

# BLOOMFIELD COLLIERY

# Annual Review Report 2017

# **Bloomfield Collieries Pty Ltd**

# **Annual Review Report 2017**

Name of Mine	Bloomfield Colliery				
Titles/Mining Leases	ML1738, CCL761	ML1738, CCL761			
Name of leaseholder	Bloomfield Collieries Pty L	imited			
Name of Mine Operator	Bloomfield Collieries Pty Limited				
MOP Commencement Date	2012	MOP Completion Date	June 2018		
AEMR Commencement Date	1/1/2017	AEMR End Date	31/12/2017		
Water Licence	20BL172035				
Name of Licence holder	Bloomfield Collieries Pty Limited				
I, Greg Lamb, certify the Bloomfield Colliery for statement on behalf of B	at this audit report is a true and the period 1/1/17 – 31/12/17 a Bloomfield Collieries Pty Ltd.	d accurate record of the compl and that I am authorised to ma	iance status of ke this		
Reporting Officer	Greg Lamb				
Title	Environmental Officer				
Signature	Graglino.				
Date	20/3/18.				

# EXECUTIVE SUMMARY

Bloomfield Collieries (Bloomfield) is one of two open cut coal mines owned by its parent company, Big Ben Holdings Pty Limited (Big Ben). Bloomfield Colliery is located at Ashtonfield, NSW, and produces approximately 0.6 million tonnes of product coal by open cut methods per year. Coal has been mined on the property for over 100 years. Underground mining by the current owner commenced in 1937 and the last coal extracted from underground operations was in 1992. The open cut commenced operations in 1966.

This report covers the reporting period from 1 January 2017 to 31 December 2017.

The Community Consultative Committee (CCC) met twice during 2017. The minutes of the CCC meetings can be viewed on the Bloomfield website (<u>www.bloomcoll.com.au</u>).

Four (4) community complaints were received during 2017.

The total rainfall for the twelve month period was 795 mm. This was 116 mm below the annual average of 911 mm.

All dust deposition gauges recorded annual averages below the 4g/m<sup>2</sup>/month limit for 2017. The long term average annual dust deposition rates are all within the nominated EPA criteria.

All Particulate Matter <10 micron (PM10) results recorded 24-hour averages below the 50 ug/m<sup>3</sup> limit for 2017. The annual average PM10 result recorded was below the 30 ug/m<sup>3</sup> limit for 2017. The annual average Total Suspended Particulates (TSP) result recorded was below the 90 ug/m<sup>3</sup> limit for 2017. Dust monitoring during the reporting period indicates that dust results are close to predicted levels.

There were 21 licensed water discharges conducted during the reporting period, with a total discharge volume of 850 ML.

There were two reportable surface water incidents during 2017. In January 2017 a water discharge to Four Mile Creek in accordance with EPL 396 water discharge conditions exceeded Total Suspended Solids (TSS) concentration limits. In October 2017 a broken pipe weld resulting in water flowing to a clean water sediment dam and discharging offsite into an intermittent drainage line known as Shamrock Creek, a tributary of Four Mile Creek. Both incidents were reported to the EPA in accordance with EPL 396 conditions as well as DRG and DPE.

A Biodiversity Offset Area has been established to compensate for land clearance at the mine. The land was purchased by Bloomfield in December 2011 and consists of 40 Ha of remnant vegetation adjacent to the Watagan State Forest. Consultation is underway with the NSW Biodiversity Conservation Trust regarding entering into a conservation agreement over the land.

During 2017 a total of 56 blasts were initiated on the site. One blast (1.8% of total shots) exceeded 115 dB blast overpressure. No blasts exceeded 120 dB blast overpressure limits.

No blasts exceeded the 5mm/sec or 10mm/sec ground vibration limits. Blast monitoring during the reporting period indicates that mean and median results are at or below predicted levels.

All noise monitoring indicated that compliance with consent criteria was met at all locations during day, evening and the night-time periods.

To date 488 Ha has been rehabilitated. During 2017 there was no rehabilitation undertaken. Throughout 2017 overburden emplacement operations were carried out within the mine void. This involved backfilling the lower areas of the void and against existing highwalls towards the final landform.

Rehabilitation monitoring was undertaken during 2017 in accordance with the Rehabilitation Management Plan. The monitoring program is based on the Landscape Function Analysis (LFA). An addition monitoring site was added since the last monitoring (2015) as well as two analogue sites (pasture & native vegetation).

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# **1** INTRODUCTION

Bloomfield Collieries (Bloomfield) is one of two open cut coal mines which a part of the Bloomfield Group of Companies (TBG). Bloomfield Colliery is located at Ashtonfield, NSW, and produces approximately 0.6 million tonnes of product coal by open cut methods per year. Coal has been mined on the property for over 100 years. Underground mining by the current owner commenced in 1937 and the last coal extracted from underground operations was in May 1992. The open cut commenced operations in 1966. Bloomfield produces mainly thermal coal with some semi soft coking coal, principally for the Asian export market. The parent company also owns Rix's Creek Mine which is located north of Singleton. Rix's Creek currently produces approximately 2 million tonnes of product coal per year.

This report covers the calendar year 2017.

This report is prepared to meet the requirements for the production of Annual Environmental Management Reports (AEMR), as outlined by the NSW Department of Primary Industries - Mineral Resources (DPI-MR) in the Guidelines to the Mining, Rehabilitation and Environmental Management Reporting Process (edg03 V3, DPI-MR, 2006). It is also prepared to meet the requirements for the Annual Review, as outlined by the NSW Department of Planning & Environment (DPE) in the *Annual Review Guideline, October 2015*.



Location of Bloomfield Colliery

# 1.1 Consents, Leases and Licences

Bloomfield operates under consents, leases and licenses presented in Table 1.

Approval/Lease/License	Issue Date	Expiry Date	Details/ Comments
Project Approval	3 September	31 December	Granted by the Minister for
07_0087	2009	2021	Planning
Mining Lease 1738	29 June 2016	29 June 2037	Granted by Minister for
			Resources and Energy
Consolidated Coal Lease	20 October 1991	8 October 2029	Granted by Minister for Mineral
(CCL) 761			Resources
Project Approval	7 June 2007	31 December	Granted by Minister for Planning
05_0136 (Abel)		2030	
Environmental Protection	31 December	Renewed	Issued by Department of
License 396	2007	Annually	Environment and Climate
			Change (now EOH)
Project Approval	16 May 2011	31 December	Granted by Minister for Planning
07_0087_ Mod 1		2021	and Infrastructure
Project Approval	29 March 2012	31 December	Granted by Minister for Planning
07_0087_ Mod 2		2021	and Infrastructure
Project Approval	20 February	31 December	Granted by Minister for Planning
07_0087_ Mod 3	2013	2021	and Infrastructure

Table 1: Approvals, Leases and Licenses for Bloomfield Colliery

The lease area for ML1738 and the PA 07\_0087 boundary are shown on Plan 1.

Project Approval (05\_0136) for the Abel Underground Mine allows for the operation of the Bloomfield Coal Handling and Preparation Plant (CHPP), Rail Loading Facility (RLF) and other related facilities required for the handling and processing of coal.

Project Approval (07\_0087) was granted by the Minister for Planning under Part 3A of the *Environment Planning & Assessment Act 1979* (EP&A Act) to allow for the completion of open cut mining operations and rehabilitation. The approval was issued 3 September, 2009 and is subject to a number of conditions. A variation to modify the Project Approval under s75W of the EP&A Act was granted on 16 May 2011 (07\_0087\_Mod 1). An additional variation to modify the Project Approval under s75W of the EP&A Act was granted on 29 March 2012 (07\_0087\_Mod 2). A further variation to modify the Project Approval under s75W of the EP&A Act was granted on 20 February 2013 (07\_0087\_Mod 3).

In December 2017 a variation to modify the Project Approval (07\_0087\_Mod 4) was submitted to the Department of Planning and Environment. The modification would allow the Colliery to continue its open cut mining operations and use existing mine infrastructure to process up to 1.3Mtpa of ROM coal until 31 December 2030.

A Mining Operations Plan (MOP) has been prepared under DREs Interim MOP Guidelines. The MOP covers the period 2012 – 2016. In December 2017 the MOP period was extended to June 2018.

# 1.2 Mine Contacts

The Bloomfield Colliery Mine Manager, Mr Brendon Clements, is the primary mining contact and is responsible for regulatory compliance. The Environmental Officer is Mr Greg Lamb who coordinates environmental management and rehabilitation operations at Bloomfield Colliery.

Mr Brendon Clements	Mine Manager	Tel: 02 4930 2641
		Mob: 0437 684 222
		Email: bclements@bloomcoll.com.au
Mr Greg Lamb	Environmental	Tel: 02 4930 2689
	Officer	Mob: 0457 819 211
		Email: glamb@bloomcoll.com.au
Environmental /		24br: 02 4030 2680
Community Hotline		24111. 02 4930 2000

# 1.3 Actions Required at Previous AEMR Review

Listed in Table 2 below are the actions required from the review of the 2016 AEMR. Also listed are the relevant sections of the report that describe the measures taken in response to these actions. The DRG review of the 2016 AEMR also included a site inspection that was conducted on the 31<sup>st</sup> May 2017.

Action Required	Requested by	Status	Report Section
Future annual reviews to include a Statement of Compliance	DPE	Complete	Section 6
Future annual reviews to include a status of independent audits section	DPE	Complete	Section 7
Future annual reviews to include an incidents and non-compliance section	DPE	Complete	Section 8
Provide data to show compliance with the limit of two blasts per day	DPE	Complete	Appendix D
Describe actions undertaken as an outcome from the complaints received	DPE	Complete	Appendix E
The next AEMR should also satisfy the reporting requirements of ML1738	DRG	Complete	Whole document

 Table 2: Action Required from AEMR 2016 Review

# 2 OPERATIONS DURING THE REPORTING PERIOD

# 2.1 Exploration

There were no exploration activities at Bloomfield during the reporting period.

# 2.2 Land Preparation

Approximately 7 Ha of land was prepared for mining during the reporting period. This area was to the west of Creek Cut and had been cleared of vegetation in previous years. Groundcover was removed and the soil material stripped. The soil material was removed and stockpiled for later use. Topsoil volumes are presented in Table 23.

# 2.3 Construction

No major construction was undertaken on the site during the reporting period.

# 2.4 Mining

During the reporting period, Bloomfield operated 15 shifts a week for 48 weeks employing 93 personnel. Production was 978,000 tonnes of raw coal, 532,000 tonnes of saleable coal and 5.9 million cubic metres of overburden moved primarily using a Hitachi 5500 excavator and Caterpillar rear dump trucks.

Mining operations continued in S Cut and Creek Cut throughout the year, generally in accordance with the mining methods described in the 2012-2016 MOP (extended to June 2018). During the next reporting period, Mining in S Cut will continue towards the west and Creek Cut will continue towards the south and west.

# 2.5 Mineral Processing

The coal handling and preparation plant (CHPP) has a throughput of up to 8.5 Mtpa, as approved under the Abel Consent. The throughput is currently rated at 1000 tonnes per hour. ROM coal and clean coal volumes are presented in Table 3.

Material	Approved limit	Previous	This reporting	Next reporting
		reporting period	period	period (forecast)
Overburden	N/A	5,918,000	5,861,000	6,000,000
ROM Coal	1,300,000	1,245,000	978,000	1,000,000
Coarse reject	N/A	299,000	290,000	340,000
Tailings	N/A	199,000	156,000	160,000
Saleable product	N/A	702,000	532,000	600,000

# Table 3: Production and Waste Summary

# 2.6 Waste Management

#### Process Waste

Process Waste from the CHPP consists of breaker reject, coarse rejects and fine rejects (tailings). Breaker reject consists of large diameter (>150mm) rocks and coal rejects, and is hauled by truck to operational open cut pits and placed under advancing overburden dumps. Coarse rejects which are separated out during processing, and are currently disposed of under advancing overburden dumps. Fine tailings are currently pumped as 20% solids slurry to Tailings Dam, a disused open cut pit in north of the mine site. Reject fines settle out of the slurry, gradually backfilling the pit, whilst the decant water is returned to the CHPP for re-use in processing. Process waste volumes are provided in Table 3.

# Waste Oil

Waste oil from scheduled maintenance of mining equipment and the workshop oil separator is collected in a storage tank and periodically evacuated for reprocessing and re-use by a licensed waste oil contractor. In 2017 a total of 63,000 litres of waste oil was collected for recycling.

# Waste Oil Filters

During the reporting period a recycling bin was installed for disposal of used oil filters. Used oil filters are placed in a 1.5m<sup>3</sup> bin and collected by licensed waste contractor for disposal. In 2017 a total of 2.7 tonnes of used filters was collected for disposal.

# Waste Metal

Bloomfield has a well implemented scrap metal recycling program, and has a high rate of onsite re-use of suitable steel. If no longer suitable for re-use, scrap metal is collected in designated skips and sold for recycling. In 2017 a total of 440 tonnes of scrap metal was collected for recycling.

# General Waste

General waste is placed in 1.5m<sup>3</sup> and 3m<sup>3</sup> bins and collected by licensed waste contractor for disposal. In 2017 a total of 84 tonnes of general waste was collected for disposal.

# Waste Paper

During the reporting period recycling bins were installed for disposal of paper and cardboard. Waste paper and cardboard waste is placed in 1.5m<sup>3</sup> and 3.0m<sup>3</sup> bins and collected by licensed waste contractor for disposal. In 2017 a total of 8 tonnes of waste paper and cardboard was collected for recycling.

# 2.7 Product Stockpiles

The ROM stockpile pad has a capacity of 150,000 tonnes and the clean coal stockpiles have a capacity of approximately 500,000 tonnes.

# 2.8 Water Management

The water management system has been designed with three primary goals and objectives:

- separation of clean water and mine water;
- safe storage and priority use of mine water on-site;
- management of water that is discharged so as to preserve the environmental values of Four Mile Creek and comply with the conditions of EPL 396.

In meeting these objectives, the following components of the system have been constructed or implemented.

# Mine Water

Bloomfield has two major mine water storage facilities referred to as Lake Kennerson and Lake Foster (see Plan 1). Water pumped from the open cuts (S Cut and Creek Cut) reports via open drains to Lake Kennerson. Run off from disturbed areas (i.e. high wall, haul roads, overburden dumps awaiting rehabilitation) which has the potential to carry suspended solids, is also directed to Lake Kennerson. Lake Kennerson dissipates velocity and allows the settlement of suspended solids.

Lake Kennerson has a valve controlled pipe which, when opened, feeds to Lake Foster. Lake Foster also receives decant water from the tailings storage facility (U Cut) and water from the stockpile dam, which collects the runoff from the CHPP and coal stockpile pads. Mine water is pumped, primarily from Lake Foster, to the CHPP for use in coal processing and for dust suppression spraying on the coal stockpile pads.

Mine water is discharged, via lockable valve pipes, into an open drain that flows to Four Mile Creek. Discharges are undertaken in accordance with conditions of the Environmental Protection Licence (EPL 396). Water samples are collected during discharge for independent water quality analysis. A monitoring station located downstream in Four Mile Creek continuously measures electrical conductivity (EC) and water level. Monthly background

sampling is conducted in Lake Kennerson, Lake Foster and various upstream and downstream watercourses (see Section 3.3 for details).

During the reporting period, fine coal rejects (tailings) was transferred for disposal to a disused open cut pit (U Cut). Water from the historic underground workings is used in dust suppression and coal processing. Water storage volumes are presented in Table 4.

	Volumes held (ML)		
	Start of Reporting Period	End of Reporting Period	Storage Capacity
Clean Water	90	90	90
Dirty Water			
Lake Kennerson	100	90	190
Lake Foster	20	30	45
Tailings Dam	150	120	600
S Cut (operational pit)	NIL	NIL	-
Creek Cut (operational pit)	440	80	-
Controlled Discharge Water (EPL 396)		850	
Contaminated Water	NIL	NIL	NIL

Table 4: Stored Water

A water balance was calculated for 2017 providing information on inputs and outputs for the site in accordance with the Water Accounting Framework. The results are shown in Table 5.

# Clean Water

Run off from undisturbed and rehabilitated areas is directed away from operational areas and mine water storages via diversion banks and channels. These banks and channels direct this run off into clean water dams or natural watercourses. The major clean water storage dam is Possums Puddle. No clean water is accessed for operational purposes and these dams overflow into natural drainage systems. Further isolation of smaller rehabilitated catchment areas from the mine water system will continue as rehabilitation work progresses.

The major natural creek running through the site is Four Mile Creek. Most of the operational mining areas at Bloomfield are located within the catchment of Four Mile Creek. A series of drains and levees direct Four Mile Creek around Lake Foster (mine water storage) and into Possums Puddle (clean water storage). From Possums Puddle clean water overflows back into Four Mile Creek.

# Waste Water

Wastewater generated on site, consisting of domestic waste from bathhouses, administration offices and associated amenity areas, passes through a Cessnock City Council approved anaerobic waste water treatment system.

# Table 5: Input – Output Statement Data

<b>Reporting Period Details</b>	Date	Storage (ML)
Start	01-January-2017	710
Finish	31-December-2017	320
	·	

INPUTS-OL	INPUTS-OUTPUTS					
Input- Output	Source/Destination	Inputs/Outputs	Total (ML)			
		Precipitation and Runoff	717			
	Surface Water	Rivers and Streams				
		External Surface Water Storages				
		Aquifer Interception	204			
	Groundwater	Bore Fields				
Input		Entrainment	78			
	Soo Water	Estuary				
		Sea/Ocean				
	Third Darty Water	Contract/Municipal				
		Waste Water	133			
	TOTAL INPUTS	1132				
	Curfage Water	Discharge	850			
	Surface water	Environmental Flows				
	Croundwater	Seepage				
	Groundwater	Reinjection				
Output	See Water	Discharge to Estuary				
		Discharge to Sea/Ocean				
	Supply to Third Party					
		Evaporation	365			
	Other	Entrainment	64			
		Other (define)				
	TOTAL OUTPUTS	1279				

# 2.9 Hazardous Materials Management

Bloomfield held dangerous goods notification and a licence to store and handle explosives in accordance with WorkCover legislation for substances stored on site. The notification covers depots for explosives, distillate, gas cylinder stores, sodium hydroxide and MIBC reagent.

Explosives are stored in an explosive magazine located on site. The magazine complies with the relevant standards for storage of explosives. Bulk materials are also stored on site in a hopper for loading into a mobile mixing unit. This area is enclosed within concrete bunding and any spillage from this area is directed into a collection tank for periodic removal by a licensed contractor.

A bunded fuel farm, designed in accordance with AS1940, is used for bulk distillate storage at the open cut workshop. Spill protected racks are used for small volume oil and lubricant storage. Distillate, MIBC and sodium hydroxide used for coal processing in the CHPP are stored in tanks contained in bunded enclosures.

ChemAlert is an online Material Safety Data Sheet (MSDS) database service and is used to provide up to date MSDS information. If new chemicals are introduced to site they must comply with system requirements and be approved by the Mine Manager.

No hazardous materials-related environmental incidents were reported during the reporting period.

# 2.10 Other Infrastructure Management

Silt traps along the edges of haul roads and hard stand areas are cleaned at regular intervals. They have been designed to capture surface run off during rain events and allow sediment to settle. All silt traps, dams, drains, bunds, lines, valves and other infrastructure used to manage runoff are inspected on a quarterly basis as part of the site Environmental Management System (EMS). Issues identified during the inspections are reported and appropriate actions taken to address these matters.

# 3 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

# 3.1 Meteorological Monitoring

Bloomfield Colliery has installed a continuously operating meteorological station in accordance with Development Consent requirements for the operation of the mine. The weather station has real-time capabilities for all personnel to access via computer or phone. The station records the following environmental parameters:

- wind speed;
- wind direction;
- temperature;
- relative humidity;
- rainfall
- solar radiation; and
- evaporation.

A comparison of monthly recorded rainfall for the 2017 reporting period and annual average data is shown in Figure 1. The total rainfall for the twelve month period was 795 mm. This was 116 mm below the annual average of 911 mm. The second half of 2017 was extremely dry with the mine site only receiving 40% of the average rainfall for that period.





A summary of the rainfall data for the past 29 years is presented in Table 6.

Devie	Average Monthly Rainfall (mm)												
Period	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
1989	177	62	168	133	95	208	52	6	15	33	48	43	1038
1990	42	448	80	190	80	58	71	135	73	57	6	39	1278
1991	83	14	4	12	90	104	39	9	6	30	37	167	593
1992	64	235	91	86	23	72	12	22	20	25	87	175	911
1993	125	53	65	16	29	81	109	64	36	31	72	33	713
1994	30	102	89	76	53	36	4	11	0	36	64	13	514
1995	162	48	171	0	129	51	1	0	78	37	184	80	942
1996	70	71	28	7	106	74	50	59	48	24	59	30	625
1997	105	101	63	0	85	78	65	28	50	34	25	56	688
1998	89	81	3	45	203	90	84	155	73	63	108	121	1114
1999	66	74	64	129	8	122	156	47	64	173	36	58	997
2000	95	34	281	149	44	12	51	36	31	58	93	28	912
2001	44	163	174	113	156	7	44	21	21	30	124	46	941
2002	54	235	172	48	55	28	31	26	25	10	43	129	856
2003	1	93	53	72	133	13	42	42	0	112	102	39	701
2004	76	163	72	45	18	10	27	44	64	154	59	38	769
2005	64	135	153	27	112	67	10	1	40	81	72	14	775
2006	38	66	39	23	11	62	50	58	194	21	53	24	635
2007	24	101	103	87	66	377	20	75	28	32	144	94	1150
2008	139	173	46	240	4	131	33	32	195	65	70	59	1184
2009	6	340	107	129	83	66	33	2	31	60	40	48	943
2010	78	35	75	28	75	118	62	43	27	66	151	70	826
2011	32	41	73	125	100	162	127	54	109	100	179	81	1182
2012	65	205	137	122	7	179	57	20	19	6	58	40	915
2013	180	184	121	101	59	99	18	11	22	43	288	22	1147
2014	16	83	138	106	30	47	22	102	38	68	23	169	844
2015	208	53	46	513	111	43	18	34	81	53	86	132	1378
2016	467	32	48	47	12	89	55	77	69	46	33	67	1041
2017	60	72	216	97	14	126	2	6	12	78	65	48	795
Average	92	120	99	95	69	90	46	42	51	56	83	68	911

Table 6: Monthly Rainfall Records

The results of wind speed and direction monitoring shows a pattern typical in the Hunter Valley. During summer the winds predominate from the south east and winter the west-northwest. Autumn and spring are transitional seasons with winds distributed between both northwest and south-easterly directions. Figure 2 shows the seasonal windroses generated for the site on a seasonal basis.



Figure 2: Windroses for Bloomfield 2017





# 3.2 Air Quality

#### 3.2.1 Environmental Management

An Air Quality Monitoring Program has been prepared and approved by DPE in accordance Development Consent requirements for the operation of the mine.

Dust can be generated by the operation of mobile plant on unsealed surfaces, loading and handling of coal and overburden in dry and windy conditions, or by blasting. Operational procedures are in place to minimise dust impacts on the surrounding environment and community. Vehicular generated dust is controlled through the use of water carts on all internal roads and high traffic areas. The company provides a fleet of three water trucks to allow for greater coverage and flexibility in dry and/or windy conditions.

Sprinkler systems operate 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. Operational practices such as not dumping to exposed locations, minimizing the drop height into trucks during loading are also employed.

The use of a predictive meteorological modeling software program is utilised to assist in planning mine operations. The software incorporates regional weather station data to predict daily weather events that may exacerbate dust impacts from operations.

A dust monitoring program is in place with 10 dust deposition gauges and 2 High Volume Air Samplers (HVOL) located on and around the mine lease area. The locations are listed in Table 7 and are shown in Plan 1. Samples are collected by independent environmental consultants and analysed by a NATA registered laboratory.

Site	Location					
On Lease						
D1	Adjacent to Buttai Reservoir					
D2	Adjacent to Main Haul Road					
D3	Communications Tower					
D4	Adjacent John Renshaw Drive					
D9	Shamrock Lane					
Off Lease						
D5	Bali Close Ashtonfield					
D6	Off Four Mile Creek Road					
D7	Off New England Highway, Avalon Estate					
D8	Adjacent of Main North Rail line at Rail Loop					
D10	Private property adjacent to John Renshaw Drive					
HVOLs	Private property adjacent to John Renshaw Drive					

# 3.2.2 Environmental Performance

# Dust Deposition

Table 8 summarises the monthly deposition rates for insoluble solids during the reporting period and includes long-term averages for the site and the EPA guideline of 4  $g/m^2/month$ .

Insoluble Solids										
Site	D1	D2	D3	(g/m D4	D5	D6	D7	D8	D9	D10
Jan-17	0.6	2.4	1.1	1.3	1.1	1.6	3.30	1.9	1.0	1.4
Feb-17	0.8	1.0	1.2	1.1	1.9	1.1	2.0	1.7	1.3	2.4
Mar-17	0.4	0.7	0.7	0.9	1.2	1.5	1.5	1.8	0.8	1.4
Apr-17	0.5	0.8	0.6	0.6	0.6	0.5	0.4	0.8	0.5	1.2
May-17	0.6	0.5	0.5	1.0	0.7	0.8	2.8c	2.0	0.4	0.4
Jun-17	0.3	0.6	0.8	1.1	1.6	1.1	0.6	1.7	0.2	1.3
Jul-17	0.7	0.4	0.6	1.8	0.6	1.1	1.0	1.4	0.5	0.6
Aug-17	0.8	2.0	1.8	2.1	1.5	1.3	1.6	2.2	1.2	2.5
Sep-17	0.7	1.3	1.4	1.4	1.9	0.9	1.0	3.4	1.8	2.0
Oct-17	0.6	3.8	0.9	1.7	1.4	1.6	2.0	2.2	1.1	2.9
Nov-17	1.1	1.4	1.7	1.0	2.3	1.3	1.6	1.3	1.0	1.2
Dec-17	0.5	1.4	0.9	1.9	1.7	1.5	2.6	1.8	1.1	1.8
Annual										
Averages										
1997-1998	1.2	1.8	1.8	1.5	1.1	1.9	1.6	1.5	1.8	1.7
1998-1999	1.5	2.1	1.8	1.6	1.3	2.4	1.6	1.1	1.8	0.9
1999-2000	1.8	2.6	1.8	1.1	1.5	1.9	2.0	1.3		
2000-2001	1.2	1.6	1.3	1.4	1.2	3.1	1.8	1.1		
2001-2002	1.1	1.8	1.4	6.6	1.3	2.0	2.4	1.3	1.4	1.7
2002-2003	1.7	2.0	1.2	4.3	1.9	2.3	1.9	1.8	1.4	2.2
2003-2004	2.4	1.6	0.8	6.5	1.2	1.5	1.4	1.3	1.0	1.0
2004-2005	1.6	1.5	1.1	3.2	1.1	2.2	1.4	1.4	0.9	1.1
2005-2006	3.4	1.9	1.2	3.1	1.0	1.4	1.5	1.4	1.2	1.9
2006-2007	2.8	2.2	1.5	3.9	3.0	1.7	1.8	1.7	1.2	1.8
2007-2008	2.7	1.9	1.6	5.2	2.1	2.0	1.9	2.2	1.2	2.3
2008-2009	1.8	1.9	3.3	6.0	1.3	1.7	2.0	1.9	1.5	2.9
2009-2010	1.8	2.4	3.2	3.1	1.4	1.6	2.3	1.8	1.5	2.8
2010-2011	1.1	1.6	1.8	1.6	0.9	2.4	1.4	1.4	1.1	2.1
2011-2012	1.6	1.5	1.3	3.4	1.5	3.8	1.2	3.2	1.0	1.9
2012	1.5	1.7	1.9	3.1	1.4	3.4	1.8	1.6	1.1	2.2
2013	1.7	1.6	2.5	1.3	1.5	2.5	1.7	1.7	1.3	1.5
2014	1.2	1.4	1.6	1.5	1.5	2.5	1.4	1.7	1.1	1.5
2015	1.3	1.3	1.5	1.4	1.3	1.3	1.1	1.3	0.9	1.5
2016	0.7	1.3	1.1	1.3	1.3	1.5	1.1	1.4	0.8	2.2
2017	0.6	1.4	1.0	1.3	1.4	1.2	1.4	1.9	0.9	1.6
Overall*	1.6	1.7	1.6	2.8	1.4	2.1	1.7	1.6	1.1	1.9
EPA Licence Limit					4	ļ				

Table 8:	Annual	Average	Dust	Deposition
	/	/		Dopoolition

Notes: \*- Overall annual average since 1997.

C - "Denotes highest result contaminated with insects, vegetation or bird droppings and considered non standard

V - Dust gauge vandalised. No result.

All dust deposition gauges recorded annual averages below the 4g/m<sup>2</sup>/month limit for 2017. The long term average annual dust deposition rates are all within the nominated criteria.

Results are graphically provided in Appendix A. Figure A1 in Appendix A shows yearly results since PA 07\_0087 approval. The results show a slight trend downwards. Sites D2 and D3 are located adjacent to operational areas well within lease boundaries. Results from these sites indicate the level of dust generated by mining operations and are unlikely to impact off site. Site D4 was located adjacent to operational areas and was repositioned in December 2012 to the southern mining lease boundary, adjacent to John Renshaw Drive.

# PM10 and TSP

Table 9 summarises the PM10 and TSP monitoring results during the reporting period and detailed results are provided in Table A1 in Appendix A. All PM10 results recorded 24-hour averages below the 50 ug/m<sup>3</sup> limit for 2017. The highest result recorded was 46 ug/m<sup>3</sup>. The annual average PM10 result recorded was below the 25 ug/m<sup>3</sup> limit for 2017. The average annual PM10 level was 17 ug/m<sup>3</sup>. The annual average TSP result recorded was below the 90 ug/m<sup>3</sup> limit for 2017. The average annual TSP level was 37 ug/m<sup>3</sup>.

	PM10 24hr (ug/m³)	TSP (ug/m³)
Maximum 24hr Average result 2016	46	-
EPA Licence Limit PM10 24hr Average	50	-
Annual Average 2015	17	37
EPA Licence Limit Annual Average	25	90

# Table 9: PM10 and TSP Results Summary 2017

Figures A2 and A3 in Appendix A shows yearly results of TSP and PM10 dust levels. The results show seasonal trends as well as rolling averages. In general higher results occur in the summer months and lower results occur in the winter months. All results are within EPA criteria.

# Dust Predictions

Dust modelling predictions conducted as part of the Environmental Assessment (PA 07\_0087) are shown in Table 10. Monitoring during the reporting period indicates that dust results are close to predicted levels. As shown in Plan 1, the nearest modelled resident to the monitoring locations is Resident N. The dust monitoring locations are actually situated closer the mine site than Resident N (refer Plan 1) and as a result the dust results are slightly higher.

# Table 10: Dust Predictions

Resident ID: N	EA Predictions	2017 Actual		
Dust Deposition D10 (g/m <sup>2</sup> /month)	0.8	1.6		
PM10 (ug/m <sup>3</sup> ) (Annual Average)	13.3	17		
TSP (ug/m <sup>3</sup> ) (Annual Average)	29.2	37		

# 3.2.3 Reportable Incidents

No reportable incidents relating to air quality occurred within the reporting period.

# 3.2.4 Further Improvements

The air quality monitoring program will be continued in accordance with Air Quality Monitoring Plan requirements.

# 3.3 Erosion and Sediment

#### 3.3.1 Environmental Management

Erosion and sedimentation control is an integral part of the site's water management system. The design of rehabilitated areas incorporates water management structures to effectively shed run-off water, whilst minimising erosion and sediment load. Progressive rehabilitation of disturbed areas as soon as is practicable also reduces the potential for erosion and downstream sedimentation.

There are a number of sediment basins around the site that are positioned to intercept run-off from other disturbed areas on-site, such as along haul roads, stockpile pads, infrastructure areas, and recently rehabilitated areas. These structures are inspected as part of the site EMS and cleaned as necessary.

Site drains used to transport mine water, or natural catchment flow, are inspected for erosion or damage as part of the site EMS, and remedial maintenance works conducted as necessary.

# 3.3.2 Environmental Performance

An area of gully erosion was repaired and rehabilitated during 2017 covering an area of approximately 0.25 Ha. No other major erosion or problems with erosion and sediment control were observed during the reporting period. Rehabilitated areas are regularly inspected in addition to quarterly inspections of erosion and sediment controls across the site.

# 3.3.3 Environmental Incidents

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

# 3.3.4 Further Improvements

An erosion and sediment control plan has been prepared in accordance with the conditions of the Project Approval. As mining and rehabilitation progresses the recommendations will be followed including ongoing quarterly inspections of erosion and sediment control structures.

# 3.4 Surface Water

#### 3.4.1 Environmental Management

A Water Management Plan (WMP) has been prepared and approved by DPE in accordance with Development Consent requirements for the operation of the mine. The Plans prescribe the process water source and supply requirements, site-water balance, storage, impact management and monitoring of surface water in the vicinity of the mining operations.

Bloomfield has several sources of surface water (mine water) that require management to avoid pollution, or a non-compliance with the site EPL.

In addition to the physical, or infrastructure, components of the mine water management system (as detailed in Section 2.8), the two major management controls for surface water pollution are *water quality monitoring* and *licensed mine water discharge*.

#### Water Quality Monitoring

The water monitoring program at Bloomfield consists of discharge sampling, which is under *licensed mine water discharge*, and background monitoring. The background monitoring sites are centred on Four Mile Creek and its tributaries and Wallis Creek tributaries to the west of the mining lease. Plan 1 shows the location of the monitoring sites and Table 11 lists the monitoring sites.

Creek	ID	Location	
Four Mile Creek	WM10	John Renshaw Drive	
	WM6	Upstream from Lake Foster	
	WM7	Possums Puddle	
	WM4	Possums Puddle Overflow	
	WM3	Elwells Creek & Four Mile Creek junction	
	WM12	Shamrocks Creek & Four Mile Creek junction	
	WM11	New England Highway	
Four Mile Creek tributary	WM2	Shamrock Creek	
	WM5	Elwells Creek	
Wallis Creek tributary	WM1	Adjacent old Rathluba Colliery	
	WM13	Buttai Creek	
On-site water storage	WM8	Lake Foster	
	WM9	Lake Kennerson	

# Table 11: Background Water Sample Locations

Table 12 outlines the background surface water analysis program undertaken at Bloomfield Colliery.

Analyte	Monthly	Quarterly	6 Monthly
рН	✓	✓	$\checkmark$
Electrical Conductivity	✓	✓	$\checkmark$
Dissolved Oxygen	✓	✓	✓
Turbidity	✓	✓	$\checkmark$
Total Suspended Solids		✓	$\checkmark$
Total Dissolved Solids		✓	$\checkmark$
Filterable Iron		✓	$\checkmark$
Chloride			✓
Sulphate			$\checkmark$
Alkalinity			$\checkmark$
Calcium			$\checkmark$
Magnesium			$\checkmark$
Sodium			$\checkmark$
Potassium			✓

Table 12: Background Water Analysis

These results are reviewed and, if required, remedial action or further investigation initiated to identify the cause of anomalies.

# Mine Water Discharge

Mine water is discharged in accordance with conditions P1, L2 and L3 of EPL 396. These conditions allow discharge of 40ML of mine water per day, within water quality limits, dependent on rainfall. Representative samples are collected at the discharge point and at the Four Mile Creek monitoring station during each day of discharge. Samples are tested on site to ensure discharge water is within the allowed water quality limits, before being dispatched to an independent NATA accredited laboratory for analysis. Discharge samples are tested for:

- pH;
- EC;
- Total Suspended Solids (TSS);
- Total Dissolved Solids (TDS); and
- Filterable Iron (for discharge point samples).

A permanent monitoring station is located on Four Mile Creek, approximately 500m upstream of the New England Highway. It records EC and water level (via pressure sensor and V-notch weir) every 15 minutes and logs the results every hour.

# Other Management

All infrastructure (i.e. drains, dams, spillways, discharge pipes and valves) used for the separation of clean water and mine water, or the discharge of mine water, are inspected as part of the site EMS, with a documented quarterly check sheet being completed.

# 3.4.2 Environmental Performance

# Background Monitoring Results

The background surface water monitoring results for the reporting period are shown in Figures 3 to 7 below. Figures 3 to 7 provide a graphical presentation of EC and pH which are the main surface water parameters, with the full data set provided in Appendix B.

Figure 3 and 4 shows EC and pH results for the Four Mile Creek sites. Figure 3 shows salinity levels are slightly elevated in the lower end the catchment. Four Mile Creek is ephemeral and the EC level varies due to rainfall and mine discharge. The higher salinity results along Four Mile Creek (Elwells Creek and Shamrock Creek junctions and New England Hwy) reflect concentration of solutes in ponds during low flow periods and from licensed discharges in addition to offsite sources such historic underground workings.

As outlined later, there were 21 licensed discharges throughout the reporting period. The monthly sample collected in February and October coincided with a licensed discharge event. EC levels vary due to rainfall and mine discharge therefore monthly and yearly trends cannot be assessed.





Figure 4 shows the pH levels in Four Mile Creek are generally consistent with ANZECC water quality guidelines (pH 6.5-8.5). pH levels vary due to rainfall and mine discharge therefore monthly and yearly trends cannot be assessed.



Figure 4: pH of Four Mile Creek

Figure 5 shows EC and pH results for water storage dams. Water quality within the mine water storage dams (Lake Kennerson and Lake Foster) varies throughout the year depending on rainfall capture in the open cut pits, CHPP water usage and frequency of licensed discharge events, which are also rainfall dependent. The freshwater dam (Possums Puddle) remains fairly constant throughout the year as it is separate from mining influences.

Figure 6 shows the pH and salinity levels in Four Mile Creek tributaries are generally consistent with ANZECC water quality guidelines. These tributaries are ephemeral streams and are often dry or not flowing (evaporating) resulting in gaps in the graphed data. The low pH levels are attributed to stagnate evaporating pools throughout a dryer than normal year. The higher EC for Shamrock Creek in October is attributed to the incident referred to Section 8.2.



Figure 5: pH & EC in Site Water Storages



Figure 6: pH & EC in Four Mile Creek Tributory

Figure 7 shows the pH and salinity levels in Wallis Creek tributaries are generally consistent with ANZECC water quality guidelines (pH 6.5-8.5 & EC 125-2200).

Previous results indicate that the surface flow adjacent to Rathluba has historically been of low pH, regardless of mining impacts. Prior to 2006 pH results were less than 4 however pH levels have been steadily increasing since then. This drainage line carries surface flow from non-mining land and rehabilitated mining land, indicating that other off-site effects may be influencing the water quality in the area. The drainage line is ephemeral and is usually dry or evaporating resulting in gaps in the graphed data.



Figure 7: pH & EC in Wallis Creek Tributary

The WMP proposed water quality trigger values for Buttai Creek (WM13) and Elwells Creek (WM5). Table 13 summarises the results, with the full data set provided in Appendix B. EC results were within either WMP or ANZECC 2000 trigger. The low pH levels at WM5 are attributed to stagnate evaporating pools throughout a dryer than normal year.

Sampling Site	рН	EC	TSS
WM5 – Elwells Creek	3.7 to 5.5	1110 to 3050	4 to 36
WMP Trigger Level	5.2 - 8.0	430 - 4000	4 - 85
WM13 – Buttai Creek	6.7 to 8.1	390 to 1100	3 to 11
WMP Trigger Level	6.4 – 7.8	380 - 1100	5 - 45
ANZECC 2000 Trigger Level	6.5 - 8.5	125 - 2200	50*

\* Standard Industry Criterion

# Discharge Monitoring Results

There were 21 licensed discharges conducted during the reporting period, with a total discharge volume of 850 ML. Table 14 shows the average, maximum and minimum water quality results at the discharge point, compared to EPA discharge water quality thresholds. Detailed daily discharge results are provided in Table B1 in Appendix B.

DATE	рН	TOTAL SUSPENDED SOLIDS (mg/L)	TOTAL DISSOLVED SOLIDS (mg/L)	CONDUCTIVITY (uS/cm)	IRON (mg/L)	DISCHARGE VOLUME (ML/day)
EPA Limits	6.5-8.5	30	-	6,000	1	40
Average	8.0	8	4,624	4,722	<0.02	24
Maximum	8.4	33	5,510	5,700	0.02	40
Minimum	7.4	1	3,140	3,520	<0.01	5

# Table 14: Discharge Sampling Analytical Results

# 3.4.3 Environmental Incidents

There were two reportable surface water incidents during 2017.

On the 2 January 2017 a licenced 72 hour discharge was begun at Bloomfield Colliery in accordance with EPL 396 water discharge conditions. Analysis of the discharge sample for the first 24 hour period recorded a Total Suspended Solids (TSS) of 33 mg/l which was an exceedance of the EPL concentration limit of 30 mg/l. The incident was reported to the EPA Pollution Line on 6 January 2017 when Bloomfield became aware of the incident. The Reference Number C00203-2017 issued by the EPA. DPE and DRG were also notified of the incident.

On the 13 October 2017 a broken pipe weld resulting in water flowing to a clean water sediment dam and discharging offsite into an intermittent drainage line known as Shamrock Creek, a tributary of Four Mile Creek. No flow from the discharge event made it into Four Mile Creek. The incident was reported to the EPA Pollution Line on 13 October 2017 and the Reference Number C15526-2017 issued. DPE and DRG were also notified of the incident

Refer to Section 8 for further details.

# 3.4.4 Further Improvements

The surface water monitoring program will be continued in accordance with WMP requirements.

# 3.5 Ground Water

# 3.5.1 Environmental Management

A Water Management Plan (WMP) has been prepared and approved by DPE in accordance with Development Consent requirements for the operation of the mine. The Plans prescribe the process water source and supply requirements, site-water balance, storage, impact management and monitoring of groundwater in the vicinity of the mining operations.

Table 15 outlines the groundwater monitoring program undertaken at Bloomfield Colliery.

Analyte	Quarterly	6 Monthly	Annual
Water Levels	✓	$\checkmark$	$\checkmark$
рН		✓	$\checkmark$
Electrical Conductivity		✓	$\checkmark$
Total Dissolved Solids		✓	$\checkmark$
Filterable Iron			$\checkmark$
Chloride			$\checkmark$
Sulphate			✓
Alkalinity			$\checkmark$
Calcium			✓
Magnesium			$\checkmark$
Sodium			$\checkmark$
Potassium			$\checkmark$

Table 15: Groundwater Monitoring Program

# 3.5.2 Environmental Performance

Monitoring was undertaken during the period and the results for 2017 and previous years are summarised in Figures 8 – 10, with the full data set provided in Appendix C. The results are fairly consistent and do not show any real trends. The S Cut high wall has moved west and is now within a few metres of Bore PD7.1. Bore PD7.1 was 11 metre deep in alluvium/weathered Permian and is now dry.



Figure 8: Groundwater Levels



Figure 9: Groundwater pH



Figure 10: Groundwater EC

# 3.5.3 Environmental Incidents

No reportable incidents relating to groundwater pollution occurred during the reporting period.

# 3.5.4 Further Improvements

The groundwater monitoring program will be continued in accordance with WMP requirements. As more groundwater data is collected any long-term trends may be identified.

# 3.6 Contaminated Land

# 3.6.1 Environmental Management

No contaminated or polluted land has been identified at Bloomfield. No significant hydrocarbon or chemical spills occurred within the Lease requiring special response, cleanup or ongoing management.

# 3.6.2 Environmental Performance

Regular inspections of hydrocarbon storage facilities are completed as part of the site EMS, and no land contamination or significant polluting incidents were reported during these inspections.

# 3.6.3 Reportable Incidents

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

#### 3.6.4 Further Improvements

As no areas of land contamination have been identified, no improvements to the current management system are planned. Regular inspections will be maintained.

# 3.7 Threatened Flora and Fauna

#### 3.7.1 Environmental Management

The Environmental Assessment included an assessment of the potential impacts associated with the clearance vegetation. Any clearing of vegetation within the project area must be undertaken in accordance with the requirements of the Project Approval.

# 3.7.2 Environmental Performance

No vegetation was cleared for within ML1738 for mining or coal washing operations during the reporting period. Biodiversity enhancement has also been considered during the planning and implementation of land rehabilitation.

A Biodiversity Offset Management Plan has been prepared and approved by DPE in December 2017 in accordance with Development Consent requirements for the operation of the mine. A Biodiversity Offset Area has been established to compensate for future land clearance at the mine. The land was purchased by Bloomfield in December 2011 and consists of 40 Ha of remnant vegetation adjacent to the Watagan State Forest. The western boundary abuts a part of Watagan State Forest on the eastern side of the Corrabare Range.

Consultation is underway with the NSW Biodiversity Conservation Trust regarding entering into a conservation agreement over the Biodiversity Offset land under Part 4, Division 12 of the *National Parks and Wildlife Act 1974*.

# 3.7.3 Reportable Incidents

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

# 3.7.4 Further Improvements

Further details on progress of the implementation measures of the Biodiversity Offset Area will be provided in the next AEMR. Further consultation will be underway with the NSW Biodiversity Conservation Trust regarding entering into a conservation agreement.
#### 3.8 Weeds & Pests

#### 3.8.1 Environmental Management

A Weed Management Plan has been developed to provide a plan for weed management at Bloomfield Colliery. The purpose of the Weed Management Plan is to conduct regular surveys to identify weed species requiring control, identify and map weed infestation locations, and implement a weed control priority action plan to control weeds. Bloomfield undertakes regular inspections and has a treatment program to control weeds across the site. A contract weedsprayer is employed in addition to mechanical support from mine plant such as dozers and backhoes when required. Over the reporting period priority was given to the control of pampas grass, blackberry and mother-of-millions. Lantana was also targeted during the reporting period.

Periodic feral animal control programs are undertaken in conjunction with neighboring mines and landowners. Activities include feral dog baiting programs. These programs are conducted annually in consultation with Local Land Services.

#### 3.8.2 Environmental Performance

Approximately \$95,000 was spent across the site on weed control during the reporting period. This consisted of a combination of spraying and slashing. Weed control works included rehabilitation areas and remnant vegetation within ML 1738 as well as land outside the mining lease under the control of Bloomfield. No Class 1 or Class 2 declared weeds were identified onsite. Table 16 lists the weed species identified and treated on site.

Common Name	Scientific Name	Priority Level
African Daisy	Senecio pterophorus	Medium
Blackberry	Rubus fruticosus	Medium
Castor Oil	Ricinus communis	Low
Crofton Weed	Ageratina adenophora	Low
Farmers Friend	Bidens pilosa	Low
Giant Parramatta Grass	Sporobolus fertilis	Low
Lantana	Lantana camara	High
Mother of Millions	Bryophyllum delagoense	Low
Pampas Grass	Cortaderia selloana	High
Morning Glory	Ipomoea indica	Low
Tobacco Bush	Solanum mauritianum	Low

#### Table 16: Weed Priority Level

During the reporting period a wild dog and fox baiting program was undertaken in conjunction with neighbouring mines and the Hunter Local Land Services. This was conducted in August 2017. The baiting program proved to be successful with 30 out of 30 baits taken.

#### 3.8.3 Reportable Incidents

No reportable incidents relating to weed management occurred during the reporting period.

#### 3.8.4 Further Improvements

The weed management budget for the upcoming reporting period will be maintained at a similar level to previous years. The control of pampass grass and African daisy remains the priority for the next reporting period in addition to the ongoing management of Lantana.

#### 3.9 Blasting

#### 3.9.1 Environmental Management

A Blast Monitoring Plan (BMP) has been prepared and approved by DPE in accordance with Development Consent requirements for the operation of the mine. Blasting activities are licensed under EPL 396. The EPL stipulates monitoring requirements, restricts blasting hours, as well as limiting airblast overpressure and ground vibration impacts at the nearest residences.

Blasting techniques have been developed in conjunction with ORICA, utilising the "nonel" initiation system and implemented to achieve maximum fragmentation and maintain levels ground vibration and overpressure levels within the approved criteria for the site.

Each blast is monitored at four nearby residences for ground vibration and overpressure. Monitors are located at residences to the south, south-east, west and north-west of current open cut operations. The location of the blast monitors is shown on Plan 1.

Also the use of a predictive meteorological modeling software program is utilised to assist in planning blast operations. The software incorporates regional weather station data to predict daily weather events that may exacerbate overpressure impacts from blasting operations.

3.9.2 Environmental Performance

All blast results for the reporting period are included in Appendix D and are summarised in Table 17 and Table 18.

During the reporting period a total of 56 blasts were initiated on the site. One blast (1.8% of total shots) exceeded 115 dB blast overpressure. No blasts exceeded 120 dB blast overpressure limits. No blasts exceeded the 5mm/sec or 10mm/sec ground vibration limits.

Blasting Criteria Limits	Allowable Exceedance <sup>1</sup>	Results 2017
Airblast Overpressure Level dB		
(Lin Peak)		
115	5 %	1.8 %
120	0 %	0 %
Ground Vibration Peak Particle		
Velocity (mm/s)		
5	5 %	0 %
10	0 %	0 %

#### Table 17: Blast Monitoring Summary

Note: 1. Percentage of the total number of blasts over a period of 12 months

Blast modelling predictions conducted as part of the Environmental Assessment (PA 07\_0087) are shown in Table 18. Monitoring during the reporting period indicates that mean and median results are near or below predicted levels.

Location	N – E	Elliotts M - Mac		MacNaughtons H - M		ncent Rd	G - Richards	
	Airblast dBL	Vibration mm/s	Airblast dBL	Vibration mm/s	Airblast dBL	Vibration mm/s	Airblast dBL	Vibration mm/s
Max	117.0	2.8	114.2	1.0	108.8	0.7	110.2	1.0
Min	81.0	0.1	92.4	0.03	84.8	0.02	87.2	0.04
Mean	103.2	0.5	100.8	0.3	94.3	0.2	100.4	0.3
Median	103.6	0.3	100.7	0.2	92.5	0.2	100.3	0.2
EA Prediction	113.0	4.8	103.5	1.2	96.5	0.4	102.1	1.0

#### Table 18: Blast Predictions

#### 3.9.3 Reportable Incidents

No reportable incidents relating to blasting occurred during the reporting period.

3.9.4 Further Improvements

Monitoring of blasts will continue in accordance with EPL and Project Approval requirements.

#### 3.10 Operational Noise

#### 3.10.1 Environmental Management

A Noise Monitoring Plan (NMP) has been prepared in accordance with the conditions of the Project Approval. The noise monitoring plan has been endorsed by the DPE. Quarterly noise monitoring has been undertaken in accordance with the monitoring plan.

The use of a predictive meteorological modeling software program is utilised to assist in planning mine operations. The software incorporates weather models and regional weather station data to predict daily weather events that may exacerbate noise impacts from operations.

During 2016 the existing predictive meteorological modelling software program was upgraded to a predictive noise emissions management tool for the mine. In addition to meteorological data it also incorporates terrain data, mining equipment locations and aerial photographs.

#### 3.10.2 Environmental Performance

Attended and unattended quarterly noise monitoring was undertaken during the reporting period which assessed noise impacts from Bloomfield Colliery against relevant criteria detailed within PA 07\_0087 at five monitoring locations (see Plan 1). Monitoring results are summarised in Table 19 and copies of the monitoring reports can be viewed on the Bloomfield website (www.bloomcoll.com.au).

All noise monitoring indicated that compliance with consent criteria was met at all locations during day, evening and the night-time periods. The noise criteria were set based on the noise predictions conducted in the Environmental Assessment (PA 07\_0087).

Night time sleep disturbance criteria (LA1(1min)) were in compliance during all monitoring events.

Location	Estimated Bloomfield LAeq(15minute) Contribution			Consent Conditions LAeq(15 minute)			Compliance		
	Day Eve Night		Day	Eve	Night	Day	Eve	Night	
March Quarter Results	6								
F – Black Hill Road, Black Hill	Inau	idible at all ti	mes	35	35	35	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1</sup>
G – Buchanan Road, Buchanan	Inau	idible at all ti	mes	39	42	37	Yes	Yes	Yes
L – Kilshanny Ave, Ashtonfield	Inau	idible at all ti	mes	35	35	35	Yes	Yes	Yes
M – John Renshaw Drive, Buttai	Inau	udible at all ti	mes	39	39	37	Yes	Yes	Yes
N – Lings Road, Buttai	Inau	udible at all ti	nes	42	42	35	Yes	Yes	Yes
June Quarter Results									
F – Black Hill Road, Black Hill	Inaudible	30	Inaudible	35	35	35	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1</sup>
G – Buchanan Road, Buchanan	Inaudible	Inaudible	<30	39	42	37	Yes	Yes	Yes
L – Kilshanny Ave, Ashtonfield	Inau	Inaudible at all times		35	35	35	Yes	Yes	Yes
M – John Renshaw Drive, Buttai	<30	33	33	39	39	37	Yes	Yes	Yes
N – Lings Road, Buttai	Inaudible at all times			42	42	35	Yes	Yes	Yes
September Quarter Results									
F – Black Hill Road, Black Hill	Inaudible at all times			35	35	35	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1</sup>
G – Buchanan Road, Buchanan	35 34 36		39	42	37	Yes	Yes	Yes	
L – Kilshanny Ave, Ashtonfield	Inau	udible at all ti	mes	35	35	35	Yes	Yes	Yes
M – John Renshaw Drive, Buttai	Inau	udible at all ti	nes	39	39	37	Yes	Yes	Yes
N – Lings Road, Buttai	Inaudible at all times		42	42	35	Yes	Yes	Yes	
December Quarter Results									
F – Black Hill Road, Black Hill	Inaudible at all times			35	35	35	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1</sup>
G – Buchanan Road, Buchanan	Inaudible	36	Inaudible	39	42	37	Yes	Yes	Yes
L – Kilshanny Ave, Ashtonfield	Inau	idible at all ti	mes	35	35	35	Yes	Yes	Yes
M – John Renshaw Drive, Buttai	Inaudible	35	36	39	39	37	Yes	Yes	Yes
N – Lings Road, Buttai	Inaudible	36	<30	42	42	35	Yes	Yes	Yes

#### Table 19: Summary of Attended Noise Monitoring Results

1 - Mine owned property

#### 3.10.3 Reportable Incidents

No reportable incidents relating to operational noise occurred during the reporting period.

#### 3.10.4 Further Improvements

The noise monitoring program will be continued in accordance with Noise Monitoring Plan requirements.

#### 3.11 Visual, Stray Light

#### 3.11.1 Environmental Management

Progressive rehabilitation of disturbed land is the main strategy for minimising visual impacts. In addition to 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.

Fixed lighting around the site has been positioned and/or shielded where possible to minimise light shed. Consideration is also given to the location and alignment of mobile light to minimise stray light.

#### 3.11.2 Environmental Performance

The visual assessment of the Bloomfield open cut noted that the main visual impacts are on residences to the south of John Renshaw Drive, to the south of the mine.

#### 3.11.3 Reportable Incidents

No reportable incidents relating to visual amenity or stray light occurred during the reporting period.

#### 3.11.4 Further Improvements

Rehabilitation of areas visible from nearby residences or road traffic will be given priority during mine planning and rehabilitation scheduling.

#### 3.12 Aboriginal Heritage

#### 3.12.1 Environmental Management

An Aboriginal Cultural Heritage Management Plan (ACHMP) was prepared in consultation with Mindaribba LALC. The plan was endorsed by OEH and DPE.

#### 3.12.2 Environmental Performance

A number of Aboriginal sites identified during the Project Approval process were previously salvaged in 2010 in accordance with the ACHMP. Representatives from Mindaribba LALC participated and monitored the process ahead of preparation for mining activities. In all, 80 artefacts were salvaged and are being stored at Bloomfield Colliery.

In 2014 an additional 3 Ha was stripped of topsoil in preparation for mining activities. In accordance with the approved ACHMP Bloomfield engaged an archaeologist and the Mindaribba LALC to monitor the ground disturbance works and salvage identified artefacts. In all a further 6 artefacts were salvaged and are being stored at Bloomfield Colliery.

In 2016 an additional 3 Ha was cleared of vegetation and stripped of topsoil in preparation for mining activities. In accordance with the approved ACHMP Bloomfield engaged an archaeologist and the Mindaribba LALC to monitor the ground disturbance works and salvage identified artefacts. An additional artefact was salvaged and is being stored at Bloomfield Colliery.

#### 3.12.3 Reportable Incidents

No reportable incidents relating to Aboriginal heritage occurred during the reporting period.

#### 3.12.4 Further Improvements

Any Aboriginal heritage evidence that is identified will be managed in accordance with the ACHMP and reported in the 2018 AEMR. The Aboriginal Cultural Heritage Management Plan (ACHMP) is under review in consultation with Mindaribba LALC and is expected to be finalised in the 2018 reporting period.

#### 3.13 Natural Heritage

#### 3.13.1 Environmental Management

No National Parks, nature reserves, or other areas of protected natural heritage are located near Bloomfield. The nearest, Pambalong Nature Reserve, is located approximately 6km to the south-east of Bloomfield mining operations. Therefore, natural heritage management is not considered a significant environmental risk.

3.13.2 Environmental Performance

N/A

3.13.3 Reportable Incidents

No reportable incidents relating to natural heritage occurred during the reporting period.

3.13.4 Further Improvements

No improvements are planned with regards to natural heritage management.

#### 3.14 Spontaneous Combustion

#### 3.14.1 Environmental Management

There was no major spontaneous combustion incidences recorded during the reporting period.

3.14.2 Environmental Performance

A small area of spontaneous combustion was identified in an overburden dump that required capping with clay to seal off the available air supply.

#### 3.14.3 Reportable Incidents

No reportable incidents relating to spontaneous combustion occurred during the reporting period.

#### 3.14.4 Further Improvements

No improvements are planned with regards to spontaneous combustion management.

#### 3.15 Bushfire

#### 3.15.1 Environmental Management

A Bushfire Management Plan for Bloomfield Colliery was prepared in consultation with representatives of the NSW Rural Fire Service (RFS). The plan divides the site into 44 fire management Sectors, describes fire risk levels across the site, and outlines site features relevant to fire management such as vegetation type, access trail locations, asset locations, and water supplies.

Weather conditions permitting, hazard reduction burns are conducted periodically by the RFS. Selection of burn location is based on risk levels, as determined by fuel load assessment and location of assets/asset protection zones. Hazard reduction clearing/slashing was also undertaken by Bloomfield along fire trails, asset protection zones and the mine boundary.

#### 3.15.2 Environmental Performance

An asset protection zone adjacent to residential areas near Ashtonfield and Buchanan was slashed and maintenance work carried on a number of tracks to enable access for hazard reduction activities by the RFS.

During 2017 a meeting was held with the RFS to discuss future hazard reduction burns within land surrounding the mine.

#### 3.15.3 Reportable Incidents

No reportable incidents relating to bushfire management occurred during the reporting period.

#### 3.15.4 Further Improvements

No improvements to the Bushfire Management Plan are planned, however, ongoing hazard reduction burning and clearing will continue in consultation with the RFS. A hazard reduction burn is planned for winter 2018.

#### 3.16 Mine Subsidence

#### 3.16.1 Environmental Management

Areas of the Bloomfield mine site (CCL 761) are undermined by historic underground workings, some relatively shallow. Sink holes associated with shallow workings are infrequent, but have previously been identified. 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 periodical inspections will continue.

#### 3.16.2 Environmental Performance

A sink hole previously filled and rehabilitated in X-Cut near Buchanan Road has been monitored throughout during 2017. The area appears stable.

#### 3.16.3 Reportable Incidents

No reportable incidents relating to subsidence management occurred during the reporting period.

#### 3.16.4 Further Improvements

Other than the remediation and rehabilitation of sink holes as identified, no improvements to subsidence management are planned.

#### 3.17 Hydrocarbon Contamination

#### 3.17.1 Environmental Management

As no areas of hydrocarbon contamination have been identified within the Bloomfield lease area, management is geared to contamination prevention. Bulk hydrocarbon storages (including the NALCO products) are located within bunded areas. The volumes of these bunded areas are capable of containing greater than 110% of the largest storage tank.

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

Hydrocarbon storage infrastructure at the CHPP and open cut is inspected regularly and documented maintenance check sheets are completed quarterly.

A dedicated contaminated soil bioremediation area is established on-site to treat any hydrocarbon contaminated due to accidental spills.

#### 3.17.2 Environmental Performance

No major areas of hydrocarbon contamination were identified during the reporting period. Soil from minor spills were collected and deposited the contaminated soil bioremediation area.

#### 3.17.3 Reportable Incidents

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

#### 3.17.4 Further Improvements

No improvements are planned for hydrocarbon management.

#### 3.18 Public Safety

#### 3.18.1 Environmental Management

Being situated close to urban areas, Bloomfield has historically had a problem with dumping of rubbish, theft and vandalism on the site. A major fencing and exclusion barrier program has greatly reduced these occurrences. Bloomfield continues to invest significant time and resources into keeping the site closed to unauthorised access, including fencing along all public roads, installing lockable gates and other temporary barriers (such as logs, rocks and concrete blocks) on major access tracks and ensuring clear signage is placed covering likely approaches.

#### 3.18.2 Environmental Performance

No public safety incidents were recorded or reported during the reporting period.

#### 3.18.3 Reportable Incidents

No reportable incidents relating to public safety during the reporting period.

#### 3.18.4 Further Improvements

No overall improvements are planned to manage public safety; however, Bloomfield will continue to maintain existing fencing, gates, barriers and signage.

#### 4 COMMUNITY RELATIONS

#### 4.1 Environmental Complaints

Four community complaints were received during the reporting period and a summary is provided below in Table 20. The complaints register for the reporting period is presented in Appendix E.

Date	lssue	Туре	Location
18-Jul-17	Noise	Resident	Black Hill
10-Oct-17	Dust	Resident	Thornton
12-Oct-17	Blasting	Resident	Black Hill
12-Oct-17	Blasting	Resident	Black Hill

#### Table 20: Community Contacts Register

Figure 11 displays a comparison of complaints with previous reporting periods, which demonstrates a decline in the number of complaints received.



Figure 11: Community Complaints

#### 4.2 Community Liaison

#### 4.2.1 Community Consultative Committee

In accordance with the Project Approval, a Community Consultative Committee (CCC) has been established. The CCC meets three times a year basis. The scheduled November 2017 meeting was postponed due to community members unable to attend. The minutes of the CCC meetings can be viewed on the Bloomfield website (<u>www.bloomcoll.com.au</u>).

Additional information about the operation has been included on the company website (<u>www.bloomcoll.com.au</u>) and information about blasting schedules advertised quarterly in local newspapers.

#### 4.2.2 Adopt-a-Road Program

Bloomfield is a participant in Cessnock City Council's Adopt-a-Road program. Bloomfield has entered into an agreement with the Council to undertake litter collection campaigns along Buchanan Road, between John Renshaw Drive and Louth Park Road, Buchanan, including Valley View Lane. Bloomfield has contracted the Kurri Kurri Community Center Inc to conduct quarterly litter collection programs.

#### 4.2.3 Community Sponsorship

The Bloomfield Group has a commitment to support local community projects and activities. As part of this commitment, during 2017 financial sponsorship and donations were provided for the following local community groups, schools, charities and community events:

- Australian Mitochondrial Disease Foundation
- Beyond Blue
- Black Dog Institute
- Cancer Council NSW
- Cancer Council NSW Relay for Life Maitland
- Carrie's Place Domestic Violence & Homelessness Services Inc
- Cerebral Palsy Alliance
- Country Women's Association NSW Disaster Relief Fund
- Cure Brain Cancer Foundation
- Darlington Volunteer Fire & Emergency Public Fund
- East Maitland Junior Rugby League Club
- East Maitland Pre School Association
- Friends of Palliative Care Inc
- Gresford Public School P&C
- Harry Perkins Institute of Medical Research
- Hunter Medical Research Institute
- Hunter River Agricultural & Horticultural Association
- Hunter Valley Grammar School Library Fund
- Hunter Valley Regional Cricket Juniors
- Kurri Kurri District Business Chamber

- Maitland City Council (Steamfest sponsorship)
- Maitland Community Pre-school
- Maitland Polocrosse Club
- Mentor Support Network
- Movember
- Mt Olive Community Centre Inc
- Multiple Sclerosis Ltd
- National Heart Foundation
- National Trust
- Newcastle Legacy Fund Singleton branch
- Northern Agricultural Association
- Pelaw Main Public School P&C
- Police Citizens Youth Clubs NSW Limited
- Property Industry Foundation
- Red Cross
- Salvation Army
- Salvation Army Red Shield Appeal
- Samaritans Foundation
- Singleton Chamber of Commerce
- Singleton Council
- Singleton Fire Brigade Social Club
- Singleton High School
- Singleton Hospital (Hunter New England Local Health District)
- Singleton Netball Association
- Singleton Sports Council
- Skallywags Pre-School
- Soil Science Australia
- St Philips Christian School Cessnock
- St Vincents de Paul
- Tenambit Sharks Footbook Club
- The Wayside Chapel
- Thornton Junior Football Club
- Thornton Public School
- University of Newcastle
- Westpac Helicopter
- Witmore Enterprises
- Youth off the Streets

#### 5 REHABILITATION

#### 5.1 Buildings

There have been no buildings or structures decommissioned over the site during the reporting period.

#### 5.2 Rehabilitation of Disturbed Land

Landscape re-contouring, topsoil handling and revegetation techniques are well established at Bloomfield. The objectives of the rehabilitation program being:

- To establish post-mining surfaces and vegetation cover which ensure a safe and stable landform of land capability class equal to that which existed prior to mining disturbance.
- Return the land to a condition suitable for a range of post-mining landuses, which take into account the proximity of the site to the urban areas of Maitland and possible future development demands.
- Create landforms that can accommodate overburden and waste products produced during coal mining and processing, and merge with adjoining undisturbed landforms.
- Reinstate a surface drainage network on the rehabilitated landforms that is hydrologically stable and incorporates adequate erosion and sediment control structures so as to effectively protect adjoining areas from potential water-borne impacts.
- Undertake a maintenance program to ensure the continued sustainability of previously rehabilitated areas.

Rehabilitation is carried out throughout the year, with the aim of timing vegetation seeding operations in spring and autumn. The majority of the lease area is relatively undisturbed remnant native bushland and no other activities are carried out on the area other than the mining operation. To date 488 Ha has been rehabilitated.

As reported in the previous AEMR, the major rehabilitation program undertaken over the past decade has now resulted in only relatively small areas becoming available for rehabilitation each year. Combined with this was an expansion of dumping area over areas previously categorised as rehabilitated.

During 2017 there was no rehabilitation undertaken. The net rehabilitation completed during the MOP period to date is 38.5 Ha which exceeds the MOP estimate of 29.3 Ha. Throughout 2017 overburden emplacement operations were carried out within the mine void. This involved backfilling the lower areas of the void and against existing highwalls towards the final landform. The highwalls on the southern and western lease boundary will eventually be backfilled to ground level. Shaping and rehabilitation of existing overburden emplacement areas will not be able to continue until backfilling areas within the void has reached the final landform. As a result there was no new landform available for rehabilitation during 2017.

Plan 2 provides an overview of the site showing areas previously rehabilitated, shaped and unshaped areas (active dumps), and active mining areas.

Table 21 provides a summary of the disturbed and rehabilitated areas at Bloomfield Colliery.

		Area Affected/Rehabilitated (hectares)			
		To date	Last report	Next Report (estimated)	
<b>A</b> :	MINE LEASE AREA				
A1	Mine Lease(s) Area	1,453			
B:	DISTURBED AREAS				
B1	<b>Infrastructure area</b> (other disturbed areas to be rehabilitated at closure including facilities, roads)	73	73	73	
B2:	Active Mining Area (excluding items B3 – B5 below)	73	77	79	
<b>B</b> 3	Waste emplacements, (active/unshaped/in or out-of-pit)	159	148	159	
B4	Tailings emplacements, (active/unshaped/uncapped)	79	79	79	
B5	Shaped waste emplacement (awaits final vegetation)	8	8	8	
ALL	DISTURBED AREAS	392	385	398	
С	REHABILITATION PROGRESS		·		
C1	Total Rehabilitated area (except for maintenance)	488	488	488	
D:	REHABILITATION ON SLOPES				
D1	10 to 18 degrees	28	28	28	
D2	Greater than 18 degrees	-	-	-	
E:	SURFACE OF REHABILITATED LAND				
E1	Pasture and grasses	483	483	483	
E2	Native forest/ecosystems	-	-	-	
E3	Plantations and crops	5	5	5	
E4	Other (include nonvegetative outcomes)	-	-	-	

Table 21:	Rehabilitation	Summarv
	. contraction	Gammary

The 488 Ha total rehabilitated area includes 21 Ha of rehabilitated and relinquished lands.

Table 22 provides a summary of the maintenance activities during the period and activities proposed for the next reporting period.

	Area Treated (ha)			
NATURE OF TREATMENT	Report period	Next period	Comment/control strategies/ treatment detail	
Additional erosion control works (drains re-contouring, rock protection)	0.25	-	Repair and rehabilitation of drain and gully erosion.	
<b>Re-covering</b> (detail – further topsoil, subsoil sealing etc)	30	20	Small, isolated bare patches & washouts across the sit to be ripped, retreated with lime, biosolids and/o fertiliser, and re-seeded during the next reporting period Actual areas small and difficult to calculate.	
Soil treatment (detail – fertiliser, lime, gypsum etc)	-	-	See "Re-covering" above.	
<b>Treatment/Management</b> (detail – grazing, cropping,	40		The northern area of K Cut fenced and cattle grazing introduced to maintain pasture.	
slashing etc)		12	The eastern side of S Cut, along southern boundary near John Renshaw Drive, fenced and cattle grazing introduced to maintain pasture	
	2.5	5	Slashing of established rehabilitation to encourage nutrient recycling and, where needed, fertiliser application.	
<b>Re-seeding/Replanting</b> (detail – species density, season etc)	-	-	See "Re-covering" above.	
Adversely Affected by Weeds (detail - type and treatment)	ML1738	ML1738	Continual localised areas of weed treatment across all disturbed and undisturbed areas (see Section 3.7), but no specific areas of intensive treatment.	
<b>Feral animal control</b> (detail – additional fencing, trapping, baiting etc)	1500	1500	Feral dog baiting undertaken during the reporting period in consultation with other large land holders in the area and Local Land Services.	

#### Table 22: Maintenance Activities on Rehabilitated Land

Table 23 provides a topsoil balance as at the end of the reporting period and the current disturbance area.

#### Table 23: Topsoil Balance

	Start of Period	End of Period
Current Disturbance Area	385 Ha	392 Ha
Stockpiled Soil Material	270,000 m <sup>3</sup>	290,000 m <sup>3</sup>
In-Situ Soil Material	170,000 m <sup>3</sup>	140,000 m <sup>3</sup>
Total Soil Material	440,000 m <sup>3</sup>	430,000 m <sup>3</sup>
Soil Cover Depth	0.11 m	0.11 m

#### 5.2.1 Rehabilitation Monitoring

Rehabilitation monitoring at Bloomfield is undertaken in accordance with the Rehabilitation Management Plan, which was developed to satisfy the requirements of the development consent for the operation.

The monitoring program is based on the Landscape Function Analysis (LFA) tool developed by the CSIRO. LFA is the core of the monitoring procedures and uses visually assessed indicators of soil surface processes that gauge how effectively a hillslope is operating as a biophysical system. It is mainly based on processes involved in surface hydrology: rainfall, infiltration, runoff, erosion, plant growth and nutrient cycling. In addition to LFA monitoring, the monitoring program also assesses the performance of rehabilitated lands in terms of ground cover protection, erosion, vegetation community composition and structure, soil properties and pasture productivity.

Rehabilitation monitoring at Bloomfield is carried on a biennial basis (i.e. every 2 years) and did not commence until 2008, at the time where much of the existing rehabilitated areas were already established. Monitoring events were subsequently conducted in 2011, 2013 and 2015, and the 2017 monitoring represented the fifth year of data collection for some of the monitoring sites.

As part of the 2017 monitoring program of works an additional three new monitoring sites were established and monitored, including one new rehabilitation site located in an area of 2016 tree rehabilitation, and two analogue sites (one in native forest community and one in undisturbed pasture) established in areas of the mining lease non-impacted by mining activities. The analogue sites were established in response to a request from DRG, and will be use to inform targets and benchmarks setting for the rehabilitation areas.

The monitoring program currently includes a total of 26 monitoring sites, comprised of 24 sites within the rehabilitated areas plus two analogue sites. Plan 3 shows the monitoring transect sites in the rehabilitation areas as well as the analogue sites. The monitoring results are summarised in the following sections.

#### **Ground Cover**

The 2017 monitoring results showed that ground cover protection was excellent across all monitoring sites and comprised within 71-100%, indicating that the 70% cover target was consistently achieved / exceeded. Ground cover in areas of tree rehabilitation was typically dominated by deposited leaf litter with only low amounts of vegetative live cover present. Conversely, ground cover at the pasture sites was generally dominated by live vegetation (i.e. grass cover), although moderate levels of grass litter were also present, reflecting the prolonged dry weather conditions experienced in the region throughout 2017 (i.e. leading to the wilting/haying off of grasses). Ground cover type and distribution at the rehabilitated sites were well aligned with those recorded at the analogue areas for the respective vegetation community types. The results of the grown cover monitoring are summarised in Figure 12.



Figure 12: Ground Cover

#### Stability

Stability is defined as the ability of the soil to withstand erosive forces, and to reform after disturbance. The results of the stability monitoring are summarised in Figure 13.



Figure 13: Stability

Despite some minor annual natural variations in index scores, soil stability remained excellent across all rehabilitated areas in 2017, and scores were generally within comparable range of

those obtained in previous monitoring years for all monitoring sites. Soil stability results at the rehabilitated sites compared positively to those at the analogue sites.

As a function of the excellent soil surface stability and protective cover, excellent slope stability was achieved throughout all monitored areas. No active erosion processes were recorded in 2017 with the potential to compromise slope stability and overall landform integrity (e.g. rill, gully or tunnel erosion).

#### Infiltration

Infiltration is defined as how the soil partitions rainfall into soil-water (water available for plants to use), and runoff water which is lost from the local system, or may also transport materials (soil, nutrients and seed) away. The results of the infiltration monitoring are summarised in Figure 14.



Figure 14: Infiltration

The infiltration index is to a great extent influenced by the existing levels of vegetative cover (ground + woody vegetation), which slow down surface water runoff allowing higher infiltration rates and water uptake by plants (whereas in areas of sparser cover the soil surface has a greater tendency for hard-setting/crusting which promotes runoff). Reflecting the very dry conditions leading up to the 2017 monitoring event, several monitoring sites showed a decrease in infiltration index scores compared to previous years' results.

Regardless, well-established (older) pasture rehabilitation sites generally performed well compared to the pasture analogue site in terms of soil infiltration potential. The infiltration index score recorded at the forest analogue site remained higher than those all rehabilitated areas, reflecting the better performance achieved in areas of undisturbed native vegetation communities with long-established and structured vegetation.

#### **Nutrient Cycling**



Nutrient cycling is defined as how efficiently organic matter is cycled back into the soil. The results of the nutrient cycling monitoring are summarised in Figure 15.

Figure 15: Nutrient Cycling

The 2017 monitoring results showed a significant decrease in nutrient cycling performance across all monitoring sites, which could not be solely attributed to the recent dry weather conditions (although these would have contributed to some extent to decrease in index scores). Rather, all datasets from previous monitoring years were investigated and it appeared that this change was not due to an actual decrease in site condition or performance, but clearly to a different interpretation of the observers during field data collection (particularly in relation to scores awarded to litter and cryptogram abundance, which are key drivers of the nutrient cycling index).

Regardless, the nutrient cycling properties recorded at the rehabilitated sites were generally comparable to those of the corresponding analogue sites, highlighting an overall acceptable performance of the rehabilitated communities in terms of nutrient cycling.

#### Vegetation Communities

#### <u>Pastures</u>

Rehabilitated pasture communities were typically dominated by exotic grass species suitable for grazing and which have been showed to provide productive pastures on post mined lands. Dominant species generally consisted of *Chloris gayana* (Rhodes grass), *Cenchrus clandestinus* (Kikuyu) and/or *Megathyrsus maximus* (Guinea grass), with other locally

common species included *Cynodon dactylon* (Couch grass) and *Paspalum dilatatum* (Paspalum).

Pasture biomass levels in 2017 were variable between monitoring sites which was influenced by different species composition and ground cover levels. The average dry biomass level for all rehabilitated pastures was of ~2,150 kg DM/ha, which was greater than biomass levels recorded at the analogue site (~950 kg DM/ha).

#### <u>Trees</u>

In areas of 'tree' or 'tree over pasture' rehabilitation, woody species densities ranged from 100 stems/ha to 9,600 stems/ha in 2017 (average of ~1,800 stems/ha), with higher densities generally recorded in area of younger rehabilitation (i.e. indicating good species germination and establishment following seeding activities) and lower plant densities recorded in areas of older rehabilitation. Projective foliage canopy cover ranged from 0-54% with an average of 16.3%. For comparison, the forest analogue sites recorded plant densities of 4,050 stems/ha and a projective foliage canopy cover of 34.5%.

Recorded species across the rehabilitated sites consisted of local native shrubs and trees and included a variety of acacias and eucalypts generally aligned consistent with naturally occurring local native vegetation communities. Most widespread tree species in rehabilitated areas consisted of *Corymbia maculata* (Spotted gum) and *Eucalyptus punctata* (Grey gum), with other commonly recorded species including *Angophora costata* (Smooth-barked Apple), *E. tereticornis* (Forest Red Gum) and Ironbark species.

Tree health condition was generally good and signs of natural regenerations were evident in most areas of older rehabilitation in the form of flowering/fruiting trees and/or presence of second generation young seedlings.

#### Weeds

Weed population levels were generally acceptable in rehabilitated areas, with 18 of the 24 monitoring sites recording less than 15% weed cover (i.e. meeting the benchmark defined in the RMP). Of the other six monitoring sites, two sites returned an estimated weed cover comprised between 15-25% and two sites an estimated weed cover of 25-50%, whilst only two sites were severely weed infested (>75% estimated weed cover).

In most cases the weed population consisted of annual environmental weeds, however the listed *Lantana camera* (Lantana) was recorded at several locations across the site with severe localised infestations observed.

#### Soils

Results of the 2017 and previous years soil monitoring indicate that soils in rehabilitated areas generally have a silty clay texture, have slightly acidic to neutral pH levels, and are non-saline and non-sodic. Overall soils show physical and chemical properties that are conducive to vegetation establishment.

#### 5.3 Other Infrastructure

No infrastructure was decommissioned during the reporting period.

#### 5.4 Rehabilitation Trials and Research

No trials or research were undertaken during the reporting period.

#### 5.5 Further Development of the Final Rehabilitation Plan

Under the current consent mining will cease at Bloomfield in 2021. In December 2017 a variation to modify the Project Approval (07\_0087\_Mod 4) was submitted to the DPE. The modification would allow the Colliery to continue its open cut mining operations until 31 December 2030. The Bloomfield washery, rail loader and tailings facility will continue to operate after the mining operations are scheduled to be completed. The continued use of the washery, rail loader and tailings facility is approved under Project Approval 05\_0136 for the Abel Underground Mine. These items associated with the operation of the washery are currently used to process coal from Bloomfield, Abel and Tasman mines. When mining is completed at Bloomfield Colliery, the washery will continue processing coal from the Abel and Tasman mines. Project Approval 05\_0136 permits operations until 2031.

The final void remaining at the end of mining will be used as the tailings facility for the washery operations. An estimated 20 M m<sup>3</sup> of storage capacity will be required for the final void as a tailings facility. This will be used for the disposal of approximately 18 M m<sup>3</sup> of waste rejects and a further 2 M m<sup>3</sup> of overburden capping. The tailings material will be capped with 2 metres of overburden material and soil and rehabilitated. Overburden material and topsoil will be stockpiled adjacent to the final void towards the end of Bloomfield mining operations to be utilised for final closure when washery operations are completed in 2031.

The current MOP expires at the end of June 2018. A new MOP will be prepared and submitted to DRG in early 2018 to cover the next MOP period.

#### 6 STATEMENT OF COMPLIANCE

#### Table 24: Statement of Compliance

Were all conditions of the relevant approvals complied with?			
PA 07_0087	No		
ML 1738	No		

#### 6.1 Project Approval PA 07\_0087

Umwelt (Australia) Pty Limited was commissioned by Bloomfield to conduct a compliance audit against Project Approval 07\_0087 for Bloomfield Colliery and covered the period 1 November 2015 to 31 July 2017. For further details regarding non-compliances with PA 07\_0087 refer to Section 7. Table 25 identifies the non-compliances with PA 07\_0087 identified by Umwelt.

Condition	Non-Compliance
Schedule 2, Condition 2(a)	During 2016 DP&E investigated an inconsistency between mining disturbance at the Bloomfield Colliery and mining limits as detailed in the document titled 'Bloomfield Colliery. Completion of Mining and Rehabilitation. Part 3A Environmental Assessment Project Application 07_0087 November 2008'. This determined that mining has occurred outside the approved disturbance footprint
Schedule 2, Condition 2(b)	One non-compliance has been identified with the Statement of Commitments.
Schedule 2, Condition 2(g)	A number of non-compliances have been identified with the conditions of this approval as identified by this audit.
Schedule 3, Condition 1	A noise exceedance of the noise criteria was recorded during quarterly monitoring undertaken in June 2016.
Schedule 4, Condition 1	Noise exceedance was not notified to the Director-General and the affected landowners/tenants.
Schedule 5, Condition 2	Blast Monitoring Program and Air Quality Monitoring Program do not contain the latest version of the Project Approval (PA 07_0087 MOD 3).
Schedule 5, Condition 5	Notification requirements to the Director General and other relevant agencies were not met for reportable incidents

#### Table 25: PA 07\_0087 Non-Compliances

Condition	Non-Compliance
SoC 1.1	During 2016 DP&E investigated an inconsistency between mining disturbance at the Bloomfield Colliery and mining limits as detailed in the document titled 'Bloomfield Colliery. Completion of Mining and Rehabilitation. Part 3A Environmental Assessment Project Application 07_0087 November 2008'. This determined that mining has occurred outside the approved disturbance footprint.

#### 6.2 Mining Lease ML1738

Table 26 identifies the non-compliances with ML1738.

Table 26:	ML1738	<b>Non-Compliances</b>
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Condition No.	Description	Compliance Status	Comments
1(a)	Within a period of three months from the date of renewal of the mining lease, the lease holder must serve on each landholder a notice in writing indicating that this mining lease has been renewed.	Non- compliant	The grant date of mining lease was 29 June 2016. However the granted lease was not forwarded to Bloomfield Colliery until 30 January 2017. Therefore the three month time period could not be met. The landholders have been notified in writing dated 20/7/17 that mining lease has been granted. A letter dated 27/11/17 received from DPE stated that no action would be taken.
4(c)	A Compliance Report must be lodged with the Department annually on the grant anniversary date for the life of this mining lease.	Non- compliant	The grant anniversary date is 29 June. Clarification was to be sort from the Department as to the due date of this Report. For example, exploration reporting is due 1 month after the annual reporting date. An Official Caution letter was issued by DPE dated 27/11/17 for non-compliance. A letter dated 29/11/17 received from DRG stated that Condition 4(c) will be removed from ML1738.

#### 7 INDEPENDENT AUDIT

In accordance with the Bloomfield Project Approval (PA 07\_0087), every three years Bloomfield is required to undertake an Independent Environmental Audit of the project. The next audit to be conducted as part of the approval conditions is due in 2018. Further details of the results of the audit will be provided in the 2018 AEMR.

During 2016 the Department of Planning and Environment (DPE) investigated an inconsistency between mining disturbance at the Bloomfield Colliery and mining limits as detailed in 'Bloomfield Colliery Completion of Mining and Rehabilitation, Part 3A Environmental Assessment Project Application 07\_0087 November 2008' (The EA).

In response to discovering the breach of the disturbance area, Bloomfield took immediate steps and provided DPE with a voluntary undertaking which was accepted by DPE in letter correspondence dated 17 May 2017. As part of the voluntary undertaking by Bloomfield, operations at Bloomfield Colliery were required to be audited to determine compliance with applicable Development Consents.

Umwelt (Australia) Pty Limited (Umwelt) was commissioned by Bloomfield to conduct a compliance audit against Project Approval 07\_0087 for Bloomfield Colliery and covered the period 1 November 2015 to 31 July 2017. The audit was conducted by Daniel Sullivan (Exemplar Global International Certified Auditor 113202) and Bridie McWhirter (Environmental Auditor) from Umwelt. The field visit component of the audit was completed on 3 August 2017.

The audit consisted of a detailed desktop review of documentation, interviews with key Bloomfield 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)'.

The audit concluded that the on the ground environmental management practices being applied at the Bloomfield Colliery 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.

Table 27 outlines the recommendations arising from the audit and an update on progress made in implementing the action plan developed as an outcome of the audit.

#### ANNUAL ENVIRONMENTAL MANAGEMENT REPORT 2017

#### Table 27: Audit Recommendations

Condition / Issue PA07_0087	Recommendation	Bloomfield Colliery Response/Actions	Status
Schedule 2, Condition 2(a) Schedule 2, Condition 2(b) Schedule 2, Condition 2(g)	Bloomfield should comply with all items of the voluntary undertaking within the defined timeframes provided by the Department. Bloomfield to seek planning approval by lodging a modification of PA 07_0087 to undertake mining operations outside of the approved disturbance area. It is noted that preparation of this modification is currently underway.	Bloomfield commit to comply with all items of the voluntary undertaking within the defined timeframes provided. Mod 4 has been submitted for draft review to DPE on December 2017.	Completed
Schedule 2, Condition 9	Revise and resubmit all management plans for approval by 30 September 2017 as requested by the Department.	All Plans submitted and approved as follows: Air Quality Monitoring Program - 21/12/2017 Water Management Plan - 21/12/2017 Noise Monitoring Program - 19/12/2017 Blast Monitoring Program - 19/12/2017 Landscape Management Plan - 19/12/2017 Rehabilitation Management Plan - 19/12/2017 Final Void Management Plan - 19/12/2017 Mine Closure Plan - 19/12/2017 Biodiversity Offset Management Plan - 19/12/2017 Environmental Management Strategy - 19/12/2017	Completed
Schedule 3, Condition 1	Ensure all operational noise minimisation measures are undertaken to ensure no exceedance of approval criteria.	Predictive Noise Model Developed and in use. Quarterly Noise compliance assessment will continue.	Completed
Schedule 3, Condition 32	Visual and lighting management measures are included in an update of the Landscape Management Plan required to be revised and submitted for approval by 30 September 2017 in order to cover requirements of this condition.	Landscape Management Plan reviewed and updated. Approved 19/12/2017	Completed
Schedule 4, Condition 1	Confirm with the Department if Bloomfield is required to provide quarterly noise monitoring results to relevant landholders since the time of exceedance (June 2016).	Seek clarification from DPE. If not required request removal of condition during Mod 4	To be completed by 30 June 2018
Schedule 5, Condition 2	Update the Appendix of the Blast Monitoring Program and the Air Quality Monitoring Program to include the latest modification of the Project Approval 07_0087 MOD 3.	This is not required as confirmed in letter from DPE dated 19/12/2017. "There is no need to reproduce the whole approval in full in the appendicies".	Completed

Bloomfield Collieries Pty Ltd

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#### 8 INCIDENTS AND NON-COMPLIANCE

As mentioned in Section 3.4.3, two reportable environmental incidents occurred at Bloomfield Colliery during the 2017 reporting period. A brief summary of the reportable incidents are presented below. The incident reports with further details of the events are provided in Appendix F.

#### 8.1 Discharge (TSS) Exceedance - 2 January 2017

On the 2 January 2017 a licenced 72 hour discharge was begun at Bloomfield Colliery in accordance with EPL 396 water discharge conditions. Analysis of the discharge sample for the first 24 hour period recorded a Total Suspended Solids (TSS) of 33 mg/l which was an exceedance of the EPL concentration limit of 30 mg/l. The incident was reported to the EPA Pollution Line on 6 January 2017 when Bloomfield became aware of the incident. The Reference Number C00203-2017 issued by the EPA. DPE and DRG were also notified of the incident.

#### 8.2 Polypipe Failure - 13 October 2017

On the 13 October 2017 a broken pipe weld resulting in water flowing to a clean water sediment dam and discharging offsite into an intermittent drainage line known as Shamrock Creek, a tributary of Four Mile Creek. No flow from the discharge event made it into Four Mile Creek. The incident was reported to the EPA Pollution Line on 13 October 2017 and the Reference Number C15526-2017 issued. DPE and DRG were also notified of the incident.

As a result of the incident investigation a risk assessment was undertaken on the pipeline infrastructure. Measures that have been implemented, or are in the process of being implemented, include double skinning of pipes, bunding of pipelines, installation of differential flowmeters, realignment of pipelines, and amending / updating of inspection regime. Quarterly progress reports are being provided to the EPA regarding the implementation of these measures.

#### 9 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

The activities for the ensuing year will generally be in accordance with the rehabilitation and landscape management strategy outlined in the Environmental Assessment and the MOP schedule. Environmental activities proposed for the next AEMR period have been previously reported within relevant sections of this document.

In December 2017 a variation to modify the Project Approval (07\_0087\_Mod 4) was submitted to the DPE. The modification would allow the Colliery to continue its open cut mining operations and use existing mine infrastructure to process up to 1.3 Mtpa of ROM coal until 31 December 2030. It is envisaged that this modification will be approved in the first half of 2018. In accordance with the Project Approval all management plans and programs required under the approval will be reviewed and updated during 2018.

The current MOP expires at the end of June 2018. A new MOP will be prepared and submitted to DRG in early 2018 to cover the next MOP period.

In accordance with the rehabilitation and landscape management strategy outlined in the Environmental Assessment and the MOP, an approximately 12 Ha area of the established rehabilitation area will be fenced and stock introduced for grazing purposes. The area will on the eastern side of S-Cut along the southern boundary near John Renshaw Drive. Further details will be provided in the next AEMR.

In accordance with Project Approval (07\_0087) an Independent Environmental Audit will be carried out on the project during 2018.

## PLANS

















#### **Bloomfield Colliery**

Annual Review Report 2017

#### Plan 3 Rehabilitation Monitoring Transects

Scale: 1:20000

Date: February 2018 Photo: January 2018

Drawing: A3

# APPENDIX A

### **DUST MONITORING RESULTS**

#### Table A1: PM10 and TSP Results 2017

6/01/2017         52         15           12/01/2017         45         30           18/01/2017         73         43           24/01/2017         58         31           30/01/2017         44         12           5/02/2017         70         24           11/02/2017         68         46           17/02/2017         60         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         45         19           13/03/2017         18         8           25/03/2017         77C         8           31/03/2017         16         6           18/04/2017         11         5           12/04/2017         16         6           18/04/2017         20         11           24/04/2017         18         3           30/04/2017         22         12           20/05/2017         43         -           30/04/2017         20         7           30/05/2017         30         10           11/06/2017         12         6           17/06/2017         19	Date	TSP Concentration (ug/m <sup>3</sup> )	PM <sub>10</sub> Concentration (ug/m <sup>3</sup> )
12/01/2017         45         30           18/01/2017         73         43           24/01/2017         58         31           30/01/2017         44         12           5/02/2017         70         24           11/02/2017         68         46           17/02/2017         68         46           17/02/2017         49         24           1/03/2017         16         8           7/03/2017         45         19           13/03/2017         18         8           25/03/2017         77C         8           31/03/2017         11         5           12/04/2017         11         5           12/04/2017         23         10           6/04/2017         20         11           30/04/2017         22         11           30/04/2017         22         12           2/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           17/06/2017         14         16           29/06/2017         11 </td <td>6/01/2017</td> <td>52</td> <td>15</td>	6/01/2017	52	15
18/01/2017         73         43           24/01/2017         58         31           30/01/2017         44         12           5/02/2017         70         24           11/02/2017         68         46           17/02/2017         50         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         18         8           25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         16         6           18/04/2017         22         12           2/05/2017         43         -           6/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/05/2017         30         10           11/06/2017         12         6           17/06/2017         19	12/01/2017	45	30
24/01/2017         58         31           30/01/2017         44         12           5/02/2017         70         24           11/02/2017         68         46           17/02/2017         50         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         77C         8           31/03/2017         77C         8           31/03/2017         11         5           12/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         30         21           18/04/2017         20         7           30/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           17/06/2017         13         16           29/06/2017         31         16           29/06/2017         31 <td>18/01/2017</td> <td>73</td> <td>43</td>	18/01/2017	73	43
30/01/2017         44         12           5/02/2017         70         24           11/02/2017         68         46           17/02/2017         50         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         45         19           13/03/2017         77C         8           25/03/2017         77C         8           31/03/2017         11         5           12/04/2017         11         5           12/04/2017         20         11           24/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         11         7           30/05/2017         31         16           29/06/2017         11         7           30/05/2017         31 <td>24/01/2017</td> <td>58</td> <td>31</td>	24/01/2017	58	31
5/02/2017         70         24           11/02/2017         68         46           17/02/2017         50         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         7         8           25/03/2017         77C         8           31/03/2017         11         5           12/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         11         7           30/05/2017         33         13           5/06/2017         19         10           23/06/2017         11         7           30/05/2017         36	30/01/2017	44	12
11/02/2017         68         46           17/02/2017         50         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         18         8           25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         11           30/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         30         10           11/06/2017         19         10           23/05/2017         30         10           11/06/2017         19         10           23/06/2017         30         10           11/06/2017         11         7           5/07/2017         26         11           11/07/2017         28 <td>5/02/2017</td> <td>70</td> <td>24</td>	5/02/2017	70	24
17/02/2017         50         29           23/02/2017         49         24           1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         77C         8           25/03/2017         77C         8           31/03/2017         11         5           12/04/2017         16         6           18/04/2017         20         11           24/04/2017         22         11           30/04/2017         22         12           2/05/2017         43         -           6/05/2017         30         21           18/05/2017         20         7           30/05/2017         33         13           5/06/2017         10         7           30/05/2017         10         1           11/06/2017         19         10           23/06/2017         11         7           5/07/2017         28         14           11/07/2017         28         14           11/07/2017         28         16           29/07/2017         33	11/02/2017	68	46
23/02/2017         49         24           1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         77C         8           31/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           17/06/2017         13         16           23/06/2017         11         7           5/07/2017         28         14           11/07/2017         28         14           11/07/2017         28         14           11/07/2017         39         16           29/07/2017         33         17           10/08/2017         13 <td>17/02/2017</td> <td>50</td> <td>29</td>	17/02/2017	50	29
1/03/2017         16         8           7/03/2017         30         19           13/03/2017         45         19           19/03/2017         18         8           25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           11/06/2017         12         6           11/06/2017         11         7           5/06/2017         11         7           5/07/2017         28         14           11/06/2017         13         16           29/06/2017         13         7           10/08/2017         36         17           29/07/2017         58	23/02/2017	49	24
7/03/2017         30         19           13/03/2017         45         19           19/03/2017         18         8           25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         16         6           18/04/2017         22         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         10         7           30/05/2017         12         6           11/06/2017         11         7           5/07/2017         10         10           23/06/2017         11         7           5/07/2017         28         14           11/06/2017         13         7           10/08/2017         38         26           4/08/2017         38	1/03/2017	16	8
13/03/2017         45         19           19/03/2017         18         8           25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         16         6           18/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         20         7           30/05/2017         30         21           18/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         31         16           29/07/2017         26         11           11/07/2017         29         15           23/07/2017         36         17           29/07/2017         38         16           29/07/2017         39 <td>7/03/2017</td> <td>30</td> <td>19</td>	7/03/2017	30	19
19/03/2017         18         8           25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         21           18/05/2017         30         10           11/06/2017         12         6           11/06/2017         12         6           11/06/2017         14         7           23/06/2017         11         7           5/07/2017         28         14           11/07/2017         28         14           11/07/2017         29         15           23/07/2017         33         16           22/08/2017         33         14           3/09/2017         33 <td>13/03/2017</td> <td>45</td> <td>19</td>	13/03/2017	45	19
25/03/2017         77C         8           31/03/2017         23         10           6/04/2017         11         5           12/04/2017         20         11           24/04/2017         22         11           30/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         20         7           30/05/2017         30         21           18/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         10         1           23/06/2017         11         7           5/07/2017         28         14           11/07/2017         28         14           11/07/2017         28         16           23/06/2017         13         7           10/08/2017         33         14           11/07/2017         28         16           23/07/2017         33	19/03/2017	18	8
31/03/2017 $23$ $10$ $6/04/2017$ 115 $12/04/2017$ 166 $18/04/2017$ 2011 $24/04/2017$ 2211 $30/04/2017$ 2212 $2/05/2017$ 43- $6/05/2017$ 3021 $18/05/2017$ 4615 $24/05/2017$ 207 $30/05/2017$ 207 $30/05/2017$ 207 $30/05/2017$ 3313 $5/06/2017$ 3010 $11/06/2017$ 126 $17/06/2017$ 117 $5/07/2017$ 2611 $11/07/2017$ 2814 $11/07/2017$ 2814 $11/07/2017$ 3916 $23/07/2017$ 3314 $3/09/2017$ 3314 $3/09/2017$ 3314 $3/09/2017$ 3216 $21/09/2017$ 4624 $3/09/2017$ 4624 $3/09/2017$ 4624 $3/09/2017$ 4624 $3/09/2017$ 4624 $3/09/2017$ 4624 $3/09/2017$ 2911	25/03/2017	77C	8
6/04/2017115 $12/04/2017$ 166 $18/04/2017$ 2011 $24/04/2017$ 2211 $30/04/2017$ 2212 $2/05/2017$ 43- $6/05/2017$ 3918 $12/05/2017$ 3021 $18/05/2017$ 207 $30/05/2017$ 207 $30/05/2017$ 207 $30/05/2017$ 3313 $5/06/2017$ 3010 $11/06/2017$ 126 $17/06/2017$ 1910 $23/06/2017$ 3116 $29/06/2017$ 117 $5/07/2017$ 2814 $11/07/2017$ 2814 $11/07/2017$ 3916 $23/07/2017$ 3314 $3/09/2017$ 3314 $3/09/2017$ 3216 $28/08/2017$ 3314 $3/09/2017$ 4216 $21/09/2017$ 4216 $21/09/2017$ 4624 $3/10/2017$ 2911	31/03/2017	23	10
12/04/2017166 $18/04/2017$ 2011 $24/04/2017$ 2211 $30/04/2017$ 2212 $2/05/2017$ 43- $6/05/2017$ 3918 $12/05/2017$ 3021 $18/05/2017$ 4615 $24/05/2017$ 207 $30/05/2017$ 3313 $5/06/2017$ 3010 $11/06/2017$ 126 $17/06/2017$ 117 $5/07/2017$ 3116 $29/06/2017$ 117 $5/07/2017$ 2814 $11/07/2017$ 2814 $17/07/2017$ 3617 $29/07/2017$ 3316 $22/08/2017$ 137 $10/08/2017$ 137 $10/08/2017$ 3314 $3/09/2017$ 3314 $3/09/2017$ 3216 $21/09/2017$ 4216 $21/09/2017$ 4624 $3/10/2017$ 2914	6/04/2017	11	5
18/04/2017         20         11           24/04/2017         22         11           30/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         30         21           18/05/2017         46         15           24/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         11         7           5/07/2017         26         11           11/07/2017         28         14           17/07/2017         29         15           23/07/2017         36         17           29/07/2017         33         16           22/08/2017         33         14           3/09/2017         33         14           3/09/2017         33         14           3/09/2017         32         16           28/08/2017         32 <td>12/04/2017</td> <td>16</td> <td>6</td>	12/04/2017	16	6
24/04/2017         22         11           30/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         46         15           24/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         11         7           5/07/2017         26         11           11/07/2017         28         14           17/07/2017         29         15           23/07/2017         36         17           29/07/2017         38         26           4/08/2017         13         7           10/08/2017         33         14           3/09/2017         33         14           3/09/2017         33         14           3/09/2017         32         16           28/08/2017         32         16           28/08/2017         33	18/04/2017	20	11
30/04/2017         22         12           2/05/2017         43         -           6/05/2017         39         18           12/05/2017         30         21           18/05/2017         46         15           24/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         11         7           5/07/2017         26         11           11/07/2017         28         14           17/07/2017         29         15           23/07/2017         36         17           29/07/2017         38         26           4/08/2017         13         7           10/08/2017         39         16           22/08/2017         33         14           3/09/2017         32         16           21/09/2017         32         16           21/09/2017         32         16           21/09/2017         44         30           3/10/9/2017         46 </td <td>24/04/2017</td> <td>22</td> <td>11</td>	24/04/2017	22	11
2/05/201743- $6/05/2017$ 3918 $12/05/2017$ 3021 $18/05/2017$ 4615 $24/05/2017$ 207 $30/05/2017$ 3313 $5/06/2017$ 3010 $11/06/2017$ 126 $17/06/2017$ 1910 $23/06/2017$ 3116 $29/06/2017$ 117 $5/07/2017$ 2611 $11/07/2017$ 2814 $17/07/2017$ 2915 $23/07/2017$ 3617 $29/07/2017$ 137 $10/08/2017$ 137 $10/08/2017$ 3916 $22/08/2017$ 3314 $3/09/2017$ 3216 $15/09/2017$ 4216 $21/09/2017$ 4216 $21/09/2017$ 4624 $3/10/2017$ 2911 $0/09/2017$ 2911	30/04/2017	22	12
6/05/2017         39         18           12/05/2017         30         21           18/05/2017         46         15           24/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         31         16           29/06/2017         11         7           5/07/2017         26         11           11/07/2017         28         14           17/07/2017         29         15           23/07/2017         36         17           29/07/2017         58         26           4/08/2017         13         7           10/08/2017         33         14           3/09/2017         33         14           3/09/2017         32         16           28/08/2017         32         16           21/09/2017         42         16           21/09/2017         42         16           21/09/2017         44         30           27/09/2017         46 </td <td>2/05/2017</td> <td>43</td> <td>-</td>	2/05/2017	43	-
12/05/2017         30         21           18/05/2017         46         15           24/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         31         16           29/06/2017         11         7           5/07/2017         26         11           11/07/2017         28         14           17/07/2017         28         14           17/07/2017         36         17           29/07/2017         58         26           4/08/2017         13         7           10/08/2017         41         20           16/08/2017         39         16           22/08/2017         33         14           3/09/2017         107         43           9/09/2017         32         16           28/08/2017         32         16           15/09/2017         46         24           3/10/2017         29         11           9/09/2017         46 </td <td>6/05/2017</td> <td>39</td> <td>18</td>	6/05/2017	39	18
18/05/2017 $46$ $15$ $24/05/2017$ $20$ $7$ $30/05/2017$ $33$ $13$ $5/06/2017$ $30$ $10$ $11/06/2017$ $12$ $6$ $17/06/2017$ $19$ $10$ $23/06/2017$ $31$ $16$ $29/06/2017$ $11$ $7$ $5/07/2017$ $26$ $11$ $11/07/2017$ $28$ $14$ $17/07/2017$ $29$ $15$ $23/07/2017$ $36$ $17$ $29/07/2017$ $58$ $26$ $4/08/2017$ $13$ $7$ $10/08/2017$ $41$ $20$ $16/08/2017$ $39$ $16$ $22/08/2017$ $33$ $14$ $3/09/2017$ $32$ $16$ $28/08/2017$ $32$ $16$ $21/09/2017$ $42$ $16$ $21/09/2017$ $46$ $24$ $3/10/2017$ $29$ $11$ $9/09/2017$ $29$ $11$ $9/10/2017$ $29$ $11$	12/05/2017	30	21
24/05/2017         20         7           30/05/2017         33         13           5/06/2017         30         10           11/06/2017         12         6           17/06/2017         19         10           23/06/2017         31         16           29/06/2017         11         7           5/07/2017         26         11           11/07/2017         28         14           17/07/2017         29         15           23/07/2017         36         17           29/07/2017         58         26           4/08/2017         13         7           10/08/2017         41         20           16/08/2017         39         16           22/08/2017         33         14           3/09/2017         107         43           9/09/2017         32         16           28/08/2017         32         16           21/09/2017         42         16           21/09/2017         42         16           21/09/2017         46         24           3/10/2017         29         11           9/10/2017         29 </td <td>18/05/2017</td> <td>46</td> <td>15</td>	18/05/2017	46	15
30/05/2017 $33$ $13$ $5/06/2017$ $30$ $10$ $11/06/2017$ $12$ $6$ $17/06/2017$ $19$ $10$ $23/06/2017$ $31$ $16$ $29/06/2017$ $11$ $7$ $5/07/2017$ $26$ $11$ $11/07/2017$ $28$ $14$ $17/07/2017$ $29$ $15$ $23/07/2017$ $36$ $17$ $29/07/2017$ $58$ $26$ $4/08/2017$ $13$ $7$ $10/08/2017$ $41$ $20$ $16/08/2017$ $39$ $16$ $22/08/2017$ $33$ $14$ $3/09/2017$ $32$ $16$ $28/08/2017$ $32$ $16$ $21/09/2017$ $42$ $16$ $21/09/2017$ $42$ $16$ $21/09/2017$ $42$ $16$ $21/09/2017$ $46$ $24$ $3/10/2017$ $29$ $11$ $9/10/2017$ $29$ $11$	24/05/2017	20	7
5/06/2017 $30$ $10$ $11/06/2017$ $12$ $6$ $17/06/2017$ $19$ $10$ $23/06/2017$ $31$ $16$ $29/06/2017$ $11$ $7$ $5/07/2017$ $26$ $11$ $11/07/2017$ $28$ $14$ $17/07/2017$ $29$ $15$ $23/07/2017$ $36$ $17$ $29/07/2017$ $58$ $26$ $4/08/2017$ $13$ $7$ $10/08/2017$ $41$ $20$ $16/08/2017$ $39$ $16$ $22/08/2017$ $28$ $16$ $28/08/2017$ $33$ $14$ $3/09/2017$ $107$ $43$ $9/09/2017$ $42$ $16$ $21/09/2017$ $64$ $30$ $27/09/2017$ $29$ $11$ $9/10/2017$ $29$ $11$	30/05/2017	33	13
11/06/2017126 $17/06/2017$ 1910 $23/06/2017$ 3116 $29/06/2017$ 117 $5/07/2017$ 2611 $11/07/2017$ 2814 $17/07/2017$ 2915 $23/07/2017$ 3617 $29/07/2017$ 5826 $4/08/2017$ 137 $10/08/2017$ 4120 $16/08/2017$ 3916 $22/08/2017$ 2816 $28/08/2017$ 3314 $3/09/2017$ 10743 $9/09/2017$ 3216 $15/09/2017$ 6430 $27/09/2017$ 2911 $9/10/2017$ 2911 $9/10/2017$ 2911	5/06/2017	30	10
17/06/20171910 $23/06/2017$ 3116 $29/06/2017$ 117 $5/07/2017$ 2611 $11/07/2017$ 2814 $17/07/2017$ 2915 $23/07/2017$ 3617 $29/07/2017$ 5826 $4/08/2017$ 137 $10/08/2017$ 4120 $16/08/2017$ 3916 $22/08/2017$ 2816 $28/08/2017$ 3314 $3/09/2017$ 10743 $9/09/2017$ 4216 $15/09/2017$ 6430 $27/09/2017$ 2911 $9/10/2017$ 2911 $9/10/2017$ 2914	11/06/2017	12	6
23/06/2017 $31$ $16$ $29/06/2017$ $11$ $7$ $5/07/2017$ $26$ $11$ $11/07/2017$ $28$ $14$ $17/07/2017$ $29$ $15$ $23/07/2017$ $36$ $17$ $29/07/2017$ $58$ $26$ $4/08/2017$ $13$ $7$ $10/08/2017$ $41$ $20$ $16/08/2017$ $39$ $16$ $22/08/2017$ $28$ $16$ $28/08/2017$ $33$ $14$ $3/09/2017$ $107$ $43$ $9/09/2017$ $32$ $16$ $15/09/2017$ $42$ $16$ $21/09/2017$ $64$ $30$ $27/09/2017$ $29$ $11$ $9/10/2017$ $29$ $11$	17/06/2017	19	10
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	23/06/2017	31	16
5/07/2017 $26$ $11$ $11/07/2017$ $28$ $14$ $17/07/2017$ $29$ $15$ $23/07/2017$ $36$ $17$ $29/07/2017$ $36$ $17$ $29/07/2017$ $58$ $26$ $4/08/2017$ $13$ $7$ $10/08/2017$ $41$ $20$ $16/08/2017$ $39$ $16$ $22/08/2017$ $28$ $16$ $28/08/2017$ $33$ $14$ $3/09/2017$ $107$ $43$ $9/09/2017$ $32$ $16$ $15/09/2017$ $42$ $16$ $21/09/2017$ $64$ $30$ $27/09/2017$ $46$ $24$ $3/10/2017$ $29$ $11$ $9/10/2017$ $35$ $14$	29/06/2017	11	7
11/07/20172814 $17/07/2017$ 2915 $23/07/2017$ 3617 $29/07/2017$ 5826 $4/08/2017$ 137 $10/08/2017$ 4120 $16/08/2017$ 3916 $22/08/2017$ 2816 $28/08/2017$ 3314 $3/09/2017$ 10743 $9/09/2017$ 3216 $15/09/2017$ 6430 $27/09/2017$ 4624 $3/10/2017$ 2911 $9/10/2017$ 3514	5/07/2017	26	11
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	11/07/2017	28	14
23/07/2017       36       17         29/07/2017       58       26         4/08/2017       13       7         10/08/2017       41       20         16/08/2017       39       16         22/08/2017       28       16         28/08/2017       33       14         3/09/2017       107       43         9/09/2017       32       16         15/09/2017       42       16         21/09/2017       64       30         27/09/2017       46       24         3/10/2017       29       11         9/10/2017       35       14	17/07/2017	29	15
29/07/2017       58       26         4/08/2017       13       7         10/08/2017       41       20         16/08/2017       39       16         22/08/2017       28       16         28/08/2017       33       14         3/09/2017       107       43         9/09/2017       32       16         15/09/2017       42       16         21/09/2017       64       30         27/09/2017       46       24         3/10/2017       29       11         9/10/2017       35       14	23/07/2017	36	17
4/08/2017137 $10/08/2017$ 4120 $16/08/2017$ 3916 $22/08/2017$ 2816 $28/08/2017$ 3314 $3/09/2017$ 10743 $9/09/2017$ 3216 $15/09/2017$ 4216 $21/09/2017$ 6430 $27/09/2017$ 4624 $3/10/2017$ 2911 $9/10/2017$ 3514	29/07/2017	58	26
10/08/2017       41       20         16/08/2017       39       16         22/08/2017       28       16         28/08/2017       33       14         3/09/2017       107       43         9/09/2017       32       16         15/09/2017       42       16         21/09/2017       64       30         27/09/2017       46       24         3/10/2017       29       11         9/10/2017       35       14	4/08/2017	13	/
16/08/2017     39     16       22/08/2017     28     16       28/08/2017     33     14       3/09/2017     107     43       9/09/2017     32     16       15/09/2017     42     16       21/09/2017     64     30       27/09/2017     46     24       3/10/2017     29     11       9/10/2017     35     14	10/08/2017	41	20
22/08/2017     28     16       28/08/2017     33     14       3/09/2017     107     43       9/09/2017     32     16       15/09/2017     42     16       21/09/2017     64     30       27/09/2017     46     24       3/10/2017     29     11       9/10/2017     35     14	16/08/2017	39	16
28/08/2017     33     14       3/09/2017     107     43       9/09/2017     32     16       15/09/2017     42     16       21/09/2017     64     30       27/09/2017     46     24       3/10/2017     29     11       9/10/2017     35     14	22/08/2017	28	16
3/09/2017         10/         43           9/09/2017         32         16           15/09/2017         42         16           21/09/2017         64         30           27/09/2017         46         24           3/10/2017         29         11           9/10/2017         35         14	28/08/2017	33	14
9/09/2017         32         16           15/09/2017         42         16           21/09/2017         64         30           27/09/2017         46         24           3/10/2017         29         11           9/10/2017         35         14	3/09/2017	107	43
15/09/2017         42         16           21/09/2017         64         30           27/09/2017         46         24           3/10/2017         29         11           9/10/2017         35         14	9/09/2017	32	10
21/09/2017         64         30           27/09/2017         46         24           3/10/2017         29         11           9/10/2017         35         14	15/09/2017	42	16
21/09/2017         46         24           3/10/2017         29         11           9/10/2017         35         14	21/09/2017	04	30
9/10/2017 29 11 9/10/2017 35 14	2/10/2017	40	<u>∠4</u>
	0/10/2017	29	1/
Date	TSP Concentration (ug/m3)	PM10 Concentration (ug/m3)	
--------------------------	---------------------------------	----------------------------------	
15/10/2017	19	10	
21/10/2017	33	19	
27/10/2017	22	13	
2/11/2017	41	21	
8/11/2017	15	7	
14/11/2017	24	9	
20/11/2017	19	10	
26/11/2017	63	23	
2/12/2017	19	8	
8/12/2017	49	26	
14/12/2017	60	32	
20/12/2017	104	44	
26/12/2017	27	14	
Maximum 24 hr Average	-	46	
EPA Limit 24hr Average	-	50	
Annual Average	37	17	
EPA Limit Annual Average	90	25	







Figure A2



Figure A3

# **APPENDIX B**

# WATER MONITORING RESULTS

Site WM1	Adja	cent Rathluba (	Colliery											
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09														Dry
13-Oct-09														Dry
03-Nov-09														Dry
13-Dec-09														Dry
13-Jan-10														Dry
09-Feb-10														Dry
08-Apr-10														Dry
14-May-10														Dry
10-Jun-10														Dry
07-Jul-10														Dry
25-Aug-10														Drv
20-Sep-10	4.22	4.820	18	3.940	0.38		1	1710	837	195	186	788	15	
19-Oct-10														Dry
19-Nov-10	4.61	1,990	4	1,360	0.06									
21-Dec-10														Dry
14-Jan-11														Dry
22-Feb-11														Dry
24-Mar-11														Dry
27-Apr-11														Dry
26-May-11														Dry
27-Jun-11	5.00	1,980	18	1,330	0.15									Dry
25-Jul-11	5.76	952	16	650	0.16		5	254	85	36	28	85	8	
26-Aug-11	5.41	1,820	5	1,220	0.06									
21-Sep-11	5.68	2224	16	1540	0.09									
26-Oct-11	6.24	2002	17	1350	0.28		2	544	256	79	68	247	9	
22-Nov-11	5.75	1508	12	1050	0.4									
15-Dec-11														Dry
25-Jan-12														Dry
17-Feb-12														Dry
30-Mar-12	6.58	1490	12	1010	0.05									
02-May-12	6.17	1,440	5	1,030	0.05		1	443	178	66	53	181	7	
24-May-12														Dry
27-Jun-12	6.67	1351	38	908	0.17									
27-Jul-12	5.82	1516	78	1140	0.1		16	580	183	79	62	214	7	
30-Aug-12														Dry
25-Sep-12														Dry
25-Oct-12														Dry
29-Nov-12														Dry
20-Dec-12														Dry
24-Jan-13														Dry
25-Feb-13	7.73	2530	52	1590	0.15									
22-Mar-13	7.39	900	56	582	4.44			101				046		
22-Apr-13	0.04	1580	17	1080	0.25		18	424	208	50	48	219	11	Deri
21. Jun 12														Dry
21-Juli-13														Dry
28-Aug-13														Drv
17-Sep-13	7.71	1340	8	831	0.13									Diy
22-Oct-13		1010			0.10									Drv
14-Nov-13														Dry
11-Dec-13														Drv
24-Jan-14														Dry
20-Feb-14						1								Drv
25-Mar-14														Dry
30-Apr-14						1								Dry
28-May-14						1								Dry
26-Jun-14														Dry
28-Jul-14														Dry
31-Aug-14	7.14	336	12		2.3	1								
22-Sep-14	1	1	1	1	1	1	1	1	1	1	1		1	Dry
27-Oct-14			İ			1							İ	Dry
21-Nov-14														Dry
22-Dec-14														Dry

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	6.4	730	9	530	0.09	14.5								
23-Feb-15														Dry
30-Mar-15														Dry
28-Apr-15	6.4	116	79	86	0.62	190	17	12	17	2.7	2.8	14	6	Floodwater
28-May-15	6	1500				4								Floodwater
24-Jun-15	5.9	1900				4								
29-Jul-15														Dry
27-Aug-15														Dry
28-Sep-15	6.7	2300				4								
22-Oct-15														Dry
30-Nov-15														Dry
21-Dec-15														Dry
29-Jan-16	5.6	1450	2	1050	0.01	2								
26-Feb-16														Dry
31-Mar-16														Dry
28-Apr-16														Dry
26-May-16														Dry
29-Jun-16														Dry
19-Jul-16														Dry
23-Aug-16	6.2	1700				13								Not flowing
28-Sep-16	6.3	1800				8								Not flowing
20-Oct-16														Dry
24-Nov-16														Dry
21-Dec-16														Dry
31-Jan-17														Dry
27-Feb-17														Dry
31-Mar-17	6.3	900				6								Not flowing
26-Apr-17														Dry
30-May-17														Dry
28-Jun-17	5	1380				4								Not flowing
26-Jul-17														Dry
30-Aug-17														Dry
28-Sep-17														Dry
24-Oct-17														Dry
28-Nov-17														Dry
13-Dec-17														Dry

Site WM2	Sham	nrock Creek @ S	Shamrock Hil	l Lane										
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	7.50	1,900			0.55	90								
13-Oct-09					0.00									
03-Nov-09	7.70	5,900	14	510	0.63	70								
13-Dec-09					0.00									
13-Jan-10	5.50	1.000			0.00	10								
09-Feb-10	5.50	1,900			0.07	19								
04-iviai-10					0.00									
14-May-10					0.00									
10-Jun-10	6.90	282	109	330	0.29	209								
07-Jul-10	7.10	333	56	204	0.30	196	5		27	7	10	32	6	
25-Aug-10	7.80	408	8	294	0.18	47								
20-Sep-10	6.54	448	20	350	0.27		21	123	33	11	17	43	7	
19-Oct-10	7.24	522	41	316	0.05									
19-Nov-10	6.19	290	59	250	0.36									
21-Dec-10	7.46	2,740	5	1,980	0.08									
14-Jan-11	7.36	3,860	8	2,880	0.05		160	1410	290	152	164	529	22	
22-Feb-11	7.65	4,120	5	3,470	0.05									
24-Mar-11	7.45	4,820	24	3,980	0.05									
27-Apr-11	6.57	1,160	16	760	0.05		13	398	72	42	47	113	15	
26-May-11	6.26	931	40	786	0.05									
27-Jun-11	6.02	562	16	482	0.21									
25-Jul-11	5.66	343	52	330	0.40		3	102	16	10	12	27	6	
26-Aug-11	6.36	650	10	400	0.05									
21-Sep-11	7.75	243	8	448	0.05									
26-Oct-11	7.36	555	16	390	0.27		10	184	26	17	22	47	9	
22-Nov-11	6.34	878	19	612	0.20									
15-Dec-11	7.86	439	79	334	0.30		20	220	20	22	20	64	0	
20-Jan-12	7.93	000	14	220	0.19		39	230	30	22	30	64	9	
30-Mar-12	6.74	514	20	390	0.63									
27-Anr-12	6.35	561	30	296	0.62		13	164	20	18	21	32	8	
24-May-12	7.92	528	6	282	0.18								-	
27-Jun-12	8.09	365	46	282	0.34									
27-Jul-12	7.69	549	5	376	0.09		4	201	28	24	28	37	6	
30-Aug-12	4.82	647	292	436	0.34									
25-Sep-12	4.96	2,860	118	2,080	1.32									
25-Oct-12														Dry
29-Nov-12														Dry
20-Dec-12														Dry
24-Jan-13														Dry
25-Feb-13	8.41	5,020	54	3,270	0.05									
22-Mar-13	6.78	415	38	266	1.24									
22-Apr-13	8.23	4,170	51	2,870	0.05		284	1380	431	107	148	756	15	
17-May-13			-											Dry
21-Jun-13	5.42	556	5	361	0.02			474		10		~~	-	
24-JUI-13	5.46	480	14	318	U.3		ï	174	27	19	21	39	/	
17-Sep 13	0.03	0/4	33	330	0.10									Dry
22-Oct-13														Drv
14-Nov-13														Dry
11-Dec-13	6.37	330	5	247	1.03									-
24-Jan-14														Dry
20-Feb-14			İ	İ					İ		İ		İ	Dry
25-Mar-14			1	1		1	1	1	1		1		l	Dry
30-Apr-14	6.35	277	28	263	0.92		4	102	14	14	14	24	12	
28-May-14	5.76	295	29		0.52									
26-Jun-14														Dry
28-Jul-14														Dry
31-Aug-14	6.73	330	35		0.44									
22-Sep-14	5.9	330				63								
27-Oct-14	5.5	340	40	220	0.05	39.7	5	130	20	13	13	21	8	
21-Nov-14														Dry
22-Dec-14														Dry

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	5.6	180	42	234	1.4	126								
23-Feb-15	7.3	210				16.5								
30-Mar-15														Dry
28-Apr-15	5	1,040	47	790	0.04	74	5	485	37	45	66	76	13	
28-May-15														Dry
24-Jun-15														Dry
29-Jul-15														Dry
27-Aug-15														Dry
28-Sep-15														Dry
22-Oct-15														Dry
30-Nov-15	7	280				43.8								
29-Jan-15	5.6	180	42	234	1.4	126								
29-Jan-16	6.2	276	47	238	1.1	69								
26-Feb-16	6.7	260				23								
31-Mar-16	7.3	640				161								
28-Apr-16														Dry
26-May-16														Dry
29-Jun-16	6	440				24								
19-Jul-16	5.5	450	4	341	0.17	7								
22-Aug-16	6.7	350				31								
28-Sep-16	7.5	390				11								
20-Oct-16	5	480	10	347	0.09	15	5	180	17	19	21	35	9	
24-Nov-16														Dry
21-Dec-16														Dry
30-Jan-17														Dry
27-Feb-17														Dry
30-Mar-17	5	370				86								Not flowing
26-Apr-17	6.2	270	21	256	3.2	94	16	94	18	12	13	17	9	Not flowing
30-May-17	5.6	460				44								Not flowing
28-Jun-17	5.6	395				27								Not flowing
27-Jul-17														Dry
30-Aug-17														Dry
28-Sep-17														Dry
24-Oct-17	6.4	5,560	10	5,620	0.05	22	150	3100	410	330	330	920	36	
28-Nov-17														Dry
13-Dec-17														Dry

Site WM3	I	Elwells Creek /	Four Mile Cre	ek Junction										
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.80	360	14	220	0.74	34								
13-Oct-09	8.10	310	370	210	0.61	46	52		38	15	10	39	3	
03-Nov-09	8.30	640	10	500	0.70	27								
13-Dec-09	7.60	410	8	140	0.23	18								
13-Jan-10	6.80	280	10	200	0.61	17	92		39	14	10	34	3	
09-Feb-10	7.30	220	14	130	0.28	14								
04-Mar-10	8.90	280	9	200	0.35	86								
08-Apr-10	8.70	323	7	220	0.20	23	54		42	18	9	33	3	
14-May-10	7.50	193	7	131	0.10	10								
10-Jun-10	6.80	462	41	370	0.14	65								
07-Jul-10	7.30	581	14	354	0.21	33	75		57	19	16	67	4	
25-Aug-10	6.10	419	10	266	0.29	28		740	110	05		050		
20-Sep-10	7.42	1,950	10	1,390	0.11		89	710	143	95	81	256	9	
19-Uct-10	7.38	336	7	100	0.15									
19-NOV-10	7.94	2,040	31	1,740	0.05									
21-Dec-10	7.44	2 140	9	1 420	0.30		101	642	217	50	70	252		
14-Jdll-11	7.74	2,140	9	2 720	0.09		101	042	217		70	303	0	
22-1 60-11	7.95	4,000	10	3,630	0.05									
24-Wal-11	7.01	326	12	234	0.00		60	52	30	14	9	41	3	
26-May-11	8.24	5 460	24	3 800	0.40		00	52	00	14				
27-Jun-11	7.44	2,950	21	2,230	0.05									
25-Jul-11	7 78	2,000	67	1 440	0.00		148	504	311	56	57	358	7	
26-Aug-11	7.24	780	20	514	0.32						0.			
21-Sep-11	8.02	1497	15	934	0.12									
26-Oct-11	7.71	627	190	436	0.39		43	140	74	19	18	80	5	
22-Nov-11	7.43	1871	29	1330	0.13									
15-Dec-11	7.76	3180	32	2190	0.05									
25-Jan-12	8.17	4810	14	3770	0.07		327	1760	513	109	201	813	18	
17-Feb-12	6.9	442	45	372	0.72									
30-Mar-12	8	3150	17	2190	0.05									
27-Apr-12	7.17	426	24	314	0.95		45	84	48	14	13	49	6	
24-May-12	7.58	351	23	224	1.25									
27-Jun-12	8.21	4810	24	3740	0.63									
27-Jul-12	7.45	1912	35	1370	0.39		82	689	192	85	81	269	8	
30-Aug-12	7.68	711	30	508	0.42									
25-Sep-12	7.94	2140	15	1330	0.1									
25-Oct-12	7.78	786	17	458	0.36		86	147	91	22	23	104	5	
29-Nov-12	8.06	4790	14	3180	0.05									
20-Dec-12	8.14	3620	12	2420	0.05									
24-Jan-13	8.03	2290	6	1510	0.06		204	690	253	62	79	400	9	
25-Feb-13	7.96	2450	54	1560	0.09									
22-Mar-13	7.58	1640	8	1110	0.27									
22-Apr-13	8.29	4150	54	2940	0.09		286	1370	427	109	149	734	15	
17-May-13	7.64	935	54	498	0.59									
21-Jun-13	7.64	860	10	580	0.35									
24-Jul-13	7.48	650	49	416	0.44		52	150	57	19	19	78	4	
28-Aug-13	7.58	596	15	345	0.34									
17-Sep-13	7.52	1180	38	758	0.17									
22-Oct-13	7.79	1250	8	703	0.17		137	246	135	23	31	192	5	
14-Nov-13	7.94	4210	14	2820	0.05									
11-Dec-13	7.29	718	15	447	0.24									
24-Jan-14	8.47	3840	26		0.07									
20-Heb-14	8.1	2810	58		0.05									
25-Mar-14	7.98	1270	1/	4000	0.07		400	005	040	400	400	450	40	
30-Apr-14	1.18	2600	20	1860	0.05		189	905	240	100	109	452	12	
20-iviay-14	7.95	307	6		0.40									
20-JUII-14	60.1	1007	10	3800	0.01									
20-Jul-14	7.04	4900	13	2020	0.03									
22-Son 14	7 /	750	23		0.23	62								
22-3ep-14	7.4	1100	17	702	0.26	20 E	108	323	116	25	32	163	5	
21-Nov-14	8	1000		102	0.20	19.3	100	520	110	2.5	52	103	5	
22-Dec-14	8	2700				15.9								
	-	I	1	1	1		1	1	1	1	1		1	1

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	8.4	3000	26	2120	0.05	29.2								
20-Feb-15	8.2	4000				8.7								
30-Mar-15	7.7	960				18.1								
28-Apr-15	7.1	984	33	636	0.25	48	41	330	82	34	38	115	6	
28-May-15	7	890				62								
24-Jun-15	7.4	690				57								
29-Jul-15	7.5	554	8	382	0.41	29.9								
27-Aug-15	8.3	4840				31								
28-Sep-15	7.7	1980				16								
22-Oct-15	6.5	960	25	633	0.09	38.4	78	280	78	39	36	110	5	
30-Nov-15	7.7	2040				20.6								
21-Dec-15	7.7	5400				14								
29-Jan-16	7.4	1290	28	942	0.37	73								
26-Feb-16	7.1	1300				45								
31-Mar-16	8.1	5000				14								
28-Apr-16	7.5	1400	8	992	0.01	14	195	440	97	39	46	210	6	
26-May-16	7.5	670				51								
29-Jun-16	6.7	2400				18								
19-Jul-16	7.1	1100	7	812	0.27	20								
22-Aug-16	7.2	960				27								
28-Sep-16	8.1	4320				11								
20-Oct-16	8.3	3100	7	2460	0.02	14	240	1100	200	92	140	640	11	
28-Nov-16	8.1	3900				22								
21-Dec-16	8	5300				6								
30-Jan-17	8.2	4490	4	3860	0.01	5								
27-Feb-17	7.5	5320				7								
30-Mar-17	7.2	2100				12								
26-Apr-17	7.5	738	10	567	0.45	19	79	210	85	28	29	110	5	
30-May-17	7.4	1420				17								
28-Jun-17	7.1	923				30								
27-Jul-17	7.1	481	8	312	0.61	23								
30-Aug-17	7	1400				8								Not flowing
28-Sep-17	8.2	3790				6								Not flowing
24-Oct-17	8.2	5510	7	5210	0.01	9	410	2300	390	200	290	1200	22	
28-Nov-17	7.4	3100				3								Not flowing
13-Dec-17	7.9	3100				4								Not flowing

Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.70	160	6	120	0.72	5								
13-Oct-09	7.10	170	4	140	0.61	10	33		28	11	4	20	3	
03-Nov-09	8.80	150	6	130	0.44	22								
13-Dec-09	7.10	160	2	90	0.13	22								
13-Jan-10	7.10	150	6	120	0.17	8	46		24	12	4	14	2	
09-Feb-10	6.30	70	2	110	0.22	5								
04-Mar-10	9.30	190	4	120	0.18	12								
08-Apr-10	8.90	171	1	130	0.59	4	43		25	13	4	14	2	
14-May-10	7.40	157	2	117	0.05	2								
10-Jun-10	5.80	1,250	58	858	0.12	83	24		07	11		12	2	
25-Aug-10	6.49	190	5	140	0.24	28	34		21		4	13	2	
20-Sep-10	7.74	180	2	128	0.46	20	31	15	22	13	4	13	2	
19-Oct-10	7.62	180	4	103	0.12								_	
19-Nov-10	7.69	332	12	226	0.63									
21-Dec-10	7.50	194	<5	164	0.70									
14-Jan-11	8.12	192	<5	123	0.37		39	14	30	10	4	18	3	
22-Feb-11	8.36	812	<5	656	0.12									
24-Mar-11	8.13	601	7	432	0.18									
27-Apr-11	7.43	185	12	116	0.50		41	12	21	13	4	16	2	
26-May-11	8.37	5,460	24	3,640	0.05									
27-Jun-11	8.04	3,250	20	2,480	0.05									
25-Jul-11	8.18	2,790	57	1,760	0.12		179	610	366	66	70	462	8	
26-Aug-11	7.36	319	14	257	0.41									
21-Sep-11	8.48	243	10	186	0.6									
26-Oct-11	8.71	4670	232	3480	0.5		328	1640	478	132	173	824	17	
22-Nov-11	7.94	760	126	534	0.37									
15-Dec-11	7.57	3340	22	2300	0.05									
25-Jan-12	8.65	2430	110	1770	0.36		126	733	250	52	87	373	10	
17-Feb-12	7.44	241	23	240	1.15									
30-Mar-12	7.8	521	5	3/4	0.69					-				
27-Apr-12	7.82	216	11	322	0.91		29	24	32	1	6	26	4	
24-May-12	0.25	206	р 20	163	1.02									
27-Jul-12	7.09	342	15	289	47.7		42	52	50	14	10	41	4	
30-Aug-12	8.07	404	15	302	0.55		72			14	10		-	
25-Sep-12	7.68	255	10	160	0.58									
25-Oct-12	7.68	308	8	155	0.47		34	19	39	11	5	24	3	
29-Nov-12	8.23	550	5	364	0.33									
20-Dec-12	8.07	495	7	290	0.28									
24-Jan-13	8.25	290	6	229	0.14		51	38	32	16	7	30	3	
25-Feb-13	7.79	843	37	554	0.42									
22-Mar-13	7.54	764	8	474	0.63									
22-Apr-13	8.34	4430	16	3110	0.05		310	1510	463	119	159	810	16	
17-May-13	7.55	194	5	150	0.9									
21-Jun-13	7.6	261	5	174	0.62									
24-Jul-13	7.54	232	5	165	0.6		28	25	25	9	5	26	3	
28-Aug-13	7.69	179	5	136	0.37									
17-Sep-13	8.35	5750	25	4400	0.05						-		-	
22-Oct-13	8.05	180	5	136	0.41		37	12	22	10	3	16	2	
14-Nov-13	8.17	890	7	511	0.23									
11-Dec-13	7.67	202	5	160	0.56									
24-Jan-14	7.56	203	5 18		0.44									
25-Mar-14	7 73	189	5		0.23									
30-Anr-14	7.74	493	9	321	0.39		53	120	45	17	16	74	4	
28-Mav-14	8.13	133	7		0.55									
26-Jun-14	7.91	187	5		0.47									
28-Jul-14	8.4	5220	8	3540	0.05									
31-Aug-14	8.17	297	6		0.32									
22-Sep-14	6.5	140				12.9					1			
27-Oct-14	7.9	230	3	112	0.24	5	30	10	30	10	3	15	2	
21-Nov-14	7	180				5								
22-Dec-14	8.3	140				3.7								

Site WM4

Four Mile Creek @ Possums Puddle Discharge

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	8.5	3220	28	2270	0.03	32								
20-Feb-15	8.2	480				5.7								
30-Mar-15	7.9	130				4.5								
28-Apr-15	7.1	1030	46	702	0.23	57	26	400	65	42	48	105	6.4	
28-May-15														No access
24-Jun-15	7.8	390				44								
29-Jul-15	7.6	308	5	222	0.61	29.1								
27-Aug-15	7.9	590				19								
28-Sep-15	7.6	300				19.7								
22-Oct-15	6.8	260	2	168	0.29	9.3	42	43	30	17	7.6	26	2.2	
30-Nov-15	8.4	210				2.5								
21-Dec-15	7	220				4								
29-Jan-16	7.2	680	10	491	0.48	35.2								
26-Feb-16	7	210				10								
31-Mar-16	8.2	4950				12								
28-Apr-16	7.3	320	5	232	0.53		49	64	33	11	10	40	4	
26-May-16	7.9	240				15								
29-Jun-16	7.4	390				13								
19-Jul-16	7.3	230	4	178	0.41	10								
22-Aug-16	7.6	200				11								
28-Sep-16	7.8	760				6								
20-Nov-16	8	200	1	147	0.21	3	40	28	22	12	6	24	3	
24-Nov-16	8.1	190				4								
21-Dec-16	7	220				4								
30-Jan-17	8.4	322	2	146	0.08	5								
27-Feb-17	8.3	5380				3								Discharging
30-Mar-17	7.3	350				6								
26-Apr-17	7.8	330	5	221	0.73	11	46	71	50	12	10	45	5	
30-May-17														No access
28-Jun-17	7.4	500				21								
27-Jul-17	7.3	228	4	159	0.7	17								
30-Aug-17	7.3	250				22								
28-Sep-17	8.3	240				15								
24-Oct-17	8.3	5100	4	4770	0.01	7	340	2200	360	190	260	1000	20	Discharging
28-Nov-17	6.9	270				9								
13-Dec-17	7.8	310				11								Not flowing

Site WM5		Elwells	Creek @ Hau	Road										
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	6.40	1,500			0.77	101								
13-Oct-09	8.20	250			0.31	114	54		20	1	9	21	2	
03-Nov-09														Dry
13-Dec-09														Dry
13-Jan-10														Dry
09-Feb-10														Dry
04-Mar-10														Dry
08-Apr-10														Dry
14-May-10														Dry
10-Jun-10														Dry
07-Jul-10														Dry
25-Aug-10														Dry
20-Sep-10														Dry
19-Oct-10														Dry
19-Nov-10	6.66	1,420	58	930	0.11									
21-Dec-10														Dry
14-Jan-11														Dry
22-Feb-11														Dry
24-Mar-11														Dry
27-Apr-11														Dry
26-May-11	6.14	1,640	53	1,280	0.11									
27-Jun-11	7.38	272	22	214	0.31									
25-Jul-11	6.64	1,950	46	1,330	0.47		70	626	116	94	83	175	9	
26-Aug-11	6.88	2,000	86	1,410	0.40									
21-Sep-11														Dry
26-Oct-11	7.90	1,552	276	1,110	0.88		34	591	86	81	69	162	8	
22-Nov-11	7.31	1,080	152	842	0.34									
15-Dec-11														Dry
25-Jan-12														Dry
17-Feb-12	6.96	1,503	58	1,230	0.33									
30-Mar-12														Dry
27-Apr-12														Dry
24-May-12														Dry
27-Jun-12														Dry
27-JUI-12														Dry
30-Aug-12														Dry
25-Sep-12														Dry
25-Oct-12														Dry
29-NOV-12														Dry
20-Dec-12														Diy
24-Jan-13	7.00	0.400	66	4.570	0.1									Dry
20-Feb-13	7.90	2,400	00	1,570	0.1									Dry
22-IVIAI-13														Dry
17-May 12														Dry
21 Jun 12														Dry
2 1-JUII-13	7 5F	303	157	205	0.02		40	69	17	17	10	20	2	Diy
29-Jui-13	1.00	323	107	203	0.00		40	00			10	29	4	Dry
20-AUG-13	7 / 9	1 700	119	1 190	0.05									Diy
22_0ct 12	1.40	1,700	110	1,100	0.00									Dev
14 Nov 12														Diy
11 Dec 12														Dry
24- Jan 14														Dry
24-Jan-14	7 80	2.810	160		0.02									DIY
20-Feb-14	60.1	2,010	100		0.06									Day
20-IVI81-14														No costat
28 May 14														INU ACCESS
20-IVI2IY-14														Day
20-JUII-14	7 60	600	0	471	0.05									DIY
20-JUI-14	7.62	033	9	4/1	0.05									
31-Aug-14	8.27	964	40		0.11	22								
22-Sep-14	7.20	1,030	0	640	0.00	10.0	EA	256	=0	40	27	04	E	
21-UCE-14	1.20	900	9	040	0.00	10.9	54	330	00	42	31	54	2	Dov
22-Dec-14														Drv

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	Iron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	6.90	1,300	19	1,020	0.05	35.7								
20-Feb-15	6.80	1,700				5								
30-Mar-15														Dry
28-Apr-15	5.20	2,240	13	1,890	0.03	8	5	1190	77	160	135	185	10	
28-May-15	6.60	1,730				6								
24-Jun-15	7.20	1,400				4								
29-Jul-15	7.10	768	5	550	0.05	8.2								
27-Aug-15	6.60	1,500				5								
28-Sep-15	7.70	1,920				4.5								
22-Oct-15	6.30	2,600	10	2,380	0.04	10.7	10	1400	110	205	160	220	12	
30-Nov-15														Dry
21-Dec-15														Dry
29-Jan-16	6.40	1,760	9	1,280	0.04	12.7								
26-Feb-16														Dry
31-Mar-16	7.00	2,300				12.5								
28-Apr-16														Dry
26-May-16														Dry
29-Jun-16	6.60	1,730				4								
19-Jul-16	6.30	1,900	8	1,540	0.09	12								
22-Aug-16	6.20	2,010				31								Not flowing
28-Sep-16	7.20	1,560				6								Not flowing
20-Nov-16														Dry
24-Nov-16														Dry
21-Dec-16	6.60	2,300				15								Not flowing
30-Jan-17														Dry
27-Feb-17	4.20	3,050				3								Not flowing
30-Mar-17	5.20	2,000				17								Not flowing
26-Apr-17	4.40	1,820	20	1,900	0.22	33	5	1100	89	120	130	200	9	Not flowing
30-May-17														Dry
28-Jun-17	4.50	1,110				2								
27-Jul-17	5.50	1,190	36	978	0.13	11								Not flowing
30-Aug-17														Dry
28-Sep-17														Dry
24-Oct-17	3.70	2,130	4	1,880	5.4	6	5	1200	71	130	130	180	7	Not flowing
28-Nov-17														Not flowing
13-Dec-17														Dry

Site WM6	Four	Mile Creek U/S	Possums Pu	ddle										
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	9.10	120	10	80	0.86	42								
13-Oct-09	8.30	110	10	85	0.54	23	38		13	12	2	8	1	
03-Nov-09	8.80	120	12	120	0.40	31								
13-Jan-10	6.70	120	5	88	0.19	13	47		12	13	2	8	1	
09-Feb-10	7.60	150	38	130	0.77	52				10	-			
04-Mar-10	8.90	140	90	350	0.24	24								
08-Apr-10	9.00	122	29	200	0.50	10	35		13	14	2	6	1	
14-May-10	8.20	124	6	87	0.17	18								
10-Jun-10	6.70	250	73	268	0.67	122								
07-Jul-10	7.40	130	10	75	0.19	6	35		11	13	2	6	1	
25-Aug-10	6.87	156	13	103	0.22	20	22	0	10	15	2	0	1	
20-Sep-10	7.35	141	5	69	0.23		32	9	12	15	2	0	'	
19-Nov-10	6.80	274	65	417	1.59									
21-Dec-10	7.13	164	24	156	0.94									
14-Jan-11	6.91	135	7	85	0.71		40	2	19	13	2	8	2	
22-Feb-11	7.16	129	<5	83	0.57									
24-Mar-11	7.34	119	5	94	0.18									
27-Apr-11	7.07	125	78	175	0.42		30	8	15	12	2	10	2	
26-May-11	7.17	125	40	144	0.05									
27-Jun-11	6.84	305	30	214	0.31		21	20	60	6	6	40	5	
26-Aug-11	7.11	245	70	256	0.46		21	20			, v			
21-Sep-11	7.15	158	18	115	0.18									
26-Oct-11	8.04	185	30	139	0.38		33	12	25	12	4	19	2	
22-Nov-11	7.53	167	51	157	0.38									
15-Dec-11	6.78	225	95	246	1.13									
25-Jan-12	8.21	171	9	105	1.06		45	3	24	13	4	13	2	
17-Feb-12	6.68	189	38	242	1.31									
30-Mar-12 27-Apr-12	7.3	284	21	230	0.94		39	15	41	8	6	30	4	
24-May-12	7.32	176	28	107	0.52			10			, v			
27-Jun-12	8.18	324	22	190	0.72									
27-Jul-12	7.15	292	44	270	1.14		38	17	57	9	7	34	4	
30-Aug-12	6.5	147	9	121	0.15									
25-Sep-12	7.27	166	14	97	0.23									
25-Oct-12	7.53	144	164	89	0.24		39	7	14	14	3	11	2	
29-Nov-12	7.44 8.10	141	12	121	0.69									
24-Jan-13	7.4	160	54	109	0.59		50	3	14	18	3	10	2	
25-Feb-13	8.24	2780	31	1760	0.05			-						
22-Mar-13	7.23	297	8	200	1.25									
22-Apr-13	7.41	166	136	198	0.25		28	17	22	9	4	17	2	
17-May-13	7.29	173	69	115	0.24									
21-Jun-13	7.28	161	9	114	0.18									
24-Jul-13	7.24	159	16	114	0.33		27	7	13	10	3	14	2	
20-Aug-13	7.36	130	7	82	0.21									
22-Oct-13	7.3	138	5	111	0.15		43	5	10	11	2	8	1	
14-Nov-13	7.12	271	5	165	0.16									
11-Dec-13	6.97	206	11	145	0.59						İ			
24-Jan-14	7.81	237	5		1.11									
20-Feb-14	8.13	196	38		0.55									
25-Mar-14	7.39	145	5		0.25									
30-Apr-14	7.75	141	14	154	0.77		18	13	28	6	3	24	3	
28-May-14	8.22	112	6		0.15									
20-Jul-14 28-Jul-14	7.47	109	7	79	0.13									
31-Aug-14	7.87	233	30		0.64	<u> </u>								
22-Sep-14	6.9	150				34.7								
27-Oct-14	7.9	150	6	84	0.32	11.5	32	10	23	10	2	9	1	
21-Nov-14	6.3	120				10.8								
22-Dec-14	7.5	130				14.9								

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	6.6	150	56	20	0.88	121								
20-Feb-15	7.2	120				12.8								
30-Mar-15	7.6	100				15.4								
28-Apr-15	6.7	337	30	254	0.97	80	22	29	64	10	8.5	37	4.8	
28-May-15	7.9	200				58								
24-Jun-15	8.2	190				63								
27-Jul-15	7.3	171	14	114	0.2	33.2								
27-Aug-15	8	110				36								
28-Sep-15	7.7	140				27								
22-Oct-15	7.1	140	5	108	0.49	7.4	48	10	16	19	3.1	9	1.1	
30-Nov-15	7.3	150				9								
21-Dec-15	6.5	120				8								
29-Jan-16	6.8	220	12	176	1	37.3								
26-Feb-16	7	190				11.8								
31-Mar-16	7.1	140				9								
28-Apr-16	7.1	120	6	98	0.41	13	39	8	14	12	4	9	2	
26-May-16	7.6	120				18								
29-Jun-16	7.5	130				44								
19-Jul-16	7.4	120	13	107	0.14	37								
22-Aug-16	7.9	140				21								
28-Sep-16	8	120				18								
20-Nov-16	7.7	130	6	104	0.26	6	43	8	16	15	3	10	1	
24-Nov-16	7.5	120				11								
21-Dec-16	6.7	150				5								
30-Jan-17	7.2	174	2	104	0.02	3								
27-Feb-17	7.4	130				4								
31-Mar-17	7.6	300				62								
26-Apr-17	7.1	195	5	168	0.77	9	39	15	38	12	5	20	3	
30-May-17	7.3	250				8								
28-Jun-17	6.8	285				15								
27-Jul-17	6.8	124	4	35	0.13	9								
30-Aug-17	7.1	150				11								
28-Sep-17	7.7	225				7								
24-Oct-17	6.7	241	2	133	0.04	3	32	49	18	21	5	14	1	
28-Nov-17	7.1	180				5								
13-Dec-17	7.6	210				5								

Site WM7	F	Possums Pudd	e											
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.50	170	7	110	0.81	82								
13-Oct-09	7.10	170	6	130	0.57	41	36		27	10	4	19	3	
03-Nov-09	8.70	160	4	140	0.38	108								
13-Dec-09	7.00	160	3	40	0.45	67								
13-Jan-10	6.80	150	2	110	0.16	11	44		24	12	4	14	2	
09-Feb-10	6.50	160	10	120	0.11	7								
04-Mar-10	8.80	170	9	97	0.81	12								
08-Apr-10	8.60	187	1	130	0.25	6	43		25	14	4	13	1	
14-May-10	7.30	158	2	119	<0.05	4								
10-Jun-10	6.80	167	46	161	0.16	75								
07-Jul-10	7.30	186	8	128	0.33	30	34		25	11	4	13	2	
25-Aug-10	6.93	188	6	145	0.37	32								
20-Sep-10	7.41	174	2	132	0.42		34	14	21	13	4	12	2	
19-Oct-10	7.40	174	6	107	0.12									
19-Nov-10	6.95	211	14	197	0.68									
21-Dec-10	7.08	194	12	159	0.77									
14-Jan-11	7.53	193	6	131	0.29		39	14	30	11	4	18	3	
22-Feb-11	7.69	175	<5	119	0.18									
24-Mar-11	7.29	164	<5	128	0.24									
27-Apr-11	7.03	178	5	133	0.49		41	8	22	13	4	15	2	
26-May-11	7.08	1/3	15	176	0.27									
27-Jun-11	6.94	235	50	270	0.48		10	10						
25-Jul-11	6.70	231	35	228	0.74		13	16	42	4	4	28	4	
26-Aug-11	7.01	247	16	230	0.38									
21-Sep-11	0.54	229	10	147	0.56		24	10	24	11	4	10	2	
20-001-11	7.61	197	14	142	0.55		34	10	24		4	10	2	
15-Dec-11	7.01	107	14	101	0.55									No access
25- Jan-12	8 71	217	8	172	0.54		27	12	28	6	5	26	3	NU access
17-Feb-12	6.9	194	38	218	0.94				20		Ŭ	20	Ŭ	
30-Mar-12	7 29	215	6	187	0.84									
27-Apr-12	7.23	210	26	152	0.89		28	11	29	6	4	23	4	
24-May-12	7.44	210	6	154	1.12		20		20			20		
27-Jun-12			, , , , , , , , , , , , , , , , , , ,	101										No access
27-Jul-12	7.51	215	14	202	0.8		27	17	40	8	5	23	4	
30-Aug-12	7.02	202	9	191	0.66				-	-		-		
25-Sep-12	7.43	230	5	133	0.57									
25-Oct-12	7.8	204	5	143	0.44		32	14	35	11	4	21	3	
29-Nov-12	8.04	213	5	130	0.35									
20-Dec-12	7.84	213	5	133	0.21									
24-Jan-13	7.81	213	5	137	0.19	1	41	13	24	14	5	20	3	
25-Feb-13														No access
22-Mar-13	7.08	209	5	161	0.74									
22-Apr-13														No access
17-May-13	7.25	196	5	155	0.9									
21-Jun-13	8.06	4960	5	3580	0.05									
24-Jul-13	7.27	197	6	147	0.61		28	13	24	8	4	21	3	
28-Aug-13	7.44	179	5	137	0.44									
17-Sep-13	7.38	162	6	83	0.23									
22-Oct-13	7.64	182	5	127	0.43		38	12	22	9	3	16	3	
14-Nov-13	7.6	184	5	118	0.28									
11-Dec-13	7.37	204	5	156	0.5									
24-Jan-14	8.17	279	5		0.39									
20-Feb-14	7.6	202	8		0.25									
25-Mar-14	7.59	188	5		0.13									
30-Apr-14	7.65	163	5	106	0.48		34	13	25	7	4	24	4	
28-May-14	7.79	127	5		0.66									
26-Jun-14	7.6	176	5		0.42									
28-Jul-14	7.49	128	5	92	0.36									
31-Aug-14	7.91	210	2		0.33									
22-Sep-14	6.8	150				11.3								
27-Oct-14	7.7	190	3	107	0.23	12.4	30	10	30	10	3	15	2	
21-Nov-14	7.2	170				7.8								
22-Dec-14	8	150		1	1	3.4	1	1	1	1	1	1	1	1

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	7.4	140	16	122	0.29	35								
20-Feb-15	7.5	140				3.8								
30-Mar-15	7.6	130				5.1								
28-Apr-15	6.5	410	48	302	0.75	93	16	105	45	12	13	48	4.9	
28-May-15	7.7	350				58								
24-Jun-15	7.8	320				45								
27-Jul-15	7.4	290	7	202	0.5	31								
27-Aug-15	8.2	230				19								
28-Sep-15	7.6	230				9								
22-Oct-15	7.8	210	2	157	0.36	4.5	44	32	27	17	5.9	22	2	
30-Nov-15	8.6	220				2.5								
21-Dec-15	6.6	200				4								
29-Jan-16	6.8	210	23	173	0.86	45.2								
26-Feb-16	7.5	220				9.4								
31-Mar-16	7	210				7								
28-Apr-16	7	250	5	206	0.46	9	41	47	28	11	7	32	3	
26-May-16	8	260				10								
29-Jun-16	7.4	220				14								
19-Jul-16	7.2	220	4	153	0.41	12								
22-Aug-16	7.7	190				9								
28-Sep-16	7.5	200				5								
20-Oct-16	7.8	200	3	153	0.19	10	39	28	23	12	5	19	3	
24-Nov-16	7.7	190				8								
21-Dec-16	6.7	200				4								
30-Jan-17	7.8	227	2	139	0.08	2								
27-Feb-17	7.6	200				5								
31-Mar-17	7.3	210				9								
26-Apr-17	7.2	230	5	181	0.66	10	28	30	41	9	6	29	4	
30-May-17	7	300				11								
28-Jun-17	7.2	235				22								
27-Jul-17	6.9	228	6	152	0.62	17								
30-Aug-17	6.9	200				17								
28-Sep-17	7.9	235				8								
24-Oct-17	7.2	246	3	182	0.22	7	29	33	33	11	5	28	3	
28-Nov-17	6.5	220				6								
13-Dec-17	7.9	240				4								

Site WM8	Lake	e Foster												
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.30	5,900	10	4,400	0.06	51								
13-Oct-09	8.10	5,900	11	4,700	0.05	6	340		456	213	251	846	28	
03-Nov-09	8.50	5,000	3	3,600	0.06	29								
13-Dec-09	8.10	6,300	3	6,200	0.08	45								
13-Jan-10	7.80	6,600	14	5,600	0.05	9	271		497	265	290	1050	30	
04-Mar-10	8.70	9,700	1	110	0.16	8								
08-Apr-10	8.70	7,720	4	6,100	0.05	6	315		556	302	318	1210	32	
14-May-10	8.20	7,670	9	5,730	0.05	7								
10-Jun-10	7.50	4,800	8	4,320	0.05	7								
07-Jul-10	8.10	5,610	6	4,390	0.05	3	325		459	237	270	988	23	
25-Aug-10	8.08	6,000	5	4,730	0.05	3								
20-Sep-10	8.15	5,110	5	4,610	0.05		375	2100	478	192	245	887	20	
19-Oct-10	8.31	5,710	2	4,600	0.05									
19-Nov-10	7.94	5,670	6	4,420	0.05									
21-Dec-10	7.89	6,110	<5	4,960	0.05		075	2840	480	286	207	060	20	
22-Feb-11	8.28	5 700	<5	4,890	0.05		275	2040	409	200	397	900	29	
24-Mar-11	8.33	6,560	8	5,530	0.09									
27-Apr-11	8.05	4,960	9	3,650	0.05		200	1640	508	136	179	811	18	
26-May-11	8.10	6,330	23	5,120	0.05									
27-Jun-11	8.03	4,160	6	3,210	0.05									
25-Jul-11	6.83	2,410	22	1,630	0.11		55	848	163	94	87	291	9	
26-Aug-11	8.10	4,750	7	3,710	0.05									
21-Sep-11	8.29	5720	12	4510	0.05									
26-Oct-11	8.5	5360	12	4330	0.05		245	2210	414	224	234	843	25	
22-Nov-11	8.1	5500	12	4670	0.06									No access
25-Jan-12	8.47	5710	10	4950	0.05		307	2330	486	186	259	903	25	NO access
17-Feb-12	7.02	5150	8	4170	0.05			2000	100		200		20	
30-Mar-12	8.27	4070	11	3130	0.05									
27-Apr-12	7.77	3980	8	3490	0.05		122	2010	277	206	205	646	21	
24-May-12	8.12	5310	26	4480	0.05									
27-Jun-12	7.7	4160	12	3460	0.05									
27-Jul-12	7.43	4960	35	4220	0.05		235	2250	440	237	246	857	24	
30-Aug-12	7.95	5770	18	4840	0.05									
25-Sep-12	8.1	6060	50	4340	0.05		220	2240	504	457	222	052	05	
29-Nov-12	8.31	6750	6	5100	0.05		329	2340	501	157	232	900	25	
20-Dec-12	8.36	6750	18	5290	0.05									
24-Jan-13	8.28	7070	12	5350	0.05		428	2990	648	144	260	1460	22	
25-Feb-13	7.79	2110	68	1420	0.12									
22-Mar-13	8.25	5360	15	3850	0.05									
22-Apr-13	7.75	5200	12	4160	0.05		213	2310	404	182	221	945	25	
17-May-13	8.17	6580	12	5020	0.05									
21-Jun-13	7.99	6230	5	4930	0.05									
24-Jul-13	7.96	5810	6	4320	0.05		131	2580	374	232	201	1030	22	
17-Sep-13	8.21	7090	10	5690	0.05									
22-Oct-03	8.25	7140	5	5920	0.05		354	3090	569	246	324	1160	31	
14-Nov-13	8.45	6230	5	4730	0.05									
11-Dec-13	8.23	4910	5	3910	0.05									
24-Jan-14	8.32	8200	5		0.05									
20-Feb-14	8.42	5610	23		0.05									
25-Mar-14	8.41	6860	5		0.05									
30-Apr-14	8.45	4130	21	2570	0.05		94	1620	282	155	149	619	18	
28-May-14	7.86	4510	5		0.05									
26-Jun-14	8.1 8.29	5940	5	3730	0.05									
31-Aug-14	7.33	4050	10	5150	0.05									
22-Sep-14	7.5	5400	10		0.00	4.6								
27-Oct-14	7.7	5500	7	4980	0.12	4.7	176	2420	422	266	262	829	26	
21-Nov-14	8	6900				34								
22-Dec-14	8.5	6100				5.7								

Site

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	7.6	3080	24	2380	0.01	35.2								
20-Feb-15	8.1	5520				5.9								
30-Mar-15	8.1	7060				6.9								
28-Apr-15	7.3	1400	61	986	0.05	114	63	530	83	58	60	155	7.8	
28-May-15	7.4	2900				11								
24-Jun-15	7.7	4040				8								
27-Jul-15	8.3	4940	4	4620	0.01	4								
27-Aug-15	8.3	5830				3								
28-Sep-15	8	5800				3.7								
22-Oct-15	8.4	5990	5	5150	0.02	7.8	300	2630	425	275	300	790	31	
30-Nov-15	8.5	6100				3								
21-Dec-15	7.3	4720				7								
29-Jan-16	5.9	1650	5	1230	0.06	10.5								
26-Feb-16	7.5	5030				7.2								
31-Mar-16	8.1	5210				11								
28-Apr-16	8	5210	3	5510	0.01	4	160	3000	385	300	300	865	30	
26-May-16	8.3	4600				3.5								
29-Jun-16	7.6	4840				2								
19-Jul-16	7.8	5000	1	4460	0.01	4								
22-Aug-16	8.1	3850				4								
28-Sep-16	8.4	4900				2								
20-Oct-16	7.8	5900	2	5490	0.01	1	240	2800	370	260	300	1000	28	
24-Nov-16	8	3950				48								
21-Dec-16	8.2	5800				4								
30-Jan-17	8.4	5230	4	5890	0.01	4								
27-Feb-17	8.4	5360				3								
31-Mar-17	7.8	2750				7								
26-Apr-17	7.3	3120	10	3030	0.01	4	44	1600	210	170	190	510	14	
30-May-17														Too low to sample
28-Jun-17	5.5	2720				5								
27-Jul-17	7.9	4870	2	4890	0.01	5								
30-Aug-17	8.3	6200				5								
28-Sep-17														Too low to sample
24-Oct-17	7.5	6280	6	6290	0.01	7	170	3200	420	320	350	1200	34	
28-Nov-17	8.2	5800				8								
13-Dec-17	8.3	6100				3								

Site WM9	Lake Ke	nnerson												
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	10.00	3,000	23	1,900	0.05	11								
13-Oct-09	9.90	3,600	8	2,400	0.21	19	38		355	45	131	528	12	
03-Nov-09	9.60	4,500	29	3,200	0.05	31								
13-Dec-09	7 70	5,000	5	5,500	0.05	6	355		602	122	257	1100	24	
09-Feb-10	8.30	8,500	14	4,300	0.05	18	333		002	122	231	1100	24	
04-Mar-10	8.90	8,800	15	530	0.05	6								
08-Apr-10	9.00	8,830	6	4,700	0.06	20	331		652	110	251	1130	23	
14-May-10	8.10	9,000	6	4,800	0.05	14								
10-Jun-10	7.80	2,190	30	1,800	0.06	48								
07-Jul-10	8.30	2,790	8	1,840	0.05	2	177		237	74	98	488	12	
25-Aug-10														
20-Sep-10	8.36	4,100	2	3,080	0.05		242	1440	373	105	167	648	15	
19-Oct-10	8.64	4,090	2	2,760	0.05									
21-Dec-10	9.15	2,990	5	2 200	0.05									
14-Jan-11	8.59	4,440	7	2,200	0.05		310	983	638	88	132	816	15	
22-Feb-11	8.53	4,820	16	3,770	0.05	L			L				L	
24-Mar-11	8.68	5,070	6	3,690	0.08									
27-Apr-11	8.48	3,600	7	2,350	0.05		244	864	484	56	113	636	13	
26-May-11	8.65	4,730	78	2,790	0.07									
27-Jun-11	8.70	3,060	5	1,890	0.05									
25-Jul-11	8.20	2,770	58	1,640	0.05		186	435	482	50	55	497	7	
26-Aug-11	8.59	3,310	26	1,920	0.05									
21-Sep-11 26-Oct-11	8.00	3960	5	2900	0.05		280	1350	419	118	134	673	13	
22-Nov-11	8.73	3250	36	2250	0.10		200	1000				0.0	10	
15-Dec-11	7.90	2350	48	1370	0.05									
25-Jan-12	8.76	4900	12	4070	0.05		305	1780	575	97	204	852	18	
17-Feb-12	7.34	2389	20	1460	0.05									
30-Mar-12	8.35	2320	18	1410	0.05									
27-Apr-12	8.92	2,140	8	1,430	0.05		169	499	307	59	59	368	9	
24-May-12	8.55	2,910	18	1,810	0.05									
27-Jun-12	8.67	2,510	20	1,580	0.05		224	418	549	50	46	532	8	
30-Aug-12	8.61	3.860	102	2.650	0.05		224	410	040	50	40	002		
25-Sep-12	8.52	4,270	5	2,800	0.05									
25-Oct-12	8.87	3,860	6	2,590	0.05		204	853	623	32	106	722	12	
29-Nov-12	9.2	4,450	6	2,920	0.05									
20-Dec-12	8.63	5,270	103	3,520	0.05									
24-Jan-13	8.39	6,650	8	4,770	0.05		505	2500	672	59	214	1440	16	
25-Feb-13	8.44	5,000	30	3,230	0.05									
22-Mar-13	8.36	4,240	5	3,040	0.05		070	1070	E01	00	115	700	40	
22-Apr-13	0.44 8.35	5,090	294	2,070	0.05		212	1070	100	ου	115	130	13	
21-Jun-13	8.38	4,460	5	2,770	0.05									
24-Jul-13	8.29	4,800	5	3,320	0.05		384	1430	525	126	159	873	14	
28-Aug-13	8.52	4,270	5	1,820	0.05									
17-Sep-13	8.66	4,640	5	2,910	0.05									
22-Oct-13	8.83	5,470	8	3,740	0.05		256	1880	571	74	225	938	17	
14-Nov-13	9.07	5,710	5	4,030	0.05									
11-Dec-13	8.23	5,370	5	3,760	0.05									
24-Jan-14 20-Feh-14	8.03	4 910	38		0.05									
25-Mar-14	8.27	6,190	6		0.05									
30-Apr-14	8.44	4,070	19	3,000	0.05	L	365	1610	395	139	178	809	20	
28-May-14	8.51	3,790	5		0.05									
26-Jun-14	8.45	4,290	6		0.05									
28-Jul-14	8.39	5,190	5	3,530	0.05									
31-Aug-14	8.39	5,430	6		0.05									
22-Sep-14	8.4	6,000				3.8								
27-Oct-14	8.3	6,700	4	4,360	0.05	8.6	534	2020	605	85	210	1060	19	
21-N0V-14	0.5 8 3	6,000				3.8 17								
22-Det-14	0.0	0,300				17		1			1			

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	8.5	4,100	23	2,980	0.01	36.8								
20-Feb-15	8.4	5,480				4.9								
30-Mar-15	8.6	5,760				30.3								
28-Apr-15	7.7	1,490	167	954	0.05	314	205	350	130	37	39	215	8.1	
28-May-15	8.3	1,390				62								
24-Jun-15	8.2	3,230				7								
27-Jul-15	8.4	4,530	5	3,640	0.01	2.3								
27-Aug-15	8.5	1,940				17								
28-Sep-15	8.3	3,300				3.7								
22-Oct-15	8.5	5,580	3	4,370	0.03	6	475	1940	480	150	220	875	24	
30-Nov-15	8.5	5,810				4.3								
21-Dec-15	8.3	5,610				6								
29-Jan-16	8.2	1,530	20	1,020	0.02	38.9								
26-Feb-16	7.5	5,800				12								
31-Mar-16	8.3	5,010				15.1								
28-Apr-16	8.1	4,640	4	4,570	0.01	5	415	2360	320	190	230	910	17	
26-May-16	8.2	5,600				4								
29-Jun-16	7.8	3,450				4								
19-Jul-16	7.8	5,170	1	4,230	0.01	2								
22-Aug-16	8.2	5,490				4								
28-Sep-16	8.7	4,710				5								
20-Oct-16	8.5	5,900	1	5,100	0.02	2	360	2500	360	170	280	1100	20	
28-Nov-16	8	5,800				11								
21-Dec-16	8	5,700				11								
30-Jan-17	7.9	4,810	13	4,440	0.01	15								
27-Feb-17	8	5,400				3								
31-Mar-17	7.7	4,600				3								
26-Apr-17	8.4	3,590	4	3,250	0.01	3	370	1500	290	150	160	780	15	
30-May-17	8.4	5,160				4								
28-Jun-17	8.6	3,540				9								
27-Jul-17	8.4	4,300	4	4,030	0.01	6								
30-Aug-17	8.6	5,400				2								
28-Sep-17	8.5	5,900				3								
24-Oct-17	8	5,450	4	5,210	0.02	6	430	2300	370	220	290	1100	23	
28-Nov-17	7.8	6,400				5								
13-Dec-17	8.2	6,200				4								

Site WM10	Four I	Mile Creek @ Jo	ohn Renshaw	Drive										
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.50	460			2.33									
13-Oct-09	8.30	440			1.26	66	84		109	10	13	73	7	
03-Nov-09	8.50	380	18	430	2.10	120								
13-Dec-09														Dry
13-Jan-10														Dry
09-Feb-10														Dry
04-Mar-10	0.70	244	47	220	4.00	24	74		20	0	7	21		Dry
14 Mov 10	8.00	241	17 50	230	0.61	21	74		29	9	1	31	4	
14-May-10	7.70	200	14	210	0.69	47								
07- Jul-10	7.70	400	28	262	0.09	47	52		88	12	11	63	5	
25-Aug-10	7.74	512	4	308	0.90	17			00	12		00	5	
20-Sep-10	7.42	516	5	306	1.07		63	17	109	14	10	72	6	
19-Oct-10	7.47	512	12	268	0.42						-			
19-Nov-10	7.07	448	13	312	1.21									
21-Dec-10	7.20	505	8	352	2.91									
14-Jan-11	7.13	478	32	294	1.96		73	1	92	9	10	60	8	
22-Feb-11														Dry
24-Mar-11														Dry
27-Apr-11	6.96	258	21	174	0.73		60	21	25	11	7	29	4	
26-May-11	7.03	261	17	251	0.63									
27-Jun-11	7.23	559	16	308	0.62									
25-Jul-11	6.53	401	14	282	0.67		24	23	87	5	8	52	6	
26-Aug-11	7.25	411	8	290	0.86									
21-Sep-11	7.65	527	8	250	1.3									
26-Oct-11	7.32	595	42	362	0.98		56	22	138	14	14	83	7	
22-Nov-11	7.72	446	26	306	2.36									
15-Dec-11	8.29	369	12	268	1.34									
25-Jan-12	7.03	514	10	322	3.55		79	1	100	11	12	64	7	
17-Feb-12	5.68	316	8	272	1.16									
30-Mar-12	7.24	456	6	278	1.28									
27-Apr-12	7.78	375	10	280	1.6		46	14	85	8	10	54	6	
24-Way-12	7.0	525	12	202	1.04									
27-Jul-12	7.51	352	21	208	1.22		46	15	77	6	0	51	6	
30-Aug-12	6.08	527	11	348	1.5		40	15		0	5	51	0	
25-Sep-12	7.18	432	20	254	0.86									
25-Oct-12	7.92	470	84	302	1.32		72	10	95	10	11	60	8	
29-Nov-12	7.51	4,900	24	3,390	0.05									
20-Dec-12														Dry
24-Jan-13	7.63	428	5	260	1.08		106	10	75	12	12	55	12	
25-Feb-13	6.86	388	41	360										
22-Mar-13	6.94	353	7	268	1.1									
22-Apr-13	7.31	238	92	262	1.13		31	10	41	4	5	39	5	
17-May-13	7.32	274	36	276	1.2									
21-Jun-13	7.22	328	5	244	1.09									
24-Jul-13	6.97	382	10	249	1.24		45	12	70	6	8	49	6	
28-Aug-13	7.24	373	15	258	0.98									
17-Sep-13	7.4	362	14	234	1.1									
22-Oct-13	7.39	475	21	334	2.31		88	10	86	9	10	60	10	
14-Nov-13	6.75	199	6	197	1									
11-Dec-13	6.69	328	5	262	0.95									
24-Jan-14	7.94	405	18		1.52									Der
20-Feb-14	7 33	187	5		0.46									Diy
30-Anr-14	7.35	168	17	217	1.17		29	11	34	4	4	31	5	
28-May-14	6.39	175	8		0.65				<u>.</u>			<u>.</u>	Ť	
26-Jun-14	7.14	194	7		0.57									
28-Jul-14	7.01	144	6	188	0.38								1	
31-Aug-14	7.16	348	7		0.88									
22-Sep-14	7.5	400	1	1	1	38.7	1	1	1	1	1	1	1	1
27-Oct-14	7.2	250	19	207	1.63	32.1	51	10	50	7	6	34	6	
21-Nov-14	7.3	260				37.6								
22-Dec-14	7.2	230				36								

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	6.5	180	20	217	1	38.9								
23-Feb-15	7	190				31.5								
30-Mar-15	7	130				31.1								
28-Apr-15	6.8	255	25	230	0.88	75	20	20	48	5.8	7	28	6.5	
28-May-15	7.2	160				47								
24-Jun-15	7.3	160				67								
27-Jul-15	7.2	247	11	215	2.1	43								
27-Aug-15	7.4	250				27								
28-Sep-15	7.8	240				29.6								
22-Oct-15	7.2	230	10	230	1.4	18.8	78	9	23	17	9.9	17	4.6	
30-Nov-15	7.3	220				26.1								
21-Dec-15	7.1	320				41								
29-Jan-16	6.9	210	14	190	1.4	34.3								
26-Feb-16	6.8	260				22								
31-Mar-16	7.2	220				36								
28-Apr-16	7.3	230	5	220	3.6	36	62	7	26	9	8	20	7	
26-May-16	6.8	190				58								
29-Jun-16	6.8	120				65								
19-Jul-16	7.3	150	8	176	1.1	43								
23-Aug-16	7	120				66								
28-Sep-16	7.3	160				40								
20-Oct-16	7.5	170	8	179	4.3	30	72	3	19	9	7	18	5	
28-Nov-16	7.2	190				14								
21-Dec-16	7.1	180				14								
30-Jan-17	6.9	177	19	147	0.77	23								
27-Feb-17	7.2	110				45								
30-Mar-17	7.3	180				22								
26-Apr-17	7.2	280	10	236	3.5	18	48	11	64	9	9	43	7	
30-May-17	6.7	295				25								
28-Jun-17	6.9	310				27								
27-Jul-17	7.1	383	4	232	2.3	28								
30-Aug-17	6.8	330				23								
28-Sep-17	7.5	380				15								
24-Oct-17	7.1	265	12	233	1.1	28	65	20	26	12	7	32	3	
28-Nov-17	6.9	190				37								
13-Dec-17	7.7	220				34								

Site WM11	Four M	lile Creek U/S N	lew England I	lighway										
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.10	3,100	8	2,100	0.23	14								
13-Oct-09	7.40	3,500	24	2,700	0.10	16	166		240	139	136	452	17	
03-Nov-09	8.10	4,400	33	3,200	0.10	17								
13-Dec-09	6.50	3,100	18	3,500	0.05	27	146		63	22	19	81	6	
09-Feb-10	6.10	320	45	310	0.38	10	140		03	22	10	01	0	
04-Mar-10	8.40	550	16	4,500	0.05	15								
08-Apr-10	8.60	356	10	260	0.32	18	76		49	16	10	48	4	
14-May-10	8.20	818	27	202	0.08	117								
10-Jun-10	6.60	721	21	476	0.18	30								
07-Jul-10	7.80	2,840	10	2,050	0.05	8	114		203	110	113	438	13	
25-Aug-10	6.59	3,240	6	2,430	0.05	8								
20-Sep-10	7.59	3,860	5	3,020	0.05		145	1590	264	168	163	509	16	
19-Oct-10	7.43	712	8	402	0.11									
19-Nov-10	7.70	3,630	12	2,410	0.13									
21-Dec-10	7.60	3,080	5	2,200	0.20		284	2220	470	217	021	942	22	
22-Feb-11	7.68	4 530	<5	3 840	0.05		204	2330	472	217	231	043	23	
24-Mar-11	7.86	5.040	6	3.750	0.06									
27-Apr-11	7.18	671	14	432	0.26		89	109	72	17	18	89	4	
26-May-11	8.02	5,710	16	4,470	0.05									
27-Jun-11	7.47	2,690	16	1,920	0.08									
25-Jul-11	7.69	2,510	41	1,580	0.14		138	586	299	61	65	388	9	
26-Aug-11	7.26	2,580	30	1,880	0.10									
21-Sep-11	8.17	3560	10	2630	0.05									
26-Oct-11	7.90	890	22	524	0.15		51	184	125	23	23	126	5	
22-Nov-11	7.92	1243	32	832	0.32									
15-Dec-11	8.14	3160	40	2180	0.05		318	1010	546	115	200	841	10	
17-Feb-12	6.98	4950	24	1140	0.08		310	1910	540	115	209	041	19	
30-Mar-12	8.04	3430	16	2390	0.05									
27-Apr-12	7.74	3000	15	1490	0.21		133	1190	244	133	138	438	16	
24-May-12	7.72	2650	24	1880	0.18									
27-Jun-12	8.12	4680	42	3570	0.05									
27-Jul-12	7.23	3040	25	2250	0.07		228	938	400	105	120	525	12	
30-Aug-12	6.48	1,043	25	724	0.27									
25-Sep-12	7.94	4,240	14	2,900	0.06									
25-Oct-12	7.52	1,706	32	1,000	0.18		163	332	222	40	52	257	9	
29-Nov-12	7.90	4,580	19	3,000	0.05									
20-Dec-12	8.18 7.79	5,020	12	3,510	0.07		242	825	301	82	103	475	13	
25-Feb-13	7.80	2,540	47	1,570	0.14		242	025	301	02	103	473	15	
22-Mar-13	7.72	4,150	8	3,070	0.05									
22-Apr-13	8.24	4,120	30	2,880	0.05		275	1310	415	104	149	716	15	
17-May-13	7.92	3,370	14	2,510	0.06									
21-Jun-13	8.06	2,480	5	1,610	0.05									
24-Jul-13	7.78	2,710	5	1,920	0.08		107	1020	205	109	116	386	12	
28-Aug-13	7.86	1,960	5	1,270	0.09							ļ		
17-Sep-13	7.75	1,710	7	1,040	0.12									
22-Oct-13	7.86	2,420	6	1,500	0.06		247	537	297	46	67	141	10	
14-NOV-13	7.84	5,270	15	3,570	0.06									
24-Jan-14	7.65	8.070	5	2,730	0.00									
20-Feb-14	6.74	1,582	22		0.09									
25-Mar-14	7.82	2,830	43		0.37							<u> </u>		
30-Apr-14	8.01	3,970	14	2,960	0.05		328	1610	379	154	176	757	19	
28-May-14	7.61	880	8		0.09									
26-Jun-14	7.98	2,840	6		0.05									
28-Jul-14	8.41	4,890	5	3,990	0.05									
31-Aug-14	7.75	2,551	13	ļ	0.07							ļ		ļ
22-Sep-14	6.90	4,050				15.7								
27-Oct-14	7.90	2,650	9	1,700	0.06	14.2	237	756	259	49	76	398	9	
21-NOV-14	8.00	3,300				13								
22 000014	0.00	0,000			I	14.5								

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	8.20	2,390	18	1,590		30.9								
20-Feb-15	8.00	4,700				6.6								
30-Mar-15	7.60	1,960				11.8								
28-Apr-15	7.40	2,280	21	1,640	0.10	42	86	870	180	89	95	275	11	
28-May-15	7.50	2,430				23								
24-Jun-15	7.50	1,960				29								
27-Jul-15	7.60	931	7	632	0.16	20								
27-Aug-15	8.20	5,100				10								
28-Sep-15	8.20	4,570				14.9								
22-Oct-15	7.40	1,030	37	658	0.07	60	105	230	120	31	31	135	7.1	
30-Nov-15	8.20	3,300				22.8								
21-Dec-15	7.80	3,600				64								
29-Jan-16	7.50	3,510	12	2,810	0.11	19.7								
26-Feb-16	7.50	4,200				36.7								
31-Mar-16	8.30	4,900				10								
28-Apr-16	7.80	3,620	39	3,000	0.01	40	28	1380	265	110	130	510	12	
26-May-16	7.50	1,600				27								
29-Jun-16	7.30	4,000				19								
19-Jul-16	7.70	4,100	14	3,460	0.01	23								
22-Aug-16	7.60	1,800				33								
28-Sep-16	8.10	4,580				11								
20-Oct-16	8.40	4,300	24	3,520	0.01	33	330	1700	310	130	190	880	15	
28-Nov-16	8.20	4,300				72								
21-Dec-16	7.60	4,300				41								
30-Jan-17	8.00	4,240	46	3,680	<0.01	16								
27-Feb-17	8.10	5,100				4								
30-Mar-17	7.40	3,900				12								
26-Apr-17	7.70	1,300	12	1,050	0.23	16	150	390	150	48	53	240	8	
30-May-17	8.00	3,550				13								
28-Jun-17	7.50	2,516				13								
27-Jul-17	7.40	720	22	879	0.32	32								
30-Aug-17	6.60	1,730				37								Not flowing
28-Sep-17	7.80	5,150				68								
24-Oct-17	8.10	5,080	22	4,520	0.01	21	360	1700	290	160	250	1000	19	
28-Nov-17	7.50	3,150				42								Not flowing
13-Dec-17	7.80	3,540				48								Not flowing

Site WM12	Shamrock (	Creek / Four Mil	e Creek Junc	tion										
Date	pН	Specific Conductance (μS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
24-Sep-09	8.00	2,800	16	1,800	0.74	52								
13-Oct-09	7.10	3,500	16	2,500	0.22	20	193		217	139	139	448	17	
03-Nov-09	8.30	6,200	2	5,200	<0.05	5								
13-Dec-09	7.30	550	64	300	<0.05	10								
13-Jan-10	6.10	310	6	190	0.30	16	90		39	13	8	32	4	
09-Feb-10	5.50	230	22	150	0.29	58								
04-Mar-10				100										
08-Apr-10	8.70	276	10	190	0.19	21	55		37	16	8	27	3	
14-May-10	7.50	200	36	1 380	0.07	9								
07-Jul-10	7.70	2.750	16	1,960	0.09	17	110		194	111	110	414	13	
25-Aug-10	7.54	3,150	10	2,360	<0.05	20							-	
20-Sep-10	7.58	2,650	8	1,970	0.14		106	1050	183	116	111	364	12	
19-Oct-10	7.40	1,520	8	936	0.07									
19-Nov-10	7.86	4,370	30	3,080	0.06									
21-Dec-10	7.67	3,920	10	3,010	0.55									
14-Jan-11	7.78	5,840	12	4,420	<0.05		252	2230	462	245	244	813	26	
22-Feb-11	7.91	4,680	12	3,720	<0.05									
24-Mar-11	8.07	5,060	16	3,670	0.07									
27-Apr-11	7.41	420	26	304	0.43		66	66	44	14	11	51	3	
26-May-11	8.24	5,690	24	3,980	<0.05									
27-Jul-11	7.49	2,800	44	2,040	0.03		160	702	327	75	77	434	10	
26-Aug-11	7.62	2,000	22	1,500	0.17		100	102	521	10			10	
21-Sep-11	7.14	1,943	16	1,230	0.05									
26-Oct-11	8.17	774	134	502	0.33		43	189	86	25	25	93	5	
22-Nov-11	8.13	2,341	58	1,630	0.18									
15-Dec-11	8.12	3,440	30	2,420	0.05									
25-Jan-12	8.17	4,940	12	4,050	0.05		333	1910	527	116	216	843	19	
17-Feb-12	6.62	1,582	18	1,200	0.7									
30-Mar-12	8.03	4,510	18	3,470	0.05									
27-Apr-12	7.76	3,300	18	2,700	0.3		147	1580	254	166	171	532	18	
24-May-12	7.66	1,066	63	684	0.62									
27-Jun-12	6 49	4,860	32	3,800	0.14		104	924	222	01	05	221	10	
30-Aug-12	6.83	1 029	43	712	0.25		104	024	232	91	95	331	10	
25-Sep-12	7.92	2,930	22	1,910	0.05									
25-Oct-12	7.57	728	145	446	0.15		92	138	89	21	22	98	5	
29-Nov-12	7.95	4,950	24	3,270	0.05									
20-Dec-12	6.4	4,480	12	3,040	0.05									
24-Jan-13														Dry
25-Feb-13														No Access
22-Mar-13	7.69	3,430	6	2,530	0.17									
22-Apr-13														No access
17-May-13														No access
21-Jun-13	7 97	3 280	10	2 530	0.12		104	1350	228	144	151	477	15	NO ACCESS
24-Jui-13 28-Aug-13	7.74	1.040	5	669	0.12		124	1350	220	1444	101	477	10	
17-Sep-13		.,0.0	Ť		0.20									Dry
22-Oct-13	7.75	1,370	5	742	0.06		160	270	152	25	34	217	6	
14-Nov-13	7.98	5,140	7	3,700	0.05									
11-Dec-13	7.44	1,830	6	1,250	0.13									
24-Jan-14	8.2	8,260	8		0.05									
20-Feb-14	8.42	4,170	29		0.05									
25-Mar-14	7.95	3,910	5		0.06									
30-Apr-14	7.85	4,390	10	3,250	0.05		306	2000	397	199	210	817	22	
28-May-14	7.34	1,752	6		0.11									
26-Jun-14	8	2,790	5		0.05									
28-Jul-14	8.44	5,000	18	3,660	0.05									
31-Aug-14	7.6	2,570	15		0.12	Ω 1								
22-3ep-14 27-Oct-14	7.6	1.200	9	778	0.76	13.8	124	340	122	26	35	175	5	
21-Nov-14	7.4	1,000	Ť		00	8.8		0.0					Ť	
22-Dec-14	8	2,640			<u> </u>	6.8			<u> </u>	<u> </u>		<u> </u>		
		1	1											

Site

Date	pН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
29-Jan-15	8.5	2,940	22	2,060	0.04	28								
23-Feb-15	8	2,000				9								
30-Mar-15	7.6	1,100				9.3								
28-Apr-15	7.5	2,350	34	1,740	0.12	59	90	880	170	92	97	280	11	
28-May-15	7.5	1,460				58								
24-Jun-15	7.6	2,490				36								
27-Jul-15	7.5	675	6	458	0.3	26								
27-Aug-15	8.3	4,990				12								
28-Sep-15	8	4,980				6.2								
22-Oct-15	7.5	980	25	661	0.06	41.4	96	260	89	35	34	125	6	
30-Nov-15	8.1	2,100				7.5								
21-Dec-15	7.8	4,800				23.8								
29-Jan-16	7.5	3,070	16	2,470	0.15	39.8								
26-Feb-16	7.3	3,500				43								
31-Mar-16	8.2	4,850				11								
28-Apr-16	7.5	1,730	12	1,210	0.17	16	155	560	115	51	60	260	7	
26-May-16	7.6	750				56								
29-Jun-16	7.2	3,120				7								
19-Jul-16	7.2	1,300	7	927	0.24	20								
22-Aug-16	7.3	1,100				25								
28-Sep-16	8.2	4,520				8								
20-Oct-16	8.5	4,700	3	4,100	0.02	7	350	2000	320	140	220	990	16	
28-Nov-16	8.2	4,500				16								
21-Dec-16	7.9	5,300				10								
30-Jan-17	8.2	4,500	9	3,930	0.01	11								
27-Feb-17	8	5,330				8								
30-Mar-17	7.3	4,000				8								
26-Apr-17	7.6	1,038	8	854	0.33	19	110	320	110	41	42	170	7	
30-May-17	7.6	1,630				13								
28-Jun-17	7.4	1,921				23								
27-Jul-17	7.2	566	7	405	0.51	31								
30-Aug-17	6.8	1,300				6								Not flowing
28-Sep-17	7.9	4,520				4								
24-Oct-17	8.3	5,490	8	5,100	0.01	9	410	1900	310	190	280	1100	22	
28-Nov-17	7.5	4,500				5								Not flowing
13-Dec-17														Dry

Site WM13	Buttai C	eek @ Buchan	an Road											
Date	рН	Specific Conductance (µS/cm)	Total Suspended Solids (mg/l)	Total Dissolved Solids (mg/l)	lron (mg/l)	Turbidity (NTU)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Comments
20-Sep-10	7.33	556	5	378	1.54		56	28	120	10	12	81	7	
19-Oct-10	7.36	603	4	320	0.81									
19-Nov-10	6.75	359	13	260	2.17									
21-Dec-10	7.36	525	5	338	2.00		86	14	101	11	12	74	5	
22-Feb-11	7.17	495	5	480	0.62		00	14	101	11	12	74	5	
24-Mar-11	7.63	594	10	416	0.39									
27-Apr-11	6.07	1100	24	766	0.05		5	378	76	39	44	118	8	
26-May-11	6.59	1110	22	880	0.05									
27-Jun-11	7.02	826	10	518	0.28									
25-Jul-11	6.39	413	22	302	0.57		17	35	83	6	8	54	5	
26-Aug-11	7.01	593	35	372	0.76									
21-Sep-11	7.19	868	24	490	0.34									
26-Oct-11	7.84	949	21	554	0.48		55	44	237	15	22	145	6	
22-Nov-11	7.47	1,323	27	860	0.37									
25-Jan-12	7.82	906	36	612	0.52		83	113	170	18	24	137	6	
17-Feb-12	6.37	291	50	339	1.06								-	
30-Mar-12	7.42	966	40	548	0.13									
27-Apr-12	7.3	459	26	384	1.2		51	41	96	11	13	69	5	
24-May-12	7.39	1,044	37	550	0.3									
27-Jun-12	7.44	882	32	526	0.78									
27-Jul-12	6.36	575	50	591	0.78		43	42	150	13	16	85	5	
30-Aug-12	6.89	135	37	788	0.19									
25-Sep-12	7.50	4.570	40		0.05		405		400	07	07	0.40		Dry
25-Uct-12	7.58	1,573	18	844	0.05		105	91	408	27	37	242	9	Dry
20-Dec-12														Dry
24-Jan-13														Dry
25-Feb-13	6.94	475	35	358	0.62									
22-Mar-13	7.21	1,010	5	574	0.48									
22-Apr-13	6.78	1,600	14	1,020	0.25		22	407	253	51	48	248	11	
17-May-13	7.38	907	38	540	0.05									
21-Jun-13	7.24	1,120	6	646	0.16									
24-Jul-13	7.28	727	11	417	0.46		54	45	151	11	15	105	6	
28-Aug-13	7.53	869	5	443	0.11									
22-Oct-13	7.59	930	8	409 541	0.05		74	74	218	19	23	155	9	
14-Nov-13	7.39	1,000	15	577	0.05		14		210	10	20	100		
11-Dec-13	6.81	599	18	364	0.56									
24-Jan-14	8.05	941	30		0.05									
20-Feb-14	8.35	957	22		0.05									
25-Mar-14	7.59	849	12		0.05									
30-Apr-14	6.89	282	6	204	0.91		33	21	66	4	6	55	7	
28-May-14	6.63	472	5		0.93									
26-Jun-14	7.65	475	5	204	0.3									
20-Jui-14 31-Aug-14	7.57	352	5 13	304	0.11									
22-Sep-14	7.7	570		<u> </u>	00	41.8								
27-Oct-14	7.4	560	60	337	1.33	15.9	69	10	116	9	12	74	8	
21-Nov-14	7.6	660	İ	İ		18.6								
22-Dec-14	7.5	690				16.4								
29-Jan-15	6.8	240	16	236	1.3	38.5								
23-Feb-15	7.2	560		ļ	ļ	7.8			ļ			ļ		
30-Mar-15	7	600				9.3		-				a-		
28-Apr-15	6.5	274	44	234	3.5	63	41	22	42	11	8.2	25	8.3	Floodwater
20-May-15	67	620				33								
27-Jul-15	7.6	919	4	542	0.42	+/ 9								
27-Aug-15	7.2	1,100				7								
28-Sep-15	7.5	760				9.1			L			L		
22-Oct-15	7.1	900	2	533	0.28	5	88	21	210	19	21	120	7.2	
30-Nov-15	7.5	590				10.2								
21-Dec-15	7	640				9.4								
29-Jan-16	7	640	11	383	0.94	12.5								

26-Feb-16	6.9	840				7								
31-Mar-16	7.1	450				13								
28-Apr-16	8	930	3	524	0.04	4	115	14	210	19	21	130	6	
26-May-16	7.6	960				19								
29-Jun-16	6.9	1,200				5								
19-Jul-16	7.8	1,180	8	757	0.01	7								Stagnant
22-Aug-16	7.5	790				13								Stagnant
28-Sep-16	7.5	800				5								
20-Oct-16	7.6	860	2	536	0.35	3	97	81	150	25	24	130	13	
28-Nov-16	7.6	940				11								Stagnant
21-Dec-16	7.7	960				9								Stagnant
30-Jan-17	8	1,060	8	623	0.02	8								
27-Feb-17	8.1	1,100				270								Cattle
30-Mar-17	7.4	390				41								
26-Apr-17	7.3	454	8	356	2.1	10	65	26	110	13	13	72	8	
30-May-17	7.1	580				7								
28-Jun-17	6.7	510				28								
27-Jul-17	7.2	547	4	364	1	12								
30-Aug-17	7.6	590				6								Not flowing
28-Sep-17	7.9	695				6								Not flowing
24-Oct-17	7.5	711	2	428	0.19	6	77	53	120	16	16	110	8	
28-Nov-17	7.5	630				8								Not flowing
13-Dec-17	7.7	670				8								Not flowing

DATE	рН	TOTAL SUSPENDED SOLIDS (mg/l)	TOTAL DISSOLVED SOLIDS (mg/l)	SPECIFIC CONDUCTANCE (uS/cm)	IRON (mg/l)	DISCHARGE VOLUME (ML/day)
02-Jan-17	8.2	33	5,110	4,710	<0.01	40
03-Jan-17	8.2	8	4,940	4,440	<0.01	20
04-Jan-17	8.1	7	5,000	4,440	<0.01	10
21-Jan-17	8.1	9	5,260	4,600	<0.01	20
25-Jan-17	8.0	19	4,820	4,930	<0.01	30
26-Jan-17	8.0	19	4,430	4,630	<0.01	10
18-Feb-19	8.0	4	5,180	4,730	0.01	20
26-Feb-17	8.3	3	5,350	4,790	<0.01	20
27-Feb-17	8.2	2	5,500	5,060	<0.01	10
28-Feb-17	8.1	10	5,510	5,160	<0.01	10
01-Mar-17	8.0	17	4,680	4,660	<0.01	10
06-Mar-17	7.9	7	4,740	4,920	<0.01	30
07-Mar-17	8.2	10	3,790	4,300	<0.01	10
17-Mar-17	7.9	5	5,000	4,980	<0.01	40
18-Mar-17	8.0	4	4,990	4,960	<0.01	40
19-Mar-17	8.2	14	3,300	3,720	<0.01	30
20-Mar-17	8.2	9	3,140	3,520	<0.01	10
24-Mar-17	8.2	7	3,730	4,410	<0.01	20
30-Mar-17	7.9	6	4,750	4,920	<0.01	40
31-Mar-17	8.2	12	3,520	4,190	<0.01	20
01-Apr-17	7.7	16	3,360	3,940	<0.01	10
05-Apr-17	7.5	13	4,090	4,130	0.02	5
06-Apr-17	8.0	19	3,890	4,820	0.01	25
20-May-17	7.7	1	5,360	5,330	0.02	40
07-Jun-17	7.4	5	4,460	4,330	<0.01	40
08-Jun-17	8.2	5	4,650	4,620	<0.01	40
09-Jun-17	8.2	2	4,610	4,710	<0.01	40
10-Jun-17	8.0	2	3,970	4,290	<0.01	20
11-Jun-17	8.2	7	4,860	4,540	<0.01	5
12-Jun-17	8.1	11	4,960	4,470	<0.01	5
14-Sep-17	8.1	1	4,650	5,420	0.01	40
15-Oct-17	8.4	3	4,900	5,500	<0.01	40
20-Oct-17	8.2	2	4,960	5,700	<0.01	40
21-Oct-17	8.0	3	4,890	5,600	<0.01	30
22-Oct-17	8.0	7	5,120	5,470	0.01	10
06-Nov-17	8.1	1	5,000	5,050	0.01	20
Max	8.4	33	5,510	5,700	0.02	40
Min	7.4	1	3,140	3,520	<0.01	5
Average	8.0	8	4,624	4,722	<0.02	24

 Table B1 - Discharge Monitoring Results 2017

# **APPENDIX C**

### **GROUNDWATER MONITORING RESULTS**

#### Bore PD2.1

Buttai Reservoir

Date	RL	Depth (m)	рН	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Iron (mg/L)	Comments
20-Sep-10	22.87	56.33	6.67	5350	3780	569	730	1330	32	74	1150	24	0.29	
19-Oct-10	22.63	56.57	6.72	6000	3100	553	802	1210	34	78	1330	27	2.45	
14-Jan-11	22.84	56.36	6.6	6420	3750	598	718	1260	30	73	1310	28	1.47	
27-Apr-11	22.61	56.59	6.6	6560	3610	483	953	1120	32	90	1200	26	2.14	
25-Jul-11	23.13	56.07	6.64	6320	3810	541	621	1230	30	72	1280	28	1.28	
26-Oct-11	23.64	55.56	7.09	6170	3660	503	506	1290	27	67	1270	29	1.61	
25-Jan-12	24.02	55.18	7.06	5720	3330	430	607	1300	34	56	1180	29	1.39	
27-Apr-12	24.44	54.76	6.64	5270	3490	409	418	1270	36	47	1130	29	1	
27-Jul-12	24.71	54.49	7.32	6120	3830	355	608	1650	134	74	1320	35	0.05	
31-Oct-12	24.64	54.56	6.74	5950	3990	592	874	1240	48	79	1370	33	11.4	
24-Jan-13	24.80	54.40	7.3	6360	4130	590	816	1190	67	78	1320	31	0.85	
22-Apr-13	25.23	53.97	6.81	6080	4170	549	654	1210	54	79	1220	30	0.79	
24-Jul-13	25.00	54.20	7.21	6820	3830	212	450	1700	159	34	1290	37	1.99	
28-Oct-13	24.82	54.38	6.87	6380	3990	622	726	1200	38	80	1310	31	2.06	
02-May-14	25.34	53.86	6.84	6460	3800									
29-Nov-14	25.40	53.80	7.3	6460	3740	560	503	1600	96	53	1220	27	0.05	
24-Feb-15	25.42	53.78												
03-Jun-15	26.72	52.48	6.7	6350	3170									
26-Aug-15	25.87	53.33												
30-Nov-15	25.92	53.28	6.9	5520	3420	350	310	1300	87	33	1300	33	0.05	
21-Mar-16	25.92	53.28												
25-May-16	25.70	53.50	7	5000	2600									
19-Aug-16	25.17	54.03												
30-Nov-16	25.12	54.08	7.3	4700	3010	330	220	1200	120	16	1100	29	0.01	
27-Feb-17	24.89	54.31												
01-May-17	25.54	53.66	8	3920	2513									
31-Aug-17	24.86	54.34												
29-Nov-17	24.74	54.46	7	4650	3020	280	400	1200	72	25	1100	24	0.02	

.

#### Bore PD2.2

### Buttai Reservoir

Date	RL	Depth (m)	рН	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Iron (mg/L)	Comments
20-Sep-10	16.29	63.37	6.69	5140	4500	319	1890	695	183	180	943	20	4.22	
19-Oct-10	15.88	63.78	6.79	5780	4300	333	2010	706	185	180	1040	22	8.83	
14-Jan-11	16.38	63.28	6.65	6170	4220	342	2300	728	191	189	1070	24	9.19	
27-Apr-11	15.87	63.79	6.42	6270	4500	288	1890	701	171	206	952	23	7.52	
25-Jul-11	17.12	62.54	6.29	6090	4250	239	1800	806	167	209	972	27	31.1	
26-Oct-11	18.58	61.08	7.03	5960	4320	206	1740	791	157	204	1000	29	6.23	
25-Jan-12	18.81	60.85	7.07	6460	4840	483	1480	1130	100	177	1170	33	0.05	
27-Apr-12	19.23	60.43	6.44	5720	4230	282	1360	1110	106	194	1090	33	23.6	
27-Jul-12	19.21	60.45	6.52	5720	4390	272	1710	1070	97	182	1110	32	30.5	
31-Oct-12	19.23	60.43	6.35	5650	4040	205	1840	892	100	178	1190	33	32.9	
24-Jan-13	19.36	60.30	6.73	5810	4110	241	1820	838	115	203	1140	31	29.1	
22-Apr-13	19.95	59.71	6.4	5480	3990	217	1480	852	76	160	1070	30	32.4	
24-Jul-13	19.53	60.13	6.81	6120	4100	246	1520	899	84	168	1140	32	12.2	
28-Oct-13	19.65	60.01	6.54	6450	4140	271	1490	901	79	154	1160	30	26.4	
02-May-14	19.94	59.72	6.46	6260										
29-Nov-14	19.36	60.30	6.7	5880	3610	302	1440	1010	70	127	1040	24	0.05	
24-Feb-15	20.35	59.31												
03-Jun-15	20.44	59.22	6.7	6110	3050									
26-Aug-15	20.22	59.44												
30-Nov-15	20.16	59.50	6.6	5670	4180	310	1300	890	66	150	1200	34	10	
21-Mar-16	19.90	59.76												
25-May-16	19.79	59.87	6.8	5800										
19-Aug-16	19.36	60.30												
30-Nov-16	19.24	60.42	6.7	5730	5510	400	2100	690	280	230	1200	25	1.9	
27-Feb-17	19.18	60.48												
01-May-17	19.32	60.34	7.3	5370	3447									
31-Aug-17	19.60	60.06												
29-Nov-17	19.63	60.03	6.8	5670	4030	360	1300	1100	55	120	1400	28	0.01	

.

### Bore PD3

### Shamrock Lane

Date	RL	Depth (m)	рН	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Iron (mg/L)	Comments
20-Sep-10	23.88	7.12	4.1	2660	2090	1	958	220	34	112	374	21	0.09	
19-Oct-10	23.62	7.38	6.37	5890	5120	217	2710	510	262	311	884	27	22.6	
14-Jan-11	23.78	7.22	6.59	6040	4940	168	2890	507	247	300	878	29	0.05	
27-Apr-11	23.27	7.73	6.7	6680	5390	134	2790	545	256	333	863	28	0.05	
25-Jul-11	24.75	6.25	6.24	6520	5280	134	2440	614	247	309	874	30	7.05	
26-Oct-11	23.97	7.03	6.52	6420	5170	120	2780	615	267	328	1010	34	0.05	
25-Jan-12	23.62	7.38	7.03	6580	6640	130	3160	595	273	347	980	33	0.06	
27-Apr-12	24.97	6.03	6.26	6190	5280	185	2670	604	286	331	957	33	0.38	
27-Jul-12	24.29	6.71	6.35	6350	5860	158	3530	622	308	345	985	33	0.61	
25-Oct-12	24.38	6.62	6.54	6820	5880	98	3280	599	362	380	1020	35	0.05	
24-Jan-13	23.70	7.30	6.07	6520	5430	2	3880	484	354	365	977	33	0.11	
22-Apr-13	24.01	6.99	5.74	5800	5340	46	3070	433	210	354	896	34	113	
24-Jul-13	24.61	6.39	5.76	6520	5720	85	3240	448	281	377	915	35	34.2	
22-Oct-13	23.92	7.08	4.63	6660	5480	1	3030	444	241	351	874	35	62.1	
02-May-14	24.48	6.52	6.2	6970										
29-Nov-14	24.17	6.83	3.5	6840	6390	5	3690	547	317	332	870	28	2.97	
24-Feb-15	23.98	7.02												
03-Jun-15	24.36	6.64	5.9	3820	1900									
26-Aug-15	24.27	6.73												
30-Nov-15	23.98	7.02	6.2	5550	5720	110	2700	400	290	330	960	37	71	
21-Mar-16	23.93	7.07												
25-May-16	23.84	7.16	6	3500	1800									
19-Aug-16	24.02	6.98												
30-Nov-16	23.89	7.11	5.2	3480	3190	15	1500	220	130	170	640	24	0.01	
27-Feb-17	24.03	6.97												
01-May-17	24.33	6.67	6.3	3740	2399									
31-Aug-17	23.97	7.03												
29-Nov-17	24.24	6.76	5.9	4670	4660	28	2600	390	240	270	990	29	17	
#### Bore PD4.1

#### Product Stockpile Pad

Date	RL	Depth (m)	рН	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	lron (mg/L)	Comments
20-Sep-10	5.23	21.35	7.17	12600	8200	520	306	3950	190	298	1980	32	0.05	
19-Oct-10	3.61	22.97	7.48	12800	7760	534	309	4390	188	291	2230	35	0.05	
14-Jan-11	2.42	24.16	7.16	13600	8290	548	359	4110	173	276	2180	38	0.05	
27-Apr-11	1.21	25.37	7.18	14800	7750	561	354	4130	178	301	2100	37	0.05	
25-Jul-11	-0.06	26.64	7.15	13700	7840	522	271	4230	176	295	2210	39	0.05	
26-Oct-11	2.36	24.22	7.53	13300	7760	461	387	4210	175	309	2350	43	0.05	
25-Jan-12	2.46	24.12	7.61	13100	8340	502	640	4320	164	331	2240	42	0.21	
27-Apr-12	14.00	12.58	6.24	2420	1890	28	1150	98	127	96	328	12	0.13	Case fail
27-Jul-12	22.97	3.61	6.34	6340	1950	27	1240	56	116	97	295	14	0.2	
25-Oct-12	23.98	2.60	6.54	10470	7350	244	2680	2040	198	402	1870	35	14.8	
24-Jan-13	24.13	2.45	6.64	10440	7040	324	2180	2600	189	352	1880	32	9.07	
22-Apr-13	22.89	3.69	6.59	10670	7700	284	1900	2600	191	384	2010	32	6.54	
24-Jul-13	21.35	5.23	6.78	11170	7400	303	1810	2560	209	386	1930	35	5.32	
28-Oct-13	19.88	6.70	7.09	11650	7460	353	1830	2640	192	360	1870	34	0.15	
02-May-14	18.69	7.89	7.06	11300										
29-Nov-14	18.41	8.17	7.2	10800	7610	400	1800	2810	193	321	1760	25	0.05	
24-Feb-15	15.93	10.65												
03-Jun-15	15.96	10.62	6.8	10760	5380									
26-Aug-15	13.18	13.40												
30-Nov-15	13.21	13.37	7.1	9200	7650	390	2000	2800	190	370	2300	39	0.04	
21-Mar-16	13.31	13.27												
25-May-16	14.62	11.96	5.9	2020	1010									
19-Aug-16	14.00	12.58												
30-Nov-16	14.08	12.50	6.7	4030	3200	130	980	720	150	160	780	20	0.14	
27-Feb-17	13.32	13.26												
01-May-17	13.37	13.21	7.1	2580	1638									
31-Aug-17	12.64	13.94												
29-Nov-17	12.70	13.88	6.7	4650	3660	150	1200	1000	160	180	930	21	0.07	

## Bore PD4.2 P

Product Stockpile Pad

Date	RL	Depth (m)	рН	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Iron (mg/L)	Comments
20-Sep-10	24.30	2.69	5.63	8390	7870	69	3900	1150	123	424	1500	30	19.5	
19-Oct-10	24.24	2.75	5.59	9060	8630	73	4870	438	163	527	1700	34	45	
14-Jan-11	24.31	2.68	5.4	9970	8880	55	5740	462	134	492	1790	37	36.8	
27-Apr-11	24.33	2.66	5.36	10800	8770	45	5470	398	147	531	1690	37	33	
25-Jul-11	24.99	2	4.32	9440	5990	1	4670	364	179	510	1540	37	0.87	
26-Oct-11	24.96	2.03	5.72	8220	4600	24	4550	358	261	520	1330	34	57.1	
25-Jan-12	24.80	2.19	5.63	7610	8550	7	4370	277	195	482	1180	31	50.6	
27-Apr-12	24.89	2.10	5.35	5890	5710	1	3210	230	168	366	930	26	63.3	
27-Jul-12	25.19	1.80	5.44	5440	6400	12	4260	238	182	415	1030	29	44.1	
25-Oct-12	24.46	2.53	3.82	7210	6780	1	4580	245	286	489	1110	31	65.4	
24-Jan-13	24.48	2.51	5.67	6760	5960	26	4940	176	298	465	1060	27	71	
22-Apr-13	24.98	2.01	5.16	6180	6430	22	4500	156	272	465	1030	26	89.2	
24-Jul-13	24.80	2.19	5.41	7160	6940	26	4410	184	351	475	1010	26	79.4	
28-Oct-13	24.34	2.65	5.7	7650	7390	1	4370	229	326	474	1050	26	77.5	
02-May-14	24.99	2.00	5.75	7100										
29-Nov-14	24.91	2.08	4.2	7300	7260	5	4600	338	410	403	958	21	16.5	
24-Feb-15	25.24	1.75												
03-Jun-15	25.28	1.71	5.5	7780	3870									
26-Aug-15	25.26	1.73												
30-Nov-15	25.29	1.70	5.9	5930	7310	49	4400	270	360	400	1100	31	50	
21-Mar-16	25.41	1.58												
25-May-16	25.39	1.60	5.5	6200	3400									
19-Aug-16	25.38	1.61												
30-Nov-16	25.26	1.73	5.5	5730	6640	25	3900	230	360	360	1000	25	0.06	
27-Feb-17	25.40	1.59												
01-May-17	25.41	1.58	6.6	5740	3681									
31-Aug-17	24.88	2.11												
29-Nov-17	25.02	1.97	6.2	5910	7420	49	4500	220	440	390	1200	26	36	

Bore PD7.1	So	uth Cut Bound	lary											
Date	RL	Depth (m)	рН	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Iron (mg/L)	Comments
20-Sep-10	17.13	10.37	6.71	4620										
19-Oct-10	16.94	10.56	6.57	4760	2640	418	477	1020	160	124	731	14	8.66	
14-Jan-11	16.78	10.72												No sample
27-Apr-11														No access
25-Jul-11														No access
26-Oct-11														No access
25-Jan-12	17.65	9.85	6.67	3020	1720	508	99	693	73	69	455	14	0.74	
27-Apr-12	19.08	8.42	5.71	2670	1850	30	434	571	75	77	408	11	13.9	
27-Jul-12	20.14	7.36	4.84	4840	1540	2	290	741	40	58	415	10	22.7	
31-Oct-12	17.48	10.02	6.44	3560	2340	211	507	848	132	110	587	14	32	
24-Jan-13	17.11	10.39	6.86	3620	2340	234	559	756	125	104	557	14	13.4	
22-Apr-13	19.52	7.98	5.15	1754	1210	7	243	446	25	36	340	7	0.27	
24-Jul-13	17.96	9.54	6.18	2220	1240	74	289	475	45	46	376	9	1.91	
28-Oct-13	17.31	10.19	6.32	7120	4680	95	444	1810	208	217	904	21	28.1	
02-May-14	17.36	10.14	5.87	12000										
29-Nov-14	17.05	10.45	6.5	8650	6420	187	562	2870	237	270	1130	19	31.3	
24-Feb-15	16.80	10.70												
03-Jun-15	16.95	10.55	6.1	6990	3480									
26-Aug-15	16.33	11.17												
30-Nov-15														Dry
21-Mar-16														Dry
25-May-16														Dry
19-Aug-16														Dry
30-Nov-16														Dry
27-Feb-17														Dry
01-May-17														Dry
31-Aug-17														Dry
29-Nov-17														Dry

## **APPENDIX D**

# **BLAST MONITORING RESULTS**

#### BLAST RESULTS 2017

 EPL No.
 396

 Licencee:
 Bloomfield Collieries Pty Ltd

 Premises:
 Bloomfield Colliery

 Four Mile Creek Rd
 Astonfield NSW 2323

Monitoring Frequency: Airblast Overpressure Limit: Ground Vibration Limit: Every blast 120 dB(Lin Peak) 10 mm/s



		Blast Monitor Location											
		EPA	ID No. 5 - Ell	iot's	EPA ID N	o. 4 - McNau	ighton's	EPA ID N	lo. 3 - Mt Vin	3 - Mt Vincent Rd		EPA ID No. 6 - Richa	
		Vibration	Airblast	Distance	Vibration	Airblast	Distance	Vibration	Airblast	Distance	Vibration	Airblast	Distance
Shot No.	Date & Time	(mm/s)	(dB)	Distance	(mm/s)	(dB)	Distance	(mm/s)	(dB)	Distance	(mm/s)	(dB)	Distance
6714	16/01/2017 1.52pm	1.21	108.2	1373	0.59	107.1	2053	0.73	92.4	2700	1.04	109.5	1848
6715	17/01/2017 1.52pm	0.26	105.8	1558	0.17	102.3	2043	0.09	101.8	2497	0.1	99.6	2107
6716	23/01/2017 10.02am	0.42	107.4	991	0.16	104.7	1907	0.12	97.8	3156	0.06	90.1	1747
6717	28/01/2017 9.45am	0.05	93.7	942	0.44	105.1	1824	0.13	100.2	3167	0.08	98.7	1836
6718	31/01/2017 1.58pm	0.2	109.9	952	0.09	109.6	1775	0.03	86.6	3129	0.05	91.4	1907
6719	2/02/2017 2.00pm	0.3	111	826	0.12	94.3	1693	0.12	108.8	3254	0.08	97.2	1955
6720	16/02/2017 1.54pm	1.94	98.9	985	0.55	102.7	1904	0.31	87	3162	0.68	100.8	1749
6721	23/02/2017 12.13pm	2.76	101.9	951	1.02	96.6	1852	0.24	91.3	3173	0.68	100.3	1803
6722	3/03/2017 11.53pm	2.23	99.1	975	0.64	94.2	1873	0.19	93.2	3153	0.69	103.2	1786
6723	8/03/2017 9.54am	2.11	101.7	865	0.48	98	1725	0.13	91	3219	0.48	95.2	1930
6724	15/03/2017 10.23am	0.14	97.5	2184	0.13	94.3	2644	0.09	98.3	1871	0.12	109	2110
6725	22/03/2017 1:00pm	0.23	107.4	2184	0.2	101.3	2644	0.13	97	1871	0.18	97.3	2110
6726	28/03/2017 2:10pm	0.26	96.6	2184	0.26	96.1	2644	0.19	100.5	1871	0.2	105.4	2110
6727	3/04/2017 10:49am	0.19	98.3	1684	0.17	95.6	2162	0.11	98.9	2370	0.13	104.9	2095
6728	11/04/2017 12:13pm	0.19	96.1	1690	0.11	99.5	2229	0.1	100.2	2365	0.11	98	1984
6729	18/05/2017 1.55pm	0.14	81	1271	0.08	97.7	1951	0.04	90.5	2793	0.07	104.3	1902
6730	25/05/2017 12:21pm	0.74	103.3	1106	0.47	100.4	1909	0.22	87	2988	0.54	95.8	1817
6731	26/05/2017 1:47pm	0.86	100.9	1264	0.37	100.7	1896	0.39	100.4	2792	0.61	109.1	1980
6732	31/05/2017 2:04pm	0.19	94	1303	0.12	100.6	2033	0.07	102	2784	0.16	96.8	1802
6733	1/06/2017 1:53pm	0.15	96.3	1335	0.1	99	2112	0.06	99.9	2783	0.13	96.1	1703
6734	14/06/2017 1:52pm	0.22	98	1241	0.08	98.2	2069	0.09	97.2	2996	0.17	98.7	1679
6735	19/06/2017 2:00pm	0.58	109	1231	0.51	104.2	1838	0.54	103.6	2822	0.5	106	2033
6736	22/06/2017 1:56	0.74	111.6	1334	0.57	102.9	1915	0.41	100.1	2719	0.42	110.2	2027
6737	3/07/2017 1:50pm	0.14	81	1366	0.28	97.2	1973	0.15	88.6	2690	0.25	104.8	1971
6738	10/07/2017 1:56pm	0.67	109.1	1452	0.36	105.5	2133	0.3	102.4	2630	0.48	97.7	1807
6739	13/07/2017 1:46pm	0.26	101.6	1283	0.1	98.3	2005	0.09	90	2798	0.15	99.6	1826
6740	21/07/2017 2:07pm	0.48	104.4	1154	0.22	101.5	1828	0.17	92.1	2903	0.27	97	1976
6741	21/07/2017 1:54pm	0.31	101.2	1376	0.13	97.1	2116	0.1	89	2725	0.23	93.2	1744
6742	25/07/2017 1:55pm	0.28	105.3	1333	0.15	101.6	2103	0.11	87.4	2780	0.23	92.9	1716
6743	3/08/2017 11.45pm	0.56	103.8	1404	0.42	103.3	2118	0.5	91.2	2687	1.02	107.1	1774
6744	8/08/2017 1:54pm	0.32	107.6	1264	0.12	106.2	1879	0.1	102.9	2789	0.13	89.1	2007
6745	12/08/2017 10:48am	0.26	107.5	1238	0.14	101.8	1945	0.1	94.4	2833	0.25	92.1	1876
6746	21/08/2017 1:48pm	0.27	103.2	1184	0.12	98.2	1912	0.09	84.9	2888	0.17	96.5	1878

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#### BLAST RESULTS 2017

 EPL No.
 396

 Licencee:
 Bloomfield Collieries Pty Ltd

 Premises:
 Bloomfield Colliery

 Four Mile Creek Rd
 Astonfield NSW 2323

Monitoring Frequency: Airblast Overpressure Limit: Ground Vibration Limit: Every blast 120 dB(Lin Peak) 10 mm/s



		Blast Monitor Location											
		EPA	ID No. 5 - Ell	iot's	EPA ID N	o. 4 - McNau	ughton's	EPA ID N	lo. 3 - Mt Vin	cent Rd	EPA II	D No. 6 - Rich	ards
		Vibration	Airblast	Distance	Vibration	Airblast	Distance	Vibration	Airblast	Distance	Vibration	Airblast	Distance
Shot No.	Date & Time	(mm/s)	(dB)	Distance	(mm/s)	(dB)	Distance	(mm/s)	(dB)	Distance	(mm/s)	(dB)	Distance
6747	23/08/2017 2:38pm	0.68	107.9	1488	0.36	104.4	2201	0.41	90.6	2614	0.73	102.6	1733
6748	23/08/2017 2:38pm	0.6	109.6	1458	0.4	102.1	2054	0.24	86.5	2598	0.18	105.1	1953
6749	29/08/2017 2:00pm	0.66	103.7	1400	0.68	101.5	1911	0.34	96.1	2656	0.44	107.1	2110
6750	7/09/2017 9:12am	0.34	110	1228	0.23	107.5	1852	0.19	87.7	2825	0.32	100.2	2011
6751	9/09/2017 11.23am	0.59	103.8	1264	0.29	100.4	1987	0.32	88.8	2815	0.45	94	1836
6752	12/09/2017 10:59am	0.4	106.2	1289	0.22	101.9	2055	0.16	88.2	2814	0.51	87.2	1750
6753	15/09/2017 1:55pm	0.6	109.3	1314	0.21	100.9	2109	0.2	86	2813	0.43	88.3	1685
6754	27/09/2017 10:22am	0.07	110.2	1256	0.06	106.6	1908	0.03	91	2802	0.04	102.4	1952
6755	29/09/2017 11:00am	0.07	103.2	1194	0.03	100.1	1863	0.02	95	2864	0.05	91.2	1961
6756	12/10/2017 1:54pm	0.85	117	1334	0.77	114.2	1889	0.7	96.5	2719	0.65	101.1	2067
6757	19/10/2017 1:55pm	0.71	107.6	1444	0.49	103	2050	0.39	88.8	2614	0.6	100.2	1941
6758	26/10/2017 1:49pm	0.11	101.4	1232	0.05	97.7	2058	0.06	91.5	2900	0.11	105.1	1690
6759	02/11/2017 1.49pm	0.13	105	1294	0.07	99.7	2074	0.05	92.5	2819	0.09	105.1	1723
6760	10/11/2017 9.57am	0.48	108.3	1175	0.26	104.8	1946	0.27	97.5	2913	0.34	108.5	1817
6761	13/11/2017 1:53pm	0.36	103.5	1085	0.23	104.3	1766	0.14	101.8	2970	0.23	104.8	2008
6762	20/11/2017 2:09pm	0.43	102.5	1084	0.31	96.8	1766	0.42	105.3	2971	0.52	107.9	2008
6763	20/11/2017 2:09pm	0.43	102.5	1084	0.31	96.8	1766	0.42	105.3	2971	0.52	107.9	2008
6764	24/11/2017 12:45pm	0.48	105.7	1147	0.42	100.5	1752	0.31	95.2	2906	0.33	107.6	2081
6765	29/11/2017 10:53am	0.24	101.9	1173	0.12	98.3	2000	0.11	91.8	2948	0.19	102	1731
6766	8/12/2017 11:10am	0.21	104.3	1264	0.13	97.3	2044	0.11	89.9	2843	0.22	99.6	1743
6767	13/12/2017 1:53pm	0.24	100.3	1136	0.21	92.4	1903	0.16	84.8	2945	0.18	106.6	1849
6768	18/12/2017 11:50am	0.3	102.8	1228	0.23	100.7	1935	0.16	87.3	2841	0.26	98	1883
6769	21/12/2017 9:10am	0.46	101	1098	0.27	98.5	1745	0.18	91.5	2955	0.19	100.7	2048

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# **APPENDIX E**

# **COMPLAINTS REGISTER**

#### **BLOOMFIELD COLLIERY**

#### COMPLAINTS REGISTER

2017



No.	About *	Time/Date	Location	Details	Action Taken / Findings
17_01	N	18/7/2017 7:58am	Black Hill	Complaint via Text message to Mine Manager. Complaint about noise the early hours of the previous evening.	Mine Manager text complainant on 18/7/17. Noise model indicated conditions suitable after 1 am therefore dayshift started at 1 am rather than running a nightshift from 10 pm. Examine options to possibly utilise lower dumps at night. Continue ground truthing of model to ensure confidence in modelling results.
17_02	D	10/10/2017 3:43pm	Thornton	Complaint via 'Website Feedback' email address. Complained about increase in dust settling on their property at Avalon Estate since they moved in four years ago.	Environmental Officer responded via email on 13/10/17. Outlined to the complainant that the washery coal stacker gantries are fitted with sprays and water carts used on the pads surrounding the stockpile areas. The closure of the Abel Underground Mine in 2016 resulted in coal throughput and train movements dropping by 75%. Bloomfield operates a network of dust gauges surrounding the mining operations since 1997 and includes one dust gauge next to Avalon Estate approx 300m from complainant's residence. The results from this gauge are within EPA criteria and show a slight downward trend over the past 5 years. The dust results are provided on our website within our Annual Environmental Management Report

No.	About *	Time/Date	Location	Details	Action Taken / Findings
17_03	В	12/10/2017	Black Hill	Complaint via phone to Mine Manager. Complaint about blast noise on 12/10/17.	Mine Manager rang compainant on 12/10/17. Explained that blast monitors indicate blast decibel results higher than normal but within allowable limits. The wind direction and wind speed at time of blast would have caused higher than normal impacts at their residence. Bloomfield do not normally blast under those conditions however a temporary blast manager was in charge. The temporary blast manager has been instructed not to blast under similar weather conditions.
17_04	В	12/10/2017 3:12pm	Black Hill	Complaint via 'Hotline'. Complaint about blast noise on 12/10/17.	Mine Manager rang compainant on 12/10/17. Explained that blast monitors indicate blast decibel results higher than normal but within allowable limits. The wind direction and wind speed at time of blast would have caused higher than normal impacts at their residence. Bloomfield do not normally blast under those conditions however a temporary blast manager was in charge. The temporary blast manager has been instructed not to blast under similar weather conditions.

\* D = Dust, N = Noise, B = Blasting, V = Visual, L = Lighting, W = Weeds, O = Other

# APPENDIX F



ABN 76 000 106 972

12 January 2017

PO Box 4 East Maitland NSW 2323

Four Mile Creek Road Ashtonfield NSW 2323 AUSTRALIA

The Regional Manager NSW Environment Protection Authority PO Box 488G NEWCASTLE NSW 2300

TEL +61 2 4930 2600 FAX+61 2 49338940

Attention: Emma Paull

Dear Emma,

## RE: EPA Pollution Line Reference No. C00203-2017

This letter is submitted to comply with EPL396 Condition R2.2 to provide written details of the above notification.

## Background

On the 2 January 2017 a 72 hour water discharge was begun at Bloomfield Colliery in accordance with EPL 396 water discharge conditions.

Laboratory analysis of the discharge sample for the first 24 hour period recorded a Total Suspended Solids (TSS) of 33 mg/l which was an exceedance of the EPL concentration limit of 30 mg/l. Once the exceedance was confirmed by the laboratory, the incident was reported to the EPA Pollution Line on 6 January 2017. The report was logged and the Reference Number C00203-2017 issued.

#### Discharge Event

On the morning of 2 January 2017 a total of 27mm of rain was recorded in an on-site automated weather station and a 72 hour discharge was carried out in accordance with EPL 396 water discharge conditions (Condition L3.2).

A sample for the first 24hr period was tested prior to discharge to ensure compliance with concentration limits as per Bloomfield procedure. Electrical Conductivity (EC) and pH were determined to be within allowable limits. An indicative TSS level was established using a Turbidity Meter which was found to be approximately 38 NTU and the release went ahead on this basis. Based on experience with Bloomfield discharge waters a Turbidity Meter reading of <40 NTU has met TSS limit of 30mg/l.

A sample was also collected for analysis at a NATA Accredited Laboratory as per Bloomfield procedure. Since the discharge commenced on Monday 2 January 2017, a public holiday, the laboratory sample was not able to be analysed until the following day.

## Discharge Results

The laboratory analysis of the first 24 hr discharge period sample recorded a TSS level of 33 mg/l which exceeded the EPL limit by 3 mg/l. The laboratory results for the water discharge sampling for the first 24 hr period are outlined in Table 1.

EPA Id No.	Pollutant / Volume	EPL Limit	Result
Point 1	Conductivity (µs/cm)	6000	4710
	рН	6.5 - 8.5	7.7
	TSS (mg/L)	30	33
	Filtered Iron (mg/L)	1	NYA <sup>1</sup>
Point 2	Conductivity (µs/cm)	-	3440
	рН	-	7.6
	TSS (mg/L)	-	13

Table	1	_	First	24	Hr	Period

The laboratory analysis of the discharge sample recorded a TSS level of 33 mg/l which exceeded the EPL limit by 3 mg/l.

A sample collected downstream at Point 2 recorded a TSS level of 13 mg/l during the first 24 hr discharge period indicating dilution of the discharge waters.

TSS analysis for the second and third 24 hr periods of the discharge were both within EPL limits at 8 mg/l and 7 mg/l respectively.

## <u>Conclusion</u>

The laboratory analysis showed that the sample exceeded to EPL limit by just 3 mg/l. The EPL 396 discharge limit for TSS of 30 mg/l is low when compared other licenced premises which are usually set at 50 mg/l.

A sample collected downstream recorded a TSS level of 13 mg/l during the first 24 hr discharge period indicating dilution of the discharge waters. Sample analysis for the second and third 24 hr periods of the discharge were both within EPL limits.

The 3 mg/l exceedance of the EPL limit for the first 24 hour period is not considered to pose a risk of harm to the environment. If you require any further information in regard to this matter please contact myself at this office.

<sup>&</sup>lt;sup>1</sup> NYA – Not yet available.

Yours faithfully BLOOMFIELD COLLIERIES PTY LIMITED

Gragland .

Greg Lamb Environmental Officer

☎ (02) 49302689
 ☑ glamb@bloomcoll.com.au



ABN 76 000 106 972

20 October 2017

The Regional Manager NSW Environment Protection Authority PO Box 488G NEWCASTLE NSW 2300 PO Box 4 East Maitland NSW 2323

Four Mile Creek Road Ashtonfield NSW 2323 AUSTRALIA

TEL +61 2 4930 2600 FAX+61 2 49338940

Attention: Emma Paull

Dear Emma,

## RE: EPA Pollution Line Reference No. C15526-2017

This letter is submitted to comply with EPL396 Condition R2.2 to provide written details of the above notification.

#### Background

At 6:30 am on the 13 October 2017 a Bloomfield operator was conducting a pipeline / pump inspection adjacent to the tailings dam area at Bloomfield Colliery. During the inspection a ruptured polypipe was discovered resulting in water discharging off the mine site. The pump was immediately shut down and investigations began.

The pipe failure was caused by a broken pipe weld resulting in water flowing to a clean water sediment dam and discharging offsite into an intermittent drainage line known as Shamrock Creek, a tributary of Four Mile Creek. No flow from the discharge made it into Four Mile Creek. See Figure 1.

The incident was reported to the EPA Pollution Line at 10:00 am on 13 October 2017 and the report was logged and the Reference Number C15526-2017 issued. Subsequent notification was provided to the NSW Department of Planning- Compliance and the Division of Resource and Geoscience- Environmental Sustainability Unit.

## Discharge Event

An investigation into the incident is summarised as follows:

• Seepage water is collected in a sump located on the boundary of the site and is pumped back to site to be included in the raw water system and used in the Coal Handling

Preparation Plant (CHPP) and for dust suppression. The water from this seepage collection point does not contain tailings of any nature.



Figure 1

- The pipeline and pump was inspected at 2:00 pm on 12 October 2017 and everything was intact and functioning properly.
- A review of pump amp records indicated that the pipe may have ruptured at approximately 2:30 pm on 12 October 2017. See Photo 1.



Photo 1 - Ruptured Polypipe

- The ruptured pipeline was discovered at 6:30 am on 13 October 2017, indicating it may have been running for 16 hours. The pump was immediately shut off.
- Based on pump capacity data, it is estimated that up to 6 megalitres of water may have been pumped during this time.
- Water from the ruptured pipeline flowed into a clean water dam. Due to very low rainfall the dam was dry prior to the incident. See Photo 2
- The dam overtopped through a spillway and flowed into Shamrock Creek, a tributary of Four Mile Creek.
- After discovery of the ruptured pipeline an excavator was used to divert water leaving the clean water dam to the seepage sump to prevent further water leaving the site.
- An inspection was undertaken which confirmed that the water did not reach Four Mile Creek. Due to low rainfall both creeks were dry at the time of the incident. The Shamrock Creek / Four Mile Creek junction was inspected after the incident and later that day. See Photo 3.
- All water from this event was contained within Bloomfield owned land, however the water did discharge beyond the EPL 396 and ML1738 boundary.



Photo 2 - Clean Water Dam



Photo 3 - Four Mile Creek and Shamrock Creek junction

## Sample Results

Water sampling was undertaken at the spill point of the clean water dam which is representative of the water which discharged offsite. The results for the water sampling is outlined in Table 1.

Analyte	Units	Dam	EPL 396 Discharge Limit
рН	pH units	7.2	6.5 - 8.5
Electrical Conductivity	uS/cm	6600	6000
Total Suspended Solids	mg/L	5	30
Dissolved Iron	mg/L	<0.01	1

## Table 1 - Sample Results

Bloomfield Colliery holds a license in accordance with EPL 396 to discharge waters after rainfall events greater than 10mm into the Four Mile Creek watercourse. The analytes in Table 1 are the pollutants listed in EPL 396 required to be tested during a licenced discharge event. The table shows the discharge pollutant limits along with the sample results. It shows that the results are similar to qualities that would be allowed to be discharged under EPL 396 with the exception of EC which exceeds limits by 10%. It should be noted that no rainfall occurred prior to this event and the water was not discharged from the licensed discharge point.

#### Outcome / Follow Up

As an outcome of the investigation the following works will be implemented to reduce the risk for a repeat of the incident:

- Replacement and relocation of the seepage pipeline as shown in Figure 2. This pipe will be replaced and relocated which will allow water to be pumped directly to the tailings dam and removal of the pipeline to the CHPP that ruptured. The seepage pumped to the tailings dam would then be re-used in the CHPP through the existing recycle water system.
- Installation of a monitoring system to detect changes in pump motor amps. If amp levels change (which would occur due to pipe rupture), the system will send an alarm to the CHPP operator.
- The new pipeline to the tailings dam will be double skinned to direct any flow from a potential rupture back into the sump.
- Inspect the junction of Shamrock and Four Mile Creek after the next rainfall event/s to monitor and sample the quality of any water flow to assess any environmental impact of the discharged waters. It is expected that rainfall will dramatically reduce the electrical conductivity of any water which enters Four Mile Creek.
- A review of the raw water reticulation system to identify any other potential areas where a pipe failure could result in discharge offsite. These areas will risk assessed and controls implemented to reduce the risk of accidental discharge. This may include the installation of leak detection systems and alarms, revision to pipe location, and double skinning of current pipes.



Figure 2 - Pipeline Changes

The seepage collection sump is located on the northern boundary of the Bloomfield mining lease in proximity of the previous Delta Colliery underground workings. As part of future mine closure planning requirements an assessment of potential influence from these workings may be required.

If you require any further information in regard to this matter please contact myself at this office.

Yours faithfully BLOOMFIELD COLLIERIES PTY LIMITED

und.

Greg Lamb Environmental Officer

☎ (02) 49302689
 ☑ glamb@bloomcoll.com.au



ABN 76 000 106 972

21 November 2017

PO Box 4 East Maitland NSW 2323

The Regional Manager NSW Environment Protection Authority PO Box 488G NEWCASTLE NSW 2300

Ashtonfield NSW 2323 AUSTRALIA

Four Mile Creek Road

TEL +61 2 4930 2600 FAX+61 2 49338940

Attention: Lisa Richards

Dear Lisa,

RE: Pipeline break, water discharge- C15526-I15528 (DOC17/544208; EF13/2650)

This letter is submitted in response to letter dated 10 November 2017 requesting further information regarding the pipeline break and water discharge event on 13 October 2017 at Bloomfield Colliery.

A review has been undertaken of the current site risk assessment, operational procedures and controls in place at the time of the incident. The 2015 site risk assessment did not identify the specific risk of rupture and offsite discharge of this line. Interim safeguards such as the installation of Citec remote monitoring had been installed however the alarms had not been set in consideration of pipeline failure, only critical motor protection. Operational procedures at the time of the event had developed as the requirement and use of this pump had increased to manage legacy issues of the neighboring Delta Colliery. These operational procedures included daily visual line inspections by the pump crew when pumps were operating.

The site procedures in place at the time of the incident were not considered to require documentation as part of the inspection and maintenance procedures in place. No supporting documentation can be supplied with this report.

The Bloomfield Group is committed to environmental compliance and has conducted a thorough risk assessment in response to this incident to significantly minimise any future risks. As part of this risk assessment a number of actions were identified which included documenting inspection and maintenance procedures and recording daily inspections. This risk assessment contains commitments of increased infrastructure for raw water and tailings management including capital expenditure and proposed timing for implementation of the associated works. A copy of the risk assessment is attached in Appendix 1 for your review.

The current Pollution Incident Management Plan (PIRMP) details a response procedure to an incident of this nature. The PIRMP was initiated in response to this event and is attached for your reference. (Appendix 2).

Update on action progress in response to discharge event.

An update on the list of follow up actions noted in the incident report dated 20 October is provided below;

• Replacement and relocation of the Seepage Line has been completed and was inspected by EPA on 10 November 2017. A windrow has been installed at the bottom of the pipe as an interim measure to direct any flow back into the pump sump.





- Daily inspections are undertaken while pumping form this location by the pump crew.
- The pipeline to provide a second skin has arrived at site and will be installed commencing by 24 November 2017. (see photo 2).

Photo 2: pipeline for "double skinning" onsite. (Dated 14 November 2017).



- Installation of a monitoring system to detect changes in pump motor Amps (under current / over current alarms) for loss of pump flow has been completed. A copy of the test email dated 16/11/2017 is attached in Appendix 3.
- The review of the raw water reticulation system has been completed and a risk assessment has been undertaken on all raw water and tailings infrastructure. The completed risk assessment is attached as Appendix 1 of this report and provides a risk ranking for each section along with commitments for completion of additional controls to minimize operational risk.

## Results of flow event - Shamrock Creek 8 November 2017.

Within the incident report to EPA dated 20 October, Bloomfield committed to conduct inspections at the Shamrock Creek, Four Mile Creek intersection following rain events. During the inspection on 8 November, following consecutive days of rain since 4 November, water was noted flowing from Shamrock Creek into Four Mile Creek. Sampling was undertaken at the three following locations;

- Shamrock Creek, prior to entering Four Mile Creek
- Four Mile Creek, upstream from the confluence with Shamrock Creek
- Four Mile Creek, downstream from the confluence with Shamrock Creek.

#### The results of the sampling is shown in table 1.

Table	1٠	Sample	Results	8	November	2017
Table		Jampie	Nesuus	υ	NUVCHIDCI	2017.

Physical Components	Units	Method	Lowest Reading	5024/1	5024/2	5024/3
				Shamrock	4 Mile -	4 mile -
				8/11/2017	8/11/2017	8/11/2017
Temperature	°C	Temp	0.1	21.4	21.3	21.2
рН	pH Units	VGT-WI/01	0.1	7.6	8.0	7.9
Electrical Conductivity	µS/cm	VGT-WI/02	50	5,5 <mark>1</mark> 0	4,160	4,500
Total Suspended Solids	mg/L	VGT-WI/03A AS3550.4	1	3	8	4
Test Description	Units	Method	Lowest Reading	5024/1	5024/2	5024/3
				Shamrock	4 Mile - Upstream	4 mile - Downstream
				8/11/2017	8/11/2017	8/11/2017
Dissolved Iron*	mg/L	EXT	0.01	0.04	0.04	0.02

Sampling of the discharge water at the date of the incident (13 October 2017) exhibited electrical conductivity results of 6,600 microsiemens. Electrical conductivity results from the samples obtained on 8<sup>th</sup> November showed that dilution of the discharge water had occurred due to recent rainfall resulting in a reduction of EC to 5,500 microsiemens. Downstream results of the sample from Four Mile Creek showed that the addition of water from Shamrock Creek increased the electrical conductivity in Four Mile Creek by 340 microsiemens. Rainfall from 13 October (discharge event), till 8 November inclusive totaled 119.8 mm which diluted the water prior to entering Four Mile Creek. A graph detailing rainfall for the period is shown in graph 1.



Graph 1. Total and Cumulative rainfall for the period 13 October - 8 November 2017.

A copy of the analytical report is attached in Appendix 4 of this report.

As noted in the previous report submitted on 20 October, Bloomfield Colliery holds a license in accordance with EPL 396 to discharge waters after rainfall events greater than 10mm into the Four Mile Creek watercourse. Table 2 lists the EPL 396 discharge limits for a licensed discharge event.

Analyte	<u>Units</u>	EPL 396 Discharge Limit
рН	pH units	6.5-8.5
Electrical Conductivity	uS/cm	6000
Total Suspended Solids	mg/L	30
Dissolved Iron	mg/L	1

The three samples taken on 8 November 2017 within the Shamrock and Four Mile Creeks are under the EPL 656 discharge criteria. It should be noted that this flow into the Four Mile Creek occurred after an 11 mm rain event the previous day. Given the rainfall event, Bloomfield were permitted to discharge, however did not do so on the 8 November from the licensed discharge point.

The Bloomfield Group is committed to environmental compliance and is regretful that this event has occurred. Bloomfield commits that the items within the Risk Assessment are completed by the dates noted and will undertake a similar risk assessment at all other Bloomfield mining operations. An internal review of all current operational and maintenance procedures associated with raw water and tailings reticulation will also be undertaken and documented at all sites. A report on the status of the implementation of infrastructure works at Bloomfield will be provided quarterly to EPA till completed.

If you require any further information in regard to this matter please contact this office.

Yours faithfully BLOOMFIELD COLLIERIES PTY LIMITED

Chris Knight Environment Manager The Bloomfield Group - Celebrating over 80 years in Business PO Box 4, EAST MAITLAND NSW 2323 Tele: 612 6578 8824 | Fax: 02 6571 1066 | Mob: 0403 058 777 Email: cknight@bloomcoll.com.au | Website: www.bloomcoll.com.au