ANNUAL REVIEW
2016
RIX'S CREEK Pty Limited

Name of Operation	**Rix's Creek Mine**
Name of operator	**Bloomfield Collieries Pty Ltd**
Development consent / project approval # **Rixs Creek North** **Rixs Creek South**	 **PA 08_0102** **DA 49/94**
Name of holder of development consent / project approvals	**Bloomfield Collieries Pty Ltd**
Mining Lease # **Rixs Creek North** **Rixs Creek South**	 **PA 08_0102 - CL 357, ML 1630, ML 1648-1651, EL 5824, A440 & A81** **DA 49/94 - CL352 & ML1432**
Name of holder of mining lease	**Bloomfield Collieries Pty Ltd**
Water License #	**20AL203407, 20AL203406, 20AL203405, 20AL209899, 20AL207389, 20AL209901, 20BL170864, 20BL168734, 20AL209919, 20WA201499, 20AL200040, 20AL200530, 20AL201231, 20AL200940, 20AL200818 20AL207396, 20AL207373, 20BL169513, 20BL172249, 20AL200846, 20AL201041,20AL200818**
Name of holder of water license	**Bloomfield Collieries Pty Ltd**
MOP / RMP start date **Rixs Creek North** **Rixs Creek South**	 **PA08_0102 – 18/01/2016** **DA49/94 - 8/3/2013**
MOP / RMP end date **Rixs Creek North** **Rixs Creek South**	 **PA08_0102 – 30/11/2017** **DA49/94 - 8/3/2020;**
Annual Review start date	**1/1/2016**
Annual Review end date	**31/12/2016**
I, Chris Quinn, certify that this audit report is a true and accurate record of the compliance status of Rix's Creek Mine for the period 1/1/2016 – 31/12/2016 and that I am authorised to make this statement on behalf of Bloomfield Collieries Pty Ltd.	
Name of authorised reporting officer	**Chris Quinn**
Title of authorised reporting officer	**Environmental Advisor**
Signature of authorised reporting officer	
Date	**12/10/2017**

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List of Abbreviations

AHD	Australian Height Datum
AR	Annual Review
bcm	Bank cubic metre
CHPP	Coal Handling and Preparation Plant
CCC	Community Consultative Committee
DA	Development Application
dBL	Noise decibels (linear)
dBA	Noise decibels (A-weighted)
DPE	Department of Planning and Environment
DRE	Division of Resources and Energy
EA	Environmental Assessment
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EL	Exploration Licence
EMP	Environmental Management Plan
EPA	Environment Protection Authority
GHG	Greenhouse Gas
EPL	Environment Protection Licence
$g/m^2/mth$	Grams per square metre per month
HRSTS	Hunter River Salinity Trading Scheme
IEA	Independent Environmental Audit
ISO	International Standard
l/s	Litres per second
MCM	Monthly Communication Meetings
MIC	Maximum Instantaneous Charge
mm/s	Millimetres per second
MOP	Mining Operations Plan
Ml	Megalitre
ML, MPL, CCL & CL	Mining Leases
Mt	Million tonnes
NAG	Noise Assessment Group
DPIW	Department of Primary Industires Water
OC	Open Cut
PIRMP	Pollution Incident Response Management Plan
PM_{10}	Particulate matter (dust) with a diameter of less than 10 microns
PPV	Peak Particle Velocity
RCS	Rix's Creek South
RCN	Rixs Creek North
ROM	Run-of-mine
STP	Sewage Treatment Plant
TBT	Toolbox Talk
TBG	The Bloomfield Group
TEOM	Tapered Element Oscillating Microbalance
TPH	Total Petroleum Hydrocarbons
µS/cm	Micro Siemens per centimetre
$µg/m^3$	Micrograms per cubic metre

SECTION 1 STATEMENT OF COMPLIANCE

Were all conditions of the relevant approval(s) complied with?	
DC # DA 49/94 Mod 6	NO
PA 08_0102	NO
ML # 1432	NO
ML # CL 357, ML 1630, ML 1648-1651, EL 5824, A440 & A81	YES

Development consent DA 49/94 was not complied with (Condition 15 – Off-site water release). The Bloomfield Group are assisting regulatory departments with the investigation of ML1432 (Condition 2d) and CL352 (Condition 3a and b) in relation to ground disturbance at Rix's Creek west pit operations being undertaken at a rate in advance of the approved staged plans within the Rix's Creek DA49/94 MOP for 2016.

Rix's Creek North Project Approval 08_0102 was not complied with Schedule 3, Condition 33 Surface water dishcarges and Mining Leases CL357, ML1630, ML1648-1651, EL5824, A440 & A81 was complied during the 2016 reporting period.

Further details can be found in Section 11 'Incidents and non-compliances during the reporting period'.

SECTION 2 INTRODUCTION

The Annual Environmental Management Report for 2016 is compiled pursuant to Condition 19 of the development consent for DA49/94 and Schedule 5, Condition 10 of PA08_0102. The report is also presented to satisfy the environmental reporting requirements of the NSW Department of Industry – Division of Resources and Energy (DRE), The NSW Office of Environment and Heritage (OEH), and the Department of Planning and Environment (DPE). This reporting period extends from 1 January 2016 to 31 December 2016.

Rix's Creek Colliery is wholly owned by The Bloomfield Group Ltd. an Australian owned family company. The Bloomfield Group also operates an open cut coal mine at East Maitland, *Bloomfield Collieries Pty. Ltd*, exploration license (EL) 7435 "*Goonbri*", EL5888 and EL5306 "*Bickham*", EL6604, EL7365 and CCL711 "*Curlewis*", engineering businesses *Four Mile Engineering* and *King's Engineering* as well as equity positions in companies specialising in renewable energies, recycling and biofuel production.

Rix's Creek mine commenced operations in July 1990 following the granting of Development Consent and Coal Lease No. 352 on 20 October 1989. This followed the submission of Coal Lease Application No. 185, an Environmental Impact Statement (EIS) and a public inquiry into the development application.

Construction began in late November 1989 establishing access roads, dams, facilities and screening bunds adjacent to the New England Highway. The Mining Operations Plan (MOP) was approved covering a five-year period, which corresponded, to Stage 1 of the mining proposal set out in the EIS.

The initial area was located adjacent to and on the northern side of the New England Highway and utilised bulldozer and scrapers to remove overburden. As mining progressed to greater depths, massive sandstone was encountered, requiring the introduction of overburden blasting. The scraper fleet was substituted with front end loader and trucks as the primary means of overburden removal. The Hebden and Barrett coal seams were mined at the rate of 300,000 tonnes of raw coal per annum.

The mining area was within old underground workings of the New Park Colliery, which dated back to the late 1800's. The underground workings were far more extensive than documented and resulted in poor coal recoveries and quality. This led to the relocation of operations to the north of the mining lease, an area termed the Arties Pit.

A bridge over the New England Highway was constructed to enable access to coal reserves in the southern area of the coal lease or South Pit. Since the completion of the bridge in June 1994 mining operations concentrated in this area. The production rate was then increased to 800,000 tonnes of raw coal per annum.

A coal preparation plant and rail loading facility were commissioned in April 1993, with all product coal being transported by rail to the port of Newcastle, where it is blended with coal from Bloomfield open cut. All product coal is sold on the export market. Prior to the commissioning of Rix's Creek washing and railing facilities, all raw coal was transported to Bloomfield Colliery for washing and blending.

During 1997 the operation expanded following the 1995 Development Consent approval allowing production to increase to current levels.

Along with the continuing operation in the South Pit, operations commenced on the extension of Arties Pit in January 1997. Production increased to 1.7 million tonnes of raw coal. Since 1997 mining operations continued in South Pit and Arties Pit. During 2002 operations commenced in West Pit on the western side of Rix's Creek adjacent to Arties Pit. The last coal was extracted from Arties Pit on 23rd June 2003. The emplacement of tailings into the Arties Pit void commenced in July 2005 with capacity reached during May 2014. Operations have continued in the West Pit with approximate production of 1,400,000 tonnes of product coal per annum. Mining in Arties Pit via open-cut finalised in 2014 with the focus of the operations continuing in West Pit.

On the 18th December 2015, HV Coking Coal Pty Limited (Glencore) completed the purchase of 100% of the Integra Mining Operations Complex. Bloomfield Collieries Pty Limited (BCL) subsequently purchased, from Glencore, the previous Integra Open Cut Operations, Coal Handling Preparation Plant, Train Loading Infrastructure and the Rail Loop. Under the "Operating, Infrastructure Access and Services Agreement", entered into by Glencore and BCL, all current mining operations covered by the 2010 Integra Complex Consent, Project 08_0101 Integra Underground Project and Project 08_0102 Integra Open Cut Project, can continue. Bloomfield Collieries Pty Limited operate the Open Cut Operations as Rix's Creek Northern Operations (RCN). This will control open cut mining in the Camberwell Pit area. Delivery of Project 08_0101 Run of Mine (ROM) coal from the Underground Mine, Coal Preparation and Train Loading Operations will all be operated and managed by RCN.

Mining Operations recommenced in the Camberwell Pit in the 2016 period. The Falbrook Pit remains in care and maintenance for the interim and is currently used as a water storage void.

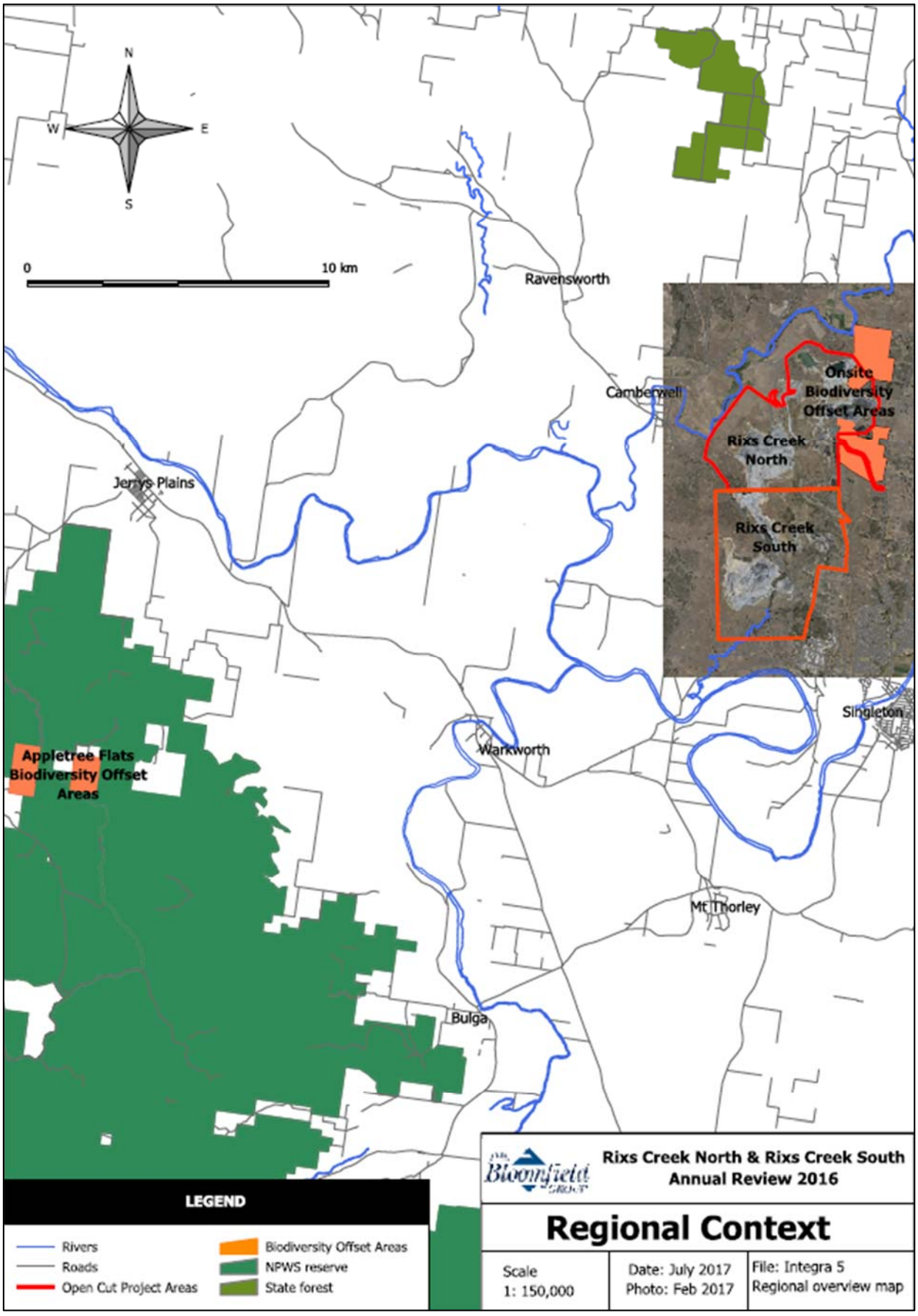


Figure 1 Regional Context Plan

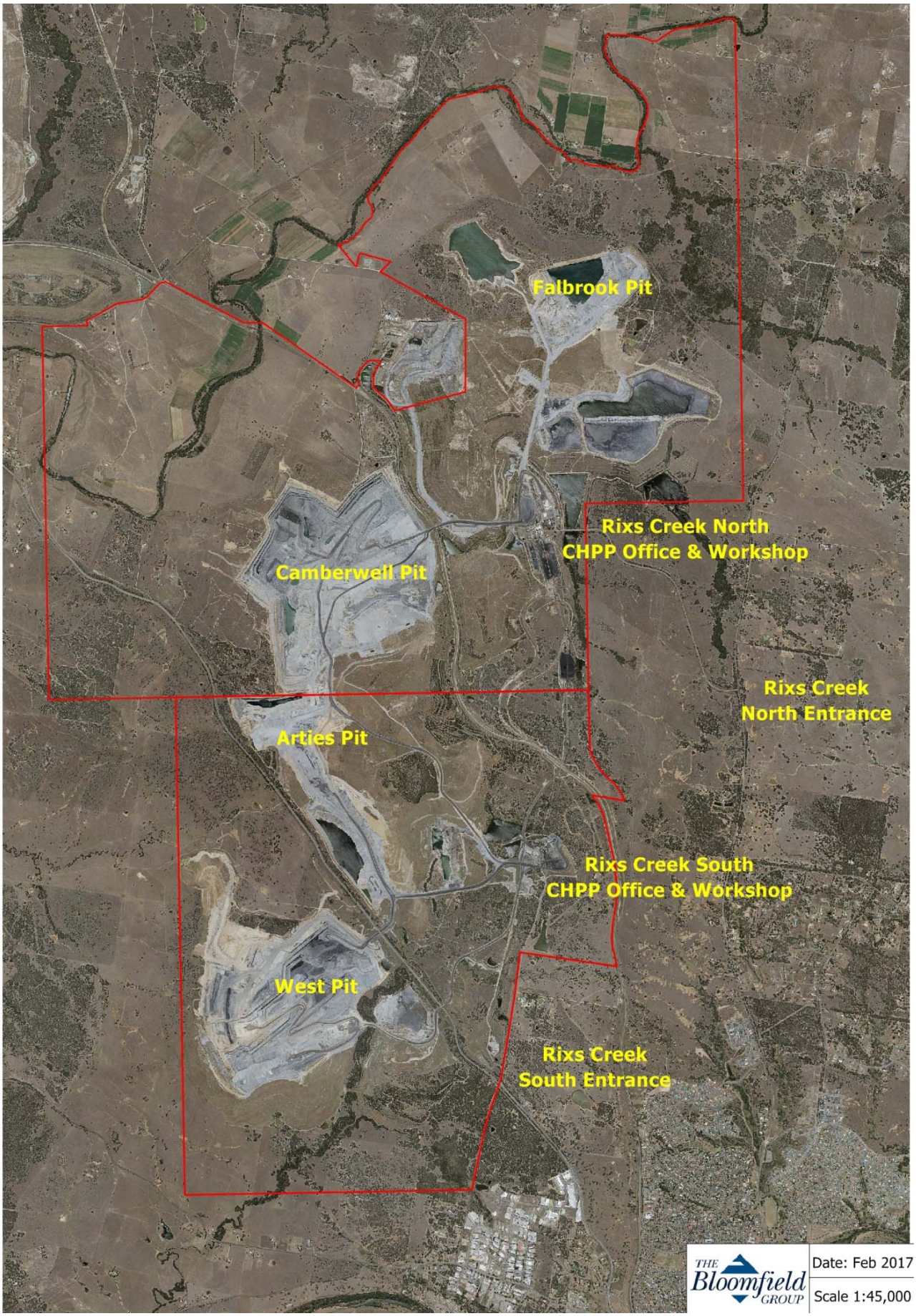


Figure 2 Site Layout and Locality Plan

2.1 Consents, Leases and Licences

A full list of consents, leases and licences held by Rix's Creek Mine is contained in Table 2 and Table 3.

Coal Lease No. 352 was renewed on 20/10/2011 allowing mining operations to continue on the site. Mineral Lease Application No. 17 to remove the surface exclusion from the remaining areas within the lease was submitted in 1995 and access agreements reached with landholders. Mining lease No. 1432 was granted by the Minister on 24/6/1998.

The development application to expand the operation submitted to the Department of Urban Affairs & Planning in November 1994 under the provisions of S.E.P.P. No. 34 was determined by the Minister in October 1995. The development consent came into effect in December 1995, and implementation progressed during 1996.

The Company holds Environmental Protection Licence No. 003391 under the Protection of the Environment Operations Act, 1997. This EPL has been varied to accept wastes on site such as biosolids (rehabilitation), refined oil (blasting) and glycerine (dust suppression). The license has also had variations for PRPs (Pollution Reduction Programs) in regard to *Coal Mine Particulate Matter Control Best Practise* as well as a noise assessment in accordance with the document, 'NSW Industrial Noise Policy', (EPA 2000). The prescribed use classification is Coal Industry Works Class I, and operational scale is more than 500 to 2,000 kilotonnes per annum. On the 18th December 2015 Environmental Protection 003391 was varied to include Rix's Creek North operations.

Rix's Creek P/L is a non-discharging participant in the Hunter River Salinity Trading Scheme holding 5 credits.

An application was made in November 2003 to vary the Development Consent to receive and process coal from Glennies Creek Coal Mine. The Notice of a Modification to a Development Consent under Section 96(2) of the Environmental Planning and Assessment Act 1979 was signed by the Minister on 23rd December 2003, modifying the Rix's Creek Development Consent to allow this activity. No coal was received during 2014.

An application was made in April 2004 to vary the Development Consent to receive coal from Bickham Bulk Sample Exploration Licence operation. The Minister signed the Notification of a Modification to Development Consent under Section 96(2) of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979) on 24th June 2004, modifying the Rix's Creek Development Consent to allow this activity. This activity was completed and the last coal railed in March 2005.

An application for a second crossing of the New England Highway to improve the efficiency of the mining operation was submitted to Department of Planning in March 2009. The Minister approved the modification under Section 96(2) of EP&A Act 1979, on 27 August 2009, for a Cut and Cover Tunnel crossing on the New England Highway. Following final approval of the design by the RTA in October 2010 construction began in November 2010 with completion of the project during June 2012. The first haul truck officially passing under the tunnel on 5 June 2012.

An application for the construction of a rail-loop off the main northern rail-way line onto Rix's Creek owned land was approved in 2013 resulting in modification number 5. No construction has commenced on this project since approval was granted.

On Friday 4th October 2013 Rix's Creek took ownership of land ahead of the West Pit operations to secure the future of mining within the lease. The three properties purchased include Lot A, D.P.404824 (previously owned by A.Bowman); Lot 122, D.P.1170863 (previously owned by E.S.Bowman); and Lot 55, D.P.252692 (previously owned by Canravo Pty Ltd).

A detailed map of Rix's Creek property ownership can be seen on the following page. Areas hatched in blue, red and green are all owned by the Bloomfield Group.

During 2014 an application to increase total material movement from 15 million BCM to 16.1 million BCM was approved resulting in modification number 6. During 2014 Rix's Creek commenced the

Rix's Creek Continuation Project (SSD# 6300) in order for the mine to continue another 21 years pending the approval of a new development consent. The draft Environmental Impact Statement (EIS) was completed and submitted for adequacy November 2015.

Mod 7 was submitted until Feburary 2016 to improve the efficiency of the Rix's Creek and Integra Open cut operations. The purpose of the modifications was to enable coal mined at one site to be processed and handled at the other site's CHPP, stockpiles and rail loading facilities.

The proposal involved:

- Allowing ROM coal from Integra's Open Cut Project to be transported to Rix's Creek CHPP for processing; and
- Allowing ROM coal from Rix's Creek to be transported to Integra's CHPP for processing

Mod 8 was to submitted to allow ROM coal to be stockpiled on 2 satellite pads near the Rixs Creek South CHPP prior to the ROM stockpile pad to reduce congestion on the ROM pad, This Mod 8 was approved in December 2016.

On December 18th 2015 Bloomfield Collieries Pty Ltd took ownership of the Vale Integra open-cut mine which will be renamed 'Rix's Creek North' (RCN). Rix's Creek Northern operations recommenced extraction of coal in May 2016.

RCN was given Project Approval under Section75W of the *Environmental Planning and Assessment Act 1979* by the Minister for Planning on 23 August 2016 for Project 08_0102 Mod 6. This Mod 6 separated the former Integra Mine Complex approval, which was a combination of the Integra Underground Project 08_0101 and Integra Open Cut Project 08_0102 (Integra Mine Complex) as it was known then.

The former Integra Mine Complex approval consolidated the following pre-existing approvals:

- Glennies Creek Colliery (105/90);
- Camberwell Coal Project (86/2889);
- Glennies Creek Colliery Surface Facilities (06_0057);
- Glennies Creek Underground Coal Project (06_0213); and
- Glennies Creek Open Cut Coal Project (06_0073).

The Rixs Creek North Project Approval 08_0102 Mod 6 includes:

- The Camberwell Pit (old South Pit/Western Extension);
- The Fallbrook Pit (old North Open Cut Pit);
- Coal Handling and Processing Plant (CHPP);
- Clean coal stockpile and rail loading facility; and
- Associated industrial areas and offices.

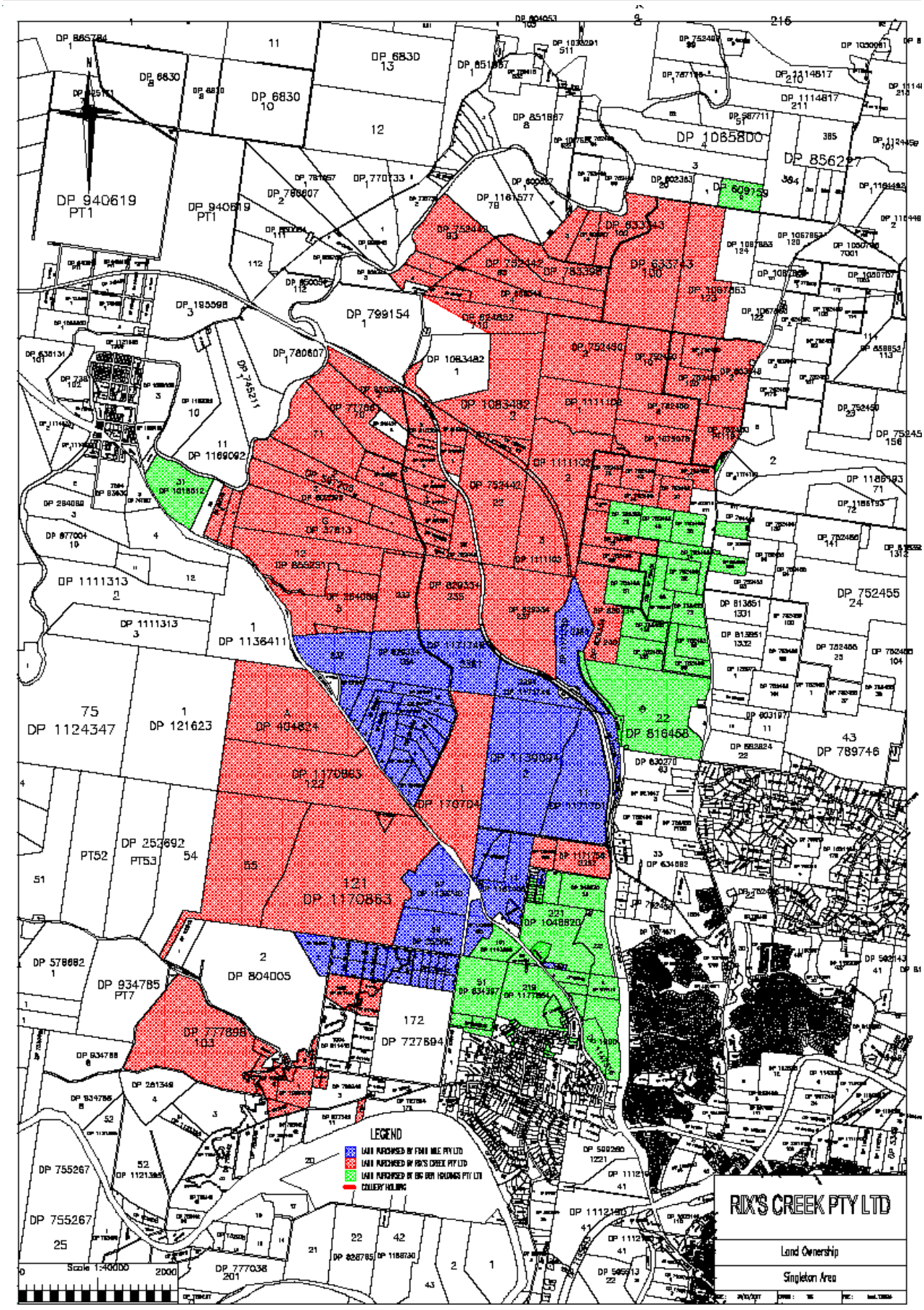


Figure 3 Land Ownership December 2016

2.2 Mine Contacts

Rix's Creek Pty Limited

Site:-	Rix's Creek Lane Singleton NSW 2330	Postal Address:-	P O Box 4 EAST MAITLAND NSW 2323.
Telephone:-	02 65788800		
Fax:-	02 65711066		

Rix's Creek Community & Blasting Hotline:-
02 49302665 (24hr)

Mine Manager:- Luke Murray
Responsible for overseeing all operations on site.
Telephone No:- 02 65788802
Mobile:- 0427 292152
E-mail:- lmurray@rixs.com.au

Technical Services Manager:- Chris Moy
Responsible for survey and mine planning.
Telephone No:- 02 65788808
Mobile:- 0415 872425
E-mail:- cmoy@rixs.com.au

Senior Environmental Officer:- John Hindmarsh
Responsible for consulting with regulatory authorities as required, provide measures for continual improvement to site procedures and ensuring all personnel are trained and competent in relation to rehabilitation of the mine site.
Telephone No:- 02 65788806
Mobile:- 0427 436285
E-mail:- jhindmarsh@rixs.com.au

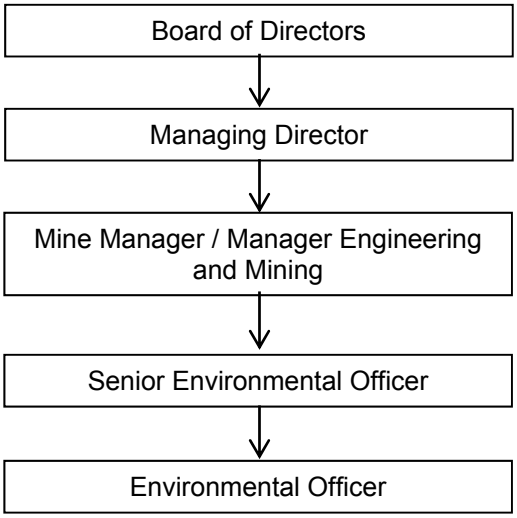
Environmental Officer:- Jason Desmond
Responsible for assisting monitoring and reporting on the environmental performance of the operation and co-ordinating the rehabilitation on the mine site. Provide support for the implementation of the Senior Environmental Officers responsibilities.
Telephone No:- 02 65788826
Mobile:- 0407 246311
E-mail:- jdesmond@rixs.com.au

Environmental Officer:- Chris Quinn
Responsible for assisting monitoring and reporting on the environmental performance of the operation and co-ordinating the rehabilitation on the mine site. Provide support for the implementation of the Senior Environmental Officers responsibilities.
Mobile:- 0427 169 302
E-mail:- cquinn@rixs.com.au

Bloomfield / Rix's Creek Website:-
www.bloomcoll.com.au

2.3 Organisational Chart (Environment)

As per *Rix's Creek Mine Management Structure Register* document:



2.4 Employment Demography

Rix's Creek currently has 236 employees comprising of staff and operators. This is a significant increase from the 140 employees in the 2015 reporting period, which was mainly due to the commencement of operations in the Camberwell Pit. The areas which include the largest number of employees are Singleton Council (32%), Maitland City Council (24%) and Cessnock City Council (19%). Rix's Creek mine endeavour to employ local personnel and local contractors are preferentially engaged as required.

Table 1 Demographic Breakdown at Rix's 2016

Council Area	Employees
Cessnock City Council	44
Dungog Shire Council	4
Lake Macquarie City Council	6
Maitland City Council	57
Mid-Coast Council	4
Muswellbrook Shire Council	10
Newcastle City Council	12
Port Stephens Council	10
Singleton Council	76
Upper Hunter Shire Council	12
Wyong Shire Council	1
TOTAL	**236**

SECTION 3 – APPROVALS

Table 2 DA 49/94 Approvals, Leases and Licences

APPROVAL	ORGANISATION	VALIDITY PERIODS
Development Consent DA 49/94	Planning NSW	October 2019
Development Consent DA 49/94 Mod 6	Planning NSW	October 2019
Coal Lease No. 352	Dept. Industry & Infrastructure	October 2031
Mining Lease No. 1432 (Section 100 Tailing's Emplacement Area 4 Approval August 2012)	Dept. Industry & Infrastructure	July 2019
Environmental Protection Licence No. 3391	Environment Protection Authority	Anniversary 3rd April each year. – In Force
Licence No 20SL050160	NSW DPI - Water	January 2018
Licence No 20SL049786	NSW DPI - Water	October 2017
Licence No 20SL060625 Converted to:- Water Access Licence 20AL201498 WAL 11084, Works Approval 20WA201499	NSW DPI - Water	June 2017
Licence No 20WA209900	NSW DPI - Water	Renewed December 2016
Notification of Dangerous Goods held on site replacing Dangerous Goods Licence NDG032405	WorkCover	Renewed, until 4/10/2016
New England Highway Closure Approval. ROL 521873	RMS	Renewed 6 monthly. Current ROL until 30/6/2016
Licence No. 20BL170863	NSW DPI - Water	Renewed December 2016
Licence No. 20BL170864	NSW DPI - Water	Renewed December 2016
License No. 20BL172457	NSW DPI - Water	Perpetuity
License No. 20BL172458	NSW DPI - Water	Perpetuity
License No. 20BL172459	NSW DPI - Water	Perpetuity
License No. 20BL172460	NSW DPI - Water	Perpetuity
License No. 20BL172461	NSW DPI - Water	Perpetuity
License No. 20BL173812	NSW DPI - Water	Perpetuity
License No. 20BL173733	NSW DPI - Water	Perpetuity
License No. 20BL173734	NSW DPI - Water	Perpetuity

Table 3 PA 08_0102 Approvals, Leases and Licences.

APPROVAL	ORGANISATION	VALIDITY PERIODS
Project Approval 08_0102	Planning NSW	26/11/2010 -31/12/2035
Development Consent 86/2889	Planning NSW	19/03/1990-19/03/2011
Development Consent Modification 2	Planning NSW	1/02/2013
Development Consent Modification 3	Planning NSW	5/10/2012
Development Consent Modification 4	Planning NSW	24/2/2016
Development Consent Modification 5	Planning NSW	26/02/2016
Development Consent Modification 6	Planning NSW	23/08/2016
Environment Protection Licence 3391	Environment Protection Authority	Licence anniversary 3rd April – In Force
Coal Lease 357	Division of Resources &Energy	18/06/2013 – 27/03/2032
Coal Lease 382	Divison of Resources &Energy	10/10/2014 (renewed) – 11/11/2033
Mining Operations Plan Rix's Creek Northern Operations	Division of Resources &Energy	1/10/2014 – 30/9/2017
Mining Lease 1437	Division of Resources &Energy	28/04/1999-27/03/2032
Mining Lease 1518	Division of Resources &Energy	14/06/2004-27/03/2032
Mining Lease 1630	Division of Resources &Energy	16/03/2009-13/03/2030
Mining Lease 1648	Division of Resources &Energy	04/01/2011-04/01/2032
Mining Lease 1649	Division of Resources &Energy	04/01/2011-04/01/2032
Mining Lease 1650	Division of Resources &Energy	04/01/2011-04/01/2032
Mining Lease 1651	Division of Resources &Energy	04/01/2011-04/01/2032
Authorisation 440	Division of Resources &Energy	16/12/2016-30/12/2018
Authorisation 81	Division of Resources &Energy	22/11/2016-04/04/2019
Notification of Dangerous Goods NDG028098	Work Cover	16/12/2017
Surface Water Licence WAL874 (240 GS)	NSW DPI - Water	Issued 31/3/2005
Surface Water Licence WAL672 (102 GS)	NSW DPI - Water	Issued 23/3/2005
Surface Water Licence WAL833 (54 GS)	NSW DPI - Water	Issued 31/3/2005
Surface Water Licence WAL797 (12 GS)	NSW DPI - Water	Issued 1/11/2006
Surface Water Licence WAL1273 (1.2 SS)	NSW DPI - Water	Issued 1/11/2006
Surface Water Licence WAL 10095 (230HS)	NSW DPI - Water	Issued 11/09/2006
Radiation Licence 5079169	Environment Protection Authority	14/04/2017
Water Access Licence 20BL 172249	Department of Water and Energy	24/07/2009-Perpetuity
Bore Licence 20AL 200530	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 200940	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201041	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201231	NSW DPI - Water	Issued 01/07/2004

APPROVAL	ORGANISATION	VALIDITY PERIODS
Bore Licence 20BL 167917	NSW DPI - Water	Issued 15/08/2000
Bore Licence 20BL 169571	NSW DPI - Water	Issued 07/03/2005
Bore Licence 20BL 169573	NSW DPI - Water	Issued 07/03/2005
Bore Licence 20BL 169574	NSW DPI - Water	Issued 07/03/2005
Bore Licence 20BL 169628	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169629	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169630	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169631	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169632	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169862	NSW DPI - Water	Issued 26/09/2005
Bore Licence 20BL 169864	NSW DPI - Water	Issued 26/09/2005
Bore Licence 20BL 171507	NSW DPI - Water	03/09/2007-Perpetuity
Bore Licence 20BL 171705	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171707	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171708	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171710	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171720	NSW DPI - Water	16/02/2008-Perpetuity
Bore Licence 20BL 171721	NSW DPI - Water	16/02/2008-Perpetuity
Bore Licence 20BL 171722	NSW DPI - Water	16/02/2008-Perpetuity
Bore Licence 20BL 171813	NSW DPI - Water	03/04/2008-Perpetuity
Bore Licence 20BL 171814	NSW DPI - Water	03/04/2008-Perpetuity
Bore Licence 20BL 172277	NSW DPI - Water	15/09/2009-Perpetuity
Bore Licence 20BL 172278	NSW DPI - Water	15/09/2009-Perpetuity
Bore Licence 20BL 172289	NSW DPI - Water	15/09/2009-Perpetuity
Bore Licence 20BL 009051	NSW DPI - Water	Issued 20/04/1959
Bore Licence 20BL 012970	NSW DPI - Water	Issued 10/12/1962
Bore Licence 20BL 169513	NSW DPI - Water	Renewed 28/02/2015
Bore Licence 20BL 171814	NSW DPI - Water	Issued 03/04/2008
Bore Licence 20AL 200530	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 200940	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201041	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201231	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20CA 200531	NSW DPI - Water	01/07/2004-25/02/2018
Bore Licence 20CA 201042	NSW DPI - Water	01/07/2004-30/06/2017
Bore Licence 20CA 201232	NSW DPI - Water	04/07/2004-30/06/2017

SECTION 4 – OPERATIONS SUMMARY

Table 4. Rix's Creek North PA08_0102 Production Summary

Material	Approved limit	Previous Reporting Period	This Reporting Period	Next Reporting Period
Waste Rock / Overburden	N/A	0 BCM	4,825,050 BCM	8,090,412 BCM
ROM Coal / Ore	4.5 Million Tonne per annum (western OC)	0t	915,010 t	1,969,335 t
Coarse reject / Fine reject (Tailings)	N/A	0t	0 t*	968,894 t
Saleable product	N/A	0t	462,393 t	1,011,663t

** RCN coal washed at RCS CHPP in 2016*

Table 5. Rix's Creek South DA49/94 Production Summary

Material	Approved limit	Previous Reporting Period	This Reporting Period	Next Reporting Period
Waste Rock / Overburden	16.1 Million BCM total material movement as per DA 49/94 Mod 6	13,364,730 BCM	13,534,982 BCM	13,400,000 BCM
ROM Coal / Ore	N/A	2,847,899 t	2,662,223 t	2,700,000 t
Total Material Movement on Site – Overburden + Coal	16.1 Million BCM total material movement as per DA 49/94 Mod 6	14,503,890 BCM	15,132,316 BCM	14,480,000 BCM
Coarse reject / Fine reject (Tailings)	N/A	1,341,958 t	1,732,359 t *	1,200,000 t
Saleable product	N/A	1,505,941 t	1,377,148 t	1,500,000 t

**Combined tailings from RCN and RCS operations*

4.1 Exploration

During 2016 no exploration was undertaken ahead of mining in the West Pit as this was completed in 2014 to better understand future resources available.

Exploration drilling was conducted in 2016 at RCN with 16 holes being drilled to better determine the mining resources within the approved area. More exploration is being planned to be undertaken commencing in late 2017 to better define the resource within the current mining tenements.

The Rix's Creek lease holding has a modelled resource of 39.1 million tonnes. Under the proposed Development Consent 29 million tonnes is recoverable by open cut method in the West Pit. There is also 8.5 million tonnes potentially gained via underground methods and relevant approvals in the North Pit under currently shaped and rehabilitated land.

Mine life is considered to be approximately 21 years. This is dependent on production rates. Currently the mine produces approximately 1.5 million tonnes saleable per annum with a total movement of 16.1 million bank cubic metres of material (previously 15 million bank cubic metres until Development Consent Modification 6 was approved in November 2014).

4.2 Land Preparation

Pre mining land preparation took place during the reporting period covering an area of 16.3 ha.

All the land area to be disturbed for South Pit has been disturbed. No further land disturbance will be necessary. Those area's shaped into final landform design have been rehabilitated as per the normal procedure.

Operations in West Pit during the year took place on previously disturbed land with an additional 16.3 ha pre-cleared for the progression of mining operations toward the North-west. No further clearing ahead of the mining operation will be required in 2017 in the West Pit. All available topsoil was removed and placed directly on shaped overburden areas as part of the rehabilitation during the year. Excess topsoil was stockpiled and will be reused in the future as reshaped areas become available. Any timber during the pre-clearing process suitable for fencing was re-used on-site as required. Excess timber was stockpiled on-site in manageable stockpiles. Some timber was placed onto rehabilitation areas for habitat construction.

4.3 Construction

The Coal Preparation Plant has undergone modifications to further enhance coal recovery and reduce water usage to maximise washing efficiency. The new design was thoroughly tested throughout 2013 with modifications undertaken where necessary. Stage 1 of a small-scale tailing's drying process was commissioned during November 2013 with early results proving very successful. This process led to Rix's Creek receiving two more solid-bowl centrifuge tailing's drying units and commissioning during November 2014 to minimise the need for tailing's dams and maximise in-pit dumping of washing plant waste product. During 2016 Rix's Creek used a combination of solid-bowl units to dispose of solid bowl water in pit as well as depositing fine reject within the active tailings facility onsite.

No other new infrastructure construction took place during 2016. The predominant infrastructure upgrades is noise shielding of the Rix's Creek CHPP on the southern and eastern sides (which minimises noise towards the Retreat / Singleton Heights areas) will be completed if the Rix's Creek continuation project is approved.

4.4 Mining

Rix's Creek South during 2016 operated three shifts a day, 15 shifts a week for 48 weeks. Day shift operated between 06:30 and 14:30, afternoon shift operated between the hours of 14:30 and 22:30 hours and night shift 22:30 and 06:30.

With the recommencement of Rix's Creek North operations, there was a staged approach to a rotating roster, with day shift commencing in March 2016 (6:30-14:30), afternoon shift commencing in May 2016 (14:3- 22:30) and night shift commencing in June 2016 (22:30 – 06:30).

The major operation took place in West Pit western side of Rix's Creek adjacent to South Pit. The last coal to be removed from Arties Pit north of New England Highway via open-cut means was extracted in February 2014. Tailing's Emplacement Area # 4 in the Pit 1 void was approved in August 2012 with the facility receiving its first tailing's during May 2014. This void is expected to continue receiving a low amount of tailing's pending the tailing's drying process which may prolong the facilities livelihood. This tailing's facility will hopefully be the last on-site whilst mining via open-cut methods.

With the purchase of Rix's Creek North mine and heavy mining equipment from Vale in December 2015, Rix's Creek have recommissioned the mining equipment to compliment the existing equipment at Rix's Creek South operations. The benefit of the inclusion of the mining fleet from the previous owners Vale, saw the introduction of sound attenuated Cat 789 trucks and Drills that have been used in elevated areas during night to reduce operational noise.

There has been no major change to mining methods on site during the reporting period. Overburden and inter-burden were removed utilising the Liebherr R9800 excavator, Hitachi EX5500 excavator, Hitachi EX3600 excavator, and large front end loaders (Caterpillar 994 & 992). At Rix's Creek Northern site the Caterpillar 6060, Caterpillar 6040 and Hitachi 3600 were recommissioned and operational. These machines load 220 (Caterpillar 793) and 180 (Caterpillar 789) tonne rear dump trucks. Associated with this machinery is the normal suite of ancillary equipment (bulldozers, graders, water carts and drills) used in the overburden and coal removal process.

During 2016 the main pit expansion areas included mining of the Rix's Creek North Camberwell Pit (formally Vale Integra). Rix's Creek West Pit continued to progress in a north-west direction aligned with the current MOP in place (I.e. between the out of pit dump and the New England Highway).

Table 6 is a list and number of the major pieces of equipment utilised on site for the mining operation.

Table 6. Equipment List 2016

Equipment List 2016	
Caterpillar 789 Truck	22
Caterpillar 793 Truck	11
Caterpillar 994 Front-End Loader	2
Caterpillar 992 Front-End Loader	2
Caterpillar 988 Front-End Loader	1
Caterpillar 950 Front-End Loader	1
Liebherr R9800 Excavator	1
Hitachi EX5500 Excavator	1
Hitachi EX3600 Excavator	2
Caterpillar 6060 Excavator	1
Caterpillar 6040 Excavator	1
Caterpillar D 11 Bulldozer	8
Caterpillar D 10 Bulldozer	6
Caterpillar Tiger R690B Bulldozer	1
Caterpillar 16G Grader	1
Caterpillar 16H Grader	1
Caterpillar 24H Grader	2
Redrill SK75	1
Redrill SK50	1
Sandvik Drill D75K	1
Sandvik Drill D50-i	1
Volvo Stemming Truck	1
Volvo Lube Truck	2
Caterpillar 773 Lube truck	2
Caterpillar 785 Water Cart (114,000 l)	2
Caterpillar 777 Water Cart (80,000 l)	4
ACCO Water Cart (10,000 l)	1

4.5 Mineral Processing

The basis of the Coal Preparation Plant design is:-

- 600 tph plant to process coking and steaming coal,
- raw coal feed size washed -50 mm to +0,
- -50 mm to +1.5 mm washed in heavy medium cyclones,
- -1.5 mm to +0.350mm is cleaned in spirals,
- -0.350 mm is cleaned by mechanical flotation (3 rougher cells and 2 cleaning cells),
- raw coal feed 600 tph maximum = 100 % of nominal feed rate,
- -50 mm to +1.5 mm = 70 % maximum = say 420 tph maximum,
- -1.5 mm to + -0.350 mm = 20 % maximum = say 120 tph,
- -0.350 to 0 mm = 10 % = say 60 tph,
- -feed rates — Nominal (tph)
  - design feed to plant — 650 (dependant on feed quality)
  - design feed to heavy medium cyclones — 420 (designed to be 70-75% of ROM feed)
  - design feed to fines plant — 180
- allow -0.350 mm to 0 mm = 10 % of plant feed = 60 tph maximum
- should the design feed rate to any circuit be exceeded, due to sizing variations, the plant feed rate would be reduced while the anomaly persisted.

Table 7. Production and Waste Summary for Rix's Creek Mine

Figures in () are for the current year	Cumulative Production (cubic metres)		
	Start of Reporting Period	**At end of Reporting Period**	**End of next reporting (estimated)**
Topsoil stripped (bcm)*	432,065	447,874 RCN – 0 RCS – 15,809	472,874 (25,000)
Topsoil used/spread (bcm)*	278,453	287,453 RCN –18,700 RCS – 27,000	307,353 (97,500)
Waste Rock (bcm)	208,711,285	227,071,317 (18,360,032) RCN – 4,825,050 RCS – 13,534,982	248,561,317 (22.9 million) RCN – 9.5million RCS – 13,4 million
Run Of Mine Coal (tonne)**	44,575,135	48,152,369 (3,577,234) RCN – 915,010 RCS – 2,662,223	52,822,369 (3.8 million) RCN – 1.1 million RCS – 2.7 million
Processing Waste Tailings / Chitter (tonne)	18,265,242	19,997,601 (1,732,359)	19,565,242 (2.0 million)
Coal (tonne)	26,267,893	28,107,434 (1,839,541) RCN - 462,393 RCS – 1,33377,148	30,619,097 (2,51 million) RCN – 1,011,663 RCS – 1,500,000

** Topsoil figures are not from the commencement of the mining operations.*

*** Waste Rock includes both RCN and RCS combined volumes for 2016 period.*

The recovery of saleable to run of mine coal for the year was 52.9%, the same result recorded in 2015. This is lower than the long-term average to date of 60%. This may be due to different coal

quantities washed from the West Pit and Camberwell Pit area (i.e. high ash, sulphur, moisture).

Raw coal is dumped by truck or loader into a 600 tonne receival hopper. From the hopper the coal is conveyed at 600-650 tph to a raw coal sizing screen. The raw coal screen is fitted with a double deck and wet screened. The top deck allows wet and +50 mm raw coal to enter the rotary breaker. The lower deck conveys wet -50 mm to +10 mm raw coal to be directed via a chute to the plant feed conveyor. The -10 mm slurry is directed into a conical sump and pumped to the plant.

The -50 mm from the sizing screen and the rotary breaker combine and are conveyed to the coal preparation plant. Material not broken in the rotary breaker is conveyed separately and removed by truck.

In the coal preparation plant the -50 mm to 0 mm raw coal from the primary raw coal sizing and breaker system is further sized on de-slime screens with each size fraction being cleaned in separate circuits.

Heavy media cyclones treat -50 mm to +1.5 mm fraction. Spiral clean -1.5 mm to 0.350 mm. The – 0.350 mm is cleaned in the mechanical cell flotation. The washed product is dewatered in centrifuges and vacuum drum filter then conveyed to a 1,000 tonne bin.

Process Waste: The coarse reject is conveyed to a 500 tonne truck-loading bin. The thickened tailings are pumped to the tailings emplacement if required or if the solid-bowl centrifuge has any mechanical or electrical issues. The solid-bowl centrifuge dried tailing's is disposed of in pit (co-dispersal) via haul trucks and this is the preferential mode of disposal prior to utilising the tailings emplacement.

Coarse reject from the coal preparation plant reports to the reject bin. From this bin it is trucked to the open cut area to be disposed of within the spoil material. Coarse reject disposal within the spoil material is controlled by the production supervisor, with tip areas being located on the basis of environmental constraints, the potential for spontaneous combustion and the stability of tip faces within the spoil area. All carbonaceous and reject material is covered by a minimum of 2 m of inert overburden material before the spoil area is shaped and rehabilitated.

The fine reject consists of a slurry of clay, silt and composite mineral and coal particles -2.2 mm to ~0 mm in size with water to a pulp density of 1.25% specific gravity and approximately 25% solids to water ratio. This slurry is pumped from the underflow of the tailings thickener through a pipeline to the tailings emplacement dam. The previous tailings emplacement (#2) ceased operation in July 2005 when tailings began being received into the old Pit 2 void (tailings emplacement #3). Tailing's emplacement #3 reached capacity during May 2014 with tailing's emplacement #4 (within Pit 1 void) now being used as the new tailing's storage area. With the dried tailing's process currently working effectively this tailing's facility should be adequate for the life of mine.

Tailing's emplacement #2 was successfully capped and partially rehabilitated in 2013 with rehabilitation of the area completed in 2014. Tailing's Dam #3 has been allowed to dewater and dry since May 2014. This area is being covered with overburden material and when this is completed then the area will be rehabilitated. The High Risk Activity notification for capping of Tailings Dam 3 is planned to be commenced in 2017. Rix's Creek have installed a third-scale dry tailing's process in December 2013 to allow reject to be trucked to the open cut area and disposed of within the spoil material. Since the one-third scale 'trial' proved effective in early 2014 another two units were installed during December 2014 to allow nearly all washed reject to be placed in-pit with overburden. This product is estimated to be 70% solids 30% moisture in comparison to traditional tailing's slurry which is generally 25% solids and 75% moisture content. During 2015 the solid-bowl process worked quite well with only minor mechanical and electrical issues minimising the effective utilisation of all three units, again, the tailing's dam # 4 could be used for full coal washing capabilities to be maintained.

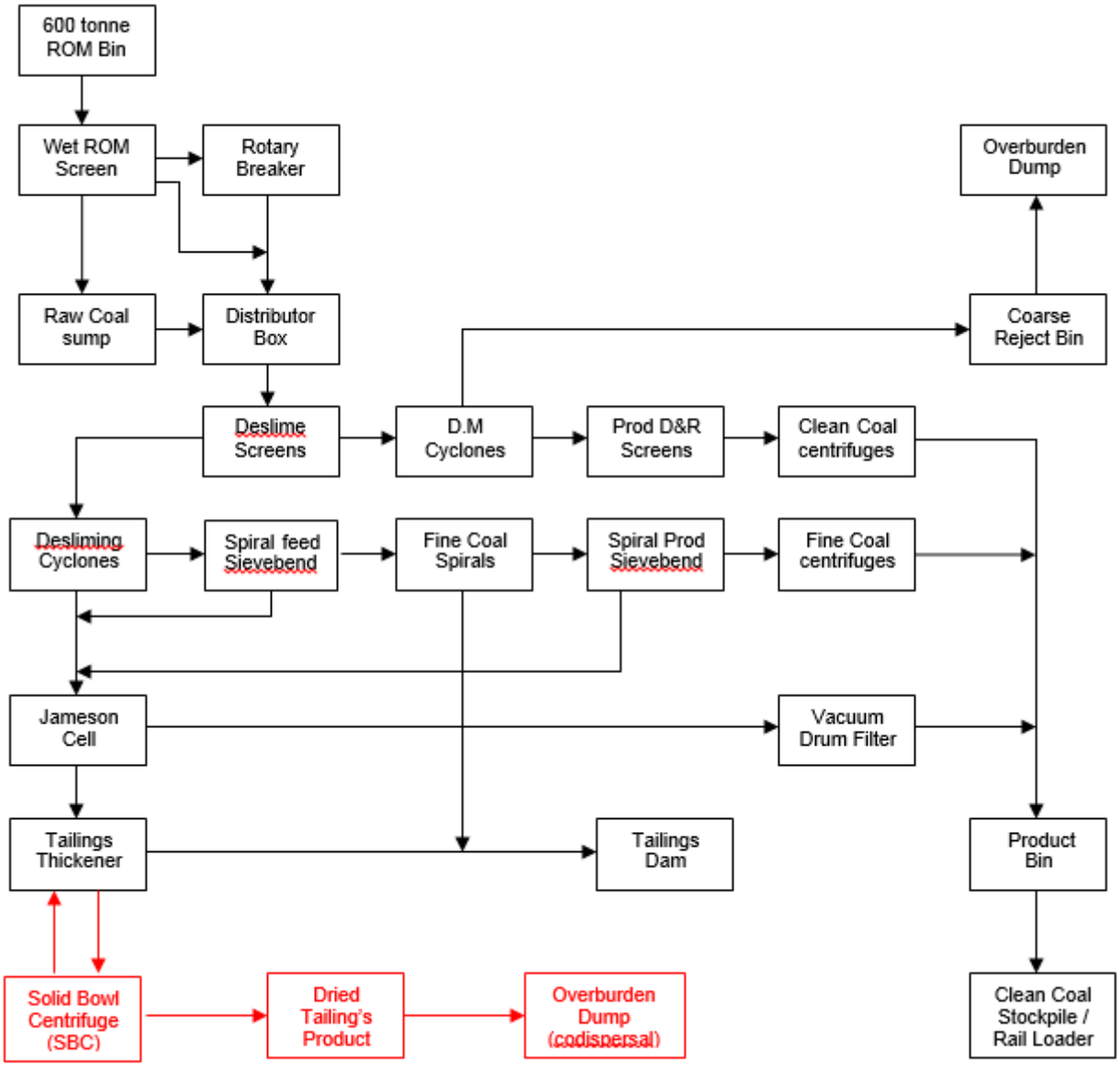


Figure 4. Coal Preparation Plant Schematic

Under DA49/94 Rix's Creek South have an approval limit on the amount of bank cubic metres that can be moved in a calendar year. Table 8 shows that Rix's Creek South removed overburden within the defined approval limit during the 2016 period.

Rix's Creek North PA 08_0102 has an approved limit on the extraction of Run of Mine Coal (4.5 Million tonnes per annum) . Table 9 shows that Rix's Creek North operations were well below the ROM extraction limit for the 2016 period in the Camberwell Pit (western mining area).

Table 8. Rix's Creek North Production

YEAR	RON-of-MINE COAL PRODUCTION (tonnes)	OVERBURDEN REMOVAL (bank cubic metres)	APPROVAL LIMIT ROM Coal (Tonnes)
2016	915,011	4,825,050	4,500,000*

* Project Approval 08_0102 Sch 2, Con.7.

Table 9. Rix's Creek South Production History

YEAR	RON-of-MINE COAL PRODUCTION (tonnes)	OVERBURDEN REMOVAL (bank cubic metres)	Total Movement of Material on site (bank cubic metres)	APPROVAL LIMIT (bank cubic metres)
1990	300,000			
1994	800,000			
1997	1,700,000	7,198,000		15,000,000
1998	1,800,000	7,052,000		15,000,000
1999	1,888,900	7,635,000		15,000,000
2000	2,288,900	7,635,000		15,000,000
2001	1,679,400	7,460,000		15,000,000
2002	1,754,001	7,787,685		15,000,000
2003	1,943,095	8,768,068		15,000,000
2004	1,931,383	8,511,771		15,000,000
2005	1,628,753	9,567,000		15,000,000
2006	2,015,042	11,547,989		15,000,000
2007	2,096,320	11,150,416		15,000,000
2008	2,096,697	11,020,152		15,000,000
2009	2,338,424	10,698,123		15,000,000
2010	2,367,229	10,267,881		15,000,000
2011	2,212,703	10,589,386		15,000,000
2012	2,689,935	10,341,895		15,000,000
2013	2,747,880	11,502,321		15,000,000
2014	2,760,693	13,234,085		16,100,000*
2015	2,847,899	13,364,730	15,073,469	16,100,000
2016	2,662,223	13,534,982	15,132,316	16,100,000

*Development Consent 49/94 - Mod 6 approval granted November 2014.

The tailings is transported by pipeline and safeguarded by:-

- use of welded PVC pipe;
- containment dams located along the length of the pipeline;
- regular pipeline inspections; and
- sequential flow meters.

The solid-bowl centrifuge system will enable a lower amount of tailing's to be transported by pipeline as the water removed during the tailing's 'drying' process allows for co-disposal of the 'dried' tailing's within the open cut emplacement area in a similar fashion to overburden. Early testing of dump areas has shown minimal surface slumping / cracking when this dried tailing's material is capped with sufficient overburden material from the mining process.

Return water is decanted from the emplacement area and pumped back to the containment water

system that feeds the coal preparation plant. This maximises the recycling of mine water across site. Even with the tailing's line not pumping at times water enters this area via rainfall and runoff as it is a large catchment.

Following the start of mining in 1990 coal was transported by road to Bloomfield Colliery at East Maitland for beneficiation and shipping to the port of Newcastle. This ceased in 1993 following the commissioning of the coal preparation plant and construction of the joint rail loop with Camberwell Coal and rail loading facility. Since 1993 all product coal has been transported, by rail to the port of Newcastle. There has been no change to the method of transport since the rail loading facility commenced operation.

Application was made during 2000 to increase the level of the 2nd tailings emplacement by 15 metres. This increased the life of the emplacement by 3 years and allowed the area (now rehabilitated) to better fit in with the surrounding landscape. The emplacement ceased operation in July 2005 when tailings receival commenced in the Pit 2 void (or 3rd Tailing's emplacement). The old emplacement was allowed to drain prior to commencing capping and rehabilitation. Capping with overburden, final landform design and rehabilitation was completed during 2014. Some areas were direct seeded with native tree species during autumn 2015 which was additional to the 3 ha of tree species already direct seeded and tube stock planted to date.

4.6 Waste Management

Waste Water: Grey water generated on site consisting of domestic waste water from the bathhouse, associated amenity areas and administration area pass through a septic system approved by the local authorities (OSSM Approval No: 2820/2002 expiry 1/3/2017). The septic tank provides a primary and secondary treatment process with solid waste processed by anaerobic bacteria. Effluent then passes to a maturation pond prior to disposal by evaporation and land irrigation. The Septic system is cleaned out 6-monthly by a suitably qualified waste contractor and the resulting waste is removed from site.

Waste Oil: Waste oil from mining equipment as a result of scheduled maintenance operations, breakdown repairs and the oil arrestor is collected in a storage tank and there after removed for recycling by a waste oil collector, Australian Waste Oil Refineries. This oil is processed and returned to site and used in blasting operations at the required specifications. During 2013 a variation to Rix's Creek EPL 3391 included specifications on the refined oil used in this process.

Most mining machinery is greased automatically by an on board system. The system is refilled from a bulk bin on the mobile service cart. Alternatively, this is carried out in the main workshop.

Any oily water from spills or contained within bunded storage areas are also collected by a waste oil collector, Australian Waste Oil Refineries. Water high in sediment, coal fines, clays is also handled via a contractor company, Transpacific Industries and handled on-site via the Tailing's Dam facility which has similar quality stored water via the tailing's line from the CHPP.

Waste Metal: Scrap metal is collected for recycling on a regular basis as required. The metal recycler sorts into hard and soft metal for further economic benefit to the company.

Copper Bin: Assorted copper on site, mostly from electrical wiring, is recycled by a metal contractor and collected on a regular basis as required. Most wiring remains with the protective layer attached but where economical a contractor strips assorted wire on-site for further economic benefit to the company. A copper waste bin is located in the electrical workshop to further minimise waste.

Waste Tyres: Discarded earthmoving machinery tyres not suitable for reuse are disposed of progressively in the void of the mining process and buried, as at present there is no recycling process available for heavy earthmoving machinery tyres in the Hunter Valley. The number of tyres disposed of simultaneously being restricted to 6 to reduce bulk, with the void then progressively backfilled with overburden and rehabilitated in the normal process. Some tyres are recycled across site and used for roadside protection, haul truck parking dividers, signage bases, etc.

General Waste: General garbage is placed in large bins and taken off site by a licenced waste contractor for disposal in the Council landfill site.

Paper/Cardboard Recycling: Paper and Cardboard is placed in large bins and taken off site by contractor for further recycling. Small paper/recycling bins are placed within the main office, workshops and CHPP's to enhance recycling.

Plastic wrapping: Plastic wrapping recycling was introduced during 2015 to site. Plastic used in the wrapping of parts and other assorted uses across site is placed in tied-off bags within the store and collected with the paper/cardboard recycling for further recycling off-site by the waste contractor.

Batteries: Small general use batteries (AA, AAA, C, D, etc) recycling was introduced during 2015 to site. Sealed battery tubs are located within the offices, electrical workshop and RCN workshop for further recycling off site by the waste contractor.

Oil Filter Bin: Used oil filters from heavy vehicles are placed in a large bin near located at both the Southern and Northern workshops and taken off site by contractor for cleaning and recycling at the waste contractor's facility.

Used printer cartridges: These are placed in a large bin within the main office and taken off site by contractor for recycling at the waste contractor's facility as required.

Rix's Creek Mine is looking at further waste segregation of rubber (i.e. hoses) on site with assistance from the waste contractor.

Table 10. Waste Volumes

2016	Waste Oil (L)	Waste Metal (kg)	General Waste (kg)	Paper/Cardboard Recycling (kg)	Oil Filters (kg)
1st Quarter	9,000	28,220	28,518	3,531	2,650
2nd Quarter	23,000	32,150	26,141	2,335	2,178
3rd Quarter	8,000	36,134	30,158	3,012	3,631
4th Quarter	23,000	26,810	27,715	2,490	2,120
TOTAL	**63,000**	**123,239**	**112,532**	**11,368**	**10,489**

4.7 Product Stockpiles

Raw coal is transported from the active mining areas in 180 and 220 tonne and rear dump trucks (Caterpillar 789 and 793) to the 30,000 tonne capacity run of mine (ROM) stockpile at the coal preparation plant prior to washing.

Product coal (clean coal) is conveyed to a 1,000 tonne bin and then transported by road vehicles 2.0 kilometres to the rail loading facilities. Each road vehicle holds approximately 48 tonnes of clean coal. The capacity of the clean coal stockpile at the rail loading facility is 185,000 tonnes. During 2002 sections of the stockpile area were resurfaced and additional drainage installed. This work was completed in May 2004. The completion was delayed due to stockpile levels.

4.8 Hazardous Material Management

Under Schedule 11 of the Work Health and Safety Regulation notification of hazardous substances occurred during 2016. The listing of dangerous goods stored on site is listed below:-

Depot 1	Above ground tank for Class C1, UN 00C1 Diesel.	110,000 litres
Depot 2	Above ground tank for Class C1, UN 00C1 Diesel.	90,000 litres
Depot 3	Above ground tank for Class C1, UN 00C1 Diesel.	90,000 Litres
Depot 5	Above ground tank for Class C1, UN 00C1 Diesel.	90,000 litres
Depot 6	Above ground tank for Class 3, UN 1989 Aldehydes, N.O.S.	15,000 litres
Depot 8	Above ground tank for Class C1, UN 00C1 Combustible liquids	60,000 litres
GAS1	Cylinder store for Class 2.1, UN1001 Acetylene, dissolved	1,000 litres
GAS2	Cylinder store for Class 2.2, UN1072 Oxygen, compressed	1,000 litres
GAS2	Cylinder store for Class 2.2, UN1006 Argon, compressed	1,000 litres
RCN1	Above ground tank for Class 5.1, Ammonium Nitrate	50,000 kg
TKN1	Above ground tank for Class 5.1, Ammonium Nitrate Emulsion	60,000 kg

TKN2	Above ground tank for Class 5.1, Ammonium Nitrate Emulsion	30,000 kg

A separate licence for the storage and handling of explosives on the site has also been made to WorkCover. License number:- XSTR100131 was renewed in June 2012 until 5/7/2017. The listing of explosives stored on site is listed below:-

MAG1	Magazine Class 1.1B, UN 360, Detonator Assemblies non-electric	10,000 units
MAG1	Magazine Class 1.4S, UN 349, Articles, Explosives, N.O.S.	10,000 metres
MAG1	Magazine Class 1.4B, UN 255, Detonators, Electric for blasting	10,000 units
MAG2	Magazine Class 1.1D, UN 65, Cord, detonating, flexible	3,000 metres
RCN1	Explosives Recepticle Class 5.1, Ammonium Nitrate (ANFO)	50,000 kg
TNK1	Above ground tank Class 5.1, UN 3375, ANFO Emulsion	80,000 litres
TNK2	Above ground tank Class 5.1, UN 3375, ANFO Emulsion	36,000 litres

Access to Material Safety Data Sheets is through the ChemAlert web site. The register is continually updated as new products are brought onsite.

Explosives are stored in explosive magazines located on site. The magazines comply with the relevant standards for storage of explosives AS 2187.

4.9 Other Infrastructure Management

There has been an ongoing maintenance program on infrastructure associated with the Rix's Creek mining operation. This has included painting of assorted buildings and substations sheds across site.

Rix's Creek has ownership of the former Vale owned rail loop to transport product coal to the port of Newcastle for export. The rail loading facility and clean coal stockpile is located off the mining lease adjacent to the northern boundary on land owned by the company. In 2017 maintenance and access of the rail loop areas will be improved and vegetation will be removed off the ballast section of the rail loop.

During 2016, recommissioning work was completed on the Rix's Creek North CHPP in preparation for washing of Integra UG ROM coal in 2017.

SECTION 5 – ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

5.1 Actions Required at Previous AEMR Review

The Rix's Creek South (DA: 49/94) annual environmental inspection took place on 17th June 2016; this inspection was undertaken to review Rix's Creek South 2015 reporting period by NSW Trade & Investment – Division of Resources & Energy (DRE). A review of the report was undertaken followed by a site tour and close-out site inspection meeting. The review was undertaken by Catherine Lewis and Kate Walsh (Inspector Environmental, DRE).

An Annual Review inspection was also conducted for the 2015 reporting period for Rix's Creek North operations (PA: 08_0102). The annual review was conducted by Kate Walsh and Paul McBain from DRE on 21st June 2016.

The Department of Planning and Environment (DPE) conducted a desk top audit for both the Rix's Creek South and the Rix's Creek North (formerly Integra Complex) 2015 annual review. DPE reviewed both the Rix's Creek South and Rix's Creek North 2015 Annual Review and considered the reports to be generaly in accordance with the conditions of approval.

SECTION 6 ENVIRONMENTAL PERFORMANCE

An extensive environmental monitoring program is conducted throughout the site and surrounding areas to monitor the impacts of the operation. Environmental parameters monitored include local meteorology, air quality, water quality, vibration and noise.

Plan 1 shows the location of monitoring sites for the various environmental parameters.

6.1 Meteorological

The RCS mine operates a meteorological station on the site. The previous station was located on the northern side of the New England Highway, adjacent to the haul road, leading to the operations on the southern side of the Highway. This unit required replacement during 2014. The new meteorological station is located on the southern side of the New England Highway, adjacent to the West Pit operations near Granbalang trig station. This new weather station commenced during April 2014 and has real-time capabilities for all personnel to access via computer or phone. There is also a meteorological station at the RCN mine located near the entry lane / main administration office. This station has real-time capabilities and is accessed via the site Environmental Monitoring system (SCADA network). Both meteorological stations record the following environmental parameters:-

- wind speed and direction;
- temperature (2m and 10m);
- relative humidity;
- solar radiation; and
- rainfall.

These parameters are recorded at 10-minute intervals and downloaded on a monthly basis. To complement this Rix's Creek Mine is a member of the Upper Hunter Sounding Group Joint Venture (UHSGJV) which provides access to an atmospheric prediction model providing more accurate weather parameter predictions for the Rix's Creek operation. This information is used by management to access environmental conditions for blast scheduling, and determine when adverse conditions exist to cease dumping to exposed locations. This model also forecasts meteorological data for the following day so operational activities can be scheduled for the predicted conditions.
Rix's Creek installed a new meteorological station near West Pit during 2014 so it is closer to the continuation of mining in the South mining lease area.

6.1.1 Rainfall

Total rainfall for the period was 705.75 mm over 76 days, which was 7.75 mm above average for the year - compared to 2015 where total rainfall was 961.75 mm and 263.75 mm above average. The yearly average for Singleton is 698 mm. The monthly rainfall data is provided in Table 11 and Figure 5 shows the results graphically.

January, June and September were the only months to receive above average rainfall. January received extensive rainfall with more than three times the average amount whilst June and September also received slightly increased rainfall. February through to May was a very dry period with all four months receiving less than half of the monthly average rainfall.

Table 11. Annual Rainfall

RIX'S CREEK ANNUAL RAINFALL 2016													
Month	January	February	March	April	May	June	July	August	September	October	November	December	**TOTAL**
Total Rainfall	248.5	13.25	23	17.5	11.75	92.5	46.25	38.75	68	30	44.5	71.75	**705.75**
Average Rainfall	75	72	71	56	46	57	51	42	45	51	58	74	**698**
Wet days (>0.5 mm rainfall)	11	3	6	3	3	7	6	10	10	5	5	7	**76**

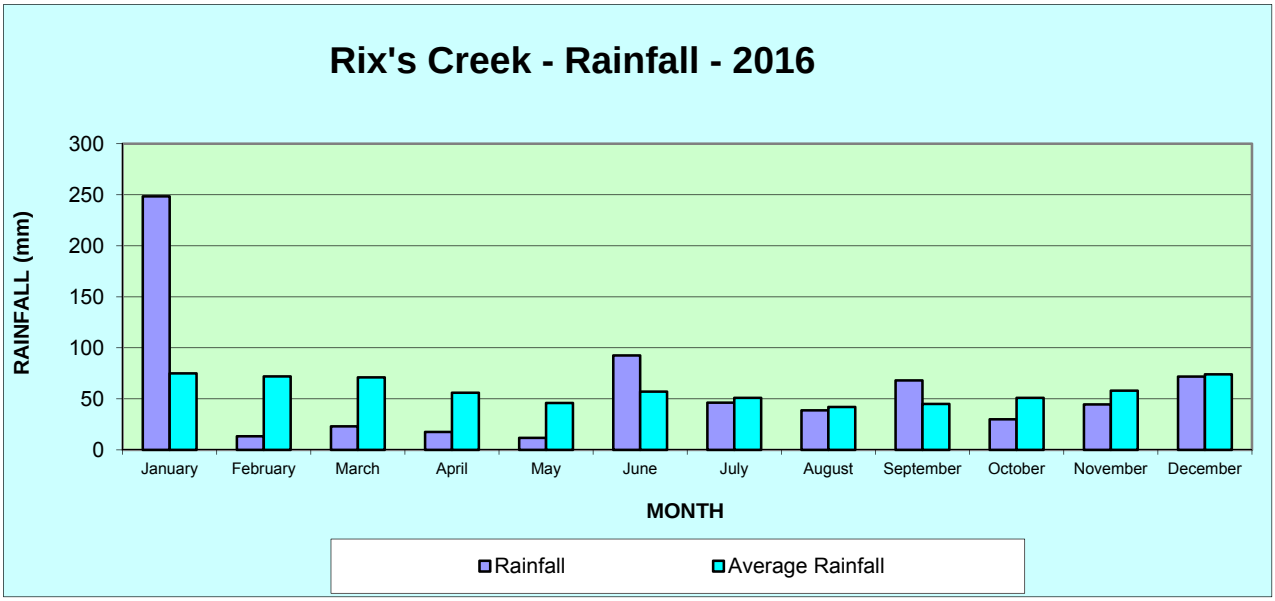


Figure 5 - Annual Rainfall 2016

6.1.2 Temperature

The maximum temperature of 39 °C occurred on 30th of December and the minimum temperature of 2.6 °C was recorded on 30th June. Figure 6 shows the monthly average maximum and minimum temperatures for the site.

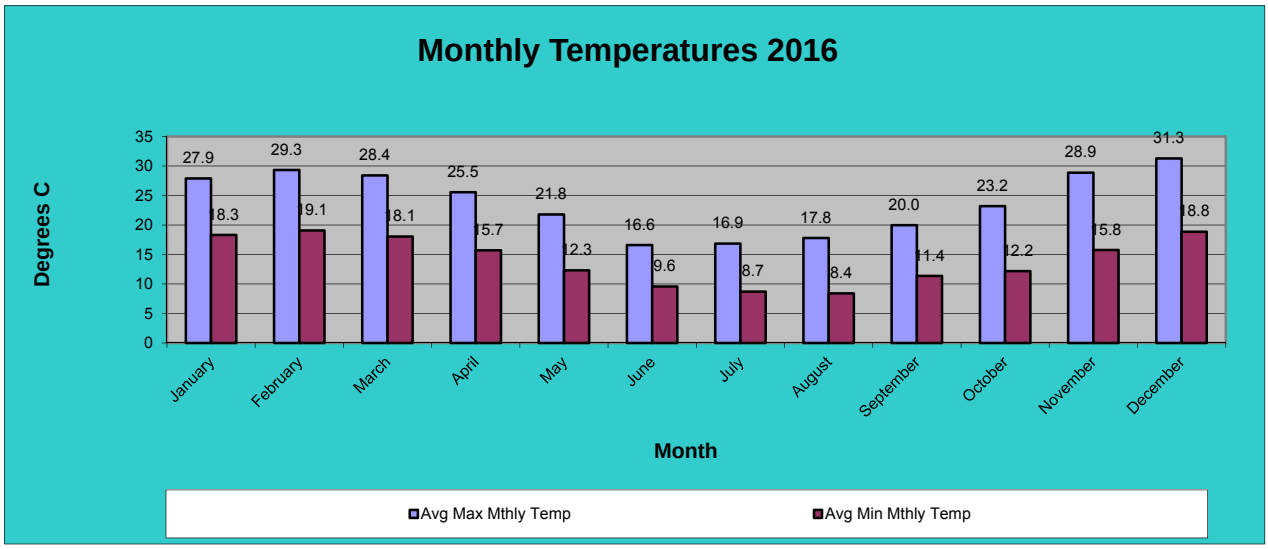
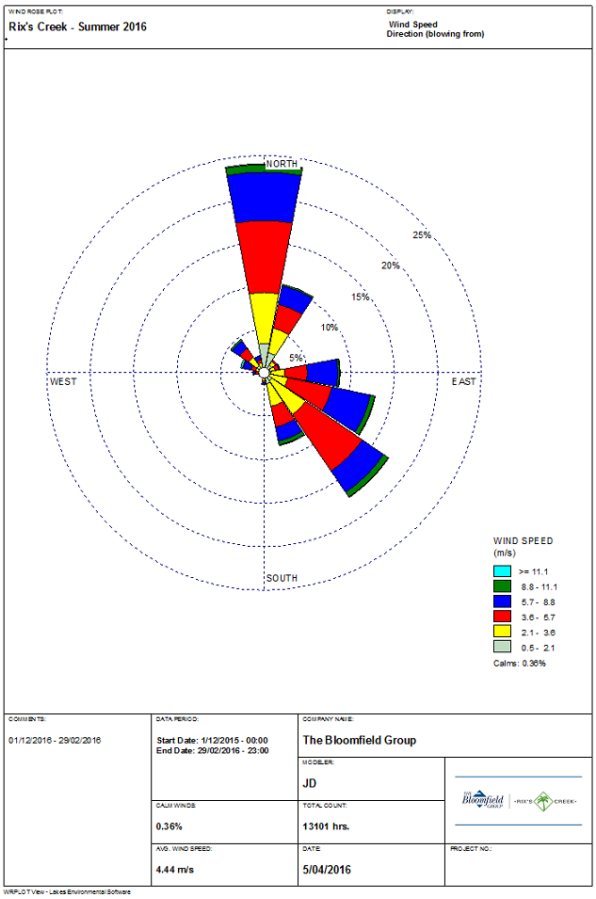


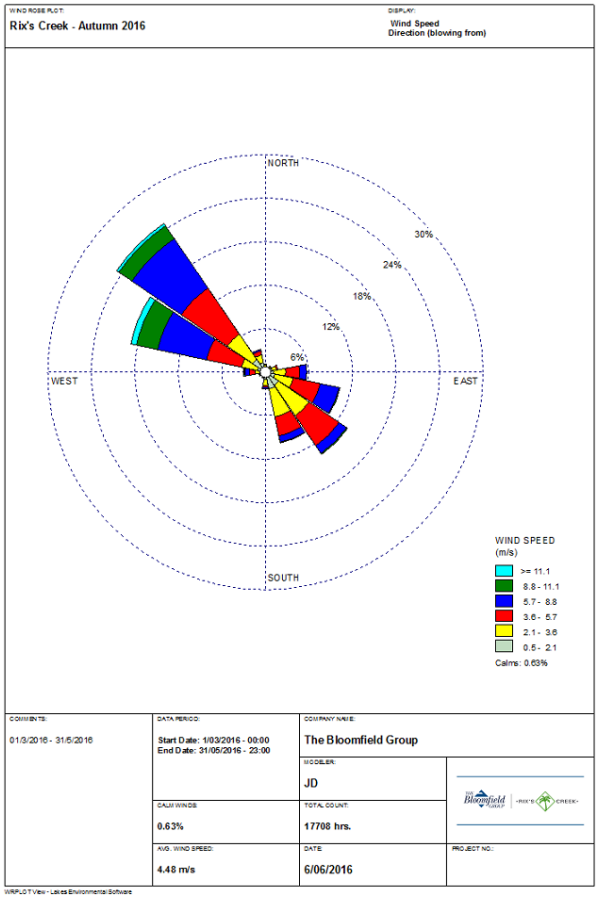
Figure 6 Monthly Average & Minimum Temperature 2016

6.1.3 Wind Speed and Direction

The results of wind speed and direction monitoring shows similar trends to previous years. During summer the winds predominate from the south east and winter the northwest. Autumn and spring are typically transitional seasons with winds distributed between both northwest and south-easterly directions. From all of the windroses it is evident the dominant wind direction for the calendar year was from the north-west.

Figure 7 shows the seasonal windroses generated for the site on a seasonal basis.





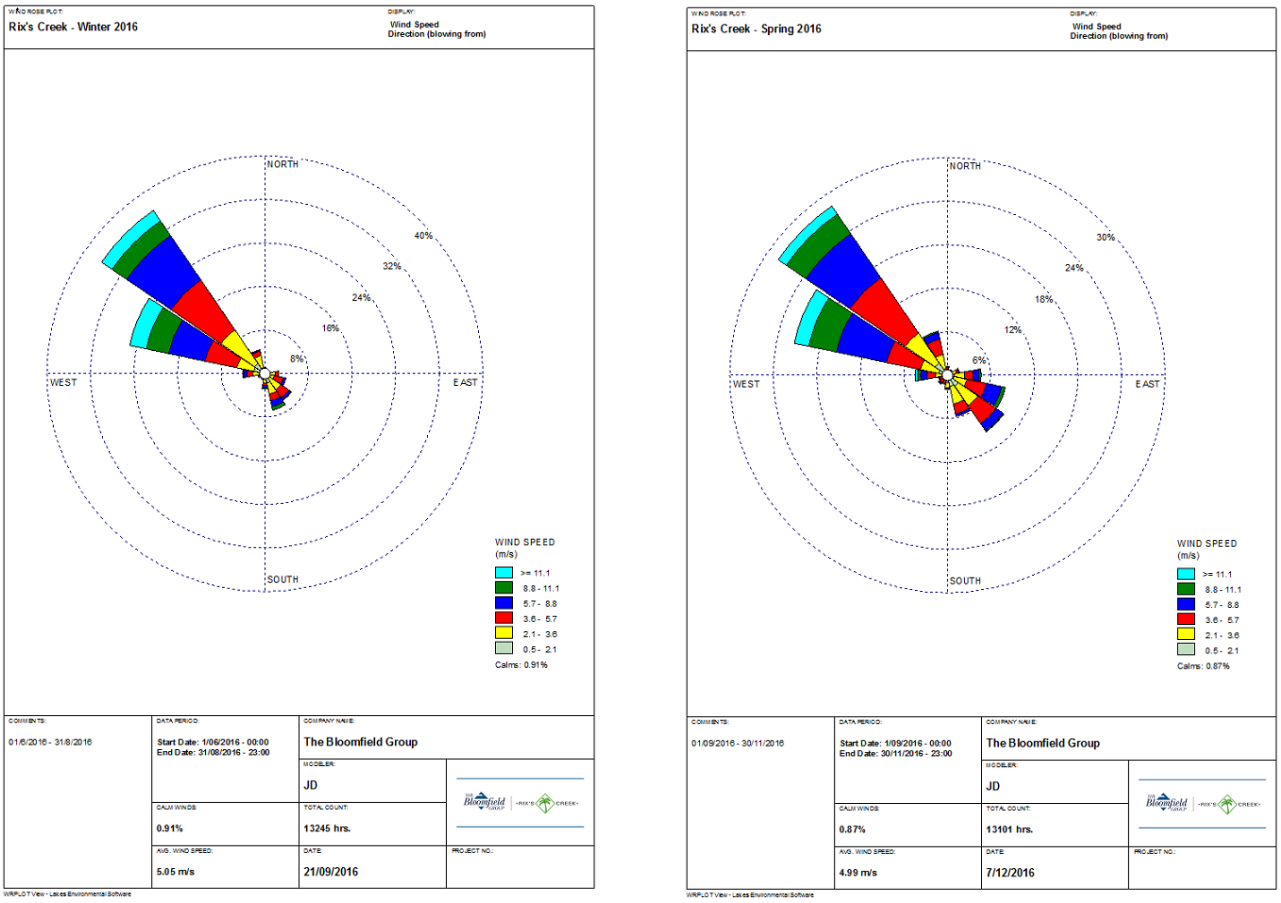
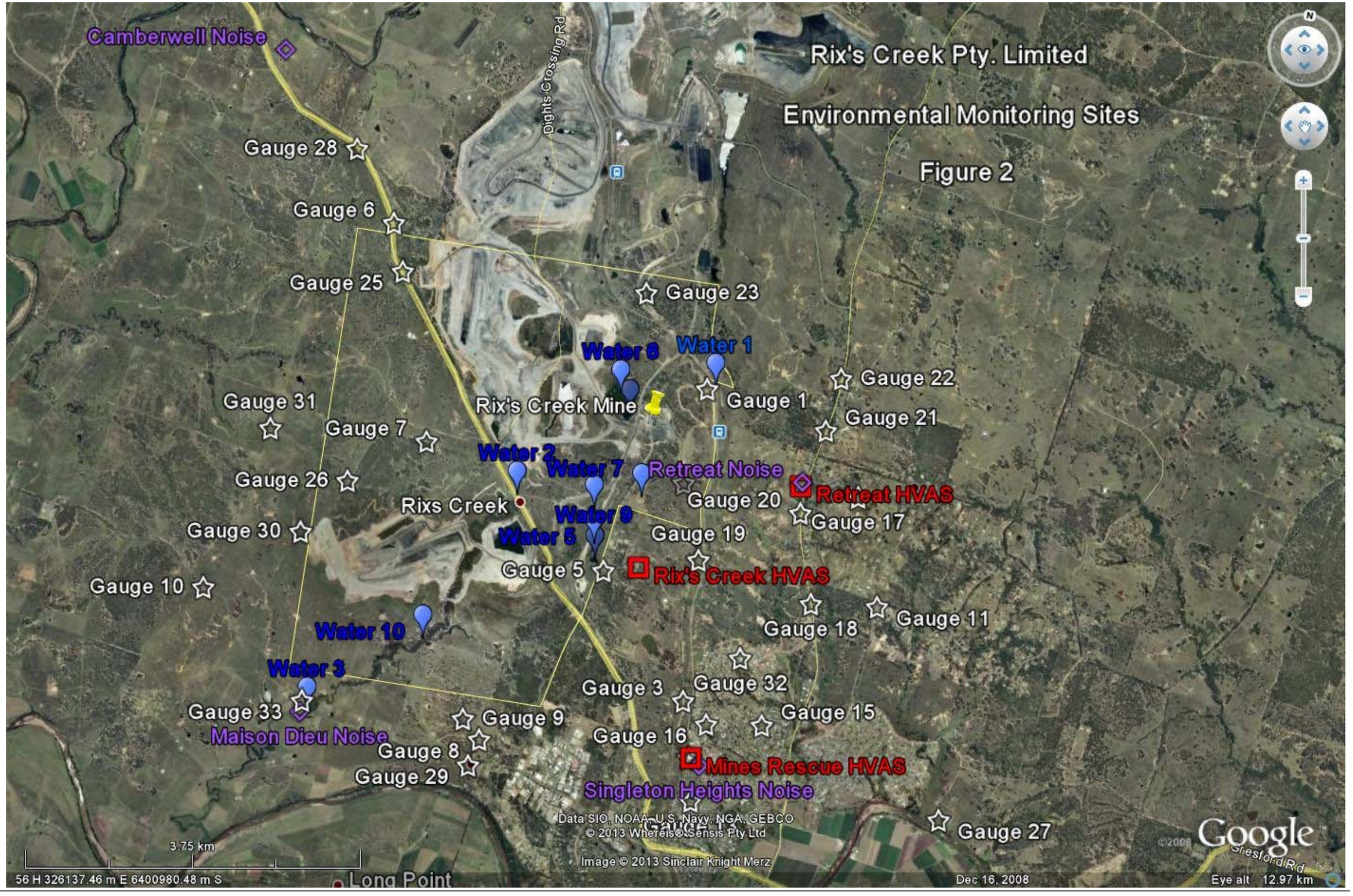
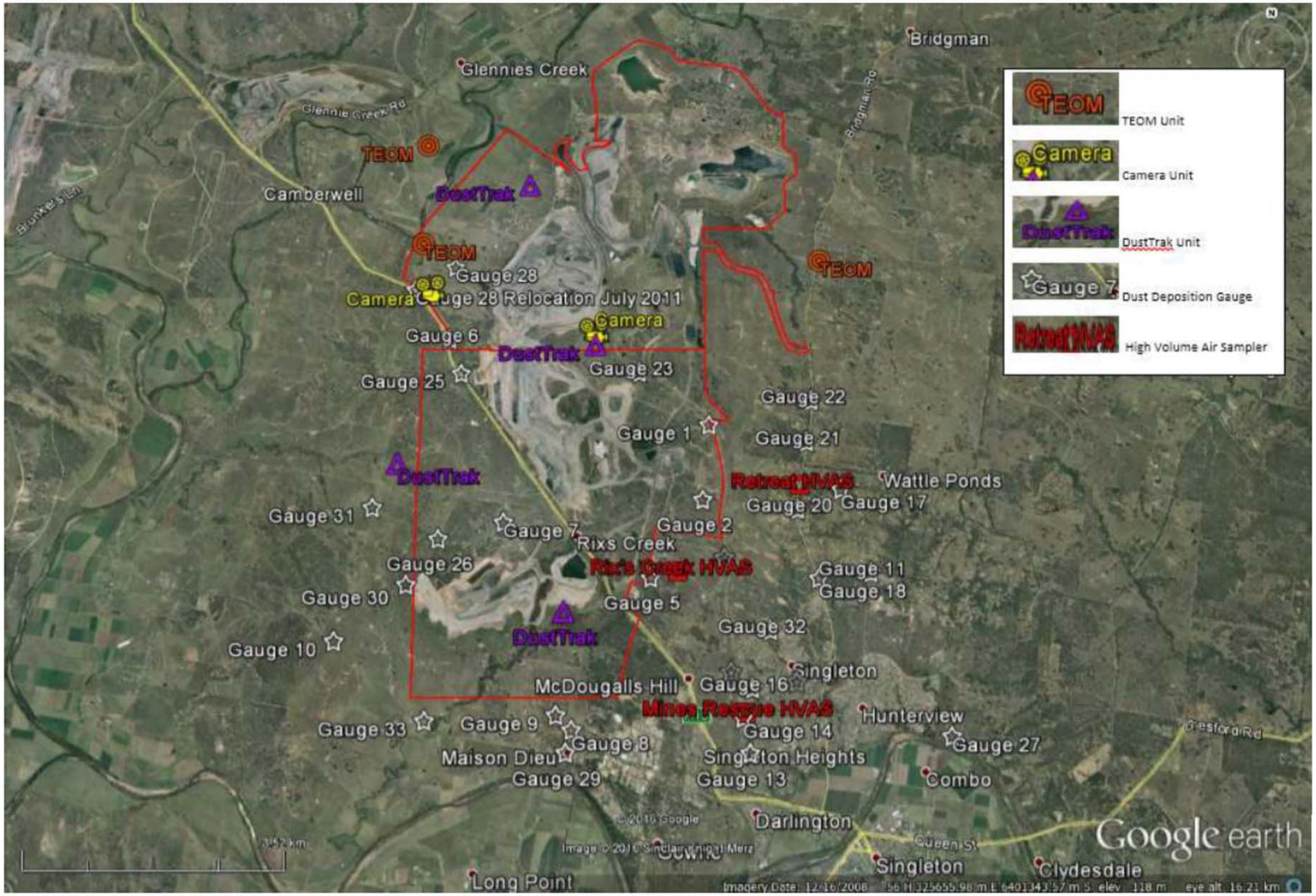
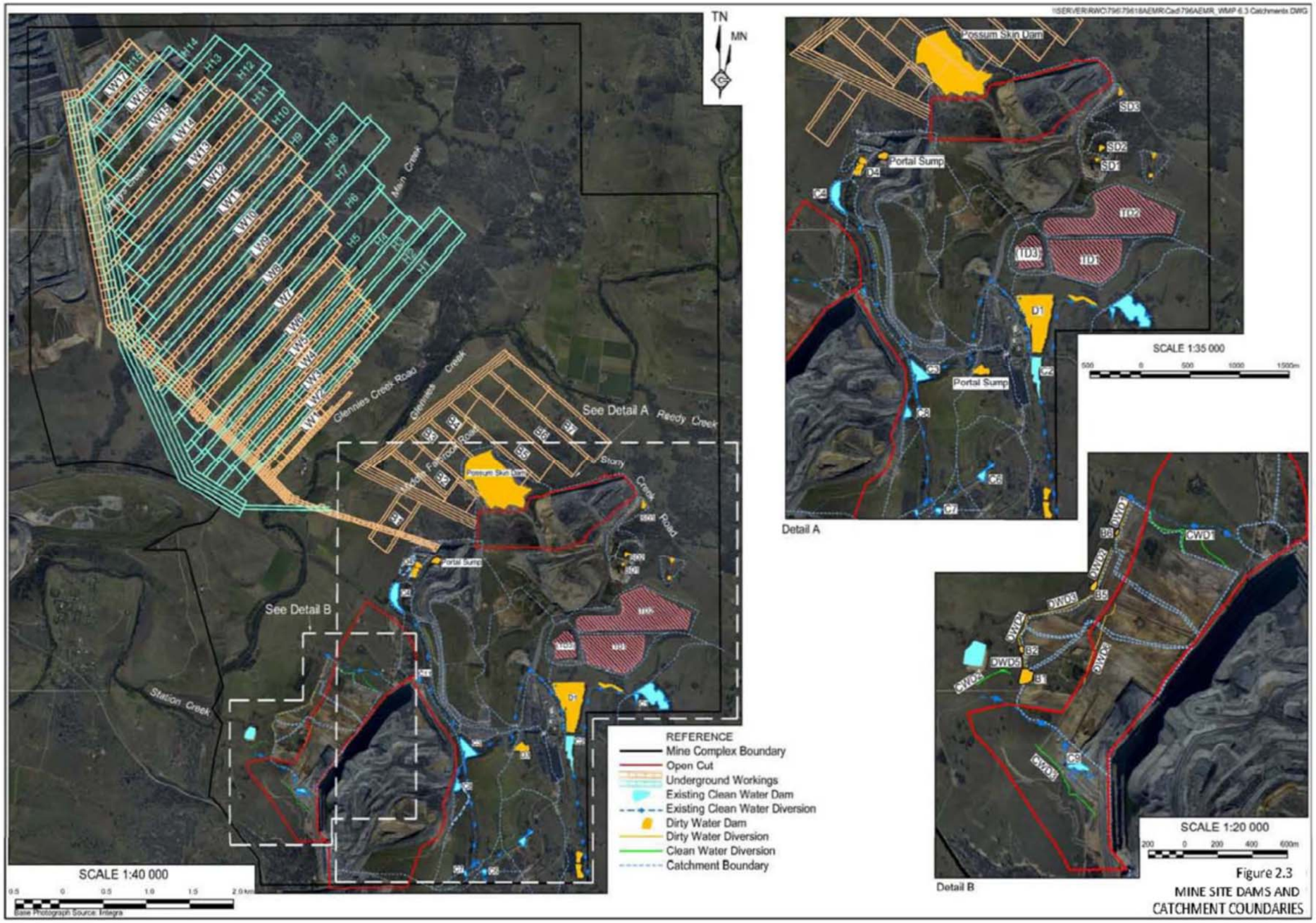


Figure 7 Windrows for Rix's Creek 2016


Rix's Creek Pty. Limited
Environmental Monitoring Sites
Figure 2
Camberwell Noise
Dights Crossing Rd
Gauge 28
Gauge 6
Gauge 25
Gauge 23
Water 6
Water 1
Rix's Creek Mine
Gauge 1
Gauge 22
Gauge 21
Gauge 31
Gauge 7
Water 2
Water 7
Retreat Noise
Retreat HVAS
Gauge 20
Gauge 17
Gauge 26
Rixs Creek
Water 9
Water 5
Gauge 19
Gauge 30
Gauge 5
Rix's Creek HVAS
Gauge 10
Water 10
Gauge 18
Gauge 11
Water 3
Gauge 3
Gauge 32
Gauge 33
Gauge 9
Gauge 15
Maison Dieu Noise
Gauge 16
Gauge 8
Mines Rescue HVAS
Gauge 29
Singleton Heights Noise
Gauge 27
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Wheres©Sensis Pty Ltd
Image © 2013 Sinclair Knight Merz
3.75 km
56 H 326137.46 m E 6400980.48 m S
Long Point
Dec 16, 2008
Eye alt 12.97 km
Google
Gresford Rd



Rixs Creek North Air Quality Monitoirng Sites



Rixs Creek North Water Monitoring Sites.

6.2 Operational Noise

6.2.1 Environmental Management

Rix's Creek has changed the monitoring and reporting of noise during 2016 as it goes through a transition period from the existing 1995 development consent into the proposed new consent (2017-onwards for a period of 21 years). Currently in 2016 to satisfy consent requirements, both 72 hour monitoring (current Consent requirement) and attended monitoring results (Updated current noise monitoring procedure) will be reported for 2016.

The Rix's Creek Complex Noise Management Plan, which includes both Rix's Creek South and Rix's Creek North mining operations was approved by Department of Planning & Environment on the 16th February 2016.

The primary objectives of the Noise Management Plan is to ensure compliance with legislative requirements, support procedures to manage and monitor noise emissions from the mine and provide management mechanisms to minimise the potential for noise from the mine to cause off site impacts were possible.

Residences surrounding the Mine have been grouped generally according to the locality and local acoustic environment. These groupings are referenced in the relevant EAs as Noise Assessment Groups (NAG).

6.2.2 Environmental Performance

Noise levels from RCN and RCS complied with the relevant criteria as detailed in the current Noise Management Plan at all monitoring location during 2016**.** A review of the projects environmental performance against predictions made in the environmental assessment is described in the Annual Noise Report in Appendix 3.

6.2.3 Reportable Incidents

No reportable incidents were recorded relating to noise during the 2016 reporting period as a result of monthly independent compliance monitoring.

6.2.4 Noise Complaints.

Thirty-eight (38) noise complaints and six (6) noise enquiries have been received in relation to operational noise over the reporting period. Over this period thirty-three (33) complaints were from two residents in Maison Dieu and McDougalls Hill over various dates. The remaining five (5) complaints were from four individual complainants who reside in Long Point, Camberwell and Bridgman and one anonymous complainant from Maison Dieu. Table 13 refers to the description of the noise complaints lodged at Rix's Creek in 2016.

Table 12 Noise Complaints

Date Received	Location	Description
12/1/16	Long Point	Noise from mining operation disturbing sleep.
8/2/16	Camberwell	Noise from mining operation clearly heard in the morning.
15/2/16	Maison Dieu	Mine noise noticeable inside of house.
17/2/16	Maison Dieu	Mine noise noticeable from back porch of home.
25/2/16	Maison Dieu	Noise from mining operation disturbing sleep.

10/3/16	Maison Dieu	Rix's mine noise/ constant mine hum disturbing resident.
10/3/16	Maison Dieu	Loud bangs and constant mining hum disturbing resident.
6/4/16	Maison Dieu	Mining operational noise complaint received from Maison Dieu resident via EPA.
8/4/16	Maison Dieu	Mine noise disturbing resident.
29/4/16*	Maison Dieu	Noise enquiry
11/5/16*	Maison Dieu	Noise enquiry
6/7/16*	Bridgman	Noise enquiry.
14/7/16*	Bridgman	Noise enquiry.
26/7/16	McDougalls Hill	Noise complaint from McDougalls Hill resident, a first time complainant. This residence was subsequently decided to be a regular attended noise monitoring site.
27/7//16	McDougalls Hill	Mine noise from Rix's creek West Pit operations disturbing resident.
28/7/16	McDougalls Hill	Mine noise from Rix's creek West Pit operations disturbing resident.
10/8/16	Maison Dieu	Mine noise disturbing resident. Noise monitoring was undertaken at complainant's residence and noise levels were compliant.
11/8/16*	Bridgman	Noise enquiry.
16/8/16	Maison Dieu	Complaint made via Department of Planning and Environment stating that equipment Noise from Rix's Creek mine site could be heard from within resident's home keeping them awake.
7/9/16	Maison Dieu	Noise from mining operation disturbing resident.
12/9/16	Maison Dieu	Mining operational noise complaint received from Maison Dieu resident via DPE.
20/9/16	McDougalls Hill	Mining operational noise complaint received from McDougalls Hill resident via EPA.
20/9/16	McDougalls Hill	Loud noise from mining operation disturbing resident.
21/9/16	Maison Dieu	Mining operational noise.
21/9/16	McDougalls Hill	Complaint received from Maison Dieu resident via DPE.
22/9/16	McDougalls Hill	Mining operational noise.
22/9/16	McDougalls Hill	Mining operational noise complaint received from McDougalls Hill resident via EPA.
22/9/16	McDougalls Hill	Mining operational noise.
26/9/16	McDougalls Hill	Mining operational noise.
27/9/16	McDougalls Hill	Mining operational noise.
28/9/16	McDougalls Hill	Mining operational noise.
28/9/16*	Maison Dieu	Noise enquiry.
18/10/16	McDougalls Hill	Mining operational noise.
30/10/16	Maison Dieu	Mining operational noise.
3/11/16	McDougalls Hill	Mining operational noise.

3/11/16	Maison Dieu	Mining operational noise.
7/11/16	McDougalls Hill	Excessive mine noise – loud machine noise / trucks being loaded.
17/11/16	Maison Dieu	Operational noise disruptive to resident.
28/11/16	McDougalls Hill	General mining noise noticed when waking up for work.
29/11/16	McDougalls Hill	Noise complaint made to Rix's Creek Hotline.
1/12/16	Maison Dieu	Anonymous complaint received from Maison Dieu resident.
5/12/16	Bridgman	Resident could hear noise from RCN operations.
5/12/16	Camberwell	Resident was woken up from mine noise. Resident could hear trucks humming, excavator loading and dozer tracks originating from the RCN operations.
14/12/16	McDougalls Hill	General mining noise noticed when waking up for work.

**Enquiry, no complaint lodged.*

6.2.5 Further Improvements.

All equipment is checked and maintained on a regular basis to ensure noise attenuation equipment silencers – mufflers are operational. All new equipment is fitted with broad band reversing alarms to minimise offsite noise impacts. Sound suppression will continue for any new pieces of equipment prior to commencing work/s on-site.

Further noise attenuation work is also anticipated for the CHPP (eastern and southern walls) and ROM Pad receival hopper to minimise noise travelling south-east from this area. This work is dependent on the approval of the Rix's Creek Continuation project.

During 2014 Rix's Creek worked with Todoroski Air Sciences (TAS) and Nigel Holmes to develop a 3-D predictive noise model for the Mine. The meteorological data from the Hunter Valley Meteorological Sounding Group Joint Venture (HVMSGJV), meteorological forecasts for the Rix's Creek mine site is used to develop half hourly predictions, of noise enhancement conditions, for each twenty four hours of Mine production. To date noise enhancement has been in predicted area's shown on model. The model was upgraded during 2015 to include all offsite receptors (residences) as follows:

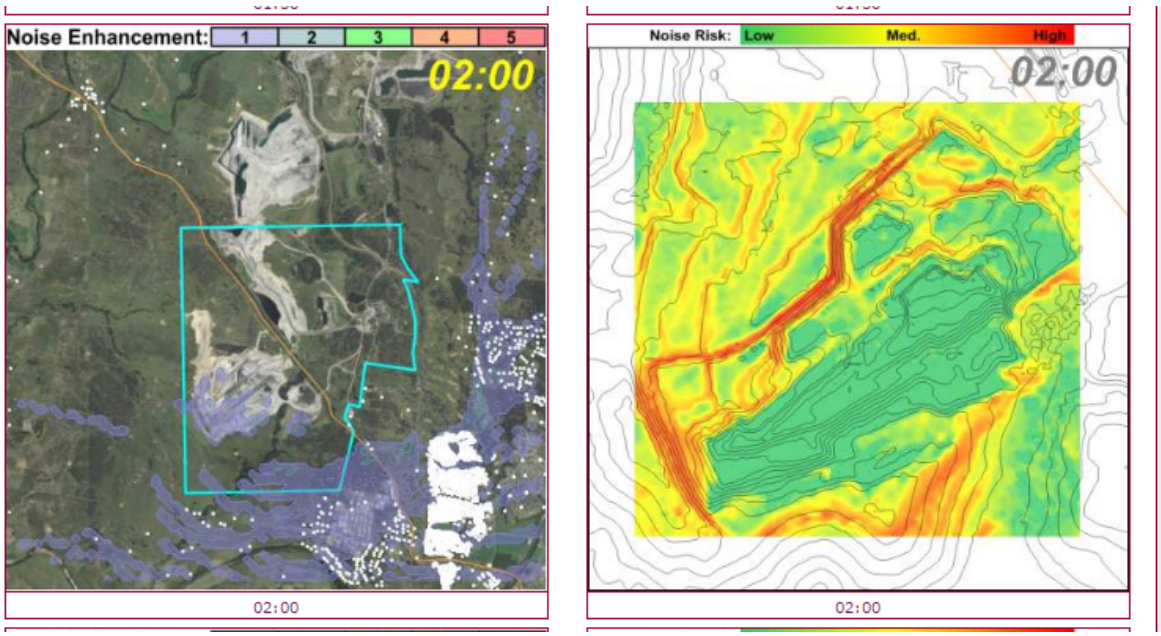


Figure 8 Updated noise model 2016 to reflect enhancement from operational areas within

open cut area.

*White dots indicate off-site receptors / residences closest to mining operation.

The use of the Todoroski 3-D noise model to predict areas of possible meteorological enhancement of Rixs Creek open cut noise, to plan mine working faces has been successful in controlling it's noise impact to current Environment Protection License (EPL 3391) Project Specific Noise Criteria as per Noise Pollution Production Program (U1 Premises Noise Limits: 12323_PRP_R02 as submitted by Global Acoustics). An integral part of the Noise Management Plan is using real time attended monitoring. The monitoring results assist in calibration of the noise model and production shift supervisor placement of the mines production units to keep mine noise levels to license conditions.

During 2016 further advancements to the Todoroski 3-D noise model has occurred (Figure 9), with areas of operational noise enhancement being highlighted in yellow within the open cut area. This provides Rix's Creek mine with additional proactive tools to manage noise when enhancement is predicted by ensuring that the allocation of sound attenuated equipment is utilised in the yellow/orange highlighted areas.

6.3 Blasting

6.3.1 Environmental Management

Blasting criteria for mining at Rix's Creek is specified in the Development Consent conditions and Environmental Protection License. The conditions state that blasting is to be carried out in accordance with the recommendations of Australian Standard 2187-1993 and in terms of ANZECC Guidelines and to the satisfaction of the EPA.

Blasting is not to be carried out within 500 m of the New England Highway or an approved deviation of the highway while open to traffic. During the year blasting in the West Pit has taken place within the 500 m exclusion zone under an approved procedure to close the Highway to traffic during blasting. The Company has approval from the Roads and Maritime Services (RMS) to conduct closures of the Highway for blasting under a Road Occupancy License (currently ROL 695092) – This approval is renewed every six months.

The conditions specified in the Development Consents and Environmental Protection License require blasts to be designed to minimise air blast overpressure and ground vibration. A NONEL (non-electric) system is used so that any blast only has less than 5 % probability of exceeding an air blast overpressure of 115 $dB_{(Linear)}$ to a maximum of 120 $dB_{(Linear)}$ and vibration with peak particle velocity of 5 mm/sec to a maximum of 10 mm/sec at the closest residence (not owned by the applicant outside the mining lease). Blasting frequency is also limited to one blast a day in the Camberwell Pit, this was maintained during the reporting period.

Instantaneous wind speed and direction information is available to management to be used in scheduling blasting operations to minimise offsite effects of air blast overpressure and dust. The Company is one of the joint venture partners in the Meteorological Sounding Group. This group has purchased equipment to measure wind speed, direction and temperature in the atmosphere. This data is then used to better predict the impacts of atmospheric conditions that can result in overpressure enhancement off site. The on-site weather station also has real-time data that can be viewed at any time by relevant site personnel. This weather station has the ability to alarm when conditions are not suitable for blasting i.e. wind speed currently greater than 10 m/s.

All blasts are monitored to record air blast overpressure and peak particle velocity at residences most likely to be effected. The modelling of dust and fume associated with blasting commenced during March 2012 and verified using DustTrak DRX dust monitors and App-Tek OdaStat gas monitors. During 2012 approximately 40 blasts were monitored in conjunction with the model. The monitoring was in conjunction with Rix's Creek daily EnvMet and NOx emissions predictive modelling. The NOx modelling shows various predicted outcomes and has played an integral part of Rix's Blast regime during 2016 and can be seen in Figure 10. The pink dots on the model are the closest residences/receptor's that can potentially be impacted via blasting. During 2016 App-Tek OdaStat gas monitors were utilised during every blast to measure any potential fume emanating from a blast

in conjunction with the dust / fume model.

Schedule 2, Condition 12(BII) of DA 49/94 requires coordination of blasting onsite with nearby mines to minimise cumulative blasting impacts. Rix's Creek send out an email blast notification to near by mines prior to all blasts that provides a figure of the location of the blast and the intended time of firing. Rix's Creek Mine also receives blast notifications from nearby mines which identifies the intended time and postion of the blast so that coordination of blasts times can oocur between mine sites. Rix's Creek Mine generally fires within the operator crib window (11:00am – 11:30am) and shift change out (2:00pm – 2:30pm).

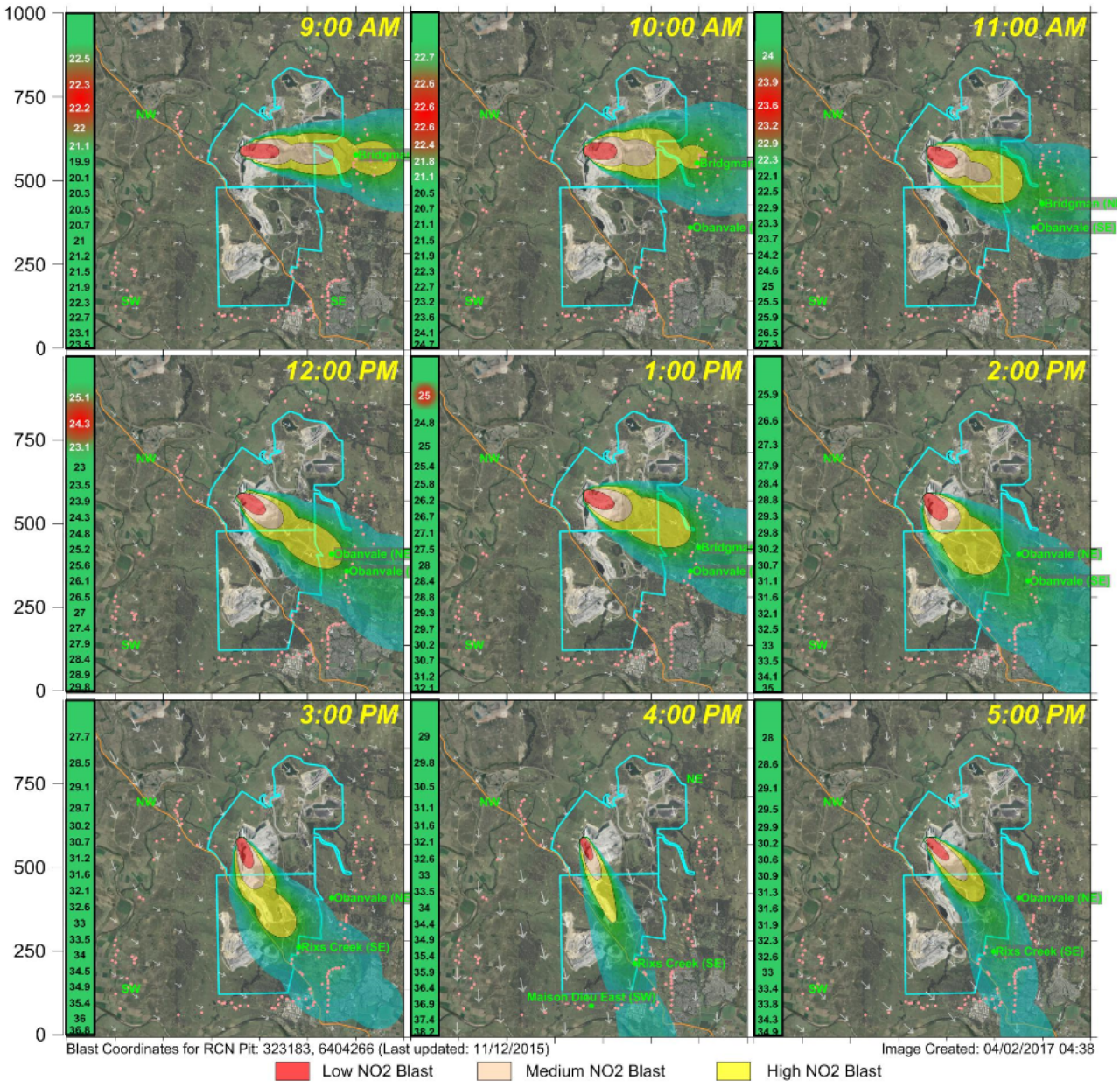


Figure 9 Blast Dust / Fume 'Plume' Model incorporated into the RCN site in 2016.

6.3.2 Environmental Performance

During 2016 a total of 153 production blasts were initiated into overburden. 108 were located in the West pit whilst 45 were located in the Camberwell Pit.

See **Appendix 2** for monitoring results of individual blasts.

Of the 153 blasts, no blasts recorded vibration over 5 mm/sec and no blasts recorded overpressure above 115 dB_{Linear}. 60 blasts were cancelled and rescheduled due to unfavourable weather conditions, this included rainfall, windspeed, wind direction, dust potential, fume potential and overpressure potential.

Of the 153 blasts the fume ratings recorded were as follows:

Rating		A	B	C
0	100	-	-	-
1	-	45	1	-
2	-	5	2	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-

6.3.3 Reportable Incidents

During 2016 nine (9) complaints were received by the Company relating to seven (7) blasts (equates to 4.6% of all blasts). See Table 32 for details. One (1) inquiry was made in 2016 regarding blasts on 6/07/2016.

Table 13 Blast Complaints

DATE	LOCATION	RESOLUTION
23/02/2016	Long Point	Complaint from Long Point resident regarding visible dust from blast drifting towards house. Wind at time of blast from east so should have not blown dust cloud towards residence which is located south of the operation. Low wind speed and dust model show large cloud pattern within lease so would have hung in air visible for period of time.
10/03/2016	Middle Falbrook	Complaint from Middle Fallbrook resident regarding ground vibration from blast. Rix's Creek provided blast results from this residence (Dulwich) to the resident. This blast did not exceed the limits of the blast agreement that is in place with this resident that has been approved by the DPE.
10/03/2016	Camberwell	Complaint from Camberwell resident regarding ground vibration from blast. Rix's Creek provided blast results to resident and blast overpressure was not exceeded at any Rix's Creek monitoring site.
23/03/2016	Camberwell	Complaint from Camberwell resident regarding ground vibration from blast. Rix's Creek provided blast results to resident and blast overpressure was not exceeded at any Rix's Creek monitoring site.
23/03/2016	Camberwell	Complaint from Camberwell resident regarding ground vibration from blast. Rix's Creek provided blast results to resident and blast overpressure was not exceeded at any Rix's Creek monitoring site.
17/06/2016	Maison Dieu	Complaint from Maison Dieu resident regarding ground vibration from blast. Rix's Creek provided blast results to resident and blast overpressure was not exceeded at any Rix's Creek monitoring site.
29/09/2016	McDougalls Hill	Complaint from McDougalls Hill resident regarding ground vibration from blast on 28/09/2016 (previous day). Rix's Creek provided blast results to resident and blast overpressure was not exceeded at any Rix's Creek monitoring site.
19/10/2016	Camberwell	Complaint from Camberwell resident regarding ground vibration from blast. Rix's Creek provided blast results to resident and blast overpressure was not exceeded at any Rix's Creek monitoring site.

20/12/2016	Singleton	Complaint from DPE (Singleton Compliance) regarding ground vibration from blast. Rix's Creek provided blast results to DPE (Singleton Compliance) and blast overpressure was not exceeded at any Rix's Creek monitoring site.

6.3.4 Further Improvements

The Company is part of the Terrock EnvMet Research Project. This allows access to the prediction model for atmospheric enhancement for overpressure. This information is used to access the potential for overpressure enhancement due to the predicted atmospheric conditions throughout the day. This information can then be used to schedule blasting operations to minimise off site environmental impacts resulting from blast overpressure. The models (overpressure, fume and dust) are now capable to have predictive forecasting for atmospheric conditions two days ahead to further enhance undertaking blasting during ideal weather conditions. The models have also been updated to include nearest receptors which are likely to be affected by blasting activities.

Rix's Creek have access to several predictive weather models in which products are selected for blasting based on possible weather conditions prior to blasting. Blast products will continually be reviewed and trialled where thought beneficial throughout 2017 to minimise fume emitted from blasting. Fume will continually be monitored on site to manage any onsite and offsite impacts in the case of a fume event resultant from a blast. Two gas analysers are also set-up downstream of all blasts to monitor any potential gasses released from blasts on the site boundary.

Rix's Creek blast fume model was updated again in 2016 to progress from the previous 2D ground level model to one displaying the modelling of altitude (up to 1000m) as well as wind speed and direction to further assist the scheduling of blasting activities.

Since the acquisition of the Rix's Creek North site, the predictive model has been updated to accommodate for this operational expansion and maintain a consistent standard of blast monitoring. Further analysis will continually be done regarding any blast vibration impacts resultant from Camberwell Pit blasts, in particular on the Dulwich residence.

Due to the acquisition of the Rix's Creek North site, a decision was made in consultation with DPE to move the Ernst Blast Meter to the Watling residence. Also, an additional blast meter was installed at Camberwell UHAQMN site to further measure any potential blast impacts on the village of Camberwell.

The ACCO 10,000L water cart was continually used across site to minimise dust from hardstand areas, concrete surfaces and in particular what it was purchased for crusting drill cuttings from the drill and blast process. The watering of drill cuttings generally follows the path of the drill on the shot and also when unfavourable wind conditions are predicted.

6.4 Air Quality

Dust and noise are the main air quality parameters that the operation has the potential to impact. There are a range of operational procedures in place to minimise the potential to generate emissions and actions to mitigate impacts in the surrounding environment.

6.4.1 Environmental Management

The Rix's Creek Mine Air Quality and Greenhouse Gas Management Plan (AQGGMP) was approved by DPE on the 16th February 2016 and addresses dust management practices and the air quality monitoring network at both Rix's Creek South and Rix's Creek North operations. This program involves monitoring air quality for dust particulates. The air quality assessment criteria are listed in Table 15.

Table 14 Air Quality Assessment Criteria

POLLUTANT	STANDARD	PERIOD	AGENCY
TSP	90µg/m3	Annual average	EPA/DPE/ National Health & Medical Research Council
PM10	50µg/m3	24 hour maximum	EPA/ DPE
	30µg/m3	Annual average	EPA/ DPE
	50µg/m3	24 hour average; 5 exceedances permitted a year	National Environment Protection Measure (NEPM)
Depositional Dust	4g/m2/month	Annual maximum total deposited dust level	EPA/ DPE
	2g/m2/month	Annual maximum increase in deposited dust level	EPA/ DPE

Dust Deposition Guages

The approved AQGGMP has a total of 30 dust deposition gauges which are located on and around the mining lease area. The location of these gauges are listed in 16 and shown in Plan 1.

The dust deposition gauges conform to Australian Standard 2724.1- 1984 Ambient Air - Particulate Matter, Part 1 - Determination of Deposited Matter expressed as insoluble solids and ash residue. Gauges have 150 mm funnels located 2 metres above the ground.

Samples are collected by AECOM, Singleton and analysed by ALS Laboratories which is a NATA registered laboratory.

High Volume Air Samplers

The approved AQGGMP has High volume air samplers which are located at three sites on the eastern side of the lease i.e. between the operation and the populated area of Singleton. These samplers run for 24 hours on a six day cycle and provide information on total suspended particulates (TSP) and particulates less than 10 micron (PM_{10}) in diameter and operate in accordance with Australian Standard 2724.3 and AS3580.9.3:2003

These units are located at:-

1) Rix's Creek Lane;
2) Singleton Heights - Mines Rescue Station; and
3) Off Bridgman Road - Lot 2, The Retreat.

Tapered Element Oscillating Mass Balance (TEOM)

The approved AQGGMP has 3 TEOMS which were reinstated at Rix's Creek North site during February 2016. PM10 is assessed for the purpose of real-time environmental management as defined by Standards Australia AS/NZS 3580.9.8.2008: Methods for sampling and analysis of ambient air – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser.

The TEOM units are located at -

1) Western extent of the Camberwell pit
2) Glennies Creek Road - Richards residence NW of Rix's Creek mining operations
3) Bridgman Road - East of mining operations

Environmental controls employed to minimise dust generation includes the application of recycled mine water to haulage roads and areas with heavy use by machinery, application of recycled mine water to drill pads (i.e. fine cuttings) and sprinkler systems on coal stockpile areas and the surrounds of the washing plant.

Conveyor systems at the washing plant and rail loader are enclosed on at least two sides to control dust.

Operational procedures for blasting include not blasting under adverse weather conditions i.e. high wind and direction conditions; when there is a likelihood that dust generated from the blast will reduce visibility at the lease boundary or New England Highway. Wind speed and direction information is available at the office for staff to make informed decisions regarding the prevailing weather conditions when scheduling blasts. This data is available real time from Rix's Creek weather station as well as the Hunter Valley Meteorological Sounding Group Joint Venture - Lemington site and through improved localised meteorologic daily forecasts.

This information is used to schedule operations so as to minimise the potential for dust emissions. Under adverse weather conditions overburden is not dumped to exposed locations. When these conditions exist the overburden removal and dumping operation is modified with dumping occurring either in pit or to areas not exposed to the prevailing winds, alternatively operations may be ceased until conditions are suitable. For blasting, information is used in a model to predict the potential for meteorological reinforcement of overpressure as well as directional travel of dust/fume from a blast. The model shows the likelihood and receptors that may be affected by the blast which in turn can alter the timing of the blast being initiated.

Rix's Creek is an active participant of the Upper Hunter Air Quality Monitoring Network. The network consists of Industry and Government. The aim is to establish a network of air quality monitors located throughout the valley from Singleton to Muswellbrook to monitor air quality. There are currently 14 monitoring sites operational. One of the monitoring sites is located between the Rix's Creek mine and Singleton town ship on land owned by the Company. This monitoring site was commissioned in August 2011 and is currently displayed on the OEH website known as 'Singleton NW' and displays wind speed, wind direction and PM10 data on a continuous basis. Rix's Creek has an annual data agreement to access data from this station for a fee.

During 2016 a site-specific dust forecasting tool was used to predict the potential for dust emissions being created on site and affecting air quality. This forecasting tool uses predictive met-data to highlight times throughout the day the operation may be affected. Based on this, the operation can be modified before the high potential of dust to occur. This includes utilising increased supervisor inspections, additional water carts, re-schedule servicing of equipment, work lower in the pit, shut-down equipment, activate water sprays on stockpiles to name a few.

PM_{10} Time Series Forecast For Thursday 14th Of January 2016

Print this page

14/01/2016																								
	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am		12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Wind Speed (m/s)	3.0	4.3	3.7	2.9	5.2	4.5	4.5	5.5	5.8	6.3	6.5	6.6	Wind Speed (m/s)	6.2	6.6	7.9	8.7	6.1	1.9	4.7	6.5	5.7	5.8	6.2	4.8
Wind Direction	WSW	W	W	WNW	WNW	NW	NW	NW	NW	NW	NW	NW	Wind Direction	NW	NNW	WNW	WNW	N	WSW	S	S	S	S	S	SSE
Max 1-hour average PM_{10} concentration ($\mu g/m^3$)																									
South-East	43	16	3	2	3	3	3	3	3	3	3	3	South-East	3	2	3	0	0	1	0	0	0	0	0	0

15/01/2016													16/01/2016											
	12am	2am	4am	6am	8am	10am	12pm	2pm	4pm	6pm	8pm	10pm		12am	2am	4am	6am	8am	10am	12pm	2pm	4pm	6pm	8pm
Wind Speed (m/s)	5.9	5.5	5.4	5.9	6.9	6.2	6.1	4.0	7.3	4.7	4.5	3.5	Wind Speed (m/s)	3.3	4.7	5.1	4.5	6.3	7.3	7.6	7.2	7.8	5.2	3.4
Wind Direction	SSE	SSE	SSE	S	S	S	S	S	SSE	SSE	SSE	SSE	Wind Direction	SSE	S	S	SSE	SE	SE	SE	SE	ESE	SE	SE
Max 2-hour average PM_{10} concentration ($\mu g/m^3$)																								
North-West	6	7	6	3	0	0	0	2	2	9	20	26	North-West	5	14	16	7	1	1	0	1	2	2	2

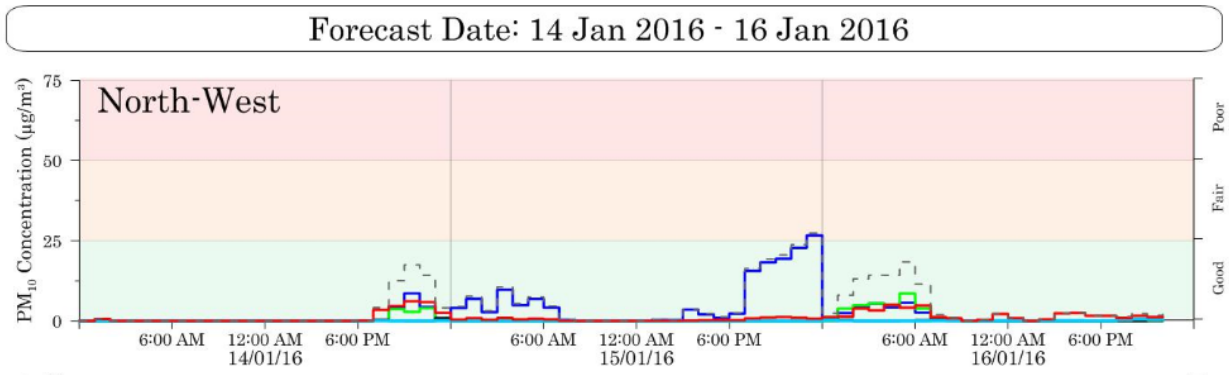


Figure 10. Evidence of dust forecasting tool to assist operations during 2016 and beyond

An additional PRP 'Particulate Matter Control Best Practice Implementation – Rix's Creek North" was enacted on the 21st December 2015 during the recommencement of operations at Rix's Creek North. This required a wheel generated dust assessment to measure uncontrolled and controlled haul road emissions and was submitted to the EPA for review the 31st June 2016.

Table 15 Dust Monitoring Sites

SITE	LOCATION
1	Adjacent to railway line on East Boundary
2	Adjacent to railway line on East Boundary
3	Near old railway cutting
~~4~~	Near Middle Falbrook Road, North boundary (discontinued - area now active mine)
5	Rix's Creek Lane East Boundary
6	Near New England Highway
7	Paddock opposite middle Falbrook Road intersection – moved to Bowman boundary fence during July 2012
8	Off Maison Dieu Road
9	Off Maison Dieu Road near Dight's Crossing intersection
10	Off Maison Dieu Road
11	Wattle Ponds Road
~~12~~	Oval near Singleton Civic Centre (discontinued due to constant vandalism)
13	Lawson Avenue, Singleton Heights
14	Mines Rescue Station, Singleton Heights
15	Gardner Circuit, Singleton Heights
16	46 D'Arbon Crescent, Singleton Heights
17	The Retreat
18	Bridgeman Road
19	Main Northern Railway
20	Bridgeman Road
21	Bridgeman Road

22	Bridgeman Road
23	Main Northern Railway
~~24~~	Off Middle Falbrook Road (discontinued - now active mining area)
25	Off New England Highway
26	Granbalang – Off New England Highway
27	Off Wattle Ponds Road adjacent to Hunter River
28	Off New England Highway north-west of lease. Relocated August 2011
29	South of Maison Dieu Road
30	West of lease
31	West of lease
32	Pre-School Gardner Circuit
33	Wright Property Maison Dieu

6.4.2 Environmental Performance

Insoluble Solids

During 2016 all 30 gauges comply with the DECC Insoluble Solids Dust Deposition assessment criteria of an annual average result of less than 4 gm/m^2/month. Location of the depositional dust gauges are referred to in Table 16.
Table 17 summarises the monthly insoluble solids deposition results for the year along with long-term averages. The results show a similar result in comparison to the 2015 results. Thirteen (13) gauges exhibited an increase in insoluble solids dust deposition result when compared to 2015, with fourteen (14) gauges showing a decrease, whilst three (3) remained the same. The overall yearly average of all gauges for 2016 was 1.7 g/m^2/month, showing a reduction of 0.2g/ m^2/month, when compared to the 2015 recording a result of 1.9 g/m^2/month.
In 2016 eight (8) of the dust deposition gauges (27%) exceeded the arbitrary annual average result of 2 g/m^2/month which was the same as eight (8) or 27% in 2015. This is interesting as 2016 was considered slightly above the long term average rainfall whilst 2015 was considered a very wet year in comparison to the annual rainfall average for Singleton.

The results from previous years are listed below:-

- 8 gauges or 27% exceeded 2 g/m^2/month 2016
- 8 gauges or 27% exceeded 2 g/m^2/month 2015
- 8 gauges or 27% exceeded 2 g/m^2/month 2014
- 11 gauges or 37% exceeded 2 g/m^2/month 2013
- 17 gauges or 57% exceeded 2 g/m^2/month 2012
- 15 gauges or 50% exceeded 2 g/m^2/month 2011
- 4 gauges or 13% exceeded 2 g/m^2/month 2010
- 17 gauges or 57% exceeded 2 g/m^2/month 2009
- 6 gauges or 20% exceeded 2 g/m^2/month 2008
- 5 gauges or 17% exceeded 2 g/m^2/month 2007
- 10 gauges or 33% exceeded 2 g/m^2/month 2006
- 5 gauges or 17% exceeded 2 g/m^2/month 2005
- 7 gauges or 23% exceeded 2 g/m^2/month 2004
- 4 gauges or 13% exceeded 2 g/m^2/month 2003
- 12 gauges or 40% exceeded 2 g/m^2/month 2002
- 11 gauges or 37% exceeded 2 g/m^2/month 2001
- 9 gauges or 32% exceeded 2 g/m^2/month 2000
- 10 gauges or 35% exceeded 2 g/m^2/month 1999
- 11 gauges or 39% exceeded 2 g/m^2/month 1998
- 12 gauges or 35% exceeded 2 g/m^2/month 1997
- 13 gauges or 35% exceeded 2 g/m^2/month 1996
- 4 gauges or 15% exceeded 2 g/m^2/month 1995

From the above long term results, the insoluble solids dust deposition levels listed for 2016 showed

the same result when compared to 2015, when using an arbitrary indicator level of 2 gm/m^2/month annual average result. The recommended deposition limit is 4 gm/m^2/month.

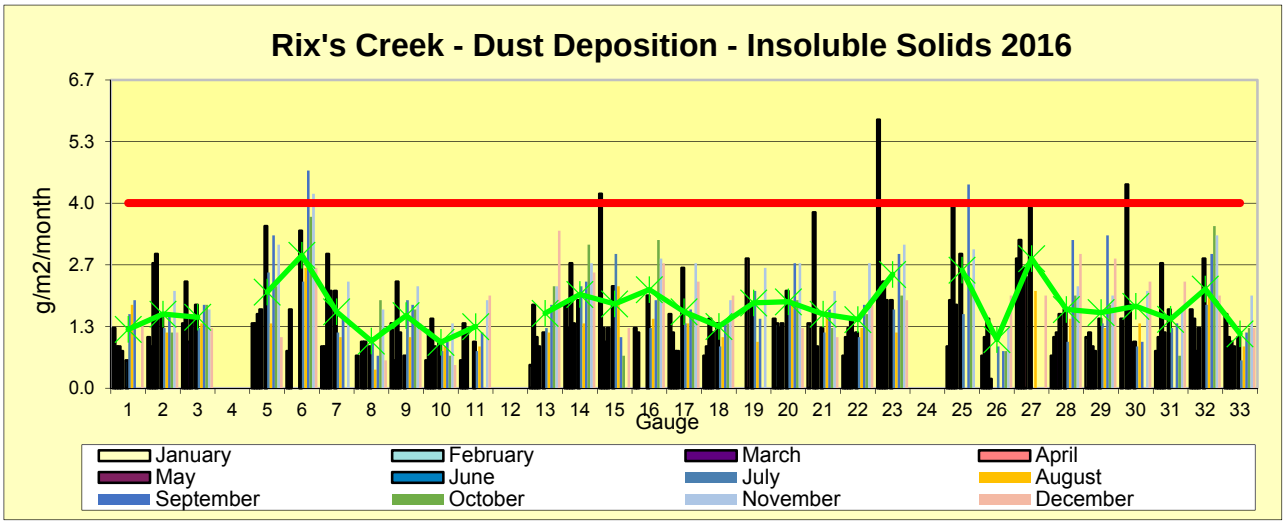


Figure 11 Rix's Creek Insoluble Solids Dust Deposition 2016

Figure 12 displays the individual monthly insoluble solids deposition rates for each gauge and annual average deposition result in gm/m^2/month. The graph does not contain any contaminated results nor have they been included in the annual averages. Thirty (30) results were contaminated over the year with either organic matter or bird droppings. A significant decrease from fifty eight (58) contaminated results in 2015. There was also one occasion where there was no result. One gauge was found damaged at the site.

Some sites individual monthly result exceeded the annual limit of 4.0 gm/m^2/month and these results are most likely as a result of localised episodic events. The maximum result was in January at Site 23 measuring 5.8gm/m^2/month. This site in close proximity to the northern rail line. Gauge 19 had five (5) contaminated results throughout the year due to mainly bird droppings.

Figure 13 shows the running 12 month rolling averages for dust deposition and gives a good indication of any trends that may be emerging around the site. From the graph the gauges with the higher results; gauges 6, 7 and 26 are located in close proximity to Pit 1 (South Pit) and Pit 3 (West Pit) mining operations. These same gauges recorded similar trends in 2013, 2014 and 2015 in comparison to the 2016 dust deposition results.

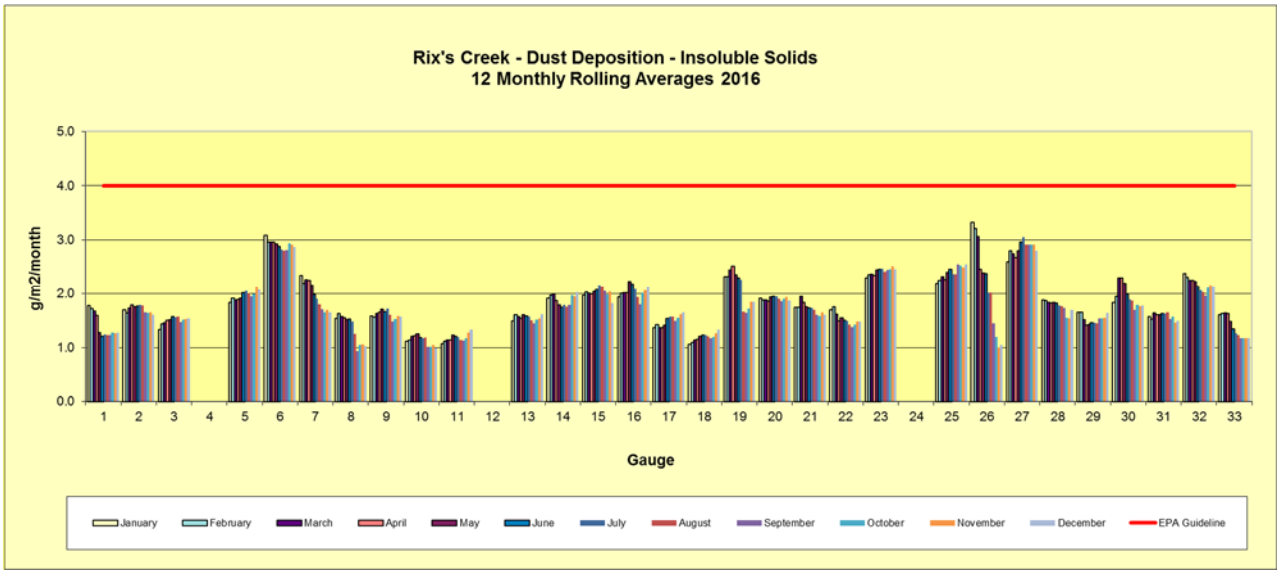


Figure 12 Insoluble Solids Dust Deposition 12 Monthly Rolling Averages 2016

Table 16 Annual Average Dust Deposition Insoluble Solids 2016

SITE	MAXIMUM RESULT 2016	MINIMUM RESULT 2016	YEARLY AVERAGE 2016	YEARLY AVERAGE 2015	LONG TERM AVERAGE (1984 – 2016)	No. of UNCONTAMINATED RESULTS	No result
1	1.9	0.6	1.3	1.8	2.3	10	0
2	2.9	0.9	1.6	1.7	2.0	12	0
3	2.3	1.0	1.5	1.4	1.4	12	0
4				-	-	-	-
5	3.5	1.1	2.1	1.8	2.1	12	0
6	4.7	0.8	2.9	3.5	2.2	10	0
7	2.9	0.9	1.7	2.5	2.1	10	0
8	1.9	0.4	1.0	1.5	1.1	1	0
9	2.5	0.6	1.6	1.5	1.2	12	0
10	1.5	0.5	1.0	1.1	1.2	12	1
11	2.3	0.6	1.3	1.1	1.9	10	0
12				-	-	-	-
13	3.4	0.5	1.6	1.5	1.3	12	0
14	3.1	1.0	2.0	1.8	2.0	12	0
15	4.2	0.7	1.8	1.7	2.0	10	0
16	3.4	1.2	2.1	2.1	1.7	10	0
17	2.7	0.8	1.7	1.7	2.1	12	0
18	2.0	0.7	1.3	1.1	1.3	12	0
19	2.8	1.0	1.8	2.3	2.0	7	0
20	2.7	1.3	1.9	1.9	4.2	12	0
21	3.8	0.9	1.6	1.8	2.8	11	0
22	2.7	0.7	1.5	1.8	1.5	12	0
23	5.8	1.2	2.5	1.8	2.2	12	0
24				-	-	-	-
25	4.4	0.9	2.6	2.3	2.2	10	0
26	2.0	0.2	1.1	4.2	1.6	11	1
27	3.9	2.0	2.8	2.4	3.1	8	0
28	3.2	0.7	1.7	2.0	1.5	12	0
29	3.3	0.8	1.6	1.6	0.9	12	0
30	4.4	0.9	1.8	1.8	1.0	10	0
31	2.7	0.7	1.5	1.6	1.1	10	0
32	3.5	0.8	2.1	2.3	0.9	12	0
33	2.0	0.6	1.2	1.5	0.8	12	0

The annual deposition results from 1996 to 2016 are plotted in Figure 14. From the graph it is difficult to pick any major trends in deposition results for any gauge over the 20 years of results. No gauges in 2016 had any major trends away from previous year's data.

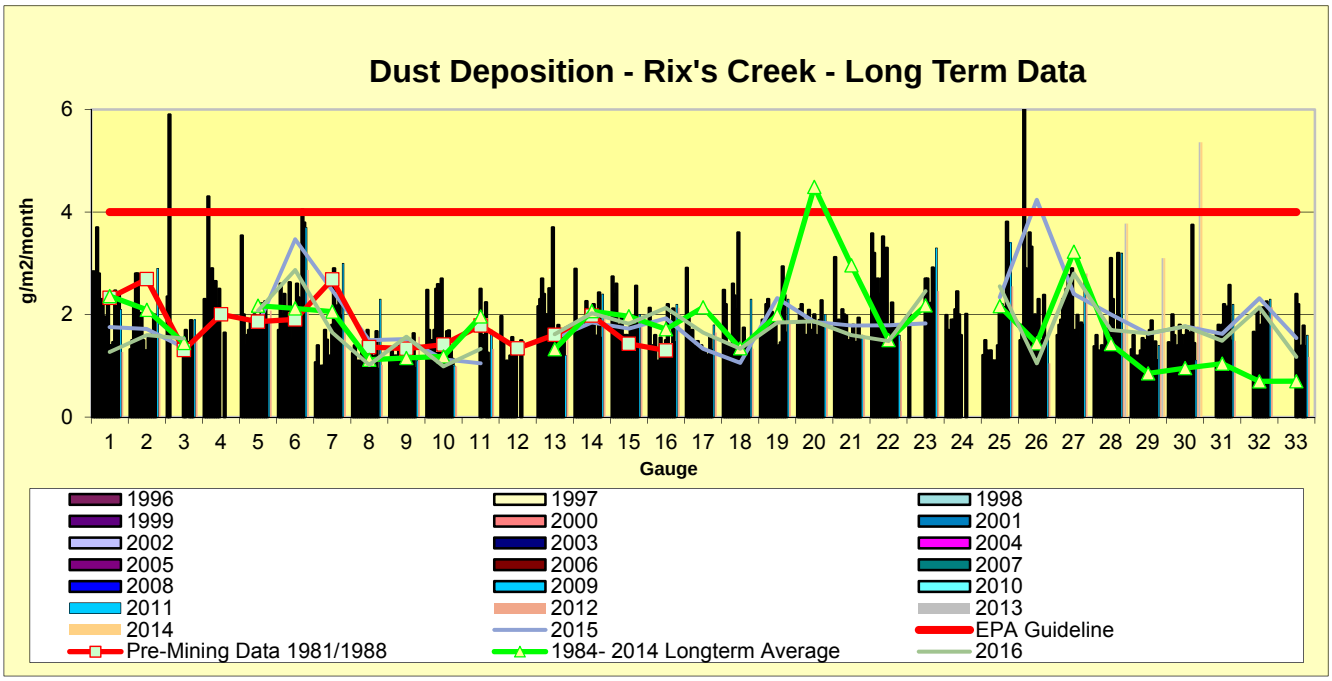


Figure 13. Long Term Insoluble Solids Dust Deposition Results

Figure 15 are isopleths plots showing dust deposition concentrations from the monitoring results. Figure 16 indicates the higher concentrations are being associated in close proximity to the active mining areas, in particular Pit 3 (West Pit) pre-strip.

The following is an extract from 'PAE Limited' report who produced the isopleth plots from the yearly data.

'Please note that our concerns regarding this method of presentation remain unchanged from our memorandum we included with the 1996 data analysis, dated 17th March 1997. In that memorandum we raised the concern that the data used to generate these plots have been prepared from 27 data points (now 31) covering a reasonably large area. It is assumed by the plotting software that there is smooth variation in dust from one data point to the next. In reality these values can vary significantly over very short distances and the plots may therefore not reflect the real detail in dust deposition.'

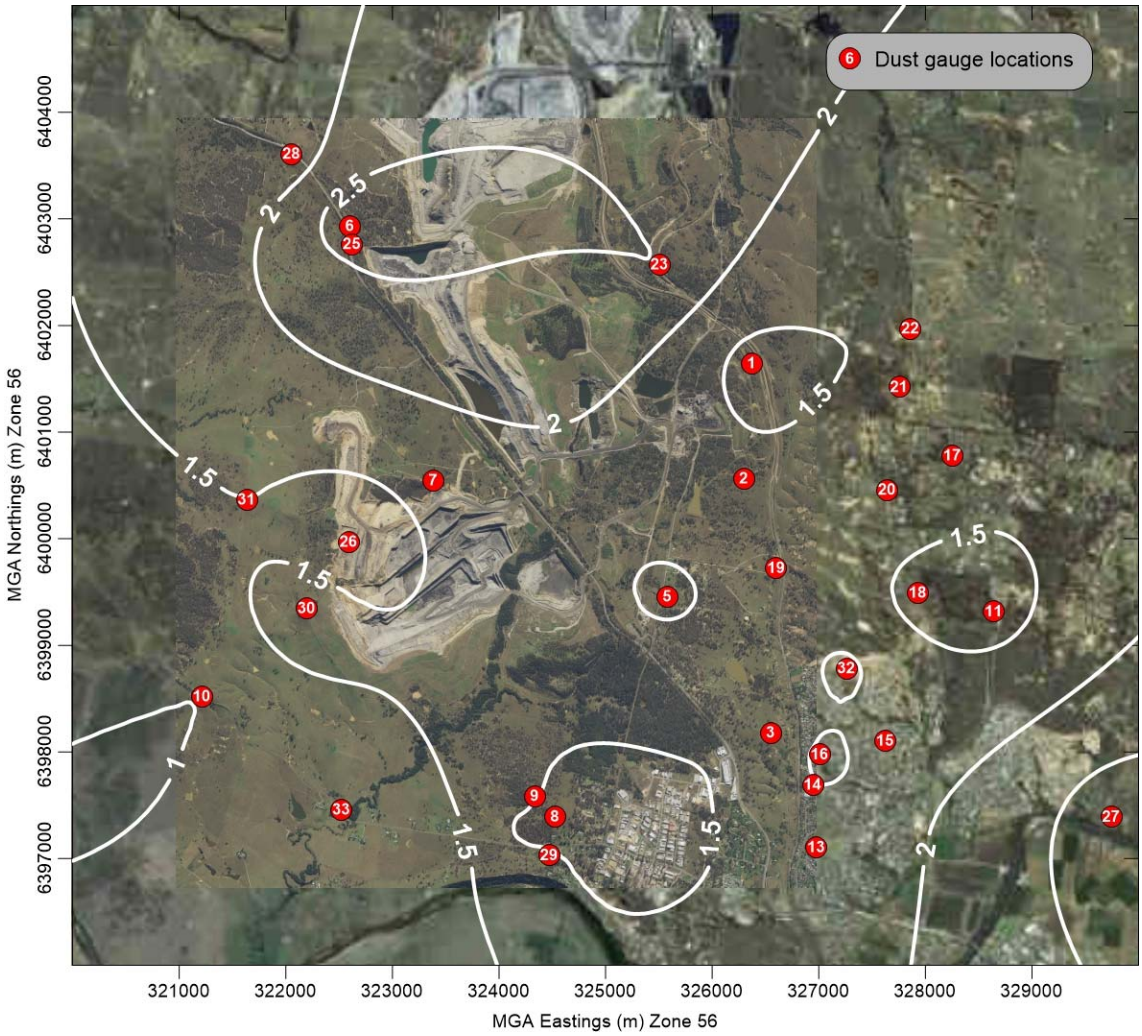


Figure 14. Measured Annual Average Insoluble Solids Isopleths 2016

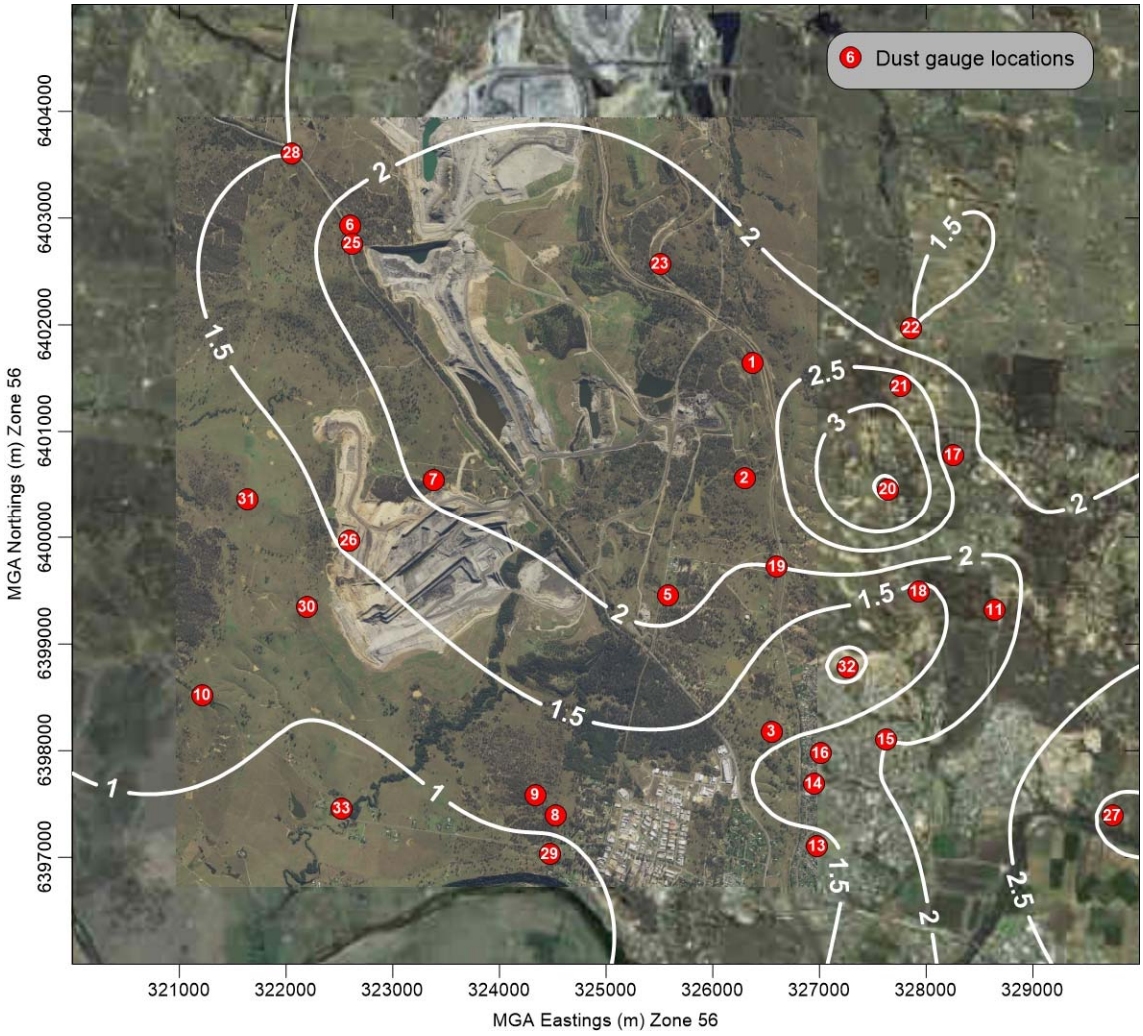


Figure 15. Measured Long Term Average Insoluble Solids Isopleths 1984 – 2016

Total Suspended Particulates

All sites are below the limit set by the National health & Medical Research Council (NHMRC) air quality guideline (Table 18) annual average of 90 *u*g/m^3. The maximum, minimum and average results summarised in Table 19 and Figure 17 show the individual results for each site throughout the year and monthly averages. There was 20 out of a possible 183 results (11%) that exceeded the annual average limit of 90 *u*g/m^3. Mines Rescue 4 results, Retreat 8, and Rix's Creek 8 results.

The last 10 years individual results that exceeded the Annual Average level of 90 *u*g/m^3 are:-

- 20 results - 11% in 2016
- 33 results – 18% in 2015
- 39 results – 21% in 2014
- 60 results – 33% in 2013
- 32 results – 17% in 2012
- 34 results – 19% in 2011
- 35 results – 19% in 2010
- 44 results – 24% in 2009
- 36 results – 20% in 2008
- 18 results – 10% in 2007
- 40 results – 22% in 2006
- 28 results – 15% in 2005

Table 17 Total Suspended Particulates (ug/m3) 2016

GAUGE	MINIMUM		MAXIMUM		AVERAGE		No. of RECORDINGS
	2016	2015	2016	2015	2016	2015	
Mines Rescue Station	9	11	125	131	48.6	51.2	100 (%)
Rix's Creek	10	7	159	189	59.6	61.3	100 (%)
The Retreat	9	12	131	284	55.8	59.7	100 (%)

The average TSP results for 2016 decreased at all of the three sites – Mines Rescue by 2.6 *u*g/m^3, Rix's Creek by 1.7 *u*g/m^3 and The Retreat by 3.9 *u*g/m^3 when compared to the 2015 average TSP results. Refer to Table 18 above.

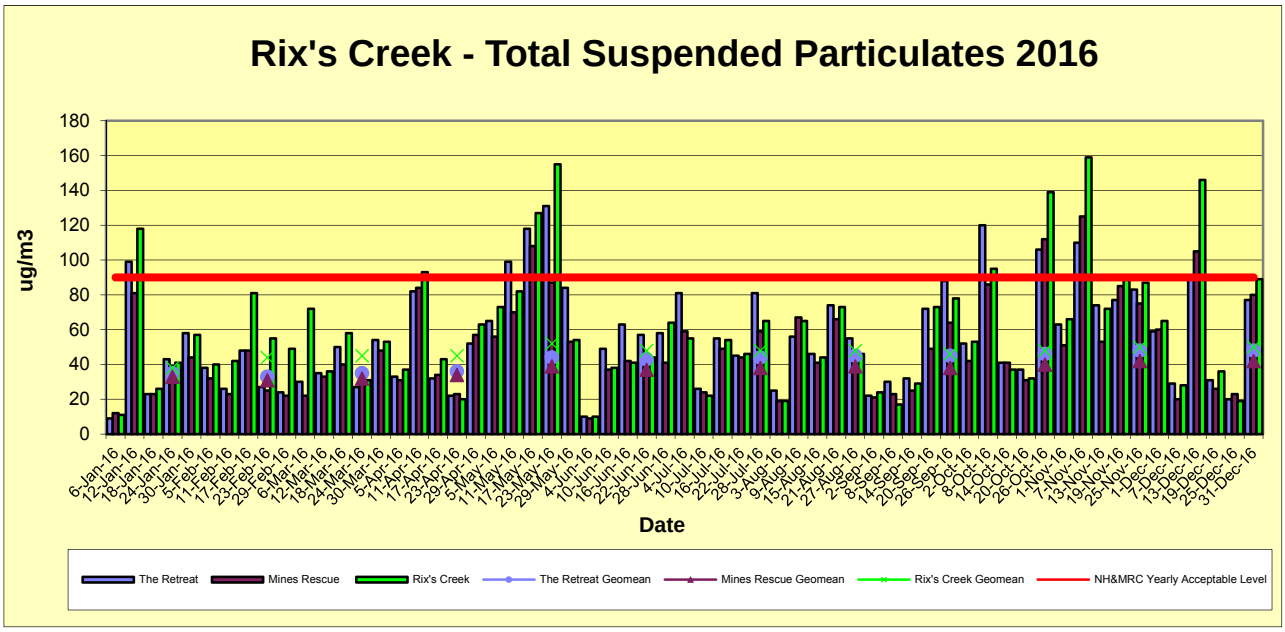


Figure 16. Total Suspended Particulates 2016

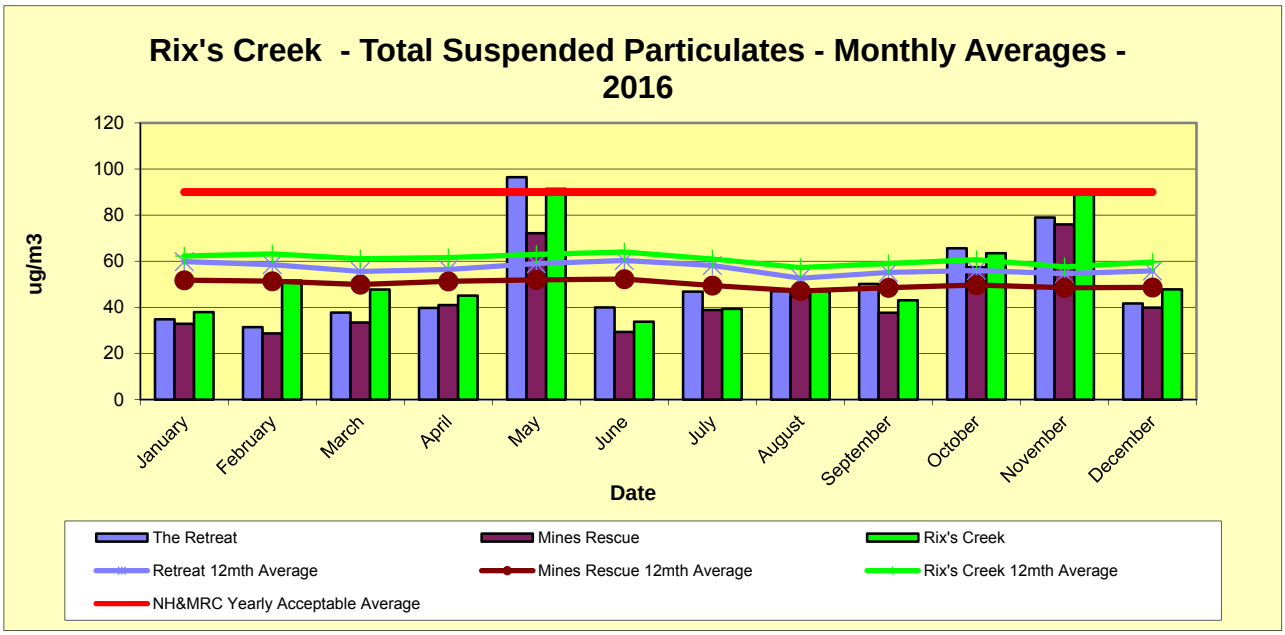


Figure 17. Total Suspended Particulates Monthly Averages & 12 Monthly Rolling Averages

Figure 18 shows the monthly average results for each site during the year along with the running 12 monthly averages. The monthly results were elevated at the Retreat and Rix's Creek sites for May and November. February through to May were all subsequently dry months of the year regarding low rainfall. In May the retreat recorded at TSP average of 96 *u*g/m^3 and Rix's Creek receptor recorded 91 *u*g/m^3 . The elevated levels in TSP correlate with the below average rainfall during May 2016. November 2016 also recorded below average rainfall which coincided with elevated regional levels of TSP.

Particulates Less Than 10 Micron

The daily level of 50 *u*g/m^3 was exceeded at the Rix's Creek site on 4 occasions during 2016.

Throughout the reporting period no problems were experienced with 100% of the data collected.

The annual averages for Mines Rescue and the Retreat receptors recorded the same average particulate matter when compared to 2015 results. The Rixs Creek receptor recorded an increase (1 *u*g/m^3) compared to last years results. All sites are well under the 30 *u*g/m^3 annual average limit. 2015 recorded significantly higher rainfall than the 2016 reporting period, yet there was no significant variance in 2016 particulate matter results when compared to 2015.

Table 18 Particulate Matter < 10 Micron 2015 (ug/m3)

GAUGE	MINIMUM		MAXIMUM		Average		No. of RECORDINGS
	2016	2015	2016	2015	2016	2015	
Mines Rescue Station	4	4	46	42	18	18	100 (%)
Rix's Creek	6	3	57	79	23	22	100 (%)
The Retreat	4	4	42	46	18	18	100 (%)

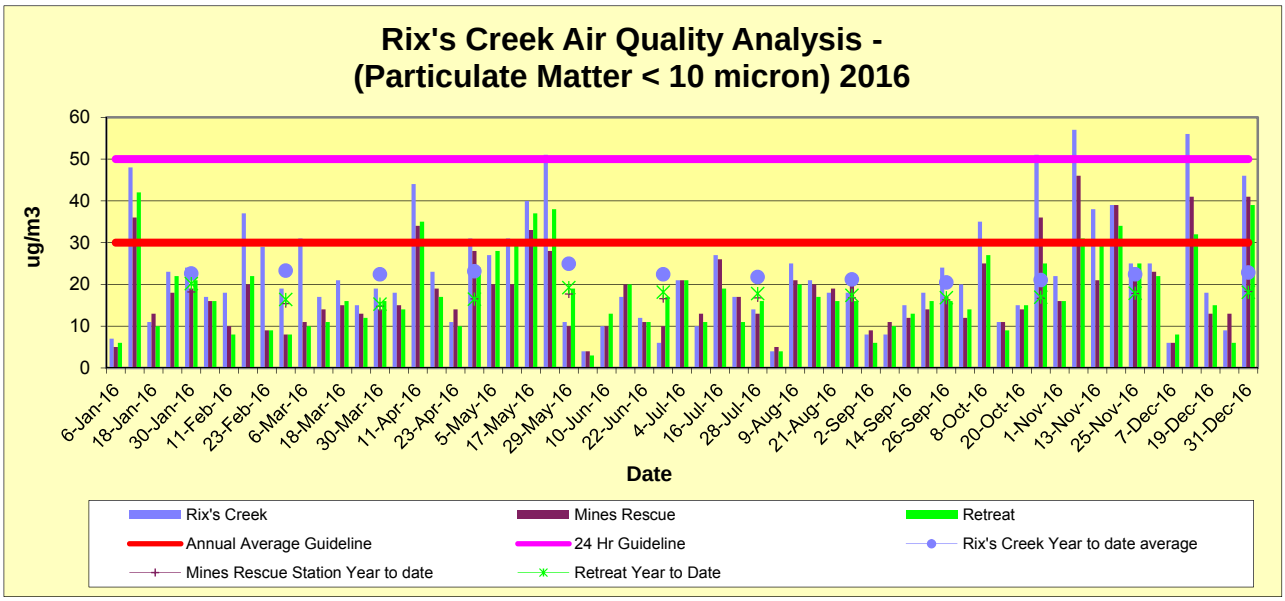


Figure 18. Particulate Matter <10 Micron 2016

Individual run results are depicted in Figure 19 with the monthly results and 12 monthly rolling averages shown in Figure 20.

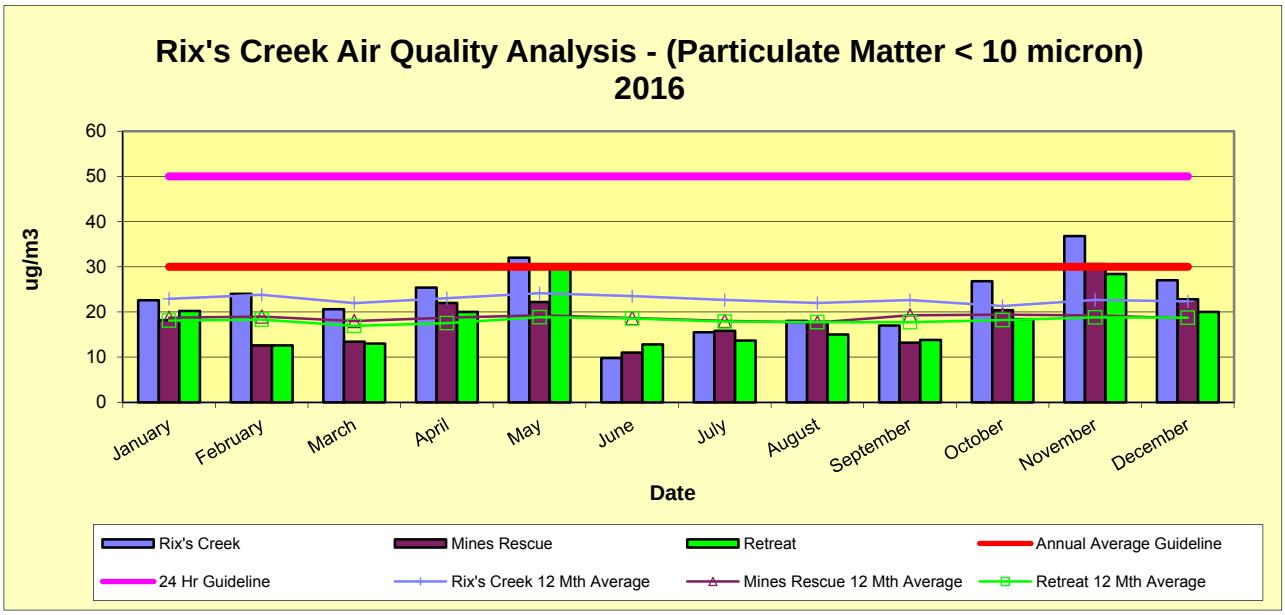


Figure 19. Particulate Matter < 10 Micron Monthly Averages & 12 Monthly Rolling Averages 2016

Figure 21 refers to the Rix's Creek Northern TEOM results for the 2016 period.

In accordance with Rixs Creek AQGGMP, three TEOMS were reinstated North West (Ricahrds), West (West EXT) and South East (Bridgman Road) of mining operations during February 2016. Results show that the Richards receptor recorded higher readings than the Western Extension and Bridgman road from March to September under North-Westerly wind influence. This correlation may indicate influence from upstream sources due to the predominant NW winds during the March to September reporting period. The 24hr rolling average was below the level of 30*u*g/m^3 for all monitoring sites from January to December 2016. During May, the Richards monitor recorded a monthly average of 38.7*u*g/m^3 which coincided with elevated winds and low rainfall.

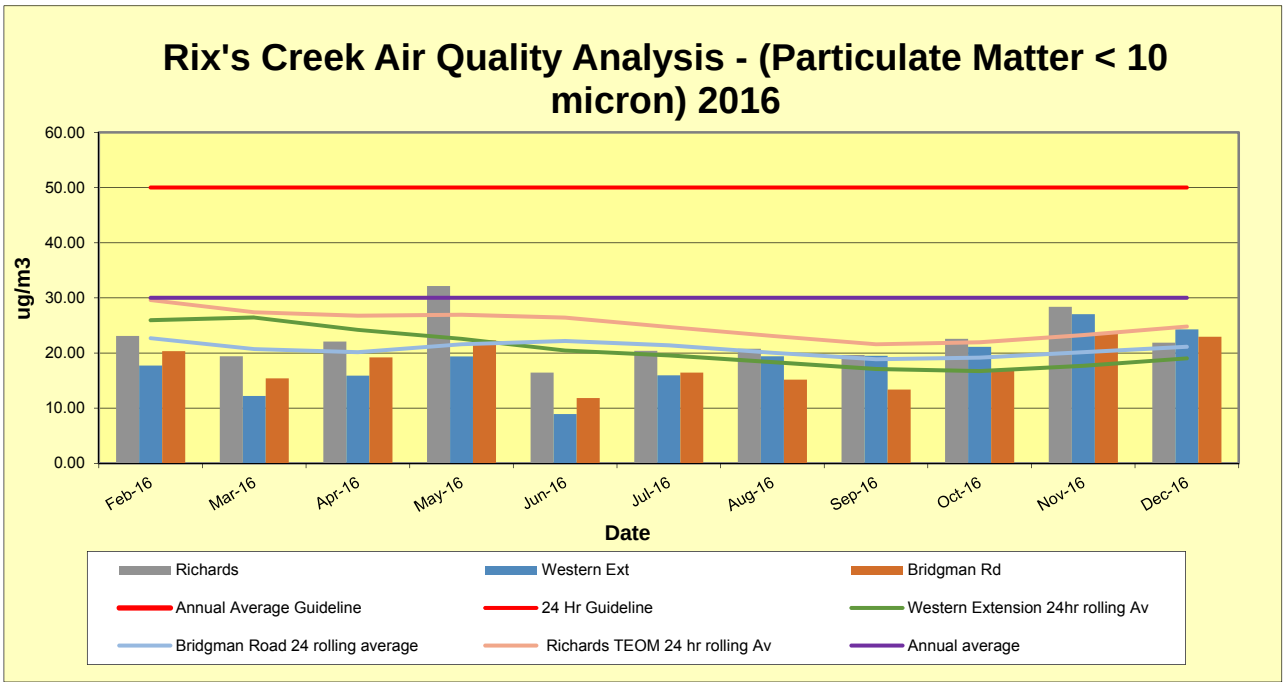


Figure 20. Particulate Matter <10 Micron Monthly Average and 12 Month Rolling Averages 2016

6.4.3 Reportable Incidents

Five (5) complaints were received in relation to air quality during the 2016 reporting period.

6.4.4 Further Improvements

The EPA issued in January 2013 a Specific Exemption under Part 6, Clause 51 and 51A of Protection of the Environment Operations (Waste) Regulation 2005 – The Rix's Creek glycerine exemption 2013 for 3 months to trial the use of glycerine as a dust suppressant for the control of vehicle generated dust. The glycerine was mixed in water carts at a 2% solution and sprayed onto haul roads. During the 3 month trial period a number of studies were conducted to satisfy the requirements of the exemption looking at the possible impacts on groundwater and surface waters. Another study examined the breakdown of the glycerine when applied on haul roads. The glycerine had to be tested to ensure its chemical attributes. Over the period of the trial, results of the chemical analysis returned some results outside the parameters set under the exemption. At the completion of the trial period reports of the studies were submitted to the EPA. Further work was undertaken over the rest of 2014 in an attempt to ascertain the source of the out of specification chemical analysis results of the glycerine. The trial was then suspended until the outcome of this investigation was known. A report was then submitted to the EPA outlining the results of this investigation into the anomalies. The anomalies arose out of differences in laboratory analytical capabilities and were not as result of sample contamination as was initially suspected.

The Glycerine exemption for dust suppression expired in May 2016. Trialling of the glycerine for dust suppression commenced in early 2015 with results well below the parameters set under this exemption. To date no glycerine has been recorded in surface water or groundwater analysis undertaken during May and November 2015 monitoring. A soil study across active haul road locations was undertaken in March 2016 as well as groundwater sampling was conducted during May 2016 before the application and subsequent exemption ends. A soil and groundwater monitoring report was completed and submitted to the EPA with results demonstrating that the total recoverable hydrocarbon levels analysed from the samples indicated no detectable levels of glycerine.

Further improvements to the Rix's Creek Real time SCADA system will be completed in 2017 to assist mining operation to make informed decisions under adverse weather conditions. This will involve the integration of existing real-time dust trak monitors situated around the Rix's Creek South operations into the SCADA network, as well as the integration of both met stations onto one real time system to form a complex wide real time monitoring system.

In accordance with a variation of EPL 3391 Rix's Creek mine will modify its air quality monitoring framework to focus on capturing upwind and downwind concentration of emissions so that a differential measurement can be obtained in 2017. This will involve a change in location to place the current Western Extension TEOM to the North West (upstream) of Rix's Creek North mine. An additional TEOM unit will be placed in the vicinity of the Obanvalle telephone tower off Bridgman Road and will be positioned to the South East (downstream) of Rix's Creek North mine.

6.5 Contaminated Polluted Land

6.5.1 Environmental Management

No contaminated or polluted land has been identified at Rix's Creek. No significant hydrocarbon or chemical spills occurred requiring special response, clean-up or ongoing management.

6.5.2 Environmental Performance

Regular inspections of hydrocarbon storage facilities are completed as part of the site EMS, and no land contamination or significant pollution incidents were reported during these inspections. A Hydrocarbon Management procedure was updated to include Rix's Creek North operations during 2016.

6.5.3 Reportable Incidents

No reportable incidents relating to land contamination occurred during the 2016 reporting period.

6.5.4 Further Improvements

The inspection regime is ongoing and management practises are in place to identify and control leaks or spills before they become contamination issues. The Hydrocarbon Management Procedure was updated in 2016 and will be regularly monitored and reviewed as necessary.

6.6 Threatened Flora and Fauna

6.6.1 Environmental Management

The Rix's Creek North Biodiversity Management Plan (BMP) was to submitted to DPE in August 2016. The objectives of the Biodiversity Management Plan are to rehabilitate, revegetate and manage land for biodiversity within the biodiversity offset areas and the mine site during and post mining.

For Rix's Creek Southern operations (DA49/94), no threatened species have been identified on site in the EIS prepared for the operation or since then as the operation has progressed. No area of significant habitat exists on the site. "*The site has been extensively disturbed as a result of previous land uses and similar species and habitats exist in surrounding areas. No rare or endangered plant or animal species were observed during the study or are likely to occur on the site."* Environmental Impact Statement for Proposed Modification of Mining Operations – Rix's Creek Coal Mine, November 1994.

6.6.2 Environmental Performance

In accordance with the Biodiversity Management Plan and RCN Project Approval (08_0102) Statement of Commitments, pre-clearing surveys are carried out and groundcover clearance protocols established prior to any vegetation clearing being undertaken. No clearing occurred during the 2016 reporting period at Rix's Creek Northern operations. At Rix's Creek South operations 16.2 hectares was cleared.

One of the performance indicators relating to the Biodiversity Management Plan is the monitoring of flora to ensure the long-term resilience and natural regeneration, with success based on the establishment and subsequent development of groundcover, mid-storey and canopy series. Performance indicators relating to the monitoring of Fauna involve determining the persistence of current populations and to ensure no impact on fauna habitats outside of defined disturbance areas. Flora and Fauna monitoring is planned to be conducted in 2017 reporting period.

The RCN Biodiversity Management Plan (BMP) was submitted to the Department on the 26th August 2016 for review and is planned to be implemented from 2017. No further correspondence has been received detailing the Departments review of the RCN Biodiversity Management Plan.

During 2016,minor weed management, outlined in section 6.7 and fence repairs to the Martins Creek BOA area were conducted. More detailed vegetation enhancement in accordance with the timelines in the RCN BMP will be carried out in 2017.

Schedule 3, Condition 39 of PA 08_0102 requires suitable arrangements be made to provide appropriate long-term security for all areas in the biodiversity offset strategy by October 31st 2016. Correspondence was received from the Department on the 26th October 2016 confirming an extension of time to secure the long term security of the Rix's Creek North Biodiversity Areas until the 31st October 2017.

Areas of timber clearing were undertaken in advance of West Pit and for haul road access to the out of pit dump. No threatened flora and fauna issues were encountered during clearing operations.

6.6.3 Reportable Incidents

No reportable incidents relating to flora and fauna management occurred during the 2016 reporting period.

6.6.4 Further Improvements

Enhancement of the Martins Creek Biodiversity Area is planned for the 2017 period. This will involve the preparation and seeding of six, half hectare plots within Martins Creek BOA with the Narrow-Leaved Ironbark, Spotted Gum, Grey Box open forest community. Flora and Fauna monitoring in line with the Biodiversity Management Plans performance indicators is also planned to be conducted in the 3rd Quarter of 2017.

Rix's Creek is a participating member of the Upper Hunter Strategic Assessment (UHSA) with likely impacts on threatened biodiversity being assessed using the Biodiversity Certification Assessment Methodology (BCAM). BCAM is being used to quantify biodiversity value as ecosystem or threatened species credits.

6.7 Weeds & Pests

6.7.1 Environmental Management

A weed control program is undertaken on site each year. During the year areas were targeted to control African Boxthorn, Mother of Millions, Prickly/Creeping/Tiger Pear, Blue Heliotrope, Galenia, St. John's wart, Scotch/Safron thistle, Cotton bush, Lantana, Castor Oil, Green Cestrum, Bitou bush, Pampas grass,African Olive and Western Australian Wattle (Acacia Saligna). During November and November extensive Pear control was carried out at western edge of Falbrook operations and undisturbed land ahead of the West Pit operations. The Western Australia Wattle (Acaia Saligna) was sprayed from February to May and from September to December 2016, to control spread at Rix's Creek North operations.

The first quarter of 2016 was focussed on African Olive works on the entire site with focus on the O'haras paddock south of the Rix's Creek South operations. The second quarter of 2016 was focussed on Mother of Millions mostly in remnant vegetation adjoining rehabilitated areas in South Pit. At Rix's Creek North, the Western Australian Wattle was focused around the Tailings Dam 2 and north of the CHPP area. The third quarter of 2015 focussed on Galenia across all rehabilitation areas

on site and grasses were sprayed around hard stand and electrical substations. The last quarter of 2016 was focused on Western Australian Wattle to the South of the rail loop and Assorted Pear to the west of the Falbrook Pit. African Boxthorn was also targeted near the south pit rehabilitation areas at Rix's Creek South. Assorted weeds and grasses surrounding site infrastructure and topsoil stockpiles were also controlled as required.

Throughout May, 1080 Wild Dog Baiting was undertaken across site in consultation with LHPA's aerial baiting in surrounding areas. During October and November a qualified pest control contractor sprayed the entire site with odourless chemical prior to summer.

6.7.2 Environmental Performance

The following weed species have been identified and treated on-site during 2016:-

- Mother-of-millions, *Bryophyllum* spp. (class 3);
- Galenia, *Galenia pubescens* (non noxious – class 4 Tamworth);
- Pampas grass, *Cortaderia* spp. (class 4);
- Prickly pear, *Cylindropuntia* spp. (class 4);
- Creeping pear, *Cylindropuntia* spp. (class 4);
- Tiger pear, *Cylindropuntia* spp. (class 4);
- African boxthorn, *Lycium ferocissimum* (class 4);
- St John's wort, *Hypericum perforatum* (class 4);
- Paterson's curse, *Echium plantaginuem* (class 4);
- Castor Oil, *Ricinus communis* (non noxious – class 4 Sydney area);
- Blue Heliotrope, *Heliotropium amplexicaule* (non noxious - class 4 outside of Singleton LGA);
- Cotton bush, *Gomphocarpus fruticosus* (non noxious);
- Green Cestrum, *Cestrum parqui* (class 3);
- Bitou bush, *Chrysanthemoides monilifera* (non-noxious – class 3/4 out of Singleton LGA);
- Lantana, *Lantana* spp. (class 4);
- Noogoora burr, *Xanthium occidentale* (class 4); and
- African Olive, *Olea europaea subspecies Africana* (class 4).

The following 1080 baits have been laid on site during 2016:

- 31 ground meat baits (targeting wild dogs) during Autumn.

The Autumn 1080 baiting program was aligned with the Upper Hunter 1080 Wild Dog Aerial baiting program.

From August to December 2016, qualified open range shooters conducted a Kangaroo culling program across site. The shooting was undertaken across five nights (across several weeks) with 204 Eastern Grey Kangaroo's (*Macropus giganteus*) culled and tagged with tags supplied by National Parks and Wildlife Service (NPWS). NPWS also provided approval for meat to be taken off-site and provided to local Wild Dog Associations for wild dog control during the May aerial baiting program as well as ground baiting for wild dog control in the local area.

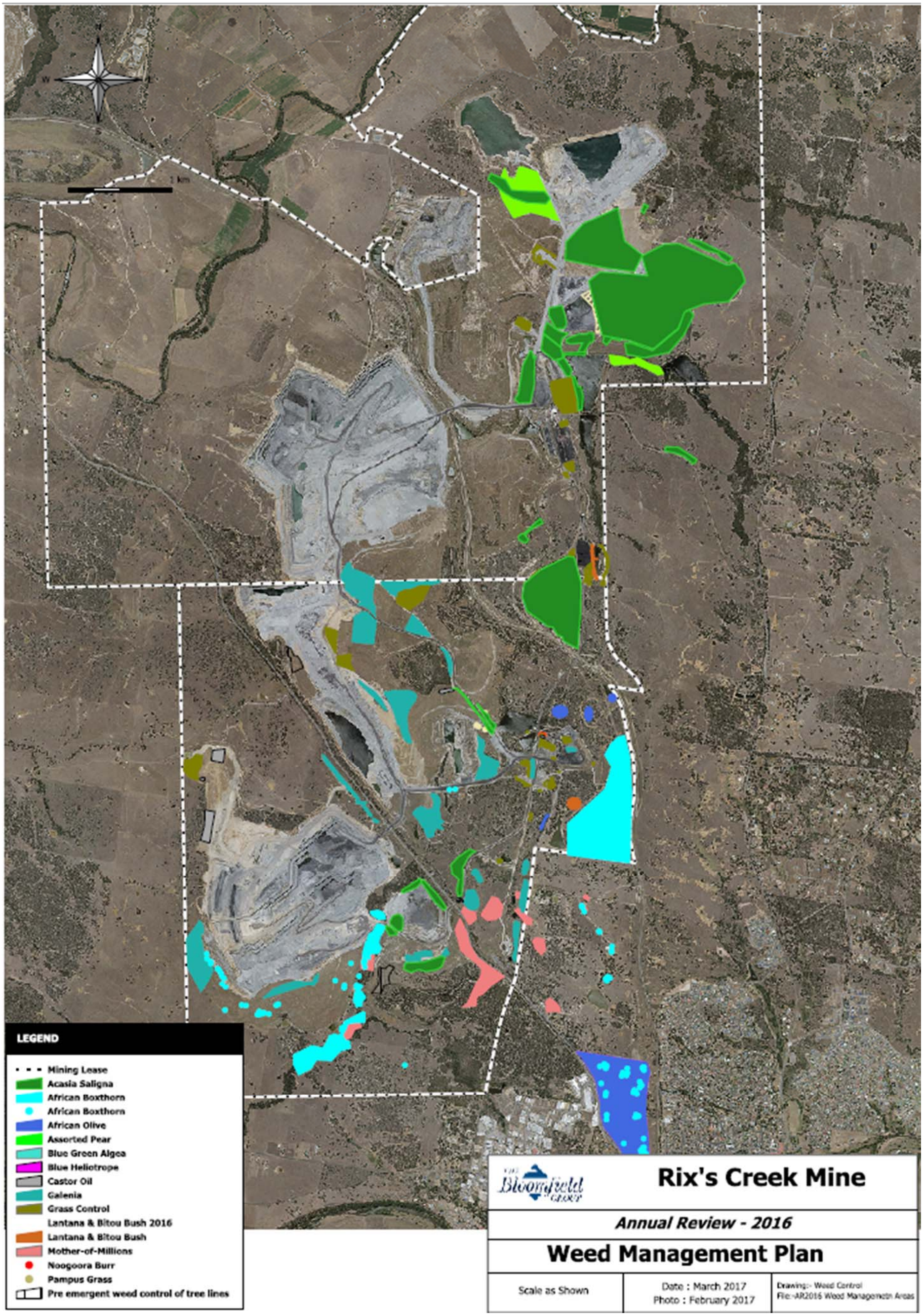


Figure 21. Weed Management Plan

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6.7.3 Reportable Incidents

No reportable incidents relating to weed and/or pest management occurred during the 2016 reporting period.

6.7.4 Further Improvements

An annual weed spraying program is undertaken to control the weeds listed in section 6.6.2. The following weed species have been identified on-site and will be managed as practicable in 2016:-

- Prickly pear, *Cylindropuntia* spp. (class 4);
- Galenia, *Galenia pubescens* (non noxious – class 4 Tamworth); and
- African Olive, *Olea europaea subspecies Africana* (class 4).

Continuation of Kangaroo culling program aligned with the annual wild dog aerial baiting program for Upper Hunter and WDA's requirements will also continue during 2017.

6.8 Visual, Stray Light

6.8.1 Environmental Management

It is a Development Consent requirement to direct or screen floodlighting away from residences and roads.

Progressive rehabilitation of mining disturbed land is the main strategy for minimising visual impacts from Rix's Creek. As well as providing a safe and stable landform, one of the key objectives of rehabilitation planning is to provide vegetated landforms that blend with the surrounding landscape.

A number of management techniques are used to minimise the impacts of stray lighting and are employed across both sites which include:

- Visual bunds established to improve visual amenity and block light;
- Light positioning and orientation for mobile lighting plant;
- Positioning mine entrance and exit roads to prevent headlights shining towards adjacent residences; and
- Awareness training to educate employees regarding the sensitivity of the operations proximity to local residents.

6.8.2 Environmental Performance

There is a standard operational procedure for lights not to be directed towards the New England Highway, main northern railway line or towards local residences.

6.8.3 Reportable Incidents

There was one (1) complaint received during the reporting period with an intrusive light shining in the vicinity of a nearby resident in the Falbrook pit, when rehabilitation was commencing on an unshaped batter. The lighting plant was adjusted and a plan was put in place to ensure that the light was set up in a non-intrusive position.

6.8.4 Further Improvements.

There has been an ongoing maintenance program replacing existing older lights with new modern LED lighting that shields and directs light more towards the ground surface rather than outwards.
Rix's Creek personnel conducting attended noise monitoring also inspect for any lights not compliant with the site's development consent and report to the shift supervisor.

6.9 Aboriginal Heritage

6.9.1 Environmental Management

Aboriginal heritage issues identified in the EIS have been addressed. Application was made and Consent No:- SZ 163 granted on 25/5/97 under Section 90 of National Parks and Wildlife Act , 1974 to Carry out the Destruction of an Aboriginal Relic/Place. The Consent was issued in relation to Aboriginal sites NWP #37-6-244 and #37-6-245.

6.9.2 Environmental Performance

The Company has given an undertaking to the Wonnarua Tribal Council Inc. to widen the exclusion from mining corridor to 40 m along the western side of Rix's Creek before mining commences in Pit 3 – West Pit. The sites listed as R1, R2, 12 and 15 will be fenced around to ensure they are not damaged during the life of mining. This was maintained in 2016.

The Company also agreed to leave a 40 metre buffer strip along Rix's Creek to preserve any possible Aboriginal heritage sites that may be associated with the Creek that were not identified.

Aboriginal sites within the mine path were identified and HLA-Envirosciences Pty Limited (now AECOM Australia) were engaged to prepare a section 90 'Consent to Destroy' application and research design for the investigation and mitigation of several known sites within the Rix's Creek mining lease.

An initial inspection and investigation of the sites took place in December 2006 involving members of the Aboriginal community. Following from this an application for Consent to Destroy was submitted to Department of Environment and Conservation in early April 2007. Approval for the Consent to Destroy was given in November 2007. Collection of artefacts took place in December 2007. One area was partially under water as the site was located on the edge of a dam. This area was revisited in February 2009 when the water was drained from the dam and the area dry. Only a few small artefacts were identified and collected.

During 2013 the proposed Rix's Creek rail loop was examined by AECOM and several Aboriginal community members for inspection and investigation of any potential sites. The construction of this rail loop did not commence during 2015.

During 2014 the proposed Rix's Creek Continuation Project area was examined by AECOM and several Aboriginal community members for inspection and investigation of any potential sites (archaeological due diligence assessment).

In accordance with the Rix's Creek North Project Approval (08_0102) an Aboriginal Heritage Management Plan sets out the procedures for the protection of Aboriginal sites as well as the salvage and care of Aboriginal objects found within the operational activities. Additional objectives of the Aboriginal Heritage Management Plan are:

- To establish an ongoing Aboriginal stakeholder consultation process;
- To describe the manner in which certain Aboriginal sites will be salvaged;
- To provide a summary research design and work plan for the sub surface excavation of select sites and areas; and
- To describe a program for Aboriginal site survey and assessment in areas not addressed by the original EA.

The Aboriginal Heritage Management Plan also outlines the importance of ongoing consultation with Aboriginal stakeholders during mining. All staff and contractors as part of a site induction are provided with information on what constitutes an artefact and what to do if an item of Aboriginal heritage is located.

6.9.3 Reportable Incidents

No artefacts were identified during operations over the 2016 reporting period.

6.9.4 Further Improvements.

It was decided to replace the collected artefacts under the Section 90 Consent to Destroy to an area protected from mining adjacent to Rix's Creek. This area was initially identified as a potential artefact site. The area is in the bend of the Creek and has been fenced to exclude access. When the study of the artefacts has concluded then they will be placed in this area.

The next step for the Rix's Creek Continuation project will be the development of an Aboriginal Cultural Heritage Management Plan which will set out procedures for the management of Aboriginal cultural heritage within the disturbance footprint of the project.

6.10 Natural Heritage

6.10.1 Environmental Management

The Rix's Creek Coke Ovens and associated works adjacent to Rix's Creek Lane are the subject of an Order made under Section 130 (1) of the Heritage Act, 1997. The order was made on 23/7/82.

The Rix's Creek Coke Ovens are also classified by the Natural Trust of Australia and are included in the Trust Register.

As such the Company prepared in 1989 a Rix's Creek Coke Ovens Conservation Plan. The Plan outlines the measures the Company has put in place and operational controls to conserve the area.

The Plan was reviewed during 2004 by Peter Lonergan of Cracknell & Lonergan a heritage architect. The following recommendations were made:-

> *17. It is my opinion that any active conservation to the fabric is unwarranted and inappropriate. The ovens ceased operation some 60 years prior to the conservation plan and now 15 years later little further deterioration has occurred, or is evident.*

Rix's Creek North operations has a Non Aboriginal Management Plan which addresses management of non –aboriginal heritage.

If during the course of works any previously unknown historical archaeological material or heritage sites/items are uncovered or identified, all work in the area of the item(s) shall cease immediately and a suitably qualified and experienced archaeologist will be consulted. If the archaeologist considers the archaeological material uncovered constitutes an archaeological 'relic', the Heritage Branch, OEH will be consulted, in accordance with Section 146 of the Heritage Act 1977 (NSW), to determine an appropriate course of action prior to the recommencement of work in the area of the item.

6.10.2 Environmental Performance

A program of cutting and cleaning the dead wood around the area was undertaken during 2006 and weed control over the area is undertaken as necessary. Mother-of-Millions weeds around the area were sprayed again this year as well as assorted Pear (*Opuntia spp.*) species. Some scattered African Boxthorn weed species were also found and sprayed as necessary. Galenia was sprayed across several old spoil heaps. Restricted access and security of the area has been maintained throughout 2016.

6.10.3 Reportable Incidents

There were no reportable incidents in relation to natural heritage during the 2016 reporting period.

6.10.4 Further Improvements.

The program of protection of the Coke oven area and other known natural heritage sites will continue. Annual inspections are undertaken of the areas with known natural heritage sites. Any weeds identified will be sprayed. Vegetation maintenance may be required as necessary and fencing and signage are checked for adequacy.

6.11 Spontaneous Combustion

6.11.1 Environmental Management

The coal seams mined at the site are not susceptible to spontaneous combustion. All stockpiles are however inspected regularly to check for heating of the material. Any coal mined and not able to be washed is stockpiled in-pit onto overburden where no combustible materials surround it.

6.11.2 Environmental Performance

N/A

6.11.3 Reportable Incidents

There were no reportable incidents relating to spontaneous combustion during the 2016 reporting period.

6.11.4 Further Improvements.

Monitoring of stockpiles will continue as an ongoing operational procedure.

6.12 Bushfire

6.12.1 Environmental Management

Fuel reduction programs are undertaken on an as needed basis and done in conjunction with the local Rural Fire Service (RFS).

6.12.2 Environmental Performance

A slashing program was undertaken regularly to reduce fuel loads. As well as reducing fuel loads mulching this material into the surface will enhance the rehabilitation through improved nutrient recycling as the material decomposes over time. Excessive grass and weeds were sprayed around site infrastructure to further reduce fuel loads. Rix's Creek and AustGrid also conducted spraying and mulching of power line easements across site throughout the year.
Proactive management was undertaken which included clearing trees that could potentially come in contact with overhead power lines and implementing an inspection program for tree trimming near the overhead power lines to reduce the occurrence of grass fires.

Grazing of cattle was undertaken around mining activities to apply grazing pressure to land ahead of the West Pit during 2016. This will continue in 2017 as the mining operation continues in a north-westerly direction along the New England Highway.

During 2014 Rix's Creek purchased a property and existing four-bay shed in Maison Dieu in which the shed is provided to the Rural Fire Service – Darlington brigade in sponsorship by the Bloomfield Group at no cost. This sponsorship continued in 2016.

6.12.3 Further Improvements.

Fuel reduction programs are undertaken on an as needed basis and done in conjunction with the local Rural Fire Service and local landholders. Areas of land owned within the lease and outside of the active mining area and rehabilitated areas will continually be leased to lessee's to graze cattle in a bid to minimise fuel loads across site.

6.13 Mine Subsidence

6.13.1 Environmental Management

Areas of the Rix's Creek mine site are undermined by historic underground workings. Sink holes associated with shallow workings are infrequent. If identified, the standard management procedure is to flag off and isolate the sink holes from access, back fill the holes and monitor for further subsidence. Once deemed stable, the area will then be rehabilitated and periodic inspections will continue.

6.13.2 Environmental Performance

There were no reportable incidents in relation to mine subsidence during the 2016 reporting period.

6.13.3 Reportable Incidents

Nil.

6.13.4 Further Improvements

Identified sink holes will be remediated and the heritage areas will be protected. No other improvements to subsidence management are planned.

6.14 Hydrocarbon Contamination

6.14.1 Environmental Management

No areas of hydrocarbon contamination have been identified within the Rix's Creek lease area. Management is geared to contamination prevention. Procedures are in place on site to handle any hydrocarbon spills. Containment equipment is located in the store, site workshops, CHPP as well as the fuel farm.

Hydrocarbon storages at Rix's Creek southern operations consist of 3 bulk storage areas. The main fuel farm for distillate and lubrication oils for machinery. The second smaller area for hydrocarbons used in the CHPP and the third a tank for processed oil/diesel for use in explosives.

At Rix's Creek Northern operations, the open cut wash down area has a sump to collect the oil/water mix. Drains at the workshop are directed to the wash down bay area sump where a loop tube surface skimmer removes the majority of hydrocarbons before the remaining water is passed through a plate separator. Recovered oil is transferred to a storage tank and a licensed waste transport contractor collects the separated waste oil from the storage tank. Water post hydrocarbon recovery then flows to mine water dam D1.

The hydrocarbon storage areas have the storage tanks located within a bunded area capable of containing greater than 110 % of the largest storage tank. The bunded area is lined with an impervious 'Claymax' product barrier. Any fluids including water and hydrocarbons drain to a sump where the water is decanted and processed through an oil arrestor to remove any hydrocarbons. The hydrocarbons are directed to a waste oil tank for recycling. The water goes into the contaminated water system for recycling through the CHPP.

All machinery is fitted with quick fill mechanisms. The inlets and outlets, at the refuelling bay and mobile tanker are positively closed with an automatic cut off when full. This refuelling method is quick and minimises any potential for spillage during the refuelling operation.

The hydrocarbon management procedure was updated to include Rix's Creek Northern operations during the reporting period.

6.14.2 Environmental Performance

There were no major hydrocarbon spills during the year. Rix's Creek developed a Hydrocarbon Management procedure to align both sites with a standardised process for minimising hydrocarbon and chemical spills or management and reporting requirements if a spill occurs.

6.14.3 Reportable Incidents

There were no external reportable incidents related to hydrocarbon management during the reporting period. The hydrocarbon spills that occurred during 2016 were contained using spill kits, or earth moving equipment was used to form a temporary bund. Material contaminated from hydrocarbon spills was relocated via a small front end loader to the bioremediation areas at Rix's Creek North or Rix's Creek South.

6.14.4 Further Improvements

The use of S200 / Micro-blaze for minor hydrocarbon spills to assist in the breaking down of hydrocarbons via bacteria will continue during 2017. This technique has proven effective and was used several times throughout the year to clean up minor spot stains around the fuel farm, oil/water sumps, and equipment.

The site remediation area is regularly turned over via backhoe within each cell. Soil samples are taken for total petroleum hydrocarbons (TPH) in which the cell results are to be less than 1000 ppm. Once results are below this criteria it can be placed back into the open cut pit. Generally after the soil has been stored for a long period and has grassed over it is a good indication to conduct soil sampling.

6.15 Public Safety.

6.15.1 Environmental Management

Visual bunds were constructed along the New England Highway adjacent to the old Middle Fallbrook Road and the southern side of the Highway from Rix's Creek to the old 'Granbalang' entrance during 2008.

These bunds were sown with a cover crop and planted with tube stock to further screen the operation and blend in with the existing remaining trees retained along the edge of the Highway. Establishment of the trees was poor and these have been prepared for replanting during 2008. Replanting of these bunds took place in 2009 with high success rates aligned with good rainfall following planting.

New bunds ahead of the West Pit operation were completed during early 2014. These were seeded by hand with two hectares of tree species (facing the highway) and two hectares of pasture species (facing the West Pit). Several hundred Casuarina luehmannii (Bull Oak) species were also planted amongst the hand seeded area's to improve tree success. To date a lot of seedlings have germinated in the area.

Fences along the New England Highway, Bridgman Road, Stoney Creek Road and Falbrook Road were checked during the year and repaired as necessary with 'No Trespassing' signs replaced every 100 m along the fences on both sides of the New England Highway in which the lease intersects. Gates along the New England Highway as well as bordering rehabilitation areas were chained secure during the 2016 period to prevent unauthorised access.

6.15.2 Environmental Performance

There we no external reported incidents reported to Police in the 2016 period, whereby illegal entry from unauthorised people was gained on site. Fences and gates were inspected on Bridgman Road, Stoney Creek Road,Falbrook Road and the New England Highway during 2016 and repaired where required.

6.15.3 Reportable Incidents

Nil.

6.15.4 Further Improvements

The installation of more visual bunds will be placed along the Highway corridor of the West Pit ahead of the operation during 2017 and rehabilitated to final landform design to improve the West Pit's visual amenity. These bunds will be installed beside the 2014 created highway bunds. A colorbond fence was also installed during 2014 alongside Rix's Creek cut and cover tunnel for further visual amenity between the tunnel and a visual bund. An additional 2,030 tube stock were also planted during autumn 2015 to further screen the mining operation from passing motorists.

No other overall improvements are planned to manage public safety, however Rix's Creek will continue to maintain and improve existing fencing, gates, barriers and signage.

SECTION 7 WATER MANAGEMENT

7.1 Rix's Creek Setting and Context

7.1.1 Geology

Regional Geology

The Project is located within the Hunter Coalfields of the Sydney Basin. The coal reserves occur within the Permian age Foybrook Formation of the Vane Sub-group, which comprises the Lemington to Hebden coal seams. The target coal seams are separated by interburden sediments, which comprise sandstone, siltstone, conglomerate, mudstone, and shale, as well as occasional minor coal seams.

The main regional geological structures in the area are two approximately parallel thrust faults, these being the continental scale Hunter Thrust Fault to the north of the Project and the Hebden Thrust Fault to the south. There are many anticlines and synclines that are significant to the Project. The axis of the anticlines and synclines are orientated approximately north–south. No major faults or other significant structures or igneous intrusions (dykes or sills) are known to occur in the mining area.

Local Geology

The Project is confined within a geological basin-like north–south trending syncline that hosts the Permian coal reserves that are part of the Whittingham Coal Measures. The syncline is approximately 8 km long by 3 km wide and is bounded by the Camberwell and Darlington Anticlines. The syncline is asymmetrical, the western limb generally dipping at a steeper angle than the eastern limb. The syncline is also locally double-plunging forming the synclinal basin structure centred on the Rix's Creek operations. North of the Rix's Creek mining lease, the syncline plunges to the north.

The major coal seams identified in the Rix's Creek syncline are (in descending stratigraphic order):

- Lemmington Seam
- Pikes Gully Seam
- Arties Seam
- Liddell Seam
- Barrett Seam
- Hebden Seam.

The seams typically out-crop within the syncline, with the outcrop of Barrett and Hebden seams to the east, west, and south, marking the limit of the mineable seams. The target coal seams vary widely throughout the area and often occur as several dispersed splits, separated by interburden sediments that comprise alternating sandstone, siltstone, conglomerate, mudstone and shale, as well as occasional minor coal seams. The Interburden between the Barrett and Upper Hebden seams increases to more than 20 m in the northern and western regions, rendering the Upper Hebden seam uneconomical to mine.

7.1.2 Hydrogeological Setting

The hydrogeology of the Upper Hunter Valley is dominated by two aquifer groups; alluvial deposits of quaternary age and consolidated sedimentary rocks of Permian age.

Alluvial Aquifer

The unconsolidated alluvium is associated with drainage lines and creeks and the regolith comprises clay-bound and silt-bound sands and gravels. Within the project area only minor alluvium, associated with Rix's Creek exists to the south of the mine lease, these deposits generally consist of low permeability clay underlain by marginally higher permeability clayey gravel and clayey sand. At Rix's Creek, alluvial aquifers are typically

thin and poorly developed, and do not comprise extensive aquifers such as those associated in the north around Glennie's Creek or the Hunter River.

Permian Coal Measures Aquifer

The Permian Coal Measures consist of a variable sequence of aquitards (predominantly siltstone and sandstone) and low permeability aquifers (coal seams). The permeability of the coal seams is typically 1 to 2 orders of magnitude greater than that of the associated interburden and overburden units, with groundwater flow within the Coal Measures predominantly confined to the cleat fractures in the coal seams. This means the coal seams themselves form the main aquifer within the hard rock system.

Within the Coal Measures, the higher permeability coal seams are the main influence of bulk horizontal hydraulic conductivity, while the lower permeability interburden sandstones, siltstones and shales influence the overall vertical hydraulic conductivity.

Increased permeability is generally associated with the crests and limbs of the major folds like the Camberwell and Muswellbrook anticlines and Rix's Creek Syncline, and areas of localised bedding flexure. Such deformation may result in enhanced cleating within the coal seams or enhanced fracturing and jointing within adjacent strata. Although it is noted from mining to date at Rix's Creek, enhanced permeability and associated groundwater inflows have not been encountered.

The hydrogeological basement lithologies on site are comprised of low permeability siltstones of the basal Saltwater Creek Formation of the Whittingham Coal Measures, and the underlying Mulbring Siltstone of the Maitland Group.

Regional Groundwater Flow

Regional groundwater flow within the Coal Measures is sustained by rainfall recharge to generally elevated areas of regolith and outcropping strata. Downward recharge to deeper strata is aided in areas of enhanced jointing and fracturing, particularly dilated joints and bedding planes in the upper weathered horizons. Downwards recharge will typically be limited by reduced fracture connectivity with depth.

Mackie (2009) compiled a regional piezometric surface from reports submitted in support of mining approvals over the period 1993 to 2004. The map typically shows groundwater flow from areas of high ground towards the Hunter River and associated alluvium, and towards major tributary drainages such as Glennie's Creek and Wollombi Brook. In the vicinity of Rix's Creek this flow is generally to the west in the vicinity of Deadman's Gully (west of Pit 1) and south to southwest in the vicinity of Rix's Creek (south of Pits 2 and 3). The regional flow regimes are altered around major below water table mining operations where drawdown influences prevail.

Mackie (2009) noted that in areas where mining has not impacted upon the Coal Measures strata, the deep pore pressure regime is observed to be generally stable in time with seasonal movements being commonly less than one metre, even during periods of sustained drought – suggesting that the shallow groundwater and basement groundwater systems are hydraulically isolated from each other for the most part.

Groundwater discharge is typically to the regional drainage and overlying alluvial aquifers of the Hunter River and its tributaries with upwards leakage associated with the sub-cropping of Coal Measures in specific areas. In areas not influenced by mining operations, upwards hydraulic gradients are often identified, and reduced water quality is often associated with areas of leakage of more saline groundwater from the Coal Measures.

Groundwater levels within the Rix's Creek Syncline are dominated by the groundwater sinks presented by the current Rix's Creek open cut mining operation at Pit 3 and the adjoining Camberwell Pit to the north, along with the Glencore Integra underground operations to the northwest.

Conceptual Hydrogeological Model

The conceptual hydrogeological model for Rix's Creek is relatively simple in that the basin-like structure of the Rix's Creek Syncline acts to isolate the Coal Measures from the broader regional hydrogeological regime, with little groundwater interaction through the bounding low permeability siltstones.

The basin-like structure as defined by the base of the Hebden Seam (and upper surface of the Saltwater Creek Formation) is depicted on Figure 23.

The limbs of the anticline have a relatively shallow dip on the eastern limb with the western limb dipping at a much steeper angle. The syncline axis also plunges from the north and south. The lowest point the Coal Measures in the synclinal basin is approximately -130mAHD.

Although geologically more complex on the local scale due to the splitting and merging of multiple minor seams, the aquifer system at Rix's Creek has been simplified and represented by a layer cake style system, with the layer geometry reflecting the synclinal basin structure. Within the layer cake, the major coal seams represent the main aquifers, with the interburden units providing low permeability aquitards between the aquifers. Within the coal seam aquifers, preferential groundwater flow is along the bedding. Large scale groundwater flow vertically between bedded units is impeded by the low permeability interburden units.

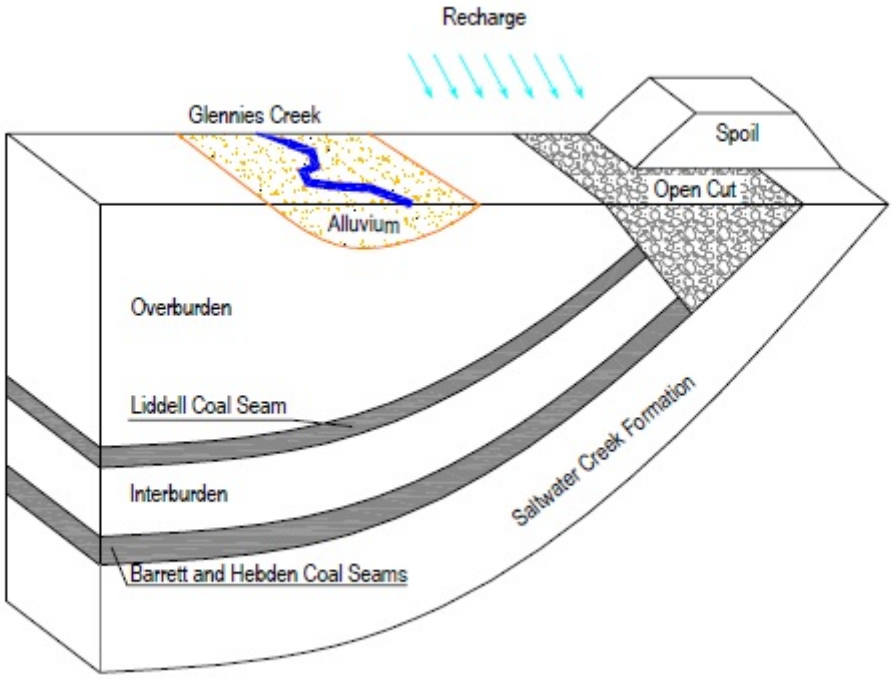

Figure 22 Conceptual Hydrogeological Model of the Rix's Creek Syncline area

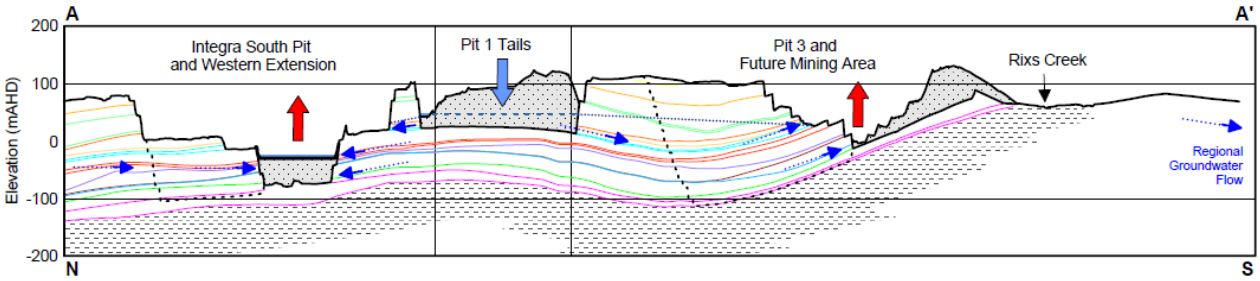

Figure 23 Conceptual Hydrogeological Cross Section

Aquifer Recharge

Rainfall recharge and infiltration will occur on remnant regolith areas, as well as rehabilitated mine areas, and direct rainfall to open cut areas. A degree of enhanced recharge and infiltration will also occur from the Old North Pit water to storage, and the deposition of tailings slurry in Pit 1 (although tailings seepage is anticipated to be a minor contributor to the overall water balance).

The lack of water level response observed at shallow monitoring bores BH3 and BH4, located within the limit of Coal Measures outcrop, demonstrates the disconnection of the shallow regolith and alluvial aquifers from

the deeper groundwater regime. It also shows that the shallow aquifers in these locations are reliant on direct rainfall recharge, which has not been diminished through mining operations.

Mine Site Catchment Hydrology

Run-off from undisturbed areas is directed away from mining operations through diversion banks, which direct run-off into natural watercourses or into a number clean water dams. Clean water dams overflow into the natural drainage system.

Within the RCS project area Rix's Creek is a losing (influent) stream, and within the RCN project area Reedy Creek, Station Creek and Glennies Creek are losing streams. The elevation of the bottom of the Creek is above groundwater level and therefore the creek does not receive a base flow from the basement aquifer system – that is, there is no direct hydraulic connection between the alluvial system and the Permian Coal Measures aquifer.

Groundwater Dependent Ecosystems

The proximity of GDEs to the Project area has been assessed by reviewing the WSP and the Groundwater Dependent Ecosystem Atlas (Bureau of Meteorology, 2012). The findings have confirmed that there are no identified GDEs in the vicinity of the Project (RCS and RCN).

Most of the existing mine footprint is situated up hydraulic gradient of Rix's Creek and there are no alluvium deposits associated with the creek in the immediate vicinity of the mine. Surface water monitoring data (EC and flow observations) obtained from the creek shows the water to be relatively fresh (EC <200 µS/cm) and flows to be occasional, which suggests that the flow within the Creek is almost entirely derived from surface water run-off.

As there is no alluvium in the mining area and no apparent base flow contributions, the pumping or interception of groundwater with the Permian Coal Measure aquifer from current or future mining activities is unlikely to impact upon on creek flow volumes in the regolith/alluvial aquifer system. The only risks to the creek therefore relate to water quality impacts associated with dirty water runoff.

7.2 Water Licences

Rix's Creek has the following active groundwater licences:

Table 19 Rix's Creek Water Licences

Water License #	Water sharing plan, sources and management zone (as applicable)	Entitlement
Rix's Creek North - Water Licences		
20AL201231	Hunter Regulated River – Zone 3A Glennie's Ck - High Security	230 ML
20AL200940	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	54 ML
20AL200530	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	102 ML
20AL200818	Hunter Regulated River – Zone 3A Glennie's Ck	23 ML
20CA200847	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	14 ML
20AL201041	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	240 ML
20AL200846	Hunter Regulated River – Zone 3A Glennie's Ck - Supplementary Water	1.2 ML
20WA207397	Hunter Unregulated and Alluvial Water Sources -	6 ML

	Unregulated River	
20CA207373	Hunter Unregulated and Alluvial Water Sources - Aquifer	5 ML
20CA200041	Hunter Regulated River Water Source	-
20CA200041	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	51 ML
20BL169513	Mining	100 ML
20BL172249	Mining	100 ML
20BL169513	Irrigation	5 ML
Rix's Creek South - Water Licences		
20AL203407	Regulated River (General Security)	159 Units
20AL203406	Regulated River (General Security)	49.5 Units
20AL203405	Regulated River (General Security)	49.5 Units
20AL203405	Domestic & Stock	24 Units
20AL209899	Water sharing plan – Hunter unregulated and alluvial water sources 2009	150 Units
20AL207389	Water sharing plan – Hunter unregulated and alluvial water sources 2009	5 Units
20WA209901	Water sharing plan – Hunter unregulated and alluvial water sources 2009	300 Units
20BL170863	Open Cut (dewatering groundwater) Hard Rock	100 ML
20BL170864	1 x Bore (dewatering groundwater)	100 ML
20BL168734	1 x Bore (monitoring bore)	1 ML
20AL209919	Water sharing plan – Hunter unregulated and alluvial water sources 2009	91 Units
20WA201499	Water sharing plan – Hunter unregulated and alluvial water sources 2009	1 Units

7.21 Water Management

Rix's Creek mine currently has two Water Management plans that outline surface water and ground water management practices including monitoring requirements, performance indicators and response plans. The Rix's Creek South Water Management Plan was developed for the site during the year (2010) as part of the development consent (DA 49/94) modification approval requirements for the cut and cover tunnel. Rix's Creek North Water Management Plan was approved by The DPE on the 16th February 2016 covering conditions of Schedule 3, Condition 36 of Project Approval 08_0102.

A sample static water balance was calculated for (2016) providing information on inputs and outputs for both the Northern and Southern operations and the results are shown in Table 21 and Table 22.

Table 21 shows that In 2016 the strategy was to manage water levels in the open cut at Rix's Creek South operations by pumping water to the CHPP for re-use, to surface dams and disused voids to maximise evaporation. Water is pumped to the CHPP Dams and to the Arties Pit void from west pit open cut operations.

Evaporation from Rix's Creek South process water dams totalled 430 ML in 2016. The major evaporation occurred at:

- The Process Dams, approximately 236 ML;
- The RCS Arties Pit Voids, approximately 32 ML;

- The RCS Tailings Dams 162 ML.

There was an estimated 47 ML of groundwater inflow into the open cut voids at Rix's Creek South during the reporting period.

Table 22 shows that in 2016 Evaporation from site process water dams at Rix's Creek North totalled 1,355 ML in 2016. The major evaporation occurred at:

- The tailings dams, approximately 441 ML;
- The Possum Skin Dam, approximately 487 ML;
- The in-pit voids, approximately 213 ML;
- Dirty Water Dams 1 & 3; approximately 209

There was an estimated 100 ML of groundwater inflow into the open cut voids during the reporting period.

The groundwater inflow and seepage from rehabilitated emplacements and spoil dumps into the Underground Portal Storage was estimated at 796 ML. The estimate is based on modelling in 2015 based on reference to an average flow of 1.4 ML/day determined from detailed measurements taken in 2007-2008.

The Rix's Creek North CHPP was not operational during 2016 and is undergoing repairs to be operational in 2017. All the coal extracted from Rix's creek North operations was washed at the Rix's Creek South CHPP with fine reject being stored in Tailings Dam 4 at Rix's Creek South operations.

Approximately 20 megalitres (ML) of potable water was sourced from the Singleton town water supply in 2016 for Rix's Creek South and Rix's Creek North operations.

Table 20 Sample Static Water Balance Rix's Creek South (2016)

Water Stream	2016 (ML)
Inputs	
Imported Fresh Water	
Imported Potable	10
Groundwater Seepage To Open Cuts	47
Underground Dewatering	0
Rainfall Runoff – Into Dirty Water System	1,749
Recycled to CHPP from Tails & Storage (not included in total)	(646)
Water from ROM Coal	187
Total Inputs	**1,919**
Outputs	
Groundwater Seepage Out	0
Dust Suppression – Water Carts	611
Exported to Other Mines – Dirty Water	0
Evaporation Fans & Sprays	0

Evaporation - Mine Water & Tailings Dams	427
Entrained in Process Waste	572
Water in Product Coal	124
Potable Usage	10
Total Outputs	**1,744**
Estimated Change in Pit Storage (increased)	**249**

Table 21 Sample Static Water Balance Rix's Creek North 2016

Water Stream	2016 (ML)
Inputs	
Imported Fresh Water	0
Imported Potable	10
Groundwater & Spoil Seepage To Portal	511
Groundwater Seepage To Open Cuts	100
Underground Dewatering	0
Rainfall Runoff – Into Dirty Water System	2,165
Recycled to CHPP from Tails & Storage (not included in total)	0
Water from ROM Coal	0
Total Inputs	**2,783**
Outputs	
Groundwater Seepage Out	0
Dust Suppression – Water Carts	145
Exported to Other Mines – Dirty Water	0
Evaporation Fans & Sprays (Operated Jan – Oct)	0
Evaporation - Mine Water & Tailings Dams	1,350
Entrained in Process Waste	0
Water in Product Coal	0
Potable Usage	10
Total Outputs	**1,505**
Estimated Change in Pit Storage (increased)	**1,278**

7.3 Surface Water

7.3.1 Environmental Management

The water management system at Rix's Creek mine has been designed with the primary objectives of:-

- segregation of uncontaminated, clean water runoff, from contaminated-mine water on site; and
- priority use of and safe disposal on site of contaminated water.

Clean Water

Runoff from undisturbed areas is directed away from mining operations through diversion banks and channels. The clean water is directed into Rix's Creek, which flows through the lease. North of the New England Highway the Creek consists of a number of flow lines in smaller catchments. South of the Highway Rix's Creek is a defined flow line amongst a belt of riparian vegetation.

Water quality is monitored in the Creek on a monthly basis when there is sufficient water to sample as Rix's Creek is an ephemeral stream. Water quality is also monitored in a smaller creek north of the operation labelled Deadman's Creek.

For Rix's Creek Northern operations, in the open cut mining lease area east of the main Northern Railway Line, rainwater runoff from non-mined or rehabilitation areas, as well as from the diversion of the Martins Creek and Blackwattle Creek catchments, is collected in a series of four dams (C1, C2, C3 and C4). A vegetated clean water channel connects these dams. C3 and C4 are maintained with sufficient freeboard to ensure adequate surge capacity during storm events. Three further dams, C5, C6 and C6a are sediment laden water dams in the south of the mining lease and these dams bywash to Dam C3.
The area west of the Main Northern Railway Line had several dams constructed in 2000 due to the increase in South Pit operations and the need to separate clean and mine water. The water management system comprises clean water dams C7 to C11. The dams and diversion banks divert clean runoff water from entering mine workings. Dams C7, C8 and C11 bywash and flow into C4 via the vegetated channel, while dam C9 (west of the south pit) bywashes into Station Creek. Dam C10 was located in the active mining area and was 'mined-through' in 2001.

Contaminated Water

Runoff from disturbed areas is contained within a system of detention dams designed to allow settlement of the suspended solids. Runoff from active mining areas is pumped to the dirty water storages.

Tailings from the coal beneficiation process are directed to the emplacement area and water decanted off the tailing's dam surface is recycled through the coal handling and preparation plant.

First priority is given to the use of contaminated water in mine operations. Contaminated water is used in the coal beneficiation process and for dust suppression via water carts for haul road watering and spraying coal stockpiles.

Hunter River Salinity Trading Scheme

Rix's Creek is a member of the Hunter River Trading Scheme holding 5 salt credits. Rix's Creek is classified as a non-discharging credit holder. Although Rix's Creek is a member of the scheme there has been no need to discharge saline water and the instrumentation necessary to participate in the scheme was not installed. As a consequence, Rix's Creek is unable to discharge and EPA has subsequently revoked the discharge component of the Environmental Protection Licence.
Credits are traded to other operations when required. Previously, Rix's Creek has traded credits to Glencore (formally Xstrata).

Rix's Creek runs the length of the Rix's Creek South mining lease area. A small portion on the east side of the site adjacent to Rix's Creek Lane is drained by a tributary of Rix's Creek, known as 'Stone

Quarry Gully'.
Grab samples are taken from Rix's Creek Southern site in four locations. They are:-

- Site 1 - Railway Underpass, as the Creek enters the site;
- Site 2 - New England Highway Bridge, at the mid-point through the mine site;
- Site 10 – Below Operation, on Rix's Creek below the operation; and
- Site 3 - Maison Dieu Road Bridge, after the Creek has left the site.

Water storage dams 1, 2, and 6 are sampled and analysed monthly. The locations of these dams are shown on Figure 33 with the relationship being:-

- Site 4-Clean Water Dam 1 - (CWD 1)
- Site 5-Clean Water Dam 2 - (CWD 2)
- Site 7-Clean Water Dam 6 - (CWD 6)

For Rix's Creek Northern operations, Environmental Protection Licence (EPL 3391) requires the monitoring of surface waters for pH, EC, TSS and TDS at the following sites on a monthly basis:

- W3 - Martins Creek, where it enters the site;
- W6 - Blackwattle Creek, where it enters the site; and
- W1 - Station Creek, where it leaves the mine site.

EPL Samples are taken on a monthly basis. Sampling site locations are indicated on Figure 25.

In addition to the EPL water sampling, the Rix's Creek North Water Management Plan was approved on the 16th February 2016. Surface water monitoring sites in Rix's Creek North Water Management Plan are listed in Table 23 and identified in Figure 24. Surface water sampling results are presented in **Appendix 4.**

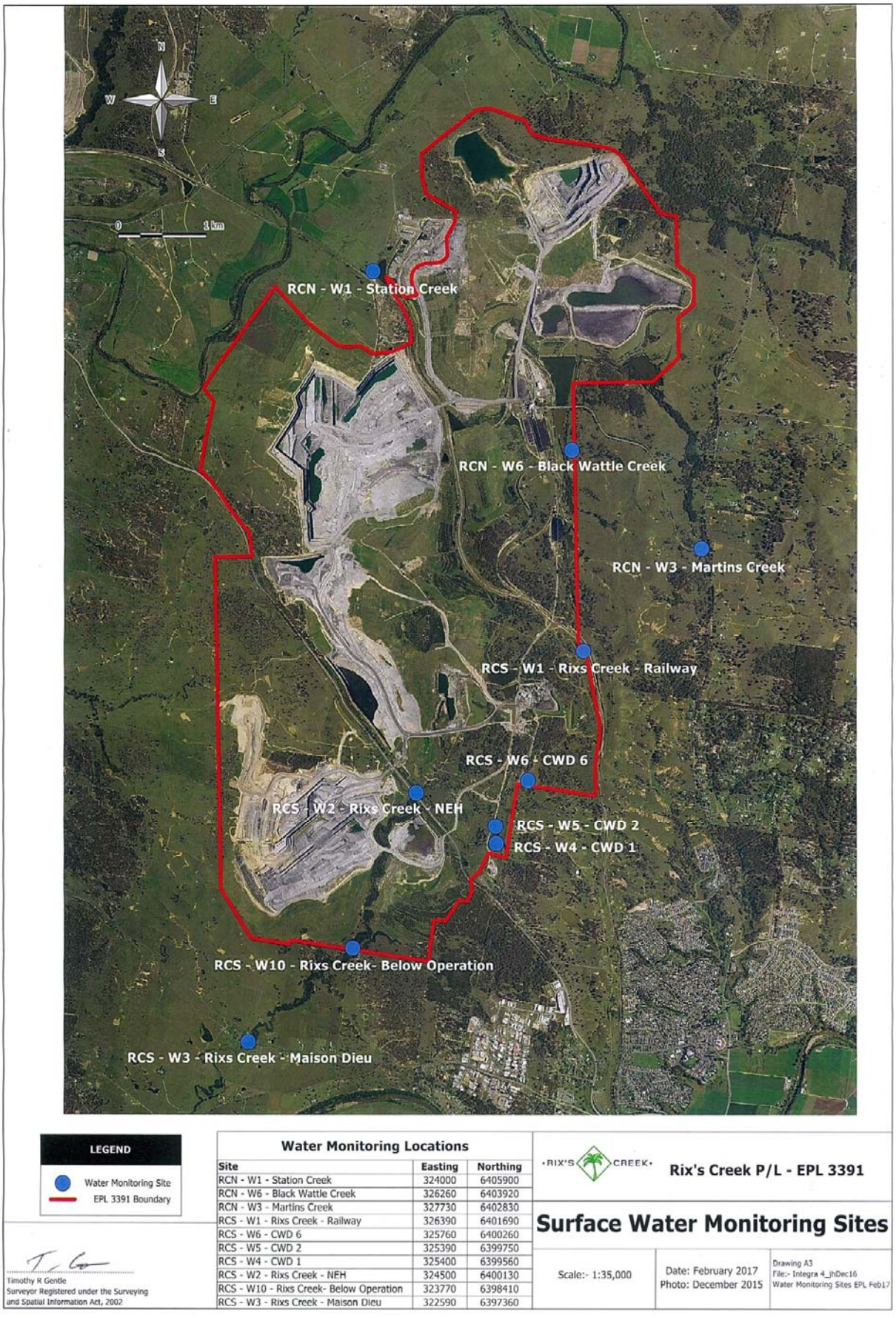

Figure 24 EPL 3391 water monitoring sites

Table 22 RCN Surface Water Monitoring Sites

Monitoring Point	Location
W1	Station Creek
W3	Martins Creek
W4	Glennies Creek upstream of the Station Creek confluence
W5	Glennies Creek downstream of the Station Creek confluence
W6	Blackwattle Creek
W7	Stony Creek where it crosses Stony Creek Road
W10	Clean Water Dam – C4
W11	Glennies Creek downstream at Camberwell where it crosses the New England Highway
W12	Clean Water Dam – C1
W13	Clean Water Dam – C6
W14	Clean Water Dam – C3
W15	Clean Water Dam – C6A (after C5 spillway channel before clean water channel)
W16	Sediment Control Dam – C7
W17	Clean Water Dam – C2
W18	Clean Water Dam – C5
W19	Mine Water Dam D1
W20	Northern Stock Water Dam No. 1
W21	Northern Stock Water Dam No. 2
W22	Station Creek Up
W23	Station Creek Down
GCS003	Possum Skin Dam
GCS004	PS Dam Seepage Collector
GCS005	PS Dam Clean Water diversion Sediment Pond
SD1	South Sediment Dam
SD2	Central Sediment Dam
SD3	North Sediment Dam
GC1	Middle Falbrook Rd Bridge
GC2	Glennies Creek Nobles Crossing
Nobles Crossing	Nobles Crossing

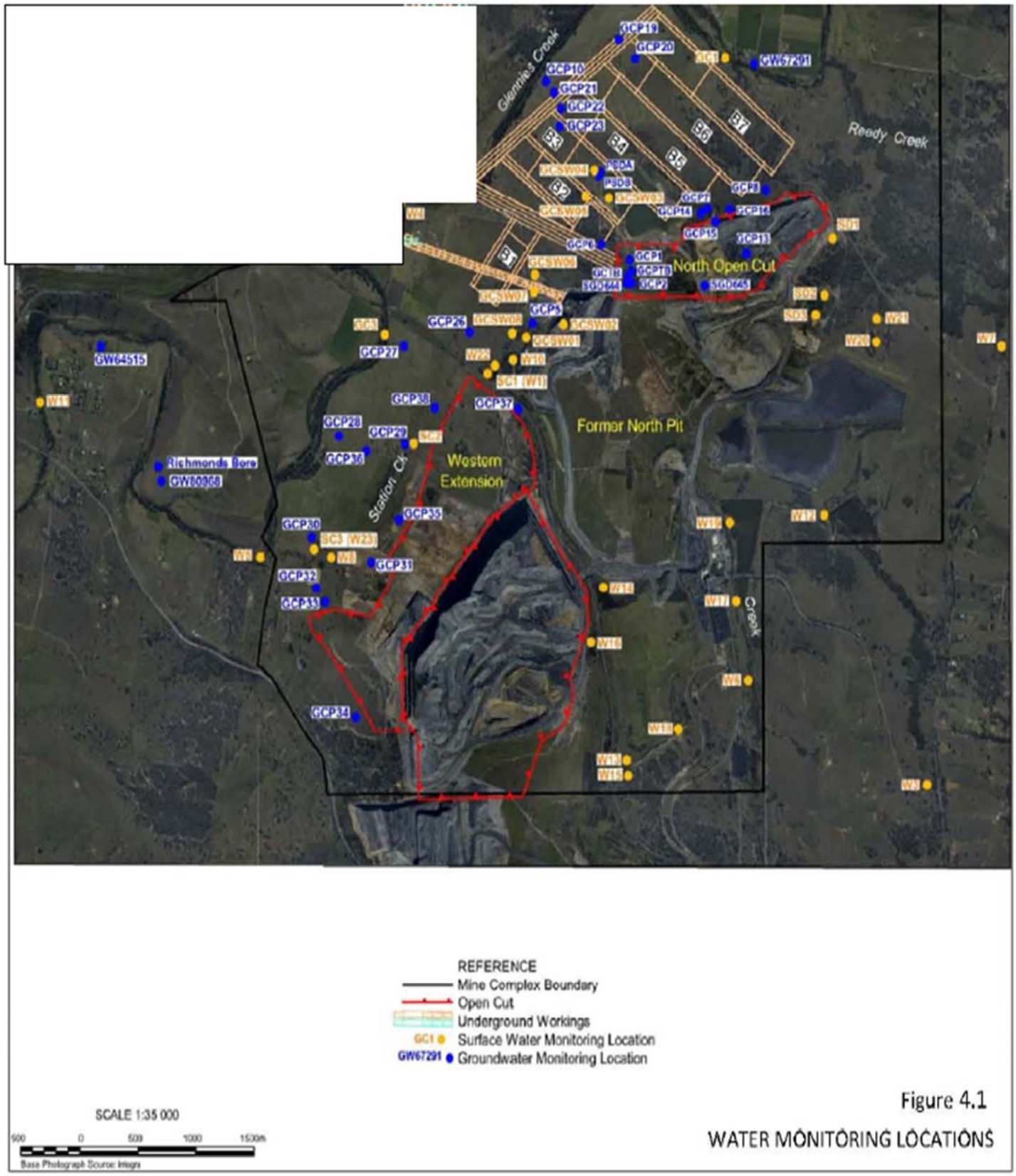

Figure 25. Rix's Creek North Ground and Surface Water Monitoring sites

Grab samples are analysed for water quality parameters of pH, electrical conductivity, total dissolved solids and total suspended solids. The water samples are analysed by Steel River Testing Mayfield as well as ALS Laboratory Group at Warabrook. Both laboratories are registered by the National Association of Testing Authorities, Australia (NATA).

Yearly rainfall was 9.75 mm above average for 2016 at 707.75 mm. Historical averages at Singleton Post Office (1881- 1967) is 698 mm.

Annual rainfall results are seen for the last 17 years and are presented in Figure 26.

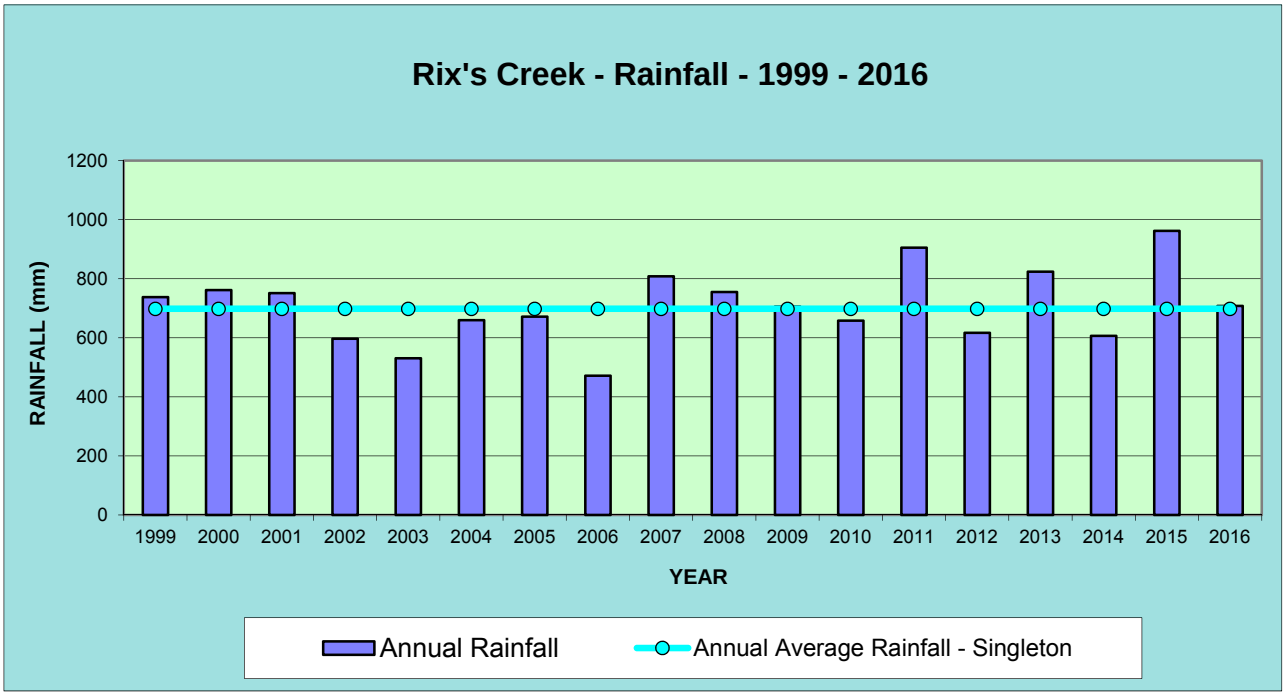

Figure 26 Annual rainfall at Rix's Creek 1999-2016

The rainfall and flows in Rix's Creek again highlight the irregular weather pattern in the Hunter Valley. The water quality in Rix's Creek reflects its ephemeral nature being affected by rainfall events and resultant flow / no flow conditions.

7.3.2 Environmental Performance

pH

The pH results for Rix's Creek Mine are presented in **Appendix 4**. The pH of Rix's Creek during 2016 ranged between 7.1 (January) at the Maison Due Bridge and 9.8 (July) at the Railway Underpass under nil flow conditions. The pH of upstream ephemerals W6 (Black Wattle Creek) ranged between 7.4 and 8.1and W3 (Martins Creek) ranging between 6.4 and 7.0. W1 (Station Creek) monitoring site is located downstream of mining operations and recorded slightly alkaline pH during the reporting period ranging between 7.1 and 7.8. W10 (Dam C4) and W16 (Dam C8) recorded similar pH values during 2016. W10 (Dam C4) recorded pH levels ranging between 7.2 (January) to 9.8 (December) and W16 (Dam C8) recorded pH ranging between 7.8 (March) to 9.8 (November).

pH levels at dam sites in the series W12 - W21 remained slightly alkaline throughout the reporting period. A number of sample points, including W3 Martins Creek, W6 Blackwattle Creek and W7 Stony Creek, were not sampled for one or more months as the sample points were too low to sample.

The January period coincided with relatively lower pH levels due to above average rainfall during the January 2016 period. September, October and November coincided with below average rainfall which correlated with increased pH levels across monitoring locations.

The general pH trend in the Creeks and site dams is to decrease under flow conditions and increase in times of nil flow. The decrease in pH under flow conditions reflects the acidic nature of rainfall. The trends and results are generally consistent with previous year's results.

Total Dissolved Solids

The Total Dissolved Soilds results for Rix's Creek Mine are presented in **Appendix 4**. Total dissolved solids ranged from 181 mg/l (June) – New England Highway to 2720 mg/l (October) – New England Highway. The high results in September and October reflect dry conditions in Rix's Creek. Total dissolved solids at monitoring site W6 (Black Wattle Creek) ranged between 946 mg/l in January and 6800mg/l in June. W6 (Black Wattle Creek) water flow is usually stagnate in drier periods with low rainfall.

The trend under flow conditions shows a general decrease down the catchment reflecting a flushing of the Creek with fresh water. Again this is dependent on the size of the flow. The higher the runoff and resultant flow, produces greater decreases in total dissolved solids results throughout the catchment.

Total Suspended Solids

Total suspended solids results are presented in **Appendix 4**. Total Suspended Solids ranged from 1 mg/l (October) at the Railway Underpass site under no flow conditions to 76 mg/l (July) at the Railway Underpass site with a low flow following sampling undertaken after a rain event. W1 (Station Creek) ranged between 4mg/l in February to 252mg/l in November. The general trend is for levels to increase down the catchment under flow conditions. The past trend is an indication that the water flowing in the Creeks increases the sediment load down the catchment.

Total dissolved solid levels at W4 (Glennies Creek Up), W5 (Glennies Creek Down) and W11 (Glennies Creek NEH) were generally low throughout the period ranging from 3mg/l (June) to 69mg/l (February) at W5 (Glennies Creek Down).

Electrical Conductivity (Salinity)

Electrical Conductivity results are presented in **Appendix 4.** The water quality parameter of **salinity** measured as specific conductance - electrical conductivity (EC) with the results tend to mirror the results of total dissolved solids. The results under flow conditions typically decrease down the catchment reflecting a flushing of the Creek with clean runoff water. During times of no flow the salinity increases at all sites, as the water becomes stagnant. This is evident from June to November at W6 (Black Wattle Creek) which is consistent with previous year's results as Black Wattle Creeks water flow is usually stagnate in drier periods with lower rainfall. Results ranged from 261 uS/cm (June) at the New England Highway site to 4610 uS/cm (October) at the Maison Dieu Bridge. The high October result at the New England Highway site occurred due to the dry conditions and minimal creek flow in the September and October period.

Salinity levels at clean water dam C4 generally fluctuated with variations in rainfall, ranging from 577uS/cm to 3050uS/cm during the 2016 reporting period.

Salinity levels at W4 (Glennies Creek Up), W5 (Glennies Creek Down) and W11 (Glennies Creek NEH) all followed a similar trend throughout the reporting period.

7.3.3 Reportable Incidents

There was two (2) reportable incidents relating to water during the 2016 reporting period. These incidents occurred during January 2016 and can be found in **Appendix 6**. Subsequently all site sediment dams were cleaned as necessary during 2016 with sediment placed within overburden dumps on site.

Outcomes implemented from the Incident Investigations included:

- The sediment dams water levels were lowered by pumping water from them back into the mine water storages in preparation for the next rainfall/runoff event in line with current procedures
- Design work was undertaken and completed in July 2016 to increase the storage capacity of the sediment dam north, to reduce the potential for the structure to overtop.
- Pipeline changes were completed on DWD3 to pump water from the west pit to Tailings Dam 4 to minimise the amount of water entering DWD3.

7.3.4 Further Improvements

During 2016 Rix's Creek additionally monitored several sites before (dams) and along Dead Man's Creek as per the monthly surface water regime for internal reference. This will continue during 2017.

A Rix's Creek Complex Water Management Plan will be written and implemented in 2017 to integrate water management across both the Rix's Creek South and Rix's Creek North mining operations. The integration to a complex Water Management Plan will standardise water management across the Rix's Creek Mine.

7.4 Groundwater

The groundwater monitoring sites across the Rix's Creek mine sites have been combined in Table 24 and are provided as a reference to compare Rix's Creek South and Rix's Creek North (formerly Integra).

Table 23 Rix's Creek Gorund Water Monitoring Sites

Bore ID	License	Easting	Northing	Screened Interval	Stick Up (m)	Surface Elevation (mAHD)	Total Depth (mbgl)
Rix's Creek North							
Open Cut Piezometers and Wells							
Glennies Creek Alluvium							
GCP9	(20BL171708)	323259	6407315	Unknown	1.5	69.885	9
GCP10	(20BL171708)	324414	6408030	Unknown	0.7	74.891	11.5
GCP19	(20BL171708)	325086	6408333	8.5 - 12	0.63	77.5	12
GCP20	(20BL171708)	325201	6408179	5.2 - 8.2	0.67	82	8.2
GCP21	(20BL171721)	324466	6407916	6 to 11	0.82	76	11
GCP22	(20BL171721)	324558	6407814	8.5 - 12	0.7	75	12
GCP23	(20BL171721)	324535	6407659	4.6 - 8	1.01	75	8
GW67291	(stock well)	326264	6408139	Unknown	Unknown	Unknown	90
Coal Measure							
GCP1	(20BL169631)	325124	6406664	Unknown	0.34	96.013	108
GCP2	(20BL169631)	325160	6406490	Unknown	0.61	105.495	105
GCP5	(20BL169631)	324337	6406203	Unknown	0.54	80.334	108
GCP6	(20BL169631)	324941	6406784	Unknown	0.38	102.931	126
GCP7	(20BL169628)	325864	6407071	60 - 72 and 96 - 102	0.1	93.034	120
GCP8	(20BL169630)	326332	6407214	Unknown	0.44	105.095	120
GCP13	(20BL169628)	326169	6406745	Unknown	0.15	105.356	66
GCP14	(20BL169628)	325774	6407042	Unknown	0.66	90.99	123
GCP15	(20BL169628)	325912	6406961	Unknown	0.42	95.035	114
GCP16	(20BL169628)	326029	6407077	Unknown	0.7	98.853	120
GCTB	(20BL169631)	325149	6406572	Unknown	0.2	102.564	90
Extended Southern Pit							
Glennies Creek Alluvium							
GCP25	(20BL171705)	323005	6406764	6.0 - 13.0	0.96	72	13
GCP26	(20BL171705)	323888	6406292	7.0 - 11.0	0.73	71.5	11
GCP28	(20BL171722)	322651	6405459	6.7 -12.0	0.8	69.5	12
GCP29	(20BL171722)	323191	6405356	4.5 - 10.0	0.9	71	10
GCP30	(20BL171720)	322438	6404649	5.5 -12.0	0.94	67.5	12

Bore ID	License	Easting	Northing	Screened Interval	Stick Up (m)	Surface Elevation (mAHD)	Total Depth (mbgl)
GCP31	(20BL171720)	322930	6404424	8.5 -14.0	0.77	70	14
GCP33	(no piezo)	322586	6404181	5m total depth	n/a	n/a	n/a
Coal Measure							
GCP27	(20BL171881)	323197	6406037	36.5-37.5	1.11	70	27.5
GCP32	(20BL171880)	322491	6404250	49.0-55.0	0.66	70.5	55.55
GCP34	(20BL171879)	322800	6403235	47.0-56.25	0.61	101	56.25
GCP35	(VWP)	323149	6404757	72, 147, 195	n/a	71	197
GCP36	(20BL171722)	322915	6405320	14.5-16.0	0.85	70.5	16
GCP37	(VWP)	324156	6405612	70, 125	n/a	80	127.5
GCP38	(20BL171878)	323468	6405626	17.0-24.3	0.98	71	24.3
Richards Bore		321110	6405184	18-24	0.4	47.87	30
SGD644 (VWP)		325143	6406526	77.6, 83.6, 94.4	n/a	104.6	104
SGD645 (VWP)		325815	6406509	57.6, 66.6, 75.2	n/a	96.6	96
GCP17		323803	6409986	5.5-7.5			7.5
GCP24		323421	6407105	46-48			48
GCP40		321112	6409047	5-6			6
Rix's Creek South							
Regolith (Upper weathered zone)							
BH3		325457	6401923	5-8	0.97	100	11
BH4		323982	6398666	7-10	0.74	63	10
BH8		321803	6401175	5-14	0.8	85.446	20
Coal Measure							
BH1		323190	6400562	115-121, 127-130	0.85	113	130
BH2		322936	6401923	84-87	0.98	136	90
BH5		324562	6399924	63-66	1.04	76.469	66.5
BH7		323345	6401709	150.5-198.5	0.72	100.86	200.5
20BL170864		324633	6400335		0.3	80.5	~70

7.4.1 Monitoring Background

As part of the water management plans for Rix's Creek, an intensive monitoring programme has been implemented to detect any impacts from mining on the groundwater regime, and from any nearby groundwater users. The greater monitoring programme incorporates both shallow and deep groundwater monitoring locations monitoring the water levels in the Glennie's Creek Alluvial deposits and the Permian Coal Measures around both Rix's Creek South Colliery and the Rix's Creek North Colliery. The monitoring locations within the Rix's Creek North mining lease boundary include the following monitoring locations:

- Groundwater levels are monitored in 4 VWPs, 43 piezometers and one production bore.
- Piezometers monitor water levels in both the regolith (alluvial) and coal seams.
- Hydrogeological conditions in the shallow and deep groundwater systems adjacent to the working seam are monitored by multi-level piezometers (nested installations).
- The Singleton STP weather station provides climatic data.
- Field water chemistry is recorded (EC and pH).
- Piezometer water levels and field chemistry are recorded on a bi-monthly basis.

Other mining activities that have the potential to impact groundwater levels and quality are:

- Tailings emplacement area - groundwater pollution;
- Spoils and emplacement – contribution of salt to surface water and groundwater;
- Surface water bodies – these may locally control groundwater levels in surrounding spoil and Permian strata; and
- Waste dumps & Coal Handling plant – surface water runoff and associated water quality issues.

7.4.2 Timeline of Mine Approvals

Rix's Creek North (previously Integra)

Mining at Glennie's Creek Open Cut Coal Mine commenced as early as the 1860's but was limited to small scale operations and at this early stage was unlikely to have any major impact on the groundwater conditions in the area. Large scale mining, likely to affect groundwater conditions near the proposed open cut, commenced in 1991, with development of the Camberwell North Pit immediately south of the Project Site. In 1999, development work commenced on the Glennie's Creek Underground Coal Mine west of the proposed Glennie's Creek Open Cut Coal Mine.

Mining from the first Long Wall Panel, LW1 commenced in August 2002. Further away from the Project Site, large scale mining at Mt Owen commenced in 1993.The proposed open cut is approximately 1.8km long in an approximate east-west direction and up to 600m wide in a north-south direction. The base of mining will be to the floor of the Hebden Seam. The maximum depth of the pit will be up to about 100m below the present ground surface. The spoil will be progressively placed in the mined-out areas behind the mining front. In December 2015, HV Coking Coal Pty Limited (HV Coking Coal), a subsidiary of Glencore Coal Pty Ltd (Glencore), acquired the Complex from Integra Coal Operations Pty Limited. Bloomfield Collieries Pty Limited (Bloomfield) then acquired Integra Open Cut (Rix's Creek North) from HV Coking Coal.

Rix's Creek South

Rix's Creek South commenced operations in 1990 and is currently comprised of two open cut pits, a Coal Handling and Preparation Plant (CHPP) and other infrastructure such as a rail siding. Historically, underground mining activities occurred to the south east of the existing southern open cut (Pit 1). Rix's Creek Mine was expanded to the north west of Pit 3 within the lease boundary in 2014.

Table 24 Rix's Creek Timeline of Approvals

Year	Project	Description	Approval Reference
Rix's Creek South			
1989	Rix's Creek Mine	Construction and operation of a Surface coal mine, associated transport and coal loading facilities, including CHPP. Consent was granted to mine up to 1.5Mtpa of ROM coal. CL 352 was subsequently granted on 20 October 1989.	Minister for Local Government and Minister for Planning
1995	Rix's Creek Mine	Coal Mining within CL 352 and on land subject to Coal Lease Application No 17 om Singleton, construction and operation of surface coal mine and infrastructure and equipment upgrades.	DA 49/94 – Minister for Urban Affairs and Planning

Year	Project	Description	Approval Reference
		Total mine production capped at 15 million bank cubic metres of material movement.	
1999	Rix's Creek Mine	Modification to amend applicable potentially affected lands monitoring requirements.	DA 49/94 Modification 1 – Minister for Infrastructure and Planning
2003	Rix's Creek Mine	Modification to receive ROM coal from Glennies Creek underground mine, process the coal and transport by rail.	DA 49/94 Modification 2 – Minister for Infrastructure and Planning
2004	Rix's Creek Mine	Modification to receive process and transport bulk coal samples from the Bickham exploration project.	DA 49/94 Modification 3 – Minister assisting the Minister for Infrastructure and Planning
2009	Rix's Creek Mine	Modification to allow a cut and cover tunnel under the New England Highway.	DA 49/94 Modification 4 – Minister for Planning
2013	Rix's Creek Mine	Modification to enable the construction and operation of a rail loop and associated clean coal stockpile and rail loading facility on the Rix's Creek mine site.	DA 49/94 Modification 5 – Minister for Planning and Infrastructure
2014	Rix's Creek Mine	• Modification of the total volume of material that can be moved annually from 15 million bank cubic metres to 16.1 million bank cubic metres.	DA 49/94 Modification 6 – Minister for Planning
2016	Rix's Creek Mine	• Modification to allow ROM Coal from RCN to be processed at RCS CHPP • Modification to allow the construction of two satellite ROM coal stockpiles at RCS	DA 49/94 Modification 7- Minister of Planning DA 49/94 Modification 8- Minister of Planning
Former Integra Mine – Rix's Creek North			
1990	Camberwell Coal Mine	Application for open cut mining of the North and South pits, development and operation of a coal handling and preparation plant, train loader and associated facilities submitted in 1990.	DA 86/2889 approved in 1990 (and subsequently modified). Approved open cut activities were incorporated into the Integra Open Cut Project (MP 08_0102).
2006	Surface Facilities Project	Construction of surface facilities at the Complex. This application was submitted in 2006.	Approved under MP 06_0057 in 2007. Approved open cut activities were incorporated into the Integra Open Cut Project (MP 08_0102).
2007	Glennies Creek Open Cut Coal Mine	The NOC Project was assessed in the Glennies Creek Open Cut Coal Mine EA prepared by R.W. Corkery & Co Pty Limited in 2007 (referred to as the NOC EA).	Approved under MP 06_0073 in 2008 (and subsequently modified). Approved open cut activities were incorporated into the Integra Open Cut Project (MP 08_0102).

Year	Project	Description	Approval Reference
2009	Integra Open Cut Project (Western Mine Area)	Western extension of the existing SOC (the western mining area) and incorporation of the approved NOC operations. An application and accompanying EA (URS 2009) (Open Cut Project EA) was lodged in 2009.	The Combined Project Approval was granted in 2010 for the Integra Open Cut Project which incorporated the NOC Project (MP 06_0073) and Surface Facilities Project (MP 06_0057). Modifications relating the Open Cut include: a) Modification 1 – extension of the NOC out-of-pit emplacement area. Approved 2012. b) Modification 3 – interim modification to timeframes in project approval. Approved 2012. c) Modification 2 – amendment to overland conveyor and extension of timeframes to secure biodiversity offsets. Approved 2013. d) Modification 4 – in relation to biodiversity offsets. Approved in January 2016. e) Modification 5- to allow RCS ROM coal to be processed at RCN CHPP. Approved in 2016
2014	Integra Open Cut Project (Western Mine Area) and Glennies Creek	Put into care and maintenance in May 2014	
2015	Integra Open Cut Project (Western Mine Area)	Surface mine, CHPP, rail facilities and surface infrastructure acquired by Bloomfield Collieries Pty Limited from HV Coking Coal and underground operations obtained by HV Coking Coal (Glencore Subsidiary) from Integra.	Modification 6- separation of Integra Complex consent into separate open cut and underground consents. Approved February 2016.

7.4.3 Environmental Performance

Rix's Creek North Groundwater Monitoring Results

The current Rix's Creek North Water Management Plan approved by DPE on the 16th February 2016

Piezometers, bores and private wells included in the Rix's Creek North groundwater monitoring program include the Foybrook Formation basement coal measures as well as the Glennie's Creek and Station Creek alluvium groups.

Due to the complex interactive depressurisation effects of numerous coal mines on steady state groundwater levels within the model area, calibration of the 2009 groundwater assessment model was more focussed on obtaining correlation between known and modelled mine inflow rates, as opposed to matching observed and modelled groundwater levels.

From the 2009 Environmental Assessment, the model indicated that the groundwater within alluvial aquifers associated with Glennie's Creek and Station Creek had the potential to be marginally to negligibly affected by the proposed pit during its active mining phase, with drawdowns ranging up to 1.2m (based on the Case 1 groundwater model hydraulic conductivity of 7.9×10^{-2}m/day) in the vicinity of the Mine Area until mining of the pit is completed.

Results from 2016 reporting period compared to the 2009 Ground Water Environmental Assessment show alluvium water levels have maintained pre-mining water levels (with variations in water levels are induced by natural creek flow process), and that dewatering of the neighbouring/underlying coal seams and broad depressurisation of the Permian basement does not result in water level impacts within the creek alluvium system. The hydrogeological conceptualisation outlined in Figure 1 shows the basis of this relationship.

The potential proposed pit groundwater inflows from the 2009 ground water environmental assessment predicted that full pit ground water inflows of 73ML/year in 2014 and 117ML/year from 2018. Table 22 refer to the 2016 sample static water balance estimated ground water seepage from RCN mine of 100ML/year, so similar to the model predicted volumes based on timing and range.

The Rix's Creek North Groundwater monitoring program is referred to in Table 26 and shown on Figure 28.

Table 25 Rix's Creek North Ground Water Monitoring Network

Bore ID	Type	Total Depth (mbgl)	Formation	Change in Water Levels during 2016 (m)
GCP09	Standpipe Piezometer	9	Glennie's Creek Alluvium	-0.06
GCP10	Standpipe Piezometer	11.5	Glennie's Creek Alluvium	0.04
GCP 19	Standpipe Piezometer	12	Glennie's Creek Alluvium	-0.10
GCP20	Standpipe Piezometer	8.2	Glennie's Creek Alluvium	Dry
GCP21	Standpipe Piezometer	8.2	Glennie's Creek Alluvium	-0.10
GCP22	Standpipe Piezometer	12	Glennie's Creek Alluvium	0.06
GCP23	Standpipe Piezometer	8	Glennie's Creek Alluvium	0.33
GCP25	Standpipe Piezometer	13	Glennie's Creek Alluvium	0.87
GCP28	Standpipe Piezometer	12	Glennie's Creek Alluvium	0.03
GCP29	Standpipe Piezometer	10	Glennie's Creek Alluvium	0
GCP30	Standpipe Piezometer	12	Glennie's Creek Alluvium	0.15
GCP31	Standpipe Piezometer	14	Glennie's Creek Alluvium	0.48
GCP32	Standpipe Piezometer	55.56	Camberwell Pit Basement	0.26
GCP34	Standpipe	56.26	Camberwell Pit Basement	0.34

Bore ID	Type	Total Depth (mbgl)	Formation	Change in Water Levels during 2016 (m)
	Piezometer			
GCP35	Vibrating Wire Piezometer multi depth	195	Camberwell Pit Basement	4.37
GCP36	Standpipe Piezometer	15.98	Camberwell Pit Basement	-0.13
GCP37	Vibrating Wire Piezometer multi depth	127.50	Camberwell Pit Basement	-0.94
SGD644	Vibrating Wire Piezometer multi depth	104	Camberwell Pit Basement	-0.1
SGD645	Vibrating Wire Piezometer multi depth	96	Camberwell Pit Basement	1.18
GCP38	Standpipe Piezometer	24.31	Camberwell Pit Basement	0.03
GCP02	Standpipe Piezometer	105	Falbrook pit Basement	0.74
GCP05	Standpipe Piezometer	108	Falbrook pit Basement	1.13
GCP06	Standpipe Piezometer	126	Falbrook pit Basement	1.25
GCP07	Standpipe Piezometer	120	Falbrook pit Basement	2.26
GCP08	Standpipe Piezometer	120	Falbrook pit Basement	-0.53
GCP13	Standpipe Piezometer	66	Falbrook pit Basement	-4.02
GCP14	Standpipe Piezometer	123	Falbrook pit Basement	2.06
GCTB	Standpipe Piezometer	90	Falbrook pit Basement	0.60

Figure 28 Rix's Creek North Ground Water Monitoring Network

The results for groundwater analysis, including range, mean and standard deviation are presented in **Appendix 5**.

The pH remained at relatively constant levels throughout the reporting period at all GC series groundwater monitoring wells (neutral to slightly alkaline range). EC was consistently low at the Glennie's Creek alluvial bore GC09 (307-445 μS/cm).

Monitoring wells B1 to B5 have been installed in order to evaluate hydrological impacts on TD2 dam wall. As such, results from these bores do not reflect groundwater impacts generally. The results recorded in each piezometer installed on TD2 were generally consistent throughout the reporting period and similar to results recorded in previous years. Bore 1, 4 and 5 was recorded as being dry for the entire reporting period. Variances in Bores 2-3 standing water levels are expected to respond to changes in water levels of TD2.

Based on the data during the 2016 reporting period, alluvial groundwater level monitoring indicated no response to mining outside of the influences of normal climatic variability upon the Falbrook Open Cut in the Glennie's Creek catchment, and the Camberwell Open Cut in the Glennie's Creek and Station Creek catchments, except for GCP28, which had a water level reduction of approximately 2m during the Winter of 2016 with a subsequent ongoing recovery.

The available basement groundwater monitoring data in the 2016 reporting period indicated;

- Recovery of GCP7, 8, 13 and 14 associated with water storage in the Falbrook Pit, along with normal climatic variability with the remaining piezometers within the Falbrook Open Cut suite, and
- continued fluctuation of GCP34 within its basal range, along with normal variability within the historic range for the remaining piezometers in the Camberwell Open cut suite

Piezometer array SGD644 in the Falbrook Open Cut area showed no mining induced depressurisation during 2016, with pressures remaining stable, even slightly recovering.

The sensor at 53.75m below surface in SGD645 indicates a recovery of several metres over the last 12 months, a lesser recovery on the middle sensor, while the deep sensor continues an ongoing depressurisation trend at 71.1mbgl, likely in response to ongoing dewatering in the Integra underground workings to the northwest.

Piezometer array GCP35 in the Camberwell open cut area indicates no variation outside of the historic range in the deepest intake at 195m below surface, a continuation of the gradual depressurisation of the 147m below surface intake, along with a definitive depressurisation of the shallowest intake (72mbgl) of around 14m that gradually started in early 2013, associated with the mining progression in the Camberwell pit.

GCP37 showed no mining induced depressurisation during 2016 outside of its historic range, with a highly stable pore pressure profile continuing to be recorded at this location.

The pH and salinity in the Glennie's Creek alluvial open standpipe piezometers has not shown any significant trends since they were installed in 2007, except for a reducing salinity profile in GCP29 and GCP30 between mid-2009 and early 2011.

The pH and salinity in the Camberwell basement open standpipe piezometers has not shown any significant trends since they were installed after mid-2007.

The pH and salinity in the Falbrook Open Cut alluvial open standpipe piezometers has not shown any significant trends since they were installed in 2012.

The pH and salinity in the Falbrook Open Cut basement open standpipe piezometers has not shown any significant trends since they were installed in 2012 except for a rise then fall in salinity in GCP14 and a reduction in salinity at GCP02.

Comparison of the analysis results for dissolved metals against the ANZECC guideline values for the protection of Freshwater Ecosystems (ANZECC, 2000) shows a number of exceedances of the guideline values, as follows:

- Copper was detected above the freshwater ecosystem value limit of 0.0014 mg/L in GCP09 at concentrations of 0.045
- Zinc was detected in piezometers GCP07, GCP08, GCP10 and GCP11 at concentrations of 0.018, 0.047 and 0.041 and 0.017 mg/L respectively, which exceeded the freshwater ecosystem guideline of 0.008 mg/L.

This is consistent with baseline studies showing in the Rix's Creek WMP (to the south) that there is a number of exceedances of the guidelines values with arsenic, chromium, cadmium, copper, nickel and zinc – so can be considered as background trends.

Rix's Creek South Groundwater Monitoring Results

In accordance with Modification 4 of the Rix's Creek South development consent (DA 49/94) the DPI Water required a groundwater monitoring programme to be developed for Rix's Creek south

operations that:

- Detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, which could be affected by the development;
- Groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts of the development;
- A program to monitor groundwater inflows to the open cut mining operations, and impacts of the development on the regions aquifers, any groundwater bores, and surrounding watercourses.

Groundwater level monitoring has been undertaken on a quarterly basis from 2012 to 2016 in accordance with the Rix's Creek Water Management Plan 2011 (WMP) approved by DPI Water.

The potential proposed groundwater inflows is licenced at 100ML/year at Rix's Creek South mine (20BL170863). Table 21 refers to the 2016 sample static water balance which calculated ground water seepage from Rix's Creek South mine of 47ML/year during 2016.

For Rix's Creek South operations, four piezometers are installed into the Permian coal measures and three into overlying regolith zone. Their locations are identified in Table 27 and shown on Figure 29. Piezometers BH1, BH2, BH5 and BH7 are the deeper bore holes into the coal measures while Piezometers BH3, BH4 and BH8 are shallow into the overlying regolith. The monitoring network also included the existing production bore 20BL170864.

Piezometer BH6 was proposed but not completed due to several problems when drilling during 2015, with BH8 being drilled in its place.

Table 26 Rix's Creek South Groundwater Monitoring Network

Bore ID	Type	Depth (mbgl)	Location	Change in Water Levels during 2016 (m)
BH1	Standpipe Piezometer	130	Middle of basin - Upper / Lower Arties	-1.06
BH2	Standpipe Piezometer	90	West of basin, close to outcrop- Lower Barrett	Bore Destroyed
BH3	Standpipe Piezometer	11	East of waste dump / backfill area- Regolith and shallow coal seams	0.71
BH4	Standpipe Piezometer	10	Rix's Creek south of Pit 3- Regolith	0.21
BH5	Standpipe Piezometer	66.5	East of Rix's Creek / tailings emplacement area- Lower Barrett	-3.34
20BL170864	Production bore	~70	Above underground Workings- All coal seams	-3.09
BH7	Standpipe Piezometer	200.5	Bottom of basin- Hebden	-1.44
BH8	Standpipe Piezometer	20	Dead Man's Creek wet of coal outcrop – regolith	-0.26

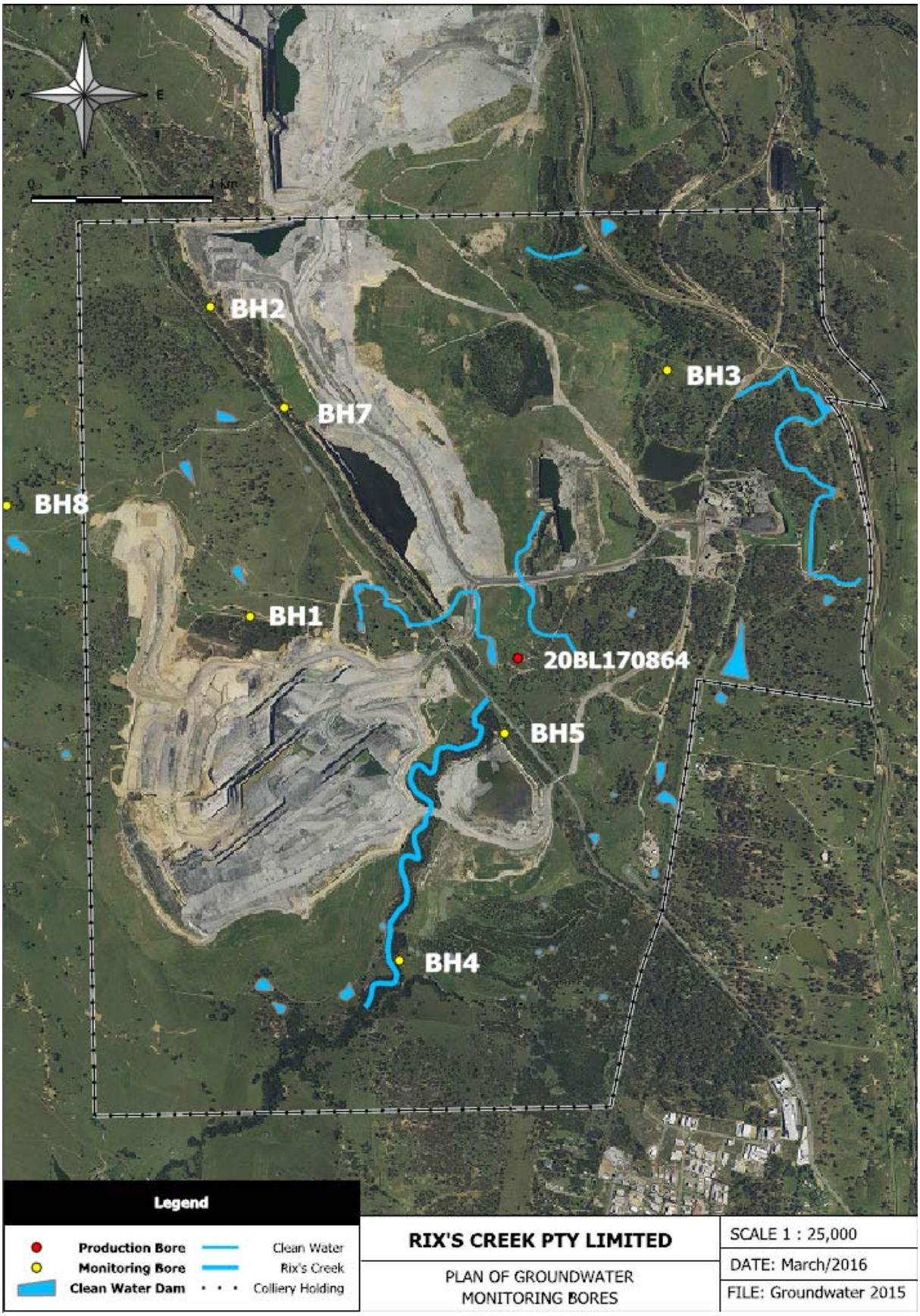

Figure 29 Rix's Creek South Groundwater Monitoring Network

A water level transducer placed in BH4 during November 2012 is set to record groundwater levels at 12 hourly intervals. This enables the groundwater levels to be compared against surface water flows in Rix's Creek. An additional water level transducer was installed during May 2015 in BH8 to compare surface water flows in Dead Man's Creek.

The groundwater levels are presented in **Appendix 5**. Rix's Creek South data collected to date show that:

Groundwater levels for Rix's Creek South groundwater bores have remained fairly consistent since the commencement of monitoring ground water levels, and the results continue to confirm the hydrogeological conceptualisation outlined above, and summarised in Figure 23 – with the Coal Measures acting in hydraulic isolation from the shallow regolith and alluvium aquifer systems. This can be seen in the hydrograph responses from BH1 (screened in Arties seam), which shows a water level response correlating with mine water management activities in the Arties Pit. In more recent times, a depressurisation response can be observed in BH1, BH5, BH7 and 20BL 170864 – which is expected to be in response to ongoing Coal Measures dewatering in the broader Rix's Creek area.

In direct contrast to these trends, the bores screened in the regolith aquifer system BH3, BH4 and BH8 have remained stable throughout the local mining activities, showing that the deeper coal measures aquifer is not hydraulically connected to the shallow regolith and alluvium system in this region.

During 2016 BH8 level ranged between 2.45-2.71mbgl, BH3 ranged between 4.17 – 4.88mbgl – stable shallow water table, fluctuating in response to seasonal rainfall trends.

Groundwater EC (mS) throughout the period of monitoring have also returned consistent results. This is all consistent with the historical groundwater EC ranges.

The average salinity values of the groundwater sampled from the screened bore in the coal seam (BH5) ranged between 4,680 to 6,140 mg/L showing high levels of salinity. BH2 is also within the coal seam but was unable to be sampled during 2016 as this bore has been recorded as being destroyed in 2012 with the last time it was successfully sampled being in February, 2012. A replacement bore for BH2 was installed during July 2015 named BH7 which recorded 7,250 mg/L in May 2016, the bore appeared to be dry during other sampling events during 2016. The salinity values within the regolith (BH3 and BH4) is also high ranging from 5,720 to 20,400 mg/L. These salinity ranges are all consistent with field water quality parameters outlined in the Rix's Creek South Water Management Plan.

Over the monitoring period salinity levels are shown to remain consistent in the coal seams and the regolith. This indicates limited connectivity (and mixing) between the two aquifer zones, and no negative water quality trends are being driven from mining operations in the area. This is consistent with the hydrogeological conceptualisation which underpins the groundwater baseline study and impact assessment work, and continues to be validated by the ongoing monitoring analysis.

Comparison of the analysis results for dissolved metals against the ANZECC guideline values for the protection of Freshwater Ecosystems (ANZECC, 2000) shows a number of exceedances of the guideline values, as follows:

- Copper was detected above the freshwater ecosystem value limit of 0.0014 mg/L in BH3 at concentrations of 0.023
- Nickel was detected above the freshwater ecosystem value limit of 0.011 mg/L in BH3 at concentrations of 0.018; and
- Zinc was detected in piezometers BH3, production bore 20BL170864 and BH8 at concentrations of 0.050, 0.015 and 0.016 mg/L respectively, which exceeded the freshwater ecosystem guideline of 0.008 mg/L.

This is consistent with baseline studies showing in the Rix's Creek WMP that there is a number of exceedances of the guidelines values with arsenic, chromium, cadmium, copper, nickel and zinc – so can be considered as background trends.

7.5 Erosion and Sediment

7.5.1 Environmental Management

Erosion and sedimentation control is an integral part of the water management across the entire site. Erosion control on reshaped and rehabilitation areas is achieved by having the minimum delay in time and area between the active mining operation and establishing rehabilitation. Revegetation of rehabilitation areas is undertaken as soon as an area becomes available with the aim to establishing a minimum of 70% ground cover, the level required to adequately control soil erosion. Accompanied with this is the use of sediment detention basins in front of the operation, along haulage roads and on drainage lines flowing from establishing rehabilitation areas.

Throughout July 2016 sediment dams across site were de-silted whilst climatic conditions were dry allowing adequate access and works to take place. A lot of dams contained a high amount of sediment due to the January 2016 storm event. This required the use of a 22 tonne excavator. Several other smaller sediment dams and drainage lines were also cleaned via an on-site backhoe as required throughout the year. These sediment dams contain the same material as that excavated from the open cut operation as well as clays, soil and silt from the natural environment.

Clean water diversions were also constructed at Rix's Creek South and Rix's Creek North mines. Shortly after the drains were constructed using a D6 dozer, the drains were cross ripped and application of pasture mix was sown to promote grass cover to reduce sediment and erosion issues. In West Pit operations, the out of pit dump was rehabilitated using the Rix's Creek pasture species with the aim of improving the water quality entering into the sediment dams. Monthly sediment and erosion checklists were completed at Rix's Creek South and Rix's Creek North mine, with routine repairs to sediment fences being completed during the reporting period.

7.5.2 Environmental Performance

Total Suspended Solids (TSS) results from water sampling is used as a key indicator of sediment control. TSS results are discussed in Section 7.3 Surface Water environmental performance section.

7.5.3 Reportable Incidents

No reportable incidents relating to erosion and sediment occurred during the 2016 reporting period.

7.5.4 Further Improvements

Any sediment collected within the light-vehicle wash-down pad, heavy-vehicle wash-down pad, diesel fill-point sump, electrical workshop sump, mechanical workshop sump are all cleaned regularly with the sediment particles relocated to the site bioremediation area.

SECTION 8 REHABILITATION

8.1 Buildings

Maintenance of structures is undertaken on as needs basis throughout the year. Throughout 2016 infrastructure sheds and structures were painted as necessary. The preferred colour scheme is light green (known as rivergum green) with this same colour utilised on the colorbond fencing installed adjacent to the bridge of the cut and cover tunnel as well as major infrastructure across the site. Previous Vale Integra (now RCN) infrastructure will remain the unintusive beige colour at present.

8.2 Post Landform Land Use

Land capability at Rix's Creek Mine is predominatly Class IV and Class V which is suitable for grazing. The primary post mining landuse goal is to provide improved pasture species with scattered tree lots and tree corridors linking surrounding rehabilitated areas, proposed tree planting corridors and surrounding existing native vegetation. The overburden emplacement areas are dsigned to be sympathetic to the surrounding landscape.

For Rix's Creek Northern operations, tree corridors will be established over the Falbrook Pit (formerly referred to as Old North Pit) waste emplacement to link the rehabilitation of the Falbrook Pit with the rehabilitation of the Camberwell Pit (formerly referred to as extended South Pit) final landform. It is anticipated that this will provide a north-south link across the RCN project Area, which will link the Biodiversity Offset Areas that join the Falbrook Pit.

The progressive rehabilitation when compared to the respective Mining Operations Plans is referred in Table 47 and demonstrated in plates 1 -8 in section 8.3.

8.3 Rehabilitation of Disturbed Land

Re-contouring, topsoil handling and revegetation techniques are generally well established at Rix's Creek and undertaken in accordance with the Bloomfield Mining Operations Land Rehabilitation Management System (LRMS).

The key elements of the LRMS include:-

- setting overall rehabilitation aim and objectives;
- developing appropriate rehabilitation indicators and completion criteria;
- undertaking land rehabilitation;
- developing and implementing a rehabilitation assessment program;
- continuing rehabilitation management and maintenance; and
- presenting a request for rehabilitation sign-off to regulators, supported by results from the assessment program.

The aim of rehabilitation at Rix's Creek Colliery is to reinstate the pre-mining land capability of grazing land, with stable landforms, compatible with the surrounding landscape, and allow for a range of possible post-mining land-uses such as agricultural lots. As of 2015 Rix's Creek is beginning to achieve large parcels of grazing land which when the areas suit the operation will be grazed to assess if the pasture rehabilitation is sustainable long-term prior to sign-off. Pasture sampling for feed quality analysis has also been monitored since 2013 through a 4 ha trial on the North Pit rehabilitation to monitor the effectiveness of bio solids used in rehabilitation areas to gain a better understanding if the pasture rehabilitation will be sustainable long-term.

Key issues that may affect the ability to successfully rehabilitate the site and proposed mitigation measures are referred to in Table 28 below.

Table 27 Key Issues and Proposed Mitigation Measures

Risk	Trigger	Proposed Mitigation Measure
Off-site release of contaminants from mined materials requiring long term management or treatment.	Data obtained from compliance monitoring program indicates exceedance.	Ongoing monitoring of runoff and seepage waters during operations to validate predictions. Mitigation measures as proposed in the WMP.
Inadequate or insufficient topsoil to create/enhance the desired ecological communities.	Monitoring and vegetation assessments highlight inadequate ground cover and or paucity in species diversity / distribution. Soil analysis indicates soil parameters are not compatible to post mining vegetation community.	Manage topsoil, overburden and substrate management procedures and soil testing. Implement maintenance revegetation program including seeding, tube stock planting of native overstorey species, fertiliser Amend growing media by the addition of organic matter e/g biosolids in areas returning to pasture Assess soil for weed contamination and treat affected soil.
Wind and water erosion.	Data obtained from compliance monitoring program indicates exceedance in suspended sediment. Complaints relating to dust.	Erosion and sedimentation controls will be employed during rehabilitation activities, including rehabilitation of the creek diversion and the repair of subsidence areas, in accordance with the WMP. Maintenance earth and revegetation works will be undertaken in the areas where erosion has been noted Annual monitoring detailed above will be designed to determine the type, source, degree, and location of potential erosion sites and source of sediment.
Impact of weeds and /or vertebrate pest animal leading to widespread failure of revegetation ecosystems.	Monitoring and vegetation assessments highlight increased weed competition.	Careful use of weed free topsoil and/or topsoil management. Encourage rapid establishment of ground cover species designed to outcompete weed species. Assessment and management of weed incursions on topsoil stockpiles prior to respreading

		Weed control undertaken in accordance with the requirements of the Noxious Weeds Act 1993. Control of pest animal species in accordance with industry guidelines.
Poor vegetation establishment success.	Monitoring data indicates non-compliance with performance criteria of the monitoring program in terms of landscape function, biodiversity and pasture productivity.	Species mix used in enhancement/rehabilitation programs are aligned to the floristic structure of the plant community of the site. Pasture species selection will be reviewed in context of pasture productivity
Asset Protection Zone (APZ) is not maintained in context of bushfire risk.	Site assessment shows unacceptable fuel levels.	Control and maintain a suitable Asset Protection Zone surrounding rehabilitation areas by slashing and controlled grazing.
Major storm event resulting in flooding, geotechnical instability, major erosion and/or widespread damage to rehabilitated areas.	Weather warnings relate to severe storms and localised flooding. Monitoring program indicates lack of adequate ground cover.	Design final landforms, structures and revegetation to cope with major storm events. Implement maintenance program on sediment structures.
Severe and/or prolonged drought leading to widespread failure of revegetation.	Monitoring and vegetation assessments highlight inadequate ground cover and or paucity in species diversity / distribution.	Selection of drought-tolerant species for revegetation. Selection of species aligned to desired vegetation community. Time plantings to take advantage of ideal weather conditions.
Changing climate leading to failure of rehabilitation, failure of environmental management controls and/or inability to attain completion criteria.	Monitoring and vegetation assessments highlight inadequate ground cover and or paucity in species diversity / distribution. Soil analysis indicates soil parameters are not compatible to post mining vegetation community.	Assess climate change risks and implement appropriate measures where required. Use of biosolids, compost materials and mulches to increase organic carbon levels and improve soil structure with resultant increase in infiltration and water holding capacity.
New regulatory requirements or evolving community expectations	Changes in relevant legislation.	Monitor trends and developments in legislation and changes to community expectations.

leading to difficulties negotiating or attaining completion criteria.		Consult with stakeholders to gain acceptance of completion criteria.
Soil, spoil physical and chemical constraints	Soil and spoil testing indicates soil parameters are not compatible to post mining vegetation community.	Identify any physical or chemical deficiencies or limiting factors (particularly alkalinity, salinity and sodicity) which may affect such things as vegetation establishment, landform stability and propensity for spontaneous combustion; and Develop selective placement strategies and/or develop suitable amelioration techniques. In 2016 rehabilitated areas were generally capped with approximately 300-500mm of inert subsoil material. Spoil, subsoil/clay and topsoil sampling was completed prior to determine the application rate of biosolids. Photos of subsoil capping of spoil material is identified in plates 1-8 in section 8.3.
Erosion of dispersable clay materials to cap spoil.	Monitoring identifies erosion in the form of rilling, tunnelling channelling or drain breaching	Regular inspections and corrective actions to fix erosion on rehabilitation as required.

The rehabilitation is undertaken to meet the following objectives.

General

- Land will be rehabilitated in accordance with relevant NSW Department of Industry – Resources & Energy (DRE) standards applicable at the time of rehabilitation i.e. Mining Operations Plan (MOP) guidelines, September 2013.
- Rehabilitated land will represent a minimal source of offsite environmental impacts, such as dust, water pollution, visual amenity and weeds.
- Rehabilitated land will require ongoing management inputs no greater than similar adjacent land.
- Rehabilitation will be compatible with the proposed post-mining land-use.

Landform

- Rehabilitated land will be safe and stable.
- Land capability will be returned to a class similar to that existing prior to the commencement of mining.
- Mined land will be re-contoured to a landform compatible with the surrounding natural landscape.
- Reinstate a stable drainage network.

Vegetation

- Rehabilitated land will be topsoiled, fertilised and sown with grass and/or native vegetation species.
- A sustainable vegetation cover will be established on rehabilitated land.

- Grazing areas will be established with a range of species suitable for pasture production in the area.
    - An example of a species mix that may be used as per Rix's Creek MOP is:-
    - **Pasture mix #1** - Rhodes Grass, Couch, Rye, Sub. Clover, Wolly Pod Vetch, Green Panic, Sirosa Phalaris, Sephi Barrel Medic, Lucerne, and Kikuyu. All summer / winter active.

Pasture mix #1 was amended in the 2013 Rix's Creek MOP with Rhodes grass being restricted from previously used rates of 5 kg/ha back to 1 kg/ha to minimise potential for 'monocultures' of Rhodes grass being dominant in the pasture rehabilitation area.

- Tree areas will be established with native species by either direct seeding or tubestock planting techniques.
    - An example of a native species mix that may be used as per Rix's Creek MOP:-
    - **Tree mix #1** - *Eucalyptus crebra, E. fibrosa, , E. mollucana, E. melliodora, Corymbia maculate, Acacia decora, A. falcata, A. implexa, A. paradoxa, A. salicina, Casuarina luehmannii, Hardenbergia violacea*, and hybrid *Eucalyptus* spp. suitable for plantations.

Rehabilitation is generally carried out on a seasonal basis in spring and autumn. Cover crops used in pasture rehabilitation may be adjusted to suit the climatic conditions at time of sowing. Preferred species may also require adjustment due to availability.

During the reporting period a total of 27 ha were rehabilitated. A further breakdown of this can be seen in **Error! Reference source not found.**.

Table 28 2016 Rehabilitation Summary

Locator	Site Name	Type	Date Sown	Species mix	Area (ha)
Arties Pit	RL140	Tree's	April	Tree #1	7.0
Arties Pit	RL140 Camberwell end topsoil stockpile & decommissioned road	Pasture	June / August	Pasture #2	4.3
West Pit	Out of Pit Dump (highway batter)	Pasture	June	Pasture #2	1.5
Arties Pit	RL140 Volcano # 3	Pasture	June	Pasture #2	1.4
Camberwell Pit	RL130 Drainage Line	Pasture	July	Pasture #2	12.5
West Pit	Out of Pit Dump	Pasture	August	Pasture #2 & Pasture #1	11.7
Arties Pit	9-ways	Pasture	September	Pasture #1	8.1
Falbrook Pit	Stoney Creek Road batter	Pasture	October - November	Pasture #1	6.2
TOTAL 2016 @ RCS					**27.0**
TOTAL 2016 @ RCN					**18.7**
CUMULATIVE TOTAL INCLUDING 2016 @ RCS					**423.1**
CUMULATIVE TOTAL INCLUDING 2016 @ RCN					**391.9**

Arties Pit Pin dump and RL140 (Tree's)

The North Pit pin dump and RL140 dump north of tree stand (adjacent to TD#2) area was rehabilitated in April 2016 totalling 7 ha. These areas were prepared in 2015 and tree seeded in 2016 with a light cover crop and starter fertiliser. This area was direct seeded via a tractor using tree species (Tree mix #1).

The area was created using overburden from the Arties Pit operation then clay and subsoil from the West Pit pre-strip was shaped onto a 1-2 and 10 degree slope. This area was overlaid with approximately 100-200 mm of topsoil using a D10 dozer. The topsoil was from the West Pit pre-strip area. Prior to seeding the area was spread with biosolids at a rate of 50 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 100 kg/ha. A cover crop was also applied to minimise the erosion and weed potential. Early indications also show some weed (galenia and scotch thistle) which will be monitored and managed accordingly. To date a low amount of seedlings are emerging due to below average rainfall conditions.

Plate. 1 Arties Pit – pin dump batter (visible from New England Highway) and RL140 dump – tree seeded areas

Arties Pit RL140 Camberwell end topsoil stockpile & decommissioned road

The Arties Pit RL140 Camberwell end topsoil stockpile and decommissioned road was rehabilitated throughout June and August 2016 totalling 4.3 ha. This area was direct seeded via tractor using pasture species (Pasture mix #2).

The area was created using overburden from the Arties Pit operation to fill to final design level then clay and subsoil from the nearby stockpiles was shaped onto a 1-2 degree slope of the area and overlaid with approximately 100-200 mm of topsoil using a D10 dozer. The topsoil was from the Arties pit area stripped several years ago. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. Early indications show a moderate to high rate of pasture seedlings emerging. A cover crop was also applied to minimise the weed potential. Early indications also show some weed (galenia) which will be monitored and managed accordingly.

Plate. 2 North Pit RL140 Camberwell end topsoil stockpile facing east

West Pit Out of Pit Dump (highway batter)

The West Pit Out of Pit Dump (top batter) site was rehabilitated throughout June 2016 totalling 1.5 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2).

The area was created using overburden from the West Pit operation then shaped into a 10 degree slope with a D10 dozer. The whole area was overlaid with approximately 100-200 mm of topsoil from the West Pit Out of Pit Dump stripped area. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor. The rip lines were created across the contour to minimise erosion from surface run-off. Two large contour banks were installed prior to rehabilitation works to direct water back into the West Pit and further minimise run-off erosion.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A

cover crop was also applied to stabilise the slope and minimise the weed potential. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 3 West Pit out of pit dump (highway batter) facing south-west across New England Highway

Arties Pit RL140 Volcano # 3

The North Pit RL140 dump site was rehabilitated in June 2016 totalling 1.4 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2).

The area was created using overburden from the West Pit operation then clay and subsoil (300-500 mm thick) from the West Pit pre-strip was shaped onto a 6-8 degree slope. This slope was overlaid with approximately 100 mm of topsoil from the West Pit pre-strip area. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor. The rip lines were created across the contour to minimise erosion from surface run-off. This area creates good undulation to the Arties Pit dump which has a more natural aesthetic for passing road-users.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 4 Arties Pit RL140 Volcano # 3

Camberwell Pit RL130 Drainage Line

The Camberwell Pit RL130 Drainage Line site was rehabilitated in July 2016 totalling 12.5 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2).

The area was created using overburden from the Camberwell Pit operation previously dumped by Vale. It was shaped onto the 10 degree slope. This slope was overlaid with approximately 100-200 mm of topsoil stockpiled within the rehabilitation area using a D10 dozer. Prior to seeding the area was spread with biosolids at a rate of 100 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A cover crop was also applied to stabilise the slope and minimise the weed potential. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures. A small 2 megalitre dam was also created within the drainage line to provide habitat for small frogs and bird life.

Plate. 4 Camberwell Pit RL130 Drainage Line – facing east

Plate. 5 Camberwell Pit RL130 Drainage Line – facing south

West Pit Out of Pit Dump

The West Pit Out of Pit Dump site was rehabilitated throughout August 2016 totalling 11.7 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2) and pasture species (Pasture #1).

The area was created using overburden from the West Pit operation then shaped into a 10 degree slope with a D10 dozer. The whole area was overlaid with approximately 100-200 mm of topsoil from the West Pit Out of Pit Dump stripped area. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor. The rip lines were created across the contour to minimise erosion from surface run-off. Two large contour banks were installed prior to rehabilitation works to direct water back into the West Pit and further minimise run-off erosion. All banks have a 0.5 degree fall.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A

cover crop was also applied to stabilise the slope, minimise the weed potential and provide good visual amenity towards the New England Highway. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 5 West Pit Out of Pit dump facing south-west across New England Highway

Arties Pit 9-ways

The North Pit 9-ways site was rehabilitated in September 2016 totalling 8.1 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #1).

The area was created using overburden from the West Pit operation then clay and subsoil (300-500 mm thick) from the West Pit pre-strip was shaped onto a 10 degree slope. This slope was overlaid with approximately 100-200 mm of topsoil from the West Pit pre-strip area. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor. The rip lines were created across the contour to minimise erosion from surface run-off. Three large contour banks were installed shortly after the rehabilitation works to direct water back into the old North Pit void and further minimise run-off erosion. These banks were also direct seeded with pasture mix #1 following completion. All banks have a 0.5 degree fall.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. Early indications also show some weed (scotch thistle and galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 7 Arties Pit dump facing north-west – photo taken while spreading topsoil over subsoil

Falbrook Pit Stoney Creek Road batter

The Falbrook Pit Stoney Creek Road site was rehabilitated in October-November 2016 totalling 6.2 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #1).

The area was created using overburden from the Falbrook Pit operation previously dumped by Vale. It was shaped from a free-fall (~37 degree slope) into a 10 degree slope. This slope was overlaid with approximately 100-200 mm of topsoil stockpiled within the rehabilitation area using a D10 dozer and 994 front-end loader. Prior to seeding the area was spread with biosolids at a rate of 100 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A cover crop was also applied to stabilise the slope and minimise the weed potential. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 8 Falbrook Pit – Stoney Creek Road batter rehabilitation facing west

An approximate area of 7 ha was tree seeded during April across the Arties Pit rehabilitation areas to create habitat corridors. These areas were prepared in 2015 and tree seeded in 2016 with a light cover crop and starter fertiliser.

5270 Tubestock were planted during June along the New England Highway, New England Highway visual bunds, North Pit dump, South Pit dump and ROM Pad noise bund. The New England Highway areas were for visual amenity, The Arties Pit dump and South Pit dump for creation of tree corridors throughout pasture rehabilitation and ROM Pad noise bund for noise shielding purposes. An additional 1000 reeds were planted around three dams on the Arties Pit dump to create habitat for frogs and bird life.

During April approximately 6 km of clean water drains were installed on rehabilitated areas via a D6 dozer. There was approximately 2.8 km installed at RCS and 3.2 km at RCN to prevent clean water entering the dirty water systems on site.

Error! Reference source not found. shows, 27 ha was rehabilitated in 2016 at RCS giving RCS a cumulative area rehabilitated of 423.1 ha since 1990. This cumulative area is 22.9 ha ahead of the MOP cumulative total of 400.2 ha in 2016 as seen in Table 31. This is a great outcome to date as Rix's Creek MOP is aligned to maximum production rates of 16.1 million BCM (Bank Cubic Metres) of material movement per year, with Rix's Creek generally well below this level in all its previous years of operation.

Error! Reference source not found. in Table 31, also shows 18.7 ha was rehabilitated in 2016 at RCN giving RCN a cumulative area rehabilitated of 391.9 ha since 2015. This cumulative area is 30.3 ha behind the MOP cumulative total of 422.2 ha in 2016 as seen in Table 46.

Table 29 2016 Rehabilitation and Disturbance Areas (ha) compared to MOP

Domain / Phase	2016 MOP	2016 Actual	2017 MOP	2018 MOP
Infrastructure Area	RCN 109.3 RCN 59.7	RCN 109.3 RCS 72.9	RCN 108.3 RCS 59.7	RCN 08.3 RCS 62.5
Tailing's Emplacement Area – RCN RCS	RCN 100.2 RCS 17.6	RCN 67.7 RCS 22.7	RCN 100.2 RCS 17.6	RCN100.2 RCS 19.3
Active Mining Area RCN RCS	RCN 96.4 RCS 82	RCN 92.1 RCS 157.5	RCN 71.4 RCS 82	RCN 73.1 RCS 84.4
Overburden Emplacement Area _RCN RCS	RCN 254 RCS 258.9	RCN 380.1 RCS 300.3	RCN 257.3 RCS 260.5	RCN255.5 RCS 260.5
Rehabilitated Lands – Pasture; Ecosystem and Landuse Establishment	RCN 9.3 RCS 56.7	RCS 18.7 RCS 27.0	RCN 2 RCS 7.2	RCN 4.2 RCS 45.9
Rehabilitated Lands – Pasture; Ecosystem and Landuse Sustainability	RCN 0 RCS 80	RCN 36.3 RCS 98.7	RCN 9.3 RCS 136.7	RCN 11.3 RCS 143.8
Total Rehabilitation – Ecosystem and Landuse Sustainability (incl. pre MOP rehabilitation)	RCN 422.2 RCS 400.2	RCN 391.9 RCS 423.1	RCN 431.5 RCS 456.9	RCN433.5 RCS 464
Rehabilitated Lands – Trees over Grass; Ecosystem and Landuse Sustainability	RCN 82.5 RCS 92.9	RCN 81.4 RCS 112.9	RCN 33.4 RCS 99.9	RCN 35.6 RCS 99.9

Error! Reference source not found., and **Error! Reference source not found.**, outline the progression of rehabilitation and this is shown in the Rehabilitation Plan 2016.
The areas previously treated with biosolids are still proving to perform exceptionally well when compared to other areas. The biosolids greatly enhances revegetation onsite given the poor quality of available topsoil. A 4 ha area was chosen on top of the North Pit Dump to conduct a trial of biosolids and compost for comparative analysis of effective rehabilitation ameliorants. This area was sown in August 2013 with good results seen during the 24 monthly analysis even through dry conditions. The area received very good rainfall in April 2015 and is expected to have further improved results during the 36-month pasture analysis (to be undertaken in 2016).

At RCN the shaped area requiring rehabilitation at the end of the reporting period was 2 ha with the area estimated to be rehabilitated during 2017 is 30 ha. There is one area of 13 ha. to be disturbed during 2017 in front of the operation and that is to the South-west of the Camberwell pit.

At RCS the shaped area requiring rehabilitation at the end of the reporting period was 9 ha with the area estimated to be rehabilitated during 2017 is 58 ha. There is no planned new areas to be disturbed ahead of the operation during 2017.

Table 30 Rehabilitation Summary

	Area Affected/Rehabilitated (hectares)			
	To date (ha)	Last report (ha)	Next Report (estimated) (ha)	
A: MINE LEASE AREA				
A1 Mine Lease(s) Area	RCN 1,917 RCS 1,823.3			
B: DISTURBED AREAS				
B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads)	RCN 109.3 RCS 72.9	RCN 109.3 RCS 67.8	RCN 108.3 RCS 62.5	
B2: Active Mining Area (excluding items B3 - B5 below)	RCN 92.1 RCS 157.5	RCN 80.4 RCS 151.4	RCN 71.4 RCS 151.4	
B3 Waste emplacements, (active/unshaped/in or out-of-pit)	RCN 380.1 RCS 300.3	RCN 231 RCS 302.5	RCN 257.3 RCS 260.5	
B4 Tailings emplacements, (active/unshaped/uncapped)	RCN 67.9 RCS 22.7	RCN 93.5 RCS 39.1	RCN 67.9 RCS 22.7	
B5 Shaped waste emplacement (awaits final vegetation)	RCN 2 RCS 9.9	RCN 40 RCS 9.0	RCN 0 RCS 0	
ALL DISTURBED AREAS	RCN 651.4 RCS 563.3	RCN 569 RCS 569.6	RCN 504.9 RCS 580.2	F1
C REHABILITATION PROGRESS				
C1 Total Rehabilitated area (except for maintenance)	RCN 391.9 RCS 423.1	RCN 374.1 RCS 396.1	RCN 421.9 RCS 481.1	F2
D: REHABILITATION ON SLOPES				
D1 10 to 18 degrees	RCN 2.5 RCS 5.2	RCN 2.5 RCS 5.2	RCN 2.5 RCS 5.2	
D2 Greater than 18 degrees	-	-	-	
E: SURFACE OF REHABILITATED LAND				
E1 Pasture and grasses	RCN 392 RCS 317.2	RCN 374.1 RCS 290.2	RCN 422 RCS 375	
E2 Native forest/ecosystems	RCN 75.1 RCS 0	RCN 75.1 RCS 0	RCN 75.1 RCS 0	
E3 Plantations and crops (Includes Tree Plantation 51 ha and bunds along Highway**)**	RCN 6.3 RCS 112.9	RCN 6.3 RCS 105.9	RCN 6.3 RCS 105.9	
E4 Other (include non-vegetative outcomes)	-	-	-	

Table 31 Maintenance Activities on Rehabilitation Land

(This period's activities and activities proposed in the next reporting period)

NATURE OF TREATMENT	Area Treated (ha)		Comment/control strategies/ treatment detail
	Report period	Next period	
Additional erosion control works (drains re-contouring, rock protection)	20	15	6 km of Contour banks constructed on 10 degree rehabilitation areas on the West Pit out-of-pit-dump and nine-ways.
Re-covering (detail - further topsoil, subsoil sealing etc)	0	0	
Soil treatment (detail - fertiliser, lime, gypsum etc)	45.7	60	Biosolids applied to all pasture areas rehabilitated. Some tree seed areas either received low rates of biosolids or did not receive biosolids in 2014 where high quality topsoil with tree seed bank is spread onto rehabilitation areas.
Treatment/Management (detail - grazing, cropping, slashing etc)	75	70	65 ha grazed on West Pit pasture rehabilitation area since April 2015. Further rehabilitation will be slashed during 2016.
Re-seeding/Replanting (detail - species density, season etc)	0	10	Area at RCN will be retreated to improve rehabilitation outcome. Area will be treated with biosolilds and resown to pasture mix.
Adversely Affected by Weeds (detail - type and treatment)	320	150	Localised areas across the site. Large areas of assorted Pear species, Galenia and African Olive were priority for 2016. Small areas of Mother–of-Millions and Paterson's Curse sprayed as well as other assorted species. This will be ongoing in 2017 with increased focus again on Galenia especially in older rehabilitation as well as follow up African Olive spraying from 2017 works.
Feral animal control (detail - additional fencing, trapping, baiting etc)	200	200	Population has been increasing and an application will be made to cull excess numbers across the site. Now allowed to harvest meat from cull. During 2016 commericla harvest was undertaken at across both RCN & RCS and will continue during 2017.

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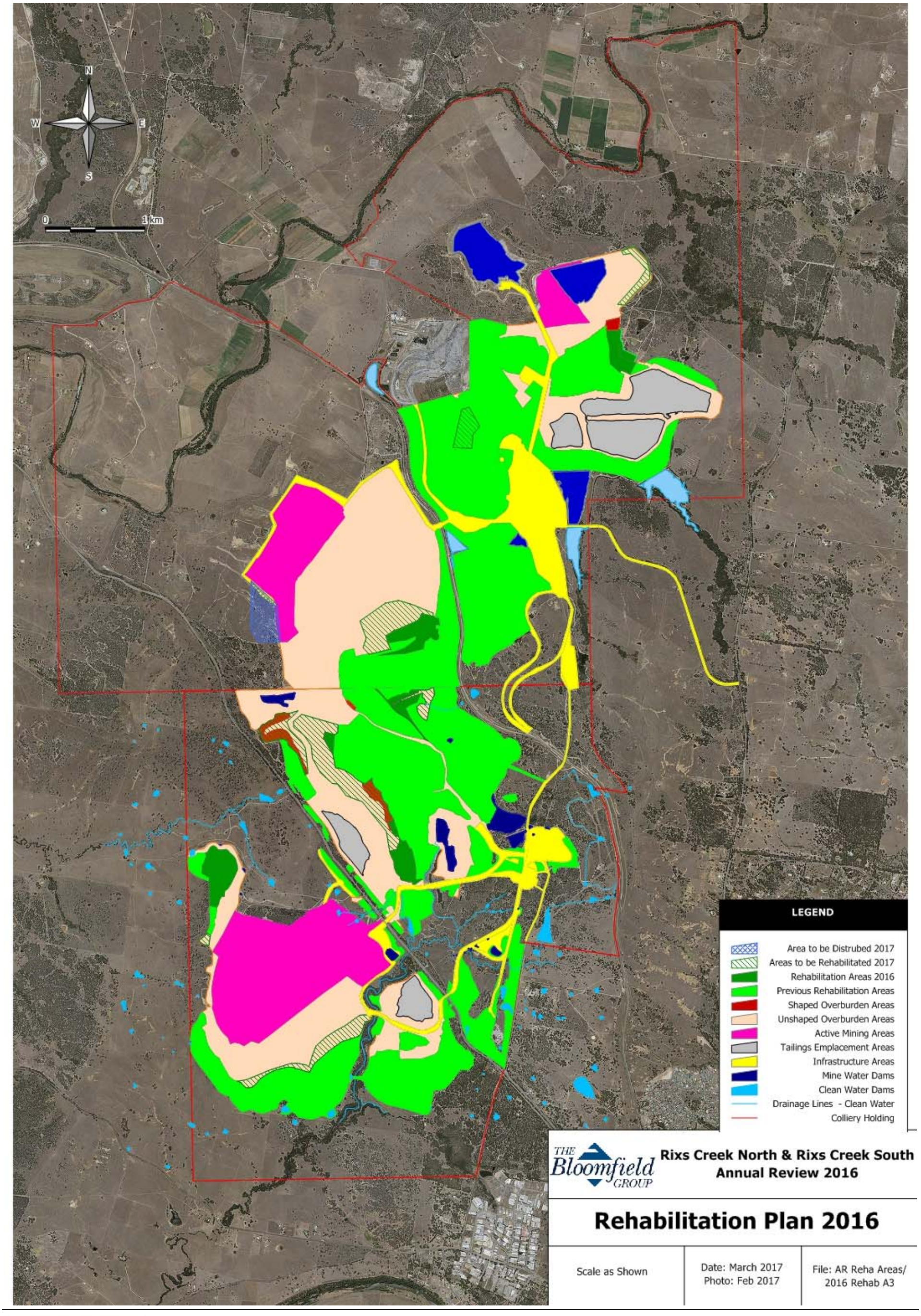
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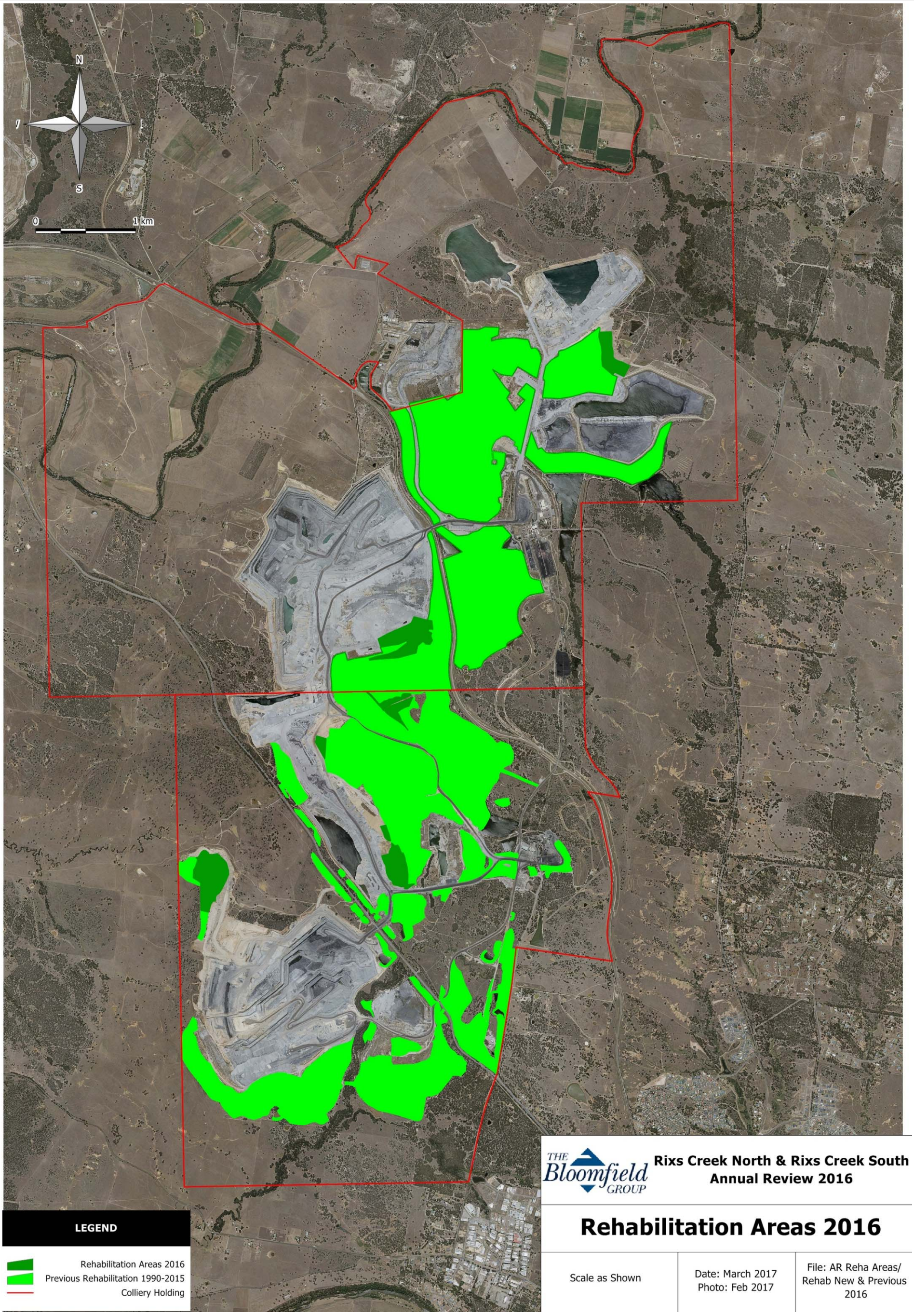
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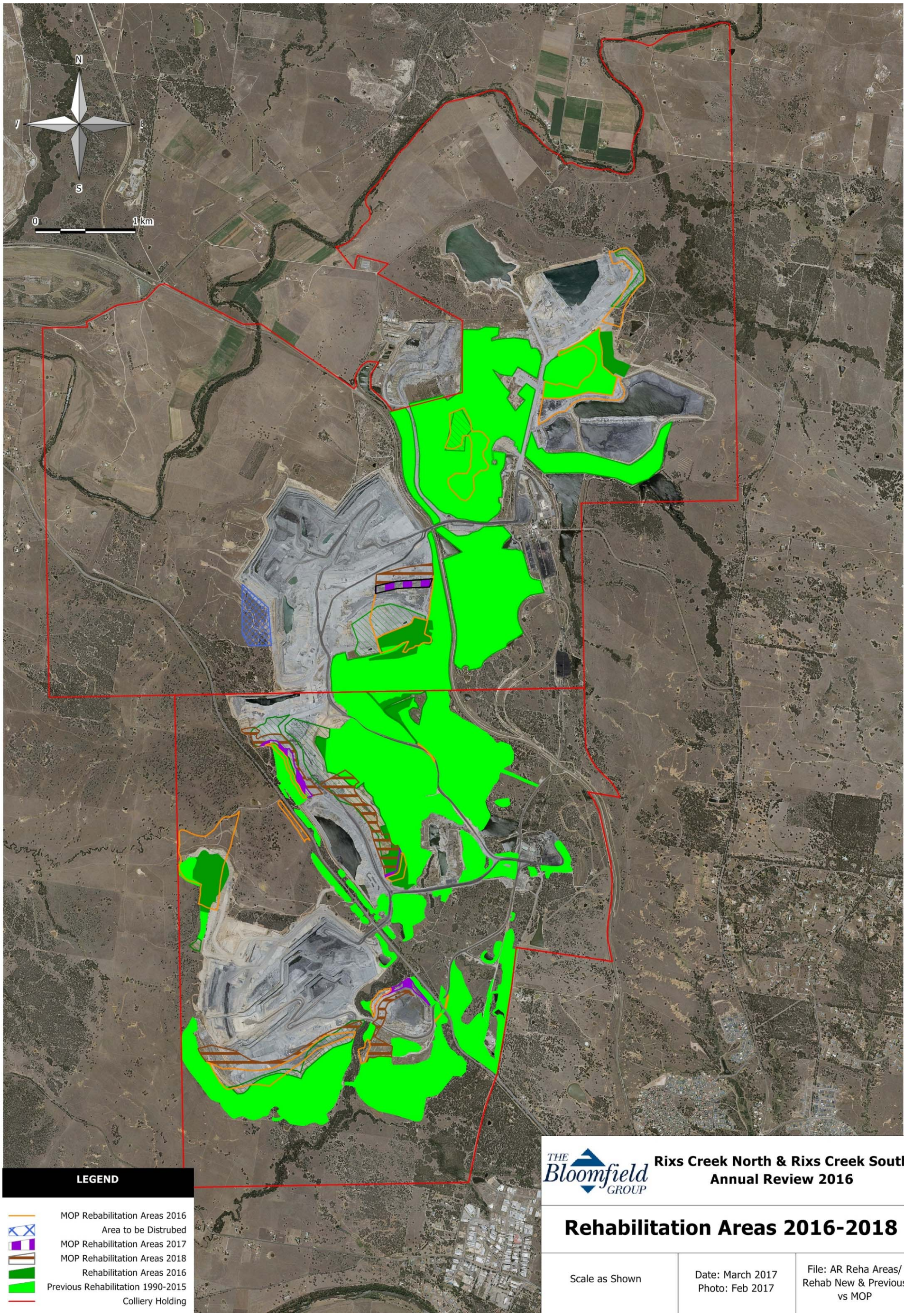
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Annual Review 2016
Rehabilitation Areas 2016-2018
Scale as Shown
Date: March 2017
Photo: Feb 2017
File: AR Reha Areas/
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8.4 Other Infrastructure

No major infrastructure was installed during 2016.

8.5 Rehabilitation Trials and Research

A 4 ha rehabilitation trial comprising of four 1 ha quadrats was conducted on site during August 2013. During 2014 this trial was monitored in February (six months after sowing) and August (12 months after sowing). During 2015 this trial was monitored during August (24 months after sowing) as well as during 2016 (36 months after sowing). Rix's Creek set up this trial to compare the conventionally used biosolids with compost (reuse of garden green waste) to evaluate the effectiveness of both products in contributing to long-term sustainability for the site. The four 1 ha quadrats were sown with conventional methods using pasture species already used on site with soil treatment as follows:

- Quadrat 1: Control with 200 kg starter fertiliser applied
- Quadrat 2: Compost at 80 t / ha
- Quadrat 3: Compost at 140 t /ha
- Quadrat 4: Biosolids at 140 t / ha (maximum allowable rate).

The six, 12, 24 and 36 monthly results to date can be seen in the graph below. To date all sites are similar in terms of pasture composition and species diversity but dry conditions in 2015 and 2016 have seen the rehabilitation growth rates lower than average annual growth rates across the site. Physically looking at the area's during August 2016 the control plot is much lower in quality then the three other plots, whilst the biosolids plot is slightly higher in quality (available green feed) then the other plots. These plots will be monitored again in August 2017 to see any seasonal influences and further rehabilitation progression (after 48 months) on the four trial plots. All four sites over the timeline of the trial have increased in stability and nutrition. In terms of soil infiltration all the sites have increased and then plateau from the 12 to 24 months results. The 48 months results (done in 2017) will be interesting to determine any further trends.

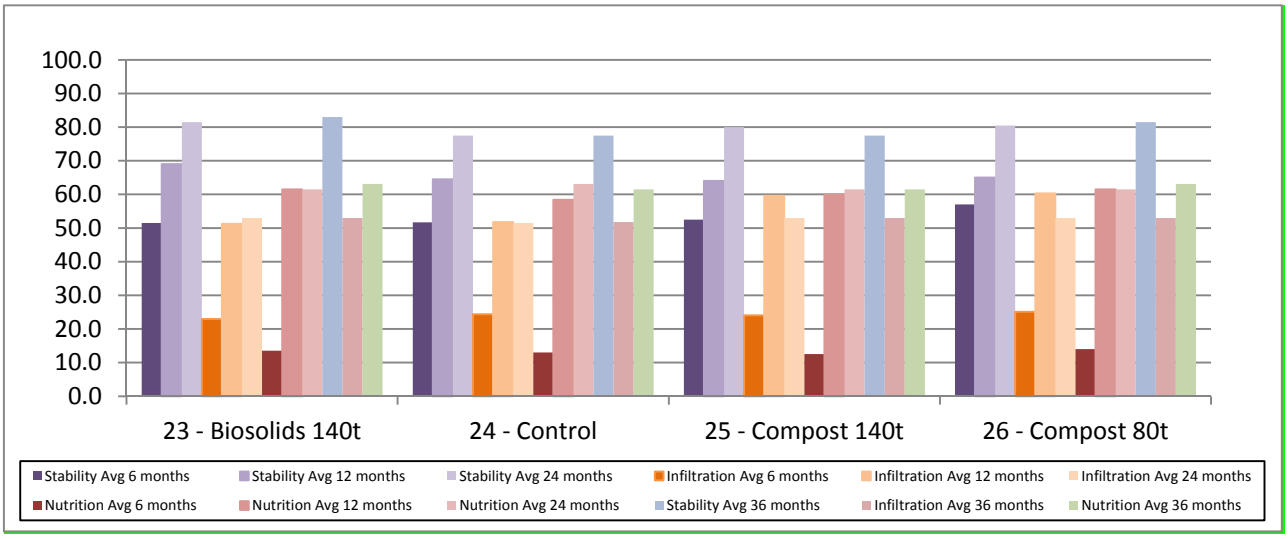

Figure 30. Summary of Rix's Creek 4 ha trial on North Pit Dump.

8.6 Rehabilitation Monitoring

Rehabilitation monitoring is conducted at Rix's Creek mine as per Bloomfield Mining Operations Land Rehabilitation Management System (LRMS). Monitoring was conducted in January 2011 on eighteen (18) existing sites and two (2) new sites less than 12 months after establishment. Rehabilitation monitoring was planned for November 2013, however, this was completed in January 2014. The timing was still throughout a prolonged dry period with similar rehabilitation conditions seen across all sites without the delay in monitoring having any impact. The monitoring included six (6) new sites, four of these being within the rehabilitation trial area of 4 ha (four 1 ha quadrats). The ultimate goal of rehabilitation monitoring is to assess rehabilitated land success prior to final sign-off by DRE. Rehabilitation monitoring was further conducted during December 2015 across the 26 sites done in 2013/2014. Out of the 26 sites monitored there was four (4) sites that are currently

being grazed by cattle being sites 15, 16, 17, and 18. No areas have been applied to DRE for final sign-off, this was last done in 2009. Rix's Creek is hopeful to graze some of its pasture rehabilitation areas in the next several years to show evidence that the land can be sustainable for long-term grazing following the completion of mining. During 2017 both RCS and RCN sites will have rehabilitation monitoring completed.

Previous rehabilitation monitoring at RCN and RCS has recognised that rehabilitation is generally transitioning toward post mining Class IV and Class V landuse goals. Post-mining land and soil capability is anticipated to be predominantly Class V with area of Class IV on lands with slope less than or equal to 10^{o}. This land will be suitable for a mix of non-intensive cattle grazing and woodland habitat.

No rehabilitation monitoring occurred during the 2016 reporting period in accordance with RCN and RCS Mining Operation Plans (MOPs). Rehabilitation monitoring is completed bi-annually as per the RCS and RCN MOPs and will occur in 2017. Rehabilitation monitoring will provide analysis into the progression of rehabilitation toward Mining Operations Plan commitments and post- mining landuse design goals.

8.7 Further Development of the Final Rehabilitation Plan

Rix's Creek (DA49/94) Mining Operations Plan was issued 8 March 2013 which conform to the new MOP guidelines developed by DRE. In accordance with the MOP Rix's Creek will provide rehabilitated land that meets the rehabilitation objectives throughout the different phases for the life of mine over the seven year period. The MOP will continue to be undertaken in accordance with the procedures outlined in it, so post mined lands are suitable for post-mining land use and in a state suitable for DRE sign-off. The Rix's Creek Mine MOP is approved to 8 March 2020.
Final rehabilitation outcomes are being agreed as Rix's Creek develops its new EIS for the Rix's Creek Continuation of Mining project. If approval is granted as part of the Rix's Creek Continuation of Mining Project, a MOP variation will be submitted aligned to any further changes made to the new consent. During the next AEMR period rehabilitation will be undertaken in line with production and the MOP with no different techniques being utilised compared with previous years. The 4 ha pasture trial on the North Pit dump will be monitored and pasture mass data will be gathered to show the area can be preferentially grazed in the next several years. Further monitoring will be undertaken where cattle is also grazing pasture rehabilitation areas on site to prove its effectiveness.

8.8 Rehabilitation Status

RCN as follows:

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	Year 2015 (ha)	Year 2016 (ha)	Year 2017 (ha)
Total mine footprint	1917	1917	1917
Total active disturbance	550	651.4	504.9
Land being prepared for rehabilitation	0	30	5
Land under active rehabilitation	17	18.7	30
Completed rehabilitation	392	374.1	422.4

RCS as follows:

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	Year 2015 (ha)	Year 2016 (ha)	Year 2017 (ha)
Total mine footprint	1823.3	1823.3	1823.3
Total active disturbance	569.6	569.6	580.2
Land being prepared for rehabilitation	9.0	9.0	7
Land under active rehabilitation	0	27	58
Completed rehabilitation	396.1	423.1	481.1

SECTION 9 COMMUNITY

9.1 Community Engagement.

Rix's Creek is required under the development consent to participate and co-operate with a Community Consultative Committee (CCC). The committee consists of three community representatives and is chaired by Council and other Govt representatives are invited to participate on the committee. Rix's Creek was the first mine in the Hunter Valley to have a CCC which has operated for 24 years.

The Committee representatives are:-

Chairperson:-	Councillor Val Scott
Community representatives:-	Patricia Bestic
	Reg Eveleigh
	Michelle Higgins
DPE representative:-	Chris Knight
Company representatives:-	Mine Manager – Luke Murray
	Senior Environmental Officer – John Hindmarsh
	Environmental Officer – Jason Desmond
	Environmental Officer – Chris Quinn

The Committee met two times during the year. Once on 10th May 2016 to present the Annual Review (AR) for 2016, and again on 20th September 2016 for the presentation of 6 monthly environmental monitoring results for the January to June 2017 monitoring period.

The last Integra CCC meeting for the combined open cut and underground was held in February. At that meeting is was decided to disband the committee. The Company proposed to the committee that the Rix's Creek CCC be expanded to include any member from the Integra CCC that has an interest in the open cut operations and wishes to join the Rix's Creek CCC if the Committee are agreeable.

Members of the Integra CCC who indicated they would join the Rix's Creek CCC were:-

- Lyn McBain,
- Deidre Olofsson,
- Greg Hall; and
- David Moran.

Rix's Creek CCC members agreed to the amalgamation of the members from the Integra CCC into the Rix's Creek CCC with the current Chairperson being a Singleton Councillor, at present Cr Val Scott.

Additional community consultation that was conducted during the reporting period included company newsletters which informed community members on updates to Rix's Creek operations, which included:

- Rix's Creek North - Commencement of Operation Newsletter – February 2016
- Rix's Creek North – Commencement of CHPP – May 2015
- Rix's Creek South Continuation of Mining Update - November 2016

Notifications on kangaroo culling and 1080 wild dog and fox baiting were also distributed throughout the community during the reporting period.

Monthly internal employee newsletters were also distributed throughout the workforce that provided updates for environmental initiatives occurring onsite.

The Environmental Department and Land Manager also had an active presence within the local community providing updates and information on Rix's Creek operations to community members.

The Company is a financial member of the Hunter Coal Environmental Group (HCEG).

The company is a financial member of the Hunter Valley Combined Wild Dog Association (HVCWDA) Incorporation.

The company is also part of the Upper Hunter Mining Dialogue (UHMD) in association with the NSW Minerals Council (NSWMC) which brings industry, community, and key stakeholder groups together across various projects and goals relating to:-

- Land Management
- Social Impacts and Infrastructure
- Water
- Emissions and Health

The Bloomfield Group UHMD representatives are:-

Executive Oversight Committee (Chair):-	Managing Director / CEO – John Richards
Steering Commitee:-	General Manager Mining Development – Garry Bailey
Emissions and Health Working Group:-	Senior Environmental Officer – John Hindmarsh
Land Management Working Group:-	Environmental Officer – Jason Desmond
Water Working Group:-	Environmental Officer – Chris Quinn
Social Impacts and Infrastructure Working Group:-	Executive Assistant to Managing Director – Suzie Messner

9.2 Community Contributions.

The company provides annual donations to approximately 30 charitable groups as well as annual sponsorship to around 50 local community groups. In particular in the Singleton Community over the last five years:

- Samaritans and the Singleton Christmas Lunch
- Singleton Legacy
- Cancer Council Singleton Office – patient support and carer transport
- Rose Point Park Tree Planting
- Many Local Junior Sporting groups
- Singleton Show
- Singleton High School, Singleton Public School, Singleton Pre-School
- Singleton Hospital and Hunter New England Health
- Uniting Care Disability Services
- SES, Salvation Army, Red Cross
- Westpac Helicopter Services
- Darlington Bush Fire Services
- Scouts and Girl Guides

Rix's Creek has had collaboration with Newcastle University and Australian Coal Association Research Program (ACARP) to support effective innovation and development for the improvement of mine operations and environmental practices. This is highlighted recently with the revolutionary tailings drying project that will do away with the need for Tailings Dams.

9.3 Community Complaints.

All complaints are dealt with under the '*Complaints Protocol for Rix's Creek Coal Mine'* as set up in response to the Rix's Creek Environmental Monitoring Committee under the original development Consent. The protocol is used to register and investigate all complaints. All complaints are referred to the Mine Manager, Mr. Luke Murray and are dealt with on an individual basis.

The Company policy is to personally deal with every complainant to expedite a resolution to his or her concern.

Table 32 Complaints 2016

No.	Date Received	Type	Location	How received	Complaints					
					Blast	Noise	Dust	Water	Lights	Odour
1*	11/1/16	Resident	Camberwell	DPE				X*		
2	12/1/16	Resident	Long Point	Phone		X				
3	8/2/16	Resident	Camberwell	Phone		X				
4	15/2/16	Resident	Maison Dieu	Phone		X				
5	17/2/16	Resident	Maison Dieu	Phone		X				
6	23/2/16	Resident	Long Point	Phone	X					
7	25/2/16	Resident	Maison Dieu	Phone		X				
8	10/3/16	Resident	Maison Dieu	Phone		X				
9	10/3/16	Resident	Maison Dieu	Phone		X				
10	10/3/16	Resident	Glennies Creek	Phone	X					
11	10/3/16	Resident	Middle Falbrook	Phone	X					
12	23/3/16	Resident	Camberwell	Phone	X					
13	23/3/16	Resident	Glennies Creek	Phone	X					
14	6/4/16	Resident	Maison Dieu	EPA		X				
15	8/4/16	Resident	Maison Dieu	Phone		X				
16*	29/4/16	Resident	Maison Dieu	Phone		X*				
17	2/5/16	Resident	Maison Dieu	Phone			X			
18*	11/5/16	Resident	Maison Dieu	Phone		X*				
19	23/5/16	Resident	Bridgman	Phone			X			
20	23/5/16	Resident	Bridgman	Phone			X			
21	17/6/16	Resident	Maison Dieu	Rix's Hotline	X					
22*	6/7/16	Resident	Bridgman	Rix's Hotline	X*	X*				
23	13/7/16	Resident	Bridgman	Rix's Hotline					X	
24*	14/7/16	Resident	Bridgman	In person		X*	X*			
25	26/7/16	Resident	McDougalls Hill	Rix's Hotline		X				
26	27/7//16	Resident	McDougalls Hill	Rix's Hotline		X				
27	28/7/16	Resident	McDougalls Hill	Rix's Hotline		X				
28	10/8/16	Resident	Maison Dieu	Phone		X				
29*	11/8/16	Resident	Bridgman	In person		X*				
30	16/8/16	Resident	Maison Dieu	DPE		X				
31	19/8/16	Resident	Mt Olive	Phone			X			
32	19/8/16	Resident	Bridgman	Email			X			

33*	23/8/16	Resident	Mt Olive	Rix's Hotline	X*					
34	7/9/16	Resident	Maison Dieu	Phone		X				
35	12/9/16	Resident	Maison Dieu	DPE		X				
36	20/9/16	Resident	McDougalls Hill	EPA		X				
37	20/9/16	Resident	McDougalls Hill	EPA		X				
38	21/9/16	Resident	Maison Dieu	Phone		X				
39	21/9/16	Resident	McDougalls Hill	Phone		X				
40	22/9/16	Resident	McDougalls Hill	Phone		X				
41	22/9/16	Resident	McDougalls Hill	EPA		X				
42	22/9/16	Resident	McDougalls Hill	Phone		X				
43	26/9/16	Resident	McDougalls Hill	Phone		X				
44	27/9/16	Resident	McDougalls Hill	Phone		X				
45	28/9/16	Resident	McDougalls Hill	Phone		X				
46*	28/9/16	Resident	Maison Dieu	Phone		X*				
47	29/9/16	Resident	McDougalls Hill	Rix's Hotline	X					
48	10/10/16	Resident	McDougalls Hill	DPE			X			
49	18/10/16	Resident	McDougalls Hill	Phone		X				
50	19/10/16	Resident	Camberwell	Phone	X					
51	30/10/16	Resident	Maison Dieu	Phone		X				
52	3/11/16	Resident	McDougalls Hill	Phone		X				
53	3/11/16	Resident	Maison Dieu	Phone		X				
54	7/11/16	Resident	McDougalls Hill	Phone		X				
55	17/11/16	Resident	Maison Dieu	Phone		X				
56	24/11/16	Resident	McDougalls Hill	Rix's Hotline	X					
57	28/11/16	Resident	McDougalls Hill	Phone		X				
58	29/11/16	Resident	McDougalls Hill	Phone		X				
59	1/12/16	Resident	Maison Dieu	Phone		X				
60	5/12/16	Resident	Bridgman	Phone		X				
61	5/12/16	Resident	Camberwell	Phone		X				
62	14/12/16	Resident	McDougalls Hill	Phone		X				
63	20/12/16	Resident	Camberwell	DPE	X					

* Enquiry to Company regarding operations.

Fifty-three (53) complaints were received by the Company during 2016. Out of the Thirty Eight (38) of the noise complaint that occurred during 2016, Thirty Three (33) noise complaints were received from 2 residences located in Maison Dieu and Gowrie. Summaries of complaints during the reporting period are shown in Table 34:

Table 33 2016 Complaints Breakdown

2016 Complaints						
Blast	Noise	Dust	Water	Lights	Odour	**Total**
9	38	5	0	1	0	**53**

Complaint made to company via:					Total:
Email	Rix's Creek Hotline	Direct phone calls	Direct from DPE	Direct from EPA	
1	10	34	5	3	**53**

An additional four (4) complaints were received by the Company, however these were not related to the operation (operation not operating), see Table 35 below:

Table 34 Complaints Received not related to Operation

Date	Regarding	Result	Total
09/04/2016	Blast	No Blast	
13/04/2016	Blast	No Blast	
23/08/2016	Blast	No Blast	
24/11/2016	Noise	Mine was not operational at time of complaint.	
			4

Six (6) operational enquiries were made in 2016, see Table 36 below:

Table 35 Operational Enquiries

Date	Received via	Regarding	Total
11/01/2016	Direct from DPE	Water	
29/04/2016	Direct phone call to company	Noise	
11/05/2016	Direct phone call to company	Noise	
6/07/2016	Rix's Hotline	Noise	
14/07/2016	In person to attended noise monitoring personnel	Dust	
28/09/2016	Direct phone call to company	Noise	
			6

All complaints have been dealt with in the various sections of the report specific to that complaint.

Table 36 Complaints 2001-2016

Year	Complaints	Enquiries	Complaints					
			Blast	Noise	Dust	Water	Lights	Odour
2001	7		2	1	3	1		
2002	29		11	9	8	1		
2003	16		5	10	1			
2004	10		7	1	1		1	
2005	12	2	4	6	1		1	
2006	27	1	4	21	1			1
2007	14		7	4			1	2
2008	4		4					
2009	7		2		5			
2010	11		2	3	3	1	2	
2011	11	5	6	2	2			1
2012	20	2	9	4	7			
2013	19	5	8	10				1
2014	20	4	2	15	3			
2015	20	3	4	16				
2016	55	8	10	38	6		1	
Average 2001-2016	16.8	3.8	5.2	7.0	3.4	1.0	1.2	1.3

Rix's Creek received 53 complaints in 2016 which is above average and also significantly higher than 20 received in 2015 at RCS. This is also the first year of production at RCN which was purchased by TBG and taken out of care and maintenance. It is preferential no complaints are received and Rix's Creek endeavour to work with the community to minimise and eliminate the sites environmental impacts.

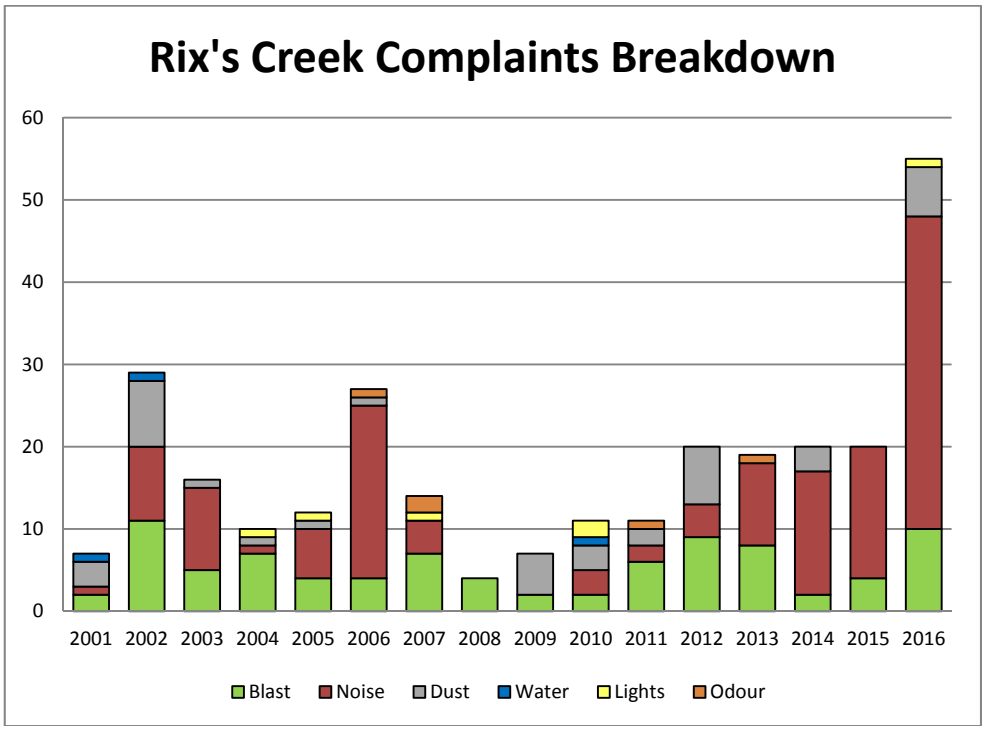

Figure 31 Summary of Rix's Creek Complaints 2001-2016

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SECTION 10 – INDEPENDENT AUDIT

There was an independent audit undertaken of the Rix's Creek South project approval DA149/94 during the reporting period in 2016. This independent audit was completed in November 2016 by Umwelt. The last independent audit of the Rixs Creek South approval was carried out in 2011 by Glade Consulting as was required under the approval.

The next Rix's Creek North development consent (PA 08_0102) Independent Environmental Audit will be completed in 2017 reporting period.

The outcomes of Independent Audit carried out in 2016 with the summary of non-compliances/action plan of development consent is shown below:

Rix's Creek South Independent Environmental audit 2016

Umwelt was commissioned by Rix's Creek Pty Ltd (Rix's Creek) to conduct an independent environmental compliance audit against Development Consent DA 49/94 (as modified) for Rix's Creek Coal Mine. The audit was undertaken for the Department of Planning and Environment (DPE) for the period 1 November 2011 to 31 October 2016. The audit also assessed compliance with the conditions of Environment Protection Licence 3391, key mining authorities and other licence documents.

The audit was conducted by Daniel Sullivan (Exemplar Global International Certified Auditor 113202) and Luke Bettridge from Umwelt. The field visit component of the audit was completed over the period 10 – 11 November 2016.

The audit consisted of a detailed desktop review of documentation, interviews with key Rix's Creek staff and a field inspection of the mining and rehabilitation areas. The audit was conducted generally consistent with 'ISO 14010 - Guidelines and General Principles for Environmental Auditing', 'ISO 14011 - Procedures for Environmental Auditing' and the 'Independent Audit Guideline. Post-approval requirements for State significant developments (Department of Planning and Environment, 2015)'.

This audit has concluded that the on the ground environmental management practices being applied at the Rix's Creek Coal mine are appropriate. The open cut pit areas assessed during the field inspection were observed to be well managed, with equipment operators and supervisory personnel demonstrating a good understanding of management actions required to minimise amenity impacts from mining activities. This observation is supported by the results from noise and dust monitoring programs and the relatively small number of community complaints received during the audit period.

The field inspection revealed that improvements are required with regard to hydrocarbon management practices, particularly in and around the workshop and with regard to the operation of the oily water separator.

Implementation of site rehabilitation during the audit period was found to have been progressing as per the Mining Operations Plan. A review of rehabilitation during the field inspection completed for this audit found that rehabilitation areas were being developed and maintained to a high standard. However it was identified that land disturbance associated with mining operations had progressed in advance of the approved stage plans within the MOP and at the time of the audit. Further to this it was also noted during the audit that Rix's Creek were in consultation with both the Department of Planning and Environment and Department of Trade and Investment – Division of Resources and Energy regarding the location and extent of mining and establishment of out of pit emplacement areas at the operation.

A review of incidents that occurred at Rix's Creek Mine since the previous audit indicated that the majority were classified as minor and related to water management, with all being documented and reported to regulatory agencies as required.

Majority of non-compliances that occurred during the audit period were administrative or low risk in nature with one medium non-compliance being identified with regard to clearing in exceedance of the approved MOP.

At the time of the audit, Rix's Creek staffs were aware of most of the identified non-compliances against development consent conditions, licences and approvals and were working to address a number of the issues identified in this report.

The following has been extracts from the Audit report.

Development Consent

A summary of the compliance assessment against Rix's Creek Mine Development Consent is included below.

Development Consent (DA49/94)

The non-compliances identified with DA49/94 are detailed below.

Table 37 Non Compliances with Development Consent (DA49/94) – From Audit Report

Condition	Non-Compliance	Risk Level
Schedule 2, Condition 1A	Not all of the conditions of the Project Approval have been complied with. See risk ratings for each individual condition.	**Low**
Schedule 2, Condition 3	Non-compliances have been recorded during the audit period for legislative acts and agencies as detailed within this condition and these are discussed in Section 4 of the report.	**Low**
Schedule 2, Condition 6(c)	No formal building maintenance program was implemented to specifically review the maintenance of buildings.	**Administrative**
Schedule 2, Condition 7	Site lighting has not been confirmed with Singleton Council that it is managed to their satisfaction.	**Administrative**
Schedule 2, Condition 9	The Traffic Management Plan was not approved by the Secretary prior to the commencement of the tunnel construction activities.	**Administrative**
Schedule 2, Condition 11	Noise monitoring is not undertaken in accordance with the requirements of this condition as noise monitoring is not undertaken on a quarterly basis, monitoring is undertaken on a 6 monthly basis.	**Low**
Schedule 2, Condition 14	• The area of disturbance onsite reflected the extent of disturbance as approved at the end of the MOP term (2020) and therefore ground disturbance was ahead of the schedule within the MOP; and • Not all sprays on site, including the coal stockpile, are automatic.	**Medium**
Schedule 2, Condition 14A	No evidence was available to confirmation that the NGERS Report had been undertaken to the satisfaction of the Secretary.	**Administrative**

Condition	Non-Compliance	Risk Level
Schedule 2, Condition 15	• Sections of the Water Management Plan did not include the information required below: - Describe measures to minimise water use by the development. - detail that visual monitoring of flow volume will be undertaken. - process for monitoring yield into the open cut. - process for monitoring impacts to baseflow and offsetting as required any loss of base flow, impacts to private land owners caused by Rix's Creek Operations.	**Low**
Schedule 2, Condition 16A	• A copy of the Landscape Management Plan marked 'final' was not forwarded to the Singleton office as requested by the DP&E. • The Final Void Management Plan was not submitted to the DP&E by the due date. • The Mine Closure Plan was not submitted to the DP&E by the due date.	**Administrative**
Schedule 2, Condition 16B	• Sections of the Rehabilitation Management Plan did not include the information required below: - procedure to protect vegetation and soil outside the disturbance areas. - procedure to manage impacts on fauna. - procedure to landscape the site to minimise visual impacts. - procedure to conserve and reuse topsoil. - information regarding the salvage and re-use of material. - monitoring program to include all measures in 16B(v) and effectiveness of these measures. - clearly state who is responsible for monitoring and reviewing the plan.	**Low**
Schedule 2, Condition 16D	• Sections of the Mine Closure Plan did not include the information required below: - objectives and criteria for mine closure for ML 1432 and completion criteria for each domain. -	**Low**
Schedule 2, Condition 19	• Sections of the Annual Environmental Management Reports/Annual Review did not include the information required below: - updated water balance for the reporting year not included each year as required *Note it was included in 2015 Annual Review.* - not all reports were submitted by the due date. - Specific targets for the next year have not been included in the 2011 2015 reports.	**Low**

Condition	Non-Compliance	Risk Level
Schedule 2, Condition 28	Not all management plans / programs were revised following the submission of an incident report under Condition 19 or modifications of the Development Consent to the satisfaction of the Secretary.	**Low**
Schedule 2, Condition 29	• Management plans have not been updated as required by Condition 28 of the Development Consent. • Some management plans have been updated without consultation being undertaken with all parties nominated by the Development Consent. No agreement with the Secretary was sought to revise the management plans without consultation with relevant parties.	**Low**

Table 38 Non Compliances with EPL 3391 - From Audit Report

Condition	Non-Compliance	Risk Level
M2.1	During the audit period, there have been a number of instances where dust gauges have not been able to be sampled due to the dust gauge being broken. These non-compliances have been reported annually to the EPA in the Annual Return.	**Low**
L1.1	Overflow of sediment dams and mine water dam at clean coal stockpile, rail loading facility and mine water dam (DWD 3) (see **Section 6.2.2**).	**Low**
L2.2	Five deliveries of waste oil were received without analysis undertaken to confirm quality limits as prescribed within the EPL had been met. It is noted that Rix's Creek has ceased utilising waste oil within blasting activities on site.	**Administrative**

Table 39 Non-Compliances With Mining Authorities - From Audit Report

Lease	Non-Compliance	Risk Level
ML 1432 – Condition 2(d) and CL 352 – Condition 3(a) and (b)	Ground disturbance at Rix's Creek has been undertaken at a rate which is in advance of the approved stage plans within the MOP for 2016.	**Medium**
CL 352 – Condition 2(b) (i)(A)	During the audit period, five incidents were reported related to the overflow of sediment dams and water release to Rix's Creek due to a pipeline leakage and seepage from old underground workings. This is further detailed in **Section 6.2.2**.	**Low**

Table 40 Rix's Creek Mine Environmental Management Plans – From Audit Report

Management Plan	Comments
Traffic Management Plan	The TMP was developed for the construction of the Rix's Creek Mine 'Cut and Cover Tunnel' crossing of the New England Highway. It is noted the TMP was provided to the DPE in 2011 following the commencement of construction of the tunnel. However, the commencement of construction activities was approved by the Roads and Maritime Services (RMS) (formerly Roads and Traffic Authority) in 2010. All relevant approvals had been obtained from the RMS including a number of Road Occupancy Licences throughout the audit period. At the time of the audit, the relevant controls in the TMP were observed to be implemented by Rix's Creek Mine. Not all requirements of the Project Approval were complied with during the preparation of the TMP, comments are provided in **Appendix 1** with non-compliances noted in Section 4.
Noise and Vibration Management Plan	The NMP has been prepared as an integrated management plan for Rix's Creek North and Rix's Creek South Mine for the period 2016 – 2019. The NMP was approved by the DP&E on 16 February 2016. It is noted that the NMP has been prepared for Rix's Creek North and South Operations. Not all operational requirements of the Project Approval have complied with the NMP, non-compliances and recommendations are noted in Section 4 with further detail provided in **Appendix 1**. A key issue is related to the noise monitoring which is being undertaken on site which is not consistent with the Development Consent e.g. real time noise monitoring is undertaken and used for operational performance management with attended monitoring undertaken on a monthly basis. This monitoring practice detailed within the Noise Management Plan as approved during 2016 does not outline the requirement for quarterly noise monitoring in accordance with the requirements of Condition 11 of the Development Consent (refer to **Section 6.3.2**) and therefore noise monitoring as required by the Development Consent is not occurring. Noise monitoring is undertake in accordance with the NMP which has been prepared to conform to the INP, however the monitoring detailed within the NMP is not consistent with the Development Consent. It is noted that Rix's Creek have well developed and implemented predictive noise and blast management systems in place and these are discussed further in **Section 6.3.2**.
Water Management Plan	The Water Management Plan (WMP) including the Erosion and Sediment Control Plan (ESCP) has been prepared for Rix's Creek Mine and was approved by the DPE on 22 January 2014. The WMP includes the site water balance, surface water and groundwater monitoring program and response plan. Each of these sections is required to be updated to ensure compliance with the Development Consent has been addressed within the WMP, non-compliances and recommendations noted in Section 4 with further detail provided in **Appendix 1**. The ESCP has been developed for the site and is compliant with the Development Consent. It is noted that Rix's Creek has not been diverted in accordance with MOD 4. The WMP will be updated prior to the diversion of Rix's Creek to include updates on monitoring and rehabilitation.

Management Plan	Comments
Landscape Management Plan	The Landscape Management Plan (LMP) has been prepared for Rix's Creek Mine and was approved by the DP&E on 22 January 2014. The LMP is the over-arching document with supporting documents including the Rehabilitation Management Plan, Final Void Management Plan and Mine Closure Plan. Administrative non-compliances with the Development Consent were related to the preparation of the Plans and submission to the DP&E after the required date. Non-compliances and recommendations are noted in Section 4 with further detail provided in **Appendix 1**. The LMP includes a Rehabilitation Management Plan (RMP), Final Void Management Plan and Mine Closure Plan as required by the Development Consent. It is noted that the RMP does not currently reflect the strong rehabilitation practices which are implemented on site and therefore it is suggested that the RMP is updated or prepared as the MOP.
Mining Operations Plan	Rix's Creek developed the Rix's Creek MOP for the period 2013 – 2020 with the MOP approved by DRE on 8 March 2013. It is noted that mining operations undertaken at Rix's Creek Mine appear to have been undertaken out to the disturbance extent as defined in "Map 3G – Mining and Rehabilitation – Year 2020" and therefore the existing ground disturbance at Rix's Creek has been undertaken at a rate which is in advance of the approved stage plans within the MOP for 2016. Rehabilitation is progressing in accordance with the schedules for rehabilitation as noted in the Rix's Creek MOP. As noted in **Section 6.2.1**, Rix's Creek are currently liaising with DRE and DPE in regards to the location of site emplacement areas and the extent of mining undertaken at Rix's Creek.

The following is the Companies reply to the Audit report with acition plan to address issues identified.

Table 41 Non Compliances with Development Consent (DA49/94) - From Audit Report

Condition	Non-Compliance	Risk Level	Action Plan
Schedule 2, Condition 1A	Not all of the conditions of the Project Approval have been complied with. See risk ratings for each individual condition.	**Low**	Addressed through the implementation of this Action Plan
Schedule 2, Condition 3	Non-compliances have been recorded during the audit period for legislative acts and agencies as detailed within this condition and these are discussed in Section 4 of the report.	**Low**	Addressed through the implementation of this Action Plan
Schedule 2, Condition 6(c)	No formal building maintenance program was implemented to specifically review the maintenance of buildings.	**Administrative**	Addressed through the updating of the Landscaping Plan
Schedule 2, Condition 7	Site lighting has not been confirmed with Singleton Council that it is managed to their satisfaction.	**Administrative**	Condition updated in MOD 8 and will be included in Annual Review.
Schedule 2, Condition 9	The Traffic Management Plan was not approved by the Secretary prior to the commencement of the tunnel construction activities.	**Administrative**	No Action Necessary
Schedule 2, Condition 11	Noise monitoring is not undertaken in accordance with the requirements of this condition as noise monitoring is not undertaken on a quarterly basis, monitoring is undertaken on a 6 monthly basis.	**Low**	Condition updated in MOD 8 and will be addressed with the review of the Noise Management Plan to be submitted by 30th April 2017.
Schedule 2, Condition 14	• The area of disturbance onsite reflected the extent of disturbance as approved at the end of the MOP term (2020) and therefore ground disturbance was ahead of the schedule within the MOP; and • Not all sprays on site, including the coal stockpile, are automatic.	**Medium**	Condition updated in MOD 8 and will be addressed with the review of the Air Quality & Green House Gas Management Plan to be submitted by 30th April 2017. Also under investigation by DRE.
Schedule 2, Condition 14A	No evidence was available to confirmation that the NGERS Report had been undertaken to the satisfaction of the Secretary.	**Administrative**	Condition updated in MOD 8 and will be addressed with the review of the Air Quality & Green House Gas Management Plan to be submitted by 30th April 2017.

Condition	Non-Compliance	Risk Level	Action Plan
Schedule 2, Condition 15	• Sections of the Water Management Plan did not include the information required below: - Describe measures to minimise water use by the development. - detail that visual monitoring of flow volume will be undertaken. - process for monitoring yield into the open cut. - process for monitoring impacts to baseflow and offsetting as required any loss of base flow, impacts to private land owners caused by Rix's Creek Operations.	**Low**	Water Management Plans to be updated to address these issues and submitted for approval following MOD 8
Schedule 2, Condition 16A	• A copy of the Landscape Management Plan marked 'final' was not forwarded to the Singleton office as requested by the DP&E. • The Final Void Management Plan was not submitted to the DP&E by the due date. • The Mine Closure Plan was not submitted to the DP&E by the due date.	**Administrative**	Landscape Management Plan to be updated following MOD 8 and submitted for approval.

Condition	Non-Compliance	Risk Level	Action Plan
Schedule 2, Condition 16B	• Sections of the Rehabilitation Management Plan did not include the information required below: - procedure to protect vegetation and soil outside the disturbance areas. - procedure to manage impacts on fauna. - procedure to landscape the site to minimise visual impacts. - procedure to conserve and reuse topsoil. - information regarding the salvage and re-use of material. - monitoring program to include all measures in 16B(v) and effectiveness of these measures. - clearly state who is responsible for monitoring and reviewing the plan.	**Low**	Rehabilitation Management Plan to be updated following MOD 8 and submitted for approval as component of Landscape Management Plan.
Schedule 2, Condition 16D	• Sections of the Mine Closure Plan did not include the information required below: - objectives and criteria for mine closure for ML 1432 and completion criteria for each domain. -	**Low**	Mine Closure Plan to be updated following MOD 8 and submitted for approval as component of Landscape Management Plan.
Schedule 2, Condition 19	• Sections of the Annual Environmental Management Reports/Annual Review did not include the information required below: - updated water balance for the reporting year not included each year as required *Note it was included in 2015 Annual Review.* - not all reports were submitted by the due date. - Specific targets for the next year have not been included in the 2011 2015 reports.	**Low**	To be updated in Annual Review for 2015 to be submitted 31st March 2017

Condition	Non-Compliance	Risk Level	Action Plan
Schedule 2, Condition 28	Not all management plans / programs were revised following the submission of an incident report under Condition 19 or modifications of the Development Consent to the satisfaction of the Secretary.	**Low**	Procedure to be developed to address this requirement to revise strategies, plans and programs.
Schedule 2, Condition 29	• Management plans have not been updated as required by Condition 28 of the Development Consent. • Some management plans have been updated without consultation being undertaken with all parties nominated by the Development Consent. No agreement with the Secretary was sought to revise the management plans without consultation with relevant parties.	**Low**	Procedure to be developed to address this requirement to revise strategies, plans and programs.

Table 42 Non Compliances with EPL 3391 From Audit Report - From Audit Report

Condition	Non-Compliance	Risk Level	Action Plan
M2.1	During the audit period, there have been a number of instances where dust gauges have not been able to be sampled due to the dust gauge being broken. These non-compliances have been reported annually to the EPA in the Annual Return.	**Low**	EPL has been varied December 2016 to remove deposition gauges monitoring
L1.1	Overflow of sediment dams and mine water dam at clean coal stockpile, rail loading facility and mine water dam (DWD 3) (see **Section 6.2.2**).	**Low**	
L2.2	Five deliveries of waste oil were received without analysis undertaken to confirm quality limits as prescribed within the EPL had been met. It is noted that Rix's Creek has ceased utilising waste oil within blasting activities on site.	**Administrative**	Waste oil exemption expired. No waste oil will be received until exemption renewed.

Table 43 Non-Compliances With Mining Authorities - From Audit Report

Lease	Non-Compliance	Risk Level	Action Plan
ML 1432 – Condition 2(d) and CL 352 – Condition 3(a) and (b)	Ground disturbance at Rix's Creek has been undertaken at a rate which is in advance of the approved stage plans within the MOP for 2016.	**Medium**	Under investigation by DRE
CL 352 – Condition 2(b)(i)(A)	During the audit period, five incidents were reported related to the overflow of sediment dams and water release to Rix's Creek due to a pipeline leakage and seepage from old underground workings. This is further detailed in **Section 6.2.2**.	**Low**	

Table 44 Consolidated Recommendations - From Audit Report

Condition / Issue	Recommendation	Action Plan
Rix's Creek Mine Development Consent (DA49/94)		
Schedule 2, Condition 4	The Annual Review is to include a summary table which details the total BCM of material moved at Rix's Creek to demonstrate compliance with this condition. Note it was confirmed Rix's Creek have complied with this condition during the audit period.	To be included in Annual Review
Schedule 2, Condition 6(c)	Formal building maintenance program to be developed and included in the Landscape Management Plan.	Addressed through the updating of the Landscaping Plan
Schedule 2, Condition 7	Confirmation should be sought from Singleton Council that site lighting is managed to their satisfaction.	Condition up dated Mod 8 - Dec 2016:- To be included in Annual Review to be submitted by 31st March 2017
Schedule 2, Condition 10	The approach with regard to noise compliance monitoring to meet this condition should be agreed with DPE and EPA and included within the Noise Management Plan for approval.	Condition updated in MOD 8 and will be addressed with the review of the Noise Management Plan to be submitted by 30th April 2017.

Condition / Issue	Recommendation	Action Plan
Schedule 2, Condition 11	Noise monitoring is to be undertaken on a quarterly basis in accordance with the requirements of this condition unless approval is received from DPE and EPA to suggest otherwise. Any approved changes to the monitoring requirements under this condition should be included in the noise management plan.	Condition updated in MOD 8 and will be addressed with the review of the Noise Management Plan to be submitted by 30th April 2017.
Schedule 2, Condition 13	A formal procedure should be prepared to outline the process that is followed onsite to assess and manage operations when the average hourly wind velocity exceeds 10 metres per second.	Formal procedure to be included in updated in the review of the Air Quality & Green House Gas Management Plan to be submitted by 30th April 2017.
Schedule 2, Condition 14	Rix's Creek to work with DRE and seek to amend the MOP to address the extent of current mining disturbance and include in the revised MOP an appropriate rehabilitation schedule. Rix's Creek to consult with DPE regarding the need to install automatic dust sprays at coal stockpiles on site.	Issue being investigated by DRE.
Schedule 2, Condition 14A	Include findings of the NGERs report in the Annual Review for submission to DPE.	To be included in Annual Review to be submitted by 31st March 2017

Condition / Issue	Recommendation	Action Plan
Schedule 2, Condition 15	Water Management Plan to be updated to include the following as required by the condition: • Inclusion of the water minimisation measures identified and implemented on site within the Water Management Plan. • Detail that visual monitoring of flow volume will be undertaken. • Detail process for monitoring yield into the open cut. • Detail the process for monitoring impacts to baseflow and offsetting as required any loss of base flow and impacts to private land owners caused by Rix's Creek Operations.	Water Management Plans to be updated to address these issues and submitted for approval following MOD 8
Schedule 2, Condition 16A	A copy of the Landscape Management Plan marked 'final' should be forwarded to the DPE Singleton office.	Landscape Management Plan to be updated following MOD 8 and submitted for approval.

Condition / Issue	Recommendation	Action Plan
Schedule 2, Condition 16B	Rehabilitation Management Plan to be updated to include the following as required by the condition: • Procedure to protect vegetation and soil outside the disturbance areas to be included in the monitoring protocol. • Procedure to manage impacts on fauna to be included in the monitoring protocol. • Procedure to landscape the site to minimise visual impacts to be included in the monitoring protocol. • Information regarding the salvage and re-use of material to be included in the RMP as the re-use of material was observed to be leading practice during the field inspection. • Monitoring program to include all measures in 16B (v) and effectiveness of these measures to be reported in the Annual Review. • Clearly state who is responsible for monitoring and reviewing the plan.	Rehabilitation Management Plan to be updated following MOD 8 and submitted for approval as component of Landscape Management Plan.
Schedule 2, Condition 16D	Mine Closure Plan to be updated to include the following as required by the condition: • Include objectives and criteria for mine closure for ML 1432 and completion criteria for each domain in the Mine Closure Plan.	Mine Closure Plan to be updated following MOD 8 and submitted for approval as component of Landscape Management Plan.

Condition / Issue	Recommendation	Action Plan
Schedule 2, Condition 19	Ensure each year that the Annual Review includes the following as required by the condition: • Provide updated water balance for the reporting year. • Specific targets for improved environmental performance.	To be included in Annual Review to be submitted by 31st March 2017
Schedule 2, Condition 27	Report waste volumes in the Annual Review compared to previous years to enable identification of waste management performance over time.	To be included in Annual Review to be submitted by 31st March 2017
Schedule 2, Condition 28 and 29	A process of regular review and revision of management plans should be established to confirm compliance with these conditions.	Procedure to be developed to address this requirement to revise strategies, plans and programs.

Environment Protection Licence		Action Plan	
EPL Variation	An EPL variation should be sought to ensure that there are no conflicting criteria between the EPL and DA (example noise criteria).	EPL has been varied December 2016 to remove deposition gauges monitoring	
Mining Authorities			
ML 1432 – Condition 2(d) and CL 352 – Condition 3(a) and (b)	Rix's Creek should work with DRE and seek to amend the MOP to address the extent of current mining disturbance and include in the revised MOP an appropriate rehabilitation schedule.	Investigation being undertaken by DRE.	

SECTION 11 – INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

Two (2) reportable environmental incident occurred at the Rix's Creek Mine during the 2016 reporting period both relating to to passive release of water offsite. A summary of the reportable incidents are presented below. The Incident reports with diagrams of the locations of the events can be found in **Appendix 6**.

Passive release of water offsite 4/1/2016 – 7/1/2016

During the period from 4/1/2016 to 7/1/2016 a significant rainfall event occurred across the region with the site receiving 141.5 mm.

This rainfall event produced significant runoff across the site. Water management structures filled with some filling to capacity and overflowing as a result of the excessive runoff. Previous analysis of rainfall data from April 2015 indicates this 2016 event matches an Annual Exceedance Probability of 10% or a 1-in-10 year rainfall intensity storm.

This incident was reported to EPA on 7th January, 2016 at 9:30 am and was logged with Reference Number: - C00220-2016. The Department of Planning and Environment, and NSW Division of Resources & Energy (DRE) were verbally notified by telephone.

Potential discharge off site Friday 22 January 2016

This potential seepage from the dam at full capacity may have resulted in water leaving the mine site via Rix's Creek. Due to recent rainfall on Friday 22nd January the creek is experiencing flow conditions upstream and downstream of the potential source of mine water entry.

On inspection of the dam this morning by Rix's Creek personnel, all pumps transferring water into the dam were ceased. A main pump permanently positioned in the dam to provide water to the nearby water-fill station was used to decrease the dam levels into another mine water storage dam. Water samples were taken of the dam (DWD3), upstream of Rix's Creek and downstream of Rix's Creek today. Water sampling was also conducted on Friday 22nd January 2016 at the same locations as part of the monthly surface water regime which will also be used for water quality reference.

The incident was reported to the EPA and was logged with Reference Number: C01142-2016. The Department of Planning and Environment, and NSW Division of Resources & Energy (DRE) were verbally notified by telephone.

SECTION 12 – ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

The operations for the coming year will be similar to 2016. Mining will be focussed in the West Pit (Pit 3) at Rix's Creek South and Camberwell Pit operations at Rix's Creek North. Due to coal advances in the West Pit a majority of overburden from the West Pit will be placed in the Arites Pit until coal reserves move in a northward fashion. Camberwell Pit mining will process in a southerly manner with pre stripping to the south west of Camberwell Pit to be completed. The overburden placement will be dumped from the eastern section of Camberwell pit and transition to the west in 2017 as per the Mining Operation Plan.

Further improvements to the Rix's Creek Real time SCADA system will be completed in 2017 to assist mining operation to make informed decisions under adverse weather conditions. This will involve the integration of existing real-time dust trac monitors situated around the Rix's Creek South operations into the SCADA network, as well as the integration of both met stations onto one real time system to form a complex wide real time monitoring system.

Environmental management is an ongoing process at Rix's Creek with continual improvement being made to the existing systems already in place. Management plans will require updating in 2017 to standardise processes across both Rix's Creek North and Rix's Creek South operations. Table 46 refers to the Environmental Performance Improvement Activities for the 2017 period.

Table 45 Environmental Performance Improvement Activities

Environmental Performance Improvement Activities	Target Date
Rix's Creek Real time SCADA system updates to combine air quality monitoring stations and meteorological stations onto one real-time monitoring framework	Q4 2017
Rix's Creek Mine Combined Water Management Plan	Q4 2017
Rix's Creek Mine Rehabilitation Progression	Q1-Q4 2017
Continued upgrades/ validation to the Environmental Forecasting Tools used at Rix's Creek Mine.	Q4 2017
The Target date for the Surrender of DA49/94 is October 2019 or sooner depending if SSD_6300 Rix's Creek Mine Continuation Project is approved.	October 2019

SECTION 13 MANAGEMENT PLAN REVIEW

Management Plans are required to be updated when a review triggered. An update can be triggered by any of the following:-

- Action from independent environmental audit;
- Submission of Annual Review;
- Approval modification;
- Result of an environmental incident; and
- Change to the operation.

The management plans for both RCN and RCS as required under their relevant approvals are listed in **Error! Reference source not found.** along with their relevant status.

Table 46 Environmental Management Plans

Approval Authority	Approval Date	Title
Rixs Creek North		
Department Planning & Environment (DPE)	19/2/2016	Noise Management Plan
DPE	19/2/2016	Blast Management Plan
DPE	19/2/2016	Air Quality & Greenhouse Gas Management Plan
DPE	19/2/2016	Water Management Plan
DPE	Pending	Biodiversity Management Plan to be updated following the determination Mod 4 by the PAC- Feb 2016
DPE	19/2/2016	Heritage Management Plan
DPE	19/2/2016	Waste Management Plan
DRE	16/1/2016	Mining Operations Plan (MOP) which becomes the Rehabilitation Management Plan
Rixs Creek South		
DPE	Submitted 1996	Landscaping Plan
DPE	2011	Transport Management Plan – Cut & Cover Tunnel
DPE	16/2/2016	Noise Management Plan
DPE	Not Triggered	Construction Noise Management Plan for Rail Loop
DPE	30/4/2017	Blast Management Plan
DPE	30/4/2017	Air Quality & Green House Gas Management Plan
DPE	22/1/2014	Water Management Plan
DPE	22/1/2014	Landscape Management Plan
	"	- Rehabilitation Management Plan

	" "	- Final Void Management Plan
		- Mine Closure Plan
DPE	Not Triggered	Biodiversity Management Plan – Rail Loop
DPE	Not Triggered	Heritage Management Plan – Rail Loop
DRE	8/3/2013	Mining Operations Plan (MOP) which becomes the Rehabilitation Management Plan
Integrated Management Plan to cover Rixs Creek North & Rixs Creek South Operation		
DPE	Pending by 30/4/2017	Noise Management Plan
DPE	Pending by 30/4/2017	Blast Management Plan
DPE	Pending by 30/4/2017	Air Quality & Greenhouse Gas Management Plan
DPE	Being Developed	Water Management Plan

Appendix 1 Air Quality Monitoring Data

	Rix's Creek Dust Deposition Insoluble Solids 2016														
	c = Contaminated Result														
	ns = no sample														
Gauge	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**Max**	**Min**	**Avg**
1	1.3	0.9	0.9	0.8	1.5	0.6	1.6	1.8	1.9	**8.2c**	**23.0c**	1.4	1.9	0.6	1.3
2	1.1	0.9	2.7	2.9	1.4	1.6	1.3	1.2	1.6	1.2	2.1	1.2	2.9	0.9	1.6
3	1.4	2.3	1.0	1.5	1.1	1.8	1.3	1.4	1.8	1.8	1.7	1.3	2.3	1.0	1.5
5	1.4	1.4	1.6	1.7	1.7	3.5	2.5	1.4	3.3	2.2	3.1	1.1	3.5	1.1	2.1
6	0.8	1.7	**6.2c**	**5.8c**	2.7	3.4	2.3	2.6	4.7	3.7	4.2	2.6	4.7	0.8	2.9
7	0.9	0.9	2.9	2.1	1.5	2.1	1.2	1.1	1.5	**4.1c**	2.3	**5.8c**	2.9	0.9	1.7
8	0.7	**20c**	1.0	1.0	1.2	0.9	1.1	0.4	0.7	1.9	1.7	0.6	1.9	0.4	1.0
9	1.4	0.6	2.3	1.2	2.5	0.7	1.9	1.1	1.8	1.7	2.2	1.4	2.5	0.6	1.6
10	0.6	1.2	1.5	0.9	1.4	1.0	0.8	0.9	1	0.7	1.4	0.5	1.5	0.5	1.0
11	0.6	1.4	1.2	**4.3c**	2.3	1.0	0.8	0.9	1.2	**3.7c**	1.9	2.0	2.3	0.6	1.3
13	0.5	1.8	1.1	0.9	1.8	1.2	1.3	1.2	1.8	2.2	2.2	3.4	3.4	0.5	1.6
14	1.8	1.3	2.7	1.4	1.0	1.9	2.2	1.4	2.3	3.1	2.7	2.5	3.1	1.0	2.0
15	4.2	1.3	1.0	1.3	**4.2c**	2.2	2.9	2.2	1.1	0.7	**2.8c**	1.3	4.2	0.7	1.8
16	1.3	1.2	**4.7c**	**8.9c**	3.4	2.0	1.3	1.5	1.9	3.2	2.8	2.7	3.4	1.2	2.1
17	1.6	1.2	0.8	0.8	1.7	2.6	1.4	1.4	1.7	1.6	2.7	2.3	2.7	0.8	1.7
18	0.7	0.9	1.5	1.2	1.6	1.4	0.9	1.1	1.4	1.4	1.9	2.0	2.0	0.7	1.3
19	**27.7c**	**4.9c**	**4.1c**	2.8	1.1	1.8	2.1	1	1.5	**4.1c**	2.6	**4.9c**	2.8	1.0	1.8
20	1.5	1.4	1.3	1.4	2.4	2.1	1.8	1.9	2.7	1.9	2.7	1.3	2.7	1.3	1.9
21	1.4	**2.1c**	3.8	0.9	1.2	1.3	1.2	1.6	1.7	1.3	2.1	1.1	3.8	0.9	1.6
22	0.7	1.1	1.3	1.5	1.7	1.2	1.1	1.3	1.8	1.6	2.7	1.8	2.7	0.7	1.5
23	5.8	2.0	2.3	1.9	2.8	1.9	1.7	1.2	2.9	2	3.1	1.9	5.8	1.2	2.5
25	0.9	1.9	4.0	1.8	2.9	2.9	1.6	**17.5c**	4.4	2.1	3.0	**4.8c**	4.4	0.9	2.6
26	0.7	1.1	1.5	0.2	1.2	**ns**	0.9	**4c**	0.8	0.8	1.3	2.0	2.0	0.2	1.1
27	2.8	3.2	2.6	2.4	3.4	3.9	**7.9c**	2.1	**18.8c**	**2.8c**	**4.4c**	2.0	3.9	2.0	2.8
28	0.7	1.1	1.2	1.6	1.3	1.7	1.0	1.5	3.2	2	2.2	2.9	3.2	0.7	1.7
29	1.1	1.2	0.9	0.8	1.5	1.5	1.4	1.3	3.3	1.8	2.0	2.8	3.3	0.8	1.6
30	1.5	**3.8c**	4.4	1.8	1.3	1.0	0.9	1.4	1	**14.0c**	2.1	2.3	4.4	0.9	1.8
31	0.8	1.1	2.7	1.2	**2.7c**	1.7	1.3	**5c**	1.4	0.7	1.7	2.3	2.7	0.7	1.5
32	1.7	1.5	0.8	1.3	2.0	2.8	1.8	2.1	2.9	3.5	3.3	2.0	3.5	0.8	2.1
33	1.6	1.1	1.0	0.9	1.1	1.1	0.6	0.9	1.2	1.3	2.0	1.3	2.0	0.6	1.2

TOTAL SUSPENDED PARTICILATES 2016 (ug/m3)				
	Date	Retreat Site	Mines Rescue Site	Rix's Creek Site
1	6-Jan-16	9	12	11
2	12-Jan-16	**99**	81	**118**
3	18-Jan-16	23	23	26
4	24-Jan-16	43	39	41
5	30-Jan-16	58	44	57
6	5-Feb-16	38	32	40
7	11-Feb-16	26	23	42
8	17-Feb-16	48	48	81
9	23-Feb-16	27	25	55
10	29-Feb-16	24	22	49
11	6-Mar-16	30	22	72
12	12-Mar-16	35	33	36
13	18-Mar-16	50	40	58
14	24-Mar-16	27	30	31
15	30-Mar-16	54	48	53
16	5-Apr-16	33	31	37
17	11-Apr-16	82	84	**93**
18	17-Apr-16	32	34	43
19	23-Apr-16	22	23	20
20	29-Apr-16	52	57	63
21	5-May-16	65	56	73
22	11-May-16	**99**	70	82
23	17-May-16	**118**	**108**	**127**
24	23-May-16	**131**	87	**155**
25	29-May-16	84	53	54
26	4-Jun-16	10	9	10
27	10-Jun-16	49	37	38
28	16-Jun-16	63	42	41
29	22-Jun-16	57	38	44
30	28-Jun-16	58	41	64
31	4-Jul-16	81	59	55
32	10-Jul-16	26	24	22
33	16-Jul-16	55	49	54
34	22-Jul-16	45	44	46
35	28-Jul-16	81	59	65
36	3-Aug-16	25	19	19
37	9-Aug-16	56	67	65
38	15-Aug-16	46	41	44
39	21-Aug-16	74	66	73
40	27-Aug-16	55	47	46
41	2-Sep-16	22	21	24

42	8-Sep-16	30	23	17
43	14-Sep-16	32	25	29
44	20-Sep-16	72	49	73
45	26-Sep-16	88	64	78
46	2-Oct-16	52	42	53
47	8-Oct-16	**120**	86	**95**
48	14-Oct-16	41	41	37
49	20-Oct-16	37	31	32
50	26-Oct-16	**106**	**112**	**139**
51	1-Nov-16	63	51	66
52	7-Nov-16	**110**	**125**	**159**
53	13-Nov-16	74	53	72
54	19-Nov-16	77	85	90
55	25-Nov-16	83	75	87
56	1-Dec-16	59	60	65
57	7-Dec-16	29	20	28
58	13-Dec-16	**91**	**105**	**146**
59	19-Dec-16	31	26	36
60	25-Dec-16	20	23	19
61	31-Dec-16	77	80	89
	Runs	61	61	61
	DNR	0	0	0
	% run	100.00%	100.00%	100.00%
	Maximum	**131**	**125**	**159**
	Minimum	9	9	10
	Average	55.8	48.6	59.6
	Results >90 ug/m3 Annual Average Limit	8	4	8

Bold – results > 90 *u*g/m^3 - annual average limit (EPA Air Quality Assessment Criteria)

Laboratory reports are available upon request from the Company.

Rix's Creek Particulate Matter <10 Micron Results 2016				
	Date	1	2	3
		Rix's Creek site	Mines Rescue Site	Retreat Site
1	6-Jan-16	7	5	6
2	12-Jan-16	48	36	42
3	18-Jan-16	11	13	10
4	24-Jan-16	23	18	22
5	30-Jan-16	24	19	21
6	5-Feb-16	17	16	16
7	11-Feb-16	18	10	8
8	17-Feb-16	37	20	22
9	23-Feb-16	29	9	9
10	29-Feb-16	19	8	8
11	6-Mar-16	31	11	10
12	12-Mar-16	17	14	11
13	18-Mar-16	21	15	16
14	24-Mar-16	15	13	12
15	30-Mar-16	19	14	16
16	5-Apr-16	18	15	14
17	11-Apr-16	44	34	35
18	17-Apr-16	23	19	17
19	23-Apr-16	11	14	10
20	29-Apr-16	31	28	24
21	5-May-16	27	20	28
22	11-May-16	31	20	30
23	17-May-16	40	33	37
24	23-May-16	51	28	38
25	29-May-16	11	10	19
26	4-Jun-16	4	4	3
27	10-Jun-16	10	10	13
28	16-Jun-16	17	20	20
29	22-Jun-16	12	11	11
30	28-Jun-16	6	10	17
31	4-Jul-16	21	21	21
32	10-Jul-16	10	13	11
33	16-Jul-16	27	26	19
34	22-Jul-16	17	17	11
35	28-Jul-16	14	13	16
36	3-Aug-16	4	5	4
37	9-Aug-16	25	21	20
38	15-Aug-16	21	20	17
39	21-Aug-16	18	19	16
40	27-Aug-16	18	20	16
41	2-Sep-16	8	9	6
42	8-Sep-16	8	11	10
43	14-Sep-16	15	12	13
44	20-Sep-16	18	14	16
45	26-Sep-16	24	17	16
46	2-Oct-16	20	12	14
47	8-Oct-16	35	25	27

48	14-Oct-16	11	11	9
49	20-Oct-16	15	14	15
50	26-Oct-16	51	36	25
51	1-Nov-16	22	16	16
52	7-Nov-16	57	46	31
53	13-Nov-16	38	21	30
54	19-Nov-16	39	39	34
55	25-Nov-16	25	24	25
56	1-Dec-16	25	23	22
57	7-Dec-16	6	6	8
58	13-Dec-16	56	41	32
59	19-Dec-16	18	13	15
60	25-Dec-16	9	13	6
61	31-Dec-16	46	41	39
	Runs	61	61	61
	DNR	0	0	0
	%	100%	100%	100%
	Maximum	57	46	42
	Minimum	4	4	3
	Average	23	18	18
	Results >50 ug/m3	4	0	0

Bold – results > 50 *u*g/m^3 – daily air quality limit over a 24 hour averaging period (EPA Air Quality Assessment Criteria)

Laboratory reports are available upon request from the Company.

Appendix 2 Blast Results

BLAST RESULTS 2016

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
12/01/2016									
	2:26 PM								
		WE08 Hebden Presplit							
			6.5	*260*	*0*				
						0.17	88.1	Thornton	RETREAT
						0.59	95.5	Mines	SINGLETON
						1.23	85.6	Wright	Maison Dieu
						0.15	100.4	Ernst /	NEH
14/01/2016									
	9:05 AM								
		WS12 Lemington 41/42							
			5.8	*306*	*0*				
						0.12	97.2	Mines	SINGLETON
						0.05	95.7	Thornton	RETREAT
						0.24	99.7	Wright	Maison Dieu
						0.13	99.2	Ernst /	NEH
18/01/2016									
	2:24 PM								
		WP10 PG28							
			2.3	*109*	*0*				
						0.52	94.6	Wright	Maison Dieu
						0.09	86.9	Ernst /	NEH
						0.14	87.4	Thornton	RETREAT
						0.17	84.8	Mines	SINGLETON
22/01/2016									
	2:30 PM								
		WE08 Hebden Presplit							
			3.5	*17*	*0*				
						0.19	97.7	Thornton	RETREAT
						0.99	95.2	Wright	Maison Dieu
						0.22	91.3	Ernst /	NEH
						0.4	81.6	Mines	SINGLETON
2/02/2016									
	2:25 PM								
		WP10 L21 Presplit							
			3	*327*	*0*				
						0.76	97.5	Mines	SINGLETON
						0.47	99.2	Thornton	RETREAT
						1.69	100.4	Wright	Maison Dieu
						0.58	85.9	Ernst /	NEH
5/02/2016									
	11:14 AM								
		WS11 L20							
			7.5	*155*	*0*				
						0.08	93.7	Mines	SINGLETON
						0.05	107.8	Ernst /	NEH
						0.04	105.4	Thornton	RETREAT
						0.18	105.7	Wright	Maison Dieu

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / OVERPRESSURE dBL		LOCATION	
	11:44 AM	WS11 L16/17	6.5	163	0			
					0.07	98	Mines	SINGLETON
					0.04	101.5	Thornton	RETREAT
					0.1	84.4	Wright	Maison Dieu
					0.06	89.3	Ernst /	NEH
12/02/2016								
	2:27 PM	WP10 A25 #1	4.3	101	0			
					0.51	105.4	Ernst /	NEH
					0.64	91.8	Mines	SINGLETON
					0.32	96.8	Thornton	RETREAT
					1.21	107.1	Wright	Maison Dieu
16/02/2016								
	2:30 PM	WP10 A25 #2	3.8	275	0			
					0.23	98.3	Ernst /	NEH
					0.98	96	Wright	Maison Dieu
					0.38	93.5	Mines	SINGLETON
					0.21	95.4	Thornton	RETREAT
17/02/2016								
	2:28 PM	WP10 A25 #3	2	96	0			
					0.57	91.6	Mines	SINGLETON
					0.34	95.4	Thornton	RETREAT
					1.69	99.3	Wright	Maison Dieu
					0.63	90	Ernst /	NEH
18/02/2016								
	2:30 PM	WS12 Lemington 40	3	119	0			
					0.36	93.3	Ernst /	NEH
					0.3	92.8	Mines	SINGLETON
					0.2	93.4	Thornton	RETREAT
					0.52	100.8	Wright	Maison Dieu
22/02/2016								
	2:26 PM	WP10 L21 Presplit	4.3	107	0			
					0.38	88	Mines	SINGLETON
					0.24	81.8	Thornton	RETREAT
					1.03	96.9	Wright	Maison Dieu
					0.42	97.1	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / OVERPRESSURE dBL		LOCATION	
					COMPLAINTS			
23/02/2016								
	2:25 PM							
		WS11 L15						
			2.8	*90*	*1*			
					0.07	93.6	Ernst /	NEH
					0.13	88.5	Mines	SINGLETON
					0.07	87.8	Thornton	RETREAT
					0.23	100.1	Wright	Maison Dieu
26/02/2016								
	11:04 AM							
		WP10 A25						
			6.8	*155*	*0*			
					0.39	90	Ernst /	NEH
					0.91	97.1	Wright	Maison Dieu
					0.42	86	Mines	SINGLETON
					0.25	92.5	Thornton	RETREAT
1/03/2016								
	11:07 AM							
		WE10 Lemington 31/32						
			6.5	*87*	*0*			
					0.39	92.9	Mines	SINGLETON
					0.14	97.7	Thornton	RETREAT
					0.4	95.5	Wright	Maison Dieu
					0.16	91	Ernst /	NEH
3/03/2016								
	11:11 AM							
		WE10 Lemington 31/32						
			2	*155*	*0*			
					0.78	95	Wright	Maison Dieu
					0.2	100	Thornton	RETREAT
					0.34	94.6	Mines	SINGLETON
					0.09	92.3	Ernst /	NEH
8/03/2016								
	11:04 AM							
		WS11 PG29						
			1.3	*74*	*0*			
					0.07	89	Mines	SINGLETON
					0.03	91.1	Thornton	RETREAT
					0.16	100.5	Wright	Maison Dieu
					<0.3	<113	Ernst /	NEH
	11:05 AM							
		WS11 L21						
			1.3	*74*	*0*			
					<0.3	<113	Ernst /	NEH
					0.15	105.7	Wright	Maison Dieu
					0.05	89.7	Thornton	RETREAT
					0.07	89.8	Mines	SINGLETON

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
10/03/2016									
	10:49 AM								
		CN08 A23							
			2.8	*314*	*2*				
						5.2	108.5	Dulwich	Middle
						1.79	94	Ernst /	NEH
						0.34	87.8	Cherry	Middle
						0.78	90.1	Camberwell	Camberwell
						0.15	91	Bridgman	Retreat
11/03/2016									
	2:26 PM								
		WE08 Barrett							
			2	*2*	*0*				
						0.78	95.2	Thornton	RETREAT
						1.31	104.5	Wright	Maison Dieu
						0.29	97.6	Ernst /	NEH
						1.46	90.5	Mines	SINGLETON
16/03/2016									
	11:04 AM								
		WS11 Upper Barrett							
			5.8	*6*	*0*				
						0.06	95.5	Ernst /	NEH
						0.07	92.9	Mines	SINGLETON
						0.04	93.6	Thornton	RETREAT
						0.2	100	Wright	Maison Dieu
17/03/2016									
	2:22 PM								
		WP10 A25							
			2.8	*3*	*0*				
						0.05	89.9	Mines	SINGLETON
						0.04	91.8	Thornton	RETREAT
						0.07	97.7	Wright	Maison Dieu
						0.02	99.9	Ernst /	NEH
18/03/2016									
	10:54 AM								
		CN08 A23							
			4.5	*4*	*0*				
						0.04	89.9	Cherry	Middle
						0.03	89.6	Camberwell	Camberwell
						0.07	96.2	Bridgman	Retreat
						0.02	99.9	Ernst /	NEH
23/03/2016									
	11:00 AM								
		CN08 A23							
			1.5	*2*	*2*				
						0.17	90.4	Bridgman	Retreat
						1.08	87.4	Camberwell	Camberwell
						0.28	89.8	Cherry	Middle
						2.04	93.2	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
7/04/2016									
	11:16 AM								
		WE10 Lemington							
			6.3	116	0				
						0.86	94.6	Wright	Maison Dieu
						0.15	101	Ernst /	NEH
						0.23	90.1	Thornton	RETREAT
						0.41	84.8	Mines	SINGLETON
12/04/2016									
	11:02 AM								
		WP09 L18/19							
			4.3	52	0				
						0.02	89.2	Thornton	RETREAT
						0.06	94.9	Wright	Maison Dieu
						0.1	98.6	Ernst /	NEH
						0.05	93	Mines	SINGLETON
	11:18 AM								
		WS11 PG29							
			4	87	0				
						0.03	98.8	Ernst /	NEH
						0.23	88.8	Mines	SINGLETON
						0.02	80.9	Thornton	RETREAT
						0.08	93	Wright	Maison Dieu
	11:31 AM								
		WS11 L16/17							
			4.8	68	0				
						0.07	99.7	Ernst /	NEH
						0.12	98	Wright	Maison Dieu
						0.06	84.8	Mines	SINGLETON
						0.03	84.4	Thornton	RETREAT
13/04/2016									
	11:07 AM								
		CM L20 Presplit							
			4.5	96	0				
						0.41	96.9	Ernst /	NEH
						0.39	88.9	Camberwell	Camberwell
						0.07	94.8	Cherry	Middle
						0.09	84.7	Bridgman	Retreat
14/04/2016									
	11:07 AM								
		CN06 A23							
			4	100	0				
						0.14	85.4	Cherry	Middle
						0.11	88.1	Bridgman	Retreat
						0.49	96.9	Camberwell	Camberwell
						0.68	101.5	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
15/04/2016									
	11:02 AM								
		WP09 L15	1	333	0				
						0.42	96	Mines	SINGLETON
						0.19	96.9	Thornton	RETREAT
						1.02	104.1	Wright	Maison Dieu
						0.09	86.5	Ernst /	NEH
19/04/2016									
	2:31 PM								
		WE10 Lemington 30	2	187	0				
						0.16	90.6	Wright	Maison Dieu
						0.04	92.4	Ernst /	NEH
						0.05	87.4	Thornton	RETREAT
						0.16	80.9	Mines	SINGLETON
20/04/2016									
	2:27 PM								
		WS11 PG28	4.3	122	0				
						0.03	102.4	Thornton	RETREAT
						0.09	92.2	Wright	Maison Dieu
						0.03	91.3	Ernst /	NEH
						0.04	85.3	Mines	SINGLETON
22/04/2016									
	11:00 AM								
		WS11 PG28	3.3	287	0				
						0.05	91	Mines	SINGLETON
						0.03	89.9	Thornton	RETREAT
						0.15	94.6	Wright	Maison Dieu
						0.06	87.4	Ernst /	NEH
	2:18 PM								
		WS11 Lower Barrett	4	142	0				
						0.04	83	Thornton	RETREAT
						0.26	96.6	Wright	Maison Dieu
						0.08	84.6	Mines	SINGLETON
						0.03	89.6	Ernst /	NEH
27/04/2016									
	2:43 PM								
		WP09 L15	4.3	82	0				
						0.25	85.8	Mines	SINGLETON
						0.15	86	Thornton	RETREAT
						0.4	95.8	Wright	Maison Dieu
						0.05	94.6	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
	2:51 PM	WE10 Lemington 35 Presplit	3.8	92	0			
					0.33	94.4	Ernst /	NEH
					0.27	103.9	Mines	SINGLETON
					0.18	83.9	Thornton	RETREAT
					0.64	95	Wright	Maison Dieu
28/04/2016								
	11:06 AM	CM Arties 24 Camberwell	0.8	213	0			
					0.12	88.6	Bridgman	Retreat
					0.1	88.4	Cherry	Middle
					1.09	94	Ernst /	NEH
					0.98	87.4	Camberwell	Camberwell
	2:21 PM	WS11 L15	1.5	242	0			
					0.08	86.9	Mines	SINGLETON
					0.03	89.5	Thornton	RETREAT
					0.15	100.3	Wright	Maison Dieu
					0.03	86.2	Ernst /	NEH
2/05/2016								
	10:56 AM	CN06 L15 Presplit	4.8	305	0			
					0.1	92.4	Bridgman	Retreat
					0.22	90.7	Cherry	Middle
					0.33	95.8	Camberwell	Camberwell
					0.24	99.5	Ernst /	NEH
4/05/2016								
	11:12 AM	CM08 L20 Presplit	5.8	298	0			
					0.78	89	Ernst /	NEH
					0.74	93.7	Camberwell	Camberwell
					0.23	96.5	Cherry	Middle
					0.13	96	Bridgman	Retreat
5/05/2016								
	11:06 AM	WE10 Lemington 40	3.5	306	0			
					0.86	105.8	Wright	Maison Dieu
					0.17	95.2	Ernst /	NEH
					0.21	107.4	Thornton	RETREAT
					0.33	100.9	Mines	SINGLETON

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
13/05/2016									
	11:06 AM								
		WE08 Hebden 7							
			8.5	*294*	*0*				
						0.11	89.8	Thornton	RETREAT
						0.59	88	Wright	Maison Dieu
						0.03	99.1	Ernst /	NEH
						0.31	92	Mines	SINGLETON
16/05/2016									
	11:03 AM								
		WS11 A25							
			1.5	*82*	*0*				
						0.04	91.1	Ernst /	NEH
						0.08	87.4	Mines	SINGLETON
						0.04	87.9	Thornton	RETREAT
						0.3	99.9	Wright	Maison Dieu
	2:28 PM								
		WE10 Lemington 32							
			1.3	*46*	*0*				
						0.31	95	Wright	Maison Dieu
						0.06	87.2	Ernst /	NEH
						0.21	89.9	Mines	SINGLETON
						0.1	95.7	Thornton	RETREAT
18/05/2016									
	11:05 AM								
		CM10 PG27							
			4.3	*303*	*0*				
						1.19	95.5	Ernst /	NEH
						0.87	92.9	Camberwell	Camberwell
						0.14	85.1	Cherry	Middle
						0.08	95.7	Bridgman	Retreat
	2:37 PM								
		WE08 Hebden 7							
			4.2	*278*	*0*				
						0.17	87.4	Thornton	RETREAT
						0.48	92	Wright	Maison Dieu
						0.34	99.3	Mines	SINGLETON
						0.02	95	Ernst /	NEH
20/05/2016									
	11:03 AM								
		CN06 A23							
			4.7	*282*	*0*				
						0.4	93	Ernst /	NEH
						0.45	88	Camberwell	Camberwell
						0.1	89	Cherry	Middle
						0.09	87.2	Bridgman	Retreat

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
	2:27 PM								
		WE08 Hebden 7							
			3.3	280	0				
						0.35	93	Wright	Maison Dieu
						0.1	85	Thornton	RETREAT
						0.15	92	Mines	SINGLETON
						0.02	83.6	Ernst /	NEH
30/05/2016									
	11:17 AM								
		CN08 A23							
			2.5	303	0				
						0.07	91.1	Ernst /	NEH
						0.08	85.8	Camberwell	Camberwell
						0.03	84.8	Cherry	Middle
						0.08	84.4	Bridgman	Retreat
	2:35 PM								
		WE08 Hebden 7							
			3.5	115	0				
						0.37	87.5	Wright	Maison Dieu
						0.03	88.7	Ernst /	NEH
						0.13	86.4	Thornton	RETREAT
						0.28	95.8	Mines	SINGLETON
		WE10 Lemington							
			3.5	115	0				
						0.1	92	Thornton	RETREAT
						0.46	93.9	Wright	Maison Dieu
						0.06	93.1	Ernst /	NEH
						0.24	92.1	Mines	SINGLETON
31/05/2016									
	11:00 AM								
		WE11 A25							
			2.8	154	0				
						0.07	92.4	Mines	SINGLETON
						0.03	92.5	Thornton	RETREAT
						0.3	101.5	Wright	Maison Dieu
						0.03	91.1	Ernst /	NEH
	11:01 AM								
		WS11 L13							
			2.8	154	0				
						0.05	88.3	Mines	SINGLETON
						0.02	90.2	Ernst /	NEH
						0.03	90.4	Thornton	RETREAT
						0.09	102.5	Wright	Maison Dieu

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
	2:58 PM	WP09 L15 Presplit	3.5	113	0				
						0.34	83	Mines	SINGLETON
						1.24	90.5	Wright	Maison Dieu
						0.32	89.1	Ernst /	NEH
						0.13	86.4	Thornton	RETREAT
1/06/2016									
	11:01 AM	WP09 L15	1.8	63	0				
						0.19	90	Ernst /	NEH
						0.52	94	Mines	SINGLETON
						0.24	97.4	Thornton	RETREAT
						1.06	104.1	Wright	Maison Dieu
	2:26 PM	WE10 Lemington 38	4.5	118	0				
						0.03	100.4	Ernst /	NEH
						0.15	96.1	Wright	Maison Dieu
						0.08	84	Mines	SINGLETON
						0.04	99	Thornton	RETREAT
2/06/2016									
	2:28 PM	WH10 L21	2.5	78	0				
						0.12	86.8	Mines	SINGLETON
						0.05	86.1	Thornton	RETREAT
						0.15	82.4	Wright	Maison Dieu
						0.05	92.5	Ernst /	NEH
3/06/2016									
	11:09 AM	CM10 PG27	3.5	136	0				
						0.15	93.3	Bridgman	Retreat
						0.14	94.8	Cherry	Middle
						1.54	99.1	Camberwell	Camberwell
						1.7	105	Ernst /	NEH
10/06/2016									
	2:19 PM	CM10 PG27	8.5	297	0				
						1.43	99.4	Camberwell	Camberwell
						0.15	99.3	Cherry	Middle
						0.14	100.2	Bridgman	Retreat
						2.32	102.3	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
14/06/2016									
	2:23 PM	WE10 PG28	*2.8*	*298*	*0*				
						0.44	101	Wright	Maison Dieu
						0.1	93.8	Ernst /	NEH
						0.25	91.7	Thornton	RETREAT
						0.6	92	Mines	SINGLETON
17/06/2016									
	11:08 AM	WP09 L15	*2.3*	*282*	*1*				
						0.22	97.4	Thornton	RETREAT
						1.27	105.6	Wright	Maison Dieu
						0.12	83	Ernst /	NEH
						0.47	105.6	Mines	SINGLETON
29/06/2016									
	11:09 AM	CN09 A23	*4.5*	*309*	*0*				
						1.77	93	Ernst /	NEH
						0.8	92	Camberwell	Camberwell
						0.19	92.1	Cherry	Middle
						0.15	94	Bridgman	Retreat
	2:31 PM	WS11 A23	*1*	*246*	*0*				
						0.08	89.5	Mines	SINGLETON
						0.04	91.4	Ernst /	NEH
						0.06	94.1	Thornton	RETREAT
						0.16	103.3	Wright	Maison Dieu
	2:37 PM	WP10 L16 Presplit	*1*	*246*	*0*				
						0.57	87.7	Mines	SINGLETON
						0.37	91.9	Thornton	RETREAT
						1.67	91.3	Wright	Maison Dieu
						0.16	81.7	Ernst /	NEH
4/07/2016									
	11:09 AM	WP10 PG28 Shot #2	*3.8*	*318*	*0*				
						0.09	85.3	Ernst /	NEH
						<0.3	<113	Mines	SINGLETON
						0.19	100	Thornton	RETREAT
						0.42	96.9	Wright	Maison Dieu

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
		WP10 PG28 Shot #3							
			3.8	318	0				
						0.09	85.3	Ernst /	NEH
						0.42	96.9	Wright	Maison Dieu
						<0.3	<113	Mines	SINGLETON
						0.19	100	Thornton	RETREAT
	2:32 PM								
		CN08 A23 #2							
			3.8	278	0				
						1.25	94.6	Ernst /	NEH
						0.92	91.1	Camberwell	Camberwell
						0.12	97.9	Cherry	Middle
						0.17	102.1	Bridgman	Retreat
5/07/2016									
	11:37 AM								
		WE10 Lemington 35							
			3.5	309	0				
						<0.3	<113	Mines	SINGLETON
						0.02	81.3	Ernst /	NEH
						0.03	94	Thornton	RETREAT
						0.07	94.4	Wright	Maison Dieu
11/07/2016									
	11:08 AM								
		CN09 A23 #3							
			6.8	312	0				
						1.7	94.7	Ernst /	NEH
						1.15	95.3	Camberwell	Camberwell
						0.2	108.6	Cherry	Middle
						0.22	107	Bridgman	Retreat
14/07/2016									
	11:05 AM								
		CN08 A22							
			8.3	314	0				
						0.03	92.4	Bridgman	Retreat
						0.02	93.9	Cherry	Middle
						0.07	98.5	Camberwell	Camberwell
						0.13	101	Ernst /	NEH
15/07/2016									
	2:22 PM								
		WE10 Lemington 35							
			1.3	174	0				
						0.16	95.2	Mines	SINGLETON
						0.12	97.9	Thornton	RETREAT
						0.2	94.9	Wright	Maison Dieu
						0.03	96.3	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
		WP10 PG28							
			1.3	174	0				
						0.12	97.9	Thornton	RETREAT
						0.2	94.9	Wright	Maison Dieu
						0.03	96.3	Ernst /	NEH
						0.16	95.2	Mines	SINGLETON
	2:23 PM								
		WS11 Barrett							
			1.3	174	0				
						0.07	90.4	Mines	SINGLETON
						0.03	94.8	Ernst /	NEH
						0.12	99.8	Wright	Maison Dieu
						0.03	97.3	Thornton	RETREAT
19/07/2016									
	11:01 AM								
		CN09 A23 #4							
			8	302	0				
						1.34	101.6	Ernst /	NEH
						1.13	97	Camberwell	Camberwell
						0.13	101	Cherry	Middle
						0.12	103.5	Bridgman	Retreat
	2:27 PM								
		WP10 L16 Presplit							
			5	303	0				
						1.73	90.2	Wright	Maison Dieu
						0.14	82.9	Ernst /	NEH
						0.18	89.5	Thornton	RETREAT
						<0.3	<113	Mines	SINGLETON
30/07/2016									
	10:44 AM								
		WP10 L20							
			2.8	282	0				
						0.15	97.9	Thornton	RETREAT
						0.86	100.5	Wright	Maison Dieu
						0.13	86.5	Ernst /	NEH
						0.18	98.19	Mines	SINGLETON
2/08/2016									
	11:16 AM								
		WP10 L20							
			3.5	148	0				
						0.09	91.6	Ernst /	NEH
						0.21	91.27	Mines	SINGLETON
						0.18	92.8	Thornton	RETREAT
						0.63	99.1	Wright	Maison Dieu

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
10/08/2016									
	11:00 AM	CM09 A23	*8.8*	*302*	*0*				
						0.68	108.1	Ernst / Camberwell	NEH
						0.7	106.8		Camberwell
11/08/2016									
	11:14 AM	WS09 L19/L20	*5*	*282*	*0*				
						0.25	102.4	Wright	Maison Dieu
						0.04	96.8	Ernst / Mines	NEH
						0.04	98.5	Thornton	RETREAT
									SINGLETON
12/08/2016									
	2:26 PM	WS11 A23	*6.8*	*313*	*0*				
								Thornton	RETREAT
						0.16	105.4	Wright	Maison Dieu
						0.03	98.2	Ernst / Mines	NEH
									SINGLETON
15/08/2016									
	2:32 PM	WE10 Lemington 32	*2.8*	*179*	*0*				
						0.11	93.9	Ernst /	NEH
						0.3	96.4	Mines	SINGLETON
						0.16	97.9	Thornton	RETREAT
						0.75	101.4	Wright	Maison Dieu
	2:33 PM	WH08 L20	*2.8*	*179*	*0*				
						0.34	102	Wright	Maison Dieu
						0.09	95.6	Ernst /	NEH
						0.25	97.1	Mines	SINGLETON
						0.22	95.6	Thornton	RETREAT
16/08/2016									
	11:05 AM	CM09 A23 #2	*4*	*319*	*0*				
						0.64	99.6	Ernst / Camberwell	NEH
						1.23	96.5		Camberwell
						0.07	88.1	Cherry	Middle
						0.07	94.4	Bridgman	Retreat

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / OVERPRESSURE dBL		LOCATION	
	2:19 PM	WE10 PG26 Presplit	5	300	0			
					0.12	88.9	Thornton	RETREAT
					1.1	107.5	Wright	Maison Dieu
					<0.3	<113	Mines	SINGLETON
					0.3	96.6	Ernst /	NEH
17/08/2016								
	2:07 PM	CN07 L19	6.5	296	0			
					0.86	103.7	Ernst /	NEH
					0.76	97.7	Camberwell	Camberwell
					0.36	94.6	Cherry	Middle
					0.29	98.5	Bridgman	Retreat
18/08/2016								
	2:40 PM	WP10 L20	2.5	296	0			
					0.06	82.9	Ernst /	NEH
					0.66	99.6	Wright	Maison Dieu
					0.15	90.5	Thornton	RETREAT
					<0.3	<113	Mines	SINGLETON
22/08/2016								
	11:05 AM	CN07 L19 #2	1.8	287	0			
					1	93.7	Camberwell	Camberwell
					0.31	90.5	Cherry	Middle
					0.23	97.8	Bridgman	Retreat
					0.9	102.2	Ernst /	NEH
24/08/2016								
	11:06 AM	WP10 L20	4.5	158	0			
					0.64	96.6	Wright	Maison Dieu
					0.07	86.1	Ernst /	NEH
					0.13	87.3	Thornton	RETREAT
					0.44	87.5	Mines	SINGLETON
26/08/2016								
	10:59 AM	WS11 A25	1.5	311	0			
					0.04	94.6	Thornton	RETREAT
					0.21	97.9	Wright	Maison Dieu
					0.03	90.2	Ernst /	NEH
					0.08	93.6	Mines	SINGLETON

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
29/08/2016									
	2:22 PM	WS11 PG28	*2.8*	*145*	*0*				
						0.14	84.3	Mines	SINGLETON
						0.04	89.2	Thornton	RETREAT
						0.34	102.4	Wright	Maison Dieu
						0.04	91.3	Ernst /	NEH
30/08/2016									
	2:38 PM	WS11 L20	*3.3*	*303*	*0*				
						0.03	94.1	Thornton	RETREAT
						0.14	103.1	Wright	Maison Dieu
						0.28	92.4	Mines	SINGLETON
						<0.3	<113	Ernst /	NEH
1/09/2016									
	11:04 AM	WE10 Lemington	*3.3*	*314*	*0*				
						0.43	101.4	Mines	SINGLETON
						0.17	99.6	Thornton	RETREAT
						0.72	101.4	Wright	Maison Dieu
						0.13	87.7	Ernst /	NEH
6/09/2016									
	2:17 PM	CN07 L19	*4*	*272*	*0*				
						0.46	99.2	Bridgman	Retreat
						0.35	92.3	Cherry	Middle
						1.86	93.4	Camberwell	Camberwell
						1.67	98.1	Ernst /	NEH
8/09/2016									
	2:29 PM	WH08 L20	*2.8*	*189*	*0*				
						0.23	108	Thornton	RETREAT
						0.42	105	Wright	Maison Dieu
						0.06	110.2	Ernst /	NEH
						0.18	104.27	Mines	SINGLETON
13/09/2016									
	2:29 PM	WP09 Hebden Presplit	*0.8*	*304*	*0*				
						<0.3	<113	Mines	SINGLETON
						0.21	91.9	Thornton	RETREAT
						1.89	97.9	Wright	Maison Dieu
						<0.3	<113	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / COMPLAINTS / OVERPRESSURE dBL		LOCATION	
	2:31 PM	WS12 Lemington 40	0.8	304	0			
					0.16	106.9	Thornton	RETREAT
					0.56	100.9	Wright	Maison Dieu
					<0.3	<113	Mines	SINGLETON
					0.19	93.9	Ernst /	NEH
17/09/2016								
	10:13 AM	WS11 Lemington 40	3	323	0			
					<0.3	<113	Mines	SINGLETON
					0.06	93.6	Thornton	RETREAT
					0.29	97.4	Wright	Maison Dieu
					0.11	87.5	Ernst /	NEH
	10:17 AM	WS11 L16/17	3	323	0			
					0.02	87.7	Ernst /	NEH
					<0.3	<113	Mines	SINGLETON
					0.03	97.1	Thornton	RETREAT
					0.13	106.6	Wright	Maison Dieu
20/09/2016								
	11:20 AM	WP09 Hebden Presplit	5	264	0			
					0.03	99.1	Ernst /	NEH
					0.42	99	Wright	Maison Dieu
					<0.3	<113	Mines	SINGLETON
					0.06	84.5	Thornton	RETREAT
	2:50 PM	CM10 L20 Presplit	4.8	278	0			
					1.83	98.4	Ernst /	NEH
					1.75	91.6	Camberwell	Camberwell
					0.54	94.8	Cherry	Middle
					0.27	99.3	Bridgman	Retreat
28/09/2016								
	11:16 AM	WP09 Barrett	1.8	308	0			
					2.38	104.3	Wright	Maison Dieu
					0.2	85.3	Ernst /	NEH
					0.47	111.6	Mines	SINGLETON
					0.72	98	Thornton	RETREAT

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / OVERPRESSURE dBL		LOCATION	
					COMPLAINTS			
	11:17 AM	WS09 A25	1.8	308	1			
					0.07	101.2	Mines	SINGLETON
					0.04	91.9	Thornton	RETREAT
					0.21	105.5	Wright	Maison Dieu
					0.03	87.3	Ernst /	NEH
	2:51 PM	CM10 A23 - Pattern 1	1.5	183	0			
					0.18	99	Cherry	Middle
					0.23	97.6	Bridgman	Retreat
					1.27	97.8	Camberwell	Camberwell
					1.62	103.1	Ernst /	NEH
		CM10 A23 - Pattern 3	1.5	183	0			
					1.62	103.1	Ernst /	NEH
					1.27	97.8	Camberwell	Camberwell
					0.18	99	Cherry	Middle
					0.23	97.6	Bridgman	Retreat
5/10/2016								
	11:03 AM	CN09 L21	8.8	303	0			
					<0.3	<113	Bridgman	Retreat
					0.15	103	Camberwell	Camberwell
					0.25	102.1	Ernst /	NEH
					0.05	106	Cherry	Middle
7/10/2016								
	11:03 AM	WS09 L16/17	6.3	286	0			
					0.11	105.7	Wright	Maison Dieu
					0.04	101.2	Ernst /	NEH
					0.02	96.5	Thornton	RETREAT
					0.07	102.7	Mines	SINGLETON
	11:11 AM	WS11 PG28	7	293	0			
					0.02	93.6	Thornton	RETREAT
					0.14	99	Wright	Maison Dieu
					0.02	99.2	Ernst /	NEH
					0.06	109.9	Mines	SINGLETON

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
11/10/2016									
	11:04 AM								
		WS09 Barrett Crop	*6.8*	*290*	*0*				
						0.1	111.3	Mines	SINGLETON
						0.05	92.8	Thornton	RETREAT
						0.79	101.9	Wright	Maison Dieu
						0.03	100.5	Ernst /	NEH
	11:06 AM								
		WS11 L20	*6.8*	*290*	*0*				
						0.05	99.6	Thornton	RETREAT
						0.15	105.3	Wright	Maison Dieu
						0.07	105.7	Mines	SINGLETON
						0.03	100.6	Ernst /	NEH
12/10/2016									
	11:10 AM								
		CM10 A23 - Pattern 4	*4.8*	*317*	*0*				
						1.61	103.5	Ernst /	NEH
						1.22	92.6	Camberwell	Camberwell
						0.15	100	Cherry	Middle
						0.16	103	Bridgman	Retreat
13/10/2016									
	2:25 PM								
		WS12 L40	*9.5*	*131*	*0*				
						0.12	100	Ernst /	NEH
						0.12	103.3	Mines	SINGLETON
						0.16	102.6	Thornton	RETREAT
						0.43	93	Wright	Maison Dieu
14/10/2016									
	11:04 AM								
		WE10 P29	*3.5*	*84*	*0*				
						0.18	92.1	Ernst /	NEH
						0.39	104.5	Wright	Maison Dieu
						0.14	97.6	Mines	SINGLETON
						0.22	97.9	Thornton	RETREAT

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
	2:22 PM	CN08 A22	4.3	122	0				
						0.25	96.7	Ernst /	NEH
						0.12	91.8	Camberwell	Camberwell
						0.05	84.7	Cherry	Middle
						0.03	97.9	Bridgman	Retreat
19/10/2016									
	11:15 AM	CM10 A23	6.3	286	1				
						1.12	94.8	Camberwell	Camberwell
						0.16	93.6	Bridgman	Retreat
						1.94	98.3	Ernst /	NEH
						0.17	92.9	Cherry	Middle
20/10/2016									
	2:30 PM	WE10 P29	4.3	115	0				
						0.06	96.8	Mines	SINGLETON
						0.36	101.9	Thornton	RETREAT
						0.84	93.4	Wright	Maison Dieu
						0.16	97.4	Ernst /	NEH
		WE10 Presplit	4.3	115	0				
						0.16	97.4	Ernst /	NEH
						0.36	101.9	Thornton	RETREAT
						0.84	93.4	Wright	Maison Dieu
						0.06	96.8	Mines	SINGLETON
21/10/2016									
	11:20 AM	CN09 A22	4.5	318	0				
						0.12	95.1	Ernst /	NEH
						0.06	91	Bridgman	Retreat
						0.08	88.1	Camberwell	Camberwell
						0.02	87.2	Cherry	Middle
25/10/2016									
	11:11 AM	WS09 Crop	6.8	315	0				
						0.05	96.7	Ernst /	NEH
						0.44	111.4	Wright	Maison Dieu
						0.12	101.1	Mines	SINGLETON
						0.06	103.7	Thornton	RETREAT

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / OVERPRESSURE dBL		LOCATION	
					COMPLAINTS			
27/10/2016								
	11:04 AM	WS11 L15	*2.5*	*348*	*0*			
					0.06	100.4	Mines	SINGLETON
					0.05	92	Thornton	RETREAT
					0.2	102.5	Wright	Maison Dieu
					0.04	85.7	Ernst /	NEH
	2:26 PM	WE10 P29	*9.3*	*105*	*0*			
					0.2	94	Thornton	RETREAT
					0.27	88	Mines	SINGLETON
					0.4	98	Wright	Maison Dieu
					0.11	105.1	Ernst /	NEH
28/10/2016								
	11:10 AM	WP10 P29	*6.5*	*131*	*0*			
					0.06	87.5	Wright	Maison Dieu
					0.02	97.8	Ernst /	NEH
					0.03	88.4	Thornton	RETREAT
					0.04	84.8	Mines	SINGLETON
1/11/2016								
	11:12 AM	WS11 A25	*1*	*182*	*0*			
					0.06	88	Mines	SINGLETON
					0.05	93.8	Thornton	RETREAT
					0.27	100	Wright	Maison Dieu
					0.04	95.3	Ernst /	NEH
2/11/2016								
	2:27 PM	WP11 L19	*5.8*	*313*	*0*			
					0.3	93.6	Wright	Maison Dieu
					0.03	95	Ernst /	NEH
					0.07	90.5	Thornton	RETREAT
					0.08	90.3	Mines	SINGLETON
3/11/2016								
	11:11 AM	CN09 L21	*3.8*	*331*	*0*			
					0.29	87.4	Camberwell	Camberwell
					0.08	89.6	Cherry	Middle
					0.05	89.5	Bridgman	Retreat
					0.45	94.2	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
4/11/2016									
	11:08 AM								
		WS11 L16/17	5	307	0				
						0.1	98.5	Wright	Maison Dieu
						0.04	95	Mines	SINGLETON
						0.04	96.6	Thornton	RETREAT
						0.03	94.4	Ernst /	NEH
8/11/2016									
	11:13 AM								
		CN06 Hebden Presplit	2.8	284	0				
						0.21	90.6	Ernst /	NEH
						0.28	91.6	Camberwell	Camberwell
						0.16	80.3	Cherry	Middle
						0.05	87.3	Bridgman	Retreat
9/11/2016									
	11:14 AM								
		WE08 L20	1.5	330	0				
						0.1	86	Ernst /	NEH
						0.53	101	Wright	Maison Dieu
						0.21	94.4	Thornton	RETREAT
						0.29	93.5	Mines	SINGLETON
		WH08 L19	1.5	330	0				
						0.1	86	Ernst /	NEH
						0.53	101	Wright	Maison Dieu
						0.29	93.5	Mines	SINGLETON
						0.21	94.4	Thornton	RETREAT
11/11/2016									
	11:00 AM								
		CN09 L21	2.3	17	0				
						0.58	91.9	Camberwell	Camberwell
						0.38	96.8	Ernst /	NEH
						0.06	83.9	Cherry	Middle
						0.05	84	Bridgman	Retreat
15/11/2016									
	10:56 AM								
		CM09 L21	0.8	282	0				
						0.1	97.7	Ernst /	NEH
						0.1	91.1	Camberwell	Camberwell
						0.02	85.9	Cherry	Middle
						0.08	84.7	Bridgman	Retreat

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
16/11/2016									
	2:23 PM								
		WE09 L20							
			3	*137*	*0*				
						0.2	94.3	Mines	SINGLETON
						0.06	98.9	Ernst /	NEH
						0.12	88.8	Thornton	RETREAT
						0.41	98	Wright	Maison Dieu
18/11/2016									
	10:59 AM								
		CN08 L21							
			4.3	*323*	*0*				
						0.45	94	Ernst /	NEH
						0.26	97.4	Camberwell	Camberwell
						0.06	85.3	Cherry	Middle
						0.13	89.2	Bridgman	Retreat
22/11/2016									
	2:24 PM								
		WP10 L19							
			1.8	*211*	*0*				
						0.06	85.2	Thornton	RETREAT
						0.29	90.9	Wright	Maison Dieu
						0.02	91.7	Ernst /	NEH
						0.07	87.8	Mines	SINGLETON
24/11/2016									
	2:26 PM								
		WS12 Barrett Crop							
			1.5	*349*	*1*				
						0.14	97.4	Mines	SINGLETON
						0.11	100.4	Thornton	RETREAT
						0.58	107.4	Wright	Maison Dieu
						0.08	100	Ernst /	NEH
25/11/2016									
	11:03 AM								
		CN08 L21							
			3	*309*	*0*				
						0.14	90.6	Camberwell	Camberwell
						0.04	94.9	Cherry	Middle
						0.24	89.2	Ernst /	NEH
						0.03	98	Bridgman	Retreat
	11:27 AM								
		WP10 L19							
			4.3	*314*	*0*				
						0.06	94.6	Mines	SINGLETON
						0.05	90.5	Thornton	RETREAT
						0.17	97.2	Wright	Maison Dieu
						0.02	88	Ernst /	NEH

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec / OVERPRESSURE dBL		LOCATION	
					COMPLAINTS			
29/11/2016								
	2:47 PM	CN08 L21	*5*	*309*	*0*			
					0.1	89.2	Bridgman	Retreat
					0.21	101.7	Camberwell	Camberwell
					0.28	92.4	Ernst /	NEH
					0.03	96.8	Cherry	Middle
30/11/2016								
	11:14 AM	WE10 PG28	*1.8*	*117*	*0*			
					0.24	91	Thornton	RETREAT
					0.72	97.3	Wright	Maison Dieu
					0.11	91.2	Ernst /	NEH
					0.37	88.9	Mines	SINGLETON
1/12/2016								
	11:04 AM	WP10 L19	*4*	*325*	*0*			
					0.02	90.6	Ernst /	NEH
					0.05	88.6	Mines	SINGLETON
					0.06	89.9	Thornton	RETREAT
					0.3	93.9	Wright	Maison Dieu
	2:30 PM	CN08 L21	*5.3*	*333*	*0*			
					0.02	95	Bridgman	Retreat
					0.02	96.6	Cherry	Middle
					0.11	92.5	Ernst /	NEH
					0.06	105.2	Camberwell	Camberwell
2/12/2016								
	11:11 AM	WS09 L21	*4*	*307*	*0*			
					0.2	92.9	Mines	SINGLETON
					0.18	90.9	Thornton	RETREAT
					0.66	101.4	Wright	Maison Dieu
					0.36	94	Ernst /	NEH
6/12/2016								
	10:57 AM	CN08 A3	*2.3*	*116*	*0*			
					0.02	89.2	Bridgman	Retreat
					0.07	97.1	Camberwell	Camberwell
					0.08	105.6	Ernst /	NEH
					0.02	104.8	Cherry	Middle

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	COMPLAINTS	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
9/12/2016									
	11:07 AM								
		WE10 PG28	*7.3*	*286*	*0*				
						0.44	102.5	Mines	SINGLETON
						0.33	105.9	Thornton	RETREAT
						0.94	102.7	Wright	Maison Dieu
						0.19	107.3	Ernst /	NEH
15/12/2016									
	2:03 PM								
		CN07 Hebden Presplit	*6.5*	*99*	*0*				
						0.23	96	Camberwell	Camberwell
						0.12	82.6	Cherry	Middle
						0.26	101.5	Ernst /	NEH
						0.04	85.4	Bridgman	Retreat
		CN08 L14 Presplit	*6.5*	*99*	*0*				
						0.23	96	Camberwell	Camberwell
						0.12	82.6	Cherry	Middle
						0.26	101.5	Ernst /	NEH
						0.04	85.4	Bridgman	Retreat
16/12/2016									
	11:39 AM								
		CN09 L21	*3.3*	*155*	*0*				
						1.25	110.4	Ernst /	NEH
						0.02	75.8	Cherry	Middle
						0.08	87.8	Camberwell	Camberwell
						0.05	84.3	Bridgman	Retreat
19/12/2016									
	2:26 PM								
		WS11 L15	*5.5*	*92*	*0*				
						0.06	89	Thornton	RETREAT
						0.21	103.9	Wright	Maison Dieu
						0.03	100	Ernst /	NEH
						0.06	83.4	Mines	SINGLETON
20/12/2016									
	11:15 AM								
		CN06 L14	*6.5*	*322*	*1*				
						1.13	105	Ernst /	NEH
						1.96	98	Camberwell	Camberwell
						0.54	97.1	Cherry	Middle
						0.25	96.9	Bridgman	Retreat

DATE	TIME	LOCATION	WIND SPEED m/sec	WIND DIRECTION	VIBRATION mm/sec	OVERPRESSURE dBL	LOCATION	
					COMPLAINTS			
21/12/2016								
	11:16 AM							
		WE10 PG28						
			6	*290*	*0*			
					0.57	98.5	Wright	Maison Dieu
					0.16	100	Ernst /	NEH
					0.27	96	Thornton	RETREAT
					0.31	95.3	Mines	SINGLETON
22/12/2016								
	2:19 PM							
		CM09 L21						
			6.5	*79*	*0*			
					0.2	105.4	Ernst /	NEH
					0.3	99.7	Camberwell	Camberwell
					0.03	90.7	Cherry	Middle
					0.02	92.7	Bridgman	Retreat
23/12/2016								
	9:09 AM							
		WS09 L15						
			2.3	*135*	*0*			
					0.04	96.9	Ernst /	NEH
					0.18	110.2	Wright	Maison Dieu
					0.05	93.7	Mines	SINGLETON
					0.03	99.9	Thornton	RETREAT

Appendix 3 2016 Noise Monitoring Report


Rix's Creek Coal Mine
Environmental Noise Monitoring
Annual Report - 2016
Prepared for
Rix's Creek Pty Limited
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Noise and Vibration Analysis and Solutions
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Rix's Creek Coal Mine

Environmental Noise Monitoring
Annual Report – 2016

Reference: 17394_R01
Report date: 10 October 2017

Prepared for
Rix's Creek Pty Limited
PO Box 4
East Maitland NSW 2323

Prepared by
Global Acoustics Pty Ltd
PO Box 3115
Thornton NSW 2322

Prepared:	Ronni Maciejowski Acoustics Technician	QA Review:	Tony Welbourne Director

Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

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Appendices

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Rix's Creek Pty Ltd (RCM) to provide a review of the their operations performance against predictions made in the environmental assessment documents for both Rix's Creek South (RCS), and the former Integra Open Cut Project Mine, now known as Rix's Creek North (RCN) for the annual review period between 1 January and 31 December 2016.

RCM is located less than 10 kilometres north-west of Singleton, NSW. A Noise and Blasting Impact Assessment was conducted in 2009 to assess noise impacts as part of the Environmental Assessment (EA) for consolidation of the development consent for RCN (formerly Integra Mine). An acoustic assessment was also conducted as part of the Environmental Impact Statement (EIS) for a modification to the RCS development consent in 1995.

As part of project approval requirements and the Noise Management Plan (NMP), noise compliance monitoring is conducted at locations surrounding RCM. Quarterly attended noise monitoring, conducted during the 2016 reporting period has been described in this report.

The survey purpose of attended monitoring is to quantify and describe the existing acoustic environment around the site and compare results with relevant limits. Comparisons were also made between environmental noise monitoring results and model predictions from the RCN (formerly Integra Mine) 2009 Environmental Assessment and the RCS 2015 Environmental Assessment for RCN and RCS respectively.

1.2 Monitoring Locations

In accordance with the NMP, there are a total of ten monitoring locations as detailed in Table 2.1 and shown on Figure 1. Monitoring is not undertaken at all locations during each month, due to the number and distance between each location. As a result, a risk-based assessment has been adopted where attended noise monitoring targets locations where operational noise from RCM is likely, with a minimum of six locations to be monitored per night. This procedure is detailed in Section 5 of the NMP, and reproduced in Appendix A.

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Table 1.1: RCM ATTENDED NOISE MONITORING LOCATIONS

Location Descriptor ID	EA Reference (RCN/RCS)[1]	Monitoring Location
NM1	132/171	End of Glennie Street, Camberwell
NM2	91/NA	Glennies Creek Road, Camberwell
NM3	47/NA	893 Middle Falbrook Road, Middle Falbrook
NM4	19/12	997 Bridgman Road, Bridgman
NM5	11/8	788 Bridgman Road, Obanvale
NM6	145/19	427 Bridgman Road, Obanvale
NM7	NA/61	McMahon Way, Singleton Heights
NM8	NA/152	Cnr Belmadar Way and Maison Dieu Road, Maison Dieu
NM9	NA/121	Llanrian Drive, Gowrie
NM10[2]	NA/135	End of Dights Crossing Road, Maison Dieu

Notes:

1. *NA indicates location was not included in the EA for that project; and*
2. *An offset correction has been applied to this measurement as the actual monitoring location is closer to RCM than the area it represents.*

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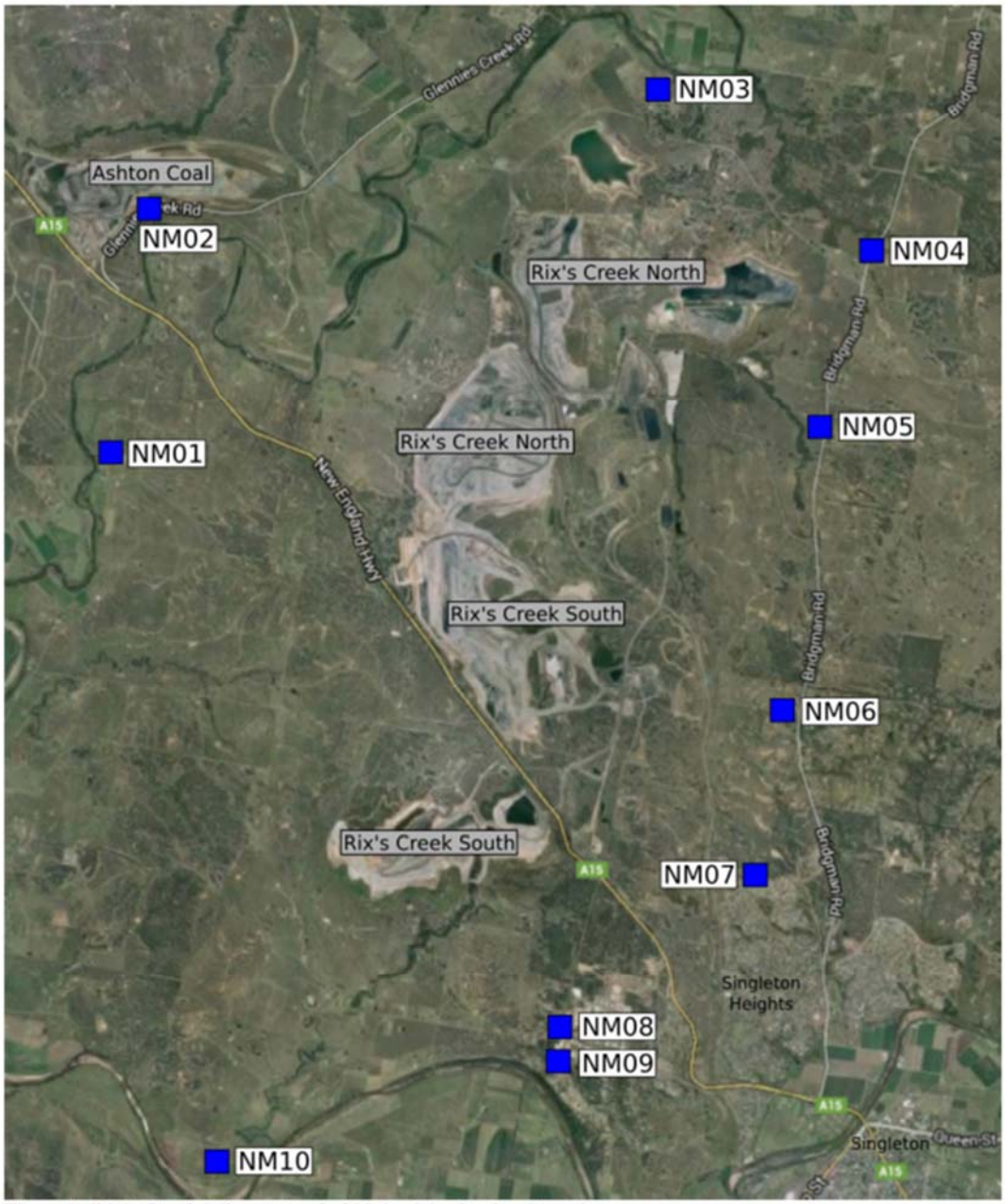

Figure 1: Rix's Creek Mine Attended Noise Monitoring Locations

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1.3 Terminology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.2.

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{Amax}	The maximum A-weighted noise level over a time period or for an event
L_{A1}	The noise level which is exceeded for 1 per cent of the time
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L_{A50}	The noise level which is exceeded for 50 per cent of the time
L_{A90}	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes
L_{Amin}	The minimum A-weighted noise level over a time period or for an event
L_{Aeq}	The average noise energy during a measurement period
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude. Estimated from wind speed and sigma theta data
IA	Inaudible. When site only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

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2 CONSENT AND CRITERIA

2.1 Project Approvals

The operations at Rix's Creek North are subject to the conditions contained in the Project Approval 08_0102 (MOD 6) last modified August 2016. Noise conditions are detailed in Schedule 3 Conditions 1-10 and Appendix 5 of the consent and are reproduced in Appendix A .

The operations at Rix's Creek South are subject to conditions contained in the Project Approval N90/00356 (MOD 8) last modified in December 2016. Noise conditions are detailed in Conditions 10 and 11, and Appendix 4 and are reproduced in Appendix A. Rix's Creek is currently going through a transition period has it moves from the existing 1995 development consent (N90/00356) into the proposed new consent (from 2017 for a period of 21 years).

2.2 Environmental Protection Licence

RCM holds Environmental Protection Licence (EPL) No. 3390. Section L2 of the most recent licence outlines noise limits and meteorological exclusions.

2.3 Noise Management Plan

The most recent version of the NMP was approved in February 2016, to address noise impacts associated with the operation of RCM. Section 5 of the NMP details the noise compliance monitoring program, including monitoring locations and methodology.

2.4 Noise Impact Criteria

The current NMP, which includes noise management requirements for both RCN and RCS, was approved in February 2016 and includes the project specific noise criteria. Table 5.7 of the NMP outlines compliance criteria for the project, which are reproduced in Table 2.1. Results from quarterly noise monitoring have been compared to these criteria.

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Table 2.1: RCM PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA[2]

Descriptor	Rix's Creek North		Rix's Creek South	
	Impact Assessment Criterion $L_{Aeq,15minute}$ dB[1]	Impact Assessment Criterion $L_{A1,1minute}$ dB[1]	Impact Assessment Criterion $L_{Aeq,15minute}$ dB[1]	Impact Assessment Criterion $L_{A1,1minute}$ dB[1]
NM1	38	48	40	48
NM2	40	47	40	47[1]
NM3	39	45	NA	NA
NM4	37	49	42	48
NM5	41	47	42	48
NM6	36	48	42	47
NM7	NA	NA	40	45
NM8	NA	NA	40	47
NM9	NA	NA	40	47
NM10[2]	NA	NA	40	47

Note:

1. *Criterion set as for Rix's Creek North in the absence of data in the EIS; and*
2. *NA indicates criteria not applicable at that location, as it was not included in the relevant EA, EIS or Project Approval.*

The RCM NMP and Environment Protection License (EPL 3391, Dec 2015) outline required meteorological conditions for criteria to be applicable during attended noise monitoring, which are as follows:

Noise emission limits apply under all meteorological conditions of:

- wind speeds up to 3m/s at 10 metres above ground level; or
- temperature inversion conditions of up to 3°C/100m and wind speed up to 2m/s at 10 metres above the ground.

2.5 RCS Noise Level Design Goals

As detailed in Section 2.1, RCS is subject to conditions in Project Approval N90/00356 (MOD 8). While quarterly noise results have been compared to impact assessment criteria in the approved NMP, RCS is still subject to the noise level design goals set out in the current Project Approval while it transitions to the new consolidated approval, relevant to both RCS and RCN.

According to the latest version of N90/00356, RCS must comply with L_{A10} night time noise level design goals as follows:

- The Retreat – 40 dB
- Singleton Heights – 40 dB
- Maison Dieu Road – 38 dB

As detailed in Appendix 4 of the Project Approval, noise limits do not apply under the following meteorological conditions:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10m above ground level; and
- temperature inversion conditions greater than 3ºC/100m.

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3 METHODOLOGY

3.1 Attended Noise Monitoring

Monitoring was conducted in accordance with the Environment Protection Authority 'Industrial Noise Policy' guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise' and the latest compliance monitoring procedure detailed in the NMP (dated February 2016).

If the exact contribution of the source of interest cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise levels, for example, L_{A10}, L_{A50} or L_{A90}. This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods as per the Industrial Noise Policy (e.g. measure closer and back calculate) to determine a value for reporting.

A measurement of $L_{A1,1minute}$ corresponds to the highest noise level generated for 0.6 of a second during one minute in the night period. In practical terms this is the highest noise level emitted from a RCM noise source during the entire measurement period (i.e. the highest level of the worst minute during the 15 minute measurement).

3.2 Meteorological Conditions

One on-site Automatic Weather Station (AWS) is currently located within each of the RCS and RCN mining lease areas. Data obtained from these stations allowed correlation of atmospheric parameters and measured noise levels.

For the purpose of determining valid meteorological conditions for which noise criteria apply:

- the Rix's Creek South AWS will be used for assessment of Rix's Creek South; and
- the Rix's Creek North AWS will be used for assessment of Rix's Creek North.

All monitoring and meteorological results have been reproduced as they were originally reported at the time of monitoring.

3.3 Integra Open Cut Environmental Assessment 2009

As part of the project to extend the South Pit at the former Integra Open Cut and to gain approval of a consolidated project approval, a Noise and Blasting Impact Assessment (URS, June 2009) was commissioned in order to assess noise impacts as part of the Environmental Assessment (EA). As part of the modelling assessment, noise levels from the Project were predicted for representative operating scenarios, time periods and weather conditions. Year 6 part pit predictions for specific meteorological conditions identified within the Acoustic Impact Assessment as 'prevailing' in accordance with the INP were compared with measured levels from attended compliance monitoring for corresponding meteorological conditions, as these are deemed to best represent the 2016 operations.

Table 19 of the Noise and Blasting Assessment lists modelled meteorological conditions; this table is reproduced below.

Table 19 Noise Modelling Meteorological Parameters

Period	Meteorological Condition	Air Temp	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	18°C	60%	0m/s	0°C/100m
Evening	Calm	12°C	75%	0m/s	0°C/100m
Night-time	Calm	6°C	90%	0m/s	0°C/100m
Night-time	Adverse	6°C	90%	0m/s	3°C/100m

The following rules were used to allocate meteorological parameter bounds for each condition:

1. For calm meteorological conditions, wind speeds less than or equal to 0.5 metres per second (m/s), all wind directions, and temperature gradients up to and including 0.5 ^{0}C/100m were included; and

2. For night adverse meteorological conditions, wind speeds less than or equal to 0.5 m/s and vertical temperature gradients in the range 1.5 to 4.0 ^{0}C/100m were included. This vertical temperature gradient range is in accordance with Table E1 of the INP for stability class F.

3.4 Rix's Creek South Noise Assessment 2015

As part of modifications to the Rix's Creek Coal Mine Development Consent originally granted in October, 1989, an Environmental impact Statement was then completed. A further Environmental Impact Statement was completed as part of changes to the Development Consent which resulted in the approval of the 1995 consent, under which RCS still currently operates.

The assessment of noise at RCS has been compared to the L_{A10} design goals contained within the most current approval for RCS as these were the result of the relevant EIS and are representative of phase 4 (mining operations years 16-21) of the Rix's Creek mine. These noise goals are based on the L_{A10} (a former method of assessing noise impacts), therefore as direct comparison is not possible, the site only L_{Aeq}

measured at relevant equivalent locations during 2016 has been compared to these design noise goals for information purposes only.

The most recent Environmental Assessment for RCS was the Rix's Creek Extension project EA for which a Noise Impact Assessment was completed in 2015 to assess noise impacts associated with the continuation of operations. As part of the modelling assessment, noise levels from the Project were predicted for representative operating scenarios, time periods and weather conditions. There were two scenarios modelled for each mining year evaluated, one being full operations (scenario 1) and the other being reduced operations (scenario 2).

The year 2017 predictions as identified in the assessment, representing the early stages of the project were compared with measured levels from attended compliance monitoring, as these are deemed to best represent 2016 operations.

As detailed in the assessment, predicted results were determined using the cumulative distribution of results methodology to produce a single 90th percentile L_{Aeq} for which monitoring results may be compared. This method involves calculating a range of L_{Aeq} results based on a large number of different meteorological conditions for each receptor and then determining the 90th percentile L_{Aeq} based on the percentage distribution of meteorological conditions. Therefore, all measured noise results for which criteria were applicable according to the impact assessment criteria meteorological exclusions, as detailed in the NMP, were compared to predictions without any further exclusion based on modelled conditions (as is required for a prevailing meteorological condition based assessment).

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4 SUMMARY OF ATTENDED MONITORING RESULTS

4.1 March 2016

Monitoring was conducted during the night period of 29/30 March 2016. A summary of RCN and RCS operational noise results from March 2016 (Quarter 1) are presented in Tables 4.1 and 4.2. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during March 2016.

Table 4.1: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – MARCH 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	29/03/2016 23:19	52	1.2	0.5	38	IA	Yes	Nil	48	IA	Yes	Nil
NM04	30/03/2016 01:23	34	0.7	-1.0	37	<25	Yes	Nil	49	<25	Yes	Nil
NM05	30/03/2016 01:01	33	0.8	0.5	41	25	Yes	Nil	47	28	Yes	Nil
NM06	30/03/2016 00:21	33	0.3	0.5	36	IA	Yes	Nil	48	IA	Yes	Nil
NM07	29/03/2016 23:53	42	0.6	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM08	29/03/2016 22:23	39	0.8	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM09	29/03/2016 22:45	37	0.7	3.0	NA	IA	NA	NA	NA	IA	NA	NA
NM10	29/03/2016 22:00	56	1.0	3.0	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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Table 4.2: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – MARCH 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG ºC/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	29/03/2016 23:19	52	1.8	4.1	40	<25	No	NA	48	<25	No	NA
NM04	30/03/2016 01:23	34	1.5	3.0	42	IA	Yes	Nil	48	IA	Yes	Nil
NM05	30/03/2016 01:01	33	1.0	3.0	42	IA	Yes	Nil	48	IA	Yes	Nil
NM06	30/03/2016 00:21	33	1.0	3.0	42	26	Yes	Nil	47	28	Yes	Nil
NM07	29/03/2016 23:53	42	1.3	0.5	40	IA	Yes	Nil	45	IA	Yes	Nil
NM08	29/03/2016 22:23	39	0.8	3.0	40	IA	Yes	Nil	47	IA	Yes	Nil
NM09	29/03/2016 22:45	37	1.5	3.0	40	32	Yes	Nil	47	38	Yes	Nil
NM10	29/03/2016 22:00	56	1.5	0.5	40	IA	Yes	Nil	47	IA	Yes	Nil

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3ºC/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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4.2 June 2016

Monitoring was conducted during the night period of 16/17 June 2016. A summary of RCN and RCS operational noise results from June 2016 (Quarter 2) are presented in Tables 4.3 and 4.4. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during June 2016.

Table 4.3: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – JUNE 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM02	16/06/16 21:00	44	1.5	-1.0	40	IA	Yes	Nil	47	IA	Yes	Nil
NM04	16/06/16 21:44	31	1.5	0.5	37	27	Yes	Nil	49	31	Yes	Nil
NM05	16/06/16 22:04	32	1.4	-1.0	41	28	Yes	Nil	47	30	Yes	Nil
NM06	16/06/16 22:37	45	0.7	0.5	36	IA	Yes	Nil	48	IA	Yes	Nil
NM07	16/06/16 23:15	40	0.4	3.0	NA	IA	NA	NA	NA	IA	NA	NA
NM08	17/06/16 00:18	39	1.1	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM09	16/06/16 23:55	39	0.8	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM10	17/06/16 00:42	39	0.6	-1.0	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

Table 4.4: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – JUNE 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG ºC/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	16/06/16 21:00	44	2.0	-1.0	40	IA	Yes	Nil	47	IA	Yes	Nil
NM04	16/06/16 21:44	31	2.0	3.0	42	27	No	NA	48	30	No	NA
NM05	16/06/16 22:04	32	1.5	-1.0	42	29	Yes	Nil	48	32	Yes	Nil
NM06	16/06/16 22:37	45	0.2	-1.0	42	42	Yes	Nil	47	47	Yes	Nil
NM07	16/06/16 23:15	40	1.0	4.1	40	39	No	NA	45	42	No	NA
NM08	17/06/16 00:18	39	2.0	0.5	40	38	No	NA	47	45	No	NA
NM09	16/06/16 23:55	39	1.0	3.0	40	39	No	NA	47	45	No	NA
NM10	17/06/16 00:42	39	1.8	3.0	40	38	No	NA	47	47	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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4.3 September 2016

Monitoring was conducted during the night period of 5/6 September 2016. A summary of RCN and RCS operational noise results from September 2016 (Quarter 3) are presented in Tables 4.5 and 4.6. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during September 2016.

Table 4.5: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	05/09/2016 21:00	47	0.9	0.5	38	IA	Yes	Nil	48	IA	Yes	Nil
NM04	06/09/2016 01:01	34	0.0	3.0	37	IA	No	NA	49	IA	No	NA
NM05	06/09/2016 00:36	36	0.4	3.0	41	IA	No	NA	47	IA	No	NA
NM06	05/09/2016 23:44	40	0.3	0.5	36	IA	Yes	Nil	48	IA	Yes	Nil
NM07	05/09/2016 23:09	36	0.4	3.0	NA	IA	NA	NA	NA	IA	NA	NA
NM08	05/09/2016 22:08	40	1.2	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM09	05/09/2016 22:36	38	0.7	3.0	NA	IA	NA	NA	NA	IA	NA	NA
NM10	05/09/2016 21:39	40	0.4	3.0	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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Table 4.6: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG ºC/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	05/09/2016 21:00	47	3.0	0.5	40	IA	No	NA	48	IA	No	NA
NM04	06/09/2016 01:01	34	0.8	0.5	42	32	Yes	Nil	48	43	Yes	Nil
NM05	06/09/2016 00:36	36	0.2	3.0	42	35	No	NA	48	37	No	NA
NM06	05/09/2016 23:44	40	2.5	3.0	42	<25	No	NA	47	30	No	NA
NM07	05/09/2016 23:09	36	3.2	0.5	40	<25	No	NA	47	<25	No	NA
NM08	05/09/2016 22:08	40	3.2	0.5	40	30	No	NA	47	32	No	NA
NM09	05/09/2016 22:36	38	3.0	0.5	40	30	No	NA	47	33	No	NA
NM10	05/09/2016 21:39	40	3.2	0.5	40	37	No	NA	47	42	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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4.4 December 2016

Monitoring was conducted during the night period of 7/8 December 2016. A summary of RCN and RCS operational noise results from December 2016 (Quarter 4) are presented in Tables 4.7 and 4.8. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during December 2016.

Table 4.7: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – DECEMBER 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	07/12/2016 23:00	41	1.8	-1.0	38	IA	Yes	Nil	48	IA	Yes	Nil
NM02	07/12/2016 22:30	45	1.8	-1.0	40	IA	Yes	Nil	47	IA	Yes	Nil
NM03	07/12/2016 21:41	54	2.4	-1.0	39	IA	Yes	Nil	45	IA	Yes	Nil
NM05	07/12/2016 21:04	42	2.8	-1.0	41	29	Yes	Nil	47	34	Yes	Nil
NM07	08/12/2016 00:55	40	1.3	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM08	07/12/2016 23:39	39	1.5	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM09	08/12/2016 00:17	41	1.8	0.5	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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Table 4.8: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – DECEMBER 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG ºC/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	07/12/2016 23:00	41	4.0	0.5	40	IA	No	NA	48	IA	No	NA
NM02	07/12/2016 22:30	45	4.5	0.5	40	IA	No	NA	47	IA	No	NA
NM03	07/12/2016 21:41	54	4.5	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM05	07/12/2016 21:04	42	4.8	-1.0	42	IA	No	NA	48	IA	No	NA
NM07	08/12/2016 00:55	40	3.2	0.5	40	<30	No	NA	45	<30	No	NA
NM08	07/12/2016 23:39	39	4.0	0.5	40	33	No	NA	47	46	No	NA
NM09	08/12/2016 00:17	41	3.8	0.5	40	33	No	NA	47	37	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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4.5 RCS Comparison to Consent Design Noise Goals

As detailed in Section 3.4, the most current consent for RCS contains L_{A10} design goals. While direct comparison between measured L_{Aeq} and these L_{A10} design goals is not accurately possible, the 2016 measured results for those monitoring locations deemed to most closely represent the former locations detailed in the consent are shown in Table 4.9.

Table 4.9: NOISE LEVELS GENERATED BY RCS AGAINST CONSENT L_{A10} NOISE DESIGN GOALS – 2016

	Location	Consent Location	L_{A10} Design Goal dB	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies[1]	Difference dB[2,3]
Quarter 1 2016	NM06	The Retreat	40	26	Yes	-14
	NM07	Singleton Heights	40	IA	Yes	NA
	NM08	Maison Dieu Road	38	IA	Yes	NA
Quarter 2 2016	NM06	The Retreat	40	42	Yes	+2
	NM07	Singleton Heights	40	39	No	NA
	NM08	Maison Dieu Road	38	38	Yes	0
Quarter 3 2016	NM06	The Retreat	40	<25	Yes	NA
	NM07	Singleton Heights	40	<25	No	NA
	NM08	Maison Dieu Road	38	30	No	NA
Quarter 4 2016	NM06[5]	The Retreat	40	-	-	-
	NM07	Singleton Heights	40	<30	No	NA
	NM08	Maison Dieu Road	38	33	No	NA

Notes:

1. *Noise emission limits do not apply for wind speeds greater than 3 m/s at 10m above ground level, or temperature inversion conditions greater than 3°C/100m;*
2. *NA indicates that either criteria do not apply due to meteorological conditions, or RCS inaudible or not directly measurable;*
3. *A positive difference indicates that the measured L_{Aeq} is greater than the L_{A10} design goal;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS; and*
5. *Noise monitoring not carried out at this location during Quarter 4 due to non-enhancing conditions in that area.*

5 COMPARISON WITH EA MODELLED PREDICTIONS

5.1 Comparison Between Attended and Modelled Results – Rix's Creek North

As detailed in Section 3.3, an acoustic impact assessment, including modelling of predicted noise levels for different operational years was conducted in order to assess noise and blasting impacts of RCN as part of the EA for a consolidated project approval. The modelled Year 6 part pit predictions presented in the assessment have been used for comparison in this report as that stage is most closely aligned to the 2016 reporting year.

Predicted Year 6 part pit operational noise levels for each non mine-owned residence are found in Appendix F6 of the Integra Open Cut Noise and Blasting Impact Assessment (June 2009), which is reproduced in Appendix A.

Measured operational levels have been compared to the predicted levels for Year 6 part pit in the Noise and Blasting Assessment for the relevant meteorological conditions. In the tables below, a positive difference is where the measured level is greater than the predicted level and a negative difference is where the measured levels are less than the predicted level. Notation used in the tables to denote differences is irrespective of the integer value sign. For example, the notation >-17 means the values are more than 17 dB less than the predicted level.

A summary of predicted noise levels for monitoring locations have been reproduced in Table 5.1.

Table 5.1: MONITORING LOCATION MODEL PREDICTIONS – $L_{Aeq,15minute}$ dB[1]

Monitoring Location ID	EA Reference	Predicted Night - Calm	Predicted Night – Adverse
NM1	132	23	33
NM2	91	27	34
NM3	47	22	27
NM4	19	20	35
NM5	11	30	40
NM6	145	21	34
NM7[1]	NA	<30	30-35 (33 used in comparison)
NM8[1]	NA	<30	<30
NM9[1]	NA	<30	<30
NM10[1]	NA	<30	<30

Notes:

1. *Predictions assumed based on contour maps (residence not included in EA).*

Table 5.2 provides the difference between measured and predicted levels with calm conditions during the night period.

Table 5.2: 2016 RCN OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST PREDICTED CALM CONDITIONS - NIGHT, YEAR 6 PART PIT[1,2]

Location	March	June	September	December
NM1	NR	-	NR	NR
NM2	-	NR	-	NR
NM3	-	-	-	NR
NM4	NR	NR	NR	-
NM5	NR	NR	NR	NR
NM6	NA	NR	NA	-
NM7	NR	NR	NR	NR
NM8	NR	NR	NR	NR
NM9	NR	NR	NR	NR
NM10	NR	NR	NR	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCN inaudible or not measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.3 for applicable meteorological bounds.*

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Table 5.3 provides the difference between measured and predicted levels with adverse conditions during the night period.

Table 5.3: 2016 RCN OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST PREDICTED ADVERSE CONDITIONS - NIGHT, YEAR 6 PART PIT[1,2]

Location	March	June	September	December
NM1	NR	-	NR	NR
NM2	-	NR	-	NR
NM3	-	-	-	NR
NM4	NR	NR	NA	-
NM5	NR	NR	NA	NR
NM6	NA	NR	NR	-
NM7	NR	NA	NA	NR
NM8	NR	NR	NR	NR
NM9	NR	NR	NR	NR
NM10	NR	NR	NA	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCN inaudible or not measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.3 for applicable meteorological bounds.*

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5.2 Comparison Between Attended and Modelled Results – Rix's Creek South

As detailed in Section 3.3, an acoustic impact assessment, including modelling of predicted noise levels for different operational years was conducted in order to assess noise impacts of RCS as part of the EA for a continued operations. The modelled Year 2017 pit predictions for scenarios 1 and 2 presented in the assessment have been used for comparison in this report as that stage most closely aligns to the 2016 reporting year.

Predicted 90th percentile L_{Aeq} operational noise levels for each non noise sensitive receptor are found in Appendix A of the Rix's Creek Coal Mine – Continuation of Mining Project Environmental Noise Assessment (AECOM, October 2015), which is reproduced in Appendix A.

Measured operational levels have been compared to the predicted levels for Year 2017 in the Noise Assessment. In the tables below, a positive difference is where the measured level is greater than the predicted level and a negative difference is where the measured levels are less than the predicted level. Notation used in the tables to denote differences is irrespective of the integer value sign. For example, the notation >-17 means the values are more than 17 dB less than the predicted level.

A summary of predicted noise levels for monitoring locations have been reproduced in Table 5.4.

Table 5.4: MONITORING LOCATION MODEL PREDICTIONS – 90th Percentile $L_{Aeq,15minute}$ dB[5]

Monitoring Location ID	EA Reference	Predicted Night Scenario 1[1]	Predicted Night Scenario 2[2]
NM1	171	40	30
NM2[3,4]	NA	38	26
NM3[3,5]	NA	39	31
NM4	12	33	28
NM5	8	39	34
NM6	19	45	40
NM7	61	42	31
NM8	152	46	39
NM9	121	43	36
NM10	135	38	28

Notes:

1. *Night Scenario 1 represents normal night operations with all proposed night plant operational;*
2. *Night scenario 2 represents a modified night period scenario, where coaling equipment, reject haulage and an additional overburden excavator (and associated trucks) is also excluded;*
3. *NA indicates location not included in EA;*
4. *This monitoring location was not included in the EA as a NSR, however falls within the N Noise Assessment Group. The most minimum prediction for this NAG has been used for comparison, as NM2 is located further from the mine than any other receptor in the group; and*
5. *This specific monitoring location was not included in the EA. Predictions modelled for NSR 181, which is located on the same street were used for comparison.*

Table 5.5 provides the difference between measured and predicted levels with a full operations scenario.

Table 5.5: 2016 RCS OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST NIGHT SCENARIO 1 (FULL OPERATIONS) - NIGHT, YEAR 2017[1,2]

Location	March	June	September	December
NM1	NR	-	NR	NR
NM2	-	NA	-	NR
NM3	-	-	-	NR
NM4	NA	NR	-1	-
NM5	NA	-10	NR	NR
NM6	-19	-3	NR	-
NM7	NA	NR	NR	NR
NM8	NA	NR	NR	NR
NM9	-11	NR	NR	NR
NM10	NA	NR	NR	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCS inaudible or not measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.4 for details regarding meteorological conditions.*

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Table 5.6 provides the difference between measured and predicted levels associated with a reduced operations scenario.

Table 5.6: 2016 RCS OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST NIGHT SCENARIO 2 (REDUCED OPERATIONS) - NIGHT, YEAR 2017[1,2]

Location	March	June	September	December
NM1	NR	-	NR	NR
NM2	-	NA	-	NR
NM3	-	-	-	NR
NM4	NA	NR	+4	-
NM5	NA	-5	NR	NR
NM6	-14	+2	NR	-
NM7	NA	NR	NR	NR
NM8	NA	NR	NR	NR
NM9	-4	NR	NR	NR
NM10	NA	NR	NR	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCS inaudible or not measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.4 for details regarding meteorological conditions.*

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6 SUMMARY

Global Acoustics was engaged by RCM to provide a summary of operational environmental noise surveys for the 2016 annual reporting year, and to compare environmental noise monitoring results with model predictions from the relevant Environmental Assessments for RCN and RCS.

6.1 Operational Noise Results

Noise levels from both RCN and RCS complied with relevant criteria as detailed in the current NMP at all monitoring locations during 2016.

6.2 Comparison to modelled predictions

Attended monitoring results were filtered to extract those that were taken during meteorological conditions that were similar to meteorological conditions included in the most relevant environmental assessments for both of RCN and RCS. These results were compared with model predictions to provide an indication of relative difference between measured and predicted levels.

6.2.1 Rix's Creek North

Results of this assessment indicate that meteorological conditions included in the Noise and Blasting Impact Assessment report (2009) did not regularly occur during attended monitoring. Six of the 31 attended compliance measurements during 2016 occurred during meteorological conditions that coincided with modelled meteorological conditions. Measured levels from RCN were all inaudible when these conditions did occur.

6.2.2 Rix's Creek South

Results of this assessment indicate that all noise levels measured during 2016 were below modelled predictions for full operations, that is, scenario 1. For the comparison with scenario 2, a model with the exclusion of select equipment, there were two measurements where noise levels were higher than predicted, which occurred at NM6 during June and NM4 during September. However, it should be noted that details on operations at that time are unavailable and it is assumed that full operations were carried out, which would make Scenario 1 the relevant prediction set for comparison.

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Appendix 4 Rix's Creek Complex Surface Water Sampling Results

Rix's Creek Sourh Surface water monitoring results:

Rix's Creek South (Site 1 – Railway Underpass) Water Quality 2016

DATE	FLOW	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	Trickle	7.2	19	300	315
29/02/2016	Nil	7.8	11	295	465
31/03/2016	Low	8.1	22	341	520
29/04/2016	Nil	8.8	9	398	527
27/05/2016	Nil	8.5	23	342	602
8/06/2016	Nil	7.9	15	350	593
29/07/2016	Nil	9.8	76	328	525
5/08/2016	Nil	8.3	6	434	593
30/09/2016	Nil	8.1	5	412	668
21/10/2016	Nil	9.0	1	447	695
25/11/2016	Nil	8.6	2	402	770
22/12/2016	Nil	8.2	3	470	796

Rix's Creek South (Site 2 - New England Highway) Water Quality 2016

DATE	FLOW	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	Low	7.4	14	533	657
29/02/2016	Nil	7.6	60	408	670
31/03/2016	Dry	-	-	-	-
29/04/2016	Nil	7.8	429	627	740
27/05/2016	Dry	-	-	-	-
8/06/2016	Nil	7.1	<5	181	261
29/07/2016	Nil	7.2	33	691	1007
5/08/2016	Nil	7.6	9	616	987
30/09/2016	Nil	7.9	8	1900	3480
21/10/2016	Nil	7.9	22	2720	4610
25/11/2016	Dry	-	-	-	-
22/12/2016	Dry	-	-	-	-

Rix's Creek South (Site 10 - Below Operation) Water Quality 2016

DATE	Flow	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	Low	7.6	19	343	547
29/02/2016	Dry	-	-	-	-
31/03/2016	Dry	-	-	-	-
29/04/2016	Nil	7.9	11	580	915
27/05/2016	Dry	-	-	-	-
8/06/2016	Nil	7.6	7	376	512
29/07/2016	Dry	-	-	-	-
5/08/2016	Moderate	8.1	16	420	688
30/09/2016	Dry	-	-	-	-
21/10/2016	Dry	-	-	-	-

25/11/2016	Dry	-	-	-	-
22/12/2016	Dry	-	-	-	-

Rix's Creek South (Site 3 - Maison Dieu) Water Quality 2016

DATE	FLOW	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	Low	7.1	25	637	1098
29/02/2016	Nil	7.6	9	2390	4150
31/03/2016	Dry	-	-	-	-
29/04/2016	Nil	7.4	23	744	1135
27/05/2016	Dry	-	-	-	-
8/06/2016	Low	7.0	14	285	407
29/07/2016	Low	7.3	30	407	520
5/08/2016	Low	7.5	12	686	1216
30/09/2016	Nil	7.7	7	2360	4190
21/10/2016	Nil	8.0	9	1840	3580
25/11/2016	Nil	7.3	8	552	996
22/12/2016	Dry	-	-	-	-

Rix's Creek South Clean Water Dam 1 Water Quality 2016

DATE	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	7.8	9	148	159
29/02/2016	7.9	17	156	188
31/03/2016	7.7	125	162	217
29/04/2016	7.7	3	183	196
27/05/2016	7.4	13	109	199
8/06/2016	7.1	24	136	205
29/07/2016	7.3	8	170	215
5/08/2016	7.4	5	177	212
30/09/2016	7.7	8	156	195
21/10/2016	9.6	6	146	186
25/11/2016	8.9	6	132	183
22/12/2016	9.5	2	153	237

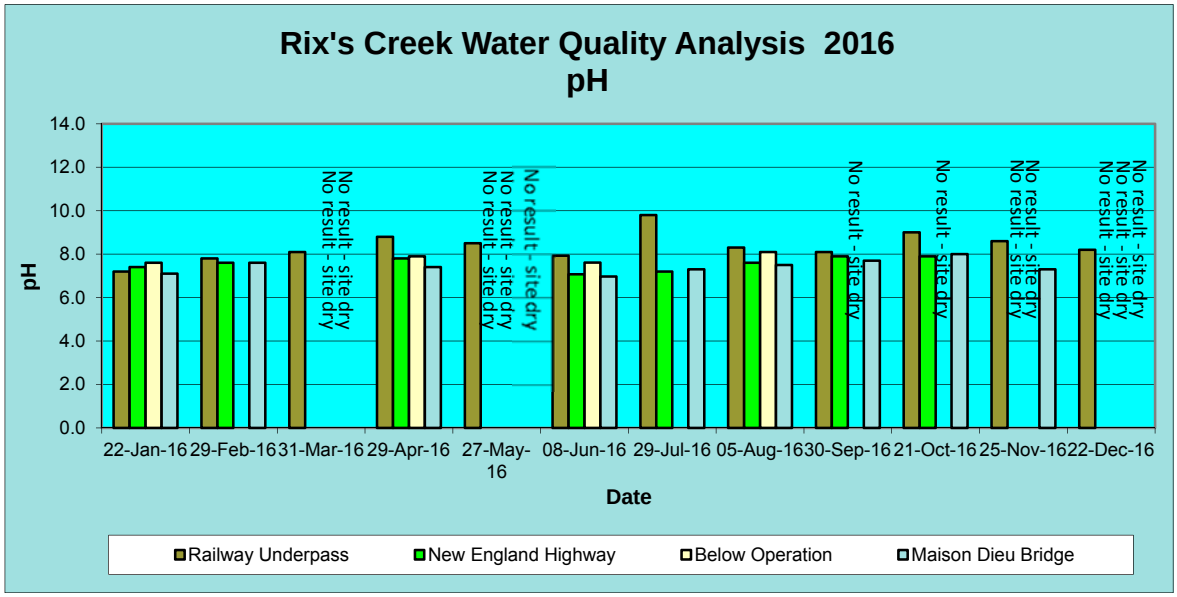
Rix's Creek South Clean Water Dam 2 Water Quality 2016

DATE	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	7.4	11	120	133
29/02/2016	8.5	7	110	132
31/03/2016	7.2	12	143	148
29/04/2016	7.6	5	165	157
27/05/2016	7.4	11	172	229
8/06/2016	7.3	<5	121	162
29/07/2016	7.7	6	158	170
5/08/2016	7.8	4	159	174
30/09/2016	7.5	8	166	159
21/10/2016	9.6	11	121	161
25/11/2016	9.6	7	149	168

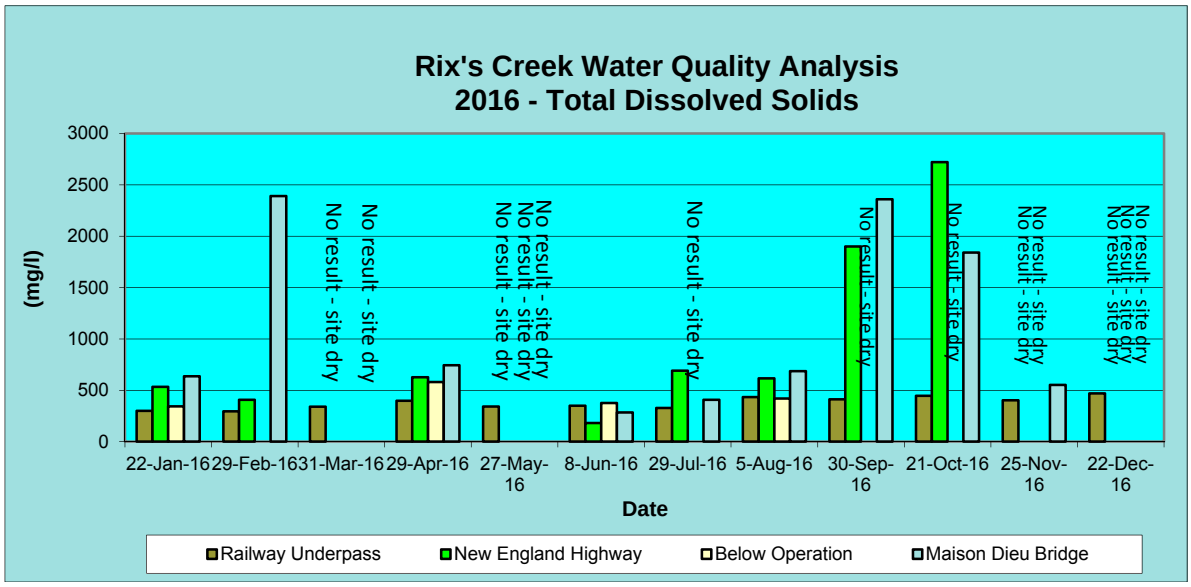
22/12/2016	9.0	5	148	232

Rix's Creek South Clean Water Dam 6 Water Quality 2016

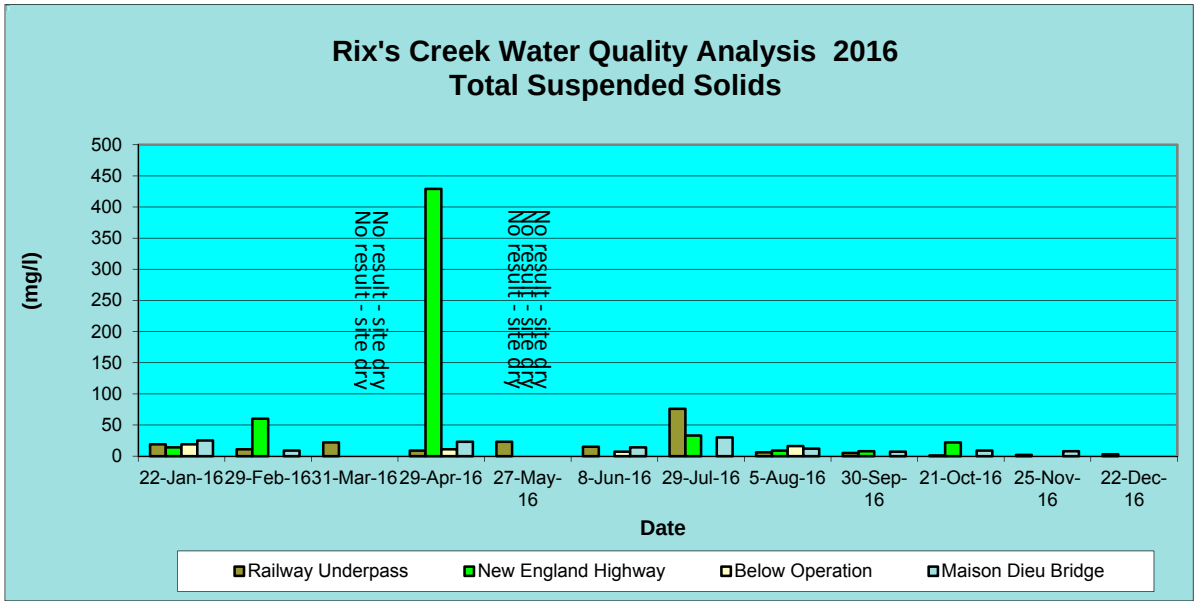
DATE	pH	TOTAL SUSPENDED SOLIDS mg/l	TOTAL DISSOLVED SOLIDS mg/l	SPECIFIC CONDUCTANCE uS/cm
22/01/2016	7.4	12	211	213
29/02/2016	8.1	109	204	229
31/03/2016	7.7	6	192	241
29/04/2016	7.7	23	212	250
27/05/2016	7.7	2	225	250
8/06/2016	7.7	30	193	245
29/07/2016	7.8	123	199	283
5/08/2016	7.9	4	207	268
30/09/2016	7.9	8	206	279
21/10/2016	8.9	4	173	323
25/11/2016	9.1	5	182	320
22/12/2016	9.1	8	194	357



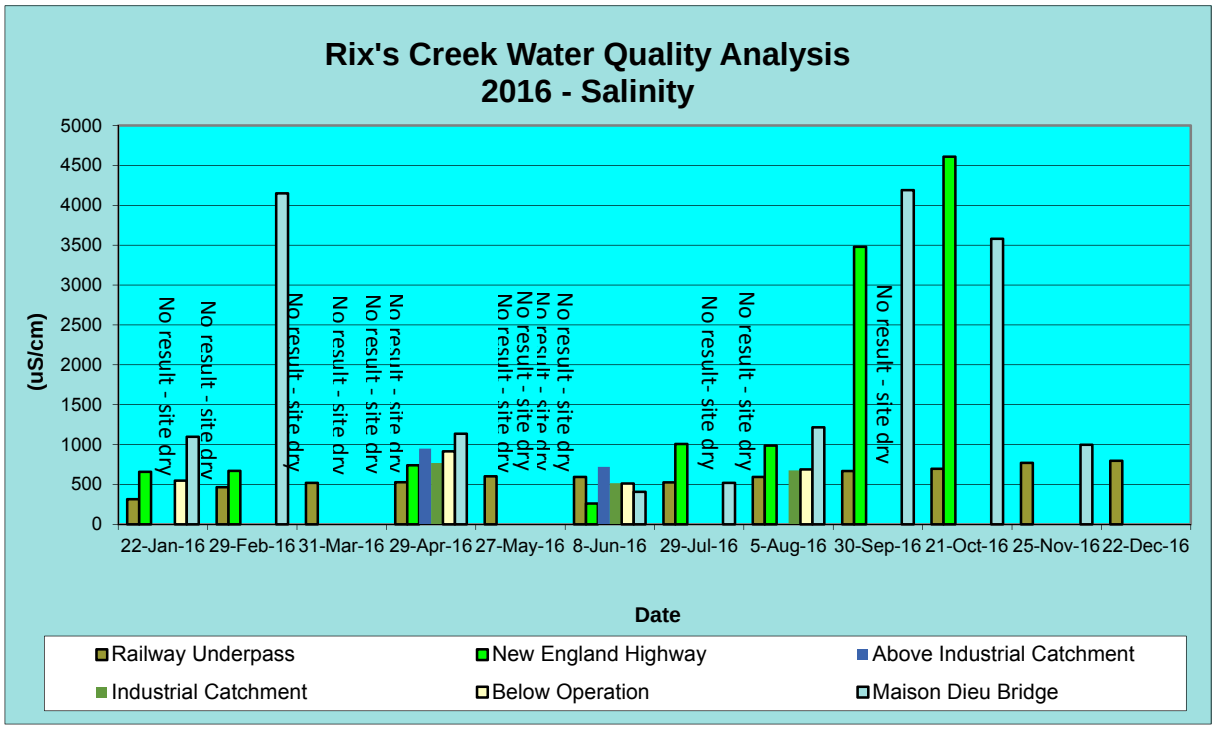
Rix's Creek Water Quality 2016 - pH.



Rix's Creek Water Quality 2016 – Total Dissolved Soilds



Rix's Creek Water Quality 2016 – Total Suspended Solids



Rix's Creek Water Quality 2016 – Electrical Conductivity (Salinity)

Rix's Creek North surface water monitoring results:

Date Sampled	Month Sampled	W1: Station Ck (EPA Site)				W3: Martins Creek (EPA Site)				W4: GI Ck Up (nobles Xing)				W5: GI Ck Dn (Oxfords)				W6: Blackwattle Ck			
		pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
25/01/2016	Jan-16	7.4	553	17	382	7.0	441	41	364	7.4	316	61	172					8.1	1545	24	946
24/02/2016	Feb-16	7.2	901	4	620	6.4	632	198	990	7.6	707	17	422	7.5	767	69	436	7.4	9010	87	6320
30 & 31/3/2016	Mar-16	7.4	1060	4	634	dry				7.6	414	11	216	7.6	469	8	259	dry			
18 & 19/4/2016	Apr-16	7.8	1301	65	766	dry				7.7	285	9	175	7.8	276	8	186	dry			
16 & 17/5/2016	May-16	7.8	1259	15	816	dry				7.5	369	5	235	7.5	423	7	220	dry			
22/06/2016	Jun-16	7.4	596	84	429	6.7	367	64	327	7.9	608	7	354	7.9	594	3	347	7.7	6080	36	3540
20/07/2016	Jul-16	7.8	1063	47	731	6.5	359	35	434	7.9	701	2	378	8.1	736	3	426	7.6	10400	14	6800
29/08/2016	Aug-16	7.8	956	25	652	6.7	510	31	450	8	584	9	360	8.1	558	10	364	7.6	6890	6	4560
15/09/2016	Sep-16	7.6	1092	35	622	6.6	250	40	608	8	771	10	402	8.1	807	9	433	8.4	7800	10	4560
27/10/2016	Oct-16	7.5	829	121	723	6.6	165	122	837	7.9	786	11	422	7.8	780	24	470	7.6	7790	33	5110
18/11/2016	Nov-16	7.1	417	252	502	6.4	229	45	644	7.6	594	16	359	7.8	652	15	368	7.6	6650	7	4300
14/12/2016	Dec-16	7.5	870	61	677	6.5	206	140	962	7.5	279	14	150	7.6	272	17	142	dry			
	HISTORICAL AVERAGE	7.5	908	61	630	6.6	351	80	624	7.7	535	14	304	7.8	576	16	332	7.8	7021	27	4517
	MIN	7.1	417.0	4.0	382.0	6.4	165.0	31.0	327.0	7.4	279.0	2.0	150.0	7.5	272.0	3.0	142.0	7.4	1545.0	6.0	946.0
	MAX	7.8	1301.0	252.0	816.0	7.0	632.0	198.0	990.0	8.0	786.0	61.0	422.0	8.1	807.0	69.0	470.0	8.4	10400.0	87.0	6800.0
	SD	0.2	275.2	69.6	132.5	0.2	155.5	59.5	254.1	0.2	191.9	15.3	105.3	0.2	195.1	18.7	112.6	0.3	2607.6	26.8	1795.7
		Dry = No sample, site was dry																			
	ns= not sampled																				

Date Sampled	Month Sampled	W7: Stony Ck				W10: Dam C4 (EPA Site)					W11: GI Ck NEH				W12: Dam C1				W13: Dam C6			
		pH	EC uS/cm	TSS mg/l	TDS mg/l	Disch. Flow	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
25/01/2016	Jan-16	7.1	388	46	366		7.5	577	21	330	7.3	304	35	249	7	265	36	202	7.1	177	79	138
24/02/2016	Feb-16	6.6	457	42	278		7.2	817	156	531	7.6	714	26	406	6.7	505	165	262	6.5	140	139	142
30 & 31/3/2016	Mar-16	7	513	12	311		8.3	1256	2	714	7.7	484	11	254	7.3	766	6	442	7.1	175	11	110
18 & 19/4/2016	Apr-16	Dry					8.2	1515	5	930	7.9	281	8	179	7.8	960	4	545	7.7	181	14	139
16 & 17/5/2016	May-16	Dry					8.2	2010	4	1190	7.7	447	3	281	7.8	1124	6	653	8.4	154	18	87
22/06/2016	Jun-16	6.3	130	12	133		8.2	2550	7	1410	7.9	502	5	279	7.8	1248	4	759	7.4	148	11	126
20/07/2016	Jul-16	6.8	192	16	110		8.6	2740	3	1570	8.1	765	4	374	8.5	1340	1	769	8.6	160	5	122
29/08/2016	Aug-16	6.6	468	5	366		8.8	2510	3	1630	8.1	561	11	363	8.5	1448	2	871	8.7	169	3	116
15/09/2016	Sep-16	6.9	364	6	219		8.7	2850	7	1550	8	799	13	408	9	1720	6	945	7.9	154	7	141
27/10/2016	Oct-16	6.9	183	13	175		9.1	2860	6	1690	7.9	809	12	454	9.8	1781	3	987	7.6	147	9	112
18/11/2016	Nov-16	6.6	126	11	116		9.4	2820	9	1650	7.8	488	27	253	9.5	1969	3	1090	7.2	217	22	197
14/12/2016	Dec-16	6.6	155	10	117		9.8	3050	7	1790	7.6	307	12	162	9	2110	2	1290	7.2	270	13	185
	HISTORICAL AVERAGE	6.7	298	17	219		8.5	2130	19	1249	7.8	538	14	305	8.2	1270	20	735	7.6	174	28	135
	MIN	6.3	126.0	5.0	110.0		7.2	577.0	2.0	330.0	7.3	281.0	3.0	162.0	6.7	265.0	1.0	202.0	6.5	140.0	3.0	87.0
	MAX	7.1	513.0	46.0	366.0		9.8	3050.0	156.0	1790.0	8.1	809.0	35.0	454.0	9.8	2110.0	165.0	1290.0	8.7	270.0	139.0	197.0
	SD	0.2	154.8	14.5	104.0		0.7	871.7	43.4	501.3	0.2	193.9	10.1	94.0	1.0	576.9	46.7	330.1	0.7	36.6	40.5	30.9
	ns= not sampled																					

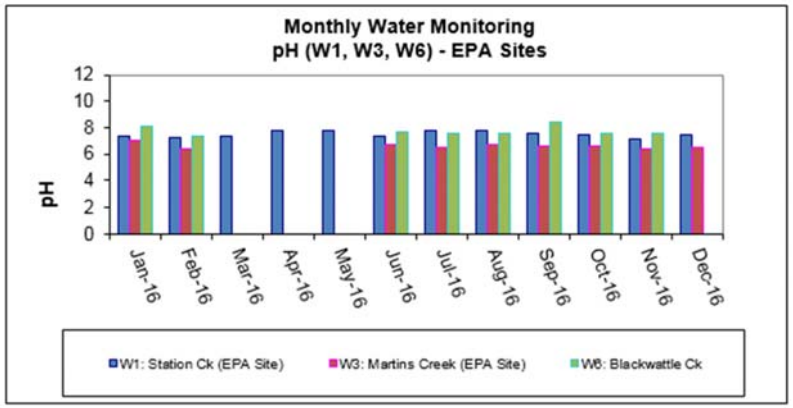
Date Sampled	Month Sampled	W14: Dam C3			W15: Dam C6A				W16: Dam C8				W17: Dam C2				W18: Dam C5			
		EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
25/01/2016	Jan-16	616	16	368	6.7	101	44	128	9.8	3960	3	2570	6.9	292	24	231	6.9	105	44	120
24/02/2016	Feb-16	1015	7	598	7.1	231	8	176	9	4280	13	2990	6.9	390	6	243	6.9	134	10	153
30 & 31/3/2016	Mar-16	1717	6	991	7.4	269	12	127	7.9	4850	80	3310	7.2	489	4	301	7.3	168	8	128
18 & 19/4/2016	Apr-16	1700	5	1150	7.6	314	19	181	8.3	5060	7	3750	7.6	544	3	337	7.6	190	16	226
16 & 17/5/2016	May-16	1931	8	1160	7.4	334	26	220	8.5	5170	43	3650	7.4	576	4	347	7.3	204	26	180
22/06/2016	Jun-16	1868	8	1160	7.1	266	57	234	8.5	4970	24	3230	7.6	578	6	348	7.2	199	35	147
20/07/2016	Jul-16	1984	6	1190	7.4	283	20	244	8.6	4540	14	3170	7.7	627	3	368	7.2	210	13	158
29/08/2016	Aug-16	1975	7	1290	7.3	286	16	233	8.7	4750	13	3410	7.7	682	3	403	7.3	214	6	190
15/09/2016	Sep-16	2170	9	1210	7.6	320	13	256	8.7	4890	8	3270	7.9	780	5	461	7.2	244	6	213
27/10/2016	Oct-16	2190	10	1290	7.9	329	8	181	9.2	5390	9	3370	8.1	807	4	439	7.5	245	7	167
18/11/2016	Nov-16	1879	6	1400	7.2	329	23	258	9.8	4110	9	3500	7.8	857	5	520	7.6	254	8	200
14/12/2016	Dec-16	2290	5	1340	7.8	377	12	256	9.7	4960	8	3430	8.2	973	11	597	7.5	276	10	199
	HISTORICAL AVERAGE	1778	8	1096	7.4	287	22	208	8.9	4744	19	3304	7.6	633	7	383	7.3	204	16	173
	MIN	616.0	5.0	368.0	6.7	101.0	8.0	127.0	7.9	3960.0	3.0	2570.0	6.9	292.0	3.0	231.0	6.9	105.0	6.0	120.0
	MAX	2290.0	16.0	1400.0	7.9	377.0	57.0	258.0	9.8	5390.0	80.0	3750.0	8.2	973.0	24.0	597.0	7.6	276.0	44.0	226.0
	SD	490.9	3.0	308.8	0.3	70.2	14.9	48.0	0.6	437.2	21.9	309.0	0.4	197.8	5.9	108.1	0.2	49.8	12.6	33.5
	ns= not sampled																			

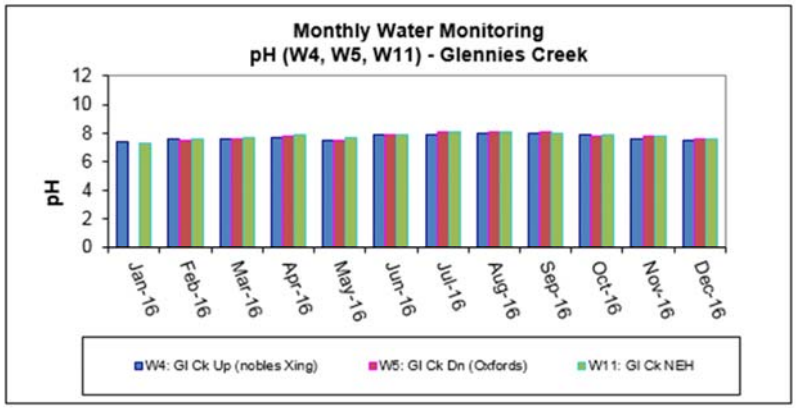
Date Sampled	Month Sampled	W19: Dam D1				W20: North Dam 1				W21: North Dam 2			
		pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
25/01/2016	Jan-16	9.1	3020	14	1940	9	3230	10	1920	7.5	520	27	366
24/02/2016	Feb-16	9	4190	4	2640	9.3	9180	19	6270	7.5	804	11	460
30 & 31/3/2016	Mar-16	8.8	6750	6	4280	8.7	10150	47	6620	7.8	868	8	437
18 & 19/4/2016	Apr-16	8.7	7620	6	5190	8.6	10130	21	7070	8.1	944	3	623
16 & 17/5/2016	May-16	8.3	8790	7	6080	8.9	10120	9	6720	8.2	1051	12	640
22/06/2016	Jun-16	8.5	8760	16	5850	9	8900	30	5470	8.4	844	20	487
20/07/2016	Jul-16	8.6	8680	8	5890	9	8940	38	5730	8.5	905	17	548
29/08/2016	Aug-16	8.7	8580	5	5880	9.3	8510	11	5850	8.6	888	7	507
15/09/2016	Sep-16	8.6	8760	9	5880	9.6	6790	11	4080	8.3	923	11	533
27/10/2016	Oct-16	8.5	8590	7	5650	9.7	7930	11	4710	8.4	975	13	563
18/11/2016	Nov-16	8.5	8300	6	6030	9.6	6120	11	4720	8.6	1035	17	641
14/12/2016	Dec-16	8.7	8780	4	6130	9.2	8270	9	5510	8.6	1116	34	677
	HISTORICAL AVERAGE	8.7	7568	8	5120	9.2	8189	19	5389	8.2	906	15	540
	MIN	8.3	3020.0	4.0	1940.0	8.6	3230.0	9.0	1920.0	7.5	520.0	3.0	366.0
	MAX	9.1	8790.0	16.0	6130.0	9.7	10150.0	47.0	7070.0	8.6	1116.0	34.0	677.0
	SD	0.2	1963.6	3.7	1424.0	0.4	2009.1	12.8	1410.8	0.4	151.7	8.7	94.2

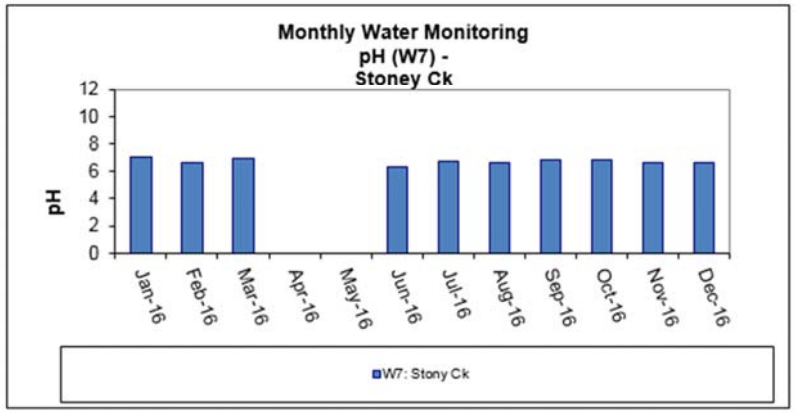
ns= not sampled

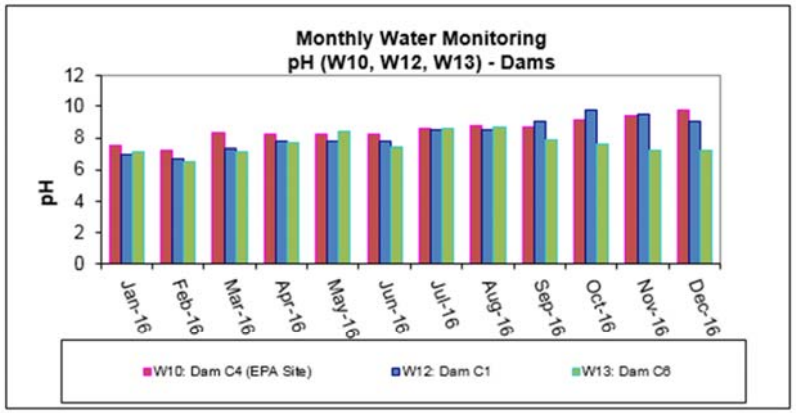
Date Sampled	GCS003 (Possum Skin Dam)				GCS004 (Seepage Pond)				GCS005 (Sediment Pond)				South Sed Dam				Central Sed Dam			
	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
25-Jan-16	9.09	7760	14		7.26	1760	18		7.49	1270	42		7.5	470	76	417	7.3	391	22	275
24-Feb-16	9.13	8440	<5		7.9	11600	<5		7.66	788	44		7.5	520	29	420	7.4	438	11	308
30-Mar-16	9.18	8260	<5		7.96	13300	<5						7.7	524	14	318	7.4	433	3	286
18-Apr-16	9.18	8430	<5		8.27	13600	<5						7.9	509	3	408	7.2	442	10	307
16-May-16	9.15	9680	<5		8.11	16600	<5						8.2	532	6	331	7.7	470	22	328
21-Jun-16	9.09	8530	16		7.25	2330	11		6	761	33		8	492	30	350	7.8	443	27	330
20-Jul-16	9.05	8860	<5		8.09	14300	<5		6.44	1100	12		8	502	29	371	7.8	465	15	284
15-Aug-16	9.21	8810	<5		7.93	14200	5		6.59	1540	10		8.1	494	18	359	7.7	437	6	314
14-Sep-16	9.19	8660	14		7.96	15700	26		7.38	12300	<5		7.8	510	31	324	7.7	468	7	306
26-Oct-16	9.26	9300	<5		8.2	11400	<5		6.93	1530	24		7.9	544	27	350	7.9	497	6	367
17-Nov-16	9.28	8930	<5		8.02	11100	22		7.03	1110	27		8.5	586	8	399	8.7	501	6	336
14-Dec-16	9.27	9440	25		8.17	15100	<5		7.32	1870	440		8.9	609	8	408	8.2	518	11	305
AVERAGE	9.17	8758	17	#DIV/0!	7.93	11749	16	#DIV/0!	6.98	2474	79	#DIV/0!	8.00	524	23	371.25	7.73	459	12	312.1667
MIN	9.05	7760	14	0	7.25	1760	5	0	6	761	10	0	7.5	470	3	318	7.2	391	3	275
MAX	9.28	9680		0	8.27	16600		0	7.66	12300		0	8.9	609		420	8.7	518		367
SD	0.07	536.48	5.25	#DIV/0!	0.33	4840.94	8.44	#DIV/0!	0.55	3702.25	146.39	#DIV/0!	0.40	39.65	19.67	37.76	0.41	35.28	7.71	25.48

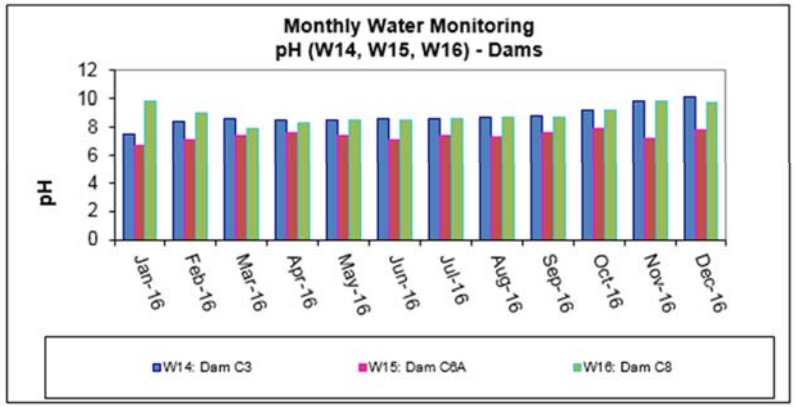
	North Sed Dam				Middle Falbrook Bridge (GC1)				Nobles Crossing				GC2			
Date Sampled	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
25-Jan-16	7.4	957	25	645	7.4	330			7.4	303			7.3	311		
24-Feb-16	8.2	1859	10	1240	7.7	716			7.6	706			7.7	711		
30-Mar-16	8.3	2150	13	1400	7.6	360			7.5	401			7.5	388		
18-Apr-16	8.4	2430	10	1740	7.6	265			7.7	262			7.6	262		
16-May-16	8.5	2740	17	1850	7.6	353			7.4	369			7.5	368		
21-Jun-16	8.3	1524	9	995	8.1	660			7.8	603			8.1	620		
20-Jul-16	8.3	1507	11	980	8	747			7.8	697			8.2	730		
15-Aug-16	8.3	1501	10	1080	7.9	604			7.8	564			7.8	566		
14-Sep-16	7.9	1390	12	930	8	823			7.7	789			7.7	793		
26-Oct-16	8	1465	11	936	8.2	773		442	8.1	778		457	8.1	759		568
17-Nov-16	8	1365	10	905	7.8	548			7.7	586			7.8	596		
14-Dec-16	8	1407	13	941	7.9	282			7.7	277			7.8	262		
AVERAGE	8.13	1691	13	1136.833	7.82	538	#DIV/0!	442	7.68	528	#DIV/0!	457	7.76	531		568
MIN	7.4	957	9	645	7.4	265	0	442	7.4	262	0	457	7.3	262	0	568
MAX	8.5	2740		1850	8.2	823		442	8.1	789		457	8.2	793		568
SD	0.30	509.07	4.46	358.96	0.24	208.98	#DIV/0!	#DIV/0!	0.19	197.01	#DIV/0!	#DIV/0!	0.27	201.39		

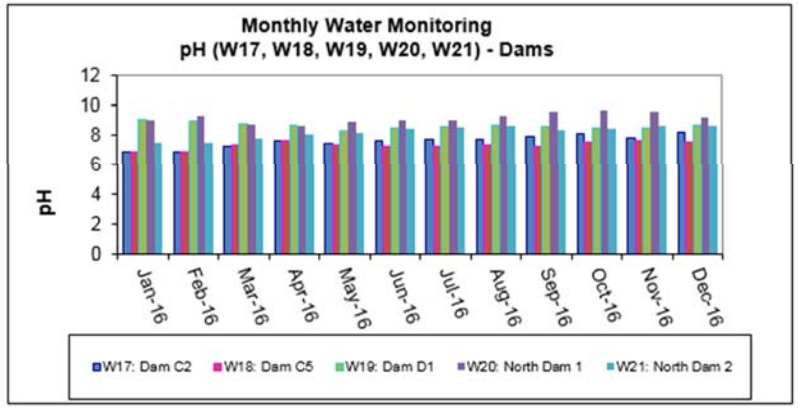

Monthly Water Monitoring
pH (W1, W3, W6) - EPA Sites
pH
0
2
4
6
8
10
12
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W1: Station Ck (EPA Site)
W3: Martins Creek (EPA Site)
W6: Blackwattle Ck

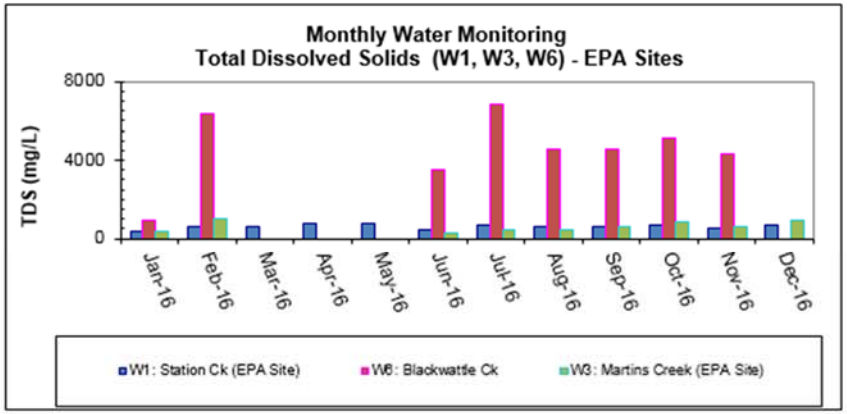

Monthly Water Monitoring
pH (W4, W5, W11) - Glennies Creek
pH
0
2
4
6
8
10
12
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

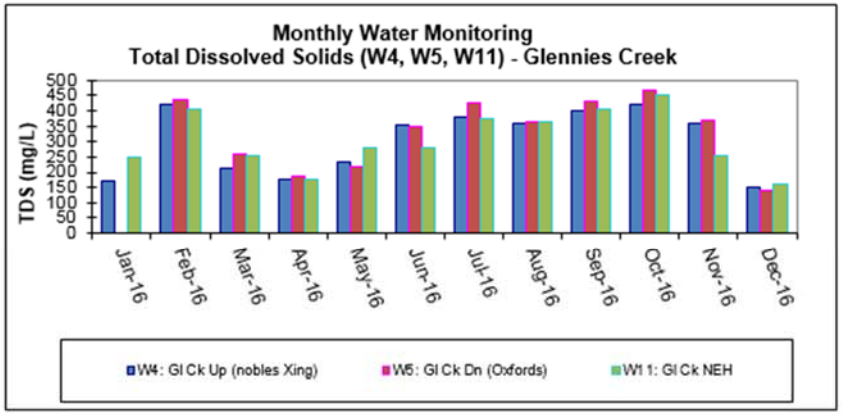

Monthly Water Monitoring
pH (W7) -
Stoney Ck
pH
0
2
4
6
8
10
12
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W7: Stony Ck

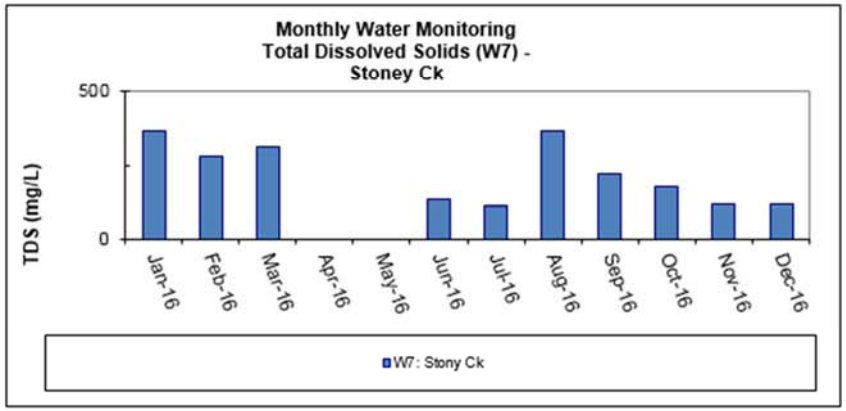

Monthly Water Monitoring
pH (W10, W12, W13) - Dams
pH
0
2
4
6
8
10
12
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

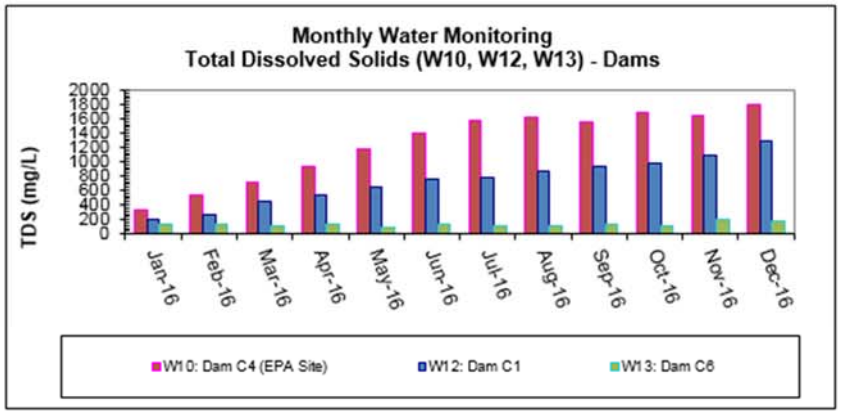

Monthly Water Monitoring
pH (W14, W15, W16) - Dams
pH
0
2
4
6
8
10
12
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W14: Dam C3
W15: Dam C6A
W16: Dam C8

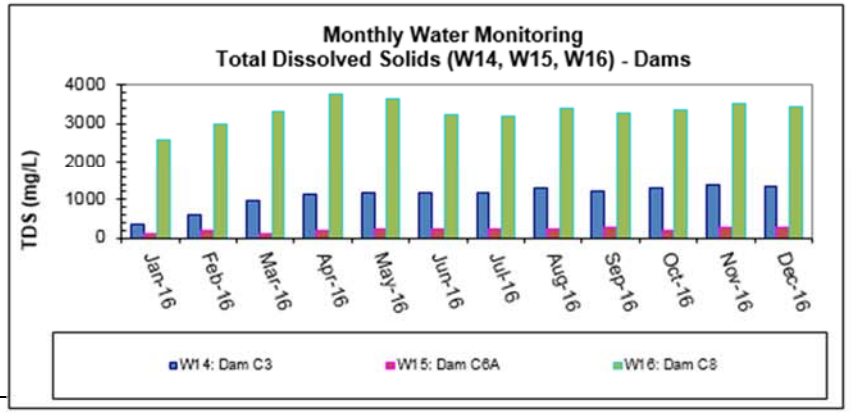

Monthly Water Monitoring
pH (W17, W18, W19, W20, W21) - Dams
pH
0
2
4
6
8
10
12
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W17: Dam C2
W18: Dam C5
W19: Dam D1
W20: North Dam 1
W21: North Dam 2

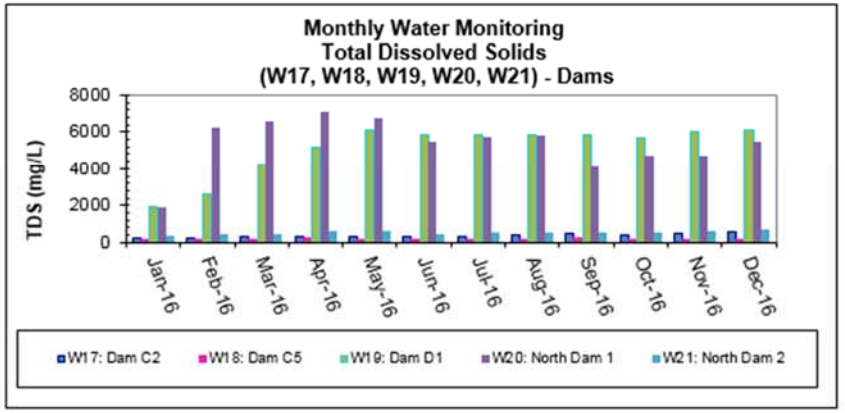

Monthly Water Monitoring
Total Dissolved Solids (W1, W3, W6) - EPA Sites
TDS (mg/L)
8000
4000
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W1: Station Ck (EPA Site)
W6: Blackwattle Ck
W3: Martins Creek (EPA Site)

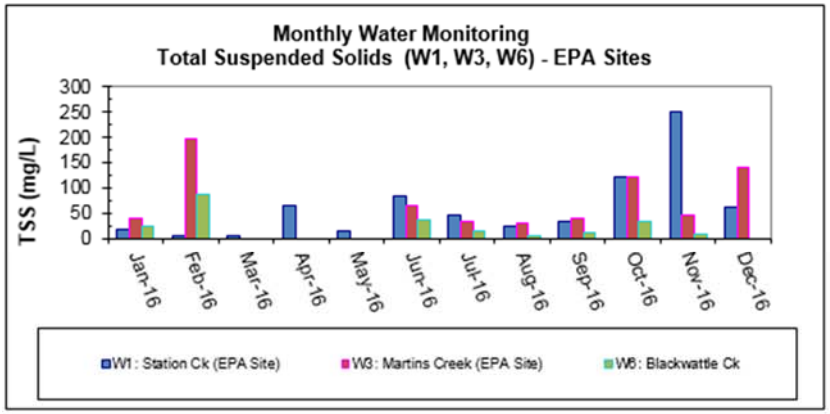

Monthly Water Monitoring
Total Dissolved Solids (W4, W5, W11) - Glennies Creek
TDS (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

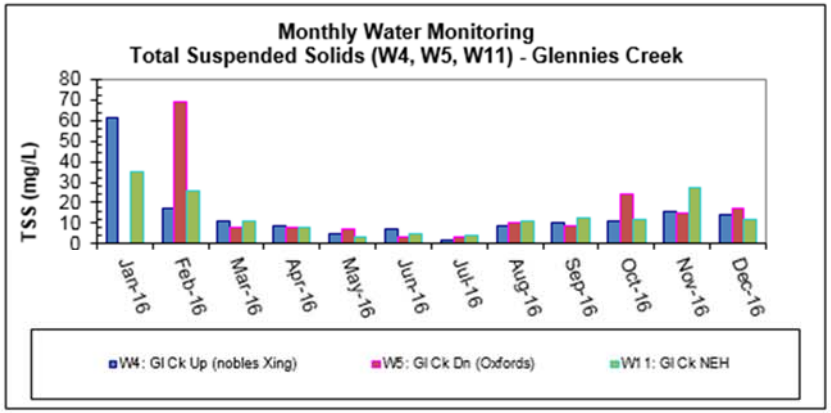

Monthly Water Monitoring
Total Dissolved Solids (W7) -
Stoney Ck
TDS (mg/L)
500
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W7: Stony Ck

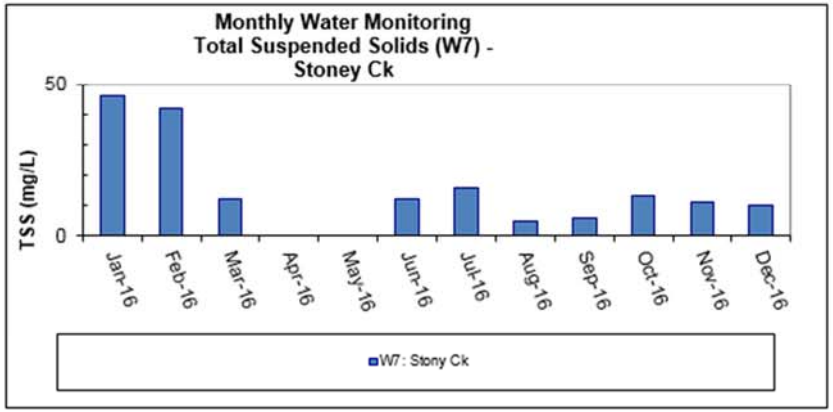

Monthly Water Monitoring
Total Dissolved Solids (W10, W12, W13) - Dams
TDS (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

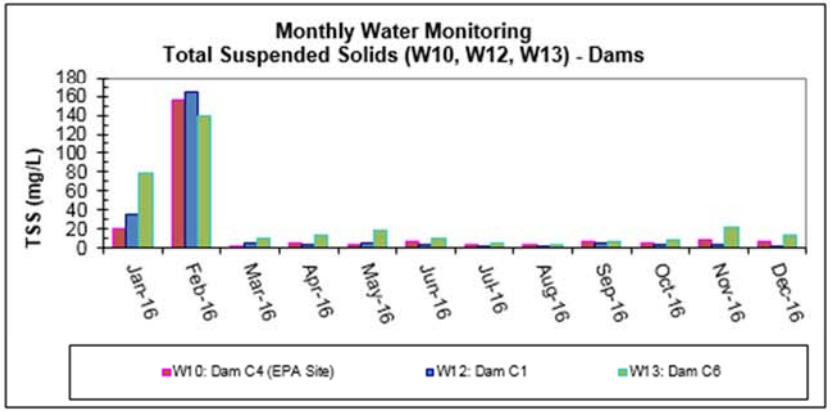

Monthly Water Monitoring
Total Dissolved Solids (W14, W15, W16) - Dams
TDS (mg/L)
4000
3000
2000
1000
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W14: Dam C3
W15: Dam C6A
W16: Dam C8

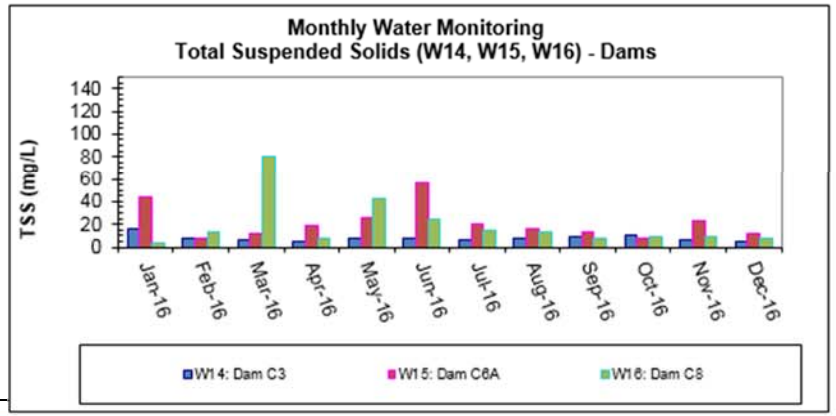

Monthly Water Monitoring
Total Dissolved Solids
(W17, W18, W19, W20, W21) - Dams
TDS (mg/L)
8000
6000
4000
2000
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W17: Dam C2
W18: Dam C5
W19: Dam D1
W20: North Dam 1
W21: North Dam 2

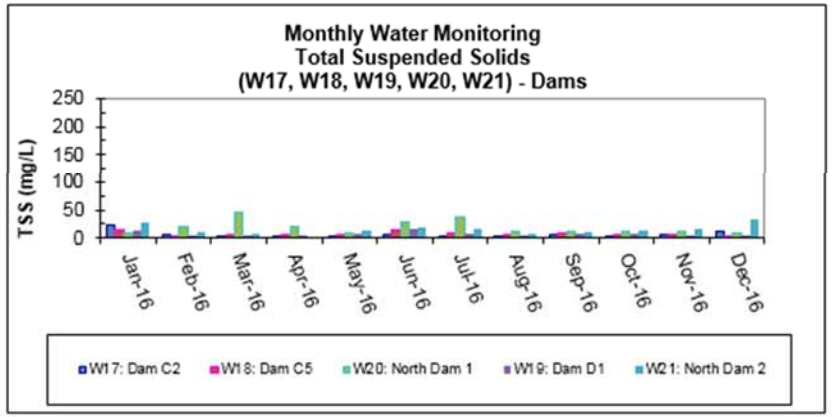

Monthly Water Monitoring
Total Suspended Solids (W1, W3, W6) - EPA Sites
TSS (mg/L)
300
250
200
150
100
50
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W1: Station Ck (EPA Site)
W3: Martins Creek (EPA Site)
W6: Blackwattle Ck

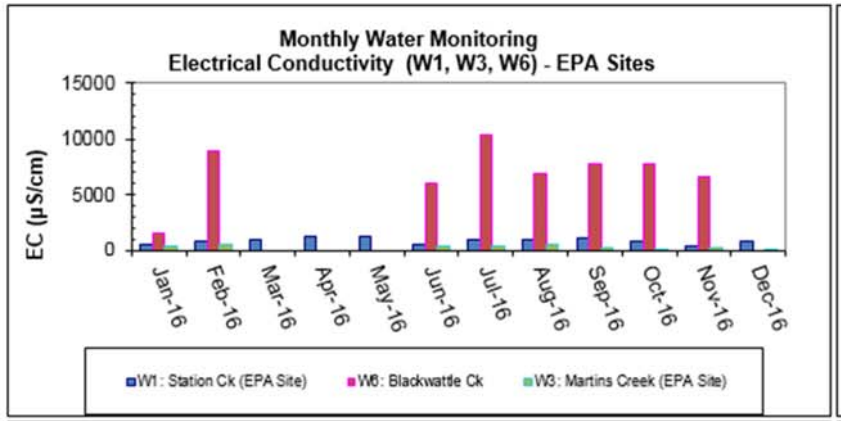

Monthly Water Monitoring
Total Suspended Solids (W4, W5, W11) - Glennies Creek
TSS (mg/L)
80
70
60
50
40
30
20
10
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

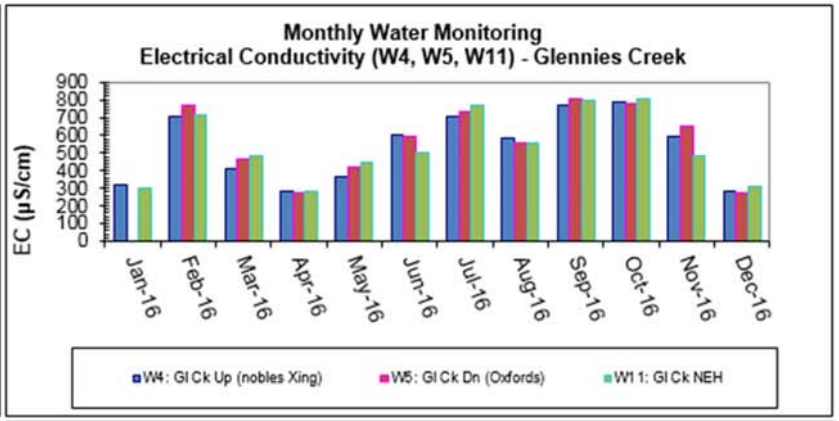

Monthly Water Monitoring
Total Suspended Solids (W7) -
Stoney Ck
TSS (mg/L)
50
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W7: Stony Ck

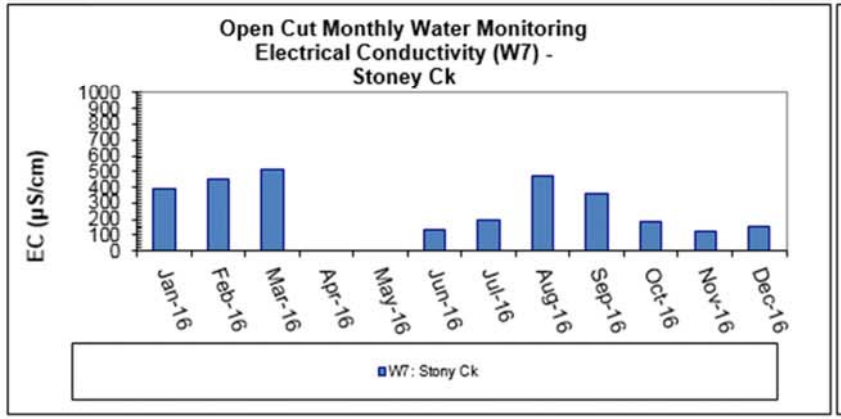

Monthly Water Monitoring
Total Suspended Solids (W10, W12, W13) - Dams
TSS (mg/L)
180
160
140
120
100
80
60
40
20
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

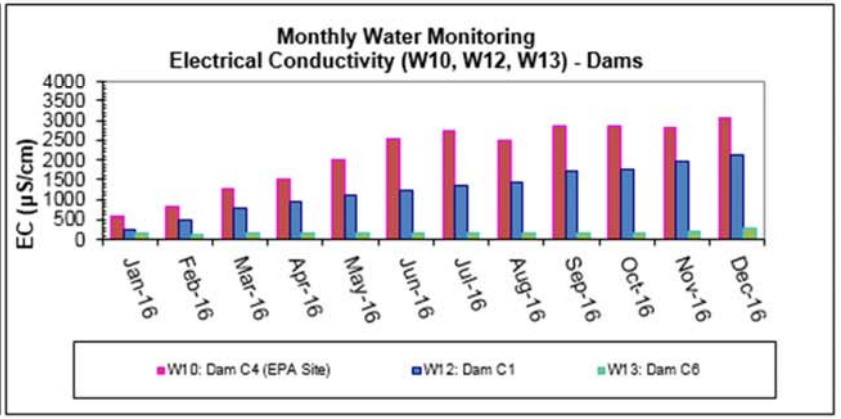

Monthly Water Monitoring
Total Suspended Solids (W14, W15, W16) - Dams
TSS (mg/L)
140
120
100
80
60
40
20
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W14: Dam C3
W15: Dam C6A
W16: Dam C8

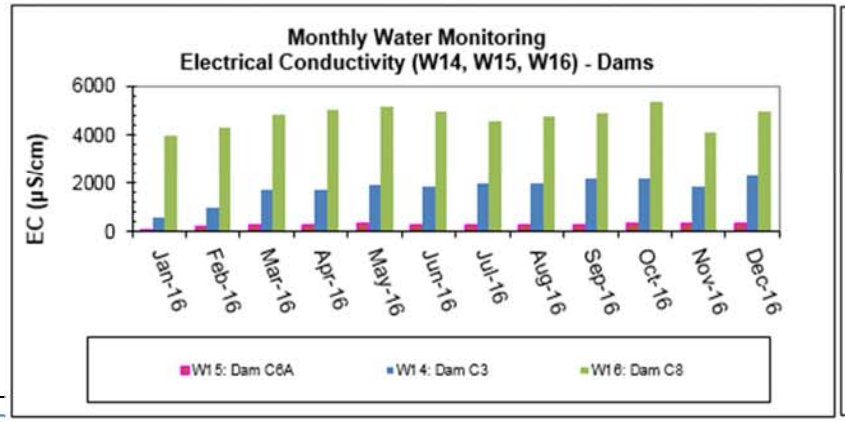

Monthly Water Monitoring
Total Suspended Solids
(W17, W18, W19, W20, W21) - Dams
TSS (mg/L)
250
200
150
100
50
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W17: Dam C2
W18: Dam C5
W20: North Dam 1
W19: Dam D1
W21: North Dam 2

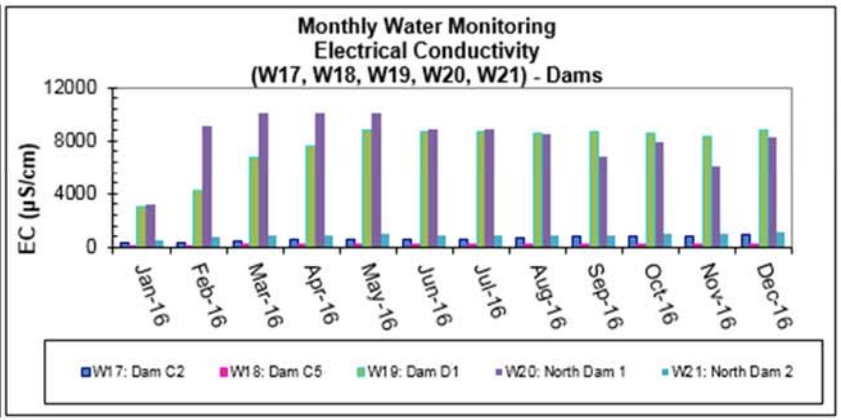

Monthly Water Monitoring
Electrical Conductivity (W1, W3, W6) - EPA Sites
EC (µS/cm)
15000
10000
5000
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W1: Station Ck (EPA Site)
W6: Blackwattle Ck
W3: Martins Creek (EPA Site)

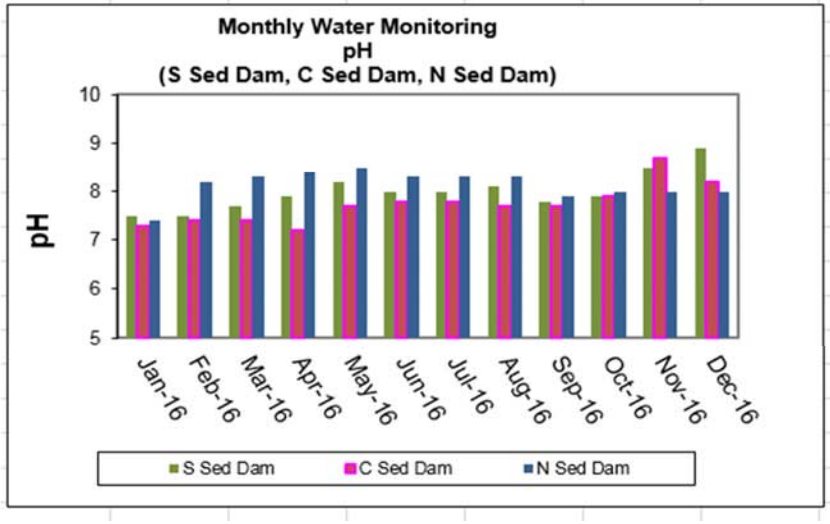

Monthly Water Monitoring
Electrical Conductivity (W4, W5, W11) - Glennies Creek
EC (µS/cm)
900
800
700
600
500
400
300
200
100
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

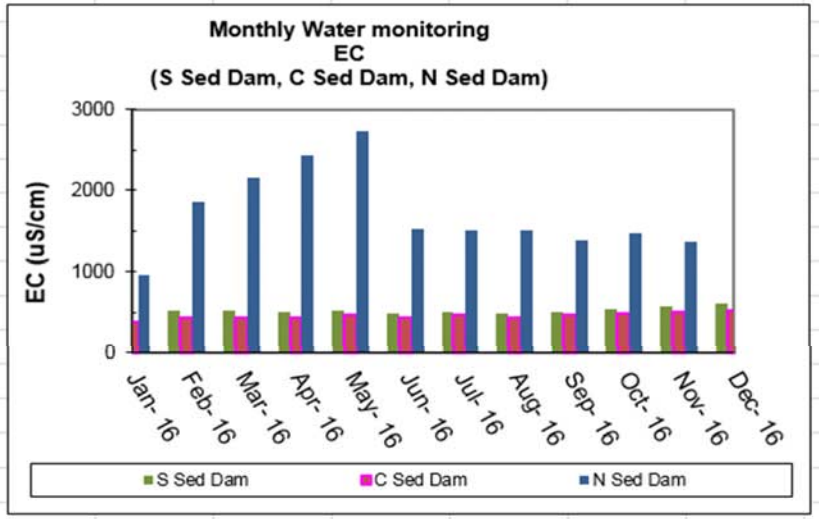

Open Cut Monthly Water Monitoring
Electrical Conductivity (W7) -
Stoney Ck
EC (µS/cm)
1000
900
800
700
600
500
400
300
200
100
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W7: Stony Ck


Monthly Water Monitoring
Electrical Conductivity (W10, W12, W13) - Dams
EC (µS/cm)
4000
3500
3000
2500
2000
1500
1000
500
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6


Monthly Water Monitoring
Electrical Conductivity (W14, W15, W16) - Dams
EC (µS/cm)
6000
4000
2000
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W15: Dam C6A
W14: Dam C3
W16: Dam C8

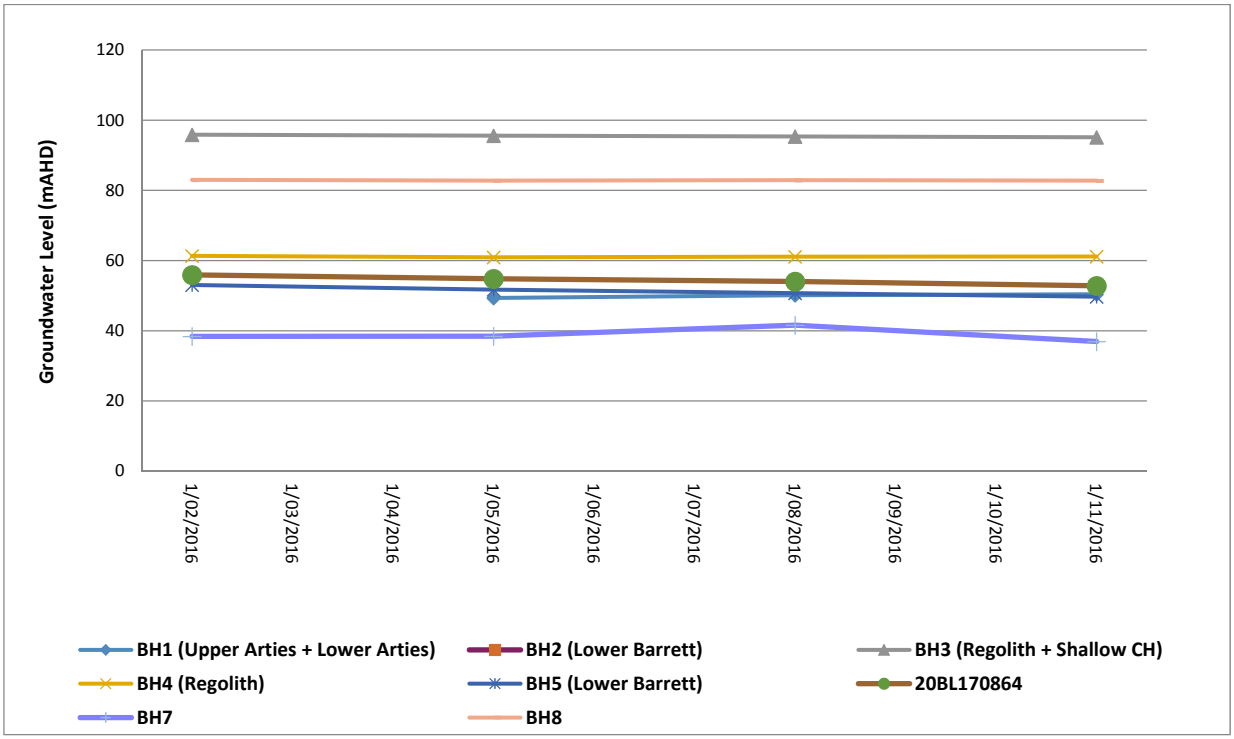

Monthly Water Monitoring
Electrical Conductivity
(W17, W18, W19, W20, W21) - Dams
EC (µS/cm)
12000
8000
4000
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
W17: Dam C2
W18: Dam C5
W19: Dam D1
W20: North Dam 1
W21: North Dam 2


Monthly Water Monitoring
pH
(S Sed Dam, C Sed Dam, N Sed Dam)
pH
10
9
8
7
6
5
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
S Sed Dam
C Sed Dam
N Sed Dam

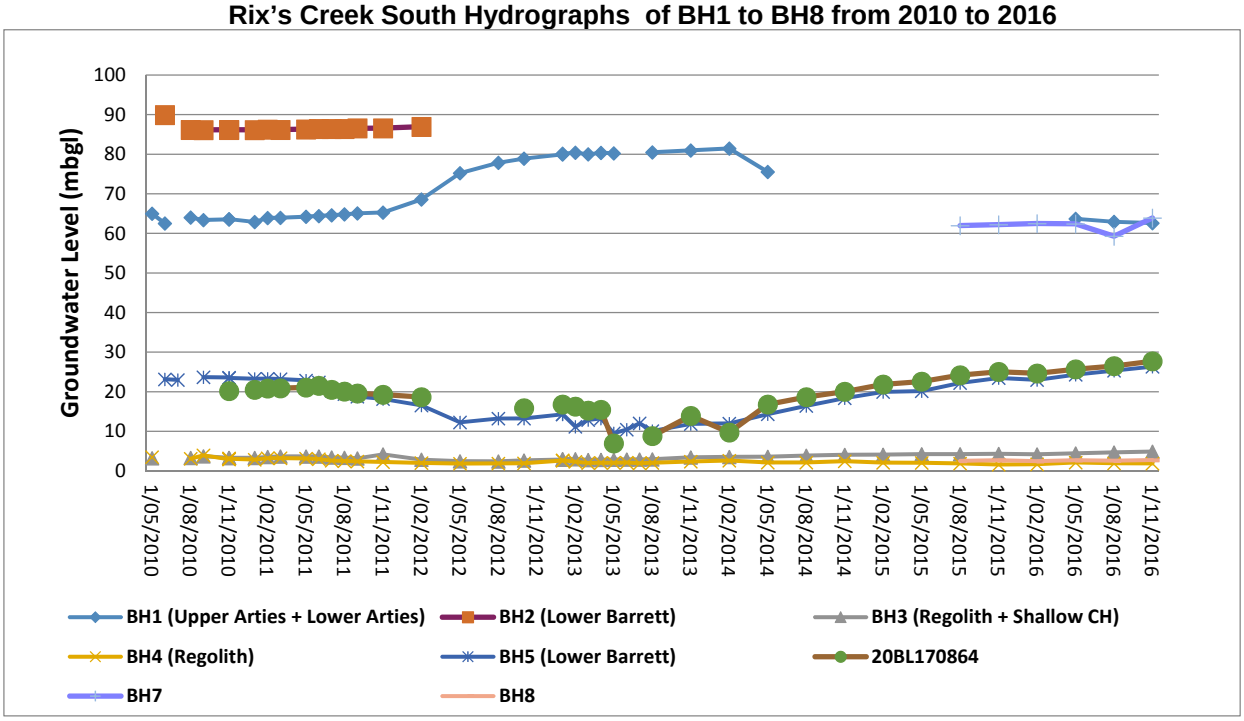

Monthly Water monitoring
EC
(S Sed Dam, C Sed Dam, N Sed Dam)
EC (uS/cm)
3000
2000
1000
0
Jan- 16
Feb- 16
Mar- 16
Apr- 16
May- 16
Jun- 16
Jul- 16
Aug- 16
Sep- 16
Oct- 16
Nov- 16
Dec- 16
S Sed Dam
C Sed Dam
N Sed Dam

Appendix 5 Rix's Creek Mine Ground Water Sampling Results

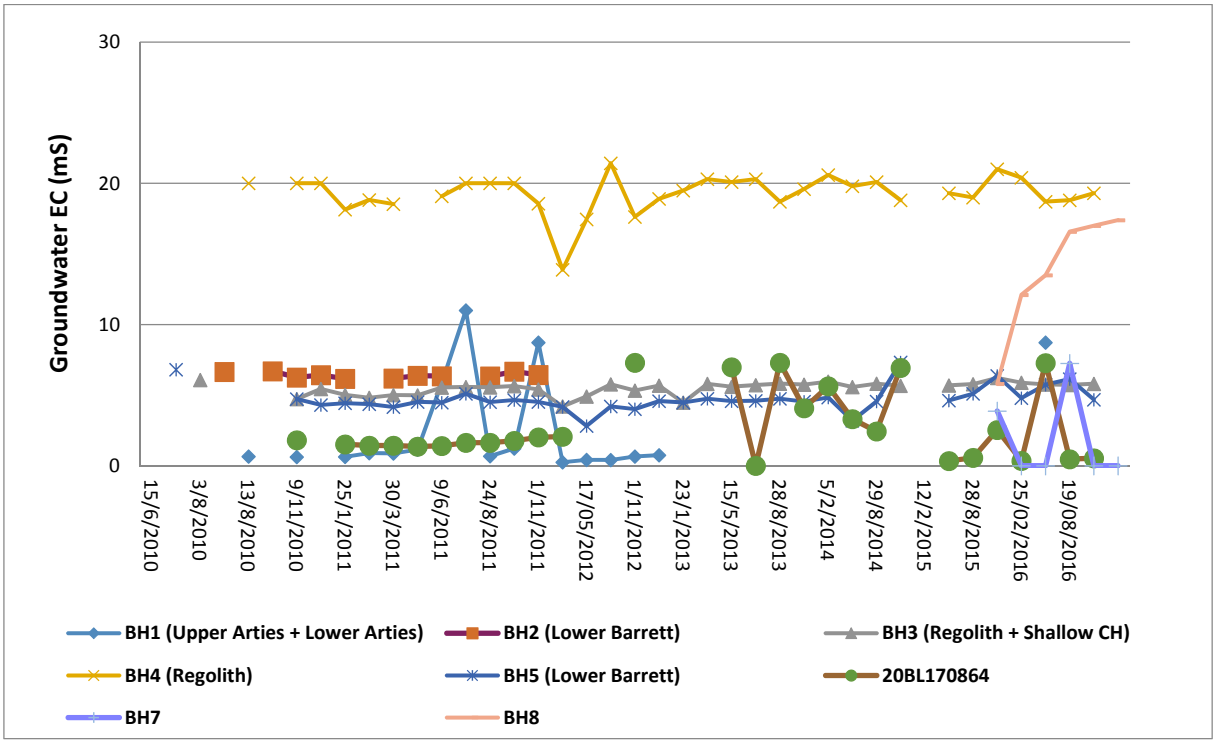
Rix's Creek South Hydrographs of BH1 to BH8 during 2016



Rix's Creek South Hydrographs of BH1 to BH8 from 2010 to 2016



Rix's Creek South Ground Water EC results for 2016



Rix's Creek North Ground Water Results

Bi-Monthly Results

	GCP01						GCP02						GCTB					
Date Sampled	pH	EC uS/cm	Depth m	Colour	Turbidity	Odour	pH	EC uS/cm	Depth m	Colour	Turbidity	Odour	pH	EC uS/cm	Depth m	Colour	Turbidity	Odour
Jan-16	8.5	11720	45.89	Green	Slight	Yes	8.2	12970	59.29	green	Slight	yes	8.6	14780	55.45	green	slight	yes
Mar-16	8.4	11480	47.8	clear	clear	nil	8.2	12500	59.15	clear	clear	yes	8.1	14160	55.24	Green	turbid	yes
May-16	8.4	11590	47.77	Green	Slight	Yes	8.35	13900	58.88	green	Slight	nil	7.9	14820	55.07	brown	slight	yes
Jul-16	8.5	11120	47.22	clear	clear	nil	8.24	12000	59.06	grey	slight	nil	8.2	13810	55.18	clear	clear	yes
Sep-16	8.5	11580	47.64	clear	clear	nil	8.34	12700	59.13	clear	clear	nil	8.1	14300	55.2	brown	slight	yes
Nov-16	8.37	12100	47.62	green	slight	nil	8.32	12600	58.9	green	slight	nil	8.3	14800	55.08	green	slight	yes
AVERAGE	8.445	11598.33	47.32				8.275	12778.3333	59.0683333				8.2	14445	55.2033333			
MIN	8.37	11120	45.89				8.2	12000	58.88				7.9	13810	55.07			
MAX	8.5	12100	47.8				8.35	13900	59.29				8.6	14820	55.45			
SD	0.06123724	319.275221	0.73213842				0.06978539	634.993438	0.15715173				0.23664319	420.559152	0.13837148			

	GCP05						GCP06						GCP07					
Date Sampled	pH	EC uS/cm	Depth m	Colour	Turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour
Jan-16	7.2	11860	34.68	clear	clear	nil	6.8	13690	37.17	green	slight	nil	7.8	7600	47.22	green	slight	yes
Mar-16	7.55	12000	34.53	clear	clear	nil	6.6	13400	37.05	clear	Slight	nil	7.6	7350	47.36	black	turbid	yes
May-16	7.85	13600	34.26	Clear	Clear	nil	6.6	13060	37.05	clear	clear	nil	7.9	7410	45.92	black	turbid	yes
Jul-16	7.31	11800	34.7	Clear	Clear	nil	6.9	12690	36.93	clear	clear	nil	7.8	7490	43.86	black	turbid	yes
Sep-16	7.79	12300	35.57	clear	clear	slight	6.7	13600	36.92	clear	clear	nil	7.7	8150	41.06	black	turbid	yes
Nov-16	7.83	11900	34.17	green	slight	nil	7.23	13000	36.99	clear	clear	nil	8.14	8430	38.63	black	turbid	yes
AVERAGE	7.59	#REF!	34.65				6.805	13240	37.018333				7.8233333	7738.3333	44.008333			
MIN	7.2	11800	34.17				6.6	12690	36.92				7.6	7350	38.63			
MAX	7.85	13600	35.57				7.23	13690	37.17				8.14	8430	47.36			
SD	0.2818806	687.65301	0.4993362				0.238642	387.34997	0.0930412				0.185652	444.36096	3.5452527			
	Dry = No sample, site was dry																	

	GCP08						GCP09						GCP10					
Date Sampled	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour
Jan-16	7	12040	42.98	L orange	Slight	Nil	6.8	445	6.15	green	slight	Nil	6.9	503	6.75	clear	clear	nil
Mar-16	6.8	11550	45	brown	turbid	nil	7.19	307	6.22	clear	Clear	nil	6.9	538	6.78	clear	clear	nil
May-16	6.8	11700	45.09	brown	turbid	yes	7.49	353	6.15	L.Orange	turbid	nil	6.8	559	6.89	clear	clear	nil
Jul-16	7	11840	44.95	brown	Slight	nil	6.89	372	6.38	Orange	turbid	nil	7	597	6.93	Clear	Clear	nil
Sep-16	7	12050	44.36	orange	Slight	nil	7.3	397	6.3	Orange	slight	nil	6.8	617	6.91	Clear	Clear	nil
Nov-16	7.5	11600	43.21	orange	turbid	nil	7.36	418	6.23	L.Orange	slight	Nil	7.66	645	6.9	green	slight	nil
AVERAGE	7.016667	11796.67	44.265				7.171667	382	6.238333				7.01	576.5	6.86			
MIN	6.8	11550	42.98				6.8	307	6.15				6.8	503	6.75			
MAX	7.5	12050	45.09				7.49	445	6.38				7.66	645	6.93			
SD	0.256255	216.3947	0.944812				0.272427	49.10397	0.089312				0.327109	52.80814	0.075366			

	GCP13						GCP14						GCP19					
Date Sampled	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour
Jan-16	6.9	13630	22.4	L.Orange	slight	nil	4.6	19220	41.1	brown	turbid	yes	7.3	2860	8.89	clear	clear	nil
Mar-16	6.7	13340	29.34	brown	turbid	nil	4.3	19130	41.25	brown	turbid	yes	6.8	2790	9.09	Clear	Clear	nil
May-16	6.7	13230	28.4	brown	turbid	nil	4.1	19100	39.82	brown	turbid	yes	6.9	2730	9.16	Clear	Clear	nil
Jul-16	6.9	12880	28.2	orange	slight	nil	4.2	17660	37.79	black	turbid	nil	7	2820	9.2	Clear	Clear	nil
Sep-16	6.8	12880	27.51	brown	slight	nil	4.2	17240	34.98	black	turbid	nil	6.9	2980	9.21	Clear	Clear	nil
Nov-16	7.26	12800	26.36	clear	clear	nil	4.47	14000	32.5	brown	turbid	yes	7.49	2960	9.23	Clear	Clear	nil
AVERAGE	6.876667	13126.67	27.035				4.311667	17725	37.90667				7.065	2856.66667	9.13			
MIN	6.7	12800	22.4				4.1	14000	32.5				6.8	2730	8.89			
MAX	7.26	13630	29.34				4.6	19220	41.25				7.49	2980	9.23			
SD	0.208006	328.0041	2.47782				0.188724	2010.7088	3.545339				0.270093	97.7070451	0.127593			

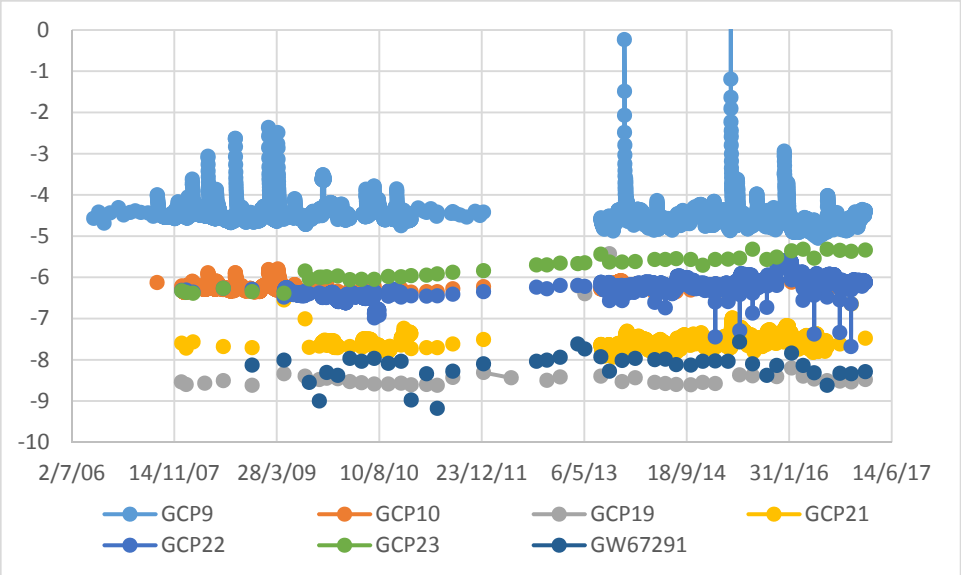
	GCP21						GCP22						GCP23					
Date Sampled	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour	pH	EC uS/cm	Depth m	colour	turbidity	odour
Jan-16	7.3	1448	8.24	clear	clear	nil	6.9	11600	6.66	clear	clear	nil	7.2	15530	6.3	green	turbid	yes
Mar-16	7.1	1413	8.36	clear	clear	nil	6.8	12010	6.7	Clear	Clear	nil	7.3	15640	6.26	clear	clear	yes
May-16	7	1428	8.37	clear	clear	nil	6.8	12080	6.77	clear	clear	yes	7.3	16020	6.48	green	Slight	yes
Jul-16	7.2	1434	8.49	clear	clear	nil	6.9	10940	6.72	Clear	Clear	nil	7.4	16320	6.26	clear	clear	yes
Sep-16	7	1424	8.45	clear	clear	nil	6.8	11630	6.73	clear	clear	nil	7.3	16490	6.29	clear	clear	yes
Nov-16	7.67	1430	7.48	clear	clear	nil	7.31	11900	6.77	green	slight	nil	7.71	15900	6.31	green	slight	nil
AVERAGE	7.211667	1429.5	8.231667				6.918333	11693.33	6.725				7.368333	15983.33	6.316667			
MIN	7	1413	7.48				6.8	10940	6.66				7.2	15530	6.26			
MAX	7.67	1448	8.49				7.31	12080	6.77				7.71	16490	6.48			
SD	0.253015	11.55422	0.378175				0.198032	417.7878	0.042308				0.178932	374.6287	0.082624			

	GCP24						GW67291					
Date Sampled	pH	EC uS/cm	Depth m	Colour	Turbidity	Odour	pH	EC uS/cm	Depth m	Colour	Turbidity	Odour
Jan-16	7.8	3130	18.66	clear	clear	nil	6.6	837	7.84	clear	clear	nil
Mar-16	7.5	3010	17.69	Clear	clear	nil	6.6	1.213	8.14	Clear	Clear	nil
May-16	7.3	3070	17.83	Clear	clear	nil	6.5	1325	8.32	Clear	Clear	nil
Jul-16	7.5	3130	18.08	Clear	clear	nil	6.6	1252	8.62	Clear	Clear	nil
Sep-16	7.3	3050	18.32	clear	clear	nil	6.6	1120	8.33	clear	clear	nil
Nov-16	7.82	3120	18.46	green	slight	nil	7.36	974	8.34	clear	clear	nil
AVERAGE	7.536667	3085	18.17333				6.71	918.2022	8.265			
MIN	7.3	3010	17.69				6.5	1.213	7.84			
MAX	7.82	3130	18.66				7.36	1325	8.62			
SD	0.229928	49.69909	0.374362				0.320936	483.3641	0.258902			

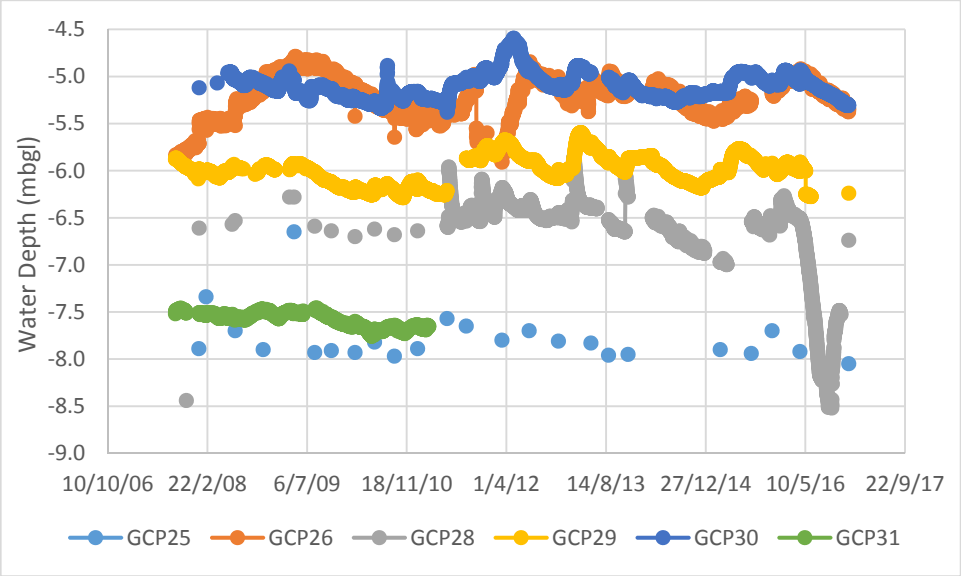
Hydrological Specailist Interpretation of Rix's Creek North 2016 Ground Water results

Based on the available data during the 2016 reporting period, alluvial groundwater level monitoring indicated no response to mining outside of the normal climatic variability from the;

- Falbrook Open Cut in the Glennies Creek catchment, and the;
- Camberwell Open Cut in the Glennies Creek and Station Creek catchments, except for GCP28, which had a water level reduction of approximately 2m during the Winter of 2016 with a subsequent ongoing recovery.



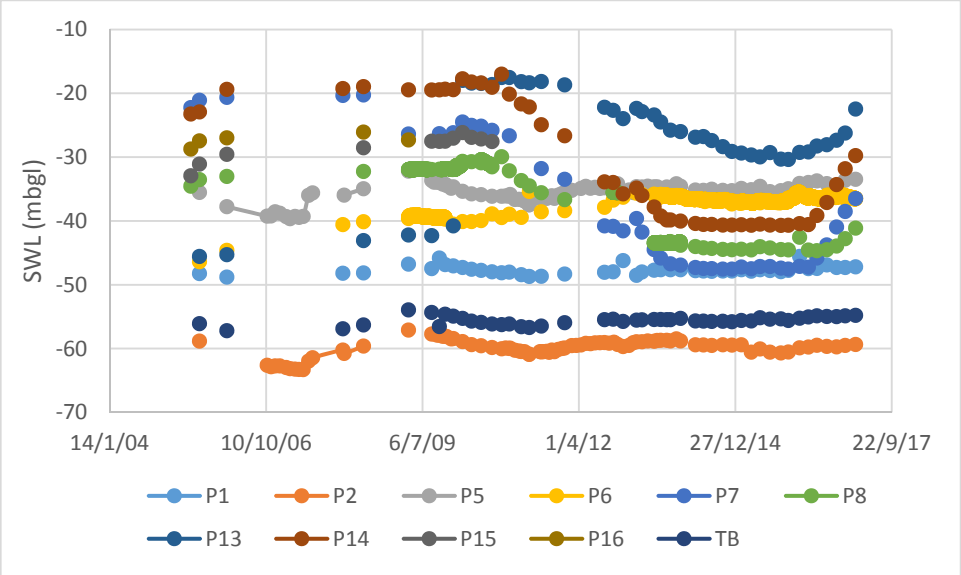
Falbrook Open Cut Alluvium



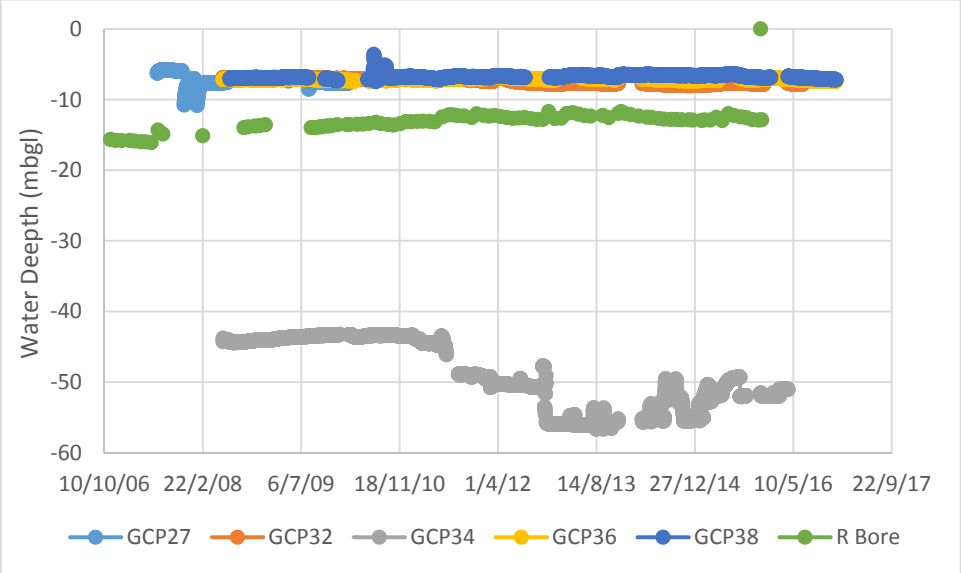
Gellnies Creek Alluvium

The available basement groundwater monitoring data in the 2016 reporting period indicated;

- Recovery of GCP7, 8, 13 and 14 along with normal climatic variability with the remaining piezometers within the Falbrook Open Cut suite, and
- continued depressurisation and recharge of GCP34 within its basal range along with normal variability within the historic range for the remaining piezometers in the Camberwell Open cut suite.



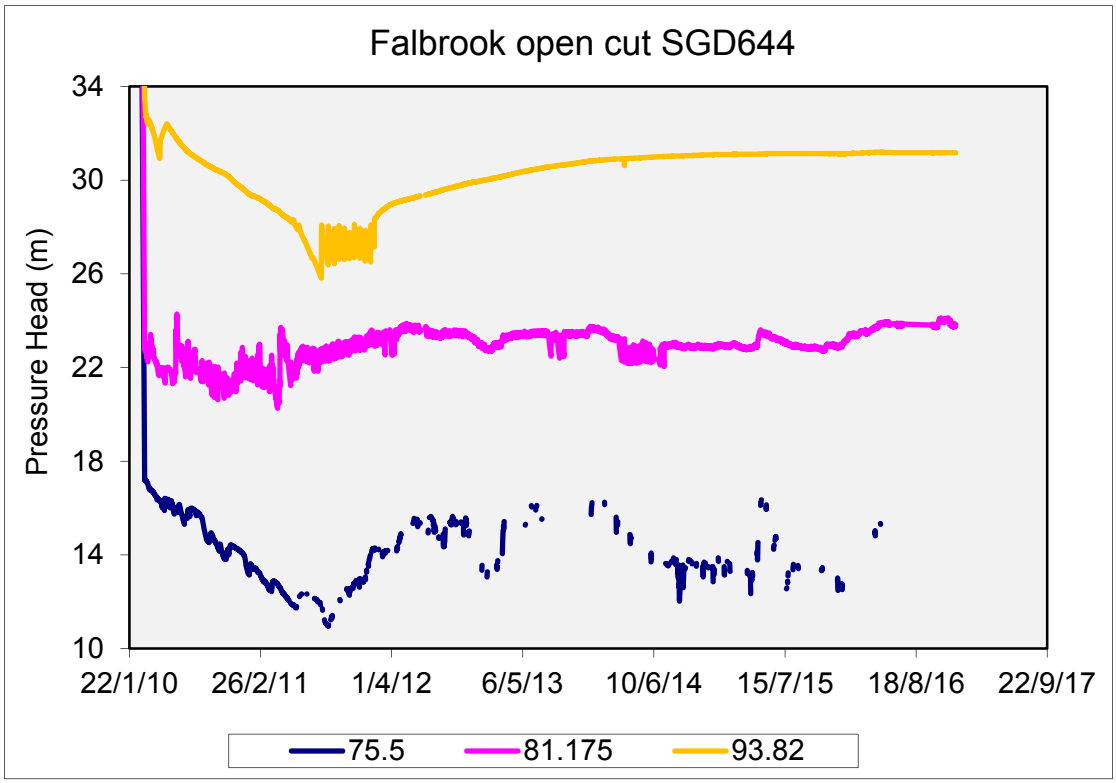
Falbrook Open Cut Basement

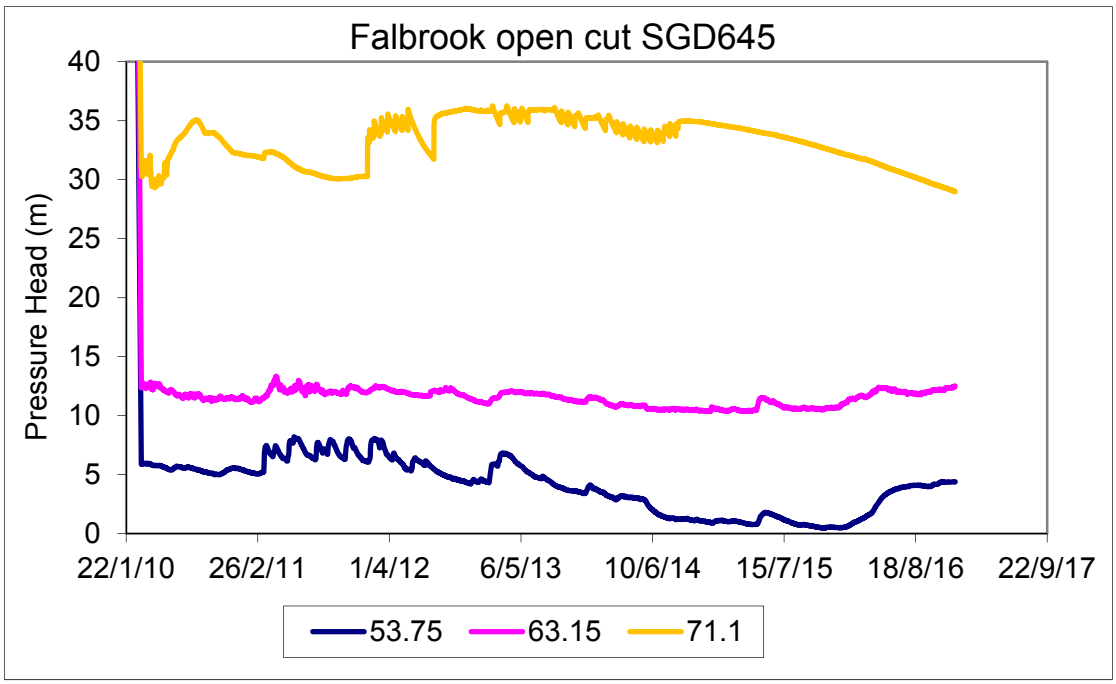


Camberwell Open Cut Basement

Piezometer array SGD644 in the Falbrook Open Cut area showed no definitive mining induced depressurisation during 2016, although some recovery is evident at 93.82mbgl.

The intake at 53.75m below surface in SGD645 indicates a minor depressurisation of approximately 6m since late March 2013 and subsequent recovery, along with a depressurisation at 71.1mbgl and no significant variation at 63.15mbgl.

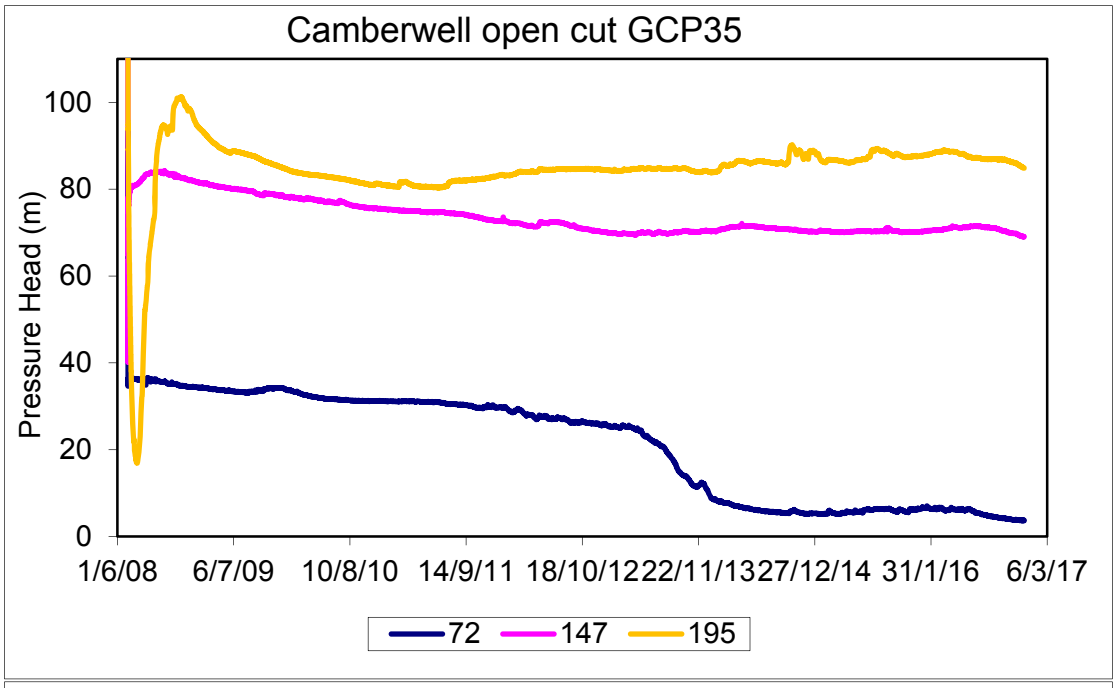


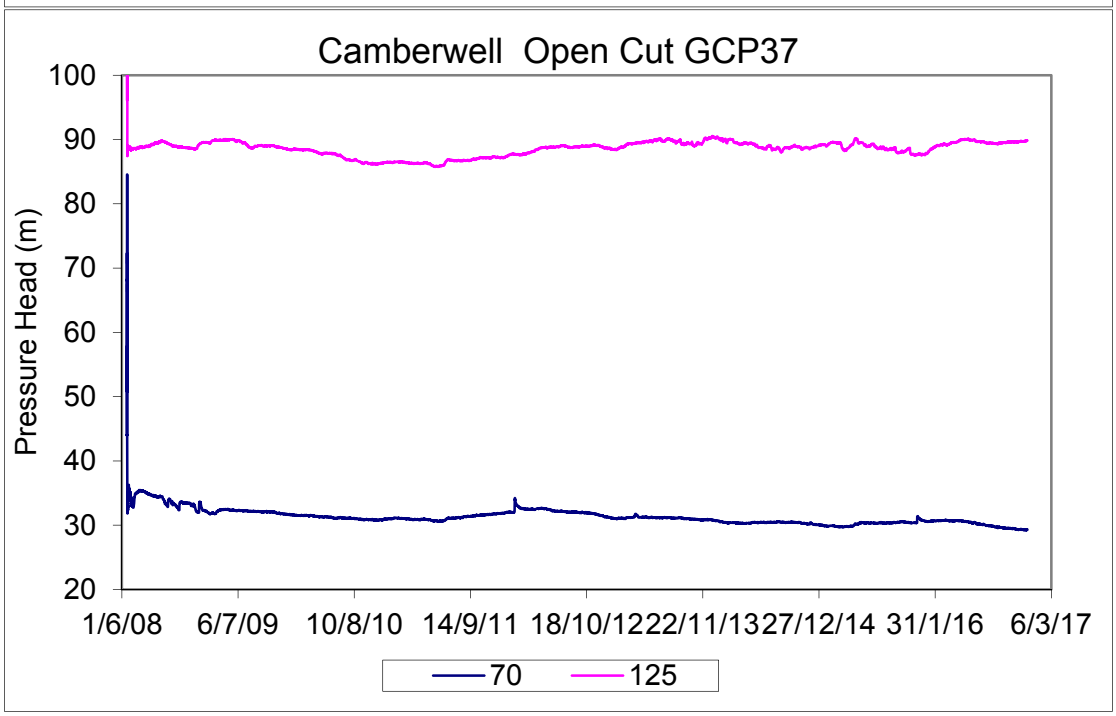


North Open Cut VWP

Piezometer array GCP35 in the Camberwell open cut area indicates no variation outside of the historic range in the deepest intake at 195m below surface, a continuation of the gradual depressurisation of the 147m below surface intake, along with a definitive depressurisation of the shallowest intake (72mbgl) of around 14m that gradually started in early 2013.

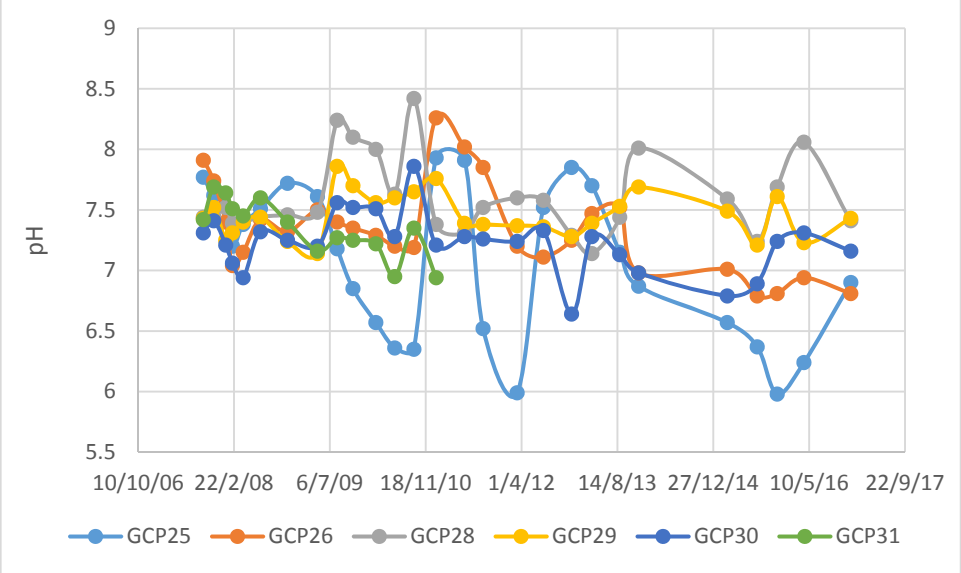
GCP37 showed no definitive mining induced depressurisation during 2016 outside of its historic range.

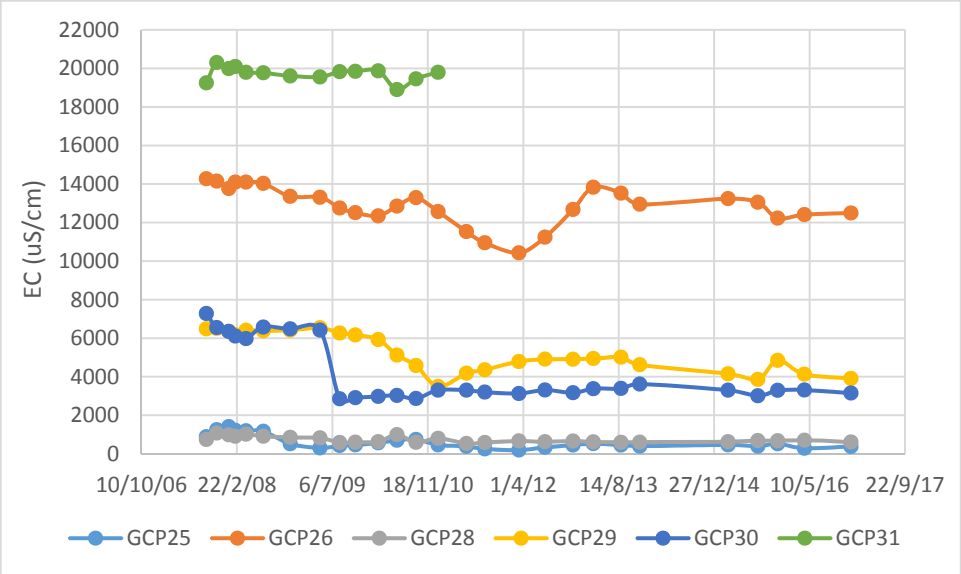




Camberwell VWP

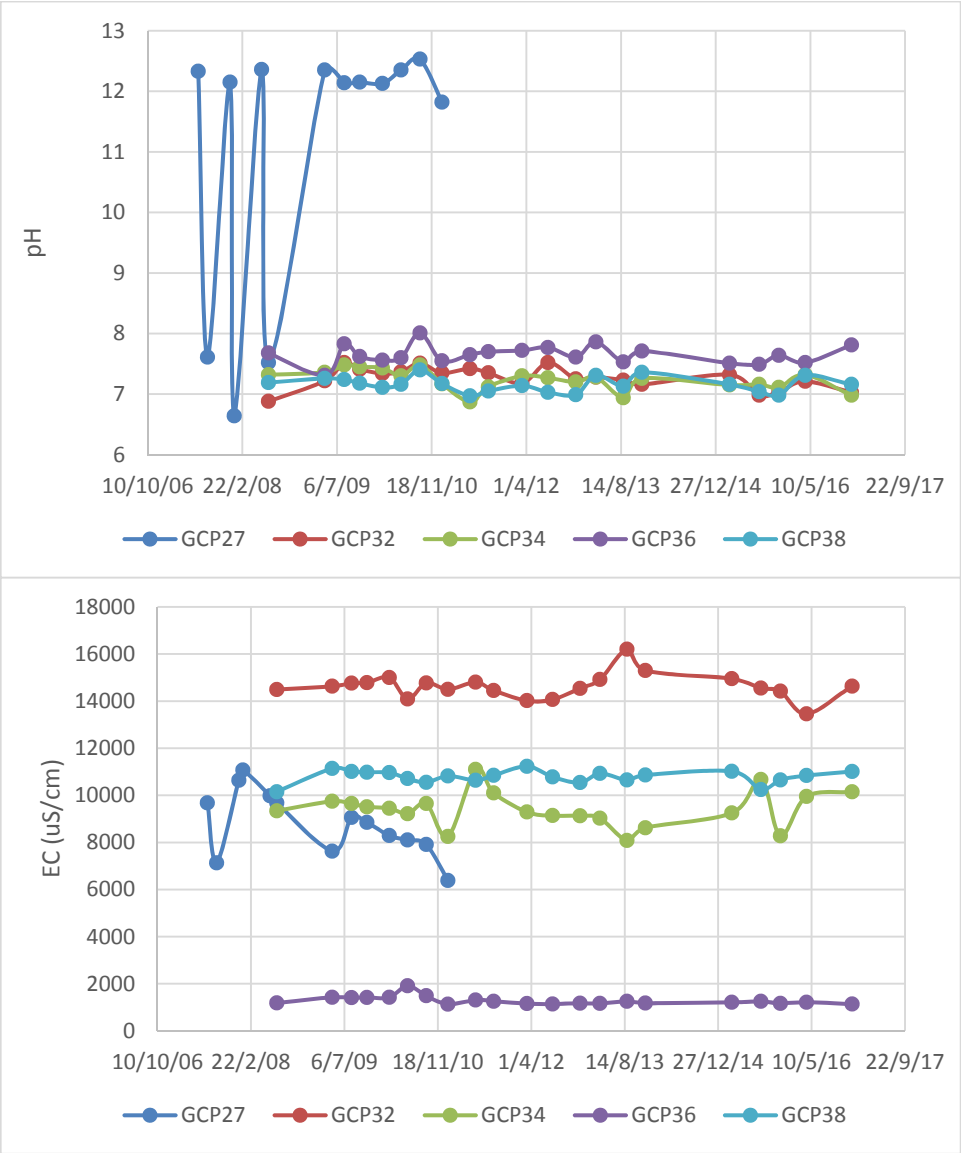
The pH and salinity in the Glennies Creek alluvial open standpipe piezometers has not shown any significant trends since they were installed in 2007, except for a partial de-salinisation in GCP29 and GCP30 between mid 2009 and early 2011.





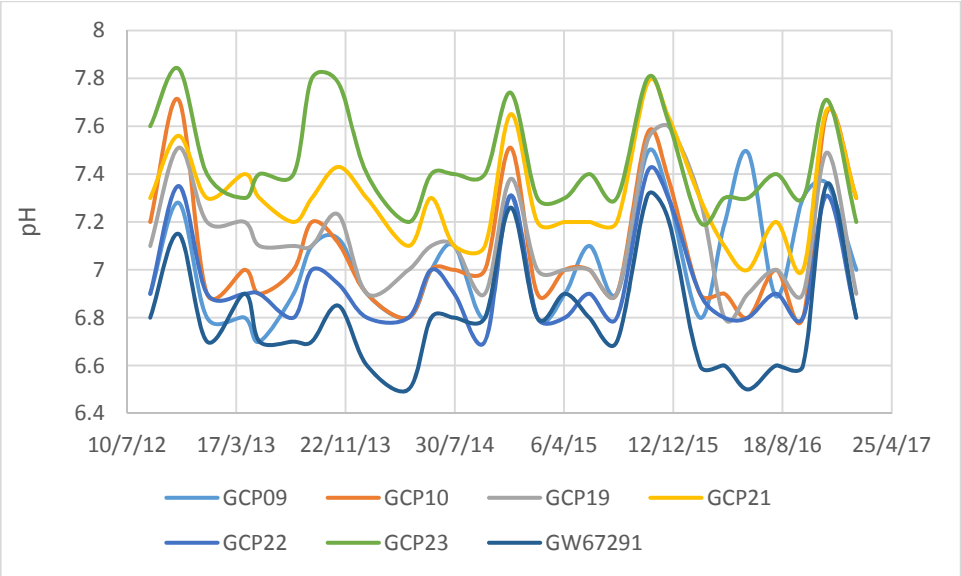
Glennies Creek Alluvium Groundwater Quality

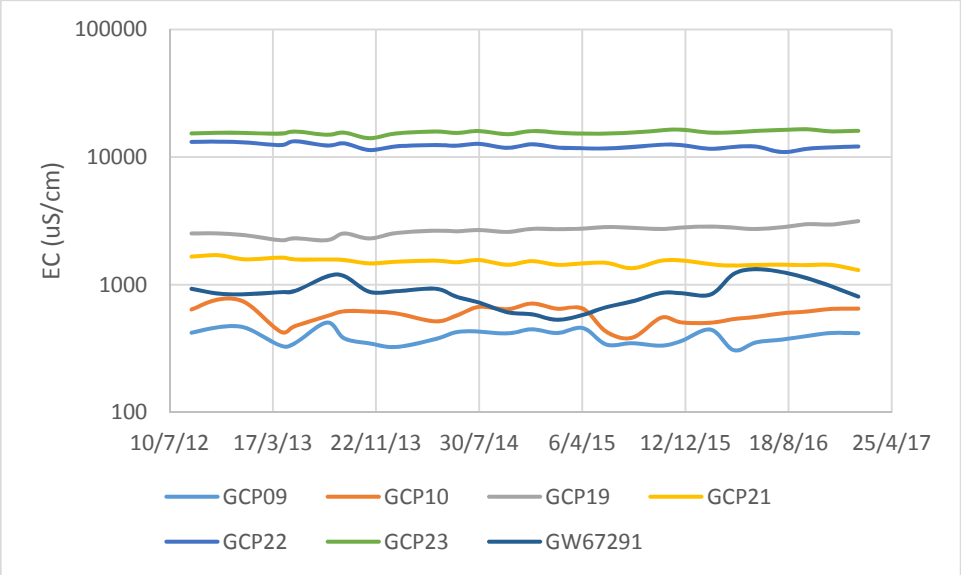
The pH and salinity in the Camberwell basement open standpipe piezometers has not shown any significant trends since they were installed after mid 2007, whilst GCP27 (a partially cement backfilled exploration bore) monitoring was discontinued as it was affected by the cement backfill.



Camberwell Basement Groundwater Quality

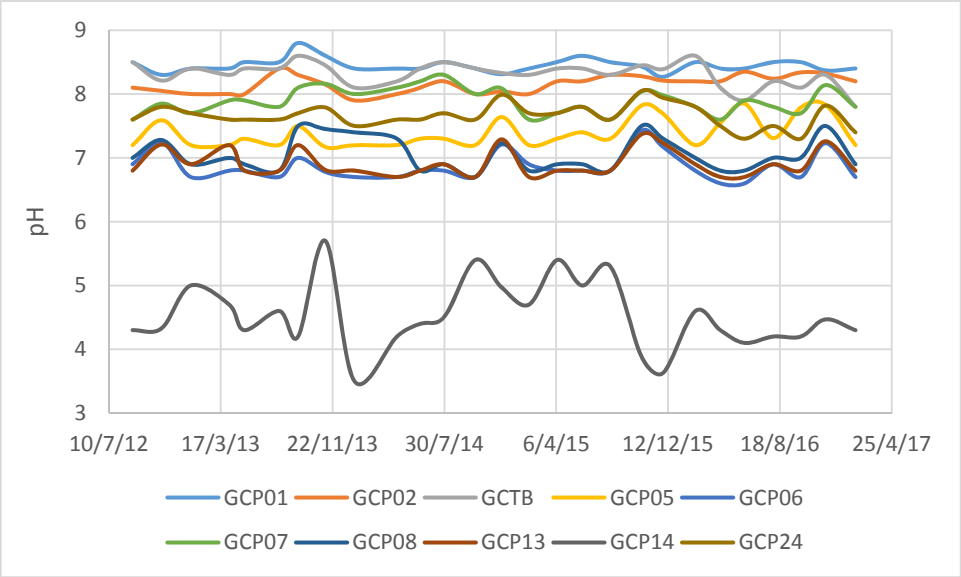
The pH and salinity in the Falbrook Open Cut alluvial open standpipe piezometers has not shown any significant trends since they were installed in 2012.

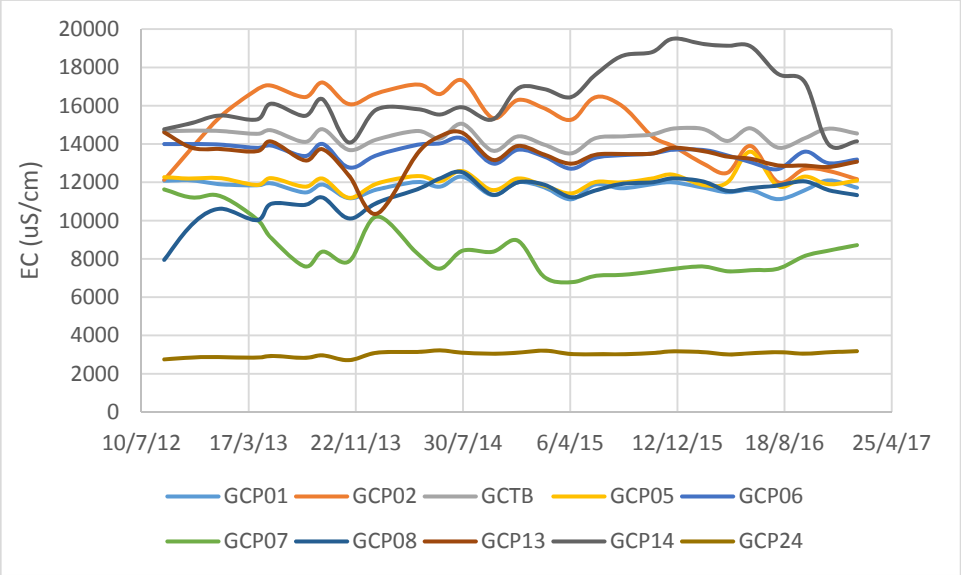




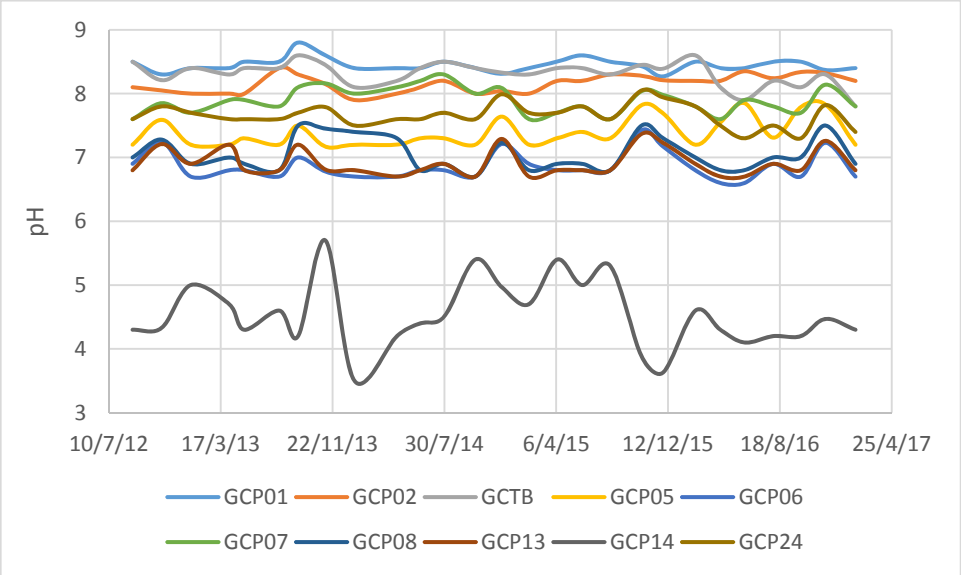
Falbrook Open Cut Alluvium Groundwater Quality

The pH and salinity in the North Open Cut basement open standpipe piezometers has not shown any significant trends since they were installed in 2012 except for a rise then fall in salinity in GCP14 and a reduction in salinity at GCP02.





The pH and salinity in the Falbrook Open Cut basement open standpipe piezometers has not shown any significant trends since they were installed in 2012 except for a rise then fall in salinity in GCP14 and a reduction in salinity at GCP02.



Appendix 6 Rix's Creek January 2016 water release incidents

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Investigation Team

Luke Murray	Mine Manager
Garry Bailey	General Manager Mining Development
John Hindmarsh	Senior Environmental Officer
Jason Desmond	Environmental Officer
Chris Quinn	Environmental Officer

Copies to

John Richards	Environmental Protection Authority (EPA)
Renata Roberts	Dept. Planning & Environment (DPE)
Luke Murray	NSW Trade & Investment, Resources & Energy
John Hindmarsh (File)	
Jason Desmond	
Chris Quinn	

Incident Description

During the period from 4/1/2016 to 7/1/2016 a significant rainfall event occurred across the region with the site receiving 141.5 mm.

Date	Rainfall
4/1/2016	14.5
5/1/2016	26.5
6/1/2016	90
7/1/2016	10.5
Total Rainfall	**141.5**

This rainfall event produced significant runoff across the site. Water management structures filled with some filling to capacity and overflowing as a result of the excessive runoff. Previous analysis of rainfall data from April 2015 indicates this 2016 event matches an Annual Exceedance Probability of 10% or a 1-in-10 year rainfall intensity storm (see Appendix I. *Review of the Reservoir Performance of Dam 10 and Dam 11 at the Rixs Creek Colliery Coal Loader.* JP Environmental July 2015).

This incident was reported to EPA on 7th January, 2016 at 9:30 am and was logged with Reference Number: - C00220-2016. Chris Knight from DPE, and John Trotter of NSW Investment, Resources & Energy were verbally notified by telephone.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Incident Outcome

The excessive runoff that the 141.5 mm of rain produced across the site resulted in:-

- Five sediment containment dams filling to capacity and overflowing releasing water into drainage lines that ran off site.
  - The overflow water from two sediment dams ran into Deadman's Gully which flows offsite.
  - One sediment dam overflowed into Rixs Creek which runs offsite, and
  - Two sediment dams Dam B2 and B5 located on the western periphery of Rix's Creek North (RCN) overflowed running offsite into the ephemeral Station Creek
- The containment dam at the clean coal stockpile and rail loading facility overflowed with the water running into Black Wattle Creek and offsite.
- Water samples were taken on 6th January, 2016 from the structures that overflowed and Station Creek. Rix's Creek was sampled on 7th January, 2016 upstream, downstream and midway through the operation. (Table 1.)
- The sample results are provided in Table 1, and location of the structures shown in Figure 1.

Table 1: Water sample results from structures that overflowed.

Location	Date	pH	Electrical Conductivity (uS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)
1 - Upstream Rail Loader	6/1/2016 13:20	6.6	62	76	126
2 – Rail Loader Containment Dam	6/1/2016 13:30 13.00	8.4	966	38	592
3- Rix's Creek - Above Operation	7/1/2016 7:30	7.2	276	42	227
4 - Sediment Dam - North	6/1/2016 13:40	8.0	1,260	256	840
5 – Rix's Creek - NEH Bridge	7/1/2016 7:40	7.2	264	38	210
6 – Rix's Creek Below Operation - Maison Dieu Bridge	7/1/2016 7:45	7.1	228	37	198

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

7 - West Pit OOPD Sediment Dam (East)	6/1/2016 14:20	7.8	280	2,860	101
8 - West Pit OOPD Sediment Dam (West)	6/1/2016 14:50	7.4	358	1,430	2,030
9 – Station Creek Upstream of B5	6/1/2016 10:35	8.2	1,779	82	1,050
10 – B2 Sediment Dam	6/1/2016 10:45	6.2	84	122	208
11 – B5 Sediment Dam	6/1/2016 10:25	6.9	127	564	384
12 – Station Creek Downstream of B5	6/1/2016 10:20	8.2	1,804	85	1,100

Mine Water Dam

Sediment Dam

Creek Flow monitoring result

Note: Locations shown in Figure 1.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release
6th January 2016

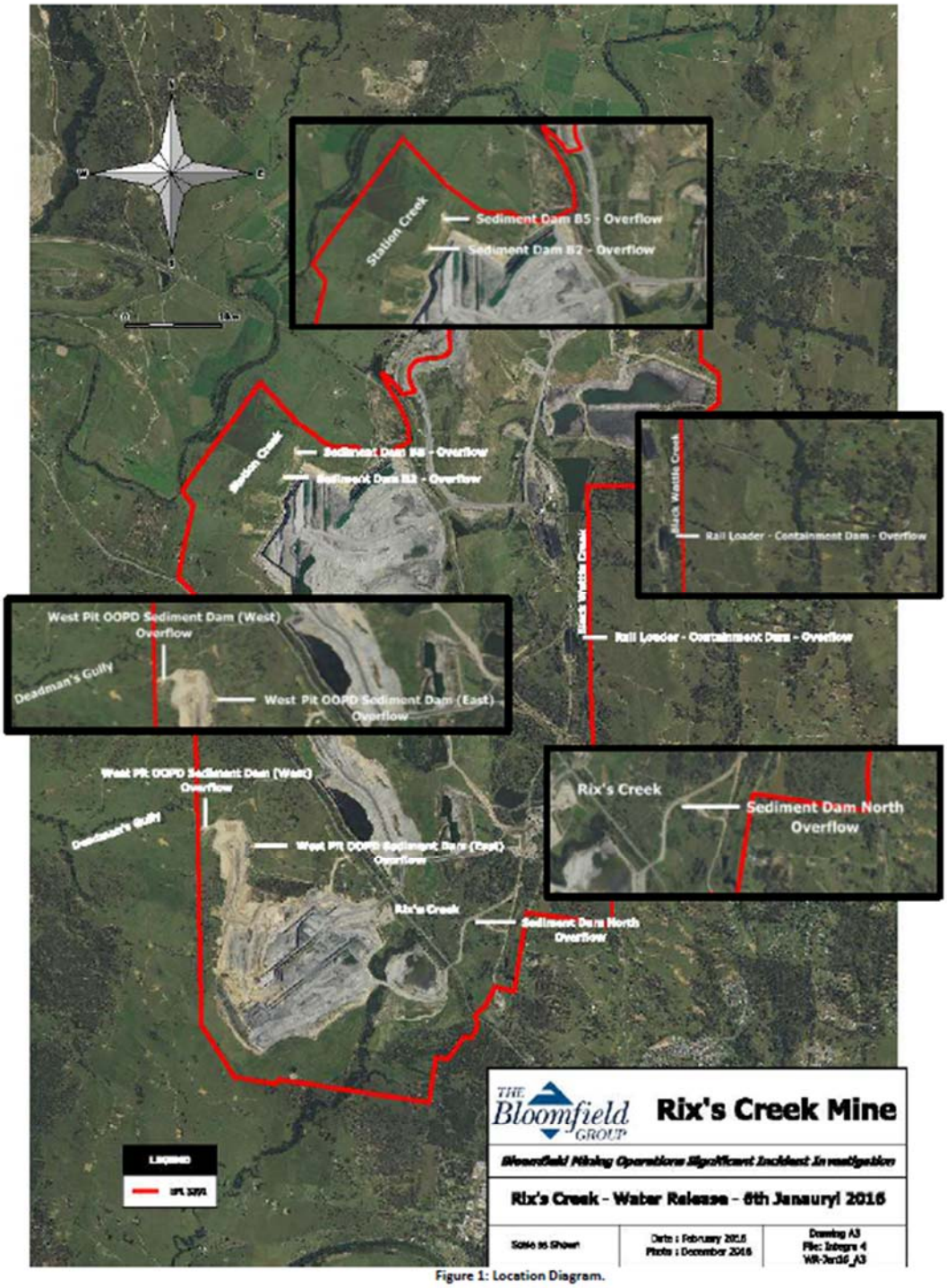


Figure 1: Location Diagram.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Events Related to the Incident

- The 142 mm of rain received in December 2015 would have provided recharge to soil moisture. December average rainfall is 74 mm.
- The above average December rain meant water levels in the rail loader containment dams was still high when the January rainfall event occurred, 141.5 mm rain over four consecutive days. The pump to lower water levels in the dams had been running continuously since mid-December. . Photographs 1 & 1A
- Review of the storage capacity of the rail loader containment dams using a daily water balance model (Appendix I) indicated they would not have overflowed in this rainfall event or any rainfall event since their construction prior to 1993 from internal catchment runoff.
- The rail loader containment dams were constructed prior to the commissioning of the rail loader back in 1993.

Photograph 1: Rail Loader Containment Dam Overflow.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Photograph 1A: Rail Loader Containment Dam Wall Overflow.

- Heavy rainfall (141.5mm over four consecutive days) caused the five sediment containment dams to fill with runoff water and overflow. These were:-
  - Sediment dam north, Photograph 2,
  - West Pit out-of-pit-dump Sediment Dam (East), Photograph 3,
  - West Pit out-of-pit-dump Sediment Dam (West), Photograph 4,
  - Sediment dam B2 and B5, Photograph 5.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Photograph 2: Sediment dam north.

Photograph 3: West Pit out-of-pit-dump Sediment Dam (East).

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Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Photograph 4: West Pit out-of-pit-dump Sediment Dam (West).

Photograph 5: Sediment Dam B5

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Mine Water Release

6th January 2016

Investigation Conclusions

The incident was investigated and the following conclusions drawn:

- The environmental impacts of the water running off site had insignificant environmental impact downstream on the receiving waters.
- Procedures in place across the site operated during the event, ie. Pumps on these dams were operated during the event.
- The pumps on these structures to lower levels following a rainfall event were not able to lower water levels sufficiently during the runoff event to prevent the structures from overtopping.
- The runoff from the rainfall event exceeded the capacity of the containment dam at the rail loader and sediment containment dams resulting in them filling and overtopping.

Follow-up

- The sediment dam's water levels were lowered by pumping water from them back into the mine water storages in preparation for the next rainfall/runoff event in line with current procedures.
- Monthly water sampling as part of the site's water management plan was undertaken on the 22nd January 2016 for the Rix's Creek site whilst the Rix's Creek North site was completed on the 27th January 2016. These results will be reviewed as per normal site practise.
- At the rail loader, investigation is being undertaken to determine if the pumping capacity can be increased by pumping to a different internal water storage structure than the current system to lower storage levels at a faster rate.
- Design work is being undertaken to see if it is possible to increase the storage capacity, given site restrictions at the location of sediment dam north, to reduce the potential for the structure to overtop.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

INVESTIGATION TEAM

Luke Murray	Mine Manager
Garry Bailey	General Manager Mining Development
John Hindmarsh	Senior Environmental Officer
Jason Desmond	Environmental Officer
Rodney Burley	Shift Supervisor

COPIES TO

John Richards
Renata Roberts
Luke Murray
John Hindmarsh
Jason Desmond (File)

Environmental Protection Authority (EPA)
Dept. Planning & Environment (DPE)
NSW Trade & Investment, Resources & Energy (DRE)

INCIDENT DESCRIPTION

As a result of recent above average rainfall received at Rix's Creek Mine during January 2016 which has dam levels and dewatering requirements increased across site, mine water dam (DWD3) situated in Rix's Creek West Pit has potentially seeped into Rix's Creek. January rainfall received was 244.5 mm which is 169.5 mm above average for the month.

This potential seepage from the dam at full capacity may have resulted in water leaving the mine site via Rix's Creek. Due to recent rainfall on Friday 22nd January, 2016 the creek is experiencing flow conditions upstream and downstream of the potential source of mine water entry.

The dam filled to capacity and overtopped at a low point in the overflow bank. The overflow bank was designed to drain back into the pit to prevent mine water leaving the site. The mine water that overtopped the bank would drain into Rix's Creek, however, there was no evidence of this water reaching and entering the Creek.

This incident was reported to the EPA Pollution Line at 14:30 on 27th January, 2016. The report was logged and Reference Number:- C01142-2016 issued. Chris Knight from DPE as well as John Trotter from DRE were contacted at 15:00 and 15:10 respectively on the same day.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

INCIDENT OUTCOME

On inspection of the dam the morning of the 27th January, 2016 by Rix's Creek personnel, all pumps transferring water into the dam were stopped. A large pump permanently positioned in the dam to provide water to the nearby water-fill station was used to transfer water into another mine water storage dam decreasing the water level in the dam (DWD3). Water samples were taken of the dam (DWD3), upstream of Rix's Creek and downstream of Rix's Creek on the same day. These are depicted in Figure 1. Water sampling was also conducted on Friday 22nd January 2016 at the same locations as part of the monthly surface water regime which was also used for water quality reference.

Table 1: Water samples results Friday 22nd January 2016 (pre-event):

Location	Date	pH	Electrical Conductivity (uS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)
1 – Railway Underpass	22/1/2016 10:40	7.2	315	19	300
2 - NEH Bridge	22/1/2016 11:45	7.4	657	14	533
3 – Below Operation	22/1/2016 12:20	7.6	547	19	343
4 – Maison Dieu Bridge	22/1/2016 10:15	7.1	1,098	25	637

Table 2: Water samples taken Wednesday 27th January 2016 (potential event):

Location	Date	pH	Electrical Conductivity (uS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)
1 – Railway Underpass	27/1/2016 11:35	7.2	280	29	199
2 - NEH Bridge	27/1/2016 11:15	7.4	422	45	292
3 – South Pit creek crossing	27/1/2016 10:55	7.3	205	67	264
4 – Below operation	27/1/2016 10:35	7.9	481	35	332

Bloomfield Mining Operations
Significant Incident Investigation
Rix's Creek – Potential mine water dam seepage
27th January 2016

5 – Maison Dieu bridge	27/1/2016 10:05	7.2	917	36	534
6 – Dight's Crossing Bridge	27/1/2016 10:00	7.1	1,030	33	578
7 – DWD3 West Pit storage	27/1/2016 11:05	8.6	3,300	11	1,950

Additional water sampling was undertaken on Friday 29th January, 2016 to further verify there was no potential environmental harm to the creek.

Table 3: Water samples taken Friday 29th January 2016 (post-event):

Location	Date	pH	Electrical Conductivity (*u*S/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)
1 - NEH Bridge	29/1/2016 12:30	7.6	553	10	368
2 – South Pit creek crossing	29/1/2016 13:00	7.5	508	36	367
3 – Below operation	29/1/2016 13:20	7.5	262	43	276
4 – Maison Dieu bridge	29/1/2016 12:20	7.1	1,146	26	645
5 – Dight's Crossing Bridge	29/1/2016 12:10	7.3	1,101	22	654
6 – DWD3 West Pit storage	29/1/2016 12:50	8.6	3,430	5	2,040

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

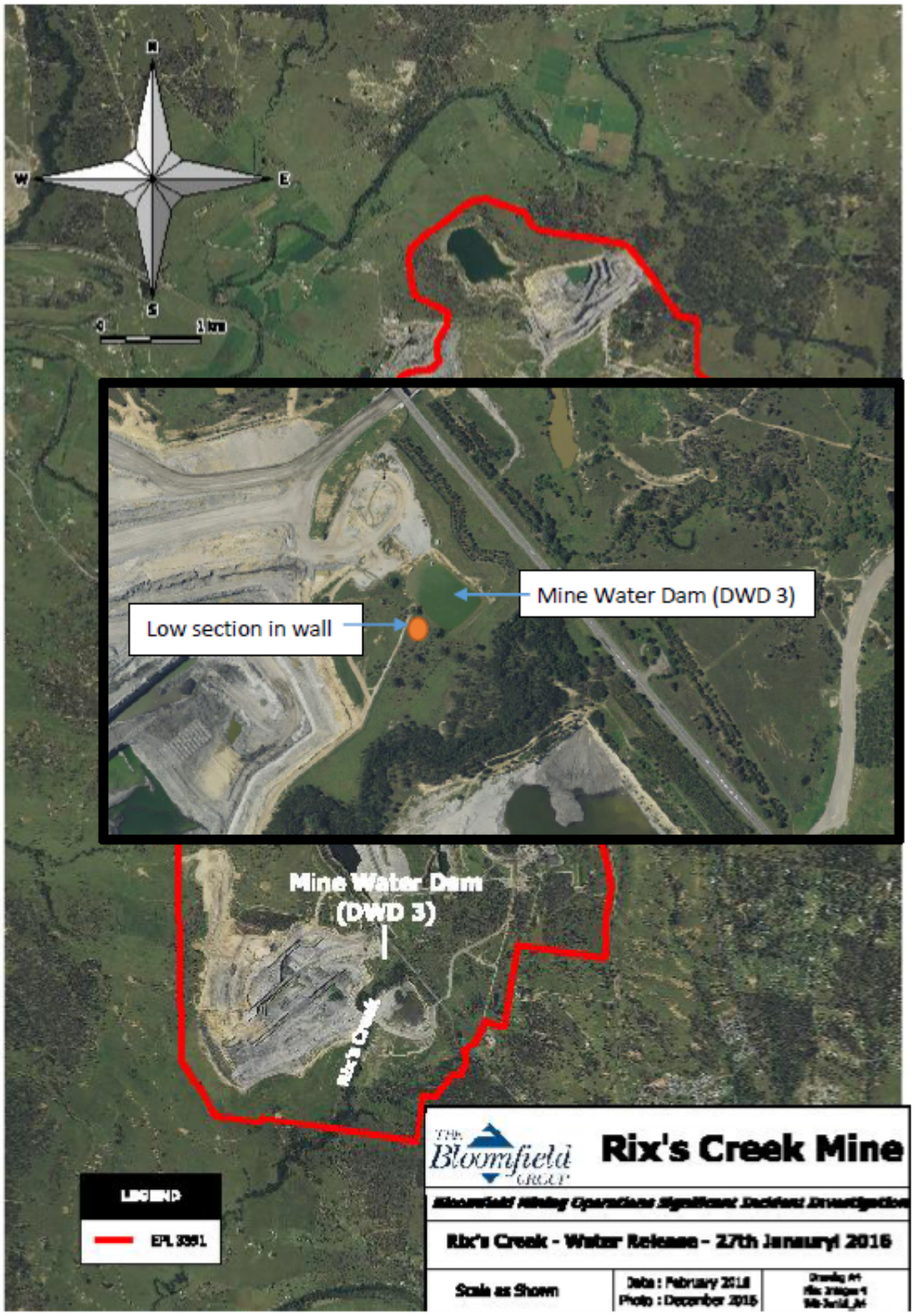

Figure 1: Location Diagram.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

Figure 2: Site Water Sampling Location Diagram.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

EVENTS RELATED TO THE INCIDENT

- The 244.5 mm of rain received in January had increased dam levels and soil moisture across site;
- The flow conditions in Rix's Creek due to recent rainfall made it difficult to find if any water had entered the Creek;
- The additional pumping of water out of the west pit into DWD3 was higher than the DWD3 pump; and
- The low spot in the southern dam wall combined with long vegetation made inspections difficult for shift supervisors reviewing dam levels and an effective overflow back into the west pit.

Photograph 1: Image of DWD3 West Pit storage

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

Photograph 2: Area of potential seepage into Rix's Creek

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Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

Photograph 3: Upstream of DWD3 in Rix's Creek

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

Photograph 4: Downstream of DWD3 – South Pit creek crossing

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

Photograph 5: Maison Dieu Bridge flow at time of sampling

INVESTIGATION CONCLUSIONS

The incident was investigated and the following conclusions drawn:

- The water from three small pumps into DWD3 were of greater water inflow then the DWD3 pump outflow resulting in the dam slowly increasing its water level resulting in the dam filling and potentially overflowing back into the pit;
- The low spot in the southern dam wall was lower than the designed outlet in which water is intended to overflow back into the west pit; and
- Any potential water leaving DWD3 with a saline nature had not contributed to any significant salinity readings in Rix's Creek and/or it was highly unlikely it caused any environmental harm.

Bloomfield Mining Operations
Significant Incident Investigation

Rix's Creek – Potential mine water dam seepage

27th January 2016

FOLLOW-UP

- ❑ Any necessary earthworks will be undertaken (this includes repairing the dam wall low spot and maintenance to dam overflow back into the west pit and eliminate overflow going into the creek);
- ❑ The West Pit DWD3 dam's water level were lowered by pumping water to the North Pit Tailing's Dam in preparation for the next rainfall event; and
- ❑ One out of the three west pit pumps pumping mine water into DWD3 were re-routed to Tailing's Dam 4 to minimise amount of water entering the dam.

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