GLENCORE

BAAL BONE COLLIERY

ANNUAL ENVIRONMENT REVIEW

1st January 2015 – 31st December 2015

GLENCORE

Name of mine:	Baal Bone Colliery
Titles/Mining Leases:	CCL 749 MPL 261 CL 391 ML 1302 ML 1382 ML 1607
MOP Commencement Date:	29/02/2016
MOP Completion Date:	31/12/2019 (Currently under review by DRE)
Annual Review Commencement Date:	01/01/2015
Annual Review End Date:	31/12/2015
Name of Leaseholder:	Wallerawang Collieries Pty Ltd
Name of mine operator:	Baal Bone Colliery
Reporting Officer	Elizabeth Fishpool Environment and Community Officer Signature: Date: 30/03/2016

Abbreviations:

ACMA – Australian Communications and Media Authority
CCL – Consolidated Coal Lease
CL – Coal Lease
CMRA – Coal Mines Regulation Act 1982
DP &E – Department of Planning & Environment
DRE -Department of Trade & Investment, Division of Resources & Energy
BOD –Biochemical Oxygen Demand
MBAS – Metheleyne Blue Active Substances
COD – Chemical Oxygen Demand
EPA – Environmental Protection Authority
EPL – Environment Protection Licence
ML – Mining Lease
MOP – Mining Operations Plan
MPL – Mining Purposes Lease
NOW – NSW Office of Water
REA - Refuse Emplacement Area
EC – Electrical Conductivity
TSS – Total Suspended Solids

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1.0 INTRODUCTION

1.1 Overview

This Annual Environmental Management Report (Annual Review) for Baal Bone Mine is prepared annually by Baal Bone Colliery (Baal Bone), to fulfil the reporting requirements of various regulatory departments. Baal Bone is operated by Wallerawang Collieries Pty Ltd (TWCL). The reporting period for this Annual Review is 1 January 2015 to 31 December 2015.

On 14 January 2011, Baal Bone received Project Approval (PA 09_0178) for the continuation of mining activities at Baal Bone via Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project Approval granted approval for the continuation of mining operations at Baal Bone until 14 December 2014, and included:

- continuation of underground mining of Longwalls (LW) 29-31 in accordance with the approved Subsidence Management Plan (SMP) and Mining Operations Plan (MOP);
- continued operation of associated surface infrastructure;
- saleable coal production of 2.0 Mtpa (equating to 2.8 Mtpa run of mine (ROM) coal);
- continued transport of prepared saleable coal to markets by rail, and up to 900,000 tonnes per annum (tpa) by road; and
- mining of other isolated Remnant Areas within existing workings.

Underground mining at Baal Bone ceased on 3 September 2011, and underground mining operations have entered into care and maintenance.

During 2012 and 2013 Baal Bone Colliery was utilised as a training facility for Glencore Xstrata employees. Underground workers completed a twelve week training course including classroom tutorials, and equipment familiarisation. The objective of the training program was to provide employees with experience and skills in an underground mining environment. Until the current down turn in the industry, Baal Bone had trained over 270 new industry entrants from Glencore's Ulan West Mine and Blakefield South Mine.

The management and administration of Glencore's NSW generic induction program has been carried out from the Baal Bone site since June 2013. In February 2014 Baal Bone also took over the management and administration of the QLD generic induction program.

In February 2015, DP&E approved amendment to the Project Approval to extend the life of mine for an additional three years until 31 December 2019 to allow the Remnant Areas to be mined. Mining methods would remain the same as that currently approved, namely, through use of continuous miner using bord and pillar/partial extraction mining methods. In December 2015, DP&E approved a second modification to the Project Approval to allow Ben Bullen Creek to remain in its current alignment.

Glencore is continuing to conduct feasibility studies for potential future uses of the mine.

1.2 Scope of this Annual Review

The layout of this Annual Review has been aligned to the Guidelines and Format for Preparations of an Annual Environmental Management Report (Version 3, January 2006).

This Annual Review has also been prepared to address the requirements of Schedule 5, Condition 3 of Baal Bone's Project Approval (PA 09_0178). Schedule 5, Condition 3 of the project approval requires a report to be submitted to DP&E reviewing the annual environmental performance of the project. The requirements of Schedule 5, Condition 3 of the Project Approval and where these are addressed in the Annual Review are listed in Table 1. References to the environmental assessment (EA) in Table 1 and throughout this report refer to the document titled *Baal Bone Colliery Environmental Assessment* dated March 2010 (AECOM, 2010).

Table 1: Requirements of Schedule 5, Condition 3 of Project Approval 09_0178

Schedule 5, Condition 3 requirement	Annual Review Section
a) describe the works that were carried out in the previous calendar year, and the works that are proposed to be carried out over the current calendar year.	Section 2.0 and Section 6.0
b) include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against: the relevant statutory requirements, limits or performance measures/criteria; the monitoring results of previous years; and the relevant predictions in the EA.	Section 3.0
c) identify any non-compliance over the previous calendar year, and describe what actions were (or are being) taken to ensure compliance;	Section 3.0
d) identify any trends in the monitoring data over the life of the project;	Section 3.0
e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and	Section 3.0
f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the project.	Section 3.0

The Annual Review will be submitted to the following authorities:

- Department of Industry, Skills and Regional Development, Division of Resources & Energy (DRE);
- NSW Department of Planning and Environment (DP&E)
- Forests NSW;
- Lithgow City Council (LCC);
- NSW Office of Water (NOW);
- Environment Protection Authority (EPA); and
- Sydney Catchment Authority (SCA).

The reporting period for this Annual Review is 1 January 2015 to 31 December 2015.

It should be noted that this Annual Review does not necessarily provide a comprehensive description of each individual operation or environmental control that is currently employed at Baal Bone; this level of detail is available in the MOP. Rather, this Annual Review focuses on providing a succinct review of the significant operational and environmental activities undertaken throughout the year. It also examines the performance of key site operations and environmental controls throughout the 2015 reporting period.

Included is a summary of monitored data (as applicable), a discussion regarding the level of compliance achieved, together with an overview of initiatives proposed and actions planned for the 2016 reporting period.

1.3 Consents, Leases and Licences

1.3.1 Current Consents, Leases and Licences

A list of all current consents, leases, licences and approvals are included below in Table 2.

Table 2: Consents, Leases, Licences and Approvals.

Type	Regulatory Authority	Approval Number	Holder	Issue Date	Expiry/ Review Date	Scope
Project Approval	DP&E	09_0178	The Wallerawang Collieries Ltd	01/12/15 Mod 2 Dec 2015	31/12/2019 (Mining operations)	s75W modification to maintain alignment of Ben Bullen Creek.
	DP&E	09_0178	The Wallerawang Collieries Ltd	14/01/2011 Mod 1 Feb 2015	31/12/2019 (Mining operations)	Part 3A Project Approval for continued operations at Baal Bone Colliery until 31 December 2019.
	DP&E	07_0035	The Wallerawang Collieries Ltd	24/10/2007	Perpetuity	Part 3A Project Approval for the Ventilation Shaft and Power Line Project.
Environment Protection Licence	EPA	765	Wallerawang Collieries Pty Ltd	1/08/2013	1/8/2018	Premises and Scheduled Activity (Coal Mining/ Washery) Licence
Mining Operations Plan	DRE	09/2520	Wallerawang Collieries Pty Ltd	29/02/2016	31/12/2019	MOP for Baal Bone Colliery Suspension of Mining Operations.
Mining Leases	DRE	CCL 749	Wallerawang Collieries Pty Ltd	05/04/1990	11/3/2030	Mining Entitlement (Consolidates CL 209, CL 246, CL 329, CL 330, CL331 and CL332) Various depths
	DRE	Consolidated Coal Lease (CCL) 770 (Part)	The Wallerawang Collieries Ltd	10/03/1992	11/12/2024	Mining Entitlement (Consolidates ML424, ML536, ML570, ML571, ML572, ML581, ML640, ML1033,

Type	Regulatory Authority	Approval Number	Holder	Issue Date	Expiry/ Review Date	Scope
						ML1125, PLL120, PLL132, PLL149, PLL144, PLL145, PLL203, CL124, CL338, CL593, CL606, MPL468, MPL72, PLL1951, PLL1952, PPL1953 and PLL1954) Various depths
	DRE	MPL 261 (Act 1973)	Wallerawang Collieries Pty Ltd	22/08/1990	22/08/2032	Mining Entitlement (Southern mine dewatering bores) Parish: Ben Bullen, Depth: Surface - 10m
	DRE	CL 391 (Act 1973)	Wallerawang Collieries Pty Ltd	24/02/1992	11/03/2030	Mining Entitlement Parish: Ben Bullen Depth: > 20m
	DRE	ML 1302 (Act 1992)	Wallerawang Collieries Pty Ltd	29/09/1992	11/03/2030	Mining Entitlement Parish: Ben Bullen Depth: >20m
	DRE	ML 1389 (Act 1992)	Wallerawang Collieries Pty Ltd	09/05/1996	08/05/2017	Mining Entitlement Parish: Ben Bullen Depth: Surface – unlimited Surface - 20m
	DRE	ML1607	Wallerawang Collieries Pty Ltd	08/01/2008	08/01/2018	Mining Lease (Purposes) Parish: Cox Depth: Surface – 10m
S126(1) Approval	DRE	317524306001	Baal Bone Colliery	14/11/2005	Perpetuity	Section 126(1) of the CMRA (1982) for the construction and operation REA 5
S100(1) Approval	DRE	317551291001	Baal Bone Colliery	12/02/2008	Perpetuity	Section 100(1) of the CMH&SA (2002) for the construction and operation of REA 6
Occupation Permit	Forests NSW	14719	Baal Bone Colliery	05/03/1991	Perpetuity	Occupation permit relevant to the power line route from the company's freehold land to Mining Purposes Lease (MPL) 261 (LW 1 mine dewatering bore); includes various subsequent extensions (LW 19

Type	Regulatory Authority	Approval Number	Holder	Issue Date	Expiry/ Review Date	Scope
						dewatering bore).
		14161	Baal Bone Colliery	08/03/1991	Perpetuity	Occupation Permit for the powerline that supplies power to the railway loop - western edge of Ben Bullen SF.
S22H(1)(a) Approval	NOW	N/A	Baal Bone Colliery	27/07/1991	Perpetuity	Section 22H(1)(a) of the Rivers and Foreshores Act (1948) exemption. Permission to undertake activities on streams and drainage lines within the Baal Bone ML.
Water Access Licence	NOW	WAL27887	Wallerawang Collieries Pty Ltd	17/7/2007	17/7/2017	Water Access Licence (under water management Act 2000) replaces bore licences: 80BL135509(near rail loop) and 80BL136703 (near UC1)
Bore Licences	NOW	80BL236132	Wallerawang Collieries Pty Ltd	18/01/1995	Perpetuity	Section 115 of the Water Act 1912. Bore – Mine dewatering LW 1 (South Bore 1).
	NOW	80BL236134	Wallerawang Collieries Pty Ltd	18/01/1995	Perpetuity	Section 115 of the Water Act 1912. Bore – Mine dewatering LW 1 (South Bore 2).
	NOW	80BL239077	Wallerawang Collieries Pty Ltd	19/06/2006	18/06/2016	Section 115 of the Water Act 1912. Bore – Mine dewatering LW 19 (North Bore).
	NOW	10BL601877	Wallerawang Collieries Pty Ltd	08/06/2007	Perpetuity	BBN175; LW29-31 groundwater monitoring piezometer
	NOW	10BL601816	Wallerawang Collieries Pty Ltd	08/06/2007	Perpetuity	BBN176; LW29-31 groundwater monitoring piezometer
	NOW	10BL601817	Wallerawang Collieries Pty Ltd	08/06/2007	Perpetuity	BBN177; LW29-31 groundwater monitoring piezometer
	NOW	10BL601970	Wallerawang Collieries Pty Ltd	05/09/2007	Perpetuity	BBN 179; LW29-31 groundwater monitoring piezometer
Water Licences	NOW	80SL046064	Wallerawang Collieries Pty Ltd	17/07/2007	17/07/2017	Section 12 of the Water Act 1912. Diversion works, 2 pumps, overshot and block

Type	Regulatory Authority	Approval Number	Holder	Issue Date	Expiry/ Review Date	Scope
						dams, bywash dam.
Acknowledgement of Dangerous Goods on Premises	Work Cover Authority	NDG023231	Wallerawang Collieries Pty Ltd	05/04/2009	Renewed Annually	Dangerous Goods Licence.
		XSTR100123	The Wallerawang Collieries Ltd		19/06/2017	Dangerous Goods Licence
Radiation Gauge	EPA	29207	Wallerawang Collieries Pty Ltd	27/7/2013	16/01/2017	To sell and possess – Radiation Control Act 1990. Coal quality sensing device
Apparatus Licence	ACMA	95441	Wallerawang Collieries Pty Ltd	27/7/2013	26/07/2016	Land Mobile (Two way Radio)- Radio communications Act 1992

1.3.2 Amendments during the Reporting Period

During 2014, mining lease renewals were sought for and granted for CL 391 and ML 1302. In addition, the NSW Department of Planning and Environment (DP&E) issued a draft recommended modification instrument for the extension of mine life until 31 December 2019 (this modification has been subsequently approved in February 2015).

1.4 Mine Contacts

Baal Bone Colliery can be contacted via telephone on (02) 6350 6900 and fax (02) 6359 0530. The postal and street addresses are as follows:

Postal: Baal Bone Colliery
PO Box 13
Lithgow NSW 2790

Street: Baal Bone Colliery
Off Castlereagh Highway
Cullen Bullen NSW 2790

Personnel responsible for environmental management at Baal Bone Colliery are shown below:

Table 3: Mine Personnel Contact Details

Contact Person	Position	Contact Details
Mark Bulkeley	Operations Manager	Ph: (02) 6350 6943 Email: Mark.Bulkeley@Glencore.com.au Fax: (02) 6359 0530
Gary Linford	Technical Services Manager	Ph: (02) 6350 6945 Email: Gary. Linford@Glencore.com.au Fax: (02) 6359 0530

Contact Person	Position	Contact Details
Elizabeth Fishpool	Environment and Community Officer	Ph: (02) 6350 6920 Email: Elizabeth.Fishpool@Glencore.com.au Fax: (02) 6359 0530

1.4 Actions Required at Previous Annual Review and Site Inspection

There was no Annual Review meeting or site inspection held during 2015. The Baal Bone Colliery Environmental representative contacted all the recipients of the Annual Review to discuss the proposed site inspection, and to suggest postponing the inspection until early 2016 to enable review and discussion of the Ben Bullen Creek Modification and new MOP concurrently. Given the care and maintenance status of Baal Bone Colliery the government agency representatives were either not interested in carrying out an inspection, or preferred for a site inspection to be carried over until 2016. An invite for a 2016 site inspection accompanied this report and is scheduled for 10 May 2016. From 2017 onwards Baal Bone Colliery will organise site inspections only at the request of government agencies, rather than pre-organising a joint site inspection each year.

Acceptance of the 2014 Annual Review was received from the Department of Planning & Environment (DPE) via written correspondence on 30 April 2015. DPE was satisfied with the form and content of the report but had the following comments:

Table 4: Annual Review comments

Comments	Status
DPE requested the following documents to be provided by 7th June 2015: - 2014 AECOM Groundwater Monitoring Report - Data for surface water oil and grease monitoring - Mine Closure Plan - A plan of monitoring bores - Action status report for 2013 Independent Environmental Audit	Requested documents sent to DPE in May 2015.
DPE requested the following documents be placed on the Baal Bone website for public viewing by 7 June 2015: - Mine Closure Plan - MOP and Rehabilitation Plan - Independent Audit Report action plan	The MOP and Audit action plan were placed on the Baal Bone website in May 2015. Baal Bone Colliery does not have a final Mine Closure Plan.

The Department also requested that the following further details are included in the 2015 Annual Review:

Table 5: Further details required in 2015 Annual Review

Requirement	Section in Annual Review
Ensure that monitoring results are graphed and analysed against previous years. Comment should be made on any trends and the site performance against impact prediction in the EA, management plans of any statutory requirements.	Section 3.0

Supply detailed further monitoring and analysis on the levels of Iron, Copper and Zinc encountered in groundwater from BBPB3.	Section 3.4
Descriptions and naming of monitoring points is consistent throughout the Annual Review and that plans are provided clearly indicting the locations.	Entire Document
All maps are to indicate North, and clearly illustrate the data in question in a legible form.	Drawings and plans
Reportable incidents, and notice of same within the Annual Review, are to be reported in response to the criteria for reporting incidents that is provided within the definitions of the DA09_0178 consent.	Section 3.20

1.5 Employment Status and Demographics

Employment details for staff based at Baal Bone Colliery are found in Tables 6 and 7 below:

Table 6: Employment Type

Employment Type	Number of persons as at 31 December 2015
Permanent	6
Contractor	5

Table 7: Male/Female Breakdown of Workforce

Gender	Number of persons as at 31 December 2015
Male	8
Female	3

Nine employees resided in the Lithgow Shire during the reporting period, with one employee residing in the Mid-Western Regional Shire, and one in Newcastle City Council area.

1.6 National Pollution Inventory

In December 1997, the NSW Parliament passed a number of new legislation that saw the start of the National Pollution Inventory (NPI) reporting process. The NPI is an internet database designed to provide the community, industry and the government with information on the types and amounts of certain substances being emitted to the environment.

Baal Bone Colliery submitted an NPI report on 16 December 2015 for the period of 1 July 2014 to 30 June 2015. The report detailed emissions of listed substances from Baal Bone Colliery to air, water and land requiring collation, analysis and interpretation of site-specific data. Results can be obtained from the NPI website www.npi.gov.au.

2.0 OPERATIONS DURING THE REPORTING PERIOD

2.1 Exploration

There was no exploration activity conducted during the reporting period.

2.2 Land Preparation

No land clearing, vegetation removal or soil removing activities were undertaken during the reporting period.

2.3 Construction

No construction activities were undertaken during the reporting period. The existing administration, amenities, workshops and coal handling infrastructure associated with the Baal Bone Colliery remained unchanged. Surface facilities and infrastructure are shown on appendices as Plan 1.

2.4 Mining

There was no underground mining extraction or transportation of coal product at Baal Bone during the reporting period.
Underground mining operations at Baal Bone ceased in September 2011, and underground mining operations entered care and maintenance. Coal washing operations were completed in December 2011. Transportation of coal product ceased in April 2012.

Following the completion of mining of Longwall 31 on 3 September 2011, underground mining operations were suspended. A notice of the suspension of operations was provided to DTI on 31 August 2011. Approval from the Department for the suspension of mining operation and labour/expenditure conditions of CCL 749, CL 391, ML 1302 and ML 1389 was received on 27 September 2012 for a period of three years.

The equipment fleet utilised for care and maintenance during 2015 is outlined below.

Table 8: Equipment Fleet

Equipment Type	Number of Units
Toyota Landcruiser Utility/ Troop Carrier	3
Manitou Forklift	1
Bobcat Skid Steer Loader	1
130 Eimco	2
Domino Road Grader	1
PJB Man transports	2

2.5 Mineral Processing

2.5.1 Production, Processing and Waste Summary

Underground mining ceased in September 2011, and coal washing activities were completed in December 2011. When operational, Baal Bone produced three grades of washed coal, principally for the export market; these being 9%, 14% and 18% ash coal.

2.5.2 Product Destination and Transportation

The transport of saleable product coal off-site via rail was completed on 25 April 2012.

The Project Approval permits transport of up to 900,000 tonnes per annum (tpa) of saleable coal by public road to the Mount Piper and Wallerawang Power Stations. No product coal was transported by road during the reporting period.

2.5.3 Ore and Product Stockpiles

The maximum working capacity of the Baal Bone coal stockpiles (both ROM and product) is approximately 1,000,000 tonnes. During the reporting period there was no stockpiled ROM coal.

2.6 Mineral Waste Management

Processing and washing of coal was completed in December 2011. As such, no mineral waste was produced during the reporting period.

2.6.1 CHPP Waste and Reject Emplacement

Historical CHPP waste comprised a mixture of high ash coal and non-coal materials, such as sedimentary rock and clay. These materials occur both within the coal seam and as floor or roof materials extracted during the mining operation. They are rejected during the beneficiation process on a specific gravity basis. CHPP waste is managed through disposal in an on-site reject emplacement area (REA).

Former REAs historically used at Baal Bone have been fully rehabilitated and capped, with the exception of REA 5 and REA 6 (refer **PLAN 1**). A geotechnical investigation completed in December 2011 determined that REA 5 Cell 1 was ready to cap, while Cell 2 required further drying before works could commence. On 1st March 2012, Baal Bone received approval from the then DTI to discontinue use of REA 5 with capping of Cell 1 completed by April 2012.
Subsequent geotechnical investigations carried out in November 2013 determined that REA 5 Cell 2 was ready to cap. Capping of REA 5 Cell 2 was completed in July – August 2014.

It is intended to retain and maintain REA 6 until a decision regarding the future activity at Baal Bone has been determined. As such REA 6 has been bunded for safety and security.

2.6.2 Reject Material

Coarse reject at Baal Bone has a particle size ranging from 100 millimetres (mm) to 100 micron (μm) and comprised approximately 22% of washery feed. Analysis of the coarse reject material has previously confirmed that it is generally non-saline, and pH is near neutral with negligible acid producing capacity. It has been shown to exhibit poor physical characteristics with a coarse texture and low water holding capacity. Even though it is chemically benign, this material is not suitable for use as a growth medium. All reshaped areas are therefore covered with a minimum of 300 mm of soil (freedig) material to provide a covering layer in which a sustainable and protective vegetative cover is established.
REA 6 has 3 Mt of coarse reject capacity remaining.

Fine reject is generally smaller than 100 μm in diameter and comprised around 7% of CHPP washery feed. Historical fine reject was pumped as 20–25 % w/w slurry to Cell 1 within REA 6.
REA 6 has 300 m^3 within cell 2 of fine reject capacity remaining.

2.7 Water Management

2.7.1 Process Water Circuit

The process water system at Baal Bone Colliery consists of water that has had the potential to be in contact with coal or carbonaceous material, and therefore has the potential to be saline. Mine water is captured on site, and stored in water storages within the mine water management system before being discharged off-site. The system also allows for the reuse and recycling of water throughout the operation.

The 2015 process water system consists of:

- groundwater inflows and outflows;
- rainfall/runoff into mine pit;
- runoff from unsealed roads; and
- dirty water runoff from CHPP, pit top facilities, stockpiles and rail load out facilities.

A network of water transfer pipelines is used to transfer water across the Baal Bone Colliery site.

As at 31 December 2015, approximately 68.5 ML of water was held within the process water circuit, see Table 9.

Table 9: Stored Water at Baal Bone Colliery – simulated using Goldsim model

	Volume Held			
Location	Start of Reporting Period	End of Reporting Period	Volume lost/gained	Maximum Storage Capacity
Dirty Water Dam	10 ML	10 ML	Remained even	37 ML
Process Water Dam	55 ML	55 ML	Remained even	55 ML
Box Cut Sump	3.5 ML	3.5 ML	Remained even	6.9 ML
Controlled Discharge Water (Salinity Trading Schemes)	Nil	Nil	Nil	Nil

Contaminated Water	Nil	Nil	Nil	Nil

Water from both the north and south boreholes is piped back to the pit top's 'Dirty Water' management system. After discharge through an iron aeration system and retention in Lake Tegan, water overflows into the hwater dam, after retention time the water is then pumped to the process water dam, overflows onto Ben Bullen Creek and then leaves site through LDP1 at the overshot dam. An overview of the current water management and monitoring system can be seen in Plan 1 and Drawing 1 and locations of the north and south de-watering bores in Drawing 2 (supplied as appendices to this report).

2.7.2 Potable Water

Potable water is purchased from State Water and is supplied through a connection into the Fish River Water Supply Pipeline. This connection services the administration centres and bathhouses. Drinking water is also taken underground in containers.

Potable water usage for the 2015 reporting period was 2.9 ML, a decrease of 46% compared to the 5.5 ML of potable water usage in 2014.

2.7.3 Sewage Treatment and Disposal

Sewage and grey water effluent from site facilities, including the administration building, bathhouse, CHPP and amenities are collected in a sump and directed through macerator pumps to an on-site sewage treatment plant (STP). The waste is treated by an activated sludge treatment process then is discharged into two maturation ponds, with a total residence time of approximately 20 days.

Following treatment and maturation the overflow from the second pond discharges onto a well vegetated transpiration bed; this is an EPL discharge location (LDP2) and monitoring point. The location of the STP and maturation ponds is shown on **PLAN 1**.

With the completion of mining at Baal Bone and the reduced number of employees on site, the discharge of LDP2 has been greatly reduced, with no discharge recorded during monthly monitoring in 2015.

2.7.5 Water Balance

The net water discharge from site has historically been in the order of 1,500 ML/year (AECOM, 2010). The majority of this water is intercepted within the underground mine workings and goaf, which is then discharged through the north and south boreholes.

During mining operations all runoff from the pit top area, stockpile area and CHPP area was used within the mine as process water as required (AECOM, 2010). Process water was supplemented with water from mine Adit No. 5 and surface runoff and seepage collected from the Boxcut Sump as required (AECOM, 2010).

Approximately 50% of leachate from the Tailings Dam was returned to the process system (AECOM, 2010). Recycled process water used on site comprising leachate return water and wash down water from the CHPP, coal stockpile and pit top areas, historically contributed approximately 63% of all process water used (AECOM, 2010).

Potable water used on site has historically accounted for approximately 4% of all water used.

The annual site water balance takes into account the following:

- water sources (including rainfall, groundwater and potable water);
- demands and losses;
- the change in the inventory of water stored underground and in surface dams; and
- discharge of water off site

Major inputs for the 2015 reporting period were:

- 2.9 ML potable water from Fish River Water Supply;
- 118 ML runoff from pit top and CHPP areas;
- 1222 ML mine dewatered from southern and northern underground mining areas; and
- 554 ML mine dewatering from Adits 2 and 5.

Major outputs of the 2015 reporting period were:

- 1222 ML groundwater dewatered via north and south boreholes (leaving site via overshot dam LDP1);
- 215 ML/year average site overflow from the Overshot Dam (not including southern and northern de-watering bores)

2.8 Hazardous Material Management

2.8.1 Status of Licence

Baal Bone holds an *Acknowledgement of Notification of Dangerous Goods on Premises* (NDG023231). In order to be granted a licence to store explosives, in accordance with the Explosives Regulation (2005), Baal Bone has nominated suitable persons to hold an Unsupervised Handling Licence following appropriate state and federal security background check. Accordingly the Explosive and Detonator Magazine was also included in the Acknowledgement.

Details of hazardous materials stored on-site during the reporting period are provided in Table 10. Location of the storage of hazardous goods can be found on **PLAN 1**.

Table 10: Hazardous Materials Stored On Site

Storage ID	Storage Type	Maximum Storage Capacity
1	Underground Tank: Diesel	50,000L
2	Above Ground Tank: LPG	37,750L
3	Above Ground Tank: LPG	37,750L
4	Above Ground Tank: LPG	5000L

2.8.2 Material Safety Data Sheets

Under Baal Bone's Environmental Management System (EMS) there is a Hazardous Substance Standard (BBN SD STD 0007 – Hazardous Substances), which deals with the safe storage, handling and disposal of

chemicals and other hazardous substances. Materials Safety Sheets (MSS) are made available to all employees at the store facility.

Baal Bone also has a comprehensive online "Chemalert" database, which provides all employees easy access to information on all chemicals held on site. Information includes but is not limited to: the safe handling of products, Personal Protective Equipment (PPE) requirements, storage, use and disposal of the materials and spill response procedures. Chemalert is available on most PCs including the one for general employee use in the lamp room.

2.9 Other Infrastructure Management

The location of existing infrastructure is shown on **PLAN 1**. During the 2015 reporting period there were no significant alterations or additions to processes or infrastructure.

2.10 Site Security

A number of safety measures have been adopted on site to ensure employee and public safety throughout all aspects of operations at Baal Bone. These security measures include:

- licensed security contractor with regular patrols during hours of non-operation;
- change of security locks;
- CCTV surveillance of key areas of site;
- lockable gates across all portals;
- perimeter fencing;
- compulsory surface and underground inductions for those working on site; and
- all visitors must be signed in and out and must be accompanied around the site by authorised personnel.

2.11 Activities during Suspension of Mining.

A notice of the 'Suspension of Operations' was provided by Baal Bone Colliery to the Department of Resources and Energy on 30 August 2011. Recognition from the Department was received on 16 September 2011. Approval from the Department for the suspension of mining operation and labour/expenditure conditions of CCL 749, CL 391, ML 1302 and ML 1389 was received on 27 September 2012, with the suspension taking effect four working days after the date of the letter for a period of three years. On 28 September 2015, Baal Bone Colliery lodged a request for a four year extension to the suspension to align with the MOP period.

A Suspension of Operations MOP was developed and submitted to the then Department of Trade and Investment (DTI) on 14 June 2012. Recognition from DTI of the acceptance of the MOP was received on 18 June 2012. A revision to the MOP was requested from DTI in February 2013 to accommodate mine de-watering activities and the incorporation of information from the Baal Bone Colliery draft Mine Closure Plan. On 18 November 2013, DTI approved amendments to the MOP including changes to the water management system at site, removal of the South East Ventilation fan and an update on the training mine status at site.

On 1 February 2016, Baal Bone submitted a new Care and Maintenance MOP to DRE for review. The new MOP period is 29 February 2016 to 31 December 2019 to align with the approved modification to PA09_0178 to extend the timeframe for mining of remnant coal until 31 December 2019.

A summary of the activities associated with the suspension of operations activities is provided in the sections below. Refer to the Baal Bone Colliery MOP for further information.

2.12.1 Salvage of Selected Underground Equipment

During the reporting period, the salvage of plant and equipment from the mine workings was continued. Salvaged plant and equipment has been cleaned and is stored on the pit top or cut throughs close to the mine entrance. Where appropriate, equipment that has been salvaged may be sold within the Glencore Group.

Salvaged equipment that has no residual value may be scrapped and recycled.

2.12.2 Maintenance of Services

Baal Bone is proposing to continue operation of the pit top (1 adit) ventilation fan throughout suspended operations, and therefore the current MOP period.

Baal Bone has developed a Care and Maintenance Mine Inspection Program Matrix. This will be used as a guideline for maintenance scheduling and inspection frequencies.

The box cut fan (North) has been switched off and it is not anticipated to operate again during the suspended operations period, but may be activated if necessary. The South East ventilation fan has been removed, and the shaft filled and capped.

Electricity, water, compressed air and communications services to the underground mine, building and pit top infrastructure will continue to operate and be maintained, subject to continued mine operations. All powerlines to the site will remain to supply buildings and offices power during the care and maintenance phase of the mine. All mine related unsealed roads, monitoring sites and dewatering bore compounds in Forests NSW land will be maintained during the care and maintenance phase.

Baal Bone Colliery currently has three mine dewatering bores, two groundwater supply bores and four shallow piezometer monitoring bores licenced with the NSW Office of Water. Pumping from boreholes will continue throughout the suspension of operations. Should Baal Bone decide to seal any borehole, detailed sealing designs will be submitted to DI for approval prior to the commencement of works.

Gas bag samples to monitor underground methane gas levels will continue to be taken during the MOP period.

3.0 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

Baal Bone maintains and operates an Environmental Management System (EMS), which has been prepared to reflect industry best practice and to specifically address Project Approval conditions, Environmental Protection Licence conditions and other statutory requirements.

Detailed plans of management and performance standards for a wide range of environmental elements have subsequently been developed. These Plans and Standards detail relevant control measures, management strategies, monitoring requirements, reporting procedures and performance expectations/criteria. Management plans can be found on the Baal Bone public website here: http://www.glencore.com.au/EN/WHO-WE-ARE/BAAL-BONE/Pages/other-publications.aspx.

It should be noted that this section of the Annual Review does not necessarily provide a comprehensive description of each individual environmental control mechanism that is currently employed at Baal Bone; this level of detail is available in the Baal Bone MOP (Suspension of Mining Operations) February 2016 to December 2019; or management plans.

Rather, this section will focus on providing a succinct review of the performance and/or modification of key control measures throughout the 2015 reporting period. Also included is a review of significant activities undertaken or actions completed throughout the year, a summary of monitored data (as applicable), a discussion regarding the level of compliance achieved; together with an overview of initiatives proposed and actions planned for the 2015 reporting period.

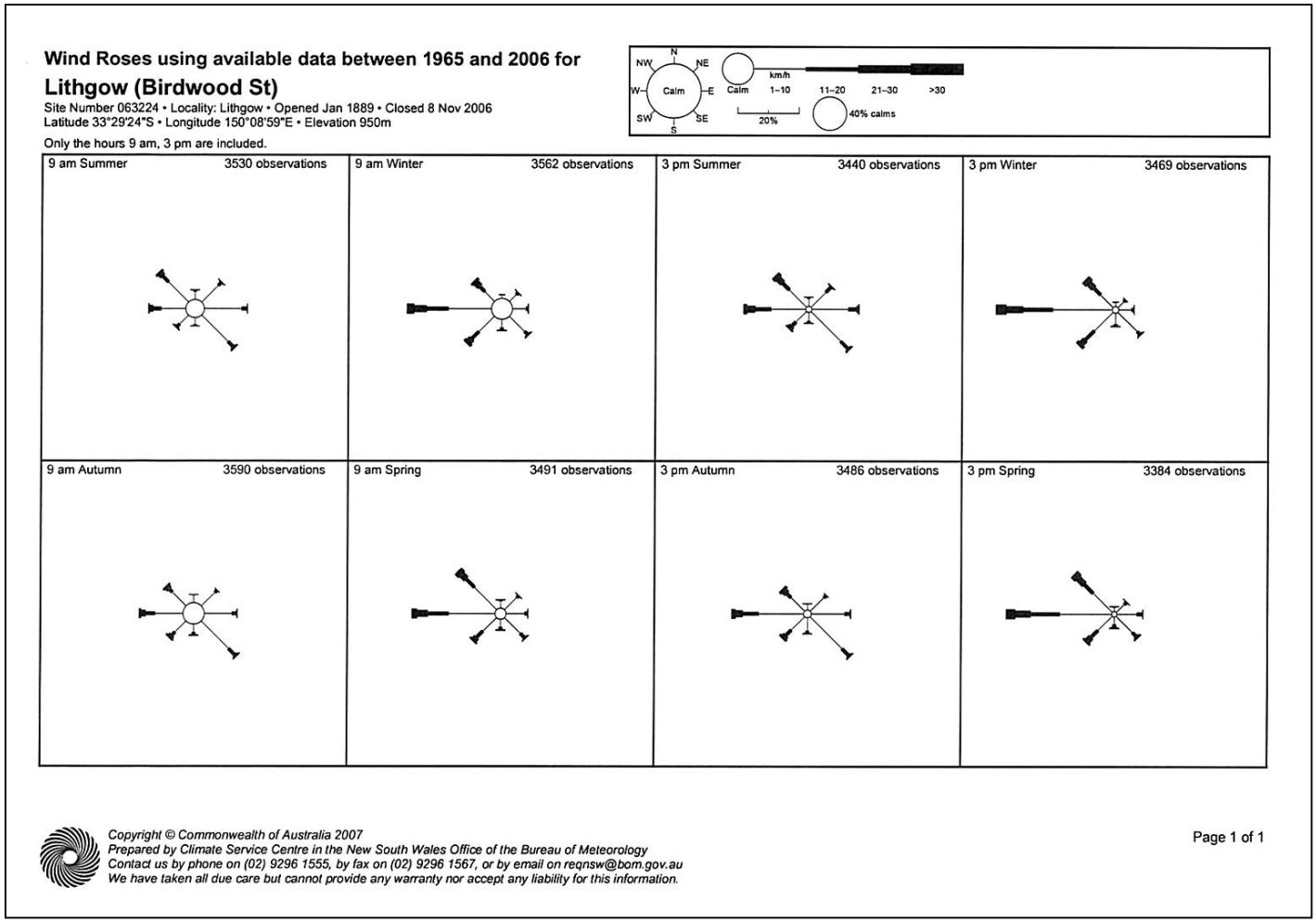
3.1 Air Pollution

3.1.1 Wind speed and direction

The Ben Bullen Range (and State Forest) provides Baal Bone with reasonable shelter from winds with the exception of those from the north-west which have a clear fetch of approximately 12 km upwind of the site. However, strong winds from the southwest and southeast may funnel through the gaps in the Ben Bullen Range and along the valleys towards the site.

Wind speed and direction at Baal Bone is comparable to the wind conditions from the Lithgow (Birdwood Street) Weather Station approximately 25km south-east of the site. Historic seasonal wind roses for this weather station are found in **Figure 1**.

Figure 1: Historic Wind Roses for the Lithgow Weather Station (Birdwood Street)



3.1.2 Dust Monitoring and Sample Locations

Monthly dust fall-out monitoring is carried out in accordance with Australian Standard AS3580.10.1 and EPL requirements. Baal Bone has engaged ALS Group Environmental Division Mudgee, a NATA Accredited laboratory, to undertake monthly sampling, monitoring and analysis.

Baal Bone maintains a network of four dust deposition gauges to monitor dust levels around site and in the vicinity of the nearest neighbour, these are:

- Sample location DM1 (EPL monitoring point No. 7);
- Sample location DM2 (EPL monitoring point No. 13);
- Sample location DM3 (EPL monitoring point No. 14); and
- Sample location DM4 (EPL monitoring point No. 15);

Sample location DM5 (EPL monitoring point No. 16) was removed from the EPL in February 2014 following consultation with the EPA regarding site dust monitoring and risks.

Locations of all air quality monitoring gauges are shown in **Drawing 1**.

3.1.3 Review and interpretation of dust monitoring results

Schedule 3, Condition 10 of PA 09_0178 includes air quality impact assessment criteria for the project which are summarised in below. The pollutants to be monitored include deposited dust, TSP and PM_{10}.

Table 11: Baal Bone air quality impact assessment criteria

Pollutant	**Averaging period**	**Criterion**	
Deposited dust	Annual	**Maximum increase** 2 g/m²/month	**Maximum total** 4 g/m²/month
		Maximum Total	
TSP	Annual (suspended)	90 µg/m³	
PM_{10}	24 hour (suspended)	50 µg/m³	
	Annual (suspended)	30 µg/m³	

Levels of deposited dust were monitored in accordance with the air quality impact assessment criteria. Results of deposited dust monitoring conducted during the 2015 reporting period provided below.

Table 12: Deposited dust monitoring results for 2015 (g/m2/month)

Month	**DM1**	**DM2**	**DM3**	**DM4**
January	0.3	0.6	0.5	0.6
February	0.7	0.4	0.7	0.6
March	0.6	0.5	0.5	0.5
April	1.2	0.1	0.3	0.2
May	1.9	0.4	0.5	0.4
June	0.2	1.3	0.2	0.2
July	0.2	0.1	0.1	0.1
August	0.1	0.1	0.1	0.1
September	0.7	0.2	5.0*	0.3
October	0.4	0.5	0.4	0.4
November	0.6	0.2	0.5	12.6**
December	0.6	0.6	3.9	0.8

* The September dust monitoring result for DM3 recorded an abnormally high result of 5.0 g/m²/month. The sample was microscopically analysed to determine the source of particles. The analysis was undertaken by the ALS Group Environmental Division, a NATA Accredited laboratory and results indicated that the insoluble matter was comprised of insects, bird droppings and vegetation. Therefore the high reading is most likely from non-mining related sources.
All dust monitoring results for 2015, are below the maximum allowable annual average dust level of 4 g/m²/month, in accordance with Schedule 3, Condition 10 of Project Approval 09_0178.

** The November dust monitoring result for DM4 recorded an abnormally high result of 12.6 g/m²/month. The sample was microscopically analysed to determine the source of particles. The analysis was undertaken by the ALS Group Environmental Division, a NATA Accredited laboratory and results indicated that the insoluble matter was comprised of 60-70% of organic matter, 30-40% of sand/clay and <10% of fine dark particles. Therefore the high reading is most likely from non-mining related sources.
All dust monitoring results for 2015, are below the maximum allowable annual average dust level of 4 g/m²/month, in accordance with Schedule 3, Condition 10 of Project Approval 09_0178.

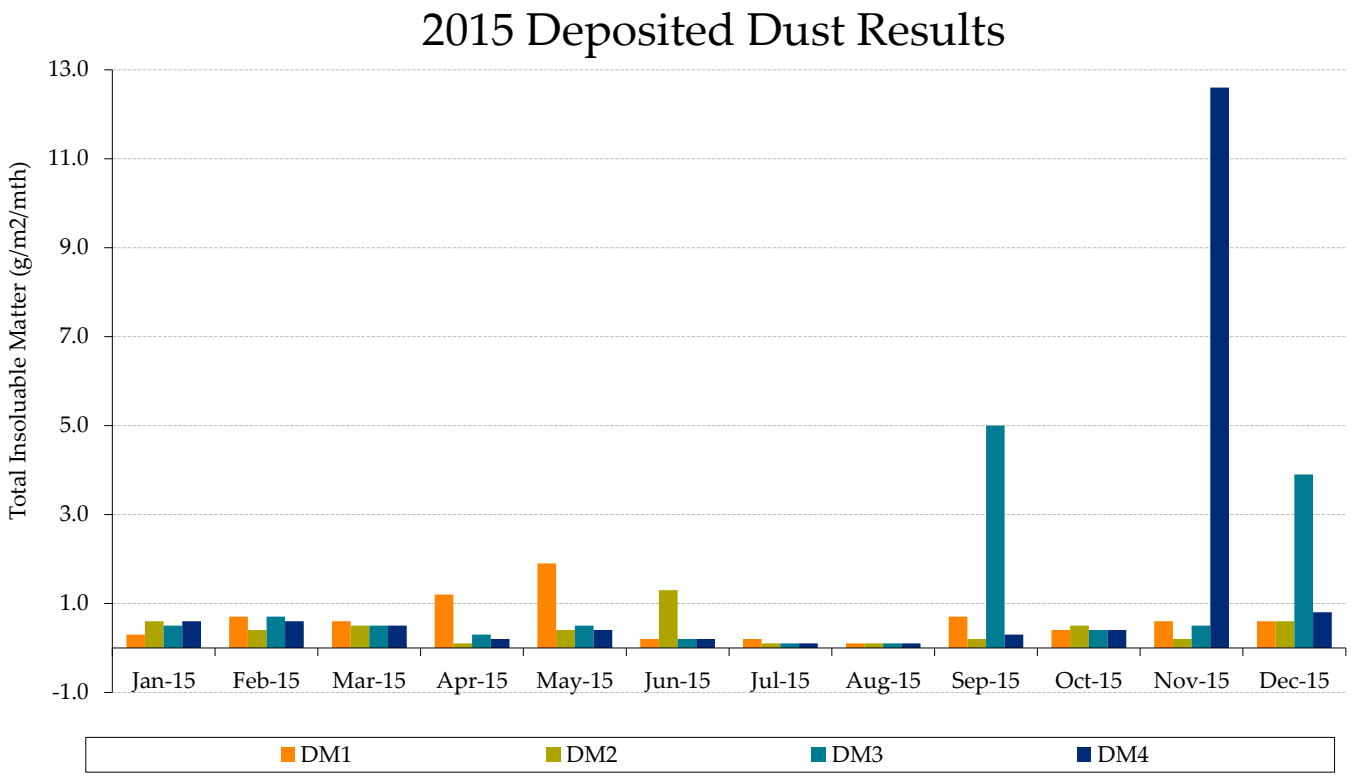


Figure 2: 2015 Deposited Dust Monthly Monitoring Results

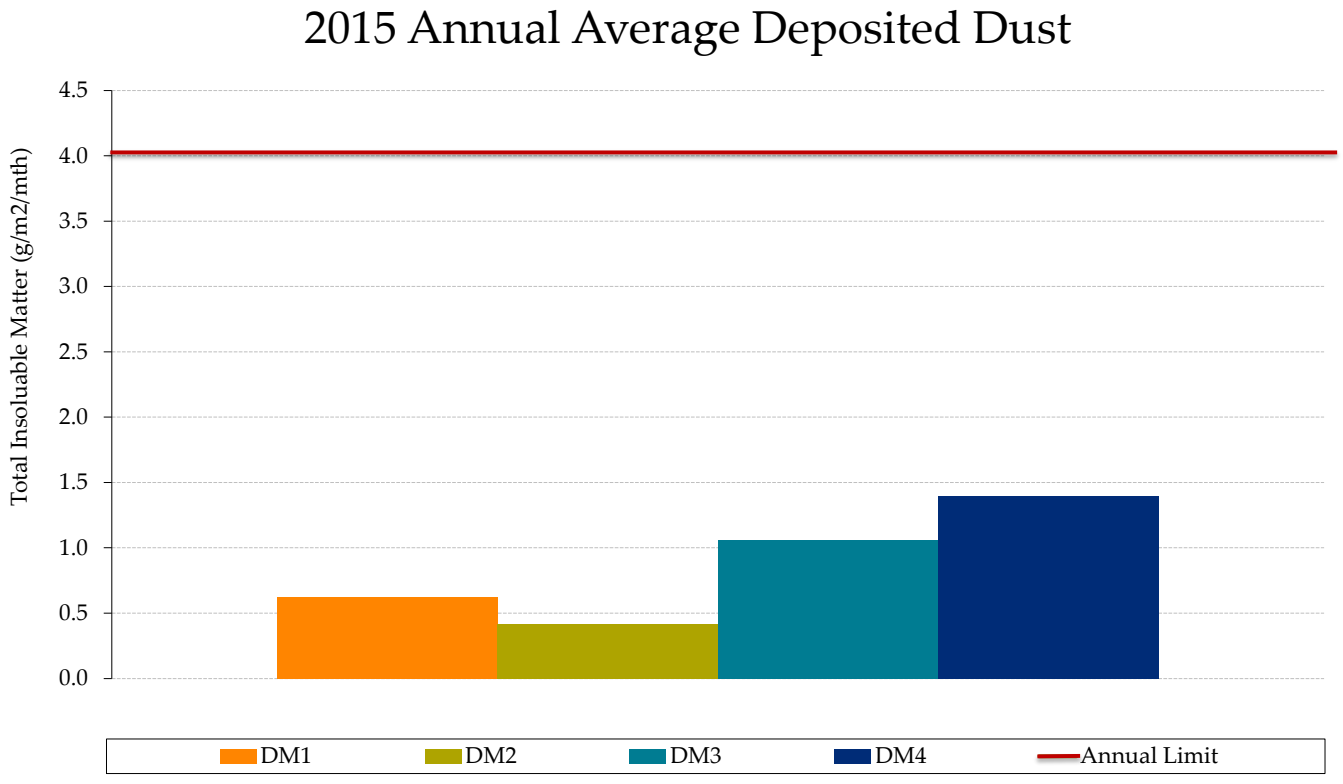


Figure 3: 2015 Annual Average Deposited Dust Results

All dust monitoring results for 2015, are below the maximum allowable annual average dust level of 4 g/m²/month, in accordance with Schedule 3, Condition 10 of Project Approval 09_0178.

3.1.4 Comparison against previous Annual Reviews

As can be expected with the continuing of Baal Bone on care and maintenance, dust deposition results have continued to remain low across the site. Results of deposited dust monitoring conducted during the 2014 reporting period are provided in **Figure 4** below. As with 2015, all dust monitoring results for 2014 were below the maximum allowable annual average dust level of 4 g/m²/month, in accordance with Schedule 3, Condition 10 of Project Approval 09_0178.

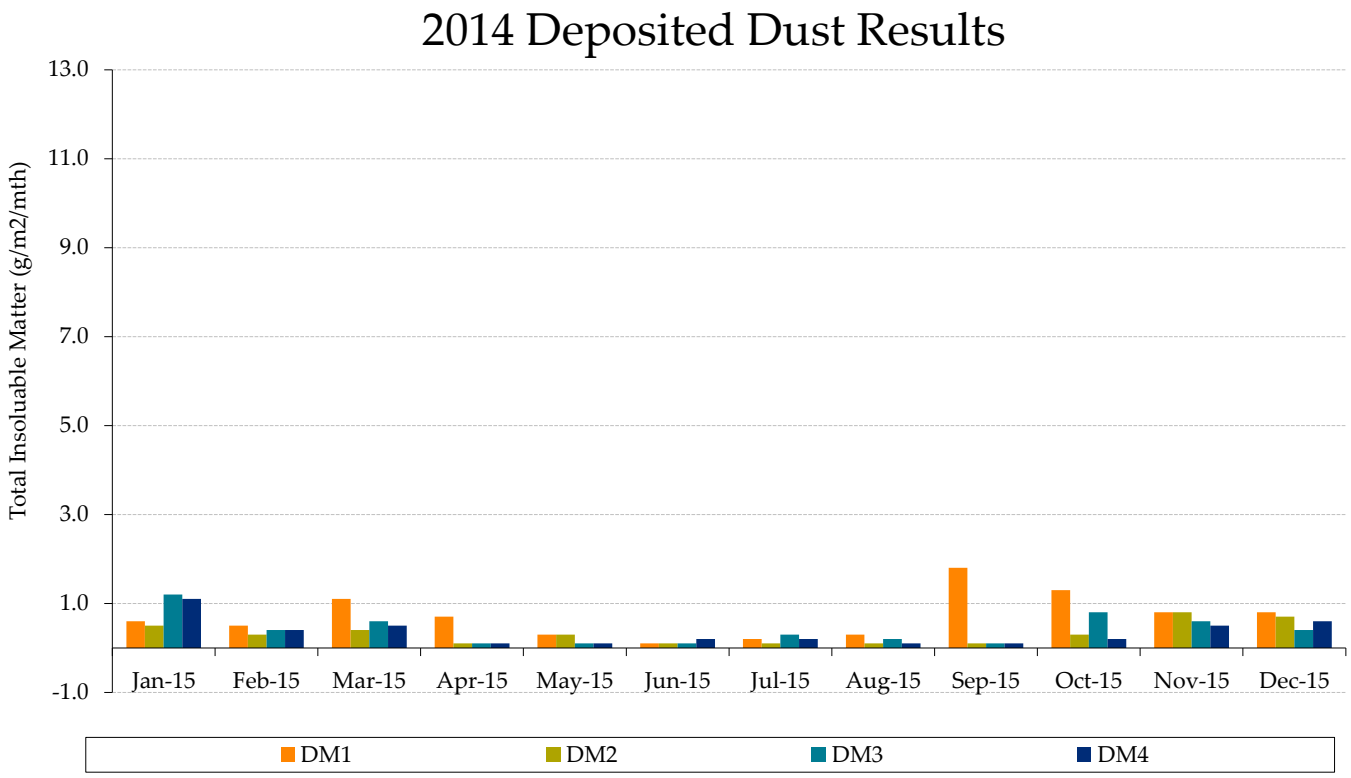


Figure 4: 2014 Deposited Dust Monitoring Results

Historically, deposited dust results have remained below the maximum allowable annual average dust level of 4 g/m²/month. **Figure 5** shows the annual averages for DM1 – DM5 for the period 2011 to 2015.

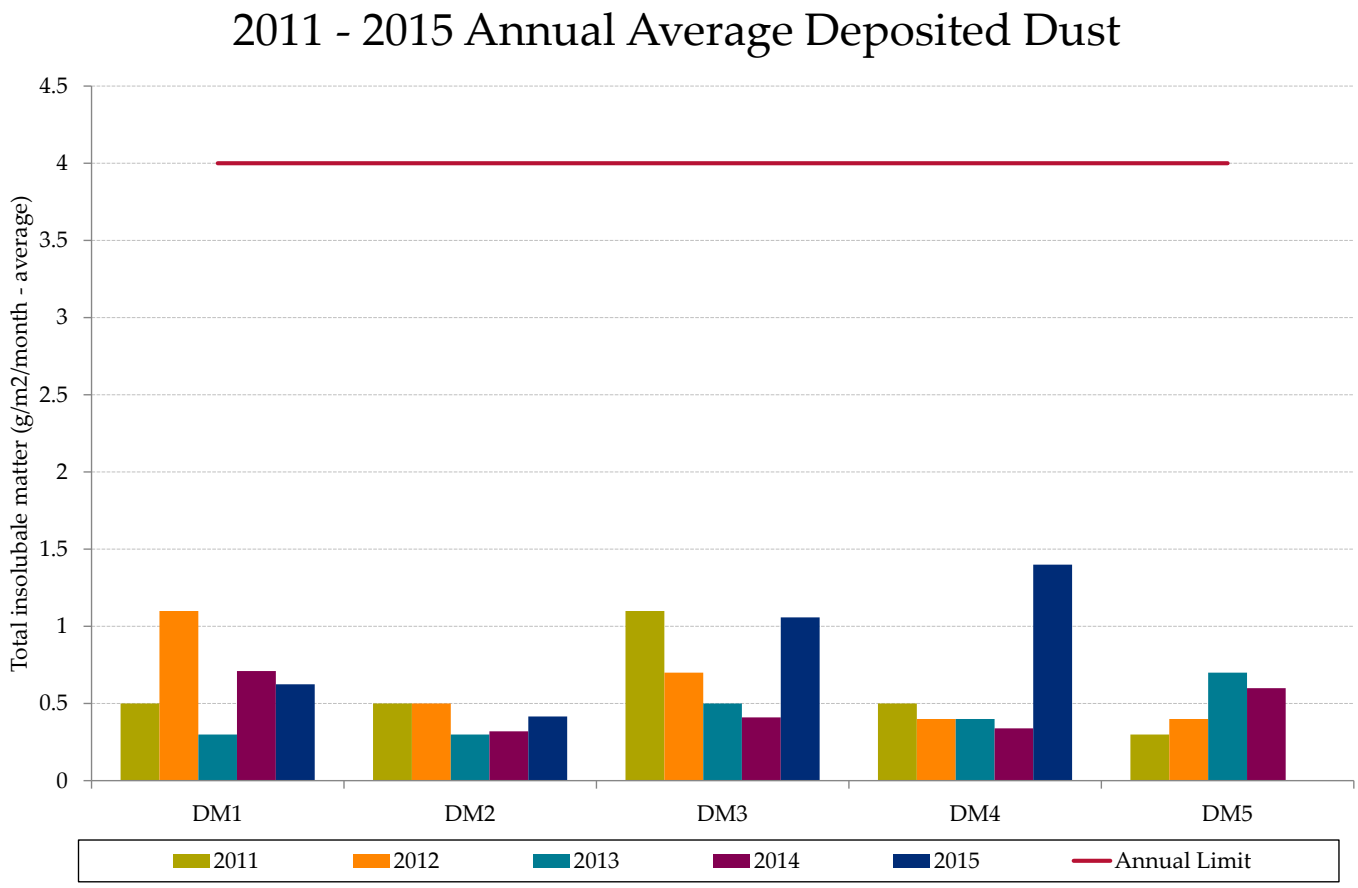


Figure 5: 2011 – 2015 Annual Average Deposited Dust Results

3.1.4 Comparison against EA

Levels of air quality pollutants as predicted under the EA are presented in below. **Table 13** shows the predicted cumulative pollutant concentration (which includes the predicted concentration from Baal Bone plus the background concentration). Deposited dust criteria are expressed as deposition rates and not concentrations. The predicted levels were all below the specified criteria.

Predicted odour levels are presented in below, and were assessed in the EA (AECOM 2010). Odour is not monitored as part of site operations; however no odour complaints were received during the reporting period.

Table 13: Maximum predicted pollutant results at the discrete sensitive receptors

Receptor Number	TSP (ug/m³)		PM_{10} (ug/m³)			Deposited Dust (g/m²/month)		Odour (OU)
	Annual	Annual cumulative*	Annual	Annual cumulative*	24 hour	Annual	Annual cumulative*	One Second
1	13.5	58.5	5.0	23.0	36.2	0.76	3.3	2.6
2	7.4	52.4	2.6	20.6	23.2	0.4	3.0	1.8
4	3.3	48.3	1.2	19.2	12.5	0.2	2.8	1.0
5	4.2	49.2	1.5	19.5	16.1	0.2	2.8	0.9

Receptor Number	TSP (ug/m^3)		PM_{10} (ug/m^3)			Deposited Dust (g/m^2/month)		Odour (OU)
	Annual	Annual cumulative*	Annual	Annual cumulative*	24 hour	Annual	Annual cumulative*	One Second
6	4.5	49.5	1.7	19.7	13.2	0.2	2.8	2.1
7	2.5	47.5	0.9	18.9	13.6	0.2	2.8	1.3
8	2.6	47.6	1.0	19.0	16.4	0.2	2.8	1.8
9	5.2	50.2	1.7	19.7	26.5	0.4	3.0	1.1
10	5.4	50.4	1.8	19.8	19.4	0.4	3.0	2.5
11	3.8	48.8	1.3	19.3	13.0	0.2	2.8	0.7
12	3.3	48.3	1.1	19.1	18.5	0.2	2.8	1.5
13	2.8	47.8	0.8	18.8	10.6	0.2	2.8	0.7
Criteria	90 ug/m^3		30 ug/m^3		50 ug/m^3	4 g/m^2/month		5 OU

* Includes the predicted concentration from Baal Bone plus ambient background concentrations

The monitoring results at DM2 for all pollutants are likely to be representative of predicted pollutant results at receptor number 2 listed in **Table 13**. The dust monitoring results for all pollutants at DM2 during the reporting period, presented in **Section 3.1.3**, are consistently lower than the maximum predicted pollutant levels within the EA, as well as below the relevant criteria.

Therefore, the air quality impacts associated with Baal Bone's operations are consistent with the predicted impacts in the EA.

3.2 Erosion and Sediment Control

In non-active areas of the mining lease, there have been negligible levels of erosion and sedimentation. Livestock are agisted on a portion of suitable non-active mining area.

In December 2014, Baal Bone engaged Umwelt Australia to conduct Channel Stability & Stream Health Monitoring across the site. A key recommendation of this monitoring was that the areas of active erosion are closely monitored and remedial actions undertaken to ensure further erosion does not occur, particularly within Ben Bullen Creek and Coxs River.

All active surface mining and rehabilitation areas fall within Baal Bone's Water Management System which is subdivided into 'clean water' and 'dirty water' systems. Features of the 'clean water' system includes upslope diversion banks, levee banks, lined channels and drains and reed beds within the Ben Bullen Creek; features of the 'dirty water' system include graded contour banks, containment bunds, primary arrestor/grit traps, sediment dams, water treatment plant and settlement dams.

The Overshot Dam is located on the Colliery's northern boundary and is the final point of containment / retention for the clean water system. It also provides an additional opportunity for settlement and/or other treatment if required. The discharge from the Overshot Dam is Licenced Discharge Point LDP1 within EPL 765 (monitoring point 11). LDP1 discharged water off-site during all months of the reporting period.

3.3 Surface Water

Baal Bone has engaged ALS Group Environmental Division Mudgee, a NATA Accredited laboratory, to undertake monthly sampling, monitoring and analysis of a range of surface and subsurface waters.

EPL No. 765 currently contains three licensed monitoring points in relation to surface water and groundwater management The EPL licensed monitoring points are provided in the **Table 14** below. The location of monitoring points can be seen **in Drawing 1**.

Table 14: EPL Licenced Monitoring Points

EPA Identification No.	Type of Monitoring Point	Description of Location
2	Discharge water quality monitoring	Sewage Transpiration Bed labelled as 'LD2'
11	Discharge to waters	Ben Bullen Creek downstream of active surface mining area, labelled as 'LDP1'
12	Upstream quality monitoring	Ben Bullen Creek upstream of active surface mining area, labelled as 'WMP1'

A copy of EPL 765 can be accessed here: www.epa.nsw.gov.au/prpoeoapp

A description of discharge and monitoring sites, analyses conducted, frequency of sampling and concentration limits (where applicable) are shown below. EPL Monitoring Points are highlighted in yellow.

Table 15: Baal Bone Colliery water monitoring locations and monthly analysis during 2015

Sample Name	Sample Location	Frequency	Pollutants Analysed	EPL Limits Apply
BBLD2	EPL Monitoring Pt No.2. In sump at discharge from STP maturation pond to transpiration bed area	Monthly during discharge	Oil & grease, TSS, pH, BOD, faecal coliforms, nitrogen, phosphorus	Not specified
BBLDP1	EPL Monitoring Pt No.11 Immediately below the pipe outlet or in stilling pool below spillway of overshoot dam	Monthly during discharge	EC, oil & grease, sulphate, iron, TSS, pH, flow rate, hardness, MBAS, nitrogen, phosphorus	Oil & grease, pH, total iron, TSS
BBWMP1	EPL Monitoring Pt No. 12 Pool within Ben Bullen creek upstream of active surface mining area	Monthly (during flow)	EC, oil & grease, sulphate, iron, TSS, pH, flow rate, hardness, nitrogen, phosphorus	Not specified
BBPOT	Potable water from main kitchen in Administration	Monthly	pH, EC, Hardness, heterotrophic standard plate count, total coliforms, E coli, Pseudomonas	N/A

Sample Name	Sample Location	Frequency	Pollutants Analysed	EPL Limits Apply
BBREAS	Spring on Ben Bullen Creek	Monthly (during flow)	EC, iron, oil & grease, pH, sulphate, nitrogen, phosphorous, and TSS	
BBDW	Dirty water dam	Monthly	EC, Iron, oil & grease, pH, Sulphate, TSS	N/A
BBPRW	Process water dam	Monthly	EC, Iron, oil & grease, pH, Sulphate, TSS	N/A
BBSTP1	STP Maturation Pond No 1 Note: Only sampled if water levels in STP2 are too low.	Monthly	pH, BOD, Faecal coliforms, nitrogen, phosphorus	N/A
BBSTP2	STP Maturation Pond No 2	Monthly	pH, BOD, Faecal coliforms, nitrogen, phosphorus	N/A
BBBC	Box cut sump	Monthly	pH, EC, iron, sulphates	N/A
BBBBC Mid	Ben Bullen Creek mid-way through site	Monthly (during flow)	Flow rate, pH, EC, TSS, iron, sulphates, oil & grease, nitrogen, phosphorus	N/A
BBLT	'Lake Tegan'	Monthly	EC, iron, oil & grease, pH, sulphate, nitrogen, phosphorous, and TSS	N/A
BBJC2	Jews Creek upstream of mining operations, but below dewatering bore discharges	Monthly (during flow)	Flow rate, pH, EC, TSS, iron, sulphates, oil & grease, nitrogen, phosphorus	N/A
BBJCH	Jews Creek headwaters upstream of all mining operations and mine dewatering discharges	Monthly (during flow)	Flow rate, pH, EC, TSS, iron, sulphates, hardness, oil & grease, nitrogen, phosphorus	N/A
BBCR	Cox's River	Monthly (during flow)	Flow rate, pH, EC, TSS, iron, sulphates, oil & grease, nitrogen, phosphorus, Hardness	N/A

3.3.1 Interpretation and Review of Monitoring Results

Condition L2 of EPL 765 outlines water concentration limits for oil and grease, pH, total suspended solids and total iron. These limits are presented below:

Table 16: EPL concentration limits

Pollutant	LD2 (EPL Monitoring Point 2)	LDP1 (EPL Monitoring Point 11)	WMP1 (EPL Monitoring Point 12)
Oil and grease (mg/L)	-	10	-
pH	-	6.5-8.5	-
Total Suspended Solids (mg/L)	-	50	-
Iron (dissolved) (mg/L)	-	1.0	-

Monitoring results for Baal Bone's three monitoring points as required by EPL 765 are discussed in **Table 17**, and **Figure 6-9**. Samples were taken monthly during discharge in accordance with the EPL.

Table 17: 2015 concentration levels recorded for EPA licensed discharge points as required by EPL 765.

EPL Point	Month	Pollutant									
		EC uS/cm	O&G mg/L	SO^{2-}_4 mg/L	Fe mg/L	TSS mg/L	pH	BOD mg/L	Faecal Coliforms cos/100ml	N mg/L	P mg/L
LD2	Jan	Sample not required	*Dry*	Sample not required		*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Feb		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Mar		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Apr		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	May		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	June		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	July		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Aug		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Sep		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Oct		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Nov		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
	Dec		*Dry*			*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*
LDP1	Jan	735	<1	224	0.21	6	7.2	Sample not required			
	Feb	1070	<1	260	<0.05	4	8.0				
	Mar	1170	<1	275	<0.05	2	8.1				
	Apr	1180	<1	313	<0.05	2	8.1				
	May	1150	<1	292	0.07	<1	8.1				
	June	1180	<1	278	<0.05	1	8.0				
	July	1180	<1	294	<0.05	2	8.1				
	Aug	1120	<1	301	0.06	2	8.2				
	Sep	1240	<1	314	<0.05	<1	8.0				

EPL Point	Month	Pollutant									
		EC uS/cm	O&G mg/L	SO^{2-4} mg/L	Fe mg/L	TSS mg/L	pH	BOD mg/L	Faecal Coliforms cos/100ml	N mg/L	P mg/L
	Oct	1150	<1	290	<0.05	2	8.1				
	Nov	1140	<1	274	<0.05	11	8.1				
	Dec	1120	<1	339	<0.05	4	8.1				
WMP1	Jan	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	Sample not required			
	Feb	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	Mar	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	Apr	*No Access*									
	May	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	June	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	July	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	Aug	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	Sep	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	Oct	*No Access*									
	Nov	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				
	Dec	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*	*Dry*				

Legend

BOD = Biological oxygen demand
EC = Electrical conductivity
Fe = Iron (dissolved)
N = Nitrogen
O & G = Oil and Grease
P = Phosphorus
SO^{2-} = Sulphate
TSS = Total suspended solids

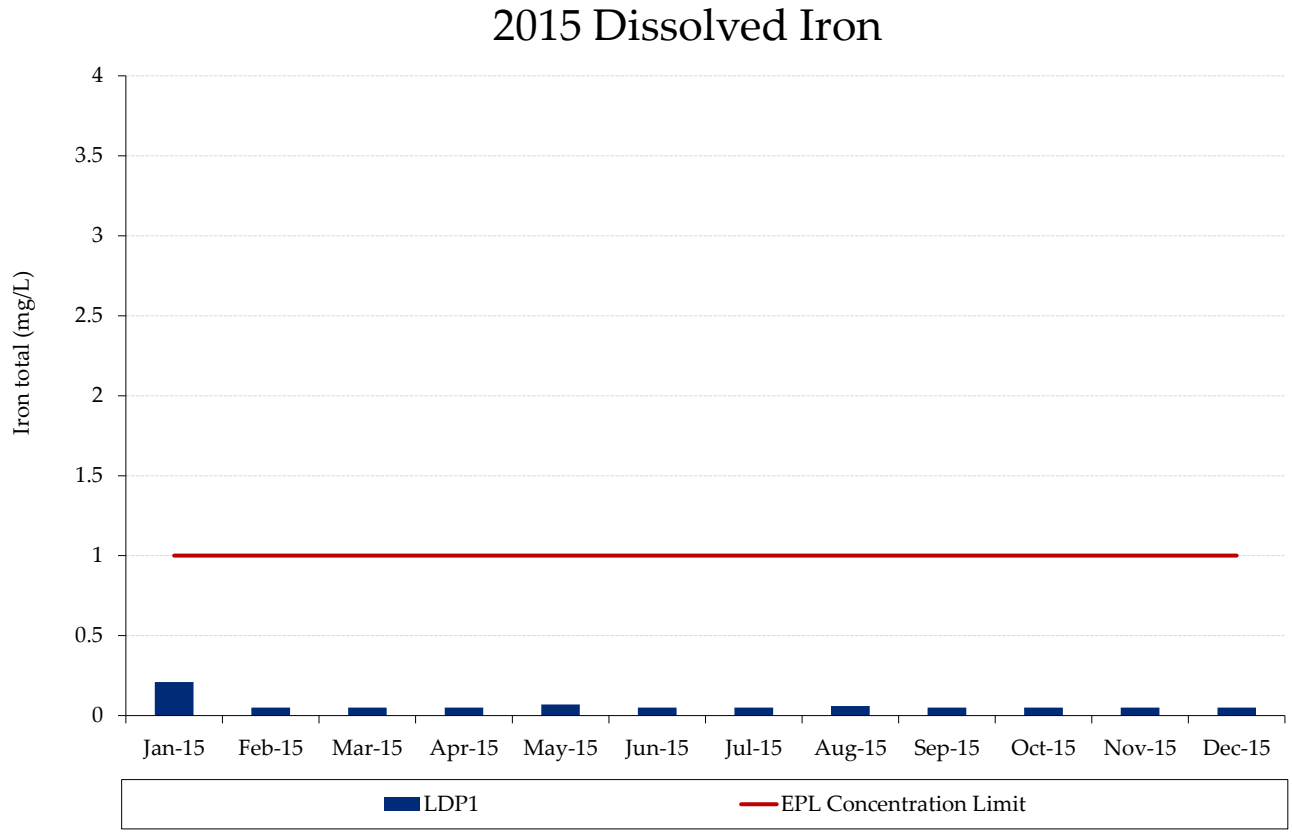


Figure 6: Dissolved Iron

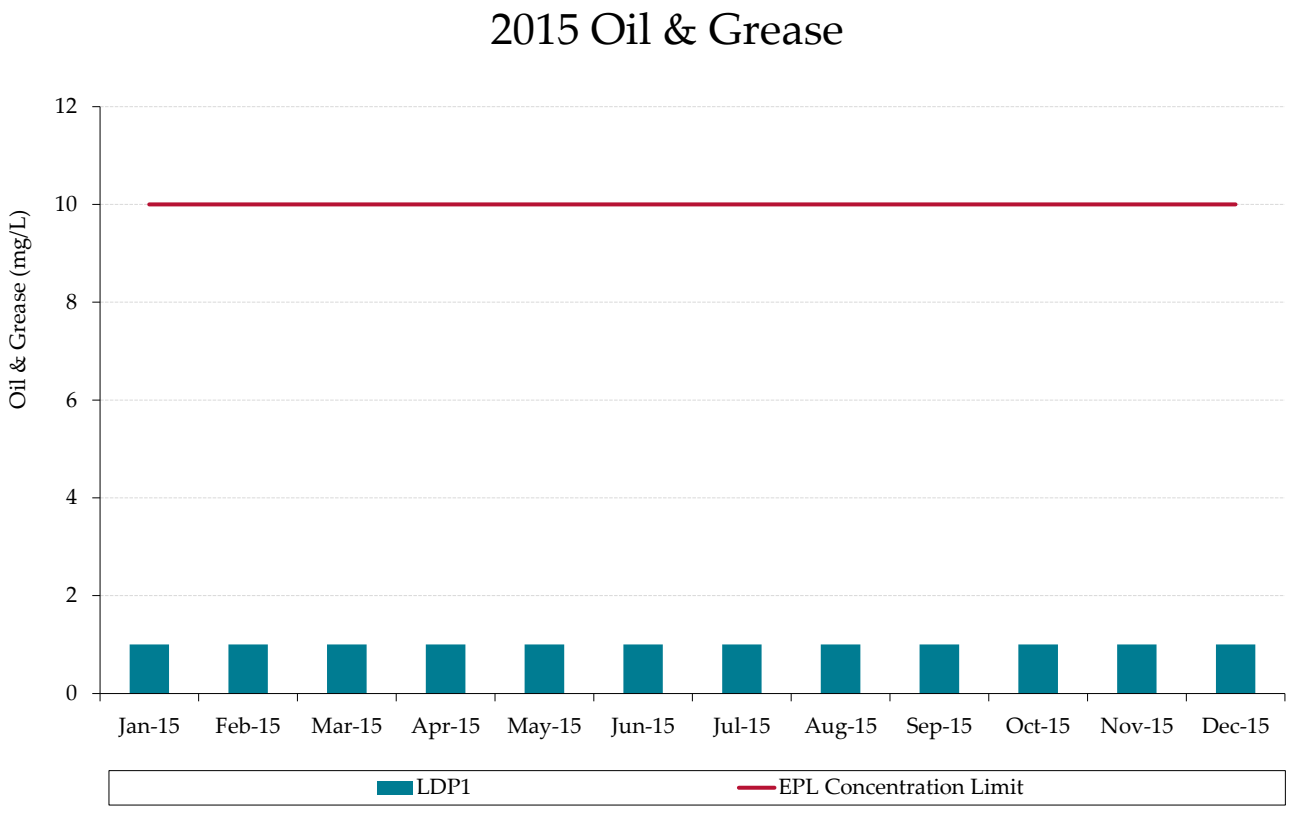


Figure 7: Oil & Grease

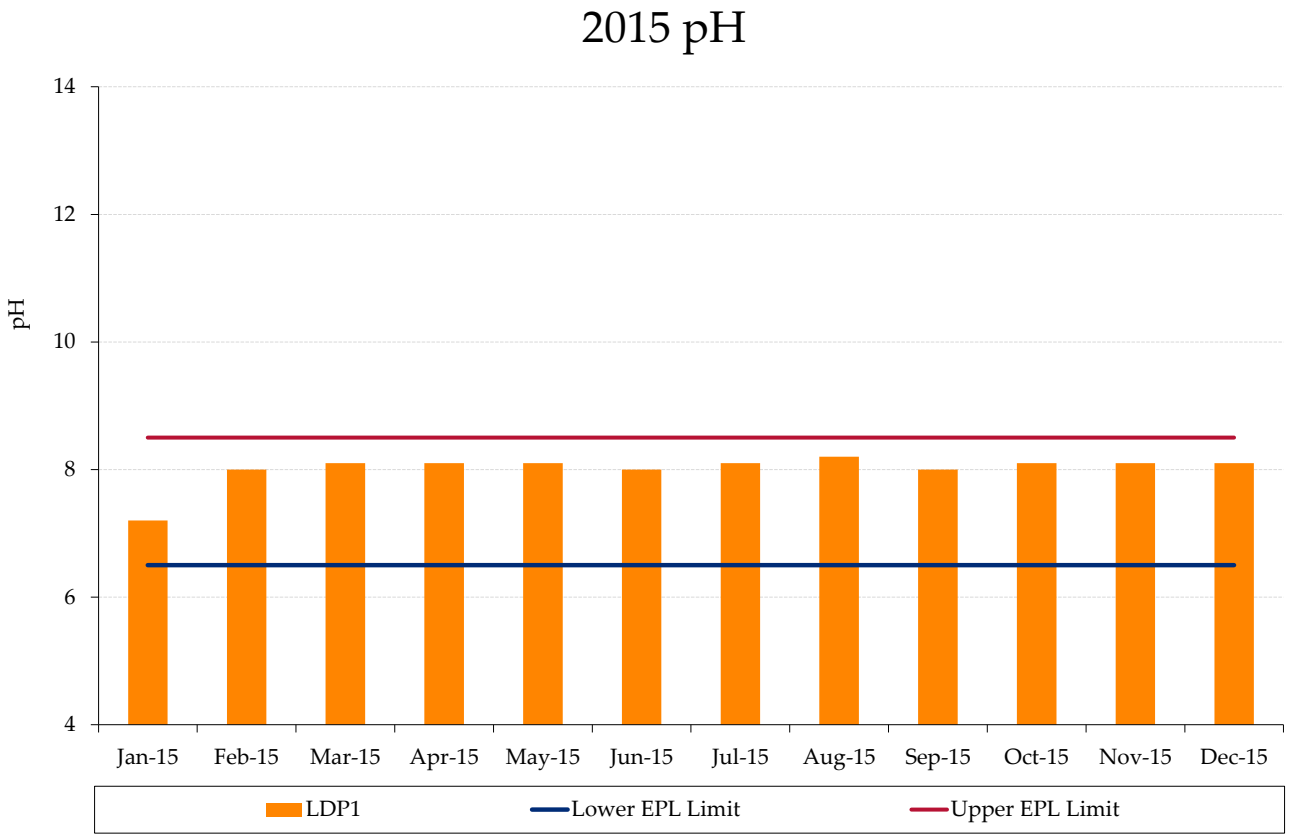


Figure 8: pH

Figure 9: Total Suspended Solids

All samples recorded were within EPL concentration limits during the 2015 reporting period.

A summary of monitoring results for EPL discharge and monitoring points (those with specified concentration limits) can be found below:

- All dissolved iron samples for 2015 were well below the concentration limit of 1 mg/L, with the highest reading of 0.21 mg/L returned in January 2015.
- All oil and grease returned levels of 1 mg/L or less, well below the EPL concentration limit of 10 mg/L.
- All samples returned pH results that were within the upper and lower EPL limits (8.5 and 6.5 respectively).
- All monthly TSS results were below the EPL concentration limit of 50 mg/L, with the highest reading of 11mg/L returned in November 2015.

Monthly EPL reporting can be accessed here: http://www.glencore.com.au/EN/who-we-are/baal-bone/Pages/epl-reporting.aspx.

3.3.2 Comparison against previous Annual Reviews

A summary of water quality results from previous Annual Reviews is provided below.

Table 17: Water quality results 2006 - 2015

Annual Review Year	Iron	Oil and Grease	pH	TSS
2006	One minor exceedance at LDP1.	Compliant	Compliant	Compliant
2007	One erroneous exceedance at LDP1 of 5.4mg/L in August 2007 – retesting showed compliant level of 0.9mg/L	Compliant	Compliant	One erroneous exceedance at LDP1 of 266mg/L in August 2007 – retesting showed compliant level of 25mg/L
2008	Compliant	Compliant	Compliant	Compliant
2009	Compliant	Compliant	Compliant	Compliant
2010	1 exceedance at LDP1 of 2mg/L in February 2010.	Compliant	Compliant	Compliant
2011	2 exceedances at LD6 in April and October and 1 exceedance at LDP1 in June 2011 of 1.2, 1.2 and 3mg/L respectively.	Compliant	Compliant	Compliant
2012	1 exceedance at LD6 of 2mg/L in September 2012.	Compliant	Compliant	Compliant
2013	Compliant	Compliant	Compliant	Two Total Suspended Solids (TSS) exceedances at LDP3 (60mg/L) and LDP6 (85mg/L) in February
2014	Total iron recorded in Jan 2014 was 1.11mg/L. However note that EPL limit is for *dissolved iron*. Sampling	Compliant	Compliant	Compliant

	routine changed to include dissolved iron.			
2015	Compliant	Compliant	Compliant	Compliant

Occasional exceedances of iron have been recorded in 2006, 2010, 2011, 2012 and 2014. Following further investigations, no apparent relation to mining operations was identified. Furthermore the EPL limit of 1mg/L is for Dissolved Iron, and the exceedences reported in previous years were Total Iron results. Monitoring was amended during 2014 to include dissolved iron at EPL monitoring points.

Figures 10 – 13 illustrate the long term trends for dissolved iron, oil and grease, pH and total suspended solids during the period 2011 to 2015 at current EPL monitoring points. Note that there has been no flow recorded at WMP1 during the period 2011-2015. Furthermore EPL monitoring points LD3 and LD6 were removed in 2013.

Figure 10 shows the iron level recorded at LDP1 from 2011 to 2015. From 1 August 2013 EPL 765 specifies a *dissolved* iron concentration limit of 10 mg/L at LDP1. Prior to this time, the iron concentration limit at LDP1 was 10 mg/L of *total* iron. Between 2011 and 2015 there has been one exceedance of the EPL iron concentration limit– in June 2011 with a reading of 3mg/L. An investigation which included follow up testing of LDP1, and examination of water transfers could find no definitive reason for the isolated spike in iron levels.

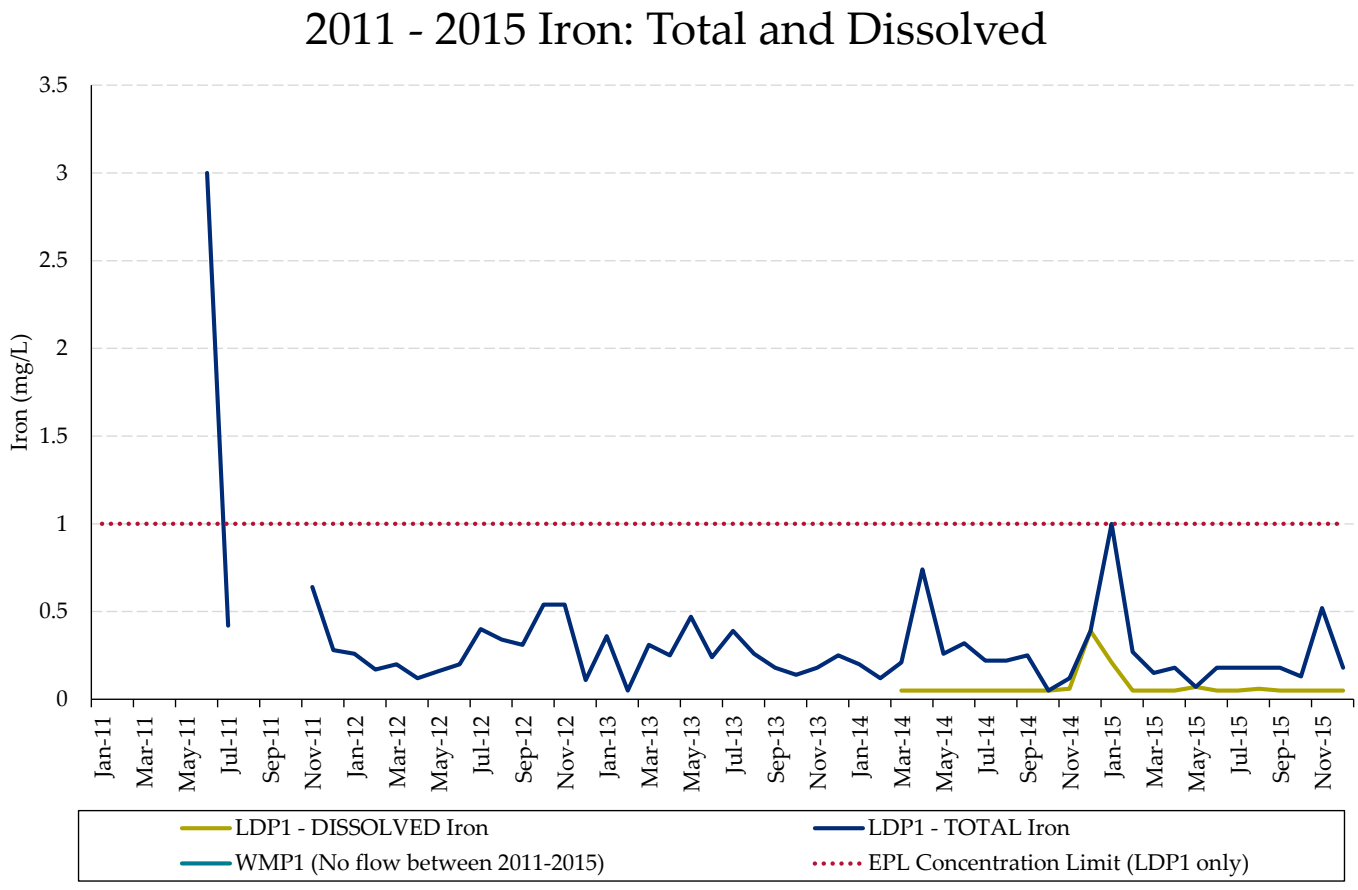


Figure 10: 2011 – 2015 Iron – Total and Dissolved.

Figure 11 shows oil and grease levels from 2011 to 2015 at LD2 and LDP1. All oil and grease levels at LDP1 during 2011 - 2015 have remained well below the EPL limit of 10 mg/L. From January 2014 onwards the limit of reporting value is < 1. Prior to January 2014, the limit of reporting was < 2, hence the step chance in reported oil and grease levels.

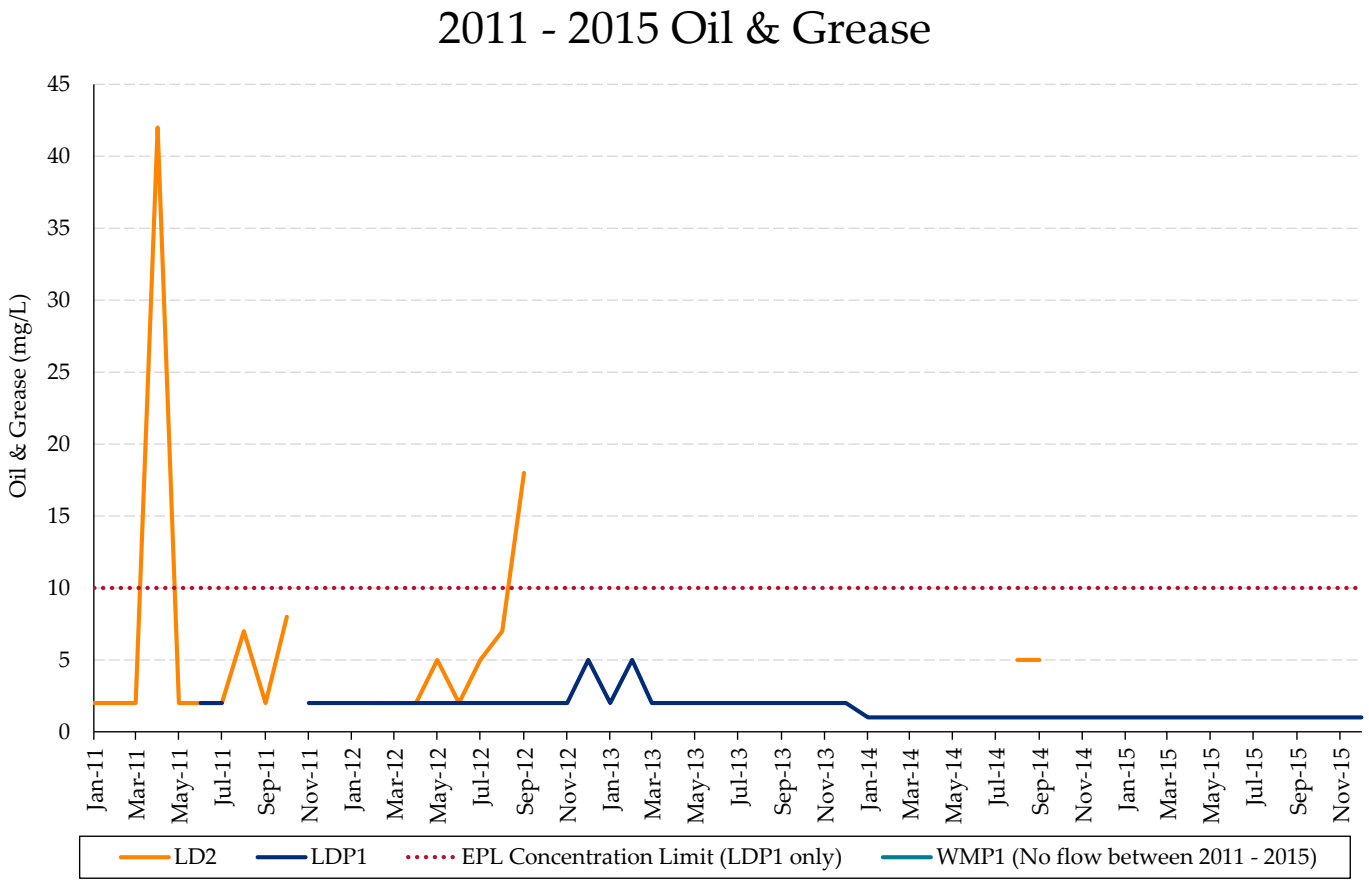


Figure 11: Oil and grease levels from 2011 to 2015

Figure 12 shows pH levels at LDP1 and LD2 between 2011 and 2015. All LDP1 pH levels during the reporting period were between the upper and lower EPL pH limits. 2012, 2013 and 2015 saw a decline in pH levels at LDP1 in the summer months – possibly due to seasonal changes.

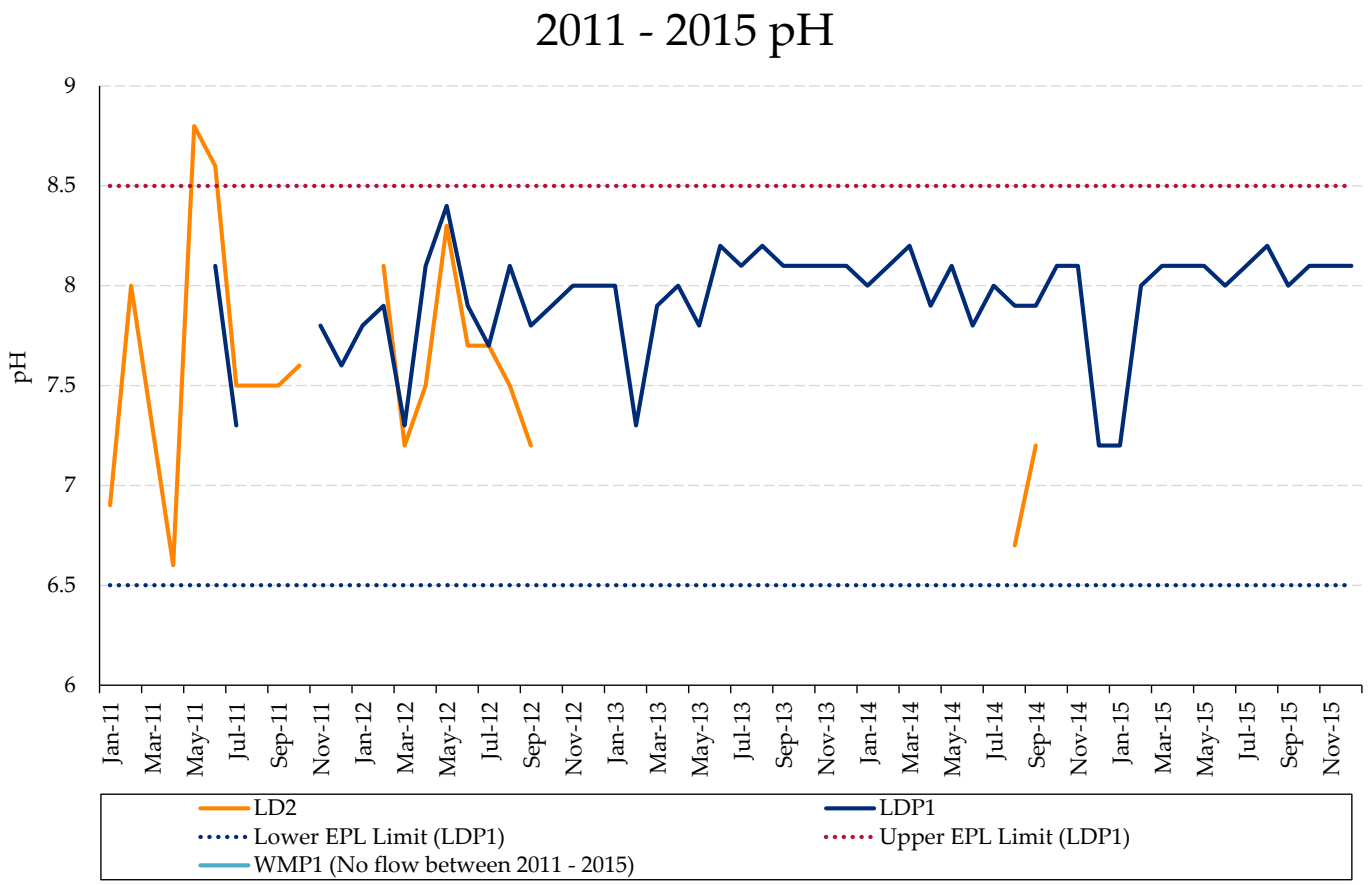


Figure 12: pH levels from 2011 to 2015

Figure 13 shows the total suspended solids at LDP1 and LD2 between 2011 and 2015. All results recorded for LDP1 are well below the EPL concentration limit of 50mg/L. 2013, 2014 and 2015 saw a slight increase in TSS levels at LDP1 during November/December –possibly due to seasonal changes.

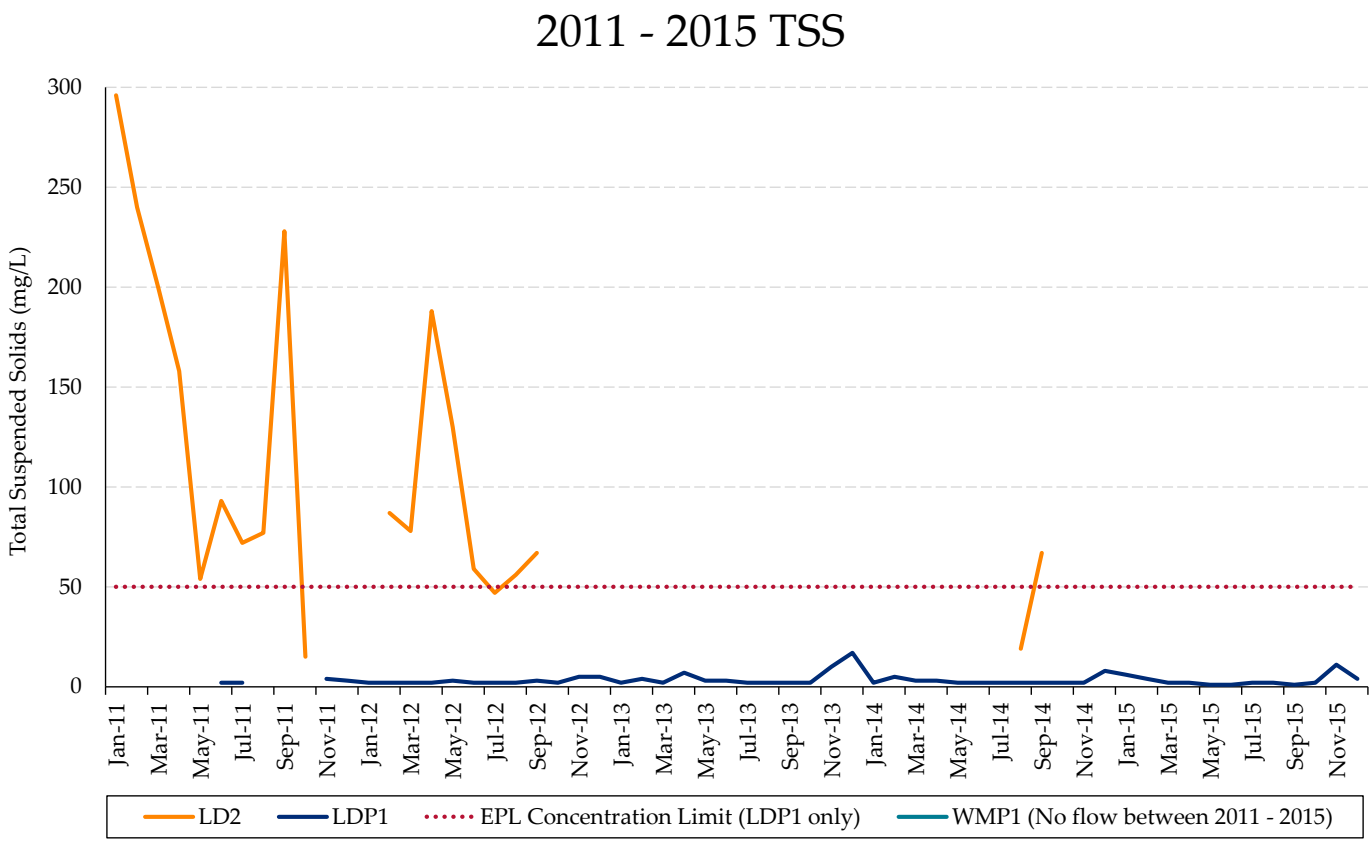


Figure 15: Total suspended solids levels from 2011 to 2015.

3.3.2 Comparison against EA

The EA reported that, based on past monitoring results for EPL discharge and monitoring points, that water quality was expected to continue to be within the EPL limits during extraction of Longwalls 29-31. This prediction is supported by the results presented in this and past Annual Reviews.

3.4 Groundwater

Baal Bone Colliery currently has three mine dewatering bores, two groundwater supply bores and four shallow piezometer monitoring bores licenced with NSW Office of Water; these are summarised in Table 18.

Water quality for the three dewatering boreholes was monitored by ALS on a monthly basis in conjunction with the surface water monitoring program up until July 2013 as described above in **Section 3.3.**

After the relinquishment of LDP3 and LDP6 in July 2013, the north and south de-watering borehole sites were no longer able to be sampled and were removed from the monthly sampling schedule. The two groundwater supply bores WAL27887 (80BK136703 and 80BL135509) are not currently used and samples are therefore not available for testing.

Table 18: Licensed bores and piezometers*

Licence Number	Expiry Date	Location / Use
WAL 27887 (80BL136703)	Perpetuity	CHPP water make-up bore near UC1 (not used during reporting period)
WAL 27887 (80BL135509)		Borehole No. 6 near Rail Loop; previously used for dust suppression (low yielding; no longer used)
80BL236132	Perpetuity	Mine dewatering Longwall 1 (South Bore 1)
80BL236134	Perpetuity	Mine dewatering Longwall 1 (South Bore 2)
80BL239077	18/06/2016	Mine dewatering Longwall 19 (North Bore)
10BL601877	Perpetuity	BBN175; LW 29-31 groundwater monitoring piezometer. This piezometer is known as **BBPB1**, and monitors the sandstone aquifer north of the Coxs River Swamp.
10BL601816	Perpetuity	BBN176; LW 29-31 groundwater monitoring piezometer This piezometer is known as **BBPB2**, and monitors the sandstone aquifer north of the Coxs River Swamp
10BL601817	Perpetuity	BBN177; LW 29-31 groundwater monitoring piezometer This piezometer is known as **BBPB3**, and monitors the sandstone aquifer on the eastern side of the Coxs River Swamp
10BL601970	Perpetuity	BBN 179; LW 29-31 groundwater monitoring piezometer This piezometer is known as **BBPB4**, and monitors the sandstone aquifer on the western side of the Coxs River Swamp

* In addition to the four piezometers licensed with NOW (**BBPB1-4**), Baal Bone has two other monitoring piezometers (**BBPB5 and BBPB 6**) which due to the shallowness of the bores do not require licence with NOW.

The six groundwater monitoring piezometers were installed and equipped with data loggers in 2007 to gather background data and to monitor subsidence effects on local groundwater regimes as part of the SMP for Longwalls 29-31.

Data loggers in the piezometers have been monitored on a regular basis to gather data regarding groundwater level fluctuations in the vicinity of the Coxs River Swamp before, during and after mining Longwalls 29-31. Baseline data obtained prior to commencement of mining confirms a strong correlation between groundwater levels and prevailing climatic conditions, in particular a strong relationship to rainfall which is a major source of recharge.

Monitoring data in the six piezometers (four aquifer and two swamp/alluvial) are presented in **Figure 16** to **Figure 22**. Piezometers BBPB1-BBPB4 monitor groundwater levels and chemistry in the deeper sandstone aquifer, while piezometers BBPB5 and BBPB6 monitor groundwater levels and chemistry in the shallower Coxs River Swamp.

Baal Bone's Surface and Groundwater Response Strategy includes a Trigger, Action, and Response Plan (TARP), which includes triggers for assessing changes to groundwater levels. Additionally, there is a Determination of Groundwater Quality TARP Trigger Values document prepared by Aurecon in May 2009 for the Longwall 29-31 area which presents trigger levels for a number of water chemistry parameters. The TARPs are used as a measure of impacts to groundwater levels and quality in both the deep sandstone and shallower swamp groundwater aquifers. The TARP trigger levels are presented below. Response and rehabilitation methodologies have also been included.

Table 19: Combined groundwater TARP trigger levels for groundwater and water quality

GROUNDWATER LEVEL TRIGGERS, ACTIONS AND MANAGEMENT RESPONSE		
NIL or MINOR IMPACT - Ongoing monitoring – normal hydrogeological conditions – no additional response required	**MODERATE IMPACT - Abnormal or anomalous condition – management options**	**MAJOR IMPACT - Continuing or worsening anomalous condition – management and/or engineering options**
Aquifer Groundwater		
No significant change in groundwater level/quality (groundwater level change <2 metre) or measured variation is within the normal range and shows normal response to climatic conditions.	Groundwater level/quality shows anomalous trend (groundwater level change >2 metre over a period of 6 months) or is not in line with the normal range or expected response to climatic conditions	Anomalous trend continues or worsens (groundwater level change >10 metres over a period of 6 months) and is well outside the normal level range or not in line with the expected response to climatic conditions
	Management response	**Engineering response**
	Field inspection, additional and/or more frequent monitoring, review by hydrogeologist and other expert consultants as required. Notification under Condition 18 of SMP Approval.	Engineering solutions only required if anomalous trends are noted in the swamp as well – see below
Swamp Groundwater		
No significant change in groundwater level/quality (groundwater level change 0.5 metre) or measured variation is within the normal range and shows normal response to climatic conditions.	Groundwater level/quality shows anomalous trend (groundwater level change >0.5 metre over a period of 6 months) or is not in line with the normal range or expected response to climatic conditions	Anomalous trend continues or worsens (groundwater level change >2 metres over a period of 6 months) and is well outside the normal level range or not in line with the expected response to climatic conditions, loss of some swamp vegetation
	Management response	**Engineering response**
	Field inspection, additional and/or more frequent monitoring, review by hydrogeologist and	Water diversion into swamp, consider other engineering solutions if condition is due to

	other expert consultants as required. Notification under Condition 18 of SMP Approval.	unexpected subsidence damage – see below

GROUNDWATER QUALITY MINOR CHANGES OR IMPACTS		
Element	**Long-term changes 50th percentile ≤ baseline 80th**	**Minor Change Criteria (>95th Percentile)**
pH*	decrease of 0.35 from 5.9 units	< 4.6 for ≤ 2 consecutive months (less than 5th Percentile)
Conductivity	increase of 230from 300 uS/cm*	>300 uS/cm for ≤ 2 consecutive months
Copper	increase of 0.011 from 0.013mg/L	>0.041 mg/L for ≤ 2 consecutive months
Iron	increase of 6.6 from 12 mg/L	>15.25 mg/L for ≤ 2 consecutive months
Zinc	increase of 0.054 from 0.089 mg/L	>0.143 mg/L for ≤ 2 consecutive months

GROUNDWATER QUALITY MODERATE IMPACTS = THE RANGE BETWEEN MINOR AND MAJOR TRIGGER LEVELS	
Element	**Short term for > 2 consecutive months (Moderate Impacts)**
pH*	pH < 4.6
Conductivity	EC > 300 µS/cm
Copper	Cu > 0.041 mg/L
Iron	Fe > 15.25 mg/L
Zinc	Zn > 0.143 mg/L

GROUNDWATER QUALITY MAJOR CHANGES OR IMPACTS				
Element	**Pre-mining Maximum**	**Major Change Criteria (80th Percentile Baseline + 2 standard deviations)**	**All Bore 80th percentile baseline**	**BBP4 80th Baseline**
pH	4.6 (minimum)	< 4.2 for > 2 consecutive months	5.1*	5.9*
Conductivity	45 uS/cm	>300 uS/cm for > 2 consecutive months	100	90
Copper	0.061 mg/L	>0.043 mg/L for > 2 consecutive months	0.013	0.002
Iron	20.0 mg/L	>24.28 mg/L for > 2 consecutive months	12.0	12.0
Zinc	0.150 mg/L	>0.175 mg/L for > 2 consecutive months	0.089	0.026

GROUNDWATER QUALITY LONG TERM IMPACTS = THE RANGE BETWEEN MINOR AND MAJOR TRIGGER LEVELS		
Post-mining analytes – 50th percentile < 80th percentile pre-mining	Post-mining analytes – 50th percentile > 80th percentile pre-mining for 2 months or less – see above for response	Post-mining analytes – 50th percentile > 80th percentile pre-mining for 2 months or less – see above for response

The water quality trigger values are in three parts, which are:

- Minor Changes
  - Long term minor changes; For each element the 50th percentile ≤ baseline 80th percentile
  - Short term minor changes Greater than the 95th percentile trigger value for < 2 months
- Major Changes
  - Exceed the baseline 80th percentile by 2 standard deviations for > 2 months

3.4.1 Groundwater Levels

Groundwater levels in the six groundwater monitoring piezometers during 2015 are presented in **Figure 16.** Long term trends of groundwater levels are shown in **Figure 17**.

Normally, piezometers BBPB2, BBPB3, and BBPB4 display the greatest variation, as they are located outside the swamp and predominately influenced by rainfall. This trend has continued in the available data. These three piezometers all responded to the heavy rainfall in mid-April 2015, and have mainly shown declining trends since then, due to the drying conditions. The declining trends were slightly reversed by a minor rise in groundwater level in response to good rain in December 2015.

The north – to – south downstream groundwater gradient has been broadly maintained over the current period (highest level observed in BBPB1 and lowest level observed in BBPB4), indicating that an overall flow has been maintained down through the swamp.

The rainfall deficit curve plots the cumulative difference between observed monthly rainfall and the long-term average. From mid-2014 to mid-2015, it tracked sideways, with noisy data, at values of -150 – -300 mm. From May 2015 it has been mainly trending steadily downward, into increased deficit, due to sustained dry conditions. Good rain in December 2015 briefly reversed the trend of increasing deficit, and it was approximately -350 mm by the end of the period, near the lowest level observed in the data set.

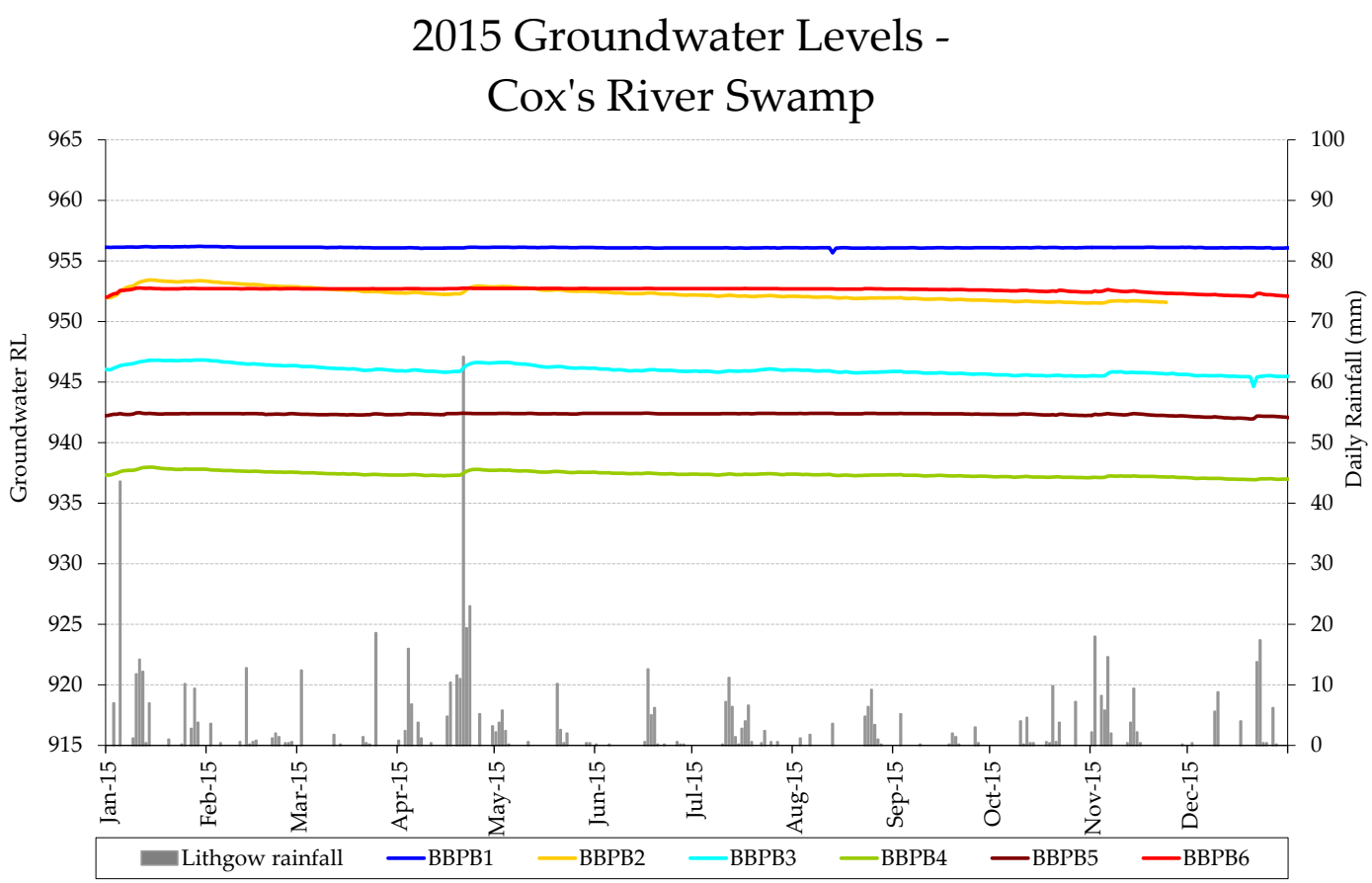


Figure 16: Groundwater levels 2015

3.4.1.1 Comparison against Previous Annual Reviews

Most groundwater levels appear to be approximately at or above pre-mining levels. The only exception is at piezometer BBPB1, where groundwater level has stabilised at RL 956 m (approximately 5 m below pre-mining level).

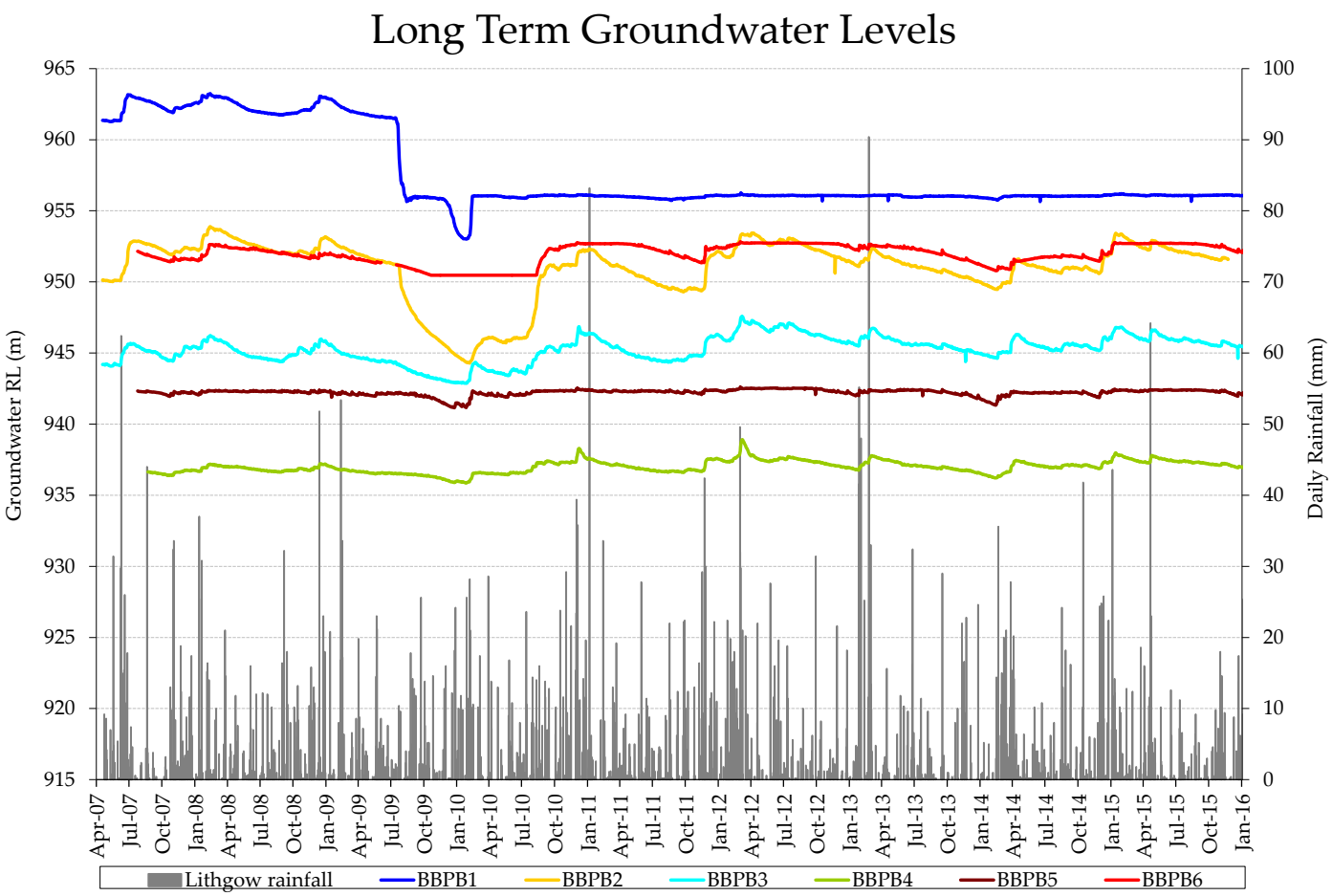


Figure 17: Longterm groundwater trends

3.4.1.2 Comparison against EA

The EA concluded that the likelihood of extraction of Longwalls 29-31 resulting in a significant impact on the Coxs River Swamp is considered extremely low.

All groundwater levels appear to be approximately at (or above) pre-mining levels, with the only exception being BBPB1, where groundwater has re-stabilised at RL956 (approximately 5 metres below pre-mining level). BBPB1 has shown a stable groundwater level since February 2010. There is obviously still some influence from the fault zone at this site as the groundwater level is below pre-mining levels. The fault zone lies between the BBPB1 and the swamp, so there is unlikely to be any hydraulic connection between the zone of depleted groundwater and the swamp. The groundwater level at BBPB1 is still higher than the groundwater level in the swamp so that even if there is a connection across the fault, groundwater flow would still be towards the swamp.

Over the long-term, an emerging trend shows that groundwater levels in BBPB2, BBPB3 and BBPB4 all appear to correlate well with the overall cumulative rainfall deficit (difference between the monthly rainfall and the long-term average). The other remaining piezometers (BBPB5 and BBPB6), all appear resistant to short-term weather variances, due to the location of BBPB5 and BBPB6 in the centre of the swamp, which always remains saturated.

Also refer to **Section 3.4.2.2.**

3.4.2 Groundwater Chemistry

Groundwater chemistry monitoring results for the reporting period are provided below in Figure 18 to Figure 22.

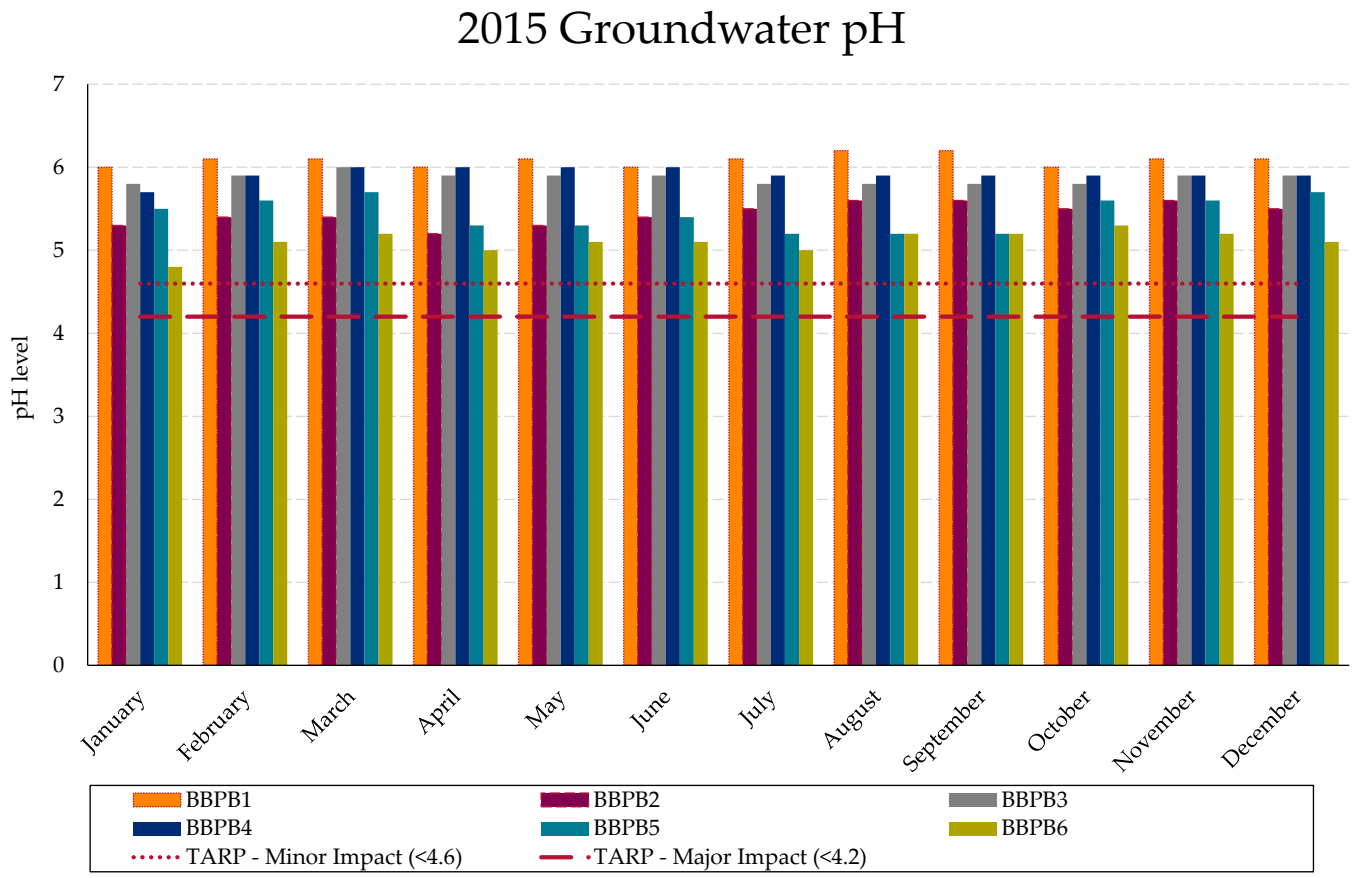


Figure 18: 2015 Groundwater pH levels.

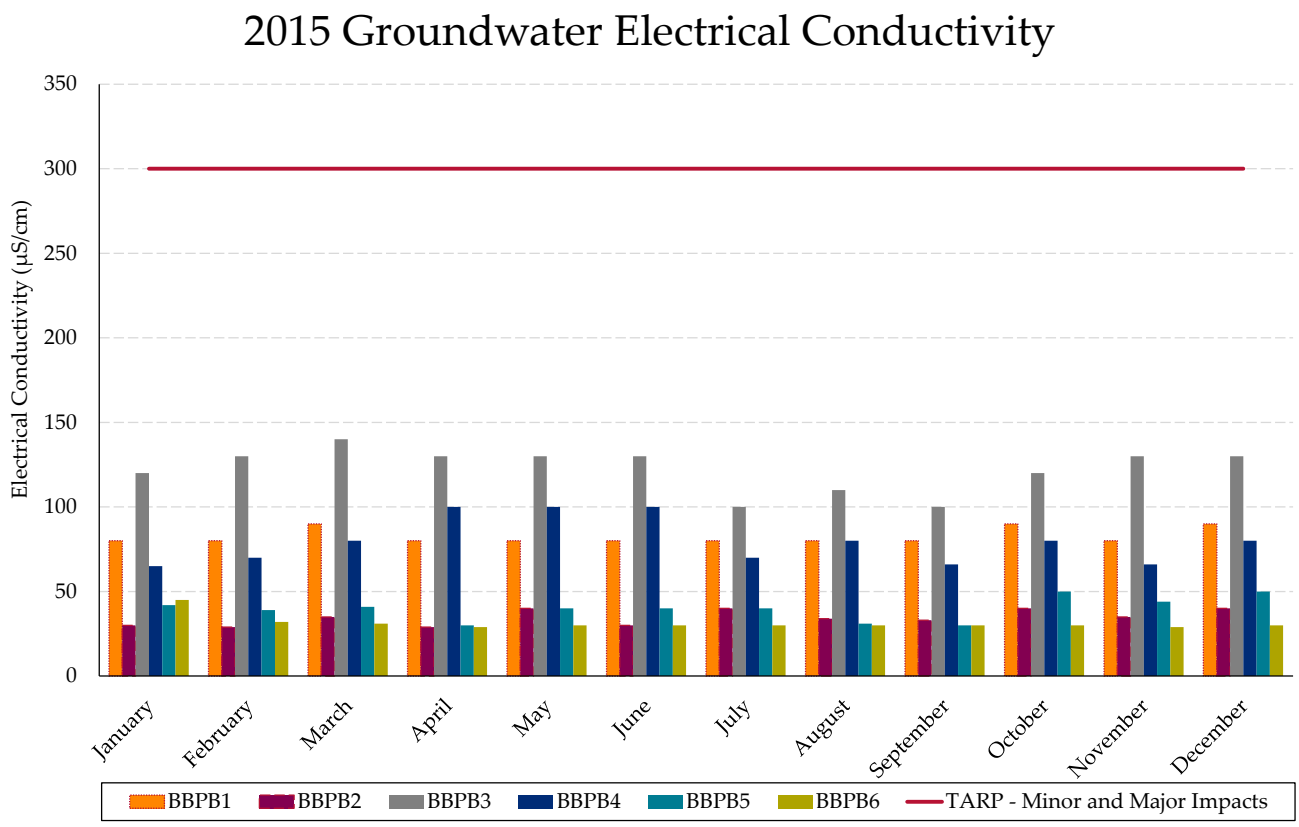


Figure 19: 2015 Groundwater Electrical Conductivity.

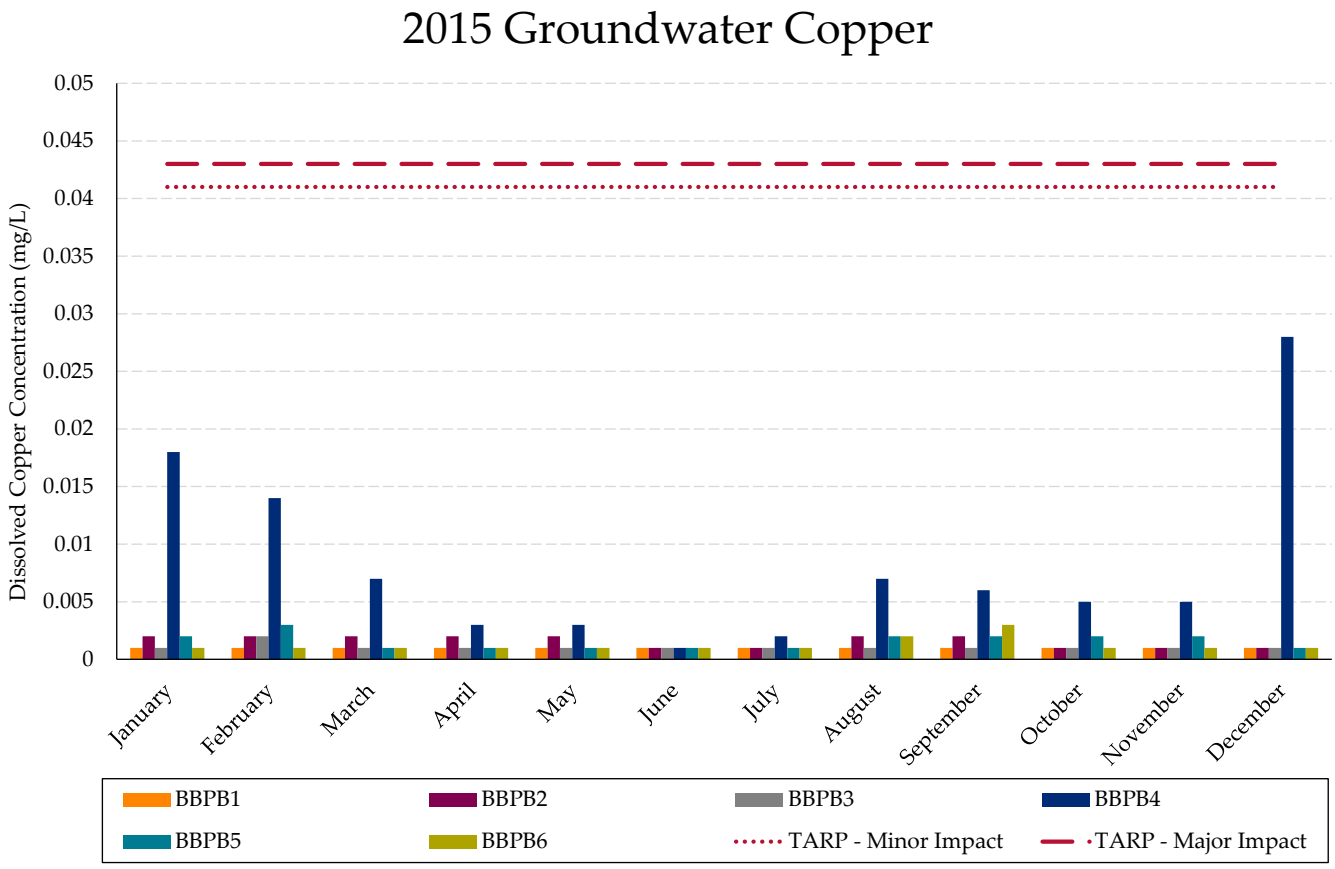


Figure 20: 2015 Groundwater copper levels.

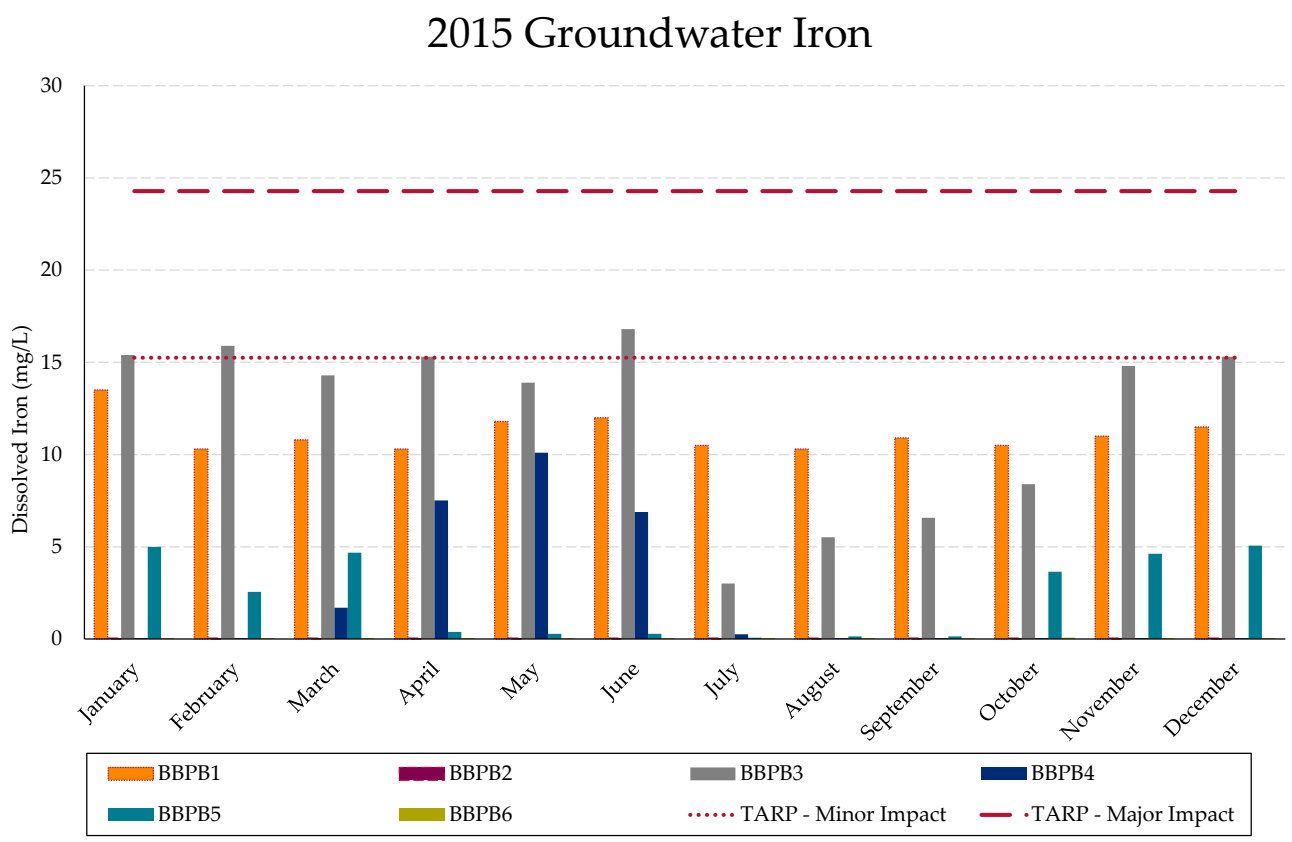


Figure 21: 2015 Groundwater Iron levels.

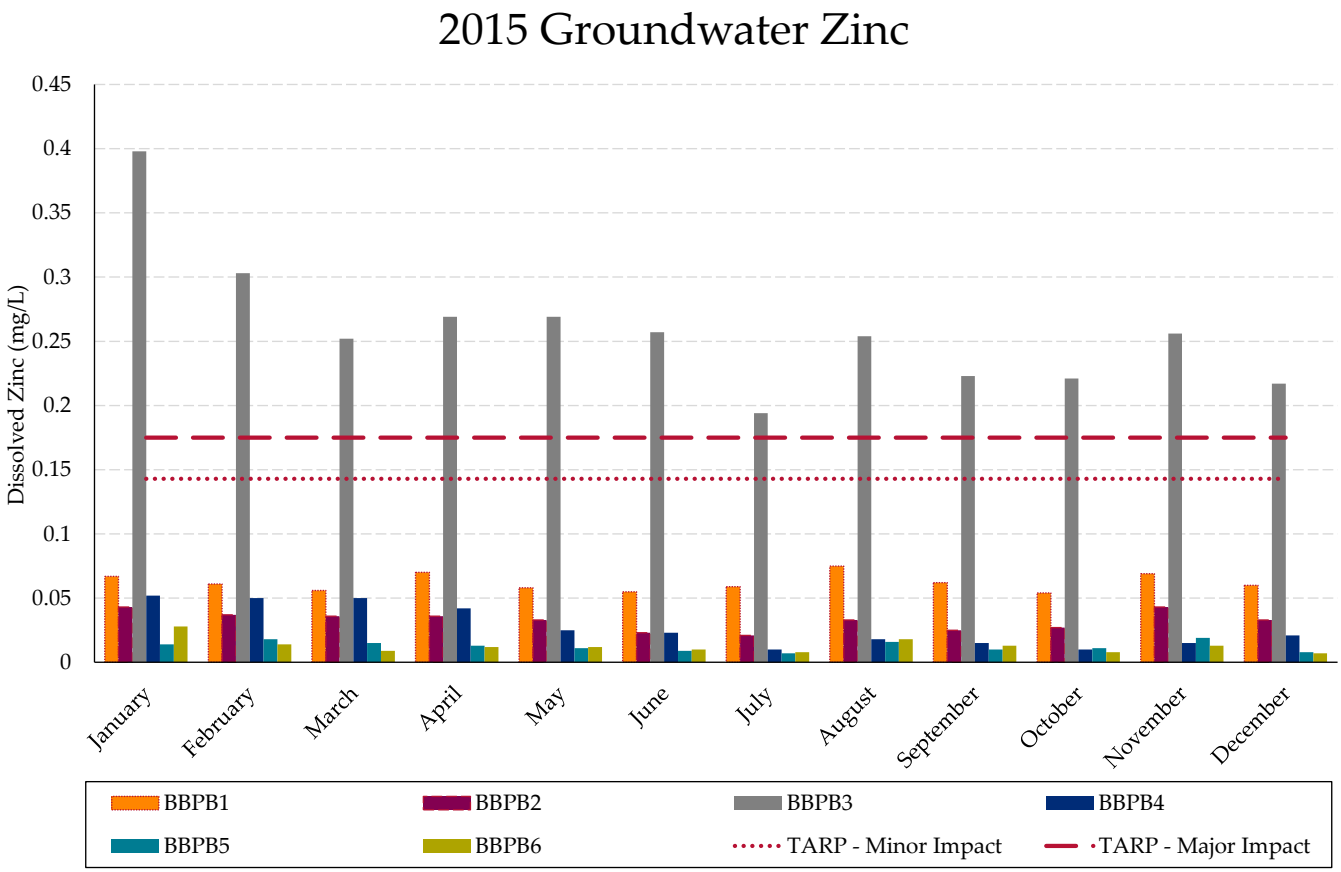


Figure 22: 2015 Groundwater Zinc Levels.

As shown in **Figure 18, Figure 19** and **Figure 20** above: pH, electrical conductivity and copper levels were within both the minor and major impact criteria for all groundwater monitoring bores during 2015.

As shown above in **Figure 21**, 2015 iron levels were below the minor impact trigger level for all groundwater monitoring wells with the exception of BBPB3. In a number of months during 2015 (Jan, Feb, Apr, Jun and Dec), BBPB3 marginally exceeded the minor impact trigger level. Due to the short nature of these exceedances (≤ 2 consecutive months) this constitutes a minor impact with no response required.

As shown above in **Figure 22**, 2015 zinc levels were below the minor impact trigger level for all groundwater monitoring wells with the exception of BBPB3. BBPB3 exceeded the minor and major impact TARP trigger levels during all months in 2015. This major impact TARP event has continued since August 2012. Note that mining in longwalls 29-31 ceased in September 2011.

In 2012 Baal Bone Colliery commissioned a report by Aurecon which investigated groundwater quality and the TARP trigger levels:
Groundwater Level and Water Quality Changes compared to TARP Trigger Values in and around the Coxs River Swamp from 2009 to 2011 for SMP Area LW29-31 (Aurecon, March 2012).

The Aurecon (March 2012) report investigated the increases in zinc at BBPB3 however was unable to find obvious reasons for these increases. The Aurecon investigation suggested that variable rainfall and corresponding changes in groundwater levels could be contributing to changes in zinc levels.
In response to the major impact TARP event at BBPB3, Baal Bone Colliery submitted an initial formal notification to the Principal Subsidence Engineer and Interagency Committee on 5 December 2012. With the continuation of the TARP major impact levels, further formal notifications were issued to the Principal Subsidence Engineer and interagency committee on 17 June and again on 5 December 2013.

3.4.2.1 Comparison against previous Annual Reviews

Table 20 summarises previous Annual Review results and any exceedances of TARP trigger levels in BBPB1 – BBPB6 during the period 2011 – 2015.

Table 20: Summary of TARP exceedances and previous Annual Review results

	BBPB1	BBPB2	BBPB3	BBPB4	BBPB5	BBPB6
2011	No TARP exceedance	No TARP exceedance	**Dissolved Iron**: Feb to Dec **Dissolved Zinc**: Jan, Feb, Aug, Nov, Dec	**Dissolved Copper**: Aug - Dec	No TARP exceedance	No TARP exceedance
2012	No TARP exceedance	No TARP exceedance	**Dissolved Iron**: Jan **Dissolved Zinc**: Jan, Jun, Aug to Dec	**Dissolved Copper:** Jan, Jul to Oct **Dissolved Zinc:** Oct	No TARP exceedance	No TARP exceedance
2013	No TARP exceedance	No TARP exceedance	**Dissolved Iron:** Jan, May, Oct to Dec **Dissolved Zinc:** Jan to Dec	**Dissolved Copper:** Sep to Dec **Dissolved Zinc:** Dec	No TARP exceedance	No TARP exceedance
2014	No TARP exceedance	No TARP exceedance	**Dissolved Iron:** Jan to Mar, Jul **Dissolved Zinc:** Jan to	**Dissolved Copper:** Jan, Sep	No TARP exceedance	No TARP exceedance

			Dec			
2015	No TARP exceedance	No TARP exceedance	**Dissolved Iron:** Jan, Feb, Apr, Jun, Dec **Dissolved Zinc**: Jan to Dec	-	No TARP exceedance	No TARP exceedance

3.4.2.2 Comparison against EA

The EA concluded that the likelihood of extraction of Longwalls 29-31 resulting in a significant impact on the Coxs River Swamp is considered extremely low.

In terms of groundwater quality, minor and major changes have been noted for pH and trace metals at some bores however electrical conductivity has not exceeded its trigger level of 300 μS/cm. This indicates that the local groundwater has a very low salinity and is consistent with the local background of only 100μS/cm.
With the exception of the major changes for copper and zinc, noted in Section 3.4.2, the other changes to groundwater quality were minor in terms of duration above the trigger levels. The Aurecon (2012) report on groundwater quality concludes that minor changes to groundwater quality can occur by chance in the variable conditions of rainfall and the resulting groundwater level changes.

In terms of both groundwater levels and quality, monitoring confirms that there has been no measurable impact from mining on the swamp.
To assess potential impacts on the swamp, monitoring of vegetation on the surface above longwalls 29 to 31 at Baal Bone Colliery commenced with a baseline survey in 2007 and have continued until 2011 with systematic monitoring of selected sites which are within the area predicted to be affected by subsidence. Gingra Ecological Surveys were engaged to prepare the final report in 2011. The report concluded that: "*There has been no evidence which would indicate an effect of subsidence on vegetation distribution and abundance at the monitoring sites.*"

Species richness recorded across all sites during spring and autumn since the recoding commenced is provided **Figure 23.** The results show that levels of species diversity recorded in 2011 were at the higher end or above the previously recorded range at each site

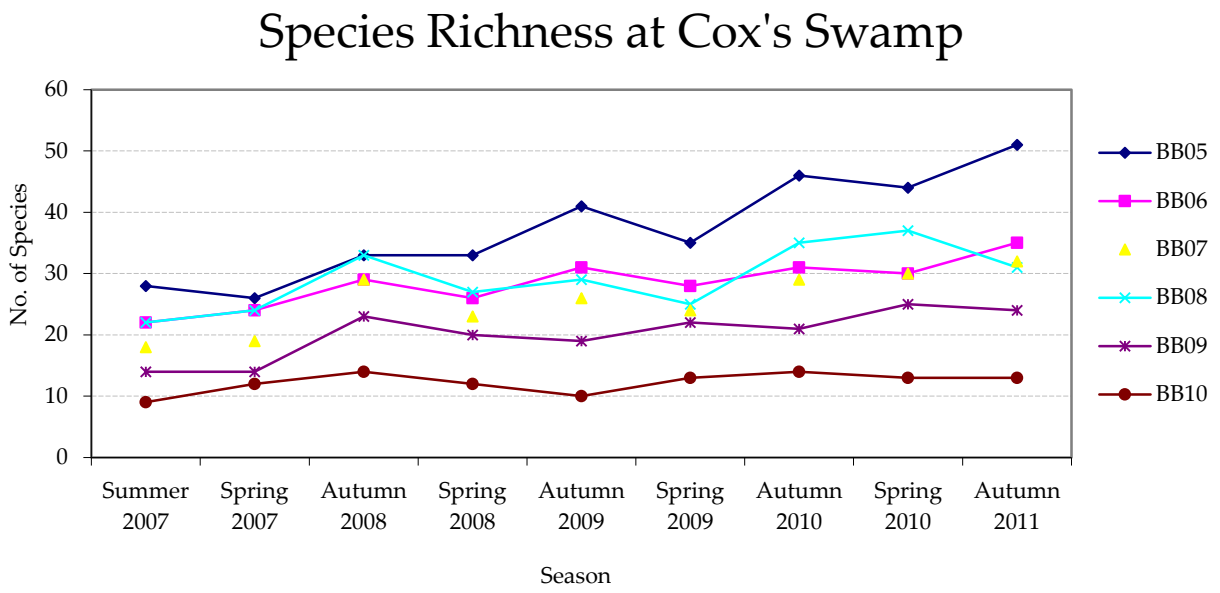


Figure 23: Summary of species richness at the monitoring sites

3.4.3 Groundwater Extraction

Mine water and groundwater intercepted by underground mining operations is extracted from both the north (Longwall 19) and south (Longwall 1) boreholes. This water is pumped via a total length of 7 kilometres of pipeline back to the pit top's 'Dirty Water' management system. After discharge through an iron aeration system and retention in Lake Tegan, water overflows into the overshot dam and leaves site through LDP1. Alternatively this water can be discharged into the dirty water dam, after retention time the water is then pumped to the process water dam, overflows onto Ben Bullen Creek and then leaves site through LDP1 at the overshot dam. An over view of the current water management and monitoring system can be seen in Plan 1 and Drawing 1 and locations of the north and south de-watering bores in Drawing 2.

Historically discharges from the north and south dewatering bores were discharged via Licence Discharge Points 3 and 6 (LDP3 and LDP6) into the Temperate Peat Swamp of Baal Bone Creek. In late 2012 the EPA requested that Baal Bone Colliery cease discharging into the Temperate Peat Swamp. Due to the requirement to sustain lowered water levels within the underground mine for the purpose of maintaining the current training facility layout, an agreement was reached by the site and the EPA that water from the boreholes would be piped back to the water management system at the pit top and discharged through LDP1 and into Jews Creek. Subsequently LDP3 and LDP6 were relinquished on 31st July 2013.

The total water extraction through the northern borehole (Longwall 19) in 2015 was 739 ML. During 2015, the total amount of water extracted through the south bores (Longwall 1) was a total of 483 ML. **Figure 24** shows monthly extractions from the dewatering bores over the 2015 reporting period.

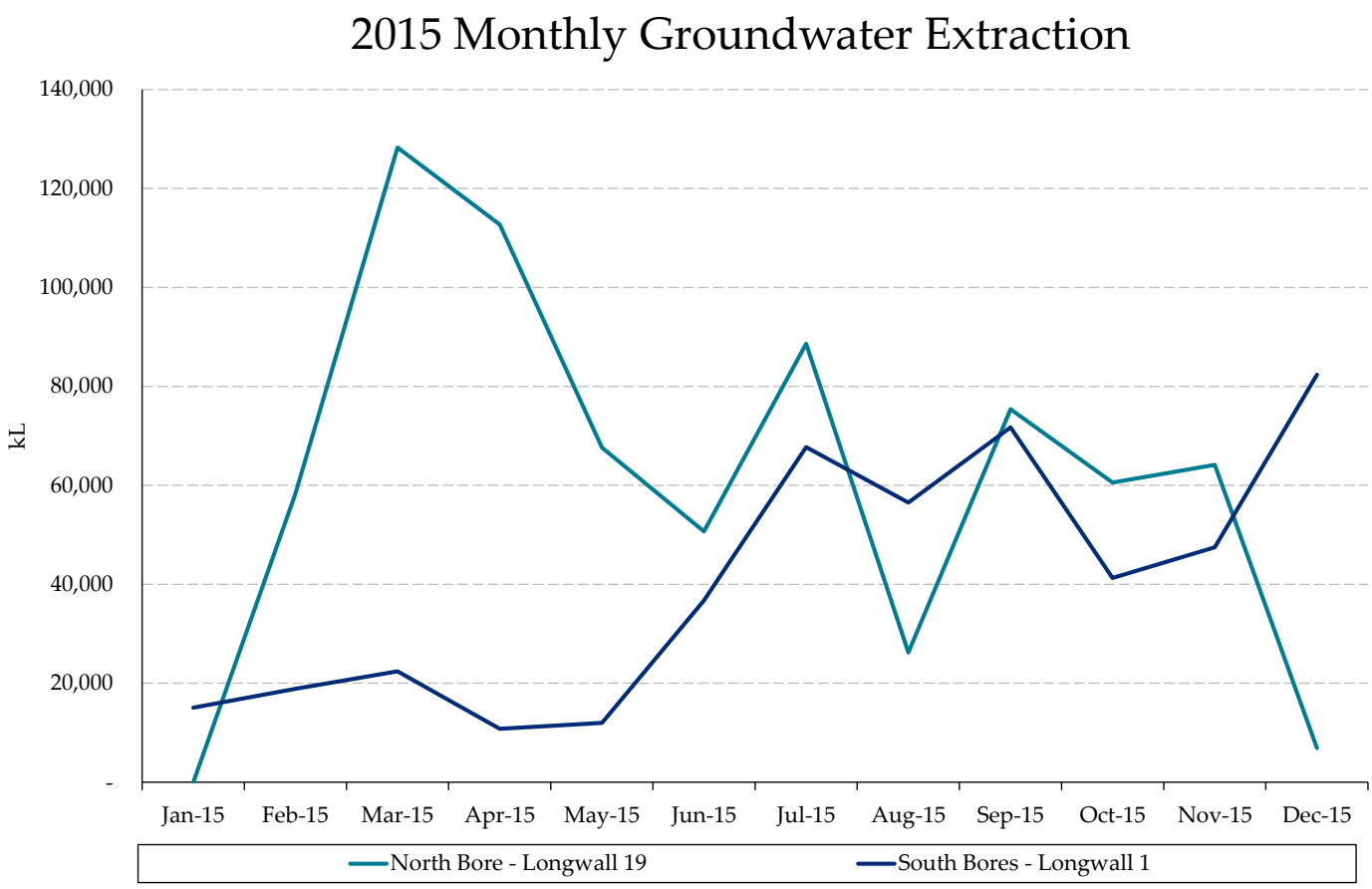


Figure 24: South dewatering bores daily extraction

3.4.3.1 Comparison against previous Annual Reviews

Figure 25 shows the reported annual extractions for the North and South bores from 2011 to 2015. Since 2012 total groundwater extraction has been steadily decreasing.

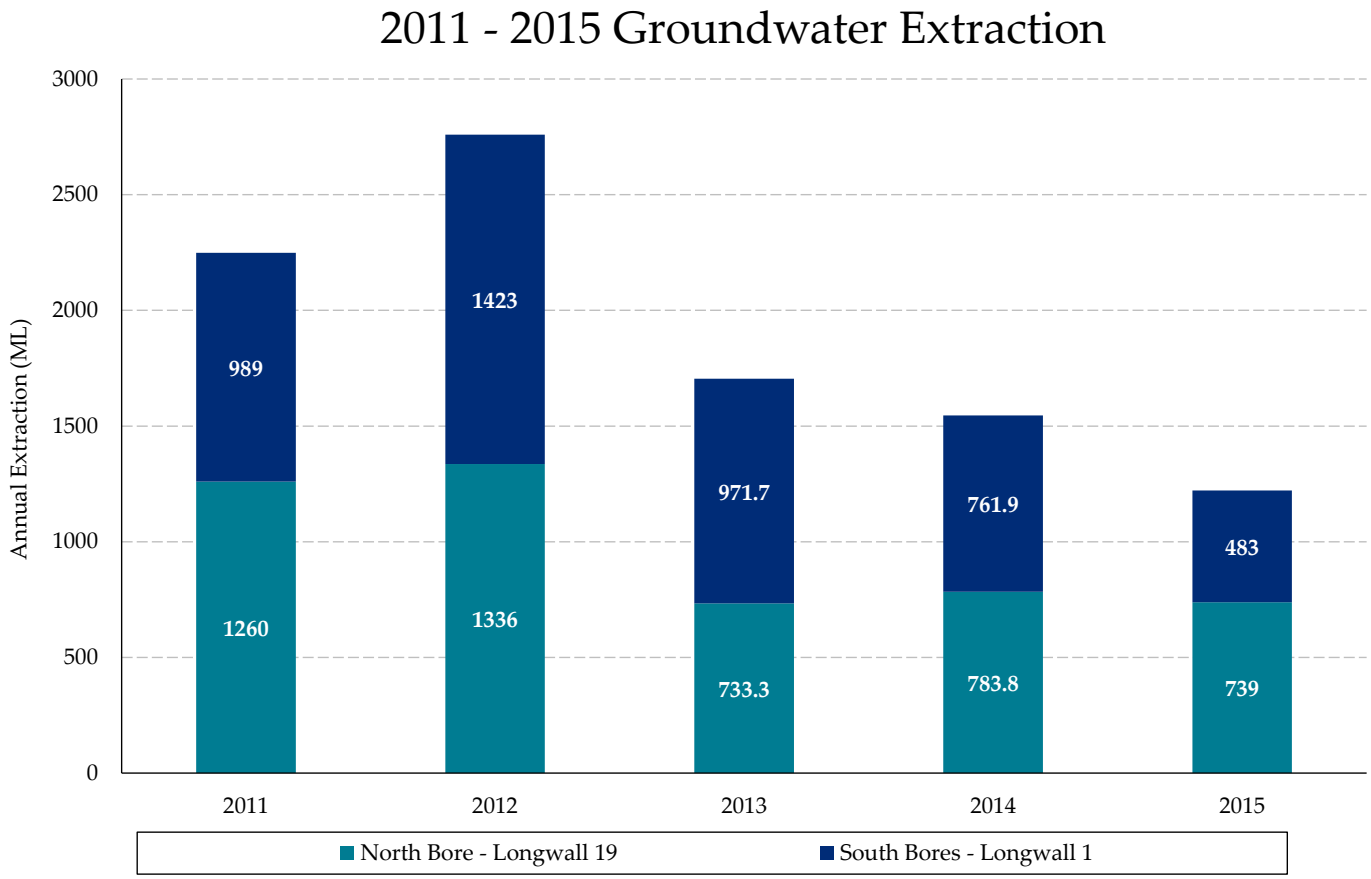


Figure 25: Long term groundwater extraction

3.4.3.2 Comparison against EA

The EA concluded that the volume of groundwater removed from the mine in 2008 was representative of the volume of groundwater that would need to be dewatered annually to ensure safe working conditions in the areas to be mined (Longwalls 29 to 31 and Remnant Areas). The volume of groundwater extracted in 2008 was approximately 1.5GL/annum.

In 2015, 1.22 GL of groundwater was extracted via the north and south dewatering bores – hence within the expected range of groundwater extraction predicted in the EA.

3.5 Contaminated Land

Known contaminated or polluted lands at Baal Bone are limited to those affected by hydrocarbons. Hydrocarbon contamination is discussed in **Section 3.17**.

There were no environmental incidents recorded or additional areas of contaminated land identified during the reporting period.

3.6 Flora

Following the completion of mining on 3 September 2011, no routine flora monitoring of the LW29-31 area was completed during the subsequent reporting periods. The last routine flora monitoring was completed in August 2011 by Gingra Ecological Surveys (Gingra), and the results are summarised below.

Results

The results show that levels of species diversity recorded in 2011 were at the higher end or above the previously recorded range at each site. At the woodlands sites BB05, BB06 and BB07, species diversity in autumn 2011 was higher than at any other sampling over the monitoring period.

Table 21 - Plant Species Diversity for LW29-31 SMP Area

Site	Species Count								
	Summer 2007	Spring 2007	Autumn 2008	Spring 2008	Autumn 2009	August 2009*	Autumn 2010	Spring 2010	Autumn 2011
BB05	28	26	33	33	41	NS	46	44	51
BB06	22	24	29	26	31	NS	31	30	35
BB07	18	19	29	23	26	NS	29	30	32
BB08	22	24	33	27	29	NS	35	37	32
BB09	14	14	23	20	19	16	21	25	24
BB10	9	12	14	12	10	10	14	13	13
TOTAL	113	119	161	141	156	26	176	179	187

*Additional requested survey

From the floral surveys undertaken to date there have been no endangered species found, however two vulnerable species and one species of regional significance have been identified in the area around Baal Bone. These include Capertee Stringybark *(Eucalyptus cannonnii)*, Clandulla Geebung *(Persoonia marginata)* and Blue Devil *(Eryngium vesiculosum)* respectively.

Potential habitat for both *E. cannonnii* and *P. marginata* are isolated to areas north of the current lease area and they have not been affected by mining activities on site. Baal Bone has developed a Biodiversity and Land Management Plan to ensure that site operations (in particular vegetation clearing and ground disturbing activities) do not potentially impact on these species.

Conclusion

There has been no evidence which would indicate an effect of subsidence on vegetation distribution and abundance at the monitoring sites

3.6.1 Comparison against EA

Floral studies conducted by Gingra as part of Baal Bone Part 3A EA predicted that no significant modification of swamp vegetation would occur as a result of the current or proposed mining operations and that mining operations are not likely to increase the impact of any relevant key threatening process on this community. These predictions are consistent with the survey results presented above.

3.7 Fauna

Following the completion of mining on 3 September 2011, no routine fauna monitoring of the LW29-31 area was completed during the subsequent reporting periods. One targeted fauna study was completed during 2012, to assess the potential impact of subsidence repairs (refer to Section 3.16.4).

The last routine fauna monitoring was completed during September 2011 by Biodiversity Monitoring Services (BMS), and the results are summarised below.

Results

A total of 20 native mammal (plus three introduced), 58 bird, five reptile and three amphibian species have been located within or near Longwall 29-31 SMP Area at Baal Bone Colliery during 2011. The list of fauna species located during the 2011 surveys in the SMP Area provides a total assemblage of species located within Baal Bone Colliery and LW29-31 SMP Area over the years. At present, 30 native mammal, 95 bird, 14 reptile and six amphibian species are known to occur within the LW29-31 SMP Area.

The number of birds, native mammals, reptile and amphibian species located in 2011 was similar to that located in earlier years. As expected with continued surveys, the number of species located within the SMP area has increased over the years. It is expected that the number of new species located each year will continue to increase and finally level out. Then the final overall species richness can be calculated from the final slope of the asymptote.

New species located during 2011 are the Eastern Pygmy-possum, House Mouse, Large Forest Bat, White-necked Heron, Buff-banded Rail, Golden-headed Cisticola, Beautiful Firetail, White's Rock-skink, Bibron's Toadlet and the Giant Dragonfly.

Overall there have been 11 threatened species located within the LW29-31 SMP Application Area at Baal Bone Colliery as a result of surveys since 2005. In 2011, the following threatened species were located: Gang-gang Cockatoo, Scarlet Robin, Varied Sittella, Eastern Pygmy-possum, Little Pied Bat, Eastern False Pipistrelle, Eastern Bent-wing Bat, and Greater Broad-nosed Bat. The first three species are part of a suite of threatened species that are listed partly because of their declining population status within the western slopes of NSW. This area (called the sheep-wheat belt) has undergone extensive clearing and much of the woodland habitat preferred by these species has been lost. However, in the Newnes Plateau region woodland habitat has been retained (albeit logged), and such bird species are still to be located. None of these threatened bird species would be directly affected by subsidence-induced changes to their preferred habitat.

Two new threatened species were located during the 2011 surveys, the Eastern Pygmy-possum and the Giant Dragonfly. Both were associated with Long Swamp, with the Eastern Pygmy-possum pit-trapped in a stand of banksia close to the swamp and at least five Giant Dragonflies were observed flying over Long Swamp close to piezometer BBPB5.

The Giant Dragonfly is listed as Endangered under the NSW TSC Act.

Table 22: - Results from analysis of data from 2006 to 2011

Biodiversity Indices	Significant Differences Between Pre and Post Mining
Species richness of faunal groups	No
Diversity indices of faunal groups	No
Capture rates of individual species	No
Contribution to the faunal assemblages by species dependent upon woodland	No
Contribution to the faunal assemblages by species declining in the Central West	No
Habitat complexity scores	No

Conclusion

The accumulation of data from the on-going surveys makes it possible to track changes to the terrestrial vertebrate fauna within the Baal Bone Colliery SMP Application Area during and after mining activities. At present, there appears to be no evidence of any significant effects from subsidence upon the fauna diversity at Baal Bone Colliery.

3.7.1 Comparison against EA

The results described above are consistent with the predictions in the EA which determined that potential impacts on fauna were largely limited to impacts on habitat as a result of subsidence. Subsidence was not expected to result in significant impacts to fauna species as the levels predicted were similar to that which has previously occurred at Baal Bone.

3.8 Weeds

Weed management at Baal Bone continued during 2015. In line with the annual land management review of the Baal Bone site conducted by DNA Environmental, a comprehensive weed spraying program targeting Blackberry was undertaken throughout the year.

3.9 Blasting

No blasting was conducted at Baal Bone during the reporting period.

3.10 Operational Noise

For the purpose of assessing the compliance status of site with licence noise limits a site attended audit and noise measurements were conducted in August 2015 By Atkins Acoustics & Associates.

The audit report concluded that:

"During the daytime audit noise from the mine ventilation fan was audible at the Muldon residence (R1). Other noise sources identified included local domestic activities, wind in the trees, insects, aircraft and distant road traffic. During the evening and night audits noise from the ventilation fan was audible at both the Muldon (R1) and Desch (R2/3) residences.

During the site-attended audits noise from the ventilation fan would not be described as tonal, impulsive, irregularity or with low frequency content. Accordingly no 'modifying factor' corrections are required to satisfy EPL 765 (L4.7). From the audit measurements and assessment, the LAeq, 15 min noise contributions from BBC during the day, evening and night assessment periods satisfied the long-term licence noise limits.

Baal Bone Colliery related LAmax noise levels were not observed to cause exceedances of the licence noise limits at measurement locations for the duration of the audit."

Full noise audit reports can be accessed from the Baal Bone publications webpage at: http://www.glencorecoal.com.au/EN/Operations/Baalbone/Pages/EPLreportingBaalBone.aspx

There were no complaints regarding operational noise received during the reporting period.

3.10.1 Comparison against EA and previous Annual Reviews

The EA predicted $L_{Aeq\ 15\ minute}$ dB(A) noise levels at residences R1 and R2/R3, both with and without the dozer operating on the ROM stockpile. The EA also predicted $L_{A1,\ 1min}$ dB(A) intermittent noise levels at R1 and R2/R3 at night. The results of the attended noise audits confirm that Baal Bone Colliery noise levels are consistent with the EA predicted noise levels.

During the 2011 Annual Review period one complaint was received from a residence adjacent to Baal Bone in relation to noise generated by surface plant operations. The complaint coincided with an environmental compliance noise audit for Baal Bone in October 2011. The October 2011 audit found that during evening hours when the dozers were operating on the ROM stockpiles, the long term licence noise limits specified under Schedule 3, Condition 4 of the Development Consent were exceeded at R1 and R2/3. However, when the dozer was not operating on the ROM stockpiles the operations would comply with the long term licence noise limits. Modification were made to equipment and stockpile orientation, and no further noise complaints have been received.

Noise audits carried out from 2012 onwards have found that LAeq, 15 min noise contributions from Baal Bone Colliery during the day, evening and night assessment periods satisfied the long-term licence noise limits. Baal Bone related LAmax noise levels were not observed to cause exceedances of the licence noise limits at measurement locations for the duration of the audits.

3.11 Visual, Stray Light

All lighting associated with the CHPP and the UC1 conveyor/ROM stockpile has been designed and constructed so as to minimise glare and stray light to sensitive receivers. During 2012, a review of lighting requirements during care and maintenance was conducted, and where appropriate lighting was minimised.

No complaints have been received during the 2015 reporting period in respect to lighting.

A Lighting Assessment of Baal Bone operations was undertaken by JP Environmental in November 2011 to determine compliance with Condition 29 of Project Approval 09_0178. All measurements of obtrusive light emitted from Baal Bone were below the relevant light intensity parameters. Any new lighting installations

required onsite in the future will be fixed in accordance with the recommendations of the Lighting Assessment to minimise the potential for obtrusive light.

3.12 Aboriginal and European Heritage

3.12.1 Aboriginal Heritage

In early 2007, an Indigenous Heritage Assessment was undertaken in conjunction with preparation of the Longwalls 29-31 Subsidence Management Plan (SMP) application. This assessment identified a potential rock shelter site (BBC-RS1) located above Longwall 30 in the Ben Bullen State Forest. An Aboriginal Cultural Heritage Management Plan (ACHMP) for the potential rock shelter site BBC-RS1 was developed by OzArk Environmental & Heritage Management Pty Ltd in 2008, based on the findings of the Indigenous Heritage Assessment. The ACHMP was workshopped by the Registered Aboriginal Parties and representatives of the former Department of Environment, Climate Change and Water (now OEH).

Schedule 3, Condition_26 of the Project Approval granted in January 2011 required that the ACHMP be updated in accordance with the EA. The ACHMP was subsequently revised in July 2011 in accordance with Condition 26.

3.12.2 European Heritage

No European Heritage Sites have been identified within the Baal Bone mining lease.

3.12.3 Comparison against EA

The EA predicted that, while subsidence may occur, it is unlikely to impact currently undetected Aboriginal sites such as open sites. Potential impacts to Aboriginal heritage associated with the mining of Longwalls 29-31 have been assessed in previous surveys (OzArk 2007a; 2010). No significant impacts were predicted in this area, however, subsidence monitoring was to be undertaken during extraction. The rock shelter site BBC-RS1 was also required to be managed in accordance with an ACHMP.

Extraction of Longwall 30 beneath BBC-RS1 occurred in July 2010. During this time, Baal Bone inspected the site twice weekly. Following extraction beneath BBC-RS1, the area was resurveyed and movement vectors were calculated. Subsidence monitoring during the reporting period has confirmed the predictions in the EA. The data showed that the rock which forms the main shelter (overhang) moved 536mm in a westerly direction and subsided approximately 717mm (10mm accuracy). However, there was no visible damage caused to BBC-RS1 as a result of the extraction of Longwall 30.

3.13 Natural Heritage

No natural heritage sites have been identified within the Baal Bone mining lease. However, the Gardens of Stone National Park lies approximately 5km north-east of Baal Bone and the Greater Blue Mountains World Heritage Area is located approximately 80 km to the south-east of Baal Bone. These areas are not expected to be affected by the operations at Baal Bone.

The Ben Bullen State Forest covers much of the lease area.

3.14 Spontaneous Combustion

No spontaneous combustion events occurred in 2015.

Whilst under care and maintenance no stockpiling of coal products is occurring. The last of Baal Bone's ROM stockpiles were transported off site in April 2012.

Baal Bone has a Spontaneous Combustion TARP for the ROM stockpile. The TARP principally involves regulating the duration of ROM storage on the stockpile to reduce residence time and therefore potential oxidation, and monitoring of internal stockpile temperatures.

3.15 Bushfire Management

In the event that a bushfire is ignited on company owned land or where bushfire poses a threat to the mining operations, the Baal Bone's Bushfire Emergency Preparedness System will be activated.

In addition, site management will ensure that:

- all boundary roads around the land within the Colliery freehold area are maintained in a condition suitable for use as fire breaks and access tracks during an emergency situation;
- main access road and helipad are maintained suitable for use by emergency services;
- dams, voids and any other areas that may be utilised as watering points can be accessed by firefighting equipment;
- portable radios are used at the time of emergency solely by the emergency response team who are trained and are provided with protective clothing;
- site earthmoving equipment can be utilised; and
- emergency phone, fire extinguishers and fire depots are located at strategic locations around the surface facilities.

Bushfire preparedness has also been included in Baal Bone's Biodiversity and Land Management Plan.

3.16 Mine Subsidence

3.16.1 Current Approvals

The SMP for development and extraction of Longwalls 29-31 expired on 1 December 2014 with mining operations in the Longwall 29-31 area were completed on 3 September 2011.

3.16.2 Longwalls 29-31 Subsidence Development (Summary of Survey Results)

Surveys of various subsidence monitoring lines were undertaken during mining of Longwalls 29-31. Maximum results of surveys conducted since 2009 are listed below.

Table 23 : LW 29-31 Subsidence Survey Data Summary

Parameter	Predicted Results	Maximum measured result		
		2009	2010	2011
Vertical subsidence (mm)	1400 - 1600	1341	1538	1726

Horizontal movement (mm)	400	450	188	538
Strain (mm/m)	9 - 21	11.7	13.7	14.2
Tilt (mm/m) K=5.0	32 - 52	25.6	23.2	43.7

As per the Longwall 29-31 SMP, a final post longwall 31 subsidence survey was carried out in May 2012. Summarised results are listed below. Results from previous surveys can be found in Subsidence Status Reports published on the Baal Bone website here: http://www.glencorecoal.com.au/EN/Operations/Baalbone/Pages/EPLreportingBaalBone.aspx

Table 24: 2012 LW29-31 Subsidence Survey Data (8 May 2012)

Line	Measured Subsidence (mm)	Measured Strain (mm/m)	Measured Tilt (mm/m)	Measured Horizontal Movement (mm)
SMP Prediction (mm)	**1400 – 1600**	**9 - 21**	**32 - 52**	**400**
E Line (LW 31)	1742 (LW30)	13.3	43.2	280
Northern Pinch Point Reflectors	+9			33
Northern Pinch Point Prisms	13			24
Southern Pinch Point Reflectors	14			9
Southern Pinch Point Prisms	2			8

The minor exceedance on E Line over LW30 has previously been reported in the 2011 Annual Review. The post mining survey conducted on 8 May 2012 noted a further increase of 14mm to a total of 142mm. The distance where this occurred is limited to a length of less than 50 metres.

3.17 Hydrocarbon Contamination

A six monthly review of the groundwater monitoring wells at Baal Bone was undertaken by AECOM during January 2015. The results of this monitoring program acknowledged that previous activities at the site, have resulted in contamination of shallow groundwater. The contamination was localised and associated with known point sources such as fuel storage areas.

The January 2015 report concluded that:
"The results of this GME indicated that groundwater contaminant concentrations have slightly increased for dissolved metals and increased for semi-volatile TRH compounds (except C34-C40) at MW01. TRH and BTEXN concentrations were not detected at MW03 and MW101, with no evidence of hydrocarbon contamination at the gauged monitoring wells.

Concentrations of selected heavy metals were reported above the assessment criteria during this GME, and have been variable over the past few years of monitoring. The presence of copper, nickel and zinc has been attributed to naturally occurring background conditions, however sampling of the wider area and up-gradient of the colliery would be required to confirm this. It is also noted that arsenic concentrations have increased at monitoring location MW01 during this GME".

On 30 November 2015, Carbon Based Environmental Pty Ltd carried out a six monthly groundwater monitoring event. The November 2015 monitoring concluded:
"When compared with the prior groundwater monitoring results from 27 January 2015 there was a reduction in petroleum hydrocarbon fractions within groundwater bore MW01, and no significant changes in results for groundwater bores MW03 and MW101.

Several groundwater metal and TRH concentrations remain above the adopted ecological or Human Health Criteria including:

- *MW01 – Arsenic, nickel and two TRH fractions remain above the ecological and human health criteria adopted.*
- *MW03 - Nickel and zinc remain above the ecological criteria adopted.*
- *MW101 – Nickel remains above both the ecological and health criteria adopted and zinc remains above the ecological criteria.*

Groundwater levels decreased between the 27 January and 30 November 2015 monitoring period across all monitoring wells between approximately 0.1m to 0.9m".

Six monthly hydrocarbon testing will continue in 2016. Contamination within the pit top and CHPP areas will be addressed at mine closure, unless routine monitoring identifies an issue that require remedial action beforehand.

3.18 Methane Drainage and Ventilation

During the reporting period, monthly gas bag samples from the underground ventilation system were analysed by Coal Mines Technical Services, a NATA accredited company.

Results from the sampling completed throughout the reporting period confirm extremely low levels of methane at Baal Bone (<0.01%). Consequently, methane drainage is not required at Baal Bone.

3.19 Public Safety

Fences are in place around the mining lease area, with all other boundary gates locked and maintained in correct working order. All access points onto the mine area are signposted to warn the public of Baal Bone Colliery's mining operations and of the risks involved. Warning signs have also been erected along public tracks in the Ben Bullen State Forest warning of mine subsidence and prohibiting entry to unauthorised persons.

All employees and contractors who enter the mining operations or workshop areas are inducted and must be suitably trained. All visitors must sign in and be accompanied by an employee or staff member of the mine if they have not been inducted.

Security and safety measures were undertaken in 2011 to prepare for suspension of operations and included the employment of security staff and placing of gates on adits. Grills were placed on conveyors in 2011. A gate lock change also took place in 2011. During 2012, fences were erected in the CHPP area and access roads blocked.

3.20 Other Issues and Risks

3.20.1 Reportable Incidents

All incidents are reported in accordance with Project Approval 09_0178 – schedule 5, condition 5.

In October 2015, Baal Bone Colliery informed DP&E and EPA of an elevated dust result at AQ3 (DM3/EPL Monitoring Point 14). A result of 5g/m^2/month was collected at AQ3 in September 2015. Following discussions with DP&E it was determined that this did not constitute a reportable incident, given the twelve month rolling average at the time was 0.5 g/m^2/month, and no further action was taken or required.

Pursuant to Glencore's categorisation of incidents, any incident that falls into the categories below must be reported to the Group Environment and Community Manager, the General Manager for Open Cut or Underground Operations (depending on the type of incident) and the Chief Operating Officer.

Category I: An incident that has caused negligible, reversible environmental impact, requiring very minor or no remediation.

Category II: An incident that has caused minor, reversible environmental impact, requiring minor remediation.

Category III: An incident that has caused moderate, reversible environmental impact with short-term effect, requiring moderate remediation.

Category IV: An incident that has cause serious environmental impact, with medium-term effect, requiring significant remediation.

Category V: An incident that has caused disastrous environmental impact, with long-term effect, requiring major remediation.

In accordance with the Glencore definitions provided above, there were no reportable environmental incidents recorded by Baal Bone during the reporting period.

There were no fines or penalties recorded during the reporting period

3.20.2 Audits Conducted During the Reporting Period

In order to assess our environmental performance at Baal Bone and to plan and implement a process of continual improvement, the audits below were conducted during 2015.

- Noise assessment
- Routine audits on dust monitoring gauges.

No Internal Environmental Compliance Audits or Independent Environmental Compliance Audits were conducted during 2015.

The annual attended noise audit was carried out in August 2015 as discussed previously in **Section 3.10.**

Audits on the five dust monitoring gauges are conducted annually. The 2015 annual site audit was conducted on 15 January 2015. This audit reported that all dust deposition gauges were compliant with the Australian Standards (AS/NZS3580.1.1:2007 and AS/NZS3580.10.1:2003).

4.0 COMMUNITY RELATIONS

4.1 Environmental Complaints

In accordance with the Baal Bone Sustainable Development Procedure BBN SD PRO 0012 - Community Complaints Management, Baal Bone Colliery has a comprehensive system in place to document and respond to community complaints in a timely manner and to maintain a comprehensive complaints database.

Consistent with conditions of Baal Bone's EPL, Baal Bone maintains a telephone complaints line for the purposes of receiving and responding to complaints from members of the public in relation to activities conducted at Baal Bone.

Upon receipt of a complaint, the following details are obtained from the complainant:

- Date of complaint;
- Notification method;
- Date of incident;
- Name of complainant;
- Contact details of complainant;
- Type of complaint;
- Actions taken;
- Persons notified; and
- Details of follow up actions taken, if required.

Following the receipt of a complaint, a thorough investigation of the complaint is undertaken and the complainant advised of the results of the investigation. Any action to be taken to prevent a recurrence is undertaken as soon as practicable.

During the 2015 reporting period there were no complaints received.

4.2 Community Liaison

4.2.1 Community Initiatives

During 2015 Baal Bone Colliery donated a mini-bus to the Cullen Bullen Public School on a long term loan and a laptop to assist children with learning disabilities.

Funding is allocated for community involvement activities annually.

4.2.2 Community Consultative Committee

The Baal Bone Colliery Community Consultative Committee (CCC) has been established to provide a formal conduit for exchange of information and views between the local community and Baal Bone's Management Team.

Membership of the 2015 Baal Bone CCC:

- Ray Blackley (Resident);
- Barbara Milne (Resident);
- Karen Desch (Adjacent landholder);
- Representative from Lithgow City Council;
- Representative from Cullen Bullen Public School;
- Mark Bulkeley (Operations Manager); and
- Ben Anderson (Environment and Community Officer).

A CCC meeting was held during the reporting period in June 2015.

The meeting was well attended by members and the following items were presented by Baal Bone:

- Ben Bullen Creek remediation
- REA 5 Capping

Regular agenda items included:

- Operations Manager's update;
- Health and Safety update;
- Environment and Community update – including rehabilitation and mine closure planning; and
- General Business and any other issues of concern from the community.

5.0 REHABILITATION

5.1 Buildings

No buildings were removed during 2015.

5.2 Rehabilitation of Disturbed Land

The current disturbed footprint of Baal Bone has been systematically and progressively reduced due to substantial rehabilitation carried out in conjunction with and following the recent open cut mining program which concluded in 2007. The current levels of disturbance at the site have been significantly reduced due to these recent rehabilitation works (refer to **PLAN 3**).

The capping of REA 5, cell 1 was completed in April 2012 A geotechnical study carried out in November 2013, indicated that REA 5, cell 2 was sufficiently dry and subsequently was capped in August 2014. Contouring and seeding of REA 5, cell 1 and 2 was completed in November 2015. The REA 5 area has now been rehabilitated.

During 2013, the south east ventilation (utilised for longwall panels 29-31) fan was removed and the shaft filled. Site levelling, fence removal and topsoil replacement was completed in June 2013. In consultation with the State Forrest, the area was prepared and seeded in 2014 using a mix of local seeds.

A summary of rehabilitation works at the start of the current MOP period (February 2016), an estimate for the end of the current MOP period (December 2019) and at mine closure are detailed in **Table 25**.

Table 25: Summary of Rehabilitation Performance

Year	Total Disturbance Area (ha)	Total Rehabilitation Area (ha)	Cumulative Rehabilitation Area (ha)
At Start of MOP (Feb 2016)	166	0	2249.23
1 (Feb 2017)*	166	27.07	2276.30
2 (Feb 2018)	166	0	2276.30
3 (Feb 2019)	166	0	2276.30
At End of MOP (Dec 2019)	166	0	2276.30

* rehabilitation of the Northern Void and adjacent areas is planned to occur during 2017, should no mining activities occur.

5.3 Rehabilitation Inspections and Monitoring

Three types of rehabilitation monitoring/inspections are undertaken at Baal Bone. These include;

- Regular inspections by site personnel,
- An annual environmental rehabilitation walk around inspection as per *CAA HSEC FRM 0025 11.16* and

- Annual ecological rehabilitation monitoring which was implemented in 2009.

5.3.1 Annual Environmental Rehabilitation Inspection

The annual environmental rehabilitation inspection was conducted by DnA Environmental in November 2015. Consistent with the 2014 inspection, the 2015 inspection identified ongoing improvements in the results of the rehabilitation areas within both the north and south former open cut areas. The inspection noted generally good rehabilitation across all areas, with some isolated areas needing additional work to remediate erosion and rilling.

The inspection also noted that although acacias are dominant across the sites, they are providing valuable ecological services in the short term via the provision of perennial vegetation cover, nitrogen fixation, dead leaf material and additional micro sites and soil surface relief. They also provide protection to eucalypts and other desirable species from extreme weather. Despite the low proportion of eucalypts in several sites, increasing morality of the acacias is expected to continue, thus increasing the proportion of eucalypts at the sites to more suitable levels in the longer term.

5.3.2 Annual Ecological Rehabilitation Monitoring

Annual Ecological Rehabilitation Monitoring is undertaken at Baal Bone Colliery to evaluate the success of rehabilitation and Baal Bone Colliery's progress towards fulfilling long term land use objectives. The monitoring program will continue within rehabilitation areas until all rehabilitation closure criteria are satisfied, as well as the requirements of the DRE.

A total of 15 permanent monitoring sites have been established throughout Baal Bone Colliery's land holdings to monitor flora, fauna, landscape function and habitat values aimed at assessing ecosystem function in remnant vegetation and rehabilitation areas. Six sites are located in remnant vegetation and 9 sites are located in rehabilitated areas.

Monitoring of these sites is undertaken annually until rehabilitation areas reach an acceptable levels of establishment, and then monitoring will be undertaken periodically.
Monitoring of these sites assesses:

- Plant community structural attributes;
- Cover, species density, height and structural diversity;
- Species richness (the number of plant species present in each structural layer of each vegetation community);
- The presence and abundance of any weed species; and
- Assessment of natural regeneration/recruitment of new species.

The findings of this monitoring program are used to assist in management recommendations for appropriate rehabilitation works within Baal Bone Colliery holdings. Where necessary, rehabilitation procedures are amended accordingly to continually improve rehabilitation standards.

The results of the 2015 monitoring are summarised below:

Native woodland rehabilitation sites
The woodland reference sites consisted of deep, well developed litter layers in moderate to extensive states of decomposition, scattered perennial grass tussocks and herbs and a mature eucalypt canopy, often with some scattered

shrubs and sub-shrubs. These sites had a very stable humus layer which was building up the soil profile and increased the capacity for moisture retention and protection against erosive forces.

In comparison, the woodland rehabilitation sites typically had limited perennial ground cover vegetation and a reduced level of litter cover and states of decomposition but often had a high perennial plant cover due to the establishing trees and shrubs, especially in the younger sites which had particularly high stem densities. The once loose and unstable soil surfaces have over time developed stable soil crusts which have become colonised with cryptogams and combined with the increasing levels of protective vegetative cover have become inherently more stable. In some cases the soils had also demonstrated increased coherency and a reduction in slaking potential due to increased microbial activity and development of a humus layer, especially in the older sites. Despite some periods of high rainfall activity, these increased ecological traits have also resulted in a reduction in the extent of erosion and deposition.

In some of the younger rehabilitation areas including NOC1, SOC4 and SOC2 however there continued to be patches of limited protective cover, limited soil surface relief and there may have been some slaking of the soils. As these bare patches were presently unstable, plants and cryptogams have not yet been able to establish but the extent of these were tending to decline, except in NOC1 and SOC4 this year. Nonetheless many ecological attributes have typically improved and have continued to demonstrate an increasing LFA trend since 2009. Most of the changes being observed are significant positive ecological changes and these are likely to progressively increase the ecological development of the rehabilitation areas over time. While Box Cut and SOC4 sites have previously been slow to establish, there have been significant improvements over the past few years despite a small setback in SOC4 this year.

In the rehabilitation sites an increasing tree population was recorded in all sites indicating good growth and development of the tree and shrub saplings. Within the older areas of rehabilitation, Box Cut and SOC3, there was a diverse population of various combinations of acacia and eucalypts. Most species were considered to be endemic species with the exception of SOC3 where some were considered to have a more northern distribution. Some of the mature acacias in these older sites had died as part of the natural successional development of the site, but these have tended to be replaced. The tree population in the younger rehabilitation areas on the NOC and SOC were presently limited to larger individuals of A. decurrens, A. dealbata (Silver Wattle), A. filicifolia (Fern-leaved Wattle) and A. rubida (Red-leaved wattle) with these species being locally endemic. This year several individuals of Eucalyptus racemosa subsp. rossii with>5cm dbh was also recorded in NOC1.

There were excessively high number of shrubs and juvenile trees (<5 cm dbh) which far exceeded those of the natural occurring woodlands and had densities that were in the order of 14800 – 31600 stems per hectare. In the rehabilitation sites there was a declining trend in the shrub population across all sites last year and while some of the larger individuals were now being recorded as part of the tree population, the vast majority of individuals had died outright as competition levels increase especially during the prolonged dry condition and the natural process of self thinning has occurred.

In previous years there has tended to be lower density of shrubs in the older Box Cut and SOC3 sites and these densities were similar to those in the woodland reference sites. In these two sites, there has been significant recruitment of acacias with thousands of seedlings which were 3 – 5 cm in height being recorded in Box Cut this year. There were also many Cassinia arcuata seedlings naturally colonising the site but there was also a small but increasing population of Rosa rubiginosa (Sweet Briar) and Rubus fruticosus (Blackberry). In SOC3, there were also many Cassinia arcuata seedlings as well as some acacia and eucalypt seedlings. These natural regeneration events are positive successional processes indicating these sites are potentially self-sustainable in the longer-term.

In the younger NOC and SOC rehabilitation areas there was also high variability in shrub densities. Last year the highest stem densities were recorded in SOC1 with 1264 stems per plot which translated into 14800 – 31600 stems per hectare. While there has been little to no change in shrub and juvenile tree densities in NOC1, NOC2 or SOC1 over the past year, a significant increase was recorded in SOC2 as a result of natural colonisation of Cassinia arcuata where 2916/3012 individuals were recorded. There continued to be a low proportion of eucalypts compared to acacias in most of the rehabilitation areas however increasing mortality of the acacias is expected to continue, thus increasing the proportion of eucalypts within the sites to more suitable levels in the longer-term.

Total ground cover is a combination of leaf litter, annual plants, cryptogams, rocks, logs and live perennial plants (<0.5m in height) and is given as an average of 10 repeated measurements recorded along the vegetation transect. There continued to be an increasing trend in total ground cover in all rehabilitation sites largely due to the accumulation of leaf litter, increasing perennial ground cover and cryptogam cover except in NOC1. SOC3 continued to meet total ground cover targets and since 2014 so did SOC1 Despite significant improvements in total ground cover the remaining sites had total cover which ranged from a low of 84.5% in Box Cut to 94.0% in NOC1.

In the rehabilitation sites leaf litter continued to be the dominant form of ground cover and the cover provided by perennial ground plants had increased in all sites this year. All rehabilitation sites except Box Cut had more than 10.5% perennial vegetation cover which was the minimum perennial cover target recorded in the reference sites. Cryptogams were not recorded in the older Box Cut and SOC3 sites or in NOC2 this year but cryptogam were not recorded in the reference sites due to the deep litter cover. Cryptogams remained particularly important in SOC1 and SOC2 where they provided up to 14% cover on average. Scattered rocks were common in all rehabilitation areas except in SOC1 and SOC3 rehabilitation areas dead leaf litter and ground cover plants become more established and had covered them over.

In 2014 all rehabilitation sites except SOC2 contained some vertical structure greater than 6.0m in height and this year none was recorded in NOC1 as numerous taller individuals had died and none had sufficiently grown in SOC2. The older rehabilitation sites SOC3 has continued to have similar canopy cover as the woodland reference sites, and this year so did SOC1, but it contained a more dense understorey. The older rehabilitation area SOC3 has developed into a woodland which has a similar structural composition to the reference sites, while Box Cut, NOC2 and SOC1 appear to be trending in that direction

In the woodland reference sites there were relatively few weeds and native species provided 97.2 – 100% of the total live plant cover. While native plants were more dominant than exotics in the rehabilitation sites native plant cover ranged from 64.6% in Box Cut to 94.9% in SOC3. While the sites continued to be weedier than the reference sites there has been an increase in native ground covers in numerous sites, including Box Cut, SOC1, SOC2 and SOC3. This year there was an increased number of exotic species in numerous rehabilitation sites, with only one rehabilitation site NOC1 having an acceptable diversity of exotic species.

Within the rehabilitation sites the diversity of most growth forms was similar to or exceeded those recorded in the reference sites, with the number of tree species (i.e. eucalypts) being much higher than required in the older Box Cut and SOC3 rehabilitation sites. This year there was an appropriate diversity of herbs, grasses and reeds in the rehabilitation areas, except in NOC1 where there was a low number of herb species.

This year four species were common to all rehabilitation areas and these included the exotic perennial forb Hypochaeris radicata (Flatweed) and the native shrubs Acacia rubida (Red-leaved wattle), Cassinia arcuata (Chinese

*Shrub) and Eucalyptus pauciflora (Snow Gum) (**Error! Reference source not found.**). Hypochaeris radicata was also recorded in all three woodland reference sites, indicating it has become well naturalised in the area. Many of the other common species recorded within the rehabilitation sites were the result of the tree seeding program and many of these were also found in the reference sites. Those that were not recorded within the reference sites are likely to be found within the local area in different habitats. The native grasses (Rytidosperma spp) and Microlaena stipoides (Weeping Rice-grass) which were also included in the seeding mixes were also recorded in five of the six rehabilitation areas. Centaurium erythraea (Common Centaury), Gamochaeta americana (Cudweed) and Plantago lanceolata (Ribwort) were also common annual exotic species.*

The rehabilitation sites were dominated by a different composition of species to the reference sites with the native perennial grass Microlaena stipoides being recorded in relatively high abundance in all rehabilitation areas, except Box Cut and SOC3 with the abundance scores having increased over the past year. Rytidosperma species were quite abundant in Box Cut and SOC03 with these cover scores also having increased. In NOC1, the small native sub-shrub Pultenaea microphylla provided comparatively high levels of ground cover but the exotic Hypochaeris radicata continued to occur in comparatively high abundance in NOC1 and NOC2.

The noxious weeds Hypericum perforatum, Rosa rubiginosa and Rubus fruticosus were recorded in the older Box Cut rehabilitation area while H. perforatum was also recorded in SOC3. In 2014 a small population of Caladenia fitzgeraldii, a relatively rare Spider Orchid which grows in sclerophyll forest in gravelly or rocky soil, was recorded in RWood02, a reference site situated in the Ben Bullen State Forest. While this species is not a listed species, Forestry Corporation NSW was notified to ensure its conservation.

In Box Cut, SOC1 and SOC2 a number of rills were originally recorded and have demonstrated a significant and declining trend over the past few years, with no active rilling being recorded in SOC1 or in Box Cut by 2014. In 2014 two small rills continued to be recorded in SOC2 but this year they had become sufficiently stable.

The soil chemistry in most of the rehabilitation area are similar to those obtained in the local woodlands with these being moderately to very strongly acidic, non saline, non sodic and low in organic matter (OM), phosphorous (P) and nitrates (N). This year however there has been a decrease in pH at NOC2 with the soils being more acidic than the local woodlands and there was a significant increase in EC with the soils now considered to be saline.

The results of the soil analyses indicate there are numerous elements which occur at elevated levels within the rehabilitation sites. In particular elevated levels of Magnesium and Sulfur were often recorded in the rehabilitation sites with exceptionally high concentrations of Magnesium occurring at Box Cut, while at NOC2, there were exceptionally high concentrations of Sulfur which may have some longer term implications in the ecological development of the sites. There were significantly high concentrations of Iron recorded in SOC3 however these high concentrations were also recorded in the woodland reference sites suggesting Iron is likely to occur at "naturally" high levels around the Baal Bone Colliery and may be the result of the long agricultural and mining history of the area. There have also been excessively high levels of Aluminium recorded in NOC1 and NOC2, with high concentrations also being recorded in SOC3 and two of the reference sites.

Exotic pasture rehabilitation sites

Since 2009 there were significant increases in stability in the pasture rehabilitation sites up until 2011 due to the development of the perennial pasture species, increasing litter and cryptogam cover and improvement in numerous other soil attributes. However thickets of acacias in NOC3 and NOC4 have become more dense and with the loss of lower leaves and branches there was a decline in rain splash protection and a reduction in perennial cover <0.5m in

height. In 2014 NOC3 and NOC4 rehabilitation sites had developed excellent litter layers which had accumulated to some depth due to high leaf fall from the acacia thickets and within these patches there tended to be moderate rates of litter decomposition, indicating high levels of microbial and fungal activity. Due to the increased litter layer there has also been a reduction in cryptogams and a decline in soil surface crusting due to the development of a humus layer, with no crusting at all observed in NOC3 last year. This year there was a further loss of some of the mature acacias and it was evident the site had been subjected to heavy macropod grazing. This has resulted in a reduction in canopy and perennial ground covers and there has been a reduction in litter cover with increased soil surface crusting and hardness.

In comparison NOC5 has maintained relatively good cover of perennial ground covers but lacked high levels of perennial canopy cover due to the absence of acacias. In NOC5, heavy grazing has continued to affect the abundance of perennial plant covers with increased soil surface crusting and erosion with the exposed soils vulnerable to slaking. NOC4 presently has similar ecological function to both of the pasture reference sites, however NOC3 and NOC5 had a lower ecological function, with NOC5 being the least functional of the pasture rehabilitation areas. All rehabilitation pasture areas however continued to meet the 70% completion LFA targets for stability, infiltration and nutrient recycling.

The rehabilitation pastures areas were tree seeded in an attempt to provide some scattered shade trees and as a result there were scattered individuals as well as large thickets of acacias across much of the Northern Open Cut area. In NOC3 and NOC4, there had been an increasing number of shrubs with a maximum of 102 and 153 individuals recorded during 2012. Since then numerous individuals have died resulting in a reduction in shrub densities in both NOC3 and NOC4 with 85 and 108 individuals recorded last year and this included a small number of volunteer Cassinia. Due to significant growth and development of some of the acacias there were now some individuals which had a dbh up to 10cm. This year there has also been a significant recruitment event of both acacia and Cassinia escalating the shrub population to densities of 227 and 183 individuals in NOC3 and NOC4 respectively.

Total ground cover is a combination of leaf litter, annual plants, cryptogams, rocks, logs and live perennial plants (<0.5m in height). All three rehabilitation sites continued to maintain a good cover of exotic pasture species however heavy macropod grazing over the past few years has resulted in a minor reduction in NOC3 and NOC5. While total ground cover has marginally improved in these sites, there was a minor reduction recorded in NOC4.

The rehabilitation sites were largely comprised of perennial plants and dead leaf litter however the proportion of perennial vegetation (<0.5m) in comparison to the reference sites was much lower and did not yet meet this important ecological indicator. The rehabilitation sites NOC4 and NOC5 also contained a much larger proportion of annual plants and cryptogams and some scattered rocks. The increasing density and height of the shrubs within NOC3 and NOC4 has resulted in a low percentage of projected foliage cover which were now in the 2.0 – 4.0m height categories along the vegetation transects. This year a small amount of cover was >6.0m in NOC4. No vertical canopy cover was recorded along the vegetation transect in NOC5 due to the limited occurrence of shrubs.

As the final landuse of the Northern Open Cut is an area of exotic pasture suitable for grazing, total and native species diversity indicators were not considered to be relevant ecological attributes and native plants provided limited plant cover in the rehabilitation areas.

Scattered individuals of the native species Acacia rubida, Senecio quadridentatus (Cotton Fireweed), Geranium solanderi (Native Geranium) and Carex inversa (Knob Sedge) were recorded in all three rehabilitation sites with Carex inversa also recorded in both pasture reference sites. There were 10 exotic species recorded in all three pasture

rehabilitation areas with exotic species including Dactylis glomerata (Cocksfoot), Gamochaeta Americana (Cudweed), Trifolium dubium (Yellow Suckling Clover) T. repens (White Clover), Centaurium erythraea (Common Centaury), Hypochaeris radicata and Plantago lanceolata being recorded in at least one of the pasture reference sites indicating these species are locally common and are a reflection of the level of historical disturbance.

The most abundant species in the reference sites were the native grasses Rytidosperma spp. (Wallaby Grass), Themeda triandra (Kangaroo Grass) and Poa labillardieri (Tussock Grass) with native ground cover Plantago varia (Variable Plantain) also providing good cover in RPast04. In contrast the rehabilitation areas were dominated by exotic species including Dactylis glomerata (Cocksfoot) which were largely sown as part of the rehabilitation. Hypochaeris radicata (Flatweed) was also becoming increasingly abundant in the rehabilitation areas, but it was also a significant part of the native pastures in the Baal Bone area and was recorded in high abundance in both pasture reference sites.

NOC3 and NOC4 pasture rehabilitation areas had soil pH and Electrical Conductivity which were similar to the local grasslands but were rather low in Organic Matter, Phosphorous, Nitrates and Cation Exchange Capacity. This year there has been a significant increase in pH, EC and ESP in NOC5, with the soils becoming slightly alkaline but they remained non saline and non sodic. No rills were recorded in any pasture site in any year.

Previous results have indicated there were numerous elements which occurred at elevated levels within the rehabilitation sites as well as in the pasture reference sites suggesting various elements can occur at "naturally" high levels around the Baal Bone Colliery and may be the result of the long agricultural and mining history of the area. This year Magnesium and Iron continue to be recorded in elevated concentrations in most rehabilitation areas, but these continued also to be elevated in the pasture reference sites. There were however, elevated levels of sulfur in all three NOC sites which were not reflected in the reference sites. These were very high in NOC5 and combined with increasing pH, EC and ESP may have implications for the longer-term development of the site.

Ridgetop woodland rehabilitation sites

The Ridgetop woodland reference site contained a mature eucalypt overstorey, scattered shrubs and a well developed litter layer with little evidence of erosion or deposition and had very stable soils. In comparison the rehabilitated vent shaft consisted largely of bare earth with scattered logs, woodchips and scattered annual and perennial plants were starting to establish. The soils were quite hard and there was presently little litter development and cryptogams were low in abundance. While the soils were typically stable there was some evidence of erosion and deposition occurring across the site.

Within the Ridgetop woodland reference site there was a stem density of 76 trees (>5cm dbh) which were comprised of three eucalypt species including E. sieberi (Silver Top Ash), E. obliqua (Messmate stringybark) and E. haemastoma (Broad-leaved Scribbly Gum). Presently no trees were recorded in the rehabilitation area. This year there were 252 shrubs and juvenile trees (<5cm dbh) which were represented by 14 different species.

In the Vent Rehab site, there were 164 seedlings recorded and these were comprised of 11 different species. The most common were Acacia buxifolia (Box-leaved Wattle) followed by Banksia ericifolia (Heath-leaved Banksia), Acacia gunnii (Ploughshare Wattle) and Acacia terminalis. There were numerous eucalypt and Daviesia seedlings. While Hardenbergia violacea (Happy Wanderer) is not technically a shrub, there were 28 individuals establishing within the site.

Total ground cover is a combination of leaf litter, annual plants, cryptogams, rocks, logs and live perennial plants (<0.5m in height). There was presently low total ground cover in the rehabilitation area and was comprised of 37%

dead litter with scattered annual plants providing 8.5% cover on average. There was also a minor contribution provided by rocks, logs and scattered perennial plants.

In the Ridgetop woodland reference sites there were a total of 37 species recorded in the monitoring plot. In comparison there were 45 species recorded in the rehabilitation area. While there was a higher floristic diversity recorded in the rehabilitation area, 13 species (29%) were exotic species, with none being recorded in the reference site. The high diversity of species in the rehabilitation area can be attributed to the colonisation of the disturbed areas from adjacent vegetation, germination from the soil seed bank as well as germination from seed applied as part of the rehabilitation of the area. In the rehabilitation area exotic species were also more abundant and with 48.8% of the live plant cover being provided by native species the site was presently weedier than desired.

Eleven species were recorded as occurring in both the rehabilitation sites and the adjacent Ridgetop woodland with numerous species being the result of a successful tree seeding program. While some species were sown onto the rehabilitation as part of the rehabilitation the data suggest that many native species are likely to have colonised the site from adjacent vegetation or have germinated from the soil seed bank. The rehabilitation site also contained a range of weed species including several exotic reed species which are not usually found in the Ridgetop communities which may be implicated with the disturbance associated with the construction and rehabilitation of the ventilation shaft.

The most abundant species in the Ridgetop reference site was a native herb Goodenia bellidifolia subsp. bellidifolia. The most abundant species in the rehabilitation site was the exotic reed Cyperus Eragrostis, which has most likely germinated from the soil seed bank. No other species had yet sufficiently established to meet the minimum criteria. No noxious or threatened species were recorded in the Ridgetop monitoring sites.

No rills were present in the VentRehab site. The soil chemistry in the rehabilitation area was very similar to the reference site and both had soils which were very strongly acidic, non saline and non sodic. While they had high OM they had a low CEC and were low in P and N. The results indicate there are exceptionally high levels of Iron in both the reference site and the rehabilitation area, indicating the high Iron concentrations are naturally occurring. There were also slightly elevated levels of sulfur in the Ridgetop woodland reference site.

Conclusion

Most rehabilitation sites were establishing particularly well despite the extremes in seasonal conditions and increased grazing pressure by resident macropod populations. While the developments occurring within the rehabilitation areas were patchy, there tended to be increasing ecological function with most ecological parameters recorded showing positive successional trends, with all sites meeting most of the 70% LFA Key Performance Indicator Targets.

The high densities of acacias have been critical to the successional development of the woodland (and pasture) sites, especially in SOC1 which has undergone the most significant transformation within only 7 years. This has largely been due to excellent growth and development of the trees and shrubs, and cryptogams and accumulating dead leaf litter which provided increasing levels of protective ground cover. There has also been increasing states of decomposition of the dead leaf litter which indicates there have been increasing microbial and fungal activity. The development of the humus layer had resulted in a reduction in soil surface crusting and an increased soil stability and coherency and subsequently there is less evidence of erosion or deposition across the site. Perennial ground covers were slow to establish however with the loss of lower leaves and branches and self thinning of the mature acacias, the dense canopy has become more open, allowing perennial ground covers to become established. This process has also been evident in the oldest rehabilitation site SOC3 which has transformed into open eucalypt dominated woodland

with many ecological attributes of the remnant reference sites, including a native grass understorey, a well developed canopy and natural regeneration of acacias and eucalypt species.

These natural successional processes were evident across the wider NOC and SOC rehabilitation areas and last year there was significant decline in shrub densities as a result of self thinning and a concurrent increase in ground cover. This year there has been a significant natural regeneration event with hundreds of small seedlings of acacias and Cassinia arcuata in many of the rehabilitation sites. The loss of the mature acacias has resulted in a much more open environment which has promoted an increase perennial ground cover plants, especially the native grass Microlaena stipoides and the native sub-shrub Pultenaea microphylla was also becoming increasingly common. While Box Cut and SOC4 sites have previously been slow to establish, there have been significant improvements in the Box Cut. Despite some adverse soil conditions in the younger woodland rehabilitation areas in particular NOC2, natural succession is likely to see the ongoing transformations in function, structure and composition with little need for direct management intervention across majority of the rehabilitation areas.

The pasture rehabilitation sites on the NOC continue to meet many of the primary completion targets and these are also likely to continue to improve unassisted in the absence of disturbance events. Heavy and continued grazing by macropods has however resulted in a decline in perennial grasses and increased abundance of exotic weeds over the past few years. The effects of heavy pressure and adverse soil chemistry have become more apparent in NOC5. Grazing intensity has probably been much more apparent during the prolonged dry conditions over the past few years, with more normal grazing intensities returning in better seasonal conditions. Monitoring of macropod (and goat) numbers should be regularly undertaken to determine if management intervention is required.

Noxious weeds including Rubus fruticosus (Blackberry), Rosa rubiginosa (Sweet Briar) and Hypericum perforatum (St John's Wort) were becoming increasingly more common. Hypericum perforatum was noted mostly growing along the roadsides but was beginning to appear in rehabilitation areas. It will be important to implement targeted weed control programs with the intent to eradicate these noxious species from site before they develop into extensive infestations.

The addition of artificial fertilisers is not encouraged on the woodland rehabilitation area as unnatural increases in fertility levels are more likely to promote growth of undesirable weeds rather than invigorate growth of desirable native species which are adapted to naturally low fertility soils. The exotic pasture area on the NOC however may benefit from the application of artificial fertilisers in order to maintain and promote the growth of the desired exotic pasture species.

5.4 Works Outstanding to Date

The areas which have not yet been rehabilitated are generally limited to the current surface infrastructure areas, including the pit-top area, CHPP, mine adits, transmissions lines, pipelines, various water management structures and the southern REA, including REA 6 and the Course Reject Emplacement Area (PLAN 3). These areas will be rehabilitated at the end of the approved mine life.

Survey has confirmed that approximately 331,000 m^3 of freedig (clay loam) material has been stockpiled for capping and covering these areas following mine decommissioning. Three dimensional modelling indicates that approximately 150,000 m^3 is required to provide a 500 mm cover over the former southern open cut

area and approximately 127,500 m^3 will be required to provide a 300 mm cover over the remaining surface infrastructure area.

5.5 Ben Bullen Creek Rehabilitation Project

Stabilisation and restoration works have been completed along two sections of the Ben Bullen Creek including riparian vegetation (tube stock) planting in sections 1 and 3. These works have been specifically designed and constructed using the philosophy of natural channel design.

Under Project Approval 09_0178, Baal Bone was required to review its water management systems which included a review of the Ben Bullen Creek Natural Channel Design and Restoration Plan, originally prepared in 2007.

A review of the Ben Bullen Creek Natural Channel Design and Restoration Plan during 2012/2013 indicated that remediation of the current Ben Bullen Creek diversion through the pit top area may be optimal to the reinstatement of the creek to its pre-disturbance pathway (approximately pathway post Ben Bullen Mine 1952).

URS were commissioned in 2013 to carry out a Phase 1 assessment of Ben Bullen Creek to consider the options of rehabilitating the current diversion verse reinstatement of the creek to its approximate pre-disturbance pathway.

Findings from the assessment recommend that the existing diversion be maintained for Ben Bullen Creek.

"The current ecological values along the existing alignment are high, with successful rehabilitation works along a large portion of the creek line. This has provided structured vegetation, a diverse mixture of flora species and fauna habitat potential. With some further remedial works, including further rehabilitation works along eastern bank (e.g. mulch, plantings and installation of woody debris) the ecological value of the creek line will improve. If any civil works are required (e.g. batter the high wall, removal of native vegetation or removal of pipelines/culverts), an impact assessment will be required to assess the effects to threatened species habitat that is currently present.

The pre-disturbance alignment for the creek line traverses the existing pit top area and consequently currently contains low ecological value. It would require substantial rehabilitation works to replicate the ecological value of the current creek alignment. This alignment is not preferred, and potential re-alignment may have impacts upon the ecological values (in-stream vegetation and flora species) of the current creek system.

The remediation of the existing course can commence in a timely manner following receipt of required approvals, allowing for additional benefits. Once the construction works are complete, the revegetation effort can begin. If the site is operational, staff will be available to review the progress of the vegetation on a regular basis. This will allow any issues to be identified and remedial action to be taken in a timely manner. Whilst this would still occur after mine closure, the time between inspections would be much greater and duration of monitoring would be shorter. It is likely that this would impact on the success of the revegetation process.

The existing course is geomorphologically stable and requires only minor adjustments to improve the geotechnical stability and revegetation potential of the banks. The modelling is a conservative estimate of channel conditions, but this also suggests the channel is stable.

The longer path of the existing course suggests that the creek will have less erosive power and is therefore more likely to remain stable in the long term. The pre-disturbance path also passes close to the adits, posing a potential risk of flood waters entering the underground workings."

Following discussions were held with DP&E in 2014, a modification was sought by Baal Bone to modify the approved final landform plan and associated conditions for the Baal Bone Coal Project under Project Approval 09_0178. The modification was sought under Section 75W of the Environmental Planning and Assessment Act 1979 (EP&A Act), and will facilitate the changes to final alignment and rehabilitation of Ben Bullen Creek. In December 2015 DP&E approved the modification to allow Ben Bullen Creek to remain in its current alignment.

During 2016 GHD has been commissioned to prepare a detailed final design for Ben Bullen Creek, and Mine Closure Water Balance.

5.6 Other Infrastructure

No other rehabilitation was undertaken during 2015 as a result of construction or decommissioning of site infrastructure.

5.7 Rehabilitation Trials and Research

There has not been any formal rehabilitation trials or research carried out at Baal Bone during the reporting period.

5.8 Finalisation of a Detailed Mine Closure Plan

5.8.1 Mine Closure Planning

In accordance with Glencore Coal NSW Sustainable Development Annexure 0038, 10.1 Mine Closure, Baal Bone is currently preparing a Detailed Mine Closure Plan.

Activities completed and/or initiated include the following:

- Desktop Constraints and Opportunities Analysis for Mine Closure (Umwelt Australia);
- Final Landuse Options Workshop and Risk Register (GSSE Environmental);
- Preparation of draft closure objectives and completion criteria for final Landuse options;
- Phase 1 and Phase 2 Contamination Survey and Assessment (ENSR Australia);
- Hazardous Materials Survey and Sire Register (SP Solutions);
- Completion of a Demolition and Dismantlement Closure Study for the site (Liberty Industrial);
- Finalisation of Mine Seal Design (Burke Engineering Services);
- Indicative market valuation of final Landuse options and accompanying cost to benefit and economic analysis of Landuse options (Trevor Hudson and Associates);
- Mine Closure Social Impact Assessment (Coakes Consulting); and
- Development and progressive implementation of Mine Closure Consultation Strategy.

As a result of these activities, a decommissioning plan has been developed for each domain within the mine area. The plan is to be revised yearly in accordance with any changes that may occur with company

goals, legislation and planning. The domain areas which require decommissioning activities are dominated by the current infrastructure areas associated with Domain 1 – Northern Void, Domain 3 – Infrastructure, Domain 4 – Central Pit Top Area, Domain 6 – Southern Void and Domain 7 – Subsidence areas. Decommissioning of current infrastructure is the first step to meet the Mine Closure criteria.

During 2016 the detailed Mine Closure Plan will be reviewed, and following its completion, elements of the Ben Bullen Creek detailed design will be included in the Mine Closure Plan.

5.8.2 Rehabilitation Liability Estimate

Baal Bone's rehabilitation liability estimate was increased in early 2012 to a total of $13,022,000 increasing from $9,723,000 at the end the 2011 reporting period.

An internal review of Baal Bone's rehabilitation liability estimate carried out in December 2012 further increased the liability estimate to $18,770,763. The revised estimate was submitted to DTI for approval together with the 2012 Annual Review.

A further review of the rehabilitation liability estimate carried out in December 2015 increased the estimate to $23,256,120. The revised estimate was submitted to DRE for approval in February 2016 together with the revised Mining Operations Plan 2016 -2019.

6.0 ACTIVTIES PROPOSED IN THE NEXT REPORTING PERIOD

6.1 Operations and Systems

Projects and targets for the 2016 reporting period include the following:

- Development of a detailed Ben Bullen Creek rehabilitation plan and Mine Closure Water Balance;
- Finalisation and approval of the Ben Bullen Creek Management Plan and Water Management Plans;
- Finalisation of the detailed Mine Closure Plan;
- Design and confirmation of the Final landform Design.

6.2 Care and Maintenance Period (Temporary Closure)

Baal Bone entered a care and maintenance period following the cessation of mining operations in 2011. During the 2016 Annual Review period, required infrastructure will remain intact and the site will continue to be managed and maintained for potential future mining or industrial land use.

The potential utilisation of the Baal Bone site for future mining activities including mining, mine training facility, use of the coal processing, rail loop or coal emplacement areas will be considered, however have not been confirmed as a future land use.

6.2 Pit-top Facilities

During the 2016 Annual Review period all infrastructure will be maintained to an operational standard. In the event that a full mine closure is decided, a rehabilitation strategy for pit top facilities is detailed in the Mining Operations Plan and Mine Closure Plan.

As the current future of mining operations at Baal Bone is uncertain, a standby strategy has been adopted for the CHPP. This has allowed the CHPP to be temporarily decommissioned, and then restarted in the future should investigations identify suitable and economically viable reserves for extraction.
Reclaim tunnels and other infrastructure have been man-proofed.

6.3 ROM and Product Stockpiles

All stockpiles have been depleted, cleaned of carbonaceous material and left in a stable condition. No activities are proposed for the 2016 Annual Review period.

6.4 Mine Ingress/Egress

The main ingress to the underground operations is provided through the No.4 adit. The primary ingress to each previous longwall is provided through the maingate roadways. Secondary egress is provided through the tail gate of each longwall panel.

All adits have been secured with steel gate. With the exception of No.4 adit, all adits will be kept locked throughout the 2016 Annual Review period. The main ingress through No.4 adit is only open during

operating hours, and access is only be available to approved underground operators for completion of routine underground maintenance, statutory inspections and possible training activities.

6.5 Voids

It is intended to retain and maintain REA 6 for future use should Baal Bone decide to continue operations in accordance with its Project Approval. Final rehabilitation of this area will occur after mine closure.

6.6 Other Infrastructure

Other infrastructure associated with Baal Bone or in the immediate vicinity includes powerlines, access tracks, boreholes and monitoring sites. All powerlines to the site will remain to supply buildings and offices power during the care and maintenance phase of the mine. All mine related access tracks and monitoring sites present on Forest NSW land will be maintained during the care and maintenance phase of the mine.

6.7 Rehabilitation

The principal objective for the rehabilitation of mined land at Baal Bone is to return the site to a condition where its landforms, soils, hydrology, flora and fauna are self-sustaining, and compatible with the surrounding land fabric.

The proposed end land use for the site includes a combination of grazing and bushland/wildlife habitat. The stated land use combination is compatible with adjoining lands. The overriding principle is to create the most beneficial future use of rehabilitated land, which can be sustained in view of the range of limiting factors. The post-mining landscape will be dominated by Class IV (grazing – occasional cultivation) and Class VI (grazing – no cultivation) Rural Land Capability Classification. Drainage paths, contour drains, ridgelines, and emplacements are to be shaped in undulating informal profiles in keeping with natural landforms of the surrounding environment. The rehabilitation work completed to date is illustrated in PLAN 3.

The areas which have not yet been rehabilitated are generally limited to the current surface infrastructure areas; these include the pit-top area, CHPP, mine adits, transmissions lines, pipelines, various water management structures and the southern reject emplacement area (PLAN 3). These areas will not be decommissioned and rehabilitated until after a decision to commence mine closure occurs.

Survey has confirmed that approximately 331,000 m^3 of freedig (clay loam) material has been stockpiled for capping and covering these areas following mine decommissioning. Three dimensional modelling indicates that approximately 150,000 m^3 is required to provide a 500 mm cover over the southern REA and approximately 127,500 m^3 will be required to provide a 300 mm cover over the remaining central infrastructure area.

It should also be noted that the southern REA including REA 6 will be maintained during the suspension of operations period. Whilst it may be progressively or temporarily rehabilitated if the opportunity arises, final rehabilitation will be completed concurrent with mine closure. Approximately 178,000 m3 of freedig (clay loam) covering material has been stockpiled in readiness. Species used in this rehabilitation will

match the species composition that was used in the Southern Area. The box cut will remain open during the care and maintenance period for future mining purposes.

To ensure Baal Bone will be able to meet the final rehabilitation objectives, the preferred methodologies to be used include a combination Landscape Function Analyses (LFA), accredited soil analyses, and an annual rehabilitation walkover inspection. Baal Bone will undertake an annual rehabilitation walkover inspection over previously rehabilitated sites. This will be completed by a suitably qualified environmental officer and will ensure that any land management issues such as weeds and erosion are raised and addressed. Inspections from site personnel will also be undertaken on monthly basis for rehabilitation with pit top inspections occurring at least fortnightly.

6.8 Community Relations

Community relations projects for the 2016 Annual Review reporting period include the following:

- Hosting at least annual CCC meetings; and
- Distribution of at least one community newsletter

7.0 REFERENCES

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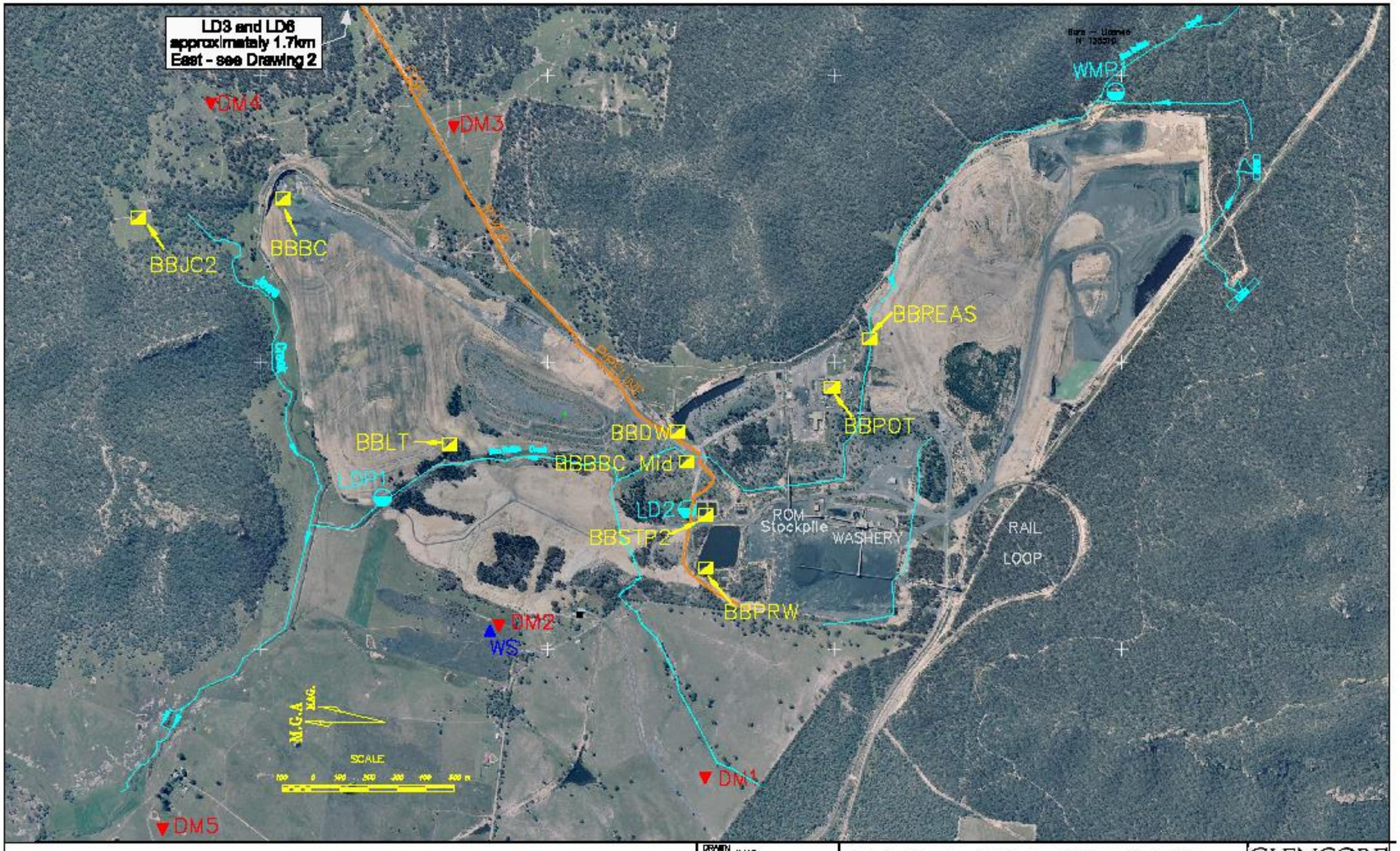
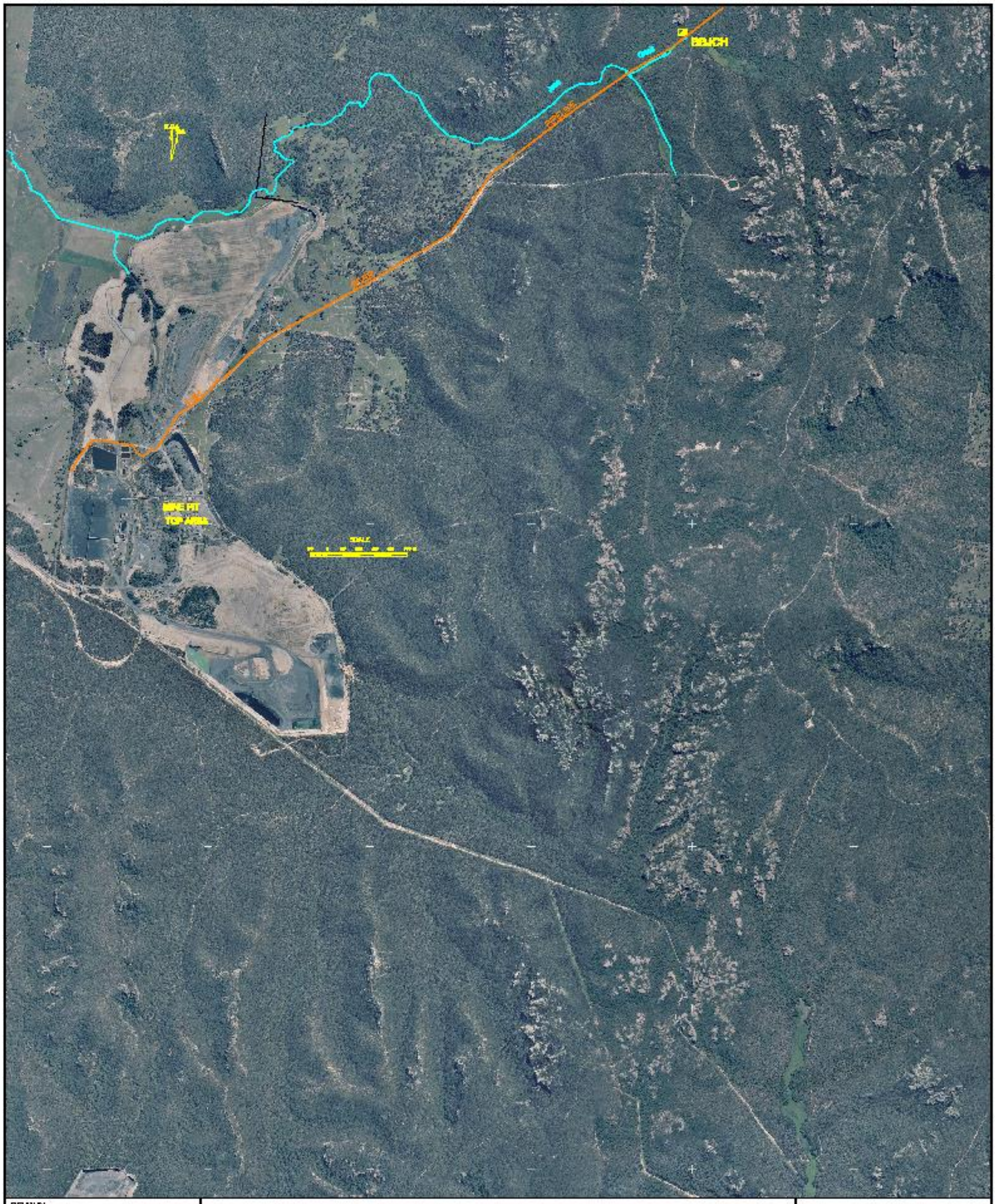

LD3 and LD6
approximately 1.7km
East - see Drawing 2
DM4
DM3
BBJC2
BBBC
BBREAS
BBPOT
BBLT
BBDW
BBBBC Mid
LDP1
LD2
BBSTP2
ROM
Stockpile
WASHERY
RAIL
LOOP
BBPRW
DM2
WS
DM1
DM5
WMP1
M.G.A.
SCALE
1 Surface Water Monitoring Site
Drainage Path
Weather Station
Fish river pipeline
1 Deposited Dust Monitoring Site
1 Internal Water Monitoring Points
DRAWN JWS
DATE 10/1/2008
REVISION 24/2/2015
CHECKED
APPROVED
SCALE NTS
BAAL BONE COLLIERY
GLENCORE
TITLE
2014 LICENCED MONITORING SITES
COMPUTER PATH G:\techserv\Technical Services\Survey\Survey Plans\Environmental\MOPs\2014AEMR\
DRAWING No. Drawing 1
A3



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DATE: 24/2/2015	TITLE: **2014 LICENCED MONITORING SITES**		
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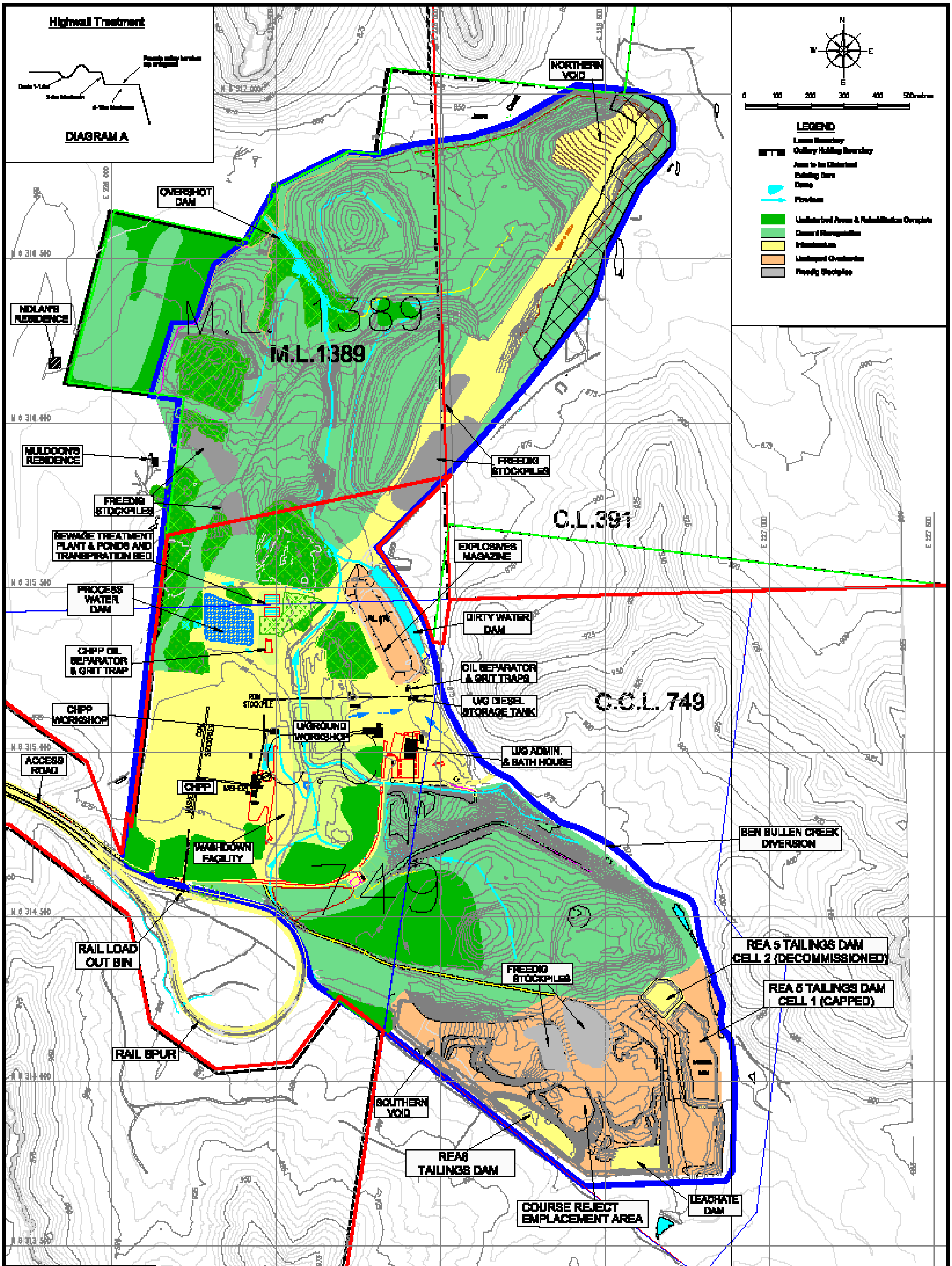

GLENCORE

BAAL BONE COLLIERY

2014 Baal Bone Annual Environmental Report
Plan 1 - Mining Activities and Surface Facilities Site Plan

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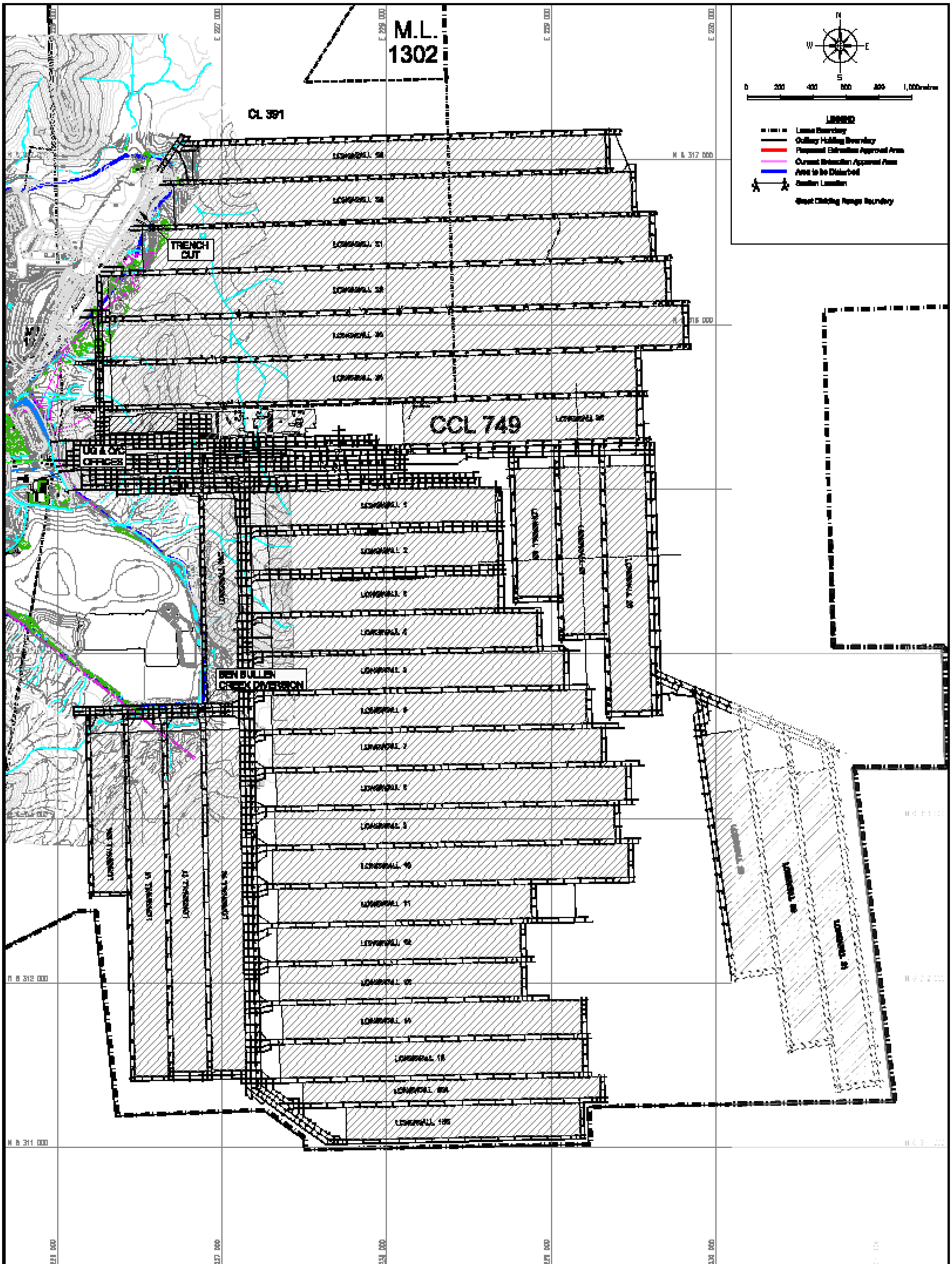

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I	[illegible]	JB	[illegible]	[illegible]
H	[illegible]	JB	Base Updated	[illegible]
H	[illegible]	JB	Proposed Underground Workings - Amended	[illegible]
F	[illegible]	JB	Proposed Underground Workings - Including South East Longwall Blocks - Amended	TK
E	[illegible]	JB	Proposed Underground Workings - Including South East Longwall Blocks - Amended	TK
D	[illegible]	JB	Proposed Underground Workings - Including South East Longwall Blocks	TK
C	[illegible]	[illegible]	Proposed Underground Workings - Consistent with Revision A.	[illegible]
B	[illegible]	[illegible]	Base Updated	[illegible]
A	[illegible]	[illegible]	Issued Drawing	[illegible]

REVISIONS

GLENCORE

BAAL BONE COLLIERY

2014 Baal Bone Annual Environmental Report
Plan 2 - Mining Activities and
Site Plan - Underground

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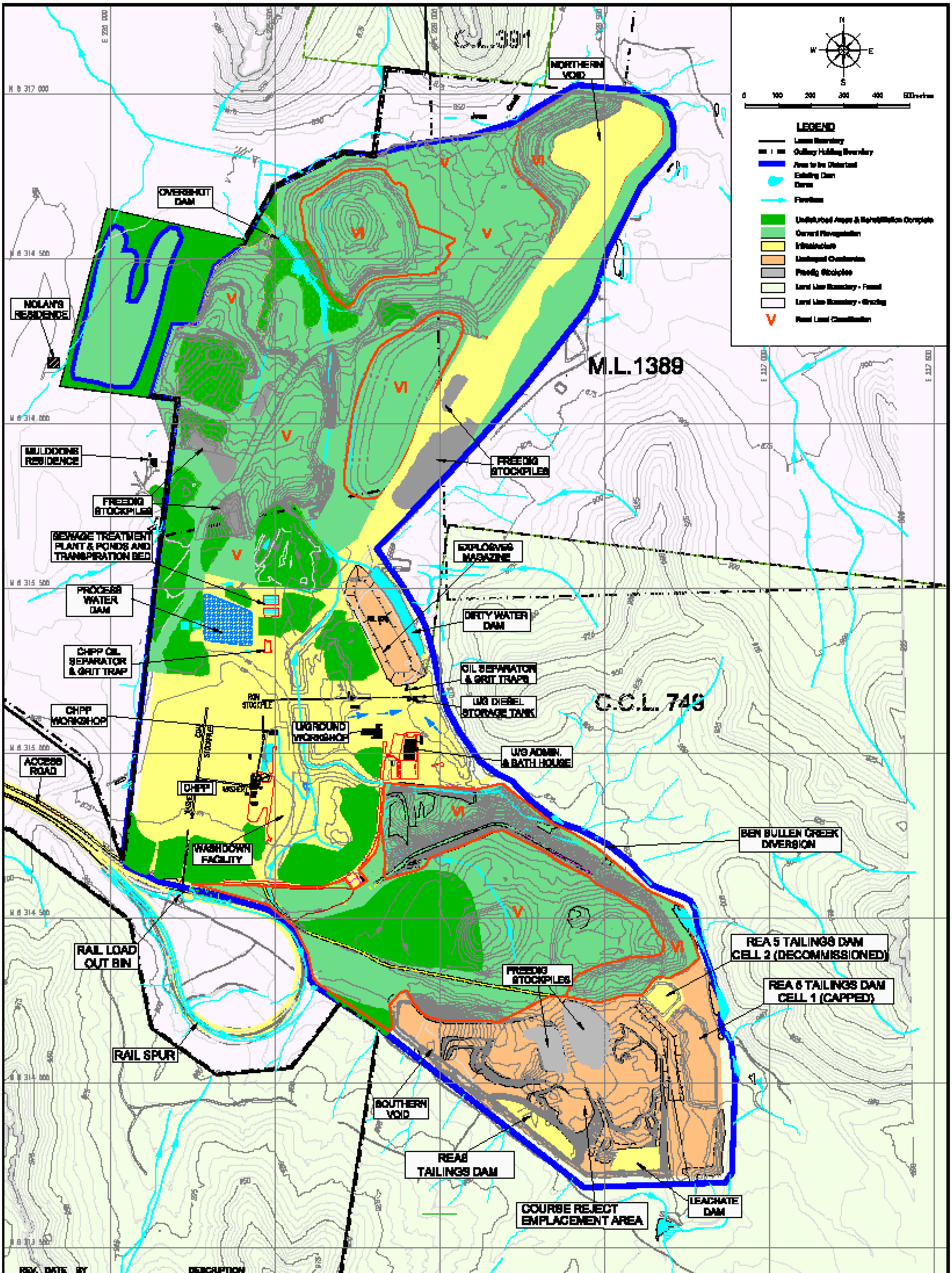
Rev. I



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XSTRATA

BAAL BONE COLLIERY

2014 Baal Bone Annual Environmental Report
Mine Operations Plan
Plan 5 - Rehabilitation Works

Date	Scale	Drawn	Checked	Approved	Sheet
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