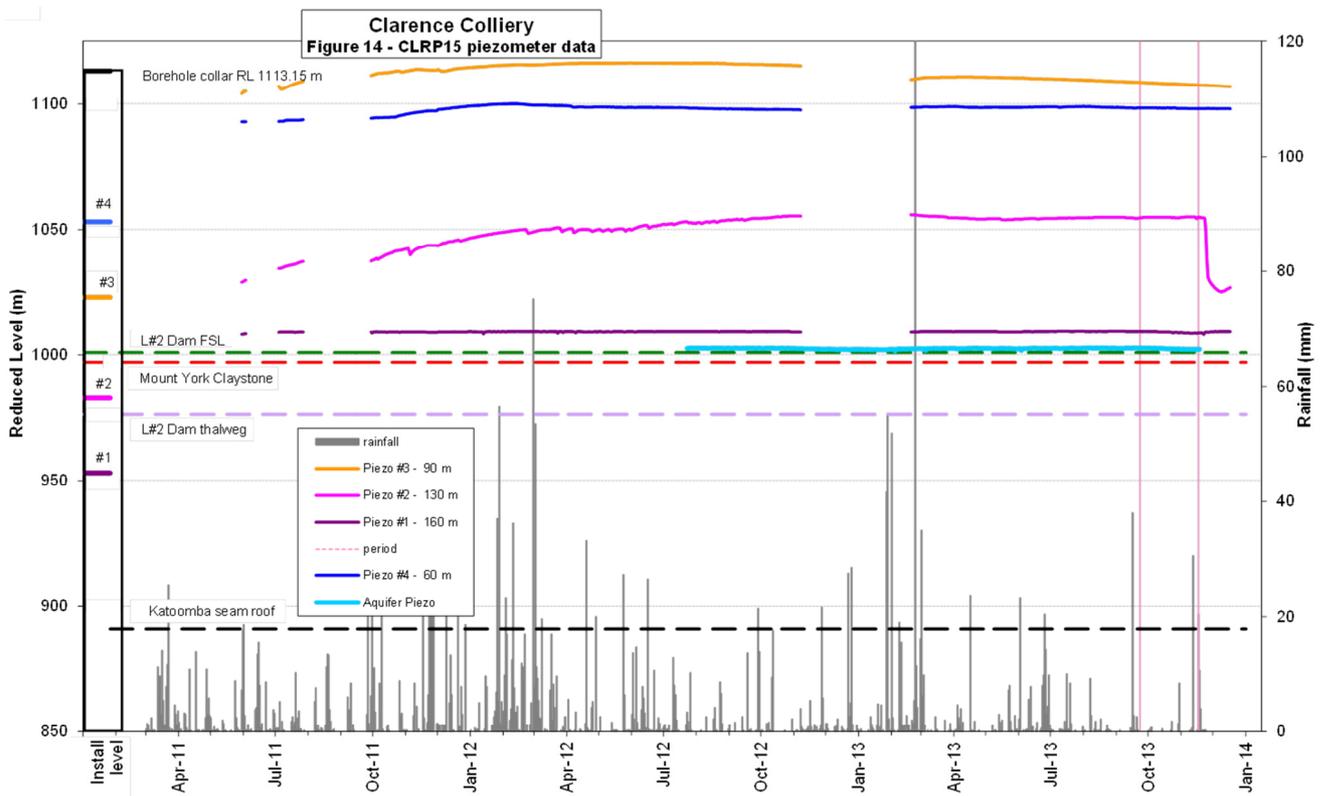


Figure 40. CLRP15 Piezometric Height

3.5.2.11 CLRP16

Pillar extraction in 716 panel was more than 1 km northeast of the borehole in August – September 2013. Pillar extraction in 700 Panel occurred over 1 km m the east during December 2013. There is no evidence of mining impact in the groundwater record.

Monitoring results for piezometric height at CLRP16 is presented in **Figure 41**.

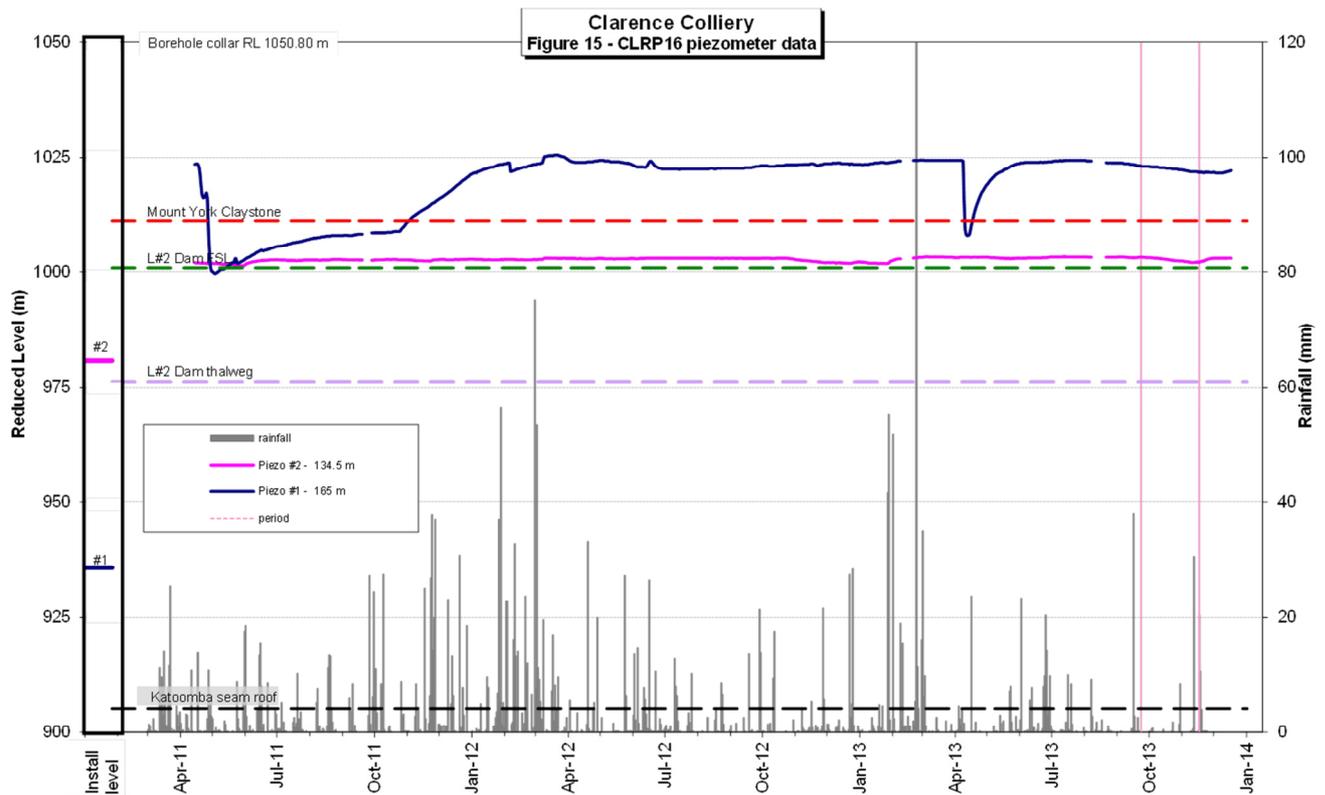


Figure 41. CLRP16 Piezometric Height

3.5.3 Shallow Groundwater Monitoring in Swamps

Happy Valley Upper Swamp was undermined in March 2010, when partial pillar extraction was carried out in panel 704. In April 2011, partial pillar extraction occurred in panel 708, c. 300 m west of the swamp. In January 2011, first workings were driven in panel 712, c. 700 m west of the swamp. In September 2011, first workings occurred in panel 706 immediately west of HVU2. In November and December 2013, pillar extraction occurred in Panel 700, approximately 700 m west-southwest of the swamp.

There is no evidence from the data of any impact on the groundwater levels in the swamp that could be attributed to the mining. Continuing monitoring shows groundwater level behaviour that is typical for these swamps in areas that have not been undermined. Changes in the measured groundwater levels appear to be due solely to prevailing weather conditions.

HV1 was undermined by first workings (710 panel) in September 2010, with partial pillar extraction in October 2010. The swamp was further undermined by first workings in panel 712 in June – July 2011, with subsequent pillar extraction under the swamp in September 2011. HV2 was undermined by first workings in panel 714 in July 2012 with subsequent partial pillar extraction in September 2012. Pillar extraction in panel 716 occurred over 500 m south-southwest of HV2 in August and September 2013, and pillar extraction in panel 700 occurred over 1.8 km south in November – December 2013. There is no recognisable response to this mining in the groundwater record.

Monitoring results for piezometric height at HV1, HV2, HVU1 and HVU2 is presented in **Figure 42**.

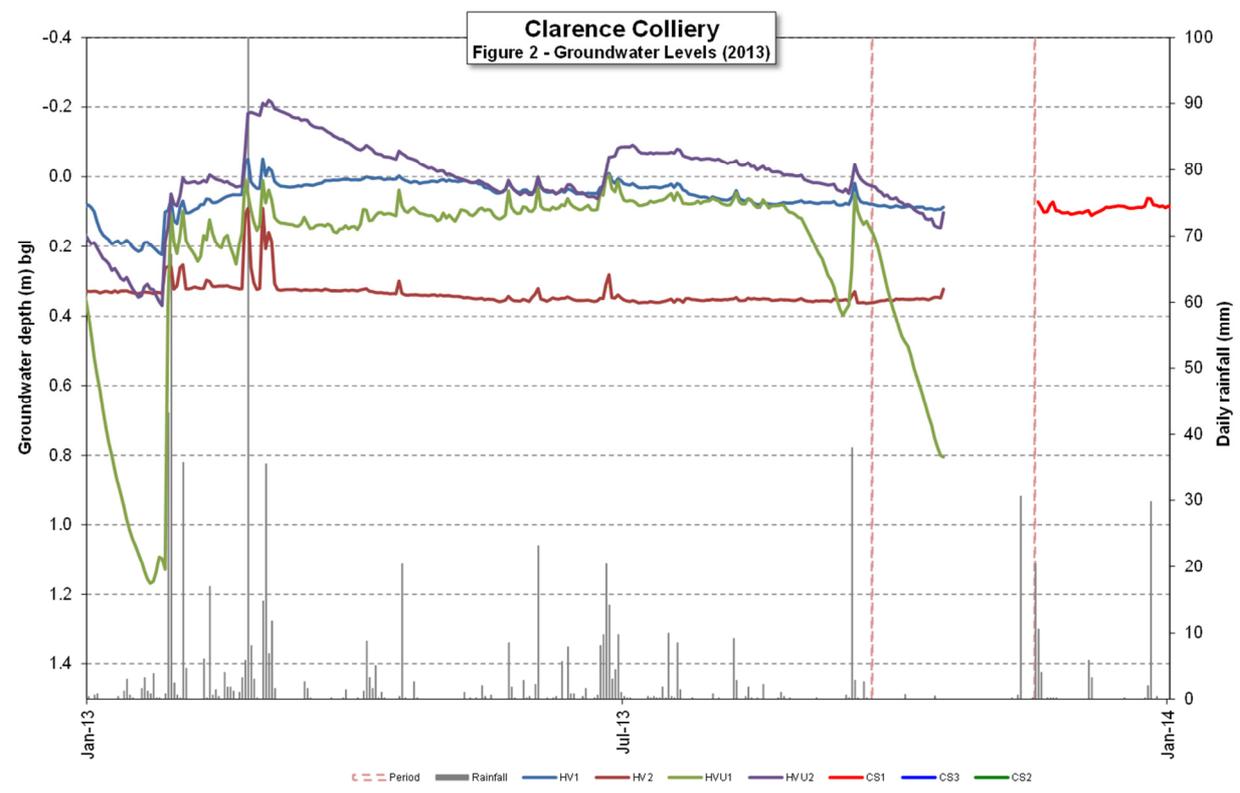


Figure 42. HV1, HV2, HVU1 and HVU2 Piezometric Height

3.6 Threatened Flora

Flora monitoring at pagoda, heath and wet gully sites within the Clarence Colliery Outbye, Eastern and 700 Western SMP Areas was undertaken by Roger Lembit of Gingra Ecological Surveys. Flora monitoring field work within swamp vegetation communities was undertaken by the University of Queensland (UQ). Swamp vegetation communities include Newnes Plateau Shrub Swamps (mapping unit MU50) and Newnes Plateau Hanging Swamps (mapping unit MU51). A report for swamp vegetation monitoring covering all Centennial sites mining underneath the Newnes Plateau was compiled and reported by the Centre for Mined Land Rehabilitation at the UQ. Fieldwork was undertaken three times within the year – autumn, spring and summer.

Results for 2013 surveys across all swamp sites on the Newnes Plateau are presented in the report *Annual 2013 Flora Report for Angus Place, Springvale and Clarence Mines, Lithgow, NSW*.

3.6.1 Results

3.6.1.1 Swamps

The swamp vegetation monitoring undertaken was conducted in a manner which allows assessment against a number of indicators which may provide evidence of an effect of subsidence. These indicators include:

- Species richness - allows for a quick measure of a site's complexity and can be compared across both season and year;
- Species composition - shows the movement of sites in relation to their species composition across the seasons within 2013;
- Exotic species - exotic plant species, or weeds, can be used as indicators of ecosystem change as they generally only occur in vegetation that has had some level of disturbance (particularly human mediated); and
- Relationship between condition and abundance for selected species - compares

the condition of dominant species with scores recorded in previous monitoring and with time since undermining.

Swamp monitoring data is collected from permanently marked with 20 x 20m plots within which vegetation abundance and condition are measured.

At each site, researchers record all species within the plot; estimate cover/abundance using a modified Braun-Blanquet scale; and estimate condition of common species using a pre-determined condition scale. During December 2013, the total time spent traversing plots disturbed by the State Mine Bushfire which proceeded through the area on 17 October 2013 was minimised to prevent trampling damage.

Quantitative assessments of weedy species are determined from transects established between the diagonal corners of the plots; at approximately 1 m intervals along these transects, a 0.5 X 0.5 m quadrat is then placed on the ground to assess the presence or absence of weeds.

Swamp vegetation monitoring in 2013 was undertaken in February (summer), May (autumn) and October (spring). No swamp monitoring sites were directly undermined during the reporting period.

Ten long term swamp monitoring sites have been established at within the Clarence mining lease including (**Figure 43**):

- *BNS01* – Bungleboori North 1, not undermined;
- *BNS02* – Bungleboori North 2, not undermined;
- *CLA01* – Banksia Swamp, not undermined;
- *CLA02* – Banksia Swamp, not undermined;
- *CLA03* – Prickly Swamp, not undermined;
- *CLA04* – Prickly Swamp, not undermined;
- *CLAW02* – Happy Valley Upper Swamp, undermined March and October 2010;
- *CLAW03* – Happy Valley Swamp, undermined December 2010;
- *CLAW04* – Swamp, not undermined; and
- *CLAW05* – Pine Swamp, not undermined.

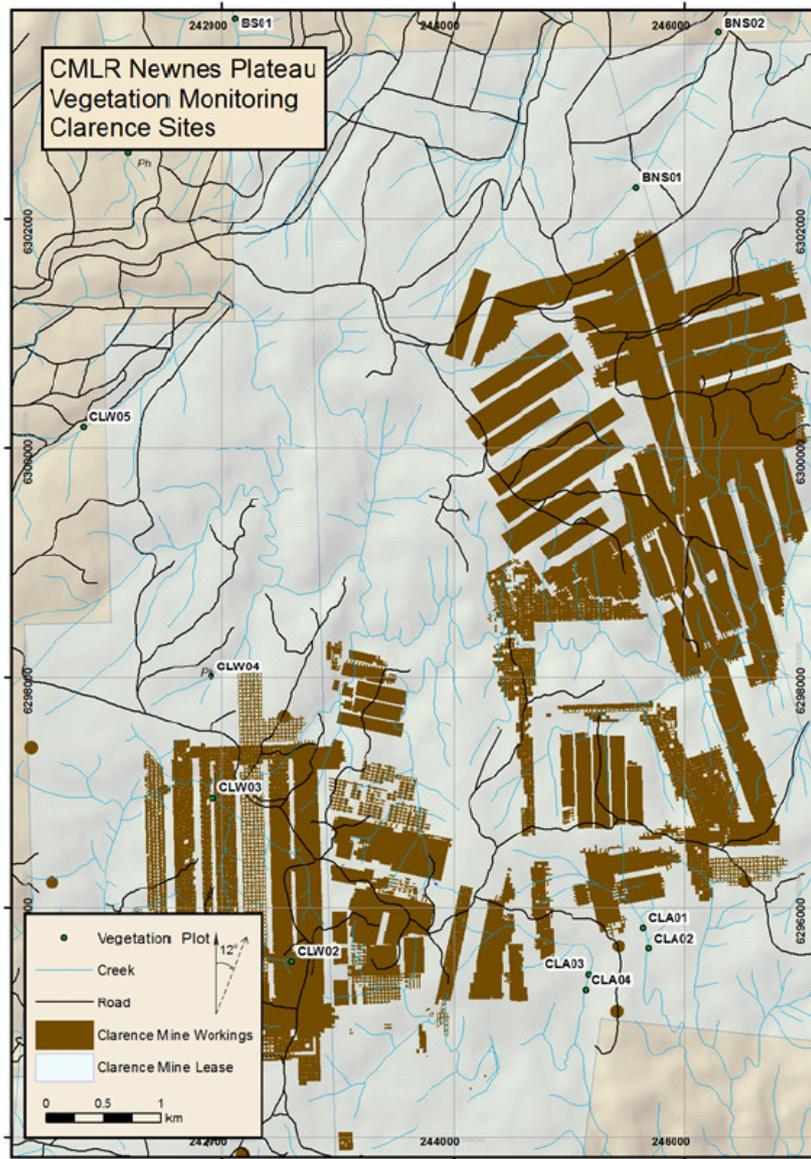


Figure 43. Location of Monitoring Sites within the Clarence Mining Lease

3.6.1.1.1 Species Richness

On the Clarence lease, ten of the twelve plots were burned in the mid-October fire (nine of which completely burned and one partially burned). A similar pattern is evident across all twelve plots of lower species richness in spring 2013 relative to earlier in the year and to previous years. As this pattern occurs in both undermined and control plots, it is unlikely to be due to mining activity; rather it is most likely a combination of the recent fires and natural variation. The highest species richness was recorded in BNS01 and CLW05 (the unburned and partially burned plots respectively); while the lowest was recorded in CLA01 (a burned plot).

3.6.1.1.2 Species Composition

The changes that occurred due to fire in spring 2013 far outweighed any other differences between seasons at affected plots. Sites that did not burn (i.e. BNS01 and BNS02 displayed at least 77% similarity in species composition between spring and the previous seasonal surveys in 2013, while those that burned had similarity scores as low as 36% due to reductions in vegetation cover. Shrub and understorey cover and the abundance of understorey species decreased at burnt sites.

3.6.1.1.3 Exotic Species

The CLW05 plot recorded the highest weedy species richness which increased by one species in spring 2013 compared to spring 2012. However, the species abundance continues to be much reduced from previous years. As this plot is a control plot (not undermined and not impacted by mine water discharge), this change in weedy species cannot be contributed to mining.

CLA04 gained one weedy species in 2013, *Hypochaeris radicata*. The rest of the Clarence plots all had equal or lesser numbers of weedy species in 2013 compared to 2012 and 2011.

3.6.1.1.4 Conclusion

Results presented in 2013 generally concur with those of the 2009, 2010 and 2011 annual reports. There is no evidence of potential effects from subsidence upon swamp vegetation.

3.6.1.2 Eastern SMP and 700 Western SMP Area

A total of six sites in the Eastern area (with two control sites) and two sites in the Clarence 700 West area (with one control site) were monitored (Table 14).

Table 14. 700 Heath/Pagoda Flora Monitoring Sites (Eastern and 700 West Areas)

Site	Location	Easting (AMG)	Northing (AMG)
Clarence East			
PAG01	Gorilla Rock	246648	6299845
PAG02	Gorilla Rock	246650	6299734
PAG03	Waratah East	247146	6300517
PAG04	Waratah East	246938	6300594
PAG05 (C)	Waratah North	247857	6303770
PAG06 (C)	Waratah North	247783	6303720
Clarence West (700 Area)			
CLW01	Heath	241669	6295394
CLW06 (C)	Heath - Paddy's Creek ridge	240367	6298981

Note: (C) denotes control site

Monitoring surveys involved recording vegetation structure, dominant species, estimated cover and height for each stratum,

full floristics, estimated cover abundance for each species using a modified Braun-Blanquet scale and condition ranking for plant species using a five point scale. Observations of general condition of vegetation in less sensitive forest and woodland habitats were also recorded.

Throughout 2013, plants were found generally to be in good condition. Plant condition at unburnt sites from the State Mine Bushfire in spring 2013 was fair, with three plant species showing signs of drought stress at PAG04. This stress was attributable to climatic conditions and not an impact of subsidence.

There was no evidence of death or dieback which could be attributed to an effect of subsidence.

3.6.1.3 Outbye SMP Area

Four vegetation monitoring quadrats were established within the heath vegetation in the Outbye Area. There were also two control sites (Table 15).

Table 15. 700 Area Heath/Pagoda Flora Monitoring Sites (Eastern and 700 Areas)

Site	Location	Easting (MGA)	Northing (MGA)
CLA0 01	Above 307 south of Bungleboori Creek	245023	6297763
CLA0 02	Above 307 south of Bungleboori Creek	245092	6297707
CLA0 03	Above 402, north of Bungleboori Creek (completed June 2009)	245504	6298627
CLA0 04	Adjacent to 602, north of Bungleboori Creek (completed April 2009)	245294	6299168
PAG05 (C)	North of Waratah Ridge	247962	6303960
PAG06 (C)	North of Waratah Ridge	247888	6303910

Note: (C) denotes control site

Monitoring surveys involved recording vegetation structure, dominant species, estimated cover and height for each stratum, full floristics, estimated cover abundance for each species using a modified Braun-Blanquet scale and condition ranking for plant species using a five point scale. Observations of general condition of vegetation in less sensitive forest and woodland habitats were also recorded.

Throughout 2013, plants in the Outbye area (associated with the monitoring program) were generally in good condition. All Outbye sites were affected by the bush fire with the impact being high to very high.

There is no indication that subsidence associated with mining of the Outbye area is having an impact on heath vegetation. Further, no surface expression of subsidence in, or near, the monitoring sites was observed.

3.6.1.4 800 SMP Area

Clarence undertakes flora monitoring of eight sites within the 800 Area. As no mining has taken place, this monitoring (commenced in Autumn 2009) continues to build on the baseline set of data. The sites sample a range of flora monitoring habitats including riparian, open forest vegetation, NPSS and heath vegetation. Results from the monitoring will not be reported as the area is yet to be approved and there is no approved environmental monitoring program.

3.7 Threatened Fauna

Fauna monitoring at Clarence Colliery was undertaken by Biodiversity Monitoring Services. Fieldwork for the 700 Area (Eastern, Western and Outbye) and 800 Area (Eastern Portion) was completed.

In 2008 sites were established within both the Outbye and 700 SMP Application Areas and in 2009 sites were established to commence baseline surveys within the '800 Area' to identify impacts (if any) of mining induced subsidence on native fauna.

Extraction within the reporting period occurred in the 700 panel and 716 panel (700 West Area) and development occurred in the 800 Area. No extraction occurred within the 700 Outbye and Eastern SMP Area during 2013. Locations of fauna monitoring sites can be seen in **Appendix 4**.

Fauna monitoring undertaken uses the methods of setting traps including Elliot traps, tomahawk cage traps, glider traps and pitfall traps, additional monitoring includes spotlighting, hair funnels, remote cameras, bird surveys, call broadcasting, herpetological searches, bat call detection, animal track recognition and opportunistic observations.

3.7.1 Criteria Used to Monitor Fauna

A set of criteria that is used to monitor and compare fauna populations within the SMP areas over time includes:

- Species richness of faunal groups;
- Diversity indices of faunal groups;
- Capture rates of individual species;
- Population status of species;
- Contribution to the faunal assemblages by threatened species, species dependent upon woodland and by species declining in the Central West;
- Habitat complexity scores; and
- Comparisons between Treatment and Control sites.

3.7.2 Results

3.7.2.1 700 Western SMP Area

Six long term fauna monitoring sites have been established at within the Western Subsidence Management Plan (SMP) areas including (**Figure 44**):

- *CLW01* – Control site, not undermined, pagoda landscape;
- *CLW02* – Undermined November 2009, swamp landscape;
- *CLW03* – Undermined October 2010, swamp landscape;
- *CLW04* – Control site, not undermined, swamp landscape;
- *CLW05* – Control site, not undermined, swamp landscape; and
- *CLW06* – Undermined November 2011, pagoda landscape.

A total of 62 bird, three reptile, four amphibian and 17 native (plus four introduced) mammal species were located within the Clarence Colliery Western SMP Application areas during the 2013 surveys. A total of 111 bird, 22 reptile, 34 native mammal and eight amphibian species have been recorded from the areas.

Threatened species identified in the 2013 surveys include:

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Scarlet Robin (*Petroica boodang*);
- Flame Robin (*Petroica phoenicea*);
- Eastern Pygmy Possum (*Cercartetus nanus*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*); and
- Giant Dragonfly (*Petaleura gigantia*).

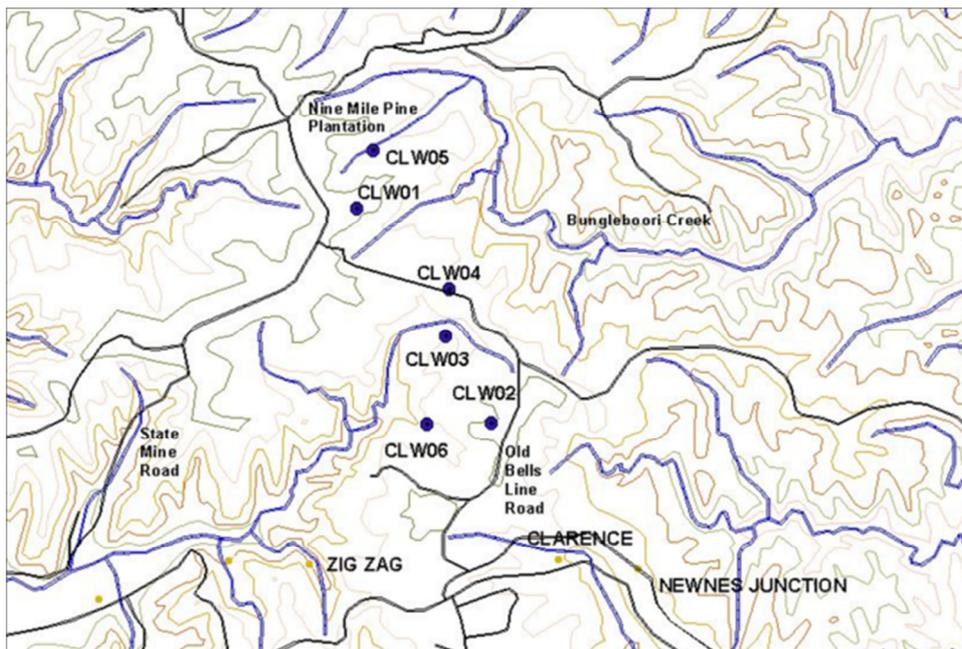


Figure 44. Location of Fauna Monitoring Sites in 700 Western SMP Area

Twenty threatened species have been located within Clarence Colliery Western SMP Application areas as a result of the surveys up to 2013. These are the Gang-gang Cockatoo, Glossy Black-cockatoo, Brown Treecreeper, Hooded Robin, Scarlet Robin, Flame Robin, Varied Sittella, Masked Owl, Powerful Owl, Squirrel Glider, Eastern Pygmy-possum, Large-eared Pied Bat, Greater Broad-nosed Bat, Large-footed Myotis, Eastern False Pipistrelle, Eastern Bentwing Bat, Little Pied Bat, Blue Mountains Water Skink, Giant Burrowing Frog and the Giant Dragonfly. Some of these species are dependant upon large areas of native woodland for populations to survive. In the Newnes Plateau region woodland habitat has been retained (albeit logged) and these threatened species are still to be located. Several of the threatened species are found in most years e.g. Gang-gang Cockatoo, Flame and Scarlet Robins and Eastern Bent-wing Bat.

Few of the threatened species would be directly affected by subsidence-induced changes to their preferred habitat, with exception of the Large-eared Myotis, Eastern Bent-wing Bat, Blue Mountains Water Skink and Giant Dragonfly. The bats can roost in caves and overhangs and the Blue Mountains Water Skink and Giant Dragonfly are associated with wet swamps. Both habitats can be directly affected by subsidence effects (cliff collapse and swamp drainage) but there is no evidence of such impacts occurring in the Clarence West SMP areas. Despite searching

preferred habitats during the warmer months in 2013, there was no evidence of the presence of the Blue Mountains Water Skink and Purple Copperwing Butterfly in the area, but the Giant Dragonfly was located at CLW03 and CLW05. A single Giant Dragonfly located at CLW03 was seen to be eaten by a Dusky Woodswallow.

The configuration of survey sites established in 2006 adequately samples the two major environments within Clarence Colliery Western SMP Application areas i.e. pagoda and wetland (swamp). These sites will provide the best possible data for the long-term monitoring of terrestrial vertebrates. The survey techniques used have been successful in locating a wide range of species, including new records for the Newnes Plateau region. The pagoda habitat mainly comprises low heath that is characteristic of pagoda and hilltop environments at Newnes Plateau.

The Western SMP areas appear to be productive, in terms of fauna diversity values. At this stage 20 threatened species are known to occur within the area. The area can be considered to be heavily disturbed by recreational activities, particularly trail bikes, and this must be brought into consideration when assessing any changes in the future.

The major influence upon the fauna populations (and vegetation) within Clarence West has been the State Mine fire that burnt out all the sites in the area. Fire is a natural part of Australian ecosystems and the State Mine fire that burnt prior to the survey of the

Clarence West area is typical of a high intensity burn. It has been observed that this fire appeared to be of greater intensity than that which occurred in 1997. The effects from the fire will last for many years but it was opportune that the sites could be entered soon after the fire was extinguished at Newnes Plateau (within a week of the fire burning in Clarence West). The data obtained in the 2013 surveys cannot be used to monitor any effects from underground mining, but it does provide an important baseline for monitoring the recovery from fire by fauna in the future. It also provides important data to compare the rates of recovery within areas that have been previously mined and those still to be mined or used as controls.

Bird and reptile numbers and diversities appear to have remained constant or risen since 2012. Native mammal populations seem to have been affected and no small ground marsupials (antechinus species) were located. Bird species were mainly those that foraged on insects with few nectar-feeding birds seen (only four honeyeater species were recorded). Many insects were observed including large numbers of flies that would have been valuable food for birds and reptiles.

As data continues to accumulate from the ongoing surveys, it will be possible to track changes to the terrestrial vertebrate fauna within the Clarence Colliery Western SMP

Application areas. At present, there appears to be no evidence of potential effects from subsidence upon the fauna diversity at Clarence Colliery.

3.7.3 700 Outbye SMP Area

Three sites surveyed in 2013 have been established within the Outbye SMP Area including (Figure 45):

- *Heath North (Site 1)* – Sandstone Plateaux Tea Tree – Dwarf Sheoak – Banksia Rock Heath Sandstone Plateau and Ridge Scribbly Gum Silvertop Ash Shrubby Woodland;
- *Gully (Site 2)* – Pagoda Rock Sparse Shrubland and Newnes Sheltered Peppermint – Brown Barrel Shrubby Forest; and
- *Heath South (Site 3)* - Exposed Blue Mountains Sydney Peppermint – Silvertop Ash Shrubby Woodland.

A total of 47 bird, five reptile, one amphibian and 17 native (plus three introduced) mammal species were located within Clarence Colliery Outbye SMP Application area during the 2013 surveys. A total of 77 bird, 23 native mammal, 15 reptile and two amphibian species have been located within the Clarence Colliery Outbye SMP Application area since 2008.

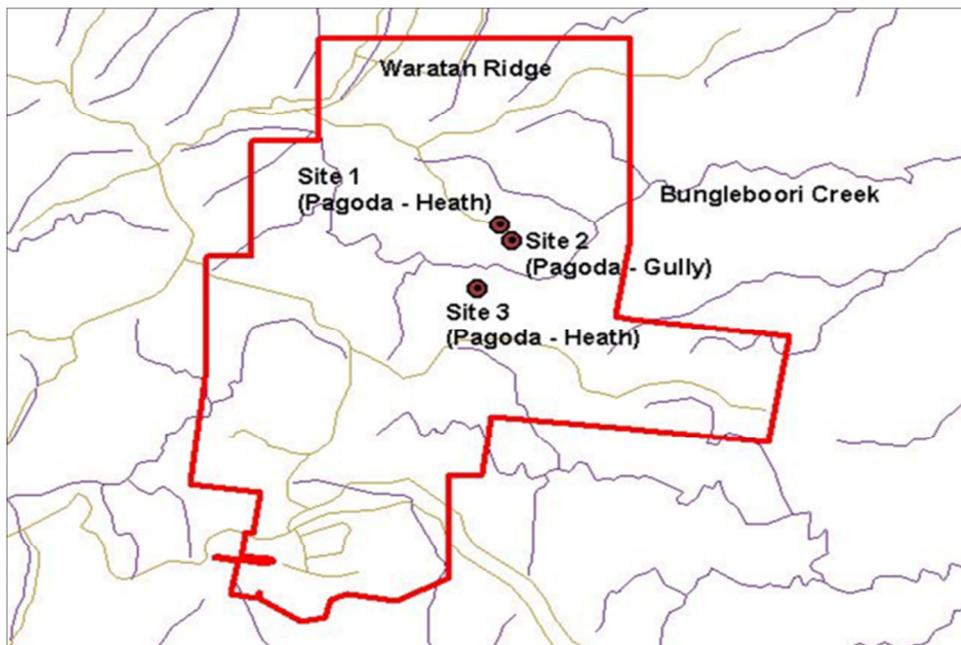


Figure 45. Location of Fauna Monitoring Sites in 700 Outbye SMP Area

Threatened species identified in the 2013 surveys include:

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus latham*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*); and
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*).

None of the threatened species should be directly affected by subsidence-induced changes to their preferred habitat and there is no indication that underground mining at Clarence Colliery has affected the population status of these threatened species or any other species.

Whilst the three sites sampled land that has not been directly undermined, Heath North (Site 1) and Gully (Site 2) are located immediately adjacent to Panel 602 where partial extraction was completed in April 2009. Heath South (Site 3) is located adjacent to 307 where no secondary extraction has occurred. The results show that there have been no significant differences in the various indices over the years and no differences between the results from 2008 and the ensuing years.

Comparison of the results from the fauna surveys since 2008 i.e. prior to mining provides an assessment of any significant changes since partial extraction occurred adjacent to Heath North (Site 1) and Gully (Site 2). The trend lines for the biodiversity indices are relatively constant, as are species richness values for all three fauna groups (birds, mammals and reptiles). This indicates that the mining activities have not shown any significant impacts on fauna.

The three survey sites established in 2008 adequately sample the two major environments within Clarence Colliery Outbye SMP Application Area that are most sensitive to subsidence i.e. pagoda and water courses. This SMP Area also represents the 314/316 area in terms of habitat type and vicinity. The survey techniques used have been successful in locating a wide range of species, including new records for the Newnes Plateau region.

As data continues to accumulate from the on-going surveys, it will be possible to track changes to the terrestrial vertebrate fauna within the Clarence Colliery Outbye Colliery SMP Application Area and the 314/316 area. At present, there appears to be no evidence

of potential effects from subsidence upon the fauna diversity at Clarence Colliery. The major effects have been from the State Mine fire that burnt through the Clarence 800 area and resulted in the loss of habitat and possibly fauna. Although the overall results do not show any significant differences between the values obtained in 2013 and that from previous years, a comparison between the burnt site and that of an unburnt site shows that the fire has affected the fauna.

The monitoring of recovery from fire within those sites mined and un-mined will be an important tool in the on-going assessment of mining activities.

3.7.4 700 Eastern SMP Area

The three sites surveyed in 2013 were the same as that surveyed in previous years including (Figure 46):

- BNS02 (Bungleboori North 1) – a swamp located within the pine forest east of Waratah Ridge Road. The swamp supports a mix of swamp and Blue Mountains Sandstone Plateau Forest;
- PAG01/02 – a pagoda and steep hill overlooking Bungleboori Creek. This site samples Pagoda Complex and Blue Mountains Sandstone Plateau Forest vegetation, as well as habitats unique to the cliffline environment; and
- PAG03/04 – a pagoda and steep hill overlooking Bungleboori Creek, similar to PAG01/02.

A total of 56 bird, seven reptile, one amphibian and 13 native (plus four introduced) mammal species were located within the Clarence Colliery Eastern SMP Application area during the 2013 surveys. A total of 99 bird, 26 reptile, 31 native mammal and five amphibian species have been recorded from the Area since 2004. Threatened species identified in the 2013 surveys include:

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus latham*);
- Scarlet Robin (*Petroica boodang*);
- Flame Robin (*Petroica phoenicea*); and
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*).

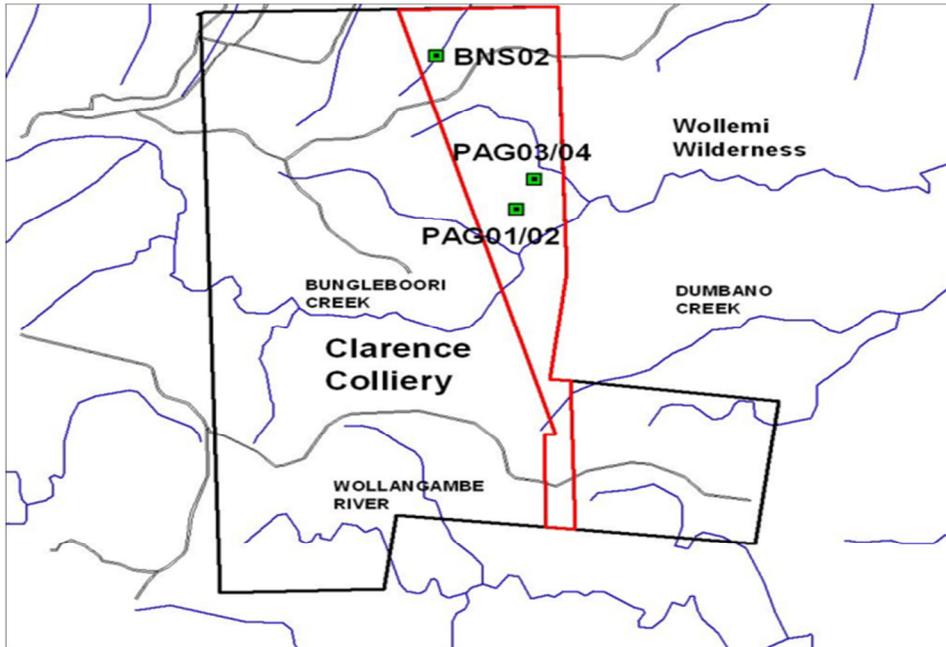


Figure 46. Location of Fauna Monitoring Sites in 700 Eastern SMP Area

The results indicate there was no impact from underground mining at Clarence Colliery affecting the population status of any threatened species or any other species. Mining activities at Clarence result in 3 – 10cm of subsidence and ongoing surveys have shown that this amount of subsidence (including tilts and strains) is not sufficient to cause negative consequences on rock shelters, pagodas and clifflines.

The two pagoda sites surveyed in the Clarence Colliery Eastern SMP Area cover land where underground mining (partial extraction) has occurred (i.e. PAG01/02 and PAG03/04). These sites are classed as treatment sites. The swamp site BNS02 samples land not yet affected by underground mining and, at present, can be classed as a control site. Comparisons with sites in other parts of Clarence Colliery assisted in obtaining a comparative assessment of changes from underground mining activities. BNS02 has been affected by logging operations next to this site and it is anticipated that changes in water levels and the native tree cover may occur. Such changes are likely to be due to the logging operations rather than mining activity. It is currently being considered moving this site to the nearby BNS01 or another swamp near the Boundary track.

The configuration of survey sites established in previous years adequately samples the two major environments within the Clarence Colliery Eastern SMP Application Area i.e. pagoda and wetland (swamp). The survey techniques used have been successful in locating a wide range of species, including new records for the Newnes Plateau region. As extraction in the Eastern SMP Area was completed early in 2009, it is evident from the survey results that there has been no significant differences in the indices measured over the years. To date, there has been no evidence of potential effects from subsidence upon the fauna diversity at Clarence Colliery.

3.7.4.8 800 Area (Eastern Portion)

During the reporting period Clarence commenced development in the 800 Area located within the eastern portion of ML 1583. Three sites were established during 2009 and fauna surveys were undertaken in autumn, spring and summer in that year and annually up to 2013. The sites include (**Figure 47**):

- *800 Swamp 1 Site* - samples Newnes Plateau Shrub Swamp in the central part of the 800 Area;
- *800 Heath Site* - samples Montane heath vegetation south of Dumbano fire trail; and
- *800 Swamp 2 Site* - samples the woodland and gully vegetation in the eastern part of the 800 Area.

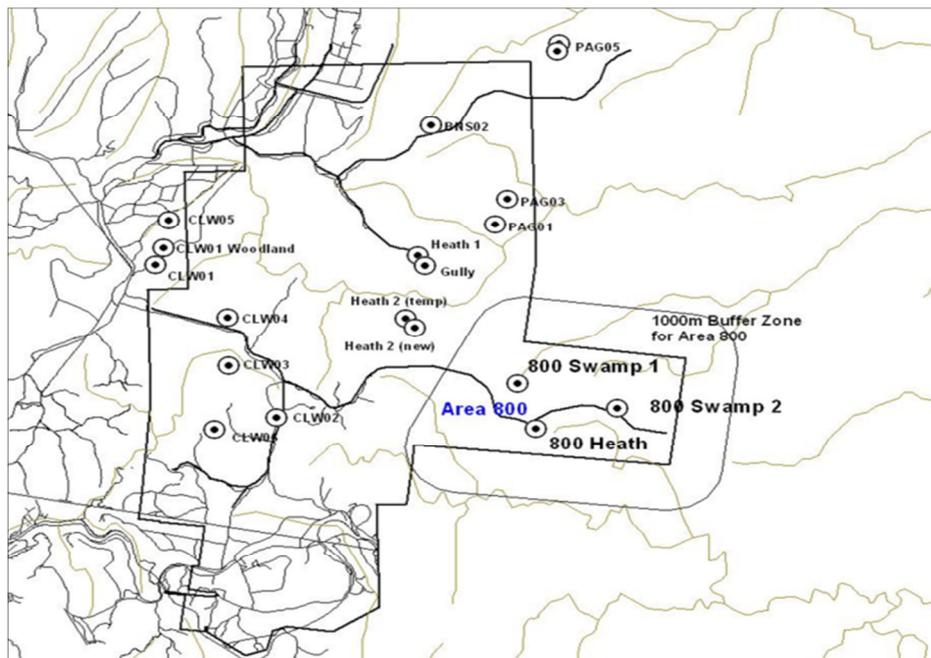


Figure 47. Location of Fauna Monitoring Sites in 800 SMP Area

A total of 51 bird, 15 native mammal (plus two introduced mammal), 10 reptile and two amphibian species were located during the surveys. Threatened species identified include:

- Eastern Pygmy Possum (*Cercartetus nanus*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*); and
- Scarlet Robin (*Petroica boodang*).

There were no significant differences between the results from the 2009 to 2013 surveys using a non-parametric Kruskal-Wallis One Way Analysis of Variance on Ranks, either for the total data or for each faunal group.

Given the low levels of subsidence from previous mining at Clarence Colliery, and the predicted low levels (3–10cm) of subsidence for Area 800, the risk of adverse impacts on fauna within this area is considered to be low.

3.8 Weeds

Weed control operations are undertaken at Clarence in accordance with the Noxious Weeds Act 1993 (NWA) which provides that occupiers of land have responsibility for controlling noxious weeds. Under Section 8 of the NWA, noxious weeds can be grouped into five classes, as follows:

- Class 1 – State Prohibited Weeds;
- Class 2 – Regionally Prohibited Weeds;
- Class 3 – Regionally Controlled Weeds;
- Class 4 – Locally Controlled Weeds;
- Class 5 – Restricted Plants.

Pampas grass (*Cortaderia selloana*) (Class 3), Blackberry (*Rubus fruticosus*) (Class 4) and St Johns Wort (*Hypericum perforatum*) (Class 3) have been recorded at Clarence with weed control measures carried out as required to control the spread of these noxious weeds around the pit top including the CHPP, administration buildings, water storages, drainage lines, access roads and rehabilitation areas.

Weeds are managed across Clarence mine through a series of control measures, including:

- Designated light vehicle roads and track delineated around the site;
- Herbicide spraying or scalping weeds off topsoil stockpiles prior to re-spreading;
- Inspections of rehabilitated areas to identify potential weed infestations; and
- Identifying and spraying existing weed populations on-site together with on-going weed spraying over the life of the operation.

Weed spraying was completed monthly in a manner that minimised soil disturbance. Any use of herbicides was carried out in accordance with appropriate requirements to minimise the risk of impact on downstream water quality. Records will be maintained of weed infestations, and control programs will be implemented according to accepted management practice for the weed species concerned. The appropriate noxious weed control or eradication method and program will be undertaken in consultation with the Local

Council and/or the local Noxious Weeds Inspector.

All weed management personnel have been trained in the use of herbicides. Herbicides listed under international conventions, such as the World Health Organisation and the Stockholm Convention, would only be used according to the requirements of those conventions.

3.9 Blasting

No blasting on the surface is undertaken at Clarence Colliery. Some shot firing is undertaken in the underground workings to excavate material to establish ventilation for the underground roadways.

3.10 Operational Noise

Clarence Environmental Impact Statement (2000) predicted no additional noise impacts from the operation would occur giving consideration to the underground extraction of coal, pit top and CHPP operation, and haulage by road or rail. Clarence monitoring to date has indicated that the Colliery has not impacted on noise in the environment. Noise monitoring results for 2013 is provided in Section 3.10.2.

3.10.1 Control Measures

Measures employed to control and limit noise emissions from the site include:

- Correct and efficient operation of all surface machinery;
- Regular servicing and maintenance of all machinery;
- Education of all drivers hauling materials through residential areas; and
- Registering all noise related complaints to identify any actions that may be necessary to further reduce noise emissions from the site.

Several options to minimise noise associated with rail loading and rail operations on the Clarence Colliery loop have been developed and implemented. These include:

- Scheduling coal train movements within day time hours where practical (this can be achieved for approximately 70% of trains);
- Scheduling coal train movements within evening hours in preference to night hours (this can be achieved for approximately 20% of trains);
- Instructing coal train operators to decelerate and accelerate slowly and smoothly when approaching rounding and departing the rail loop;
- Filling the train loading bin during daylight hours and maintaining the bin at greater than 60% during train loading operations (so as not to create excess noise from filling the bin); and
- Maintaining the train loading infrastructure by including weekly inspections on the coal loading conveyor belt system to detect wearing and noisy rollers, monthly inspections on the drive motors and belts for early detection of failing parts and yearly structural inspections on the belt gantry and associated infrastructure to detect and repair loose components potentially leading to noise. Corrective action required as a result of these inspections is managed through the mine planning corrective action system.

3.10.2 Results

Condition 15 of Schedule 3 of DA 504-00 states that, noise generated by the development, excluding train-loading facilities and rail operations, should not exceed the noise impact assessment criteria (**Table 16**) at any residence on privately owned land.

Noise monitoring results to date indicate that noise levels from the colliery operations are below those stated in Condition 15 of Schedule 3 of DA 504-00. The noise monitoring results for 2013 (attended) is presented in **Table 17** and results for 2013 (unattended) in **Table 18**.

Table 16. Noise Impact Assessment Criteria

Frequency	Receptor	Duration	Outcome
Annual (March of each Year)	Closest potentially affected residences	1 Day Attended, 1 Evening Attended, 1 Night Attended. 5 Day Unattended 5 Evening Unattended 5 Night Unattended.	LAeq, LA90, LA10, LA1 and LAeq,15min (dB(A)) for day, evening and night. LAeq, LA90, LA10, LA1 and LAeq,15min (dB(A)) for day, evening and night.

Table 17. Short Term Noise Monitoring Results 2013 (Attended)

Day	LA _{eq}	Estimated Mine Contribution LA _{eq} (15 minute)	DA Consent Limit (Daytime)	Description of Noise Emissions
3:57 PM	50	38	38	- Traffic noise from Sandham Road 74 - Bird song 45 - 47 - Trees in wind 44 - 45 - Clarence Colliery general operations audible up to 38 - Clarence Colliery Train Loading operations 44 - 49
4:28 PM	49	38	38	- Traffic noise from Sandham Road 72 - Train Passby 46 - 63 - Trees in wind 42 - 43 - Clarence Colliery general operations audible up to 38 - Clarence Colliery Train Loading operations 45
4:59 PM	43	38	38	- Traffic noise from Sandham Road 63 - Trees in wind 41 - 49 - Clarence Colliery general operations audible up to 38 - Clarence Colliery Train Loading 42-46
5:28 PM	43	38	38	- Trees in wind 45 - 46 - Bird song 49 - Clarence Colliery general operations audible up to 38 Clarence Colliery Train Loading 42 - 43
6:31 PM	45	36	36	- Traffic noise from Sandham Road 67 - 68 - Birds (intermittent) 42 - Trees in wind 45 - 46 - Clarence Colliery general operations audible up to 36 - Clarence Colliery Train loading operations 43 - 44
7:02 PM	42	36	36	- Traffic noise from Chifley road (intermittent) 41 - Birds (intermittent) 43 - 58 - Trees in wind 45 - 46 - Insects Constant 49 - 54 (constant) - Dog 46 - Clarence Colliery general operations audible up to 36 - Clarence Colliery Train loading operations 39 - 50
7:30 PM	52	36	36	- Traffic noise from Sandham Road 62 - 76 - Birds (intermittent) 55 - Trees in wind 40 - 44 (constant) - Insects 48 - 49 (constant) - Clarence Colliery general operations (vehicle Reversing

				Alarms) audible up to 50 - Clarence Colliery Train loading operations 49 – 52 (constant)
7:45 PM	48	36	36	- Trees in wind 45 - 50 (constant) - Insects 49 - 54 (constant) - Operations (vehicle Reversing Alarms) audible up to 48 - Clarence Colliery general operations audible up to 36
10:49 PM	44	35	35	- Trees in wind 40 - 45 (Constant) - Train Passby 56 - Insect (Constant) 45 - 51 - Clarence Colliery general operations audible (constant) up to 36.
11:04 PM	43	35	35	- Trees in wind 40 - 45 (constant) - Plane 48 - Insect (Constant) 45 - 48 - Clarence Colliery general operations audible (constant) up to 36. - Clarence Colliery REA IV Haul Trucks audible (Intermittent) up to 47.
11:20 PM	44	35	35	- Trees in wind 40 - 45 (constant) - Insect (Constant) 43 - 44 - Clarence Colliery general operations audible (constant) up to 36. - Clarence Colliery REA IV Haul Trucks audible (Intermittent) up to 46.
11:35 PM	49	35	35	- Traffic noise from Sandham Road 72 - Trees in wind 40 - 45 (constant) - Insect (Constant) 45 - 48 - Train Passby 59 - Clarence Colliery general operations audible (constant) up to 36. - Clarence Colliery REA IV Haul Trucks audible (Intermittent) up to 44.

Table 18. Long Term Noise Monitoring Results 2013 (Unattended)

Date	Measured Noise Source Leq (dB(A))	Modification (dB(A))	Factor	Adjusted Noise Source Leq (dB(A))	Development Consent Criteria		
					Day	Evening	Night
26 April 2013	22	10		32	38	36	35
27 April 2013	20	10		30	38	36	35
28 April 2013	19	10		29	38	36	35
29 April 2013	19	10		29	38	36	35
30 April 2013	21	10		31	38	36	35
1 May 2013	20	10		30	38	36	35
2 May 2013	22	10		32	38	36	35
3 May 2013	22	10		32	38	36	35

3.11 Visual or Stray Light

Clarence Colliery's nearest neighbour is approximately 1.5 kilometres from the mine and is separated from the Colliery by a ridge. Consequently the risk of off-site visual or lighting impacts from the operation is extremely low. Nevertheless, in accordance with Condition 22 of DA 504-00, all external lighting associated with operations at Clarence complies with Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.

No community complaints have been recorded regarding light annoyance at Clarence.

3.12 Aboriginal Heritage

Aboriginal sites in the area are generally situated in rock shelters although some open sites associated with hanging swamps have been found. No archaeological sites have been recorded within the Pit Top area. Seven aboriginal sites have been recorded in ML1353 of which six are located on or adjacent to Mt. Horne within ML 1354. The seventh site is located in CCL 705.

Two major site complexes have been identified within ML1353 & ML1354; one at Mt Horne (Site 1) and one south of Waratah Ridge Road (Site 2) approximately 300m west of Mt Horne. An archaeological survey was conducted for the Clarence Colliery Lease Extension Environmental Impact Statement (EIS) (International Environmental Consultants 2000) and included a search of the DEC-NPWS database and the Native Title Register as well as a field survey of the lease extension areas. The desktop search identified 63 Aboriginal sites in the vicinity of the mine. Of these sites, 44 sites are within the lease areas. The 44 sites include:

- Twelve rock shelters with art;
- Eleven rock shelters with deposits;
- Six axe grinding groove sites;
- Fourteen open camp sites; and
- One scarred tree.

The archaeological field survey identified nine indigenous heritage sites and two isolated artefacts. The sites included six open campsites, two rock shelters with deposits and one group of three scarred trees which were recorded as one site. Six sites consisting of four open campsites and two rock shelters were located in the western section of ML1583. Three sites consisting of two open camp sites and 1 group of three scarred trees, as well as two isolated artefacts, were located in the eastern part of ML1583.

As described above, a number of aboriginal sites have been recorded in the Clarence

Colliery lease areas. However, underground mining as proposed by Clarence will have no impact on Indigenous open scatter sites, scarred trees or isolated artefacts within the lease area because the mining method used does not result in any significant direct surface impacts (International Environmental Consultants 2000).

Archaeological assessments for each SMP have been carried out in accordance with NSW Office of Environment and Heritage (OEH) Aboriginal Cultural Heritage Consultation requirements.

A Cultural Heritage Assessment was undertaken in 2013 for preparation of the establishment of REA IV. No Aboriginal objects or places have been identified within the Project Area; therefore, it is assessed that there is no identified risk of harm to Aboriginal objects or places.

No archaeological sites were disturbed during the reporting period. With subsidence levels less than 100mm using the partial extraction mining method, no impacts on Aboriginal Heritage sites are expected from underground mining.

An agreement with the Gundungurra Tribal Council has been reached with regards to future mining and prospecting activities at Clarence. The Gundungurra Tribal Council is to be involved in all aboriginal heritage surveys for any exploration, surface development and subsidence planning activities.

3.12.1 European Heritage

A number of European heritage items have been identified in the Clarence Colliery lease areas include:

- A section of the Zig Zag Railway and associated buildings;
- The old Newnes railway route, which crosses the existing lease near the ventilation fan and the north western portion of ML1583. The Newnes rail link was constructed across the Newnes plateau between Newnes Junction in the south and Newnes in the north. The railway was completed in 1907, but was later abandoned with the cessation of mining at Newnes;
- The Old Bells Line of Road that passes across the western section of the Clarence Colliery lease areas; and
- A large disused corrugated iron and cement water storage tank located in the north-western section of the lease areas, above Bungleboori Creek. This tank was identified in the Clarence EIS in 2000,

and may have been associated with the Newnes Railway activities in the area.

The literature review conducted as part of the archaeological investigations for the 2000 Clarence Colliery EIS also identified Happy Valley Springs as the site of a Drovers Camp from the 1820s. However, no physical evidence of this camp was identified during the field survey.

As is the case with all surface features, the major potential threat to heritage items from the underground mining operations is from potential subsidence related impacts. The partial extraction underground mining method used at Clarence and the resulting minimal surface disturbance means that there will be no direct impact on items of heritage significance in the vicinity of Clarence Colliery. Clarence's lease area partially abuts the Blue Mountains National Park (BMNP), Wollemi Wilderness Area (WWA) and the Greater Blue Mountains World Heritage Area (GBMWA) to the east and Newnes State Forest to the north. The BMNP, WWA and GBMWA contain large pristine areas of great scenic and aesthetic value as well as providing primary habitat to a number of threatened and protected species (Clarence Colliery 2005, 2011 & 2013).

Partial extraction of coal is extremely unlikely to affect the BMNP, WWA and the GBMWA. This is due to the fact that the level of subsidence will not exceed and that subsidence impacts will not occur outside the mining area (Clarence Colliery 2005, 2011 & 2013).

There is no overlap between the mining leases and the BMNP, WWA and the GBMWA.

Newnes State Forest occupies the majority of the surface area at Clarence Colliery. The forest is currently managed by State Forests, who regularly carry out logging activities. In addition to logging, State Forests also maintain a number of tracks which attracts 4WD and trail bike enthusiasts. The area is also popular with campers and bushwalkers.

As part of the SMP application process, a legislative review of the environmental sensitivity of land occupied by Clarence Colliery is undertaken.

There has been no impact to European heritage during the reporting period.

3.12.2 Natural Heritage

Newnes State Forest occupies a large portion of the area above the Clarence coal leases. The natural heritage values of the area have been reviewed and characterised as inputs for the subsidence management planning

process. The significant values consisted of swamps, creeks and endangered flora and fauna. There was no impact to natural heritage during the reporting period.

3.13 Spontaneous Combustion

Clarence Colliery has not had any incidences of spontaneous combustion either underground or within surface emplacements, a therefore considered a low risk. However, through the mine's telemetric monitoring system Clarence has the ability to continuously monitor and respond to any evidence of spontaneous combustion, in the unlikely event that the situation should arise. This system monitors both conveyor belt roadways as well as return roadways of working sections and outbye areas for ventilation flow, methane and carbon monoxide. The monitoring system has a readout and alarm at the surface as well as systems in place defining alarm levels and appropriate responses should they be triggered.

Clarence Colliery mines coal from the Katoomba seam, which is known to have a low propensity for spontaneous combustion. The low propensity for spontaneous combustion is identified from coal self-heating laboratory testing and a historical absence of spontaneous combustion at Clarence Colliery. No incidents of spontaneous combustion occurred during the reporting period. Clarence has no record of a heating event at the CHPP or in the underground.

3.14 Bushfire

Clarence maintains an Asset Protection Zone (APZ) around all assets situated within the Clarence Mining Lease where possible. Asset Protection Zones act as a buffer between the development and the hazard and are the principal fire protection mechanism.

Fire prevention strategies employed on site include the following:

- Maintaining all mobile equipment in good working order with efficient exhaust systems and ensuring fire extinguishers are installed;
- Ensuring clearing operations are not undertaken during periods of extreme fire danger;
- Clarence Colliery's earthmoving equipment is available for fire fighting purposes in the event of a fire approaching the Pit Top; and
- Fire fighting water is reticulated around the Pit Top.

3.15 Mine Subsidence

The location of environmental monitoring sites related to subsidence is shown in **Appendix 4**.

3.15.1 SMP Applications and Variations

During 2013, the following SMP applications and variations occurred:

- Clarence requested a variation to the scheduled 700A-E lines. This was approved on 21st November 2012. Surveys (as described below) were consolidated into one survey for each line which was undertaken in January 2013.
 - 700A and 700B lines – originally scheduled for 28th November 2012 for 12 months post 712 Panel and 24 months post 710 Panel;
 - 700A, 700B, 700C and 700E lines originally scheduled for 4th December 2012 for 36 months post 702 Panel;
 - 700A, 700B, 700C and 700D lines originally scheduled for 31st March 2013 for 36 months post 704 Panel; and
 - 700A and 700B lines – originally scheduled for 20th April 2013 for 24 months post 708 Panel.
- Submission of monthly reports for October, November and December 2012 to Dams Safety Committee for mining (first workings and partial extraction) within the Lithgow No.2 Dam Notification Area.
- Approval to discontinue subsidence monitoring along the 605 line (approved 11th February 2013).
- Variation to Clarence-1, Clarence-2 and Clarence-3 to reduce the frequency of monitoring associated with the dam wall movement, rock markers and water fingerprinting from monthly to quarterly was received on 28th March 2013.
- Submission of monthly reports for January, February, March, April and May 2013 to Dams Safety Committee for mining (first workings and partial extraction) within the Lithgow No.2 Dam Notification Area.
- Submission of the 800 Area Addendum report including submission of a Subsidence and Underground Monitoring Program.
- Submission of monthly reports for June, July, August and September 2013 to Dams Safety Committee for mining (first workings

and partial extraction) within the Lithgow No.2 Dam Notification Area.

- Approval of three variations including two variations for the 700W SMP and one variation for the 700 Area all approved on 18th September 2013.
- Submission of the 900 Area SMP application in September 2013.

3.15.2 Summary of Subsidence Monitoring

During the 2013 reporting period the following monitoring was undertaken in relation to subsidence:

- Resurvey of the 707 line on 6th February 2013.
- Resurvey of the rock marks around Lithgow No.2 Dam on 5th November 2012, 7th December 2012, 7th January 2013 and 5th February 2013 under DSC approval (monthly).
- Resurvey of the Lithgow No.2 Dam wall on 6th November 2012, 13th November 2012, 3 December 2012, 7th January 2013 and 5th February 2013 under DSC approval (two weekly during the extraction of 707 panel and then monthly).
- Resurvey of the 707 line on 6th June 2013 (6 months post extraction of 707 Panel in accordance with the DSC approval requirements).
- Resurvey of the rock marks around Lithgow No.2 Dam on 7 March 2013 and 13 June 2013 under DSC approval.
- Resurvey of the Lithgow No.2 Dam wall on 13 March 2013 and 18 June 2013 under DSC approval.
- Resurvey of the rock marks around Lithgow No.2 Dam on 5th September 2013 under DSC approval.
- Resurvey of the Lithgow No.2 Dam wall on 4th September 2013 and on the 23rd September 2013 (whilst mining in the Notification Area) under DSC approval.
- Surface subsidence management inspections.

All subsidence monitoring has been carried out in accordance with the relevant Subsidence and Environmental Monitoring Programs as stipulated by the various SMP approvals as outlined in **Section 1.1**.

3.15.3 Subsidence Results

All subsidence monitoring results for 2013 were within the 100mm maximum predicted in the SMP for all panels relevant to the 700 West Area, 700 Area, Outbye Areas and 314/316 panels and within the elastic limit of the overburden strata (100±25mm, Strata Engineering Australia 2005). The subsidence monitoring results are in accordance with those predicted in the Environmental Impact Statement (2000).

3.15.4 Flora and Fauna Results

Flora and fauna monitoring has shown no measurable impact from mining during 2013. Results for flora and fauna monitoring can be found in **Section 3.6** and **Section 3.7** respectively.

3.15.5 Groundwater Monitoring Results

Groundwater monitoring results during 2013 did not indicate any adverse impact on the near-surface aquifers. Full details on groundwater monitoring are provided in **Section 3.5**.

3.15.6 Photographic Monitoring and Surface Inspections

During 2013 extraction occurred beneath Happy Valley Swamp (714 panel in September), Farmers Swamp (714 panel in April) and Farmers South Swamp (707 panel in October). The photographic monitoring

events undertaken during the reporting period are detailed below for each swamp.

Happy Valley Swamp

- First 4 monthly post mining 714 panel (16th January 2013);
- Second 4 monthly post mining 714 panel and pre mining 716 (23rd July 2013); and
- Third 4 monthly post mining 714 panel and pre mining 716 (16th December 2013).

Farmers Swamp

- First 4 monthly post mining 714 panel (2nd May 2013);
- Second 4 monthly post mining 714 panel undermining and extraction at 12 c/t (9th and 15th August 2013); and
- Third 4 monthly post mining 714 panel undermining and extraction at 12 c/t (16th December 2013).

Farmers Swamp South

- First 4 monthly post mining 707 panel (7th March 2013);
- Second 4 monthly post mining 707 panel (25th July 2013); and
- Third 4 monthly post mining 707 panel (3rd December 2013).

There was no evidence of any mining related impacts detected during 2013 from photographic monitoring of swamps.

Table 19. Maximum Recorded Subsidence for each Panel/Area

Panel/Area	Maximum Recorded Subsidence	Comments
Extracted Panels 2013		
Panel 700		Extraction within 700 panel commenced on 27 th November 2013 and continued into until the end of the reporting period.
Previously Extracted Areas		
Panel 707	14mm	Surveyed 6 February 2013.
Panel 702	42mm	Surveyed 30 January 2013.
Panel 704	41mm	Surveyed 30 January 2013.
Panel 708	42mm	Surveyed 30 January 2013.
Panel 710	43mm	Surveyed 30 January 2013.
Panel 712	53mm	Surveyed 30 January 2013.
Panel 714	61mm	Surveyed 30 January 2013.
Panel 306 / Outbye	40mm	Surveyed 12 September 2013.
Panels 400, 402 and 403	32mm	Surveyed 3 June 2013.
609 Area	103mm	Surveyed 2 September 2013.

3.16 Contaminated Land Management

3.16.1 Phase 2 Environmental Site Assessment

Clarence completed a targeted Phase 2 Environmental Site Assessment (ESA) during 2012. The objective of the ESA was to assess the presence of soil and groundwater contamination in targeted areas identified as areas of potential concern within the CHPP and Pit Top areas.

The assessment included soil sampling, installation of seven groundwater monitoring wells, groundwater sampling and surface water sampling. Gathered information and analysis was used to create a conceptual site model which identifies impact media, contaminant transport pathways, exposure routes and exposed receptors to evaluate the risks associated with contamination.

An Action Plan was developed and the following monitoring was completed during the 2013 reporting period:

- Bi-annual Groundwater Water Quality Analysis and measurement of Standing Water Levels (SWLs) at the nine installed bore holes. Samples are to be analysed for Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TPH, BTEX and PAH; and
- Bi-annual Surface Water Quality Assessment at the Clarence Main Dam (in addition to monthly compliance sampling).

Samples are to be analysed for Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TPH, BTEX and PAH.

Nine bore holes (monitoring wells) and Clarence Main Dam were sampled in August, October and December 2013 including:

- MW01;
- MW02;
- MW03;
- MW04;
- MW05;
- MW06;
- MW07;
- MW08;
- MW09; and
- Dam01.

Monitoring results have recorded below 'trigger' levels for chemicals within water using the assessment criteria endorsed by NSW EPA to evaluate groundwater analytical results based on the ANZECC/ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC [2000])* and Clarence's EPL 726 concentration limits.

Monitoring and sampling will continue and results will be analysed and trended to identify any potential groundwater contamination.

3.17 Methane Drainage

Methane has not been detected by any of Clarence's gas monitoring systems. This suggests that the region of the Katoomba coal seam that Clarence operates in is void of Methane gas. The monitoring systems include hand held gas detectors, real time gas monitoring throughout the mine, and routine monthly gas bag sampling of the underground environment with analysis by a gas chromatograph.

Methane drainage is not required at the Clarence Colliery.

Clarence has a conventional Ventilation system consisting of a two main fans, exhausting air from the mine through a ventilation shaft. The mine has 2 intake access drifts and one intake ventilation shaft. Air is directed to each mining area using a system of stoppings, regulators and overcasts. Air is directed to the mining face areas using a system of brattice stoppings and wings. Air quality monitoring is conducted by mining supervisors using hand held devices, and in real time from the control room. There were no major issues or changes to the Ventilation system at Clarence during the reporting period.

3.18 Public Safety

Public safety risks associated with the mine are largely from public trespass on land around the Pit Top area. The site is fenced and sign posted and security gates operated by personal pin numbers are on both roads into the Pit Top area.

The main access areas to the site are fully fenced with six foot man proof fencing. The fencing runs along the southern boundary of the site beside the rail loop and up the western side of the pit top to the main car park area. All visitors to site are required to sign in at the main office, under the site representative they are visiting.

All people required to carry out work on site must be inducted and if required to carry out work underground, complete an underground induction. All contractors on site must sign in at the computer in the lamp room or CHPP crib room. They must have a valid purchase order number to sign in under before any work can begin, they must have completed the required safe work method statements for the task and supplied Workers Compensation and insurance details to their site representative.

During the reporting period there were no incidents relating to public safety.

3.19 Other Issues and Risks

3.19.1 Risk Management

Environmental risks were considered within the Clarence Environment and Community Risk Assessment in 2013. The Risk Assessment is reviewed biennially inclusive of the current Environmental Risk Register (ERR) 22.

3.19.2 Feral Animals

Clarence Colliery commenced a feral cat trapping program around the surface operations area. Trapping was conducted by Biodiversity Monitoring Services from 21-24 May 2013. A total of 22 traps were set around the site for three nights (a total of 66 trap nights). Traps were placed near the washplant, around pipes and buildings in the storage complex, and under dongas next to the offices. All trapping was conducted using NPWS Scientific Licence No. S10282, ACEC Approval No. AW96/033. A total of three feral cats were removed from site. All were taken to a Veterinary clinic in Lithgow where they were euthanased in a humane manner.

3.19.3 Greenhouse Gases

Clarence undertakes monitoring of greenhouse gas emissions for reporting under the National Greenhouse and Energy Reporting (NGER) Program. Under the Program Clarence reports on:

- Greenhouse gas emissions;
- Energy production; and
- Energy consumption.

Of the six greenhouse gases identified in the Kyoto Protocol, Clarence Colliery produces one of these, carbon dioxide (CO₂).

Greenhouse gas emissions reported through the NGER reporting program for the 2013 financial year reporting period (as reported) are listed in **Table 20**.

Scope 1 emissions refer to direct emission sources from Clarence. Scope 2 emissions refer to indirect emissions from the consumption of energy or heat produced by another organisation.

Table 20. Greenhouse Gas Emissions 2013 Reporting Period (CO₂ –e T)

Financial Year 2012	Financial Year 2012	Financial Year 2011	Financial Year 2010	Financial Year 2009	Scope
9 289	8 925	7 133	15 418	14 559	Scope 1
38 380	33 007	31 764	27 413	27 682	Scope 2

3.19.4 Energy Efficiency Projects

Clarence has developed and implemented three projects targeted to reducing greenhouse gas emissions. The projects are outlined in **Table 21**, **Table 22** and Table 23.

16 LED lights replaced existing 400W lights in the top and bottom car parks, surface conveyor 1, motor drive room and MCC2 (Crusher Control Building) and 8 LED clusters of extra low voltage replaced existing twice 36 watt fluoro lights. To date, this project has halved energy consumption. The CHPP Water Recycling Project and Water Strategy Review have been reviewed and are both meeting energy efficiency goals and targets.

Table 21. Workshop Lighting Renewal

Mine/Colliery	Clarence
Project Name	Workshop Lighting Renewal
Project Status	Completed
Project Description	R400W sodium vapour lights replaced with low energy consumption LED lighting.
Project Costs in \$	\$3,200
Demand Savings in kVA	6.4
Maintenance Cost Savings in \$/yr	\$32,000
Energy Type (Diesel/Electricity)	Electricity
Energy Saving in kWh/year or l/year	116,800
Project Completion Date	01/11/2013

Table 22. CHPP Water Recycling Project

Mine/Colliery	Clarence
Project Name	CHPP Water Recycling
Project Status	Completed
Project Description	Recycle discharge water of CHPP after primary cleaning. Saves 45l/s water which was previously transferred underground and requiring pumping (266m head = 195kW) over 4380 operating hours (12h/day).
Project Costs in \$	\$25,000
Demand Savings in kVA	190
Maintenance Cost Savings in \$/yr	\$5,000
Energy Type (Diesel/Electricity)	Electricity
Energy Saving in kWh/year or l/year	836,944
Project Completion Date	01/07/2013

Table 23. Water Strategy Review

Mine/Colliery	Clarence
Project Name	Water Strategy Review
Project Status	Completed
Project Description	Underground Water Management Review, install fire tanks adjacent to the mine water treatment plant and reduce pump head by 30m.
Project Costs in \$	\$240,000
Demand Savings in kVA	40
Maintenance Cost Savings in \$/yr	\$35,000
Energy Type (Diesel/Electricity)	Electricity
Energy Saving in kWh/year or l/year	1,563,056
Project Completion Date	01/12/2014

4. Community Relations

4.1 Environmental Complaints

Clarence received five noise complaints during the reporting period. A summary of community complaints over the last five years is provided in **Table 24**.

A noise complaint was made on 22 January 2013. A Clarence resident contacted the Clarence Colliery community complaints hotline because of an identified nuisance noise which the resident identified was resonating from the Clarence Colliery ventilation facility. Clarence Colliery conducted a detailed review of all operation data to identify the source of the nuisance noise. This review did not identify any significant changes in operations at Clarence Colliery to cause the nuisance noise. Monitoring was completed to ensure compliance with development consent conditions at the complainants residence. Monitoring data was compliant with Clarence's development consent conditions for all monitoring periods.

Three noise complaints were received which reported a low frequency nuisance noise which was believed to be resonating from the Clarence Colliery Ventilation Facility on 2 April 2013, 5 April 2013 and 24 April 2013. Long Term Monitoring was conducted at the complainant's place of residence. Monitoring data was compliant with Clarence's development consent conditions for all monitoring periods.

A noise complaint was made at Mount Irvine property residences on 9 July 2013. The complainant stated he could hear an industrial noise at his property. Clarence personnel attended to the property to identify the noise source. No noise was audible at the time. All monitoring completed in 2013 was compliant with Clarence's development consent conditions for all monitoring periods.

Table 24. Community Complaints over a Five Year Period

	2009	2010	2011	2012	2013
Complaints	0	1	0	1	5
Type	0	Coal fallen from truck	NA	Dust	Noise

4.2 Community Liaison

Clarence undertakes community engagement through planned and unplanned activities outlined in the Clarence Stakeholder Engagement Plan and below.

During 2013 Clarence contributed through monetary and in kind donations to local community events and organisations. During the 2013 period community events and organisations supported are outlined in below:

- Rylstone/Kandos Show Society
- Portland Easter Family Festival
- Lithgow Show Society
- Henbury Golf Club Associates
- Big Air Skate Day in Kandos
- Kandos Rylstone Waratahs
- District Renta Scooter Inc
- Mid-Western Regional Seniors
- Rydal Village Association Inc
- Rylstone Women's Bowling Club
- Portland Easter Family Festival
- Scots School Pipes & Drums
- Lithgow City Band
- Lithgow's Community Kitchen
- Clarence/Dargan Rural Fire Brigade
- PCYC Lithgow
- St Patrick's School Lithgow P&F
- St Joseph's School Portland
- Lithgow Athletics Club
- Kandos Rylstone Men's Shed
- Lithgow & District Volunteer Rescue Squad
- Australia Roof Bolting & Coal Shovelling Titles 2013
- Blinky Bill Portland Child Care Centre
- Mt Victoria Great Train Weekend
- Mingaan Aboriginal Corporation - NAIDOC week
- Ride for the Chopper - Westpac Helicopter Rescue
- Pink Ball Wallerawang
- The Rylstone Club Ltd
- Lithgow Public School P&C Association
- Rylstone & District Historical Society
- Mountain Cruizers Car Club
- Kandos Rylstone Men's Shed
- Three Tree Lodge
- Portland Central School
- Central West Vision Team
- Rylstone Street Feast
- Mid-Western Regional Sheepdog
- St Patricks School P & F Association
- Springvale Children's Xmas Club

- Lithgow Show Society
- Kandos High School
- Rotary Club of Rylstone
- Rylstone Public School
- Wallerawang Public School
- Wallerawang - Lidsdale P&C Association
- Ilford Public School
- Kandos Public School
- Rylstone Kandos Street Machine Club
- Portland Development Association
- Rydal A, H & P Society
- Wallerawang Public School
- Lithgow Workmen's Valley Women's Bowling Club
- Lithgow & District Cancer Support Group
- Lithgow High School
- Cancer Council Relay for Life
- Rylstone/Kandos Family Fun Day

- Lithgow Community Private Hospital
- Henbury Open Golf Tournament
- 2013 Celebrate Lithgow Festival
- Anglican Parish of Rylstone-Kandos

4.2.1 Celebrate Lithgow

Centennial participated in the annual Celebrate Lithgow activities held in November 2013. Centennial had an information stall set up in the street fair. Representatives from each of Centennials Western Operations and Projects were available to provide information regarding operations and environmental management at each site (**Figure 48**).

Clarence provided information regarding the proposed 900 SMP Area and recent rehabilitation activities undertaken.



Figure 48. Centennial Representatives at the Celebrate Lithgow Street Fair

4.2.2 Beyond Blue

Clarence Colliery held a BBQ and a Beyond Blue representative was organised to provide Mental Health Awareness sessions for each shift. A donation of \$3,800 was raised for Beyond Blue to help those affected by mental health issues.

4.2.3 Portland Spring Fair

Centennial participated in the annual Portland Spring Fair activities held in October 2013. Centennial had an information stall set up at the fair with representatives from each of Centennials Western Operations available to provide information regarding operations and environmental management at each site. Centennial representatives from various operations also participated in the wheel barrow racing (**Figure 49**).



Figure 49. Centennial representatives participating in Wheel Barrow Racing at Portland Spring Fair

4.2.4 National Aboriginal and Islander Day Observance Committee (NAIDOC) Celebrations

Centennial supplied representatives to run the BBQ during Lithgow NAIDOC celebrations held in September 2013 (Figure 50). The 2013 NAIDOC celebrations organized by Mingaan Aboriginal Corporation included Wiradjuri dance, Koori Sports, the Taronga Zoo mobile as well as information stalls, displays and activities.



Figure 50. Centennial Representatives participating in Hartley NAIDOC Celebrations

4.2.5 The Biggest Morning Tea

Clarence Colliery participated and raised money for the Cancer Council in the Biggest Morning Tea. A BBQ was held at each shift and a Cancer Council donation box provided which raised a total of \$5,160.

4.2.6 Movember

Team Clarence Colliery raised a total of \$560 during 'Movember' 2013. 'Movember' raises money and awareness for Men's Health issues.

4.2.7 Gundungurra Cultural Awareness Training

In November 2013, Centennial Coal representatives undertook an Aboriginal Cultural Awareness Program facilitated by the Gundungurra Tribal Council Aboriginal Corporation. During the program, participants engaged in activities, viewed and learned about the importance of cultural practices, heard Aboriginal people's personal stories and shared experiences.



Figure 51. Centennial Representatives Participating in the Cultural Awareness Program

4.2.8 Community Consultative Committee

The Clarence Colliery Community Consultative Committee (CCC) was established in 2006. Committee meeting minutes are available online at the Centennial Coal website (www.centennialcoal.com.au). The Clarence CCC met four times during 2013. Information presented in the meetings include operational, environmental and community performance updates.

Specific items discussed during committee meetings in 2012 include:

- The Subsidence Management Plan Development for 900 Area;
- The proposed modification to DA-504.00 for the construction of a new proposed Reject Emplacement Area;
- Rehabilitation Activities;
- Water Management Activities and Improvements;
- 800 Area Exploration Program;
- Community Activities; and
- Environmental incidents/complaints.

5. Rehabilitation

5.1 Buildings

Given that the mine has coal reserves to sustain current production levels for in excess of 20 years and that all site buildings are required, no buildings are scheduled for removal in the near future.

5.2 Rehabilitation of Disturbed Land

5.2.1 Reject Emplacement Area IV

To allow the development of REA IVa (western extension of REA IV), an additional 0.9ha was cleared during the reporting period. According to best management rehabilitation practices, stripped topsoil and subsoil was applied directly on the completed batters 3 and 4. Direct application of topsoil and cleared

vegetation Subsoil was applied at 0.5m in depth and covered with 100mm of topsoil. Upstream sediment controls were installed in the rehabilitated areas in the form of sediment dams (add and refer to photo) and lined run-off control drains installed. The area was seeded by spray application of a sterile cover crop, native seed collected from site, fertiliser and a binding agent (**Figure 52**). EFA will be employed to monitor the progress of rehabilitation and track against analogue sites to ensure the final meets the requirements set out in Clarence's Mine Closure and Rehabilitation Plan.

A rehabilitation plan is shown in **Appendix 7** and a rehabilitation summary for Clarence is given in **Table 25** and **Table 26**.



Figure 52. Rehabilitation Progress and Seed Spraying of REA IV in 2013

Table 25. Rehabilitation Summary

MINE LEASE AREA	Area Affected/Rehabilitated (hectares)			
	To Date	Last Report	Next Report (estimated)	
A1: Mine Lease(s) Area	7740			
B: Disturbed Areas				
B1: Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads)	39	39	39	
B2: Active Mining Area, (excluding items B3-B5 below)	0	0	0	
B3: Waste emplacements (active/unshaped/in or out-of-pit)	11.9	11	11.9	
B4: Tailings emplacements, (active/unshaped/in or out-of-pit)	0	0	0	
B5: Shaped waste emplacement (awaits final vegetation)	14	14	14	
ALL DISTURBED AREAS	64.9	64	64.9	F1
C: REHABILITATION PROGRESS				
C1: Total Rehabilitated Area (except for maintenance)	22.5	19.5	22.5	F2
D: REHABILITATION ON SLOPES				
D1: 10 to 18 degrees	0	0	0	
D2: Greater than 18 degrees	0	0	0	
E: SURFACE OF REHABILITATED LAND				
E1: Pasture and grasses	0	0	0	
E2: Native forest/ecosystems	22.5	19.5	22.5	
E3: Plantations and crops	0	0	0	
E4: Other (include non vegetative outcomes)	0	0	0	

Table 26. Maintenance Activities on Rehabilitated Land - Clarence

NATURE OF TREATMENT	Area Treated (ha)		Comment/control treatment detail	strategies/
	Report Period	Next Period		
Additional erosion control (drains re-contouring, rock protection)	0.2	0.1	Re-contouring of REA IV drains, installation of additional sediment control structures, installation of mesh and seeding.	
Re-covering (detail-further topsoil, subsoil sealing etc)	3	0	Progressive Rehabilitation of complete REA IV Batters.	
Soil Treatment (detail-fertiliser, lime, gypsum etc)	0	0		
Treatment/Management (detail-grazing, cropping, slashing etc)	0	0		
Re-seeding/Replanting (detail-species density, season etc)	3	0	Cover crop and native seed applied	
Adversely Affected by Weeds (detail-type and treatment)	19.5	19.5	Hand spraying for all environmental and noxious weeds.	
Feral animal control (detail – additional fencing, trapping, baiting etc)	N/A	N/A	Feral Cat Trapping	

5.2.2 Newnes Plateau

As discussed in **Section 2.1**, three partly-cored drill holes were drilled in 2013.

Upon completion, exploration boreholes with piezometers are rehabilitated through a specific grouting process undertaken by the drilling contractor. A specific grout mix is applied to the bottom of the borehole through a 20mm grout pipe. The grouting is carried out in stages using separate grout pipes permanently in the hole. The pipes are installed at typically 70 to 100m intervals, but not more than 100m intervals. The grout is pumped into the bottom pipe and a known volume is added to bring the grout level to a theoretical level 10m above the next pipe. The pipe above is flushed with water immediately after grouting to dilute any grout at this level to allow further grouting from this level after an initial cure period. Once the piezometers are all grouted in then the mix is thickened by the addition of further cement to obtain a quicker set while filling the top of the hole to surface.

All boreholes were rehabbed and sealed in accordance with the DTIRIS guideline 'EDG01 Environmental Management Guideline for Industry - Borehole Sealing Requirements on Land: Coal Exploration' (Department of Mineral Resources 1997).

5.3 Rehabilitation Monitoring

Annual rehabilitation monitoring is undertaken as a way to track, document and report on the success and performance of rehabilitation activities against the overall rehabilitation objectives for the site.

The rehabilitation monitoring program involves several components, including the CSIRO-developed Landscape Function Analysis (LFA) tool (Tongway and Hindley 2004), vegetation dynamics, habitat complexity and disturbance assessments and photographic monitoring.

Permanent monitoring transects were established in areas of post-mined rehabilitated lands and correspondingly in adjacent undisturbed areas to provide analogue/reference sites. An analogue site is an ecosystem that serves as a model for restoring another ecosystem, and can be appropriately used to set the benchmarks for rehabilitation and track rehabilitation progress and outcomes (Nichols 2005). Assessing the analogue sites is an integral part of the rehabilitation monitoring program, with the

data collected and derived from these sites used to establish target values for key biophysical parameters and indicators related to vegetation diversity/structure and habitat complexity, and providing data on the long term goal for the rehabilitation areas.

Overall, the data derived from the monitoring program provides a scientifically robust platform against which the effectiveness of post-mining rehabilitation techniques can be assessed and, where applicable, amended. This is done with the aim of achieving sustainable post-mining vegetation communities, which are aligned to the proposed post-mining land use for the Clarence mining lease area.

The monitoring program currently includes seven transects, comprising four transects in rehabilitated areas and three analogue transects (**Table 27, Figure 53 and Figure 54**).

Table 27. Study Transects of Rehabilitation Monitoring Program

Transect	Type	Location	Rehabilitation Works Completion
Transect 1	Rehabilitation	REA I	2002
Transect 2	Rehabilitation	REA II	1996
Transect 3	Rehabilitation	REA III	2002
Transect 4	Analogue	South-east of Transect 2	NA
Transect 5	Analogue	Directly downslope of Transect 3	NA
Transect 6	Analogue	North-west of Transect 3	NA
New Transect (2013)	Rehabilitation	REA IV	2012



Figure 53. Rehabilitation Transects - REA I, II, III and IV

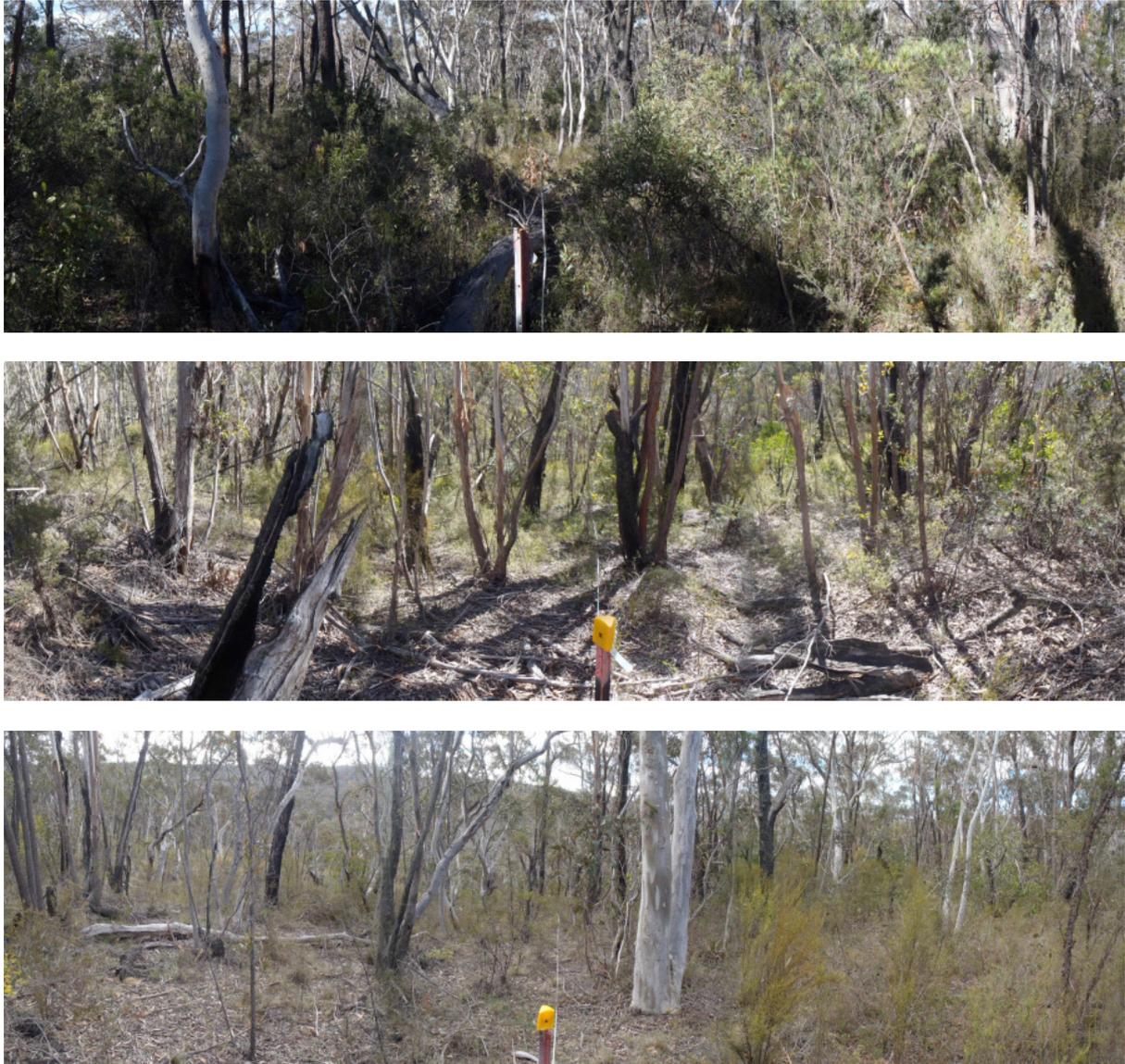


Figure 54. Analogue Transects - 1, 2 and 3

The 2013 monitoring results returned scores showing overall stability across the older rehabilitated areas, while the monitoring of the recently established and rehabilitated REA IV was inevitably biased towards lower scores and poorer performances as a function of the young age of the rehabilitation in this area.

The monitoring program was designed so that the performance of each monitoring transect can be extrapolated to the broader REA within which it is located. As such, the best rehabilitation performance is achieved in REA I (with an overall 'good' transect rating) followed by REA II ('satisfactory' rating), REA III ('poor' rating) and finally REA IV ('very poor'). However, the performance scores of REA IV are expected to improve significantly over the next few years as vegetation establishes and the site stabilises.

Vegetative ground cover, infiltration potential, nutrient cycling, canopy cover and habitat complexity are the monitoring parameters that consistently return lower scores across all rehabilitated areas. Amongst these components, the improvement of canopy cover and habitat complexity scores will be provided with time as vegetation matures and ecosystems develop. Likewise, it is expected for the nutrient cycling potential in rehabilitated lands to remain low for a number of years. The nutrient cycling index is considered the most sensitive index of rehabilitation success as it is often non-existent in the early years of rehabilitation, and it usually takes a number of years until scores improve (Tongway et al, 1998). However, the high incidence of bare ground still present across the rehabilitated land should be treated with a higher level of concern, as it exposes the soils to the effects of erosion which may eventually lead to several flow on impacts on site stability, vegetation establishment, weed incursion and undermine the overall rehabilitation performance. Additionally, high percentages of bare ground also reduce the potential for water to infiltrate into the soil profile by increasing surface runoff, which further inhibits vegetation establishment.

Soil erosion, although present and active in areas at the time of the 2013 monitoring, is still relatively limited with only localised impacts, and sites display good stability. Nonetheless, erosion should continue to be cautiously monitored in future monitoring years to ensure it does not lead to widespread degradation of the rehabilitated areas.

REA I and REA II appear to be on track overall towards achieving self-sustainability and eventually approaching the benchmarks set by

the corresponding analogue areas. These sites are generally stable and show satisfactory landscape organisation and functioning. They also perform well (REA I) to acceptable (REA II) in terms of woody species density and diversity despite:

- The proportions and abundance of certain species not being fully aligned with the naturally occurring vegetation communities at REA I; and
- Species composition and assemblage differing slightly from the adjacent analogue communities at REA II.

In contrast, the rehabilitation performance in REA III is poorer (despite rehabilitation at the site being over 10 years old, i.e. established at the same time as in REA I) with perennial ground cover struggling to establish. The landscape function is less efficient in retaining resources with fewer, smaller patches. As a result, vegetation density and diversity are lower and active erosion is more severe. Species assemblages are nonetheless satisfactory with the majority of species present occurring naturally within the surrounding local communities. As noted in last year's report (AECOM, 2012) there is evidence of past fire disturbance at the site, and it is possible that the site showed poor resilience and did not recover well from that event.

Given its very young age, the rehabilitation performance at REA IV cannot be assessed nor conclusions drawn. The site received a very poor rating based on the applied methodologies, however its performance should improve in the coming years. It is essential to monitor rehabilitation success regularly and as early as possible following rehabilitation establishment. Indeed, the rate of transition on newly formed rehabilitation areas is relatively quick and these changes should be recorded to identify if rehabilitation is trending in the right direction and/or if additional management actions or interventions are required. The earlier issues or problems are identified, the easier and more cost effective they are to remediate.

Finally, all areas and the site as a whole perform very well in relation to the potential impacts from vertebrate pests and weeds. Feral animals do not appear to be an issue on site, while the incidence of weeds is minimal and has reduced from the levels observed during the previous monitoring event. This indicates the success and efficiency of the weed spraying control program implemented at Clarence. Monitoring of pests and weeds will continue and the weed control program

maintained as required to promote rehabilitation success.

A commitment to effective rehabilitation involves an on-going monitoring and maintenance program throughout and beyond the operation of the mine. Areas being rehabilitated will be regularly inspected in and assessed against the long and short-term rehabilitation objectives. During regular inspections, aspects of rehabilitation to be monitored will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of tree and shrub plantings;
- Adequacy of drainage controls and any other installed surface water management feature;
- Presence of cracking or other subsidence impacts (could include some slumping/settling in the REA rehabilitation areas as well as mine induced subsidence);
- Presence/absence of weeds; and
- General stability of the rehabilitation site.

Where the rehabilitation success appears limited, maintenance activities will be initiated. These may include re-seeding and where necessary, the application of specialised treatments such as composted mulch to areas with poor vegetation establishment.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance. Maintenance will continue until such time as the objectives are met, although it is generally accepted that it will be at least five years beyond closure.

At the completion of rehabilitation establishment, monitoring will be carried out to assess early rehabilitation success, identify the need for any remedial action and determine whether rehabilitation is likely to meet long-term objectives and mine closure criteria.

A dedicated monitoring system will be identified in order to assess effectiveness of implementation of the rehabilitation measures as well as to identify the need for corrective action as soon as required. The monitoring program will be developed for each closure domain, incorporating the most appropriate indicators and methods that;

- Provide a measure of completion criteria to be assessed in accordance with the defined rehabilitation objectives;
- Are reproducible;
- Utilise scientific recognised techniques; and
- Are cost-effective.

Post rehabilitation, sites will monitor rehabilitation areas to demonstrate progress

towards the completion criteria. This will be achieved through:

- Annual rehabilitation inspections that evaluate the success of the rehabilitation operation and reviews the trajectory of the rehabilitation towards completion criteria determined for the closure domain; and
- Long-term rehabilitation monitoring which is scientifically based and evaluates the progress of rehabilitation towards fulfilling completion criteria and the statutory requirements that may apply to the site.

The annual rehabilitation will be carried out by the Site Environment & Community Coordinator and/or specialist consultant to check for risks that may impact the success of rehabilitation.

5.2.3 Mine Closure and Rehabilitation Plan

In 2012 Clarence developed a Conceptual Rehabilitation and Rehabilitation and Mine Closure Plan for the site. The purpose of the plan is to document the methodologies currently undertaken and proposed for the ongoing rehabilitation of the site and to also document the mine closure assumptions used by Clarence to make appropriate financial provisions for the eventual decommissioning and rehabilitation of the site. Its primary aim is to ensure that rehabilitation and closure planning incorporates suitable ecosystem and biodiversity management strategies linked to a suitable post mine closure land use. This will ensure that at the completion of mining, the land can be returned to a long term stable and sustainable post-mining landform.

Further to the above, Schedule 3 Condition 28 of the Clarence Development Consent (DA 504 -00) states the requirement for Clarence to prepare a Mine Closure Strategy. This plan is to be completed at least 3 years prior to the cessation of mining, it requires that Clarence prepare the Strategy, in consultation with council, I&I NSW, Sydney Catchment Authority and Department of Climate Change and Water.

The general objectives adopted in the development of the Conceptual Rehabilitation and Closure Plan were to derive the most appropriate option(s) for closure in terms of performance and cost. The development of this Plan is based on a process whereby the desired closure and post closure options are evaluated. The strategy involves:

Establishment of an overall vision for closure with objectives for each component of the project (e.g. social, environmental, employees etc.);

- Identification of options and evaluation against the vision to assess their viability;
- Definition of the preferred options for closure and assumptions for further research as the site moves towards the detailed closure planning phase;
- Definition of objectives and targets to achieve the preferred options; and
- Description of the communication and consultation process for the preferred options.

It is recognised that the most effective Rehabilitation and Mine Closure Plans are those that are integrated with the long term operational plans of the mine and are subject to regular review to accommodate regulatory, technological, social and economic change.

6. Activities Proposed in the Next AEMR Period

The activities proposed for 2013 are generally in accordance with the current MOP, and include:

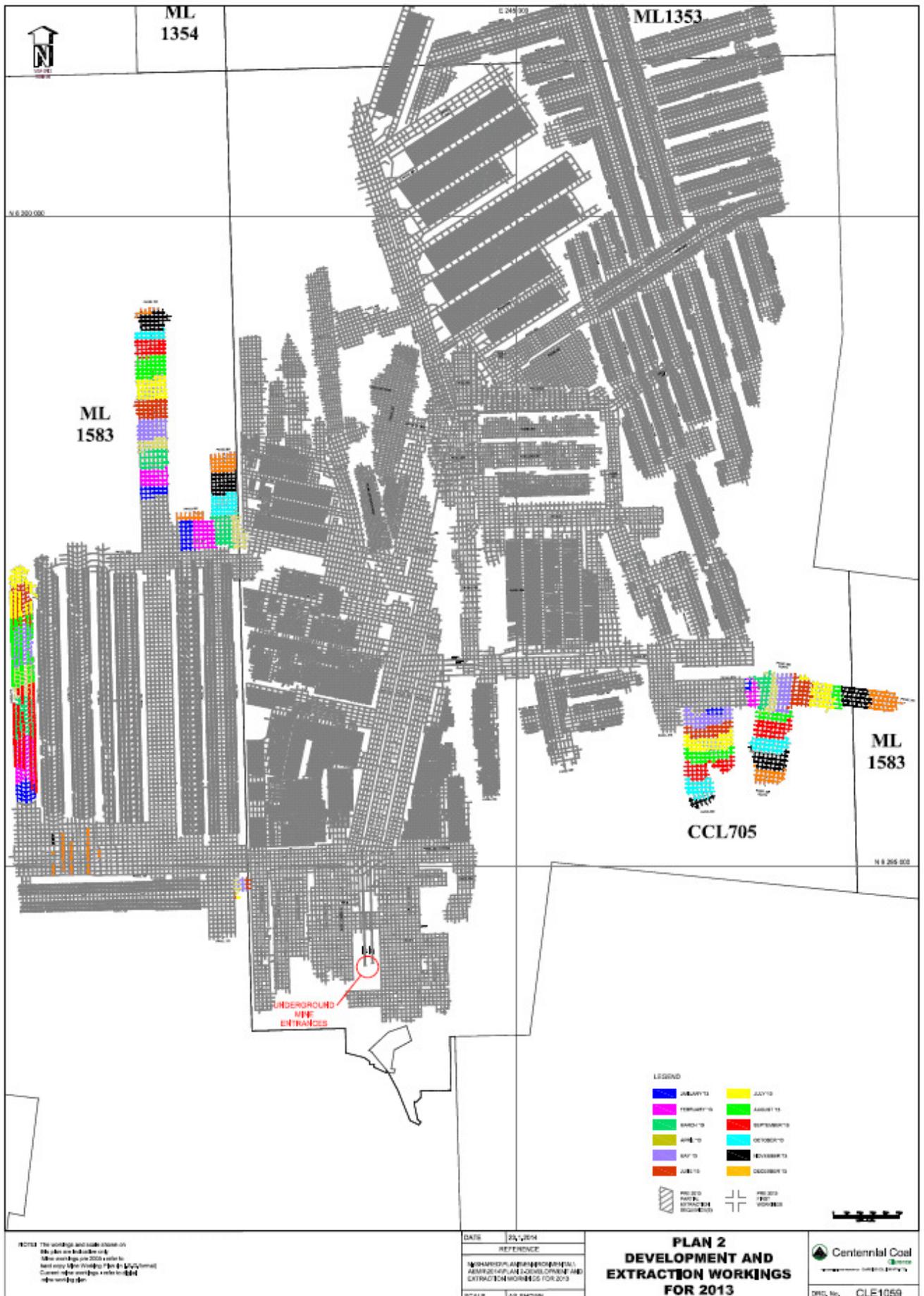
- Seek a modification to DA-504.00 to allow the construction of a new Reject Emplacement Area (REA VI);
- Continued planning for progressive decommissioning and rehabilitation of Reject Emplacement Area III and Reject Emplacement Area IV;
- Continued Ecosystem Function Analysis (EFA) rehabilitation monitoring;
- Continued of planning for life of mine reject emplacement;
- Conduct a three hole exploration program within the '900 area' on the Newnes Plateau;
- Complete required actions outlined in the site specific Best Management Practice particulate determination to reduce particle emissions from the premises;
- Gain final approval for the Mining Operations Plan covering 2014 – 2020;
- Continue monitoring of shallow bore holes for Phase 2 Environmental Site Assessment Report;
- Upgrade of Leachate Dam No.2 from 3ML to 10 ML;
- Commission Primary Arrestor slurry pump;
- Continued Water Strategy Team Meetings and Improvements to the Clarence Water Management System; and
- Internal operation of the Water Treatment Plant and continued improvement to operation, monitoring and maintenance systems.

Regional Location Plan

Appendix 1

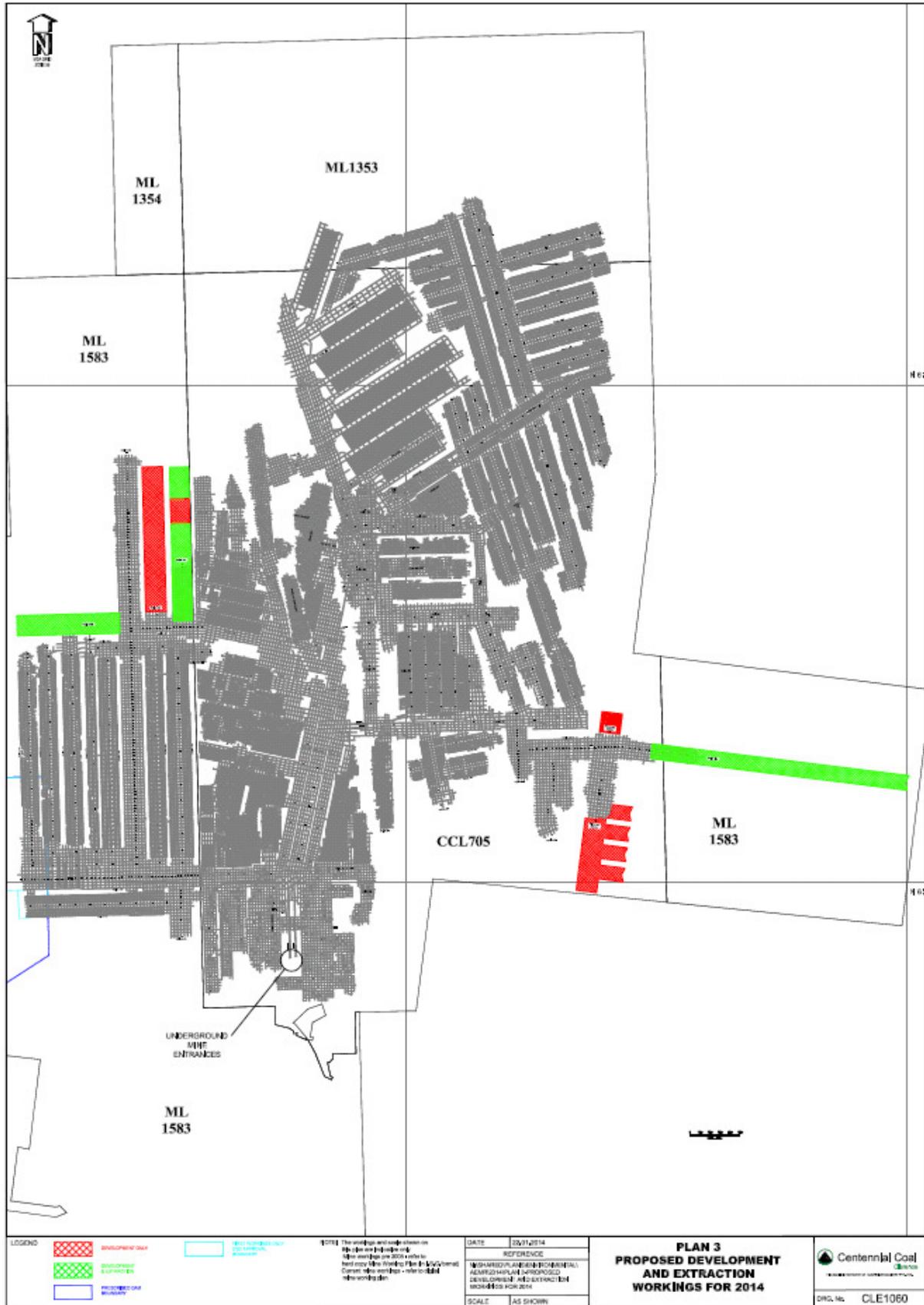
2013 Workings

Appendix 2



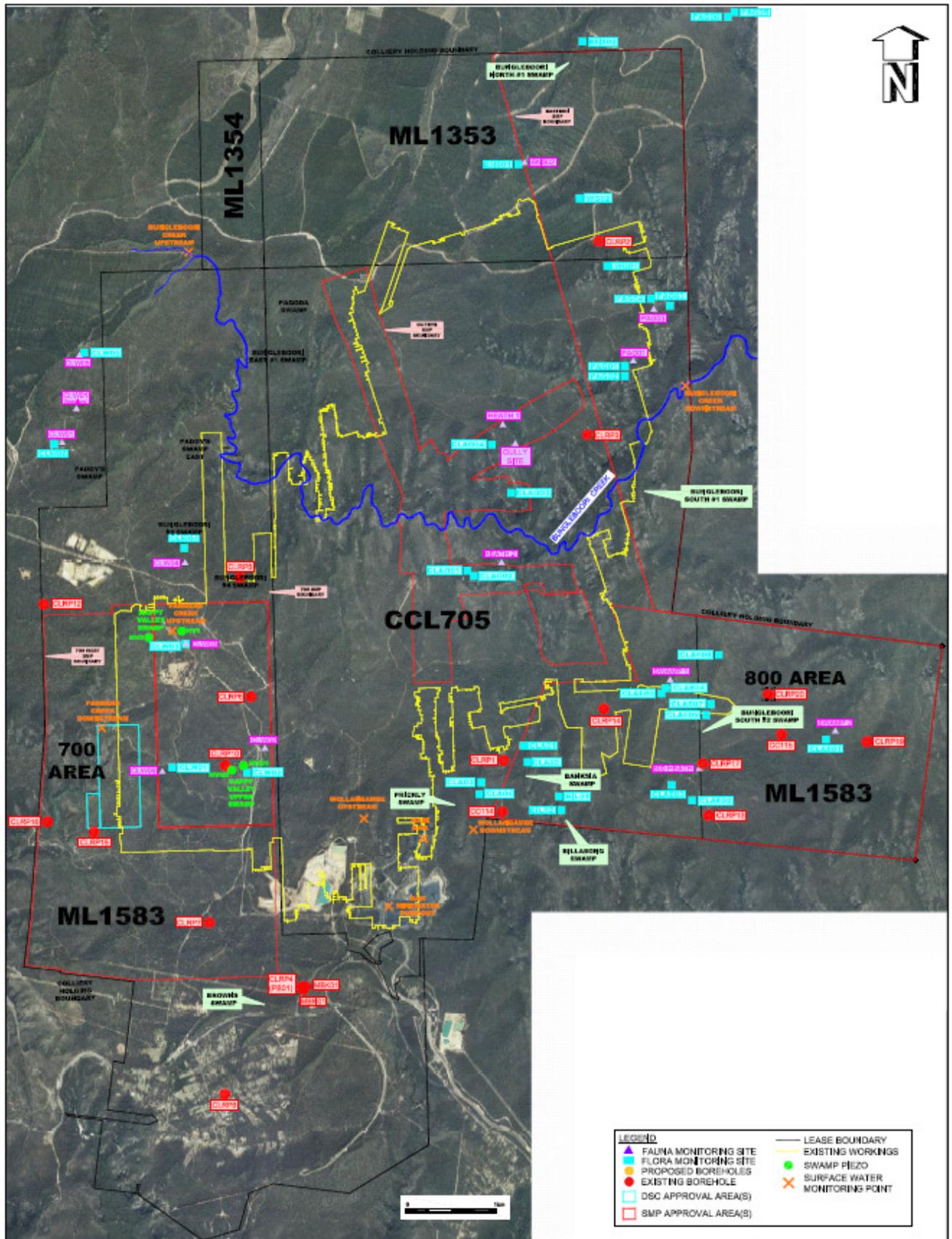
2014 Proposed Workings

Appendix 3



Combined Surface Monitoring Points

Appendix 4



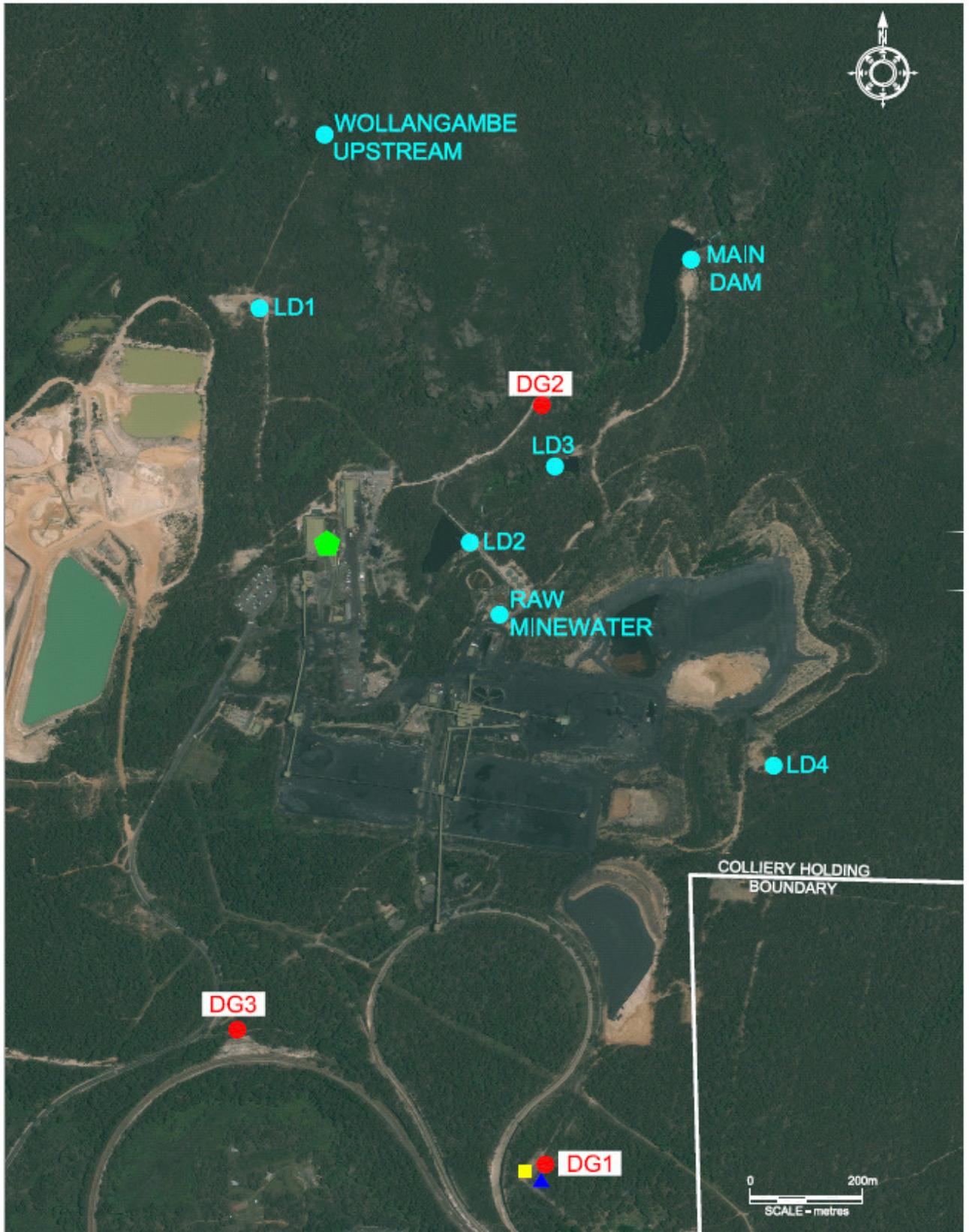
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SCALE	AS SHOWN

PLAN 4 COMBINED SURFACE MONITORING POINTS

 Centennial Coal
Clarence
© 2014 CENTENNIAL CLARENCE COLLIERY PTY, LTD.
 DRG. No. CLE1062

Pit Top Monitoring Locations

Appendix 5



DATE	31.01.2014	PLAN 5 CLARENCE COLLIERY PIT TOP MONITORING LOCATIONS	 DUST MONITORING SITE(S)  NOISE MONITORING SITE  TSP & PM10 MONITORING SITE  WATER MONITORING SITE(S)  WEATHER STATION	 Clarence Colliery <small>THIS DRAWING IS THE PROPERTY OF CLARENCE COLLIERY PTY. LTD.</small> DRG. No. CLE1063
REFERENCE				
SCALE	AS SHOWN			

Aerial View of Surface Facilities

Appendix 6



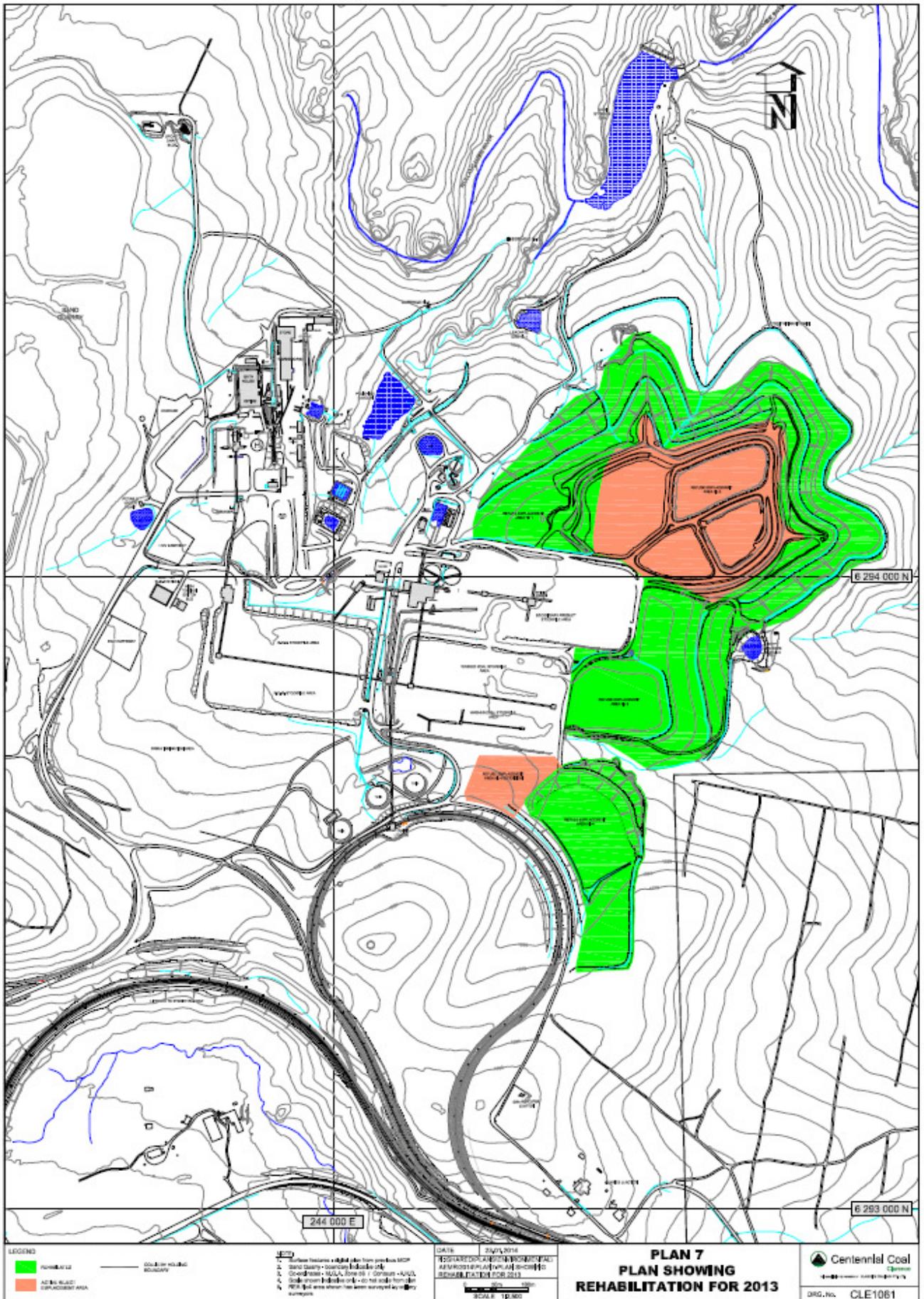
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SCALE	AS SHOWN

PLAN 6
AERIAL VIEW OF SURFACE FACILITIES


Clarence Colliery
THE DIVISION OF THE COMPANY OF CLARENCE COLLIERY PTY. LTD.
 DRG. No. CLE1064

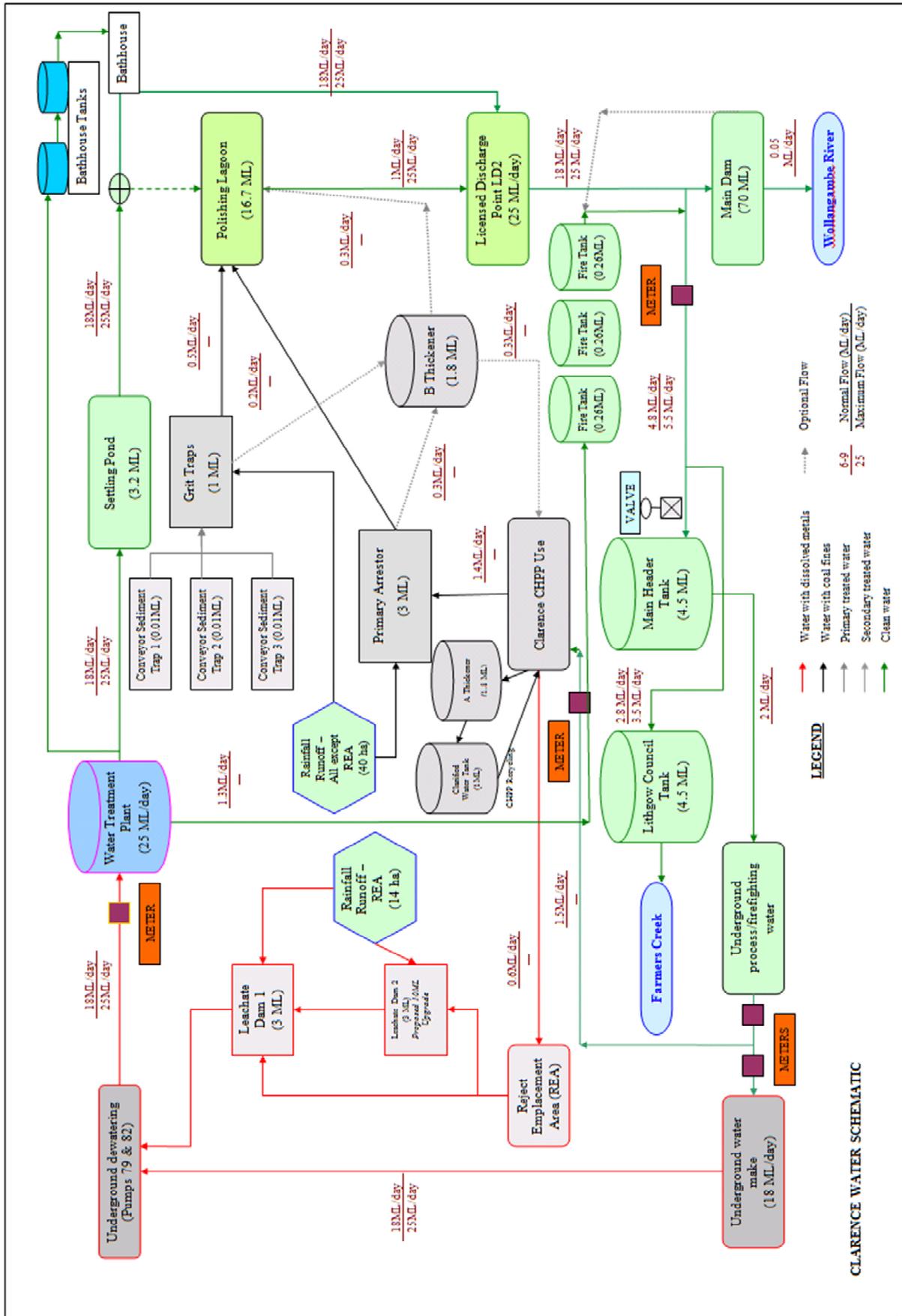
Surface Rehabilitation 2013

Appendix 7



Clarence Water Schematic

Appendix 8



Centennial Coal Environment and Community Policy

Appendix 9



Environment and Community Policy

Our Vision

To conduct our business in an efficient and environmentally responsible manner, that is compatible with the expectations of our shareholders, government, employees and the community.

Beliefs

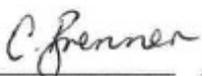
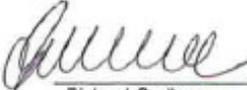
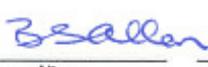
Everyone has a responsibility for minimising impact to the environment

Environmental performance can always be improved

Respecting our stakeholders is essential to business success

Guiding Principles

- P1 Appropriate decisions are made
- P2 Risk management strategies are implemented based on clear science and valid data
- P3 Stakeholders are identified and respected
- P4 Environmental impacts are recognised and minimised
- P5 Legal obligations are known and respected
- P6 Environmental management is integrated into our business
- P7 Environmental performance is continually improved
- P8 Natural resources are used efficiently
- P9 Performance is assessed and reported

 Catherine Brenner Director	 Bob Cameron Managing Director	 Ken Moss Chairman	 Paul Moy Director
 Richard Grellman Director	 Bruce Allen Director	General Manager	Mine Manager

18 August 2009

Development Consent DA 504-00

Appendix 10

**Environment Protection Licence
No. 726**

Appendix 11



Centennial Coal