Enhance Place Pty Limited
ABN: 31 077 105 867

PINE DALE MINE

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT 2014

Prepared by: Enhance Place Pty Ltd
February 2015

TITLE

Name of Mine:	Pine Dale Mine
Titles/Mining Leases:	ML1569, ML1578, ML1664, ML 1637
Project Approval Number:	10_0041
MOP Commencement Date	April 2014
MOP Completion Date	April 2017
AEMR Commencement Date:	1 January 2014
AEMR Completion Date:	31 December 2014
Name of Leaseholder:	Enhance Place Pty Limited
Reporting Officer:	Mr Graham Goodwin
Title:	Manager of Mining Engineering

CONTENTS

LIST OF PLANS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

EXECUTIVE SUMMARY

Energy Australia (EA) owns Enhance Place Pty Ltd (Enhance Place) which operates the Pine Dale Mine located approximately 17km northwest of Lithgow in the Western Coalfields of New South Wales.

Coal extraction was most recently undertaken within the Yarraboldy Extension consistent with Project Approval 10_0041 (Approval). Granted by the Minister for Planning and Infrastructure on 20 February 2011, the Approval provided for the extraction of up to 800,000 tonnes of Run of Mine coal through to 31st December 2014. In April 2014 approved mineable resources were exhausted with the mine then entering into care and maintenance.

The Pine Dale Mine Annual Environmental Management Report (AEMR) has been prepared pursuant to Schedule 5, Condition 3 of the Project Approval 10_0041 and in accordance with the *Department of Trade and Investment - Division of Resources and Energy Guidelines to the Mining, Rehabilitation and Environmental Management Process* (EDG03).

The Pine Dale Mine achieved an acceptable standard of environmental performance during the reporting period as evidenced by the following:

- Air quality monitoring results recorded during the reporting period for depositional dust, total suspended particulates (TSP) and fine particulate matter (PM_{10}) were well below the NSW Environmental Protection Authority (EPA) assessment criteria in Blackmans Flat and other privately owned properties adjacent to Enhance Place Mining Leases;
- There were no noise exceedances from mining activities recorded at privately owned properties recorded during the reporting period;
- Blasting impacts were managed within the assessment criteria limits for overpressure and ground vibration with no exceedances recorded during the reporting period;
- There were no surface water discharge events during the reporting period; and,
- Water monitoring results were compliant with Environment Protection Licence 4911.

During the reporting period, an assessment of rehabilitation areas was completed (refer to Appendix C). Rehabilitation areas are generally stable in Areas A and B with an overall reduction in weed presence. In the 2015 reporting period it is recommended to continue weed management and implement strategies to enhance pasture establishment within Area C and along contour drains.

1 INTRODUCTION AND GENERAL OBJECTIVES

EnergyAustralia (EA) owns Enhance Place Pty Ltd (Enhance Place) which operates the Pine Dale Mine near Lithgow in the Western Coalfields of New South Wales (refer to Plan 1.) EA acquired the Pine Dale Mine in June 2012.

Pine Dale Mine is located at Blackmans Flat, 17km north of Lithgow off the Castlereagh Highway. The site is approximately 3km via the Castlereagh highway from the Mt. Piper Power Station (MPPS) and immediately across the Highway from the Springvale Joint Venture Coal Preparation & Handling Facility.

This Annual Environmental Management Report (AEMR) refers to the environment and community performance of the Pine Dale Mine from 1 January 2014 to 31 December 2014 (Reporting period).

This report has been prepared in accordance with the *Department of Trade and Investment - Division of Resources and Energy (DRE) Guidelines to the Mining, Rehabilitation and Environmental Management Process* (EDG03).

This AEMR has been prepared pursuant to Schedule 5, Condition 3 of Project Approval (PA) 10_0041 granted by the Department of Planning and Infrastructure (DP&I) under section 75J of the Environmental Planning & Assessment Act 1979 (EP&A Act) on 20 February 2011.

The Yarraboldy Extension PA10_0041 provides for the extraction of up to 800,000 tonnes (t) of Run of Mine (ROM) through to 31 December 2014 at a maximum rate of 350,000 tonnes per annum (tpa).

During the reporting period, mining extraction occurred from January through March 2014 when Approved mining resources were exhausted. For the remainder of the reporting period, the mine has been in care and maintenance, and rehabilitation activities have been undertaken.

This AEMR is distributed to the following stakeholders:

- NSW Department of Planning & Environment;
- NSW Division of Resources and Energy;
- Environment Protection Authority (EPA);
- NSW Office of Environment and Heritage (OEH);
- NSW Office of Water (NOW);
- Forest Corporation of NSW; and,
- Lithgow City Council (LCC).

1.1 Consents, Leases and Licences

Pine Dale Mine operates in accordance with relevant licenses and approvals which are summarised in **Table 1**.

Table 1
Status of Consents, Leases and Licences

Permit Type	Permit Number	Relevant Dates	Description
Project Approval	PA 10_0041	Granted 20 February 2012 Expires 31 December 2014	Granted by Minister of DP&I, Section 75J of the EP&A Act. A modification to PA 10_0041 was granted in March 2012.
Environmental Protection Licence	EPL 4911	Review Due Date 29 Aug 2018	EPL held by Enhance Place Pty Ltd
Mining Lease	ML1578 (Act 1992)	Granted 15 March 2006	ML 1578 incorporates 69.4ha of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML 1569 (Act 1992)	Granted 4 July 2007	ML1569 incorporates 161 ha within the boundary of the Pine Dale Mine, Yarraboldy Extension.
Mining Lease	ML1664 (Act 1992)	Granted 10 January 2012	ML 1664 incorporates 4.1 ha of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML1637	Granted 18 June 2012	ML1637 incorporates 6.108 ha to the south east of the Pine Dale Mine, for the purposes of constructing, maintaining or using a railway.
Bore Licence	10BL165933	Granted 22 December 2005	Issued by the Department of Natural Resources (DNR) under Part 5 of the Water Act 1912 for the use of six piezometers for monitoring groundwater levels and quality.
Bore Licence	10BL604181	Dated 23 November 2010	This licence was issued by DECCW – NOW under Part 5 of the *Water Act 1912* for interception and use of up to 200ML of groundwater per year.
Flood Control Works Licence	10CW801601	Dated 23 December 2005	Issued by the DNR under Part 8 of the *Water Act 1912* for the construction of noise/flood bunding along the boundaries of Mining Areas A, B and C.

1.2 Actions Required from Previous AEMR Review

A letter of acceptance for the 2013 AEMR was received from DRE on 16 July 2014. Actions required by DRE and where they have been addressed in the 2014 AEMR are provided in **Table 2**.

Table 2
Actions Required from 2013 AEMR Review

Item	Action Required (2013 AEMR)	AEMR Section
1	*No results provided of the Purple Copper Butterfly monitoring – Provide results for the Purple Copper Butterfly monitoring in next year's AEMR.*	Section 3.7
2	*Results of monitoring against the rehabilitation completion criteria – DRE requests that monitoring is undertaken against the rehabilitation completion criteria and results are reported in the rehabilitation section of future AEMR's.*	Appendix C
4	*Water management structures within Area C appear to be controlling erosion on the sloped sections. These structures are largely bare earth – Pine Dale should consider seeding the exposed earth within the water management structures in Area C.*	Section 6

1.3 Mine Contacts

The Contact details for Pine Dale Mine are listed in **Table 3**.

Table 3
Mine Contacts

Contact Person	Position	Telephone	Facsimile
Mr Graham Goodwin	Manager of Mine Engineering	(02) 6355 7893	(02) 6355 7894

2 SUMMARY OF OPERATIONS

2.1 Exploration

There was no exploration drilling activities carried out at the Pine Dale Mine during the reporting period.

2.2 Land Preparation

Land preparation, which occurs directly in advance of open cut mining, involves the clearing of generally remnant vegetation, stripping and removal of topsoil, subsoil and clay, and the removal of overburden by trucks. The waste rock is loaded by an excavator into the haul trucks where it is transported to previously mined areas waiting to be backfilled.

During the reporting period, 5 ha of the Yarraboldy Extension was cleared and mined. This involved the clearing and stripping of vegetation, topsoil, subsoil, clay and overburden. Mining and land clearing activities during the reporting period are discussed in more detail in **Section 2.4**.

2.3 Construction

No construction work was undertaken at the Pine Dale Mine during the reporting period.

2.4 Mining

Pine Dale Mine uses an excavator and fleet of trucks for the extraction of coal from multiple seams and the removal of overburden. The overburden and interburden waste rock is removed using a combination of rip, push and blasting methods. Blasted and ripped waste rock is loaded by an excavator into the haul trucks where it is transported to previously mined areas waiting to be backfilled.

Mining commenced north of the Private Haul Road in the western section of the Yarraboldy Extension area and progressed east for the first three months of the reporting period.

Operational mining and the last coal sales ceased at the end of March 2014 as all of the approved minable reserves at the Pine Dale Mine had been exhausted (see **Plan 5**). This is generally consistent with the forecasted 2014 duration of mining provided in the 2013 AEMR.

During the reporting period 56,212t of ROM coal was extracted at Pine Dale Mine which is within the approved 350,000 tpa of ROM coal permissible under PA 10_0041. The production and waste volumes during the reporting period are summarised in **Table 4**.

During the 2014 Report period, Pine Dale Mine used the Minex mining software package to assist with improving production and overburden estimates.

Table 4
Production and Waste Summary

	Cumulative Production		
	Start of Reporting Period	**End of Reporting Period**	**End of Next Reporting Period (estimated)**
Topsoil Stripped	30,862 m^3	30862m^3	0
Topsoil used/spread	25,026 m^3	31526 m^3	0
Waste Rock	13,212,742 m^3	15,157,864 m^3	0
Ore	n/a	n/a	n/a
Processing Waste	n/a	n/a	n/a
Product	1,490,159 t	1,546,371 t	0

2.5 Coal Processing

There is no Coal Preparation Plant at the Pine Dale Mine and so no processing waste is produced. All ROM coal extracted from the open cut is transported by haul trucks to the onsite coal crushing plant where it is sized and screened into product coal with a top size ≤50 mm. The screened coal is either temporarily stockpiled or transported directly to the MPPS. At the completion of mining extraction, the coal crushing plant has been decommissioned.

COAL TRANSPORTING

Product coal is delivered to the MPPS by covered road trucks via the Angus Place to MPPS Private Haul Road. In accordance with PA 10_0014, coal transport activities occur between the hours of 7:00am to 8:00pm, Monday to Saturday, and at no time on Sundays or public holidays. Pursuant to Schedule 3, Condition 35 of PA 10_0041, no product coal was transported to the MPPS via the Castlereagh Highway during the reporting period. No product coal was transported to any other customer during the reporting period.

2.6 Waste Management

Overburden and interburden is placed in waste dumps until shaping of the final land formation is required. No overburden or interburden was removed from site during the reporting period.

All hydrocarbon products are securely stored within a bund to prevent any land or water contamination. Hydrocarbons from equipment maintenance undertaken on the site were collected in drums and removed from site by the Mining Contractor.

All general wastes originating from the office, amenities, ablutions and first-aid facilities, together with routine maintenance consumables from the servicing of mobile equipment (e.g. air filters) are disposed of in closed garbage bins located adjacent to the amenities building. The bins are collected weekly by licensed waste contractors (SITA Lithgow) and the contents disposed of at Council's Waste Depot. All recyclables are placed in separate bins for collection and recycling.

2.7 Product Stockpiles

When mining extractions activities were being undertaken, the capacity of the ROM stockpile was 20,000 t whilst the capacity of the product stockpile was limited to 5,000 t. The ROM stockpile or product stockpile was not enlarged during the reporting

period outside of the capacity approved under PA 10_0041. As the mine entered into care and maintenance, the product stockpiles were decommissioned.

2.8 Water Management

On a regional scale, the Pine Dale Mine lies within the Neubeck's Creek catchment which is a sub-catchment of the Upper Cox's River catchment, which in turn is part of the Warragamba Catchment, administered by the Sydney Catchment Authority.

The runoff from the surrounding area reports to the Cox's River via Neubeck's Creek (a perennial tributary) which runs into Blue Lake, a former open cut mining void. Neubeck's Creek is understood to flow intermittently (noting that many of its tributaries are temporary), with flows influenced by water discharges from other upstream industrial land uses.

The water management system at Pine Dale Mine has been designed as a closed loop system, with all clean water diverted around the mining site. It is also designed not to discharge any water from the site into Neubeck's Creek unless required to under an emergency. Drainage of surface water within the site is generally to the south and southeast following the natural topography for treatment prior to discharge into the underground workings (see Plan 4). The runoff from the north is captured in temporary sumps and used as dust suppression when required.

STORED WATER

There are no permanent water storage structures at the Pine Dale Mine. Clean water diversion structures are utilised at the site in conjunction with temporary sediment ponds. Temporary sediment ponds are constructed downslope of disturbed areas to ensure the capture of 'dirty' water and treatment prior to discharge into the underground workings.

GROUND WATER

There was no measurable groundwater intercepted during the reporting period. More details and results of groundwater monitoring are discussed in **Section 3.5**.

SURFACE WATER

During the reporting period, all surface water monitoring at the Pine Dale Mine was undertaken in accordance with EPL 4911. Table 5 details the locations, frequency and sampling methods for surface water monitoring. The parameters analysed were consistent with the requirements of EPL 4911 and results of surface water monitoring are discussed in Section 3.4 and at Appendix B.

No discharge of waters via LDP13 occurred during the reporting period.

Potable Water for use in the offices and amenities is sourced from town water mains supply.

Table 5
Surface Water Monitoring Locations and Frequency

Monitoring Location	Type of Monitoring Point	Frequency	Sampling Method
Point 2	Ambient Water Monitoring	*Quarterly*	Grab sample for Oil & Grease, TSS, filtered iron and sulphate concentrations. Probe for pH, Electrical Conductivity and Turbidity measurements.
		Daily during discharge for pH, EC and turbidity	
Point 3	Ambient Water Monitoring	*Quarterly*	
		Daily during discharge for pH, EC and Turbidity	
LDP 13	Discharge monitoring (to surface water)	*Weekly during discharge*	
		Daily during discharge for pH, EC and Turbidity	
Point 14	Ambient Water Monitoring	*Quarterly*	
		Daily during discharge for pH, EC and turbidity	

2.9 Hazardous Materials Management

During mining activity, hazardous materials stored on site are limited to bulk storage of diesel fuel and small quantities of miscellaneous chemicals for vehicle maintenance (i.e. oils and lubricants). The diesel storage capacity at the Pine Dale Mine is 30,000L and is stored in a tank located within a bunded steel container with lockable doors. It is located together with the associated bowser in the fuel bay in the northern corner of the maintenance area. Diesel fuel is delivered to site by a mobile diesel tanker as required.

There are no bulk oils stored on site. Oils are brought onto site as required by the Mining Contractor. Waste oil and oil drums are removed from site by the Mining Contractor for disposal. Material Safety Data Sheets (MSDS) accompany the materials on site and are kept in a folder with the Hazardous Materials Register, located in the main office.

During the care and maintenance term, fuel and oils will be held on site in the event machinery is required to assist with rehabilitation activities.

2.10 Other Infrastructure Management

There is no other infrastructure outside that described above at the Pine Dale Mine.

3 ENVIRONMENTAL MANAGEMENT

The Pine Dale Mine regards sound environmental performance and community liaison as integral components of its operations. Pine Dale Mine seeks to:

- Minimise the impact of its operations on the environment through effective environmental management;
- Communicate with the community, consider its concerns and expectations and move to a solution;
- Ensure that employees and contractors recognise they are accountable for their actions;
- Comply with applicable environmental laws and other obligations;
- Use effective environmental management to comply with all environmental laws and minimise adverse environmental impacts;
- Provide awareness training for employees;
- Monitor, audit, and review performance;
- Communicate with key stakeholders, the community and government;
- Promote active employee participation to continuously improve environmental management and performance;
- Reduce and reuse waste where practicable; and
- Undertake appropriate decommissioning and rehabilitation.

Environmental Monitoring

The monitoring program in the MOP provides a reference for all the environmental monitoring procedures and timing for monitoring to be undertaken during the care and maintenance of the Pine Dale Mine.

Locations of monitoring sites are shown in **Appendix A**.

Risk Assessment

In order to identify areas where mining and mining related activities have the potential to place the natural environment at risk, the risk matrix shown in

Table 6 has been developed for the Pine Dale Mine. The identification and assessment of environmental risks at the mine has allowed appropriate management plans and procedures to be developed to minimise the potential risk to the environment.

Table 6
Environmental and Rehabilitation Risk Matrix

	Issue	Land preparation, vegetation and topsoil stripping[6]	All construction activities including earth moving[6]	Mine development and mining, surface and underground[6]	Use/maintenance of roads, tracks and equipment	Waste rock emplacement management	Mineral processing facilities and infrastructure	Ore/product stockpiling and handling[6]	Water management including term event contingencies	Hazardous materials and fuel, handling/spills management	Sewerage	Rubbish disposal	Rehabilitation activities	Rehabilitated land and remaining features
Air Quality	Air pollution – dust/other	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
Water	Erosion / sediment minimisation	✓	✓		✓		✓	✓					✓	
	Surface water pollution[1]	✓	✓		✓		✓	✓		✓	✓	✓	✓	
	Ground water pollution			✓					✓					
Soil	Contaminated or polluted land	✓	✓	✓	✓								✓	
Flora	Threatened flora protection	✓	✓											
Fauna	Threatened fauna protection	✓	✓											
Flora	Weed control and management	✓	✓		✓								✓	✓
Noise	Operational noise	✓	✓	✓	✓		✓	✓					✓	
	Vibration / air blast				✓									
Visual Amenity	Visual amenity, stray light[2]	✓	✓	✓	✓		✓	✓				✓	✓	
Heritage	Aboriginal heritage[3]													
	Natural heritage conservation[4]													
Fire Mgt	Spontaneous combustion			✓				✓						
	Bushfire	✓			✓								✓	
	Mine subsidence													
Soil and Water	Hydrocarbon contamination						✓			✓				
	Methane drainage / venting													
Public Safety	Public safety[5]	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	

1 - Off site pollution only.
2 - Construction and production activities will occur between 7:00am and 6:00pm and hence stray light is not likely to affect visual amenity. Transport and maintenance activities are permitted at later times each day.
3 - No items of Aboriginal heritage significance have been identified within the site.
4 - The site is highly disturbed and does not contain items / areas of natural heritage significance.
5 - All activities carry some form of risk to public safety; however, there will be no public access to areas where these activities are undertaken.
6 – Not relevant when mine in care and maintenance

Environmental Management

Environmental management is reflected in procedures outlined in the MOP.

3.1 Meteorological Monitoring

In accordance with Schedule 3, Condition 22 of PA 10_0041, Pine Dale Mine operates a meteorological monitoring station. A summary of monthly meteorological monitoring results are presented in the following sections and **Appendix B**.

RAINFALL

Pine Dale Mine received 704.8mm of rainfall and experienced 145 rainfall days during the 2014 reporting period. Rainfall during this reporting period was observed to be greater than rainfall recorded in 2013 (576.8mm and 109 rainfall days). The monthly rainfall data for 2014 is summarised in **Table 7.**

TEMPERATURE

Temperature is monitored at two heights (2 metres and 10 metres respectively) to account for temperature inversions. The maximum temperature recorded during the reporting period was 37.7°C at 2m during January and 36.3°C at the 10m sensor, during November. The lowest temperature occurred in July, with a recording of -6.9°C at 2m and -6.8°C at 10m. A summary of monthly temperatures for 2014 is included in **Table 7**.

WIND SPEED, DIRECTION & SIGMA THETA

Recordings of wind parameters are monitored from the stations' 10 metre mast. Predominant wind directions at the site in 2014 were observed to be from a west-north-westerly, north-westerly and south-easterly direction; however wind directions were shown to fluctuate on a seasonal basis. The maximum wind speed measured at the site was 16.6m/s in July 2014. Sigma theta data was measured continuously throughout the entire 2014 monitoring period. A summary of monthly wind speed, predominant directions and sigma theta recordings in 2014 is included in **Table 7**.

RELATIVE HUMIDITY

Relative humidity was measured in the 2014 monitoring period. A summary of monthly humidity variations for 2014 is included in **Table 7**.

Table 7
Pine Dale Mine Meteorological Station Summary 2014

Month	Rainfall (mm)	Cumulative Rainfall (mm)	No of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (°)			Relative Humidity (%)			Wind Speed (m/s)			Modal Wind Direction
				Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
January	5.6	5.6	6	20.3	3.9	37.7	19.7	3.9	35.4	34.1	0.0	102.6	57.1	4.7	96.9	1.7	0.0	13.5	ESE
February	85.8	91.4	8	19.2	4.3	36.6	18.6	4.5	34.8	32.0	0.0	101.5	66.6	5.3	96.7	1.6	0.0	13.6	ESE
March	145.2	236.6	22	16.1	3.8	27.1	15.8	3.9	25.3	30.2	0.0	101.7	81.0	35.3	98.1	1.1	0.0	12.8	ESE
April	59.4	296	11	12.9	-0.5	27.1	12.7	-0.3	26.0	25.8	0.0	103.6	79.2	20.0	98.1	1.2	0.0	11.9	WNW
May	13.0	309	8	8.5	-1.7	22.3	8.5	-1.3	20.9	21.0	0.0	101.5	80.8	30.4	97.5	1.3	0.0	13.5	WNW
June	41.0	350	19	6.7	-4.1	17.8	6.6	-4.1	16.8	22.9	0.0	98.7	82.1	38.9	97.8	2.0	0.0	15.8	WNW
July	29.2	379.2	13	5.2	-6.9	17.8	5.3	-6.8	16.9	23.1	0.0	102.1	76.4	19.4	97.2	2.0	0.0	16.6	WNW
August	50.6	429.8	16	6.2	-6.1	17.8	6.1	-6.0	17.1	26.8	0.0	99.3	78.4	16.3	97.9	1.3	0.0	14.4	SSE
September	31.2	461	12	9.7	-3.5	25.8	9.5	-3.5	24.9	27.0	0.0	100.9	69.5	17.3	97.7	1.7	0.0	16.6	W
October	54.6	515.6	6	13.7	-2.3	30.9	13.4	-2.5	29.4	25.5	0.0	99.0	60.1	12.4	96.4	1.7	0.0	15.4	W
November	56.6	572.2	8	17.9	-0.2	37.2	17.5	0	36.3	28.8	0.0	99.8	58.8	11.3	96.8	1.9	0.0	16.5	WNW
December	132.6	704.8	16	18.3	5.4	31.4	17.9	5.6	30.6	30.4	0.0	102.1	68.2	10.2	96.6	1.9	0.0	15.2	NW
TOTAL	**704.8**	-	**145**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	**5.6**	-	**6**	-	**-6.9**	-	-	**-6.8**	-	-	**0.0**	-	-	**4.7**	-	-	**0.0**	-	-
Maximum	**145.2**	-	**22**	-	-	**37.7**	-	-	**36.3**	-	-	**103.6**	-	-	**98.1**	-	-	**16.6**	-

3.2 Air Quality

Air quality management is a priority at the Pine Dale Mine. During mining extraction, onsite dust suppression is performed using a 50,000L tanker from water accumulated in the in-pit sumps, sediment basins, or from the abandoned Wallerawang Colliery underground workings. The tanker will typically make four trips on dry days targeting the active haul roads, and only if necessary on wet days. During care and maintenance water for dust suppression is sourced from the onsite sediment basins.

Air quality is monitored at seven locations including nine depositional dust gauges (DDG) and one high volume air sampler (HVAS) site which monitors Total Suspended Particulates (TSP) and particulates less than 10µm (PM_{10}). Continual monitoring is performed by RCA Laboratories Environmental and a summary report on data collected throughout the reporting period is available in **Appendix B**.

DEPOSTIONAL DUST

Depositional Dust results for the period January – December 2014 show an annual average insoluble solids range of 0.5 g/m² per month to 0.9 g/m² per month for all dust gauges. These results fall well below the nominated assessment criteria of an annual average of 4.0 g/m² per month, as stipulated in the OEH (DEC) document Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (August 2005)

Table 8
Depositional Dust Monitoring Results

Date	Total Insoluble Solids (g/m².month)									
	Gauge Location									
	D1	D2	D3	D4	D5	D6	PCB1	PCB2	PCB3	PCB7
Jan-14	1.0	1.1	1.5	0.6	1.9	1.0	1.3	0.9	1.1	1.1
Feb-14	0.8	0.5	1.0	0.4	0.4	0.3	1.3	1.1	0.8	0.7
Mar-14	0.7	0.4	0.5	0.6	0.4	0.2	1.3	0.9	1.1	1.1
Apr-14	0.6	0.3	0.1	0.6	0.4	0.4	0.4	0.3	0.4	0.6
May-14	0.5	0.3	0.2	0.3	0.1	0.3	0.5	0.3	0.1	0.2
Jun-14	0.6	0.4	0.7	0.3	0.6	1.1	0.6	0.1	0.3	0.3
Jul-14	0.5	0.4	0.6	0.3	0.3	0.5	0.6	0.4	0.4	0.4
Aug-14	0.3	0.2	0.4	0.2	0.3	0.2	0.5	0.3	0.3	0.1
Sep-14	0.8	FB	1.0	0.5	0.4	0.5	0.8	RN	0.6	0.7
Oct-14	0.9	0.8	1.0	0.6	EB	0.5	0.5	0.7	0.5	0.6
Nov-14	1.2	1.1	1.2	0.7	1.9	0.9	1.3	1.0	0.6	1.0
Dec-14	2.7	1.3	2.0	1.4	1.4	1.0	1.7	1.6	1.8	1.8
Annual Averages										
2012	0.9	0.6	1.0	0.5	0.7	0.8	4.9	1.1	0.7	1.7
2013	1.6	0.7	0.9	0.6	0.6	1.0	0.8	0.6	0.6	0.4
2014	0.9	0.6	0.9	0.5	0.7	0.6	0.9	0.7	0.7	0.7
OEH Annual Average Assessment Criteria	**4.0**									

Notes: EB – Sample contaminated by excess bird droppings; sample rejected.
FB – Sample contaminated by feathers and bird droppings; sample rejected.
RN – Sample invalid; crucible broken during analysis.

HIGH VOLUME AIR SAMPLES

Annual average PM_{10} and TSP monitoring results are summarised in **Table 9** and presented in **Appendix B**. All PM_{10} results recorded 24-hour average concentrations below the 50µg/m³ Impact Assessment Criteria (IAC) for 2014. The highest PM_{10} result recorded for 2014 was 34µg/m³ on 16th January 2014. The annual average PM_{10} result recorded in 2014 was 9.5µg/m³ which is well below the long term 30µg/m³ annual average assessment criteria. The highest TSP result recorded for 2014 was 72µg/m³ on 30th December 2014. The 2014 period's annual average TSP result recorded was 20.4µg/m³ which is well below the 90µg/m³ assessment criteria.

The long term average annual PM_{10} and TSP levels are all within the nominated assessment criteria. Results also demonstrate consistent PM_{10} and TSP levels were recorded at the site throughout the 2011 to 2014 monitoring period (see **Table 9**). A slight increase in both PM_{10} and TSP levels between 2011 and 2012 is most likely attributed to the commencement of mining in 2012, whilst the increase in particulate concentrations between 2012 and 2013 may be attributable to considerably lower rainfall received at the site during the 2013 monitoring period. There has been a notable decrease in levels during 2014; this is likely due to the higher rainfall recorded during 2014 and the cessation of mining activities in April.

Table 9
PM_{10} and TSP Summary

	Particulate Matter <10µm (µg/m³)	**TSP (µg/m³)**
Maximum 24h Average result 2011	35	n/a
Maximum 24h Average result 2012	33	n/a
Maximum 24h Average result 2013	85*	n/a
Maximum 24h Average result 2014	34	n/a
PM_{10} 24h Assessment Criteria **	50	Not Required
Annual Average 2011	11	20
Annual Average 2012	11	25
Annual Average 2013	13	26
Annual Average 2014	9.5	20
Total Suspended Particulate (TSP)Annual Average Assessment Criteria**	30	90

* Result was influenced by external sources (bushfires) that are outside of the control of the project.
**Air Quality Assessment Criteria listed in the OEH (DEC) document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (August 2005*).

The existing air quality monitoring program and dust management practices will continue to be implemented throughout 2015. All air quality monitoring units will be regularly calibrated and audited to ensure compliance with the appropriate Australian Standard in 2015.

3.3 Erosion and Sediment

The erosion and sediment controls for Pine Dale Mine have been implemented to safeguard against soil loss and minimise potential water quality impacts. Erosion control structures have been installed around the site with the principle aim of containing sediment at its source. All runoff from disturbed areas is contained in temporary pollution control ponds within the open cut itself and surrounding hardstand areas.

Exposed areas which have been disturbed by the operation are controlled though the use of windrows constructed by subsoil and/or clay material. Once vegetation has been cleared and topsoil removed, subsoil and clay material is pushed against the interface between the disturbed and undisturbed area(s). Dozers are used to build a windrow where the potential for erosion impacts exist, and are also managed through the use of temporary measures, such as silt fencing, to avoid sedimentation impacts on downstream waterways until the area has been rehabilitated. Additionally, temporary sediment ponds are constructed downslope of disturbed areas to ensure the capture of 'dirty' water and treatment prior to discharge into the underground workings. The management measures for the control of erosion described above is also put in place to increase batter and bench stability prior to establishment of permanent rehabilitation measures, where possible.

Erosion control structures at Pine Dale Mine are inspected on a monthly basis, particularly after significant rainfall events and repaired where necessary. Erosion and sediment control works which were undertaken during the reporting period included:

- The maintenance of haul roads on a regular basis with a grader to limit the build-up of fine sediment and material, which limits the amount of sediment that enters onsite dams;
- The installation of windrows and silt fencing to prevent potential surface water impacts and sediment entering Neubeck's Creek;
- The removal of sediment from roadside drains and low spots both within the pit and on the crusher pad when required;
- The regular removal of topsoil and clay from each area to be mined so as to limit the amount of material which has the potential to enter sediment dams through surface runoff.
- Sowing of fast growing seed on exposed areas including the amenity bund and contoured stockpiles

The effectiveness of the erosion and sediment control structures at Pine Dale Mine was demonstrated by their performance against a number of high rainfall events throughout the reporting period (March 145.2mm and December 132.6mm).

3.4 Surface Water Pollution

Surface water quality at Pine Dale Mine is managed in accordance with the Water Management Plan. In accordance with EPL 4911 the following four points at Pine Dale Mine are required to be monitored:

- Ambient Water Monitoring **Point 2** – Upstream of Delta Electricity flow gauge;
- Ambient Water Monitoring **Point 3** – 100m downstream of bridge near site office;
- Discharge and Monitoring **Point 13** – Neubeck's Creek below final settling dam; and
- Ambient Water Monitoring **Point 14** – Cox's River downstream of Blue Lake.

A further seven locations are monitored in accordance with the site Water Management Plan:

- S1 – Lamberts Gully Downstream, Neubeck's Creek;
- S2 – Neubeck's Creek at the bridge (site office)
- S3 – Neubeck's Creek, 100m downstream of bridge near site office;
- S4 – Cox's River upstream of Blue Lake
- S5 – Blue Lake upstream of Neubeck's Creek confluence;
- S6 – Neubeck's Creek downstream of discharge point
- S7 – Cox's River downstream of Neubeck's Creek confluence
- The Bong – water source for dust suppression

The locations of the monitoring points are indicated on the Site Plan in **Appendix A**. Samples were analysed by RCA Laboratories (NATA Accreditation No. 9811).

Summary of Monitoring Results

Surface water samples collected for EPL compliance during the January – December 2014 period show water quality analysis results are generally compliant with the Concentration Limits specified by the Water Management Plan and EPL 4911.

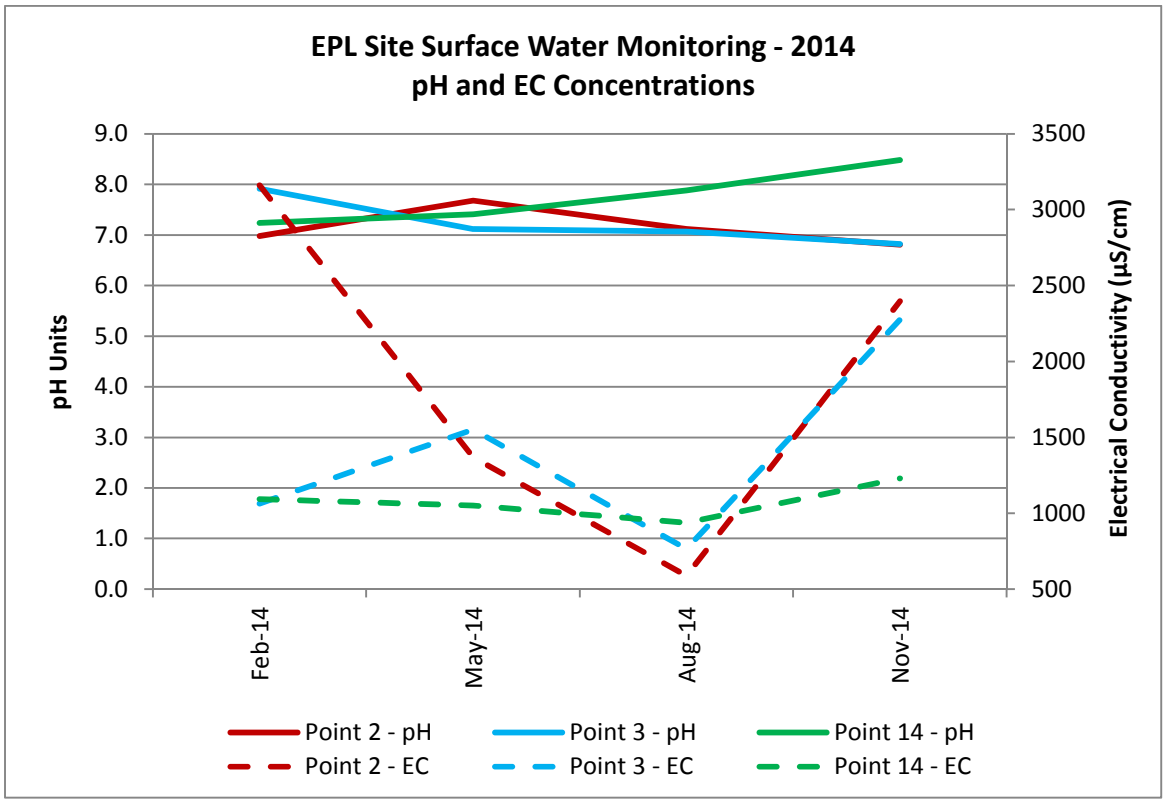
Monitoring Points 2 and 3 are ambient surface water monitoring points on Neubeck's Creek and are required to be sampled on a quarterly basis and daily during discharge events. Monitoring Point 14 is an ambient surface water monitoring point located on the Cox's River which assesses the water quality downstream of the Pine Dale Mine. There are no EPL Limits for monitoring Points 2, 3 and 14.

There were no controlled surface water discharge events during the reporting period. As such no samples were collected from licensed discharge monitoring Points 13 during the 2014 reporting period. As there was no discharge from licenced discharge point 13 during the reporting period, EPL 4911 limits were not exceeded.

During the monitoring period, EC was shown to fluctuate at the three EPL monitoring sites, whilst pH was observed to be reasonably consistent.

Surface water monitoring results for Environmental Protection Licence compliance for the 2014 period are summarised in **Appendix B**. Results are presented graphically in **Figure 1**.

Figure 1
EPL Surface Water Results Summary



Additional site surface water samples (S1 to S7 & The Bong) associated with the Water Management Plan collected during the January – December 2014 period are generally shown to be consistent over the duration of the monitoring period. The pH results recorded at monitoring sites S3 to S7 are shown to be stable throughout the sampling period, however, the pH recorded at monitoring sites S1 and The Bong were shown to fluctuate somewhat. During the monitoring period, EC was observed to fluctuate across the majority of sampling sites, whilst S4 and S5 were observed to be relatively stable. No clear EC trend is evident for the sampling sites. The water level of Neubeck's Creek at monitoring location S2 was stable throughout the duration of the monitoring period. No sample could be collected from S6 during the November 2014 monitoring event as the location was dry.

Additional site surface water monitoring results for Water Management Plan compliance for the 2014 period are summarised in **Appendix B**. Results are presented graphically in **Figure 2** and **Figure 3**.

Figure 2
Additional Site Surface Water Results Summary

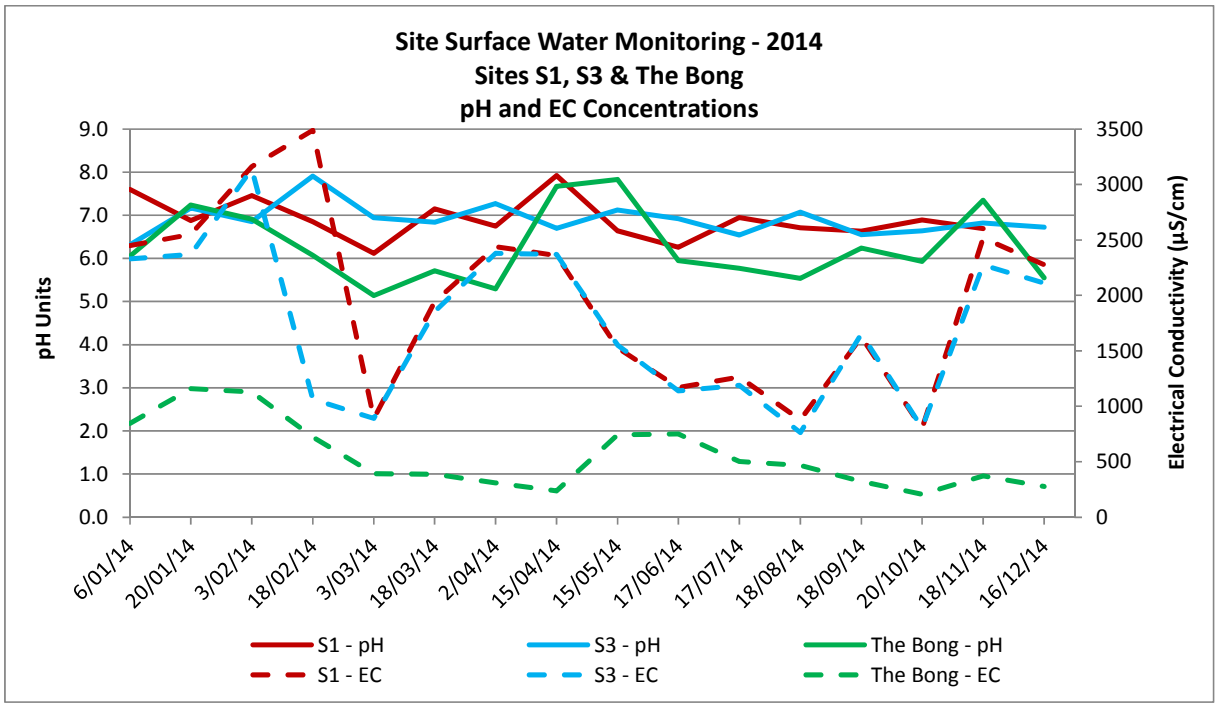
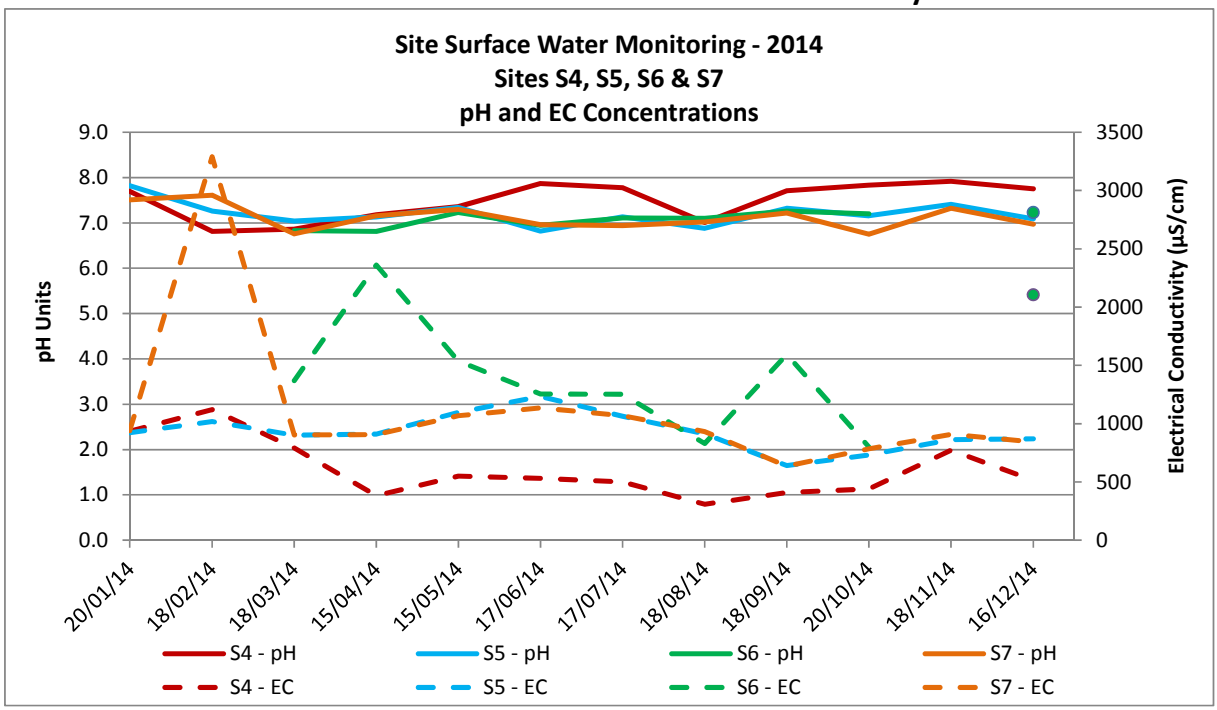


Figure 3
Additional Site Surface Water Results Summary



3.5 Ground Water Pollution

Groundwater data is collected by RCA Laboratories and analysed at a NATA registered laboratory. Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the approved Groundwater Management Plan (documented within the site Water

Management Plan, July 2011). Sampling is conducted at a total of three locations within the mine site; a further five locations surrounding the Yarraboldy Extension area; and two locations at the former Enhance Place Mine Site. Groundwater monitoring is not a requirement of EPL 4911. A copy of the monitored results are provided in full in **Appendix B**.

GROUNDWATER CRITERIA AND TRIGGER LEVELS

The site specific Trigger Values developed for the Pine Dale Mine, as stipulated in the sites' Groundwater Management Plan in accordance with Schedule 3, Condition 27(c) of the Project Approval (PA 10_0041) are currently under review, therefore the Trigger Level values presented in the previous version of the sites' Groundwater Monitoring Program (Dec 2005) have been adopted for the purpose of compliance assessment in this report. The adopted trigger level values are detailed in **Appendix B**.

As groundwater monitoring was not undertaken until the commencement of construction and mining operations, a true baseline level is not available. In the absence of baseline values, average values have been calculated based on results from monitoring undertaken during the period October 2005 to December 2006. A subsequent round of baseline monitoring has been undertaken during the period January 2011 to July 2013, from which updated trigger levels are currently being developed.

The Groundwater Management Plan details the protocol for the investigation, notification, and mitigation of any identified exceedances of the impacts on groundwater levels. The Groundwater Management Plan also provides the groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts.

GROUNDWATER WATER QUALITY

Groundwater samples collected from the on-site groundwater bores during the January – December 2014 period generally show water quality results which are consistent throughout the monitoring period. The electrical conductivity levels at Old Shaft indicated a slight increasing trend throughout 2014. Water quality within the site bores was shown to be compliant with the trigger levels for key water monitoring parameters pH and EC, as nominated in the *Groundwater Monitoring Program (Dec 2005)*. Trigger levels for filtered iron were generally compliant for Bores P6 and P7 throughout 2014. The filtered iron Trigger level was exceeded at Bore P6 in June, July and December; and at Bore P7 during the May and August monitoring events. The concentration of filtered iron generally fluctuated between 20mg/L to 30mg/L at Bore P6. The concentration of filtered iron at Bore P7 fluctuated between 0.18mg/L to 3.92mg/L during the 2014 monitoring period.

All site bores exhibited standing water levels which were consistent throughout the 2014 monitoring period. There was a slight increase in water level from January to April 2014; however the water level has generally remained stable since May 2014. Trigger levels for water depth were shown to be compliant for the entire monitoring period during 2014 at Bore P7. There is no Trigger level for Bore P6 and Old Shaft.

Results of site groundwater bores are presented graphically in **Figures 4, 5** and **6**.

Figure 4
Site Groundwater Bores pH & EC Result Summary – Bores P6 and P7

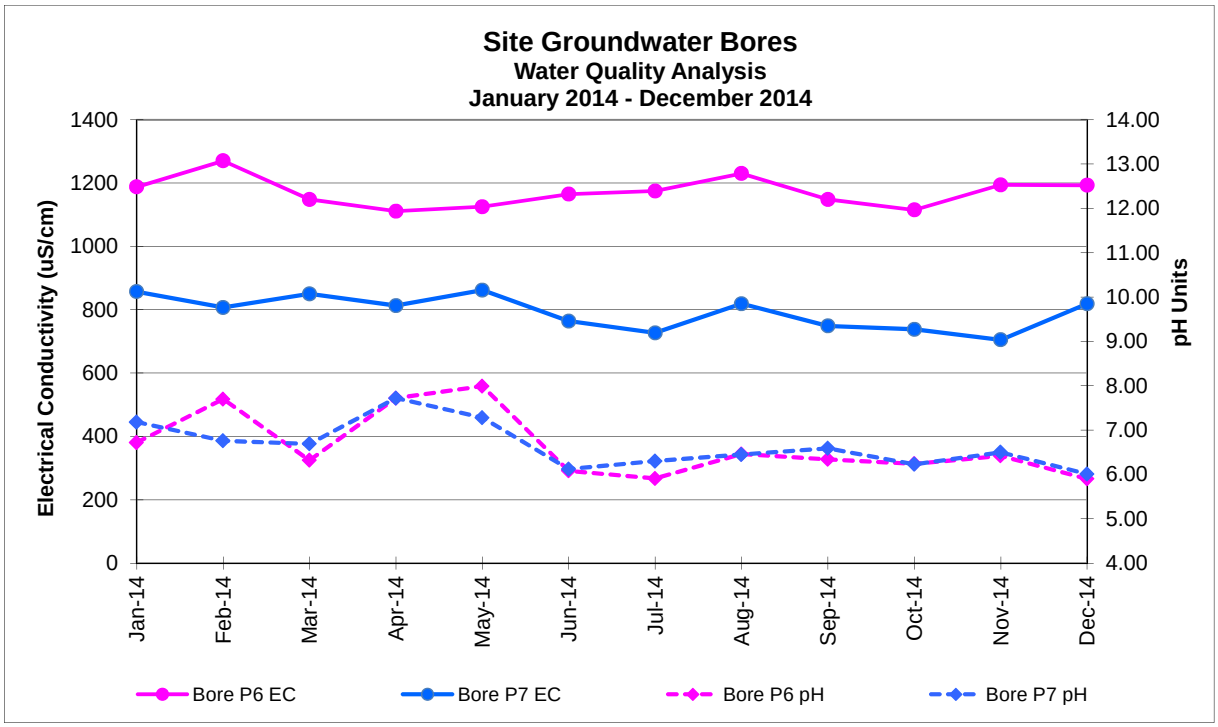


Figure 5
Site Groundwater Bores Result Summary – Old Shaft

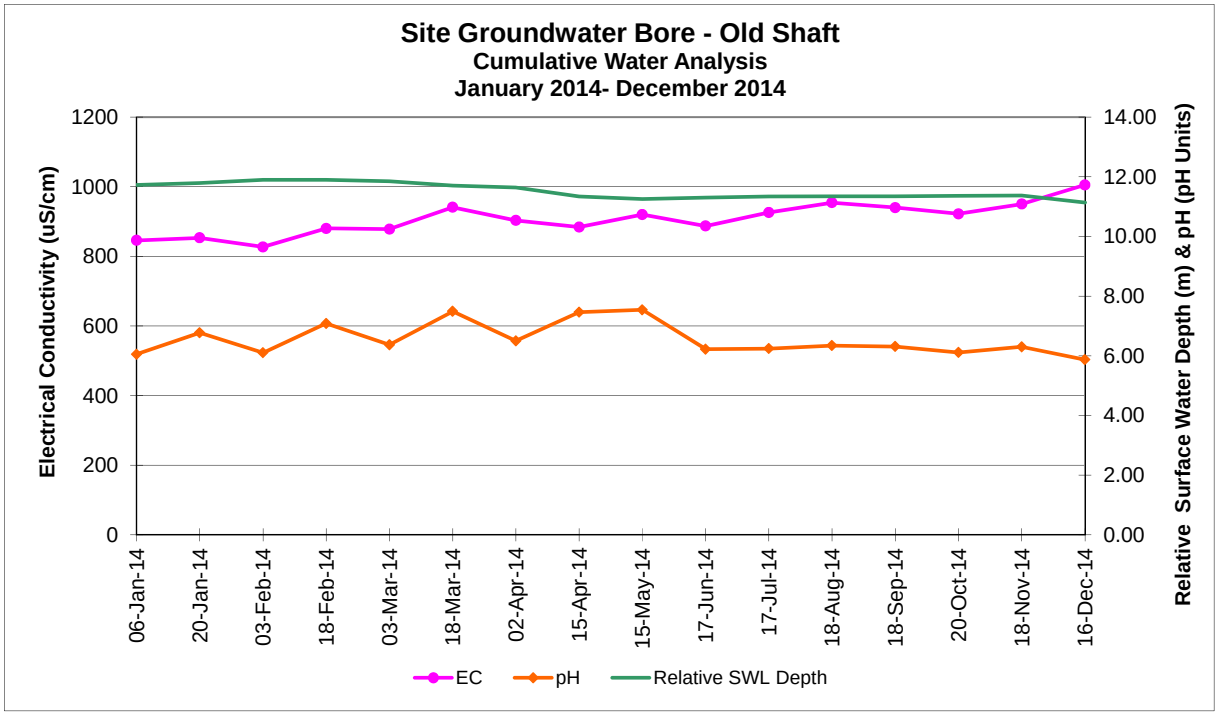
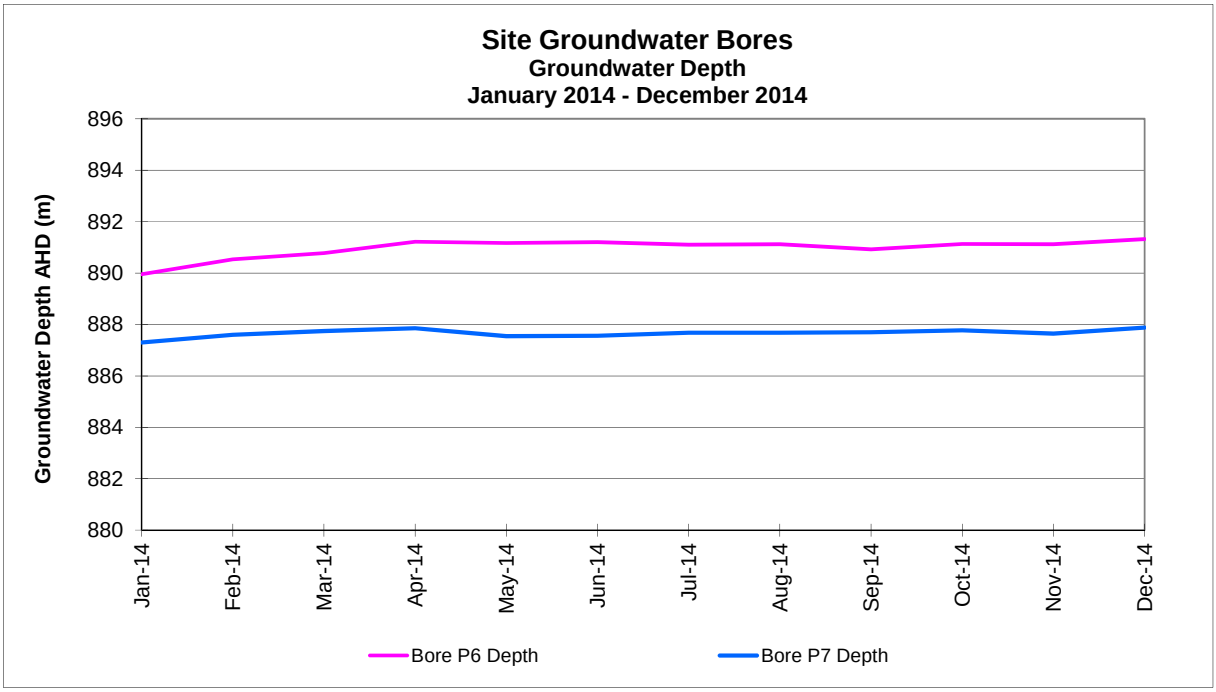


Figure 6
Site Groundwater Bores Water Level Summary – Bores P6 and P7



The results of quarterly water quality monitoring within the off-site groundwater bores are generally shown to be consistent throughout the 2014 monitoring period. The electrical conductivity levels in Bore D are shown to decrease during September 2014, however the concentrations are shown to increase again during sampling in December. Groundwater samples collected from the off-site bores were shown to be compliant with the trigger levels for the key water monitoring parameters pH and EC.

All off-site bores exhibited consistently stable standing water levels throughout the 2014 monitoring period. No standing water level data could be collected during May 2014, due to the water level meter being under repair. Trigger levels for water depth were shown to be compliant at all of the off-site groundwater bores during the 2014 monitoring period with the exception of Bore D (EP DDH4/GW) and E (EP PDH7/GW). Bore D exhibited water levels which were slightly below the Standing Water Level trigger from January to March and July to December. Bore E exhibited water levels which were slightly below the Standing Water Level trigger from January to February and during November 2014. Results for off-site groundwater bores are presented graphically in **Figures 7** and **8**.

Figure 7
Off-Site Groundwater Bores Result Summary

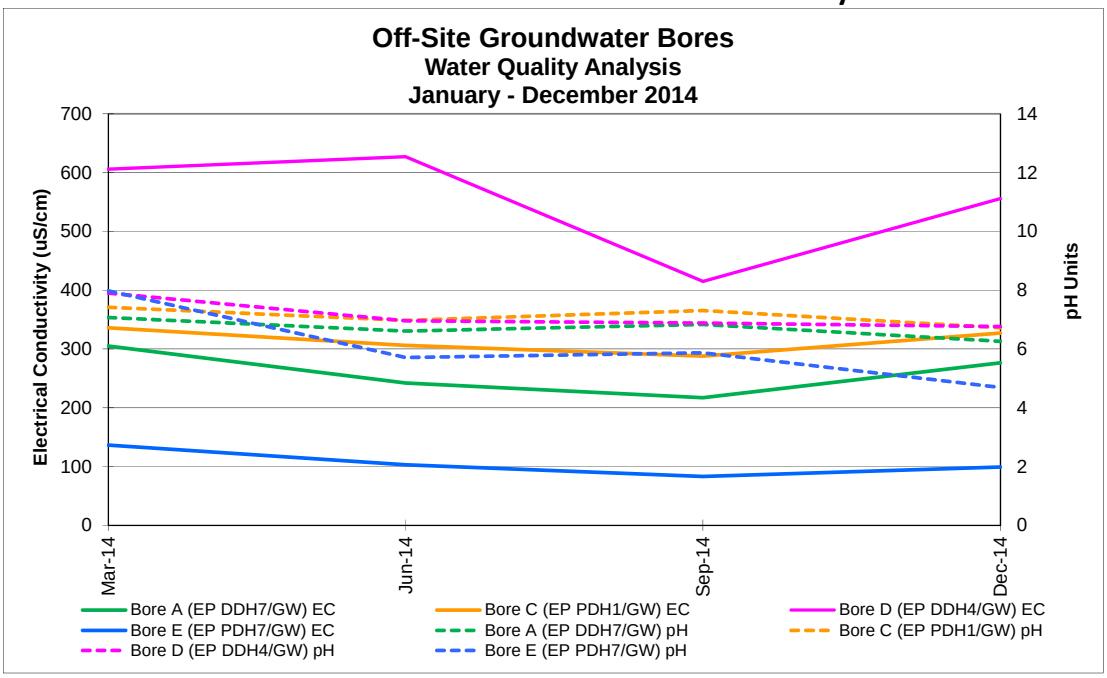
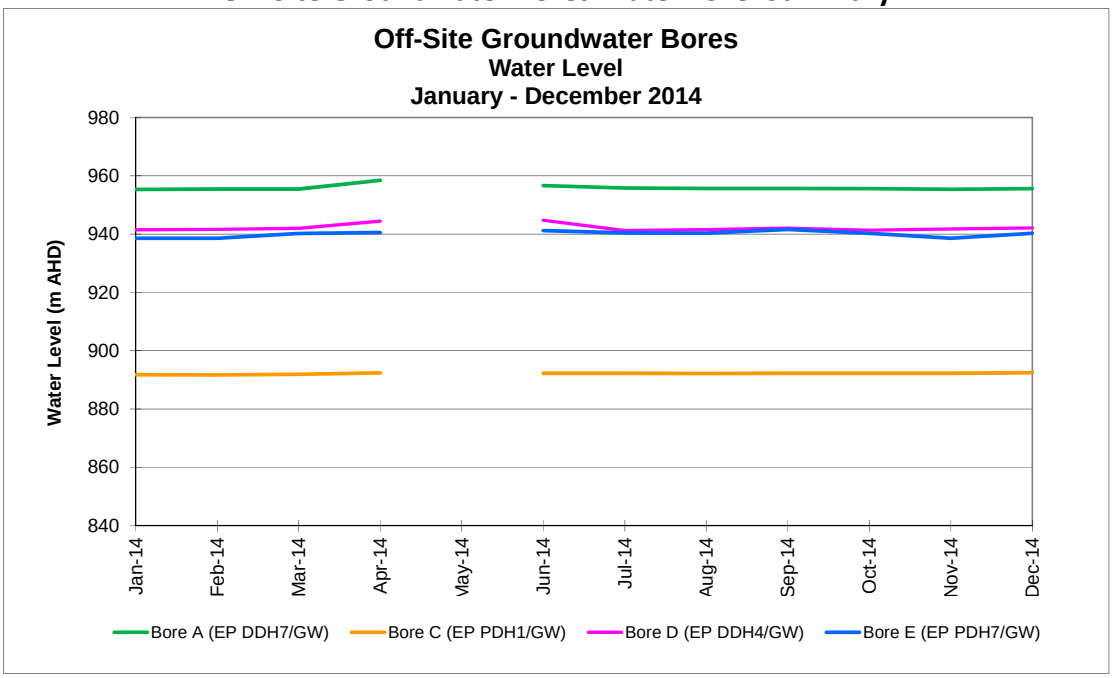


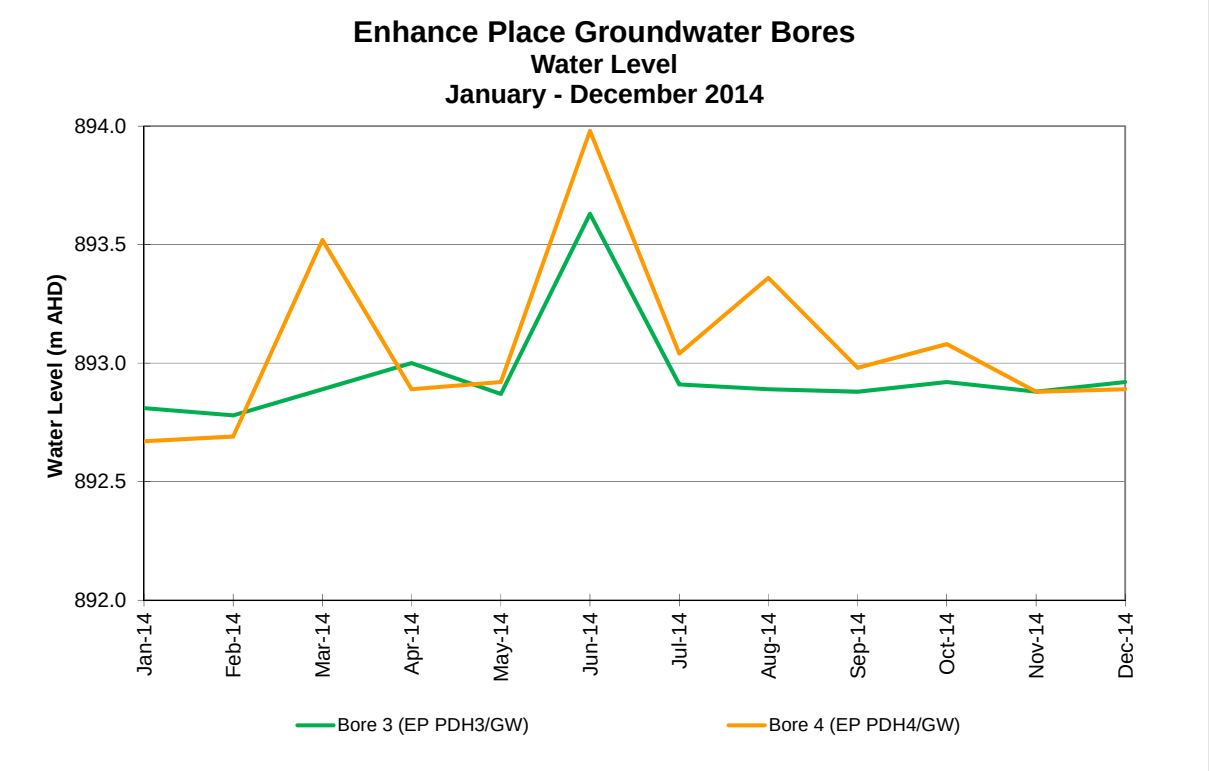
Figure 8
Off-Site Groundwater Bores Water Level Summary



Note: No standing water level data could be collected during May 2014, due to the water level meter being under repair.

The two monitoring bores located at the former Enhance Place mine exhibited standing water levels which fluctuated throughout the 2014 monitoring period. The greatest change in standing water level was observed at Bore 4 (EP PDH4/GW), however fluctuations decreased towards the end of 2014. These bores do not have any water level triggers nominated in the Water Management Plan. Results for the Enhance Place groundwater bores are presented graphically in **Figure 9**.

Figure 9
Enhance Place Groundwater Bores Water Level Summary



A detailed summary of groundwater results can be found in **Appendix A**.

3.6 Contaminated Polluted Land

There was no land identified as being significantly contaminated or polluted during the reporting period. However, a minor localised oil spill was observed in the workshop area during the 2014 external environmental audit. Recommendations were made in the audit and actions undertaken to clean-up the localised spill with waste material being disposed of by the mining contractor.

3.7 Threatened Flora & Fauna

Measures for the management and mitigation of flora and fauna impacts at Pine Dale Mine and in the surrounding area are provided in the MOP. There was no threatened flora or fauna identified within the active mining area during the reporting period.

Bathurst Copperwing Butterfly

The Bathurst Copperwing Butterfly (BCB), listed as an Endangered species under the *Threatened Species Conservation Act 1995* and Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999* has been identified adjacent to the eastern boundary of the Pine Dale Mine Yarraboldy Extension within an area of its habitat native Blackthorn (Bursaria spinosa subsp. Lasiophylla). Native Blackthorn is found throughout the local area.

To minimise potential direct and indirect impacts of dust and vibration from the Pine Dale Mine on the BCB, the following mitigation measures have been implemented:

a) maintenance of fencing and earth bunds around known BCB habitat;
b) mining activity not occurring within 200m of the main habitat area between September 2013 through end February 2014, and September 2014 through end February 2015 when the flying season of the adult and larvae stages of the BCB were apparent as determined by an independent ecologist; and
c) implementation of further management and mitigation measures in accordance with Project Approval and *Particular Manner Decision 2011/6016*.

A BCB Monitoring Program has been implemented to monitor potential indirect impacts from extractive mining activities (particularity blasting and vibration) on the known populations of the butterfly. The field survey monitoring is conducted to coincide with the adult and larvae stages of the BCB with monitoring being undertaken by ecologists from Ecological Australia Pty Ltd. Data collected from dust gauges located within the habitat area is provided within **Appendix B.**

Results of the ecologist field monitoring are provided in the following table:

Monitoring season	Purpose of field survey	Date of field surveys	Survey results	Conclusion	Response
2013-2014	Undertake weekly surveys to confirm commencement of BCB larval feeding season	5 September 2013	No larvae or evidence of larvae identified; eight adult BCB identified	Due to evidence of adult BCB, precautionary approach taken that BCB larval feeding season has commenced.	No mining activities to occur within 200m of BCB main habitat area.
		13 September 2013	No larvae or evidence of larvae identified; one adult BCB identified		
	To confirm larvae are not actively foraging above ground, within habitat area	Evening 11- 12 March 2014	No larvae identified	The BCB in larvae form is no longer coming to the surface	Mining activities can recommence within 200m of BCB main habitat area.
2014-2015 (current)	Undertake weekly surveys to confirm commencement of BCB larval feeding season	5 September 2014	No larvae or evidence of larvae identified; no adult BCB identified	Lack of active larvae observed on the plants inspected suggests that the PCB breeding season had only recently commenced and the adult individuals observed had only recently emerged.	No mining activities to occur within 200m of BCB main habitat area.
		12 September 2014	No larvae or evidence of larvae identified; >36 adult BCB identified		
	To confirm larvae are not actively foraging above ground, within habitat area	*Field surveys scheduled for March 2015*	-	-	-

The monitoring program will be reviewed following the completion of the current seasons monitoring, in line with the mine entering care and maintenance.

Austral Toadflax *(Thesium Australe)*

Austral Toadflax is listed as vulnerable under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). An erect to scrambling perennial herb it occurs in small population's parasitising a range of grass species which at Pine Dale Mine is Kangaroo Grass. At subalpine and tableland climates the species dies back to rootstock during winter and resprouts in spring.

Surveys conducted by Eco Logical Australia in March 2011 identified a total of 260 individual Austral toadflax plants in three patches located beyond the north-west crest of the Yarraboldy Stage 1 Extension pit.

A Species Management Plan completed in consultation with the Department of Environment has been developed to mitigate the impact of open cut mining on the host habitat within the *Austral Toadflax buffer area*. This includes:

- Inclusion of 50m buffer zone from known specimens referred to as the *Austral Toadflax buffer area;*
- installation and maintenance of fencing and signage between the open cut boundary and known location of specimens;
- installation of additional signage and barriers when operating in close proximity to the Austral toadflax buffer area; and,
- Control of noxious weed infestations and feral animals.

During the reporting period, the rehabilitation monitoring report noted that mining activity had not encroached within the habitat area (refer to Appendix C). Control of noxious weeds within and surrounding the habitat area will be undertaken in the next reporting period.

3.8 Weeds

Weed control activities at Pine Dale Mine are undertaken in accordance with MOP. Weed inspections were undertaken on a regular basis with a large portion of weeds on the mine's property being sprayed or chipped during the reporting period, particularity within Area A and C. Approximately 10ha was actively sprayed during the reporting period.

Weed control methods target four noxious weeds previously identified within the Pine Dale Mine and Yarraboldy Extension area, namely:

- African Lovegrass (*Eragrostis curvula*);
- Blackberry (*Rubus fruticosus aggregate species*);
- Briar Rose (*Rosa rubiginosa*); and
- St John's Wort (*Hypericum perforatum*).

The control of weeds will be undertaken on an ongoing basis consistent with the MOP as required to ensure noxious species are managed accordingly.

3.9 Blasting

During the reporting period, blasting was only undertaken during January 2014 through to February 2014 comprising a total of 3 blasts. The blasting results for the 2014 period compared to the blast monitoring criteria are summarised in **Table 10**. The results for each

blast event during the reporting period are presented in RCA Laboratories Environmental Report 6880-870a (see **Appendix B**).

Table 10
Blast Monitoring Criteria and 2014 Results

Air blast overpressure dB(Lin. Peak)	Allowable exceedance*	Results 2014 (Exceedance %)
115	5%	0.0%
120	0%	0.0%
Ground vibration (mm/s)		
5	5%	0.0%
10	0%	0.0%

* Percentage of the total number of blasts

All air blast overpressure and ground vibration results for 2014 remained well within the relevant criteria of <115dB (Lin. Peak) and <5 mm/s at all monitoring sites. All blasts occurred between the hours of 10:00am and 3:00pm (Monday to Friday), with no more than one blast per day during the reporting period as required under PA 10_0041. All blasts on site are carried out by Downer EDI Mining – Blasting Services Pty Ltd.

3.10 Operational Noise

Mining related noise impacts at Pine Dale Mine are managed in accordance with PA 10_0041, EPL 4911 and the approved Noise Monitoring Program. Noise emissions from Pine Dale Mine operations were monitored on a quarterly basis at six locations surrounding the site during the reporting period by RCA Laboratories (see **Plan 1A**). These locations included:

- NM1 – the Green residence, Blackman's flat;
- NM2 – the Cherry residence, Blackman's flat;
- NM3 – Castlereagh Highway, east of Blackman's flat;
- NM4 – the Rensen residence, north of View Street, Blackman's flat;
- NM5 – the Fraser residence, Wolgan Road, Lidsdale; and
- NM6 – the Turek residence, Wolgan Road, Lidsdale.

The operational noise assessment criteria is 42 dB $L_{Aeq\ (15\ minute)}$ at three of the six monitoring locations (NM1 to NM3); and a noise assessment criteria of 35dB $L_{Aeq\ (15\ minute)}$ at the remaining three monitoring locations (NM4 to NM6). During construction and removal of the amenity bund the noise assessment criteria is 46dB $L_{Aeq\ (15\ minute)}$ at receptors NM1, NM2 and NM3.

Attended quarterly noise monitoring was undertaken routinely during the 2014 reporting period (January, April, September and December) to assess any noise impacts from Pine Dale Mine against relevant criteria detailed within PA 10_0041 and EPL 4911. The measured $L_{Aeq,\ 15min}$ noise contribution from the Pinedale Mine at all noise monitoring locations measured during 2014 were below the target noise goal for all 15-minute surveys.

Results for each noise survey during the reporting period are presented in full in **Appendix B**.

3.11 Visual, Stray Light

There were no adverse impacts associated with stray light or visual disturbance identified during the reporting period. There were no complaints received during the reporting period regarding visual and stray light impacts.

3.12 Aboriginal Heritage

There were no artefacts of Aboriginal Cultural Heritage found at the Pine Dale Mine during the reporting period.

3.13 Natural Heritage

No items or areas of natural heritage significance were recorded or are considered to occur within the approved disturbance area at Pine Dale Mine.

3.14 Spontaneous Combustion

There were no incidences of spontaneous combustion in coal stockpiles or overburden material during the reporting period. The Lithgow Seam is known to have a low propensity for spontaneous combustion. Following approved resources being exhausted, coal stockpiles have been decommissioned.

3.15 Mine Subsidence

There were no issues regarding mine subsidence during the reporting period.

3.16 Hydrocarbon Contamination

There were no reported incidents of hydrocarbon contamination at Pine Dale Mine over the reporting period, with the exception of the localised oil spill within the workshop area noted in sections 3.6. Refer to **Section 0** for details on hydrocarbon storage.

3.17 Bushfire

Bush fire control strategies for Pine Dale Mine are managed in accordance with the approved Bush Fire Management Plan. These strategies are employed for preventing the occurrence and spread of any fire events that may impact on the site or in surrounding lands (i.e. Ben Bullen State Forest). As such, measures are taken at Pine Dale Mine to prevent the occurrence and spread of fire through proper maintenance of machinery and equipment, and the maintenance of access roads.

During the reporting period there were no bush fire events at or in close proximity to Pine Dale Mine.

3.18 Methane Drainage/Ventilation

The underground workings at this site were closed in 1986 and decommissioned over the period from 1987 to 1990. Methane levels are considered to be negligible at the Pine Dale Mine. There are two remaining entries to the underground workings, being the 1A mine entry and the Punch Mine Entry. These are used as surface water storage facilities as per the approved Water Management Plan.

3.19 Public Safety

No issues of public safety occurred during the reporting period. The entire perimeter of the Pine Dale Mine property is fenced, with “No Trespassing” signs displayed at various intervals. “Do Not Enter” and “Danger” signs are also displayed along the fence of the private sealed haul road. There has been a continuation of the elimination of trespassing, as continual fencing monitoring, upgrades and repairs have continued to occur during the reporting period. During the care and maintenance term, the site has continued to be regularly monitored by mine personnel.

3.20 Other Issues and Risks

There are no other known issues or identified hazards at the operating Pine Dale Mine.

4 COMMUNITY RELATIONS

4.1 Environmental Complaints

All stakeholder and community complaints regarding Pine Dale Mine are documented, with appropriate actions taken as soon as possible to determine the likely cause of the complaint and all possible corrective actions to resolve the problem and prevent its recurrence. Complaints are recorded and retained at the site office.

During the reporting period, a total of 2 complaints were recorded from 2 complainants, a significant decrease from 13 complaints received during the 2013 reporting period.

One complaint received during the reporting period related to noise (from a non-mining source); whilst a second complaint was made regarding the rehabilitation and land use of the site (see **Table 11**).

Table 11
Community Complaints

Complaint Type	Complaints Received 2014
Noise	1
Air Quality	0
Blasting	0
Traffic	0
Water	0
Other	1
Total	**2**

4.2 Community Liaison

COMMUNITY CONSULTATIVE COMMITTEE

Community Consultative Committee (CCC) meetings were held on 6 February 2014 and 11 December 2014.

The Pine Dale Mine CCC commenced in January 2012 and comprises representatives from the local community, LCC and Pine Dale Mine. The Committee meets on a biannual basis to discuss matters relating to the Pine Dale mine. The CCC meeting minutes are made publicly available via the Company's website www.energyaustralia.com.au.

WEBSITE INFORMATION

A website is maintained to keep the broader community up to date with recent activities at the Pine Dale Mine in accordance with Schedule 5, Condition 10 of the PA 10_0041. Copies of the following documents are made publicly available on website:

- EPL 4911 reporting;
- Yarraboldy Extension Environmental Impact Statement;
- Project Approval 10_0041;
- Environmental Management Plans for the Pine Dale Mine;
- CCC minutes;
- Community complaints; and
- Blasting information.

SOCIAL/ ECONOMIC CONTRIBUTIONS

Pine Dale Mine has contributed to the economy of the district and State by providing direct employment, indirect employment and through the purchase of services and materials from regional suppliers. Coal supplies to MPPS provide competitively priced energy for the NSW electricity market which ultimately flows through to provide economic benefit to electricity consumers.

5 REHABILITATION

5.1 Buildings

There were no buildings removed or constructed during the reporting period.

5.2 Rehabilitation of Disturbed Land

During the reporting period, an agronomist was engaged to inform development of quantitative rehabilitation completion criteria and provide advice and recommendations for pasture improvement strategies for each of the rehabilitation domains at Pine Dale Mine. The agronomist recommendations have been incorporated within the Care and Maintenance MOP, approved by DRE.

Pine Dale Mine is made up of a series of rehabilitation areas, comprising a series of parcels of land which are at various stages of being progressively rehabilitated back to a self-sustainable native ecosystem (acceptable post-mining land use and capability). This includes Areas A, B, C and 8. As the Yarraboldy Extension may form part of future mining operations, only temporary maintenance activities have and will be undertaken within this area until such time as project approval is obtained. The location of each rehabilitation area is depicted at **Appendix A**.

The principal re-vegetation technique currently employed is direct seeding using native tree and shrub species for woodland communities and pasture species for areas intended for agricultural activities.

The proposed final landform aims to emulate the pre-mining environment and to enhance local and regional ecological linkages across the site and surrounding areas. A summary of the disturbed and rehabilitated areas at the Pine Dale Mine can be seen in **Table 12**.

Yarraboldy Extension

To minimise dust dispersion and soil erosion, overburden stockpiles located within the northern area of the Yarraboldy Extension have been recontoured and seeded with pasture species.

The amenity bund located along the southern boundary of the Yarraboldy Extension has been reprofiled with the southern batter now having a gradient of 18^{o} to minimise erosion and enhance establishment of seedlings. Following the application and tilling of topsoil, a grass and native tree species seed mix has been applied followed by mulch and assorted range of decomposing crushed wood.

Amenity bund - re profiled to 18°

Amenity bund - application of mulch, grass and native species seed mix.

Rehabilitation Area A

Seeding of Area A commenced in 2008, with 1500 trees planted. In 2010 an additional 400 trees were planted with the assistance of the Gundungurra Tribal Aboriginal Council. In October 2013 further direct seeding and application of an organic mulch layer and lime was applied however drought conditions in quarter four 2013 limited the outcomes of this work.

During the reporting term an intensive weed spraying program was undertaken within Area A. A revised rehabilitation strategy was also developed, incorporating recommendations from an agronomist for input within the CMMOP.

Rehabilitation Area B and C

Areas B and C had lime applied in October 2013 to control soil pH and provide improved soil conditions to promote pasture growth. Below average rainfall, particularly in quarter four 2013 has inhibited growth and the response of the lime application.

The final landform and water management structures have been completed and the areas seeded for pasture in accordance with Planning Approval 10_0041 and the requirements of the landowner. During the reporting term an intensive weed spraying program was undertaken within Area A, particularly along the site boundaries and spot spraying within the central area.

Rehabilitation monitoring of Areas B and C will continue to be undertaken to ensure the rehabilitated areas are progressing towards the agreed target levels.

Rehabilitation Area 8

Seeding of area 8 commenced in 2008, with a pasture mixture known as 'Cox's River Mix'. The vegetation communities prior to mining include a mixture of cleared land, pasture, pines and eucalyptus.

During the reporting term an intensive weed spraying program was undertaken. The rehabilitation assessment report found that the eastern portion of Area 8 had 85% groundcover and comprised similar species and density to that of the less developed locations in Area C.

Table 12
Rehabilitation Summary

	Area Affected/Rehabilitated (ha)		
	To end 2014	**Last report**	**Next Report (estimated)**
A: MINE LEASE AREA			
A1 Mine Lease Area	98.1	98.1	98.1
B: DISTURBED AREAS			
B1 Infrastructure Area	21.0	21.0	21.0
B2 Active Mining Area	6.6	4.6	6.6
B3 Waste emplacements	17.7	15.2	17.7
B4 Tailings emplacements	N/A	N/A	N/A
B5 Shaped Waste Placement	11.5	5.3	11.5
ALL DISTURBED AREAS	56.8	46.1	56.8
C: REHABILITATION PROGRESS			
C1 Total Rehabilitated Area (except for maintenance)	32	32	38.2
D: REHABILITATION ON SLOPES			
D1 10 to 18 degrees	3.2	0	3.2
D2 Greater than 18 degrees	3	0	0
E: SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses	24.5	24.5	24.5
E2 Native forest/ecosystems	7.5	7.5	7.5
E3 Plantations and crops	0	0	0
E4 Other (include non-vegetative outcomes)	0	0	0

During 2014 additional maintenance activities were conducted on rehabilitated lands in the form of erosion control, fertilizing and weed mitigation (see

Table 13).

Table 13
Maintenance Activities on Rehabilitated Land

	Area Treated (ha)		
	Report Period	**Next Period**	**Comment/control strategies/treatment detail**
Additional erosion control works	1	1	Ongoing maintenance of sedimentation fencing was conducted in and around the rehabilitated areas.
Recovering	0	0	No further topsoil or subsoil sealing was required during the reporting period.
Soil treatment	0	5	No further soil treatment was required during the reporting period. Soil treatment proposed within Area A.
Treatment/Management	0	0	No grazing cropping or slashing was conducted during the reporting period.
Re-seeding/Replanting	1	5	Contingency for any seeding failure.
Adversely affected by weeds	10	10	Weed spraying was conducted through all rehabilitated areas and proposed to continue in the next period
Feral animal control	2	0	Rabbit control was undertaken during the reporting period.

5.3 Other Infrastructure

There was no rehabilitation of other infrastructure during the reporting period.

5.4 Rehabilitation Trials and Research

There were no rehabilitation trials or research undertaken during the reporting period.

5.5 Further Development of the Final Rehabilitation Plan

A Care and Maintenance MOP has been formerly approved by DRE in February 2015. The CMMOP sets out the rehabilitation objective and criteria during the Care and Maintenance Term. The final landform and rehabilitation plan remains unchanged from that MOP Approved in February 2011.

6 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

The activities proposed for the 2015 reporting period are consistent with the C&M MOP.

MINING

All recoverable coal within the approved mining area was extracted during early 2014. No mining activities are proposed during the 2015 monitoring period.

REHABILATION

Rehabilitation activities will be undertaken during the 2015 period on areas that will not be directly impacted by a future mining operation at the Pine Dale Mine. Maintenance and rehabilitation activities as recommended in the C&M MOP will continue throughout 2015.

Further weed spraying is proposed to be undertaken in the next spraying season, followed by resowing exposed surfaces with groundcover herbs and grasses per recommendations in the Rehabilitation Monitoring Report (Appendix C). Exposed contour drains with Area A will be seeded, with soil amelioration being undertaken consistent with the C&M MOP.

All maintenance activities required on the rehabilitation areas will continue throughout 2015 (sediment fences, fertilizing, re-seeding, weed control etc.)

FUTURE MINING DEVELOPMENT

Subject to market conditions, in order to maintain supply of commercial coal to MPPS, Enhance Place intends to lodge an application with the Department of Planning and Environment to extend the existing mining operations. Engagement with regulators and other key stakeholders will continue to be undertaken throughout 2015.

APPENDIX A

SITE PLANS 2014

NOTES:

CEH SURVEY
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
"Astrolabe" 1 Rutherford Lane, LITHGOW 2790
ABN: 68 056 544 551 Office: (02) 6351 2281
Email: survey@ceh.com.au Website: www.ceh.com.au

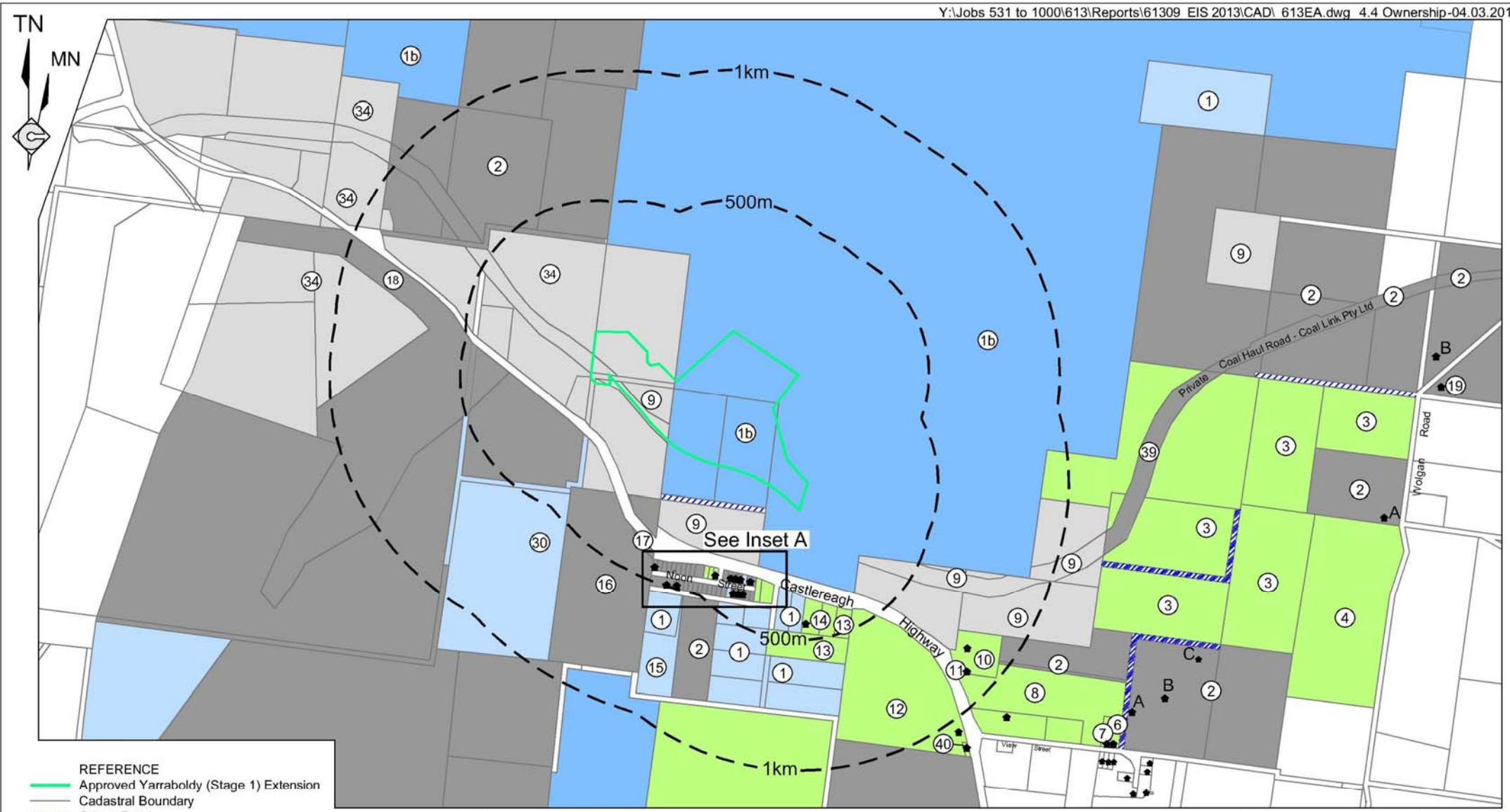
DATE	31–12–14
AMENDED	20–02–15
SURVEYOR	AERIAL PHOTO/TE/TH
DRAWN	K.L.F./D.M.
CHECKED	

PINEDALE MINE
AEMR PLAN
END DECEMBER 2014

SCALE - 1 : 4000 (A1 Sheet)

DWG No

PINE-AEMR14(A)



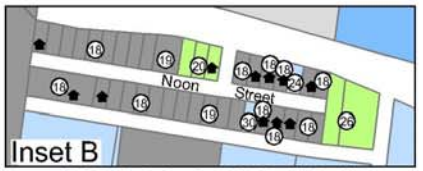
REFERENCE
- Approved Yarraboldy (Stage 1) Extension
- Cadastral Boundary
- Crown Road
- Residence
- (1) Landowner Reference (See Table)
- Energy Australia / Enhance Place Land
- Mining-related Land
- Crown / Government Land
- Ben Bullen State Forest (Forestry Corporation of NSW)
- Privately Owned Land

SCALE 1:25 000 (A4)

250 0 250 500 750 1000 1250 m

Land Ownership Source: Department of Lands - LPI Online Search
Base Map Source: Craven Elliston & Hayes Pty Ltd

Ref	Landowner	Ref	Landowner
1	Crown Land	15	State Land Services
1b	Ben Bullen State Forest (Forestry Corporation of NSW)	16	GC Springvale Pty Limited & Samsung Development (Aust) Pty Limited
2	Centennial Fassifern Pty Limited	17	Centennial Springvale Pty Limited & Samsung Development (Aust) Pty Limited
3	G. & A. Jenkins	18	Centennial Springvale Pty Limited & Springvale SK Kores Pty Limited
4	A. Fraser	19	Ivanhoe Coal Pty Limited
6	R. & H. Taylor	20	W. Doherty
7	K. May	24	The Council of the Shire of Blaxland
8	N. & J. Watson	26	The Trustees of the Catholic Church
9	Enhance Place Pty Ltd	30	The Council of the City of Lithgow
10	P. & E. Barnes	34	Delta Electricity
11	C. Jonkers & J. Favell	38	D.J & J.W Hunt
12	M S & L J Morris	39	Lidsdale Holdings Pty Ltd
13	J. Cope	40	T.L Elms
14	J. Cherry		



INSET A SCALE (A4)

0 100 200 300 400 500 m

LAND OWNERSHIP

BEN BULLEN STATE FOREST

No. 434

No. 1 EXTENSION

Pinedale Leases		
Portion	Coal Lease	Plan
ML81	ML1578	M27054
ML82	ML1569	M27055
ML119	ML1664	M27204
ML340	ML1637	M27161

Enhance Place Leases		
Portion	Coal Lease	Plan
ML35	ML1422	M26857
ML79	ML1458	M26893R
ML80	ML1520	M26982R

ML1637
(Extends to Lidsdale Siding - See Plan M27161)

NOTES:

N

MGA Zone 56

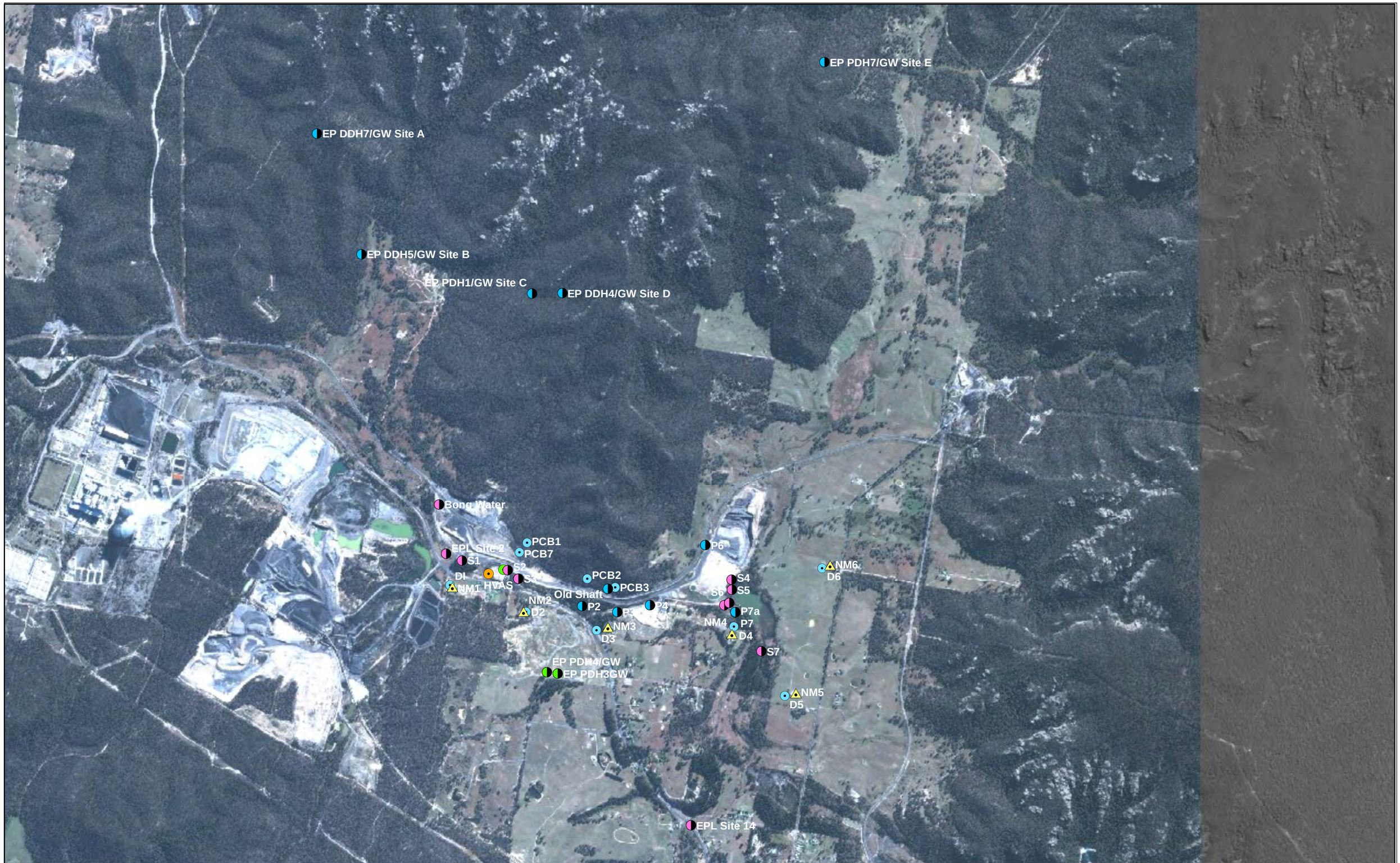
CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
ACN 056 544 551
"ASTROLABE" RUTHERFORD LANE, LITHGOW, 2790 PH: (02) 6351 2281, FAX: (02) 6352 1339
Email : survey@ceh.com.au

DATE	19.12.2013
AMENDED	
SURVEYOR	T.E.
DRAWN	D.M.
CHECKED	

ENHANCE PLACE PTY LIMITED
LEASES
PINEDALE OPENCUT MINE & ENHANCE OPENCUT MINE

SCALE - 1:12500 (A3)

DWG No
3/1770_ML



Legend

- Noise Monitoring Location
- Depositional Dust Monitoring Location
- Enhance Groundwater Monitoring Location
- Groundwater Monitoring Location
- High Volume Air Sampling Location
- Metorological Monitoring Location
- Surface Water Monitoring Location

500 250 0 500 1,000 1,500

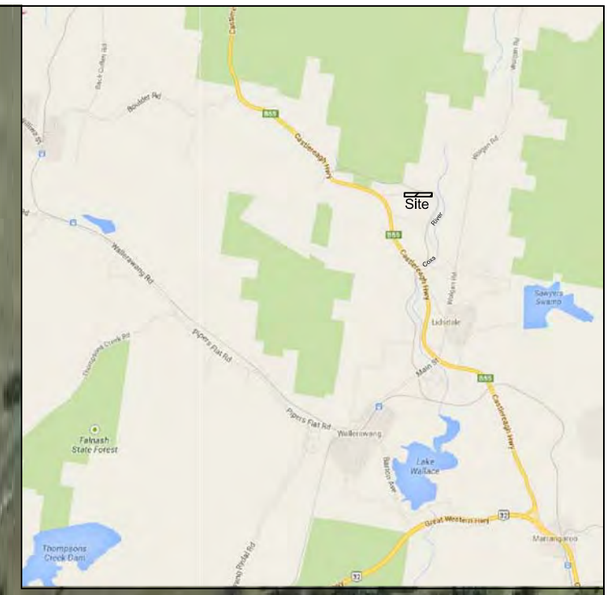
metres

N

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PINE DALE MINE
ENVIRONMENTAL MONITORING LOCATIONS

CLIENT	Pine Dale Mine			PROJECT No	6880-870a/010
DRAWN BY	KT	SCALE	1:30,000 (A3)	DRAWING No	1
APPROVED BY	KT	DATE	10/02/2015	OFFICE	NEWCASTLE



Locality Plan
N.T.S.

Mine Office

SH4

SH2

SH1
Clean Water Diversion

SH3
SH3a
LDP13

Castlereagh Highway

View Street

LEGEND
- Monitoring location
- Licence discharge point location
- Clean water diversion location

SH5

0 50 100 150 200 250
metres

Aerial image taken from Google Earth, 23 May 2006

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

LOCATION PLAN OF CHANNEL STABILITY, STREAM AND VEGETATIVE HEALTH OF NEUBECKS CREEK MONITORING SITES

CLIENT	Pine Dale Mine			RCA Ref	6880-870a/010
DRAWN BY	KS	SCALE	1 : 5000 (A3)	DRAWING No 2	REV 0
APPROVED BY	KT	DATE	10/2/2015	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

Plan 8

R.W. CORKERY & CO. PTY. LIMITED

Figure 2.8
INDICATIVE FINAL LANDFORM AND REVEGETATION

APPENDIX B

ENVIRONMENTAL MONITORING SUMMARY REPORT

RCA Laboratories- Environmental Report 6880-870a

AEMR SUMMARY REPORT COMPILED FOR PINE DALE MINE

Environmental Performance Monitoring
January – December 2014

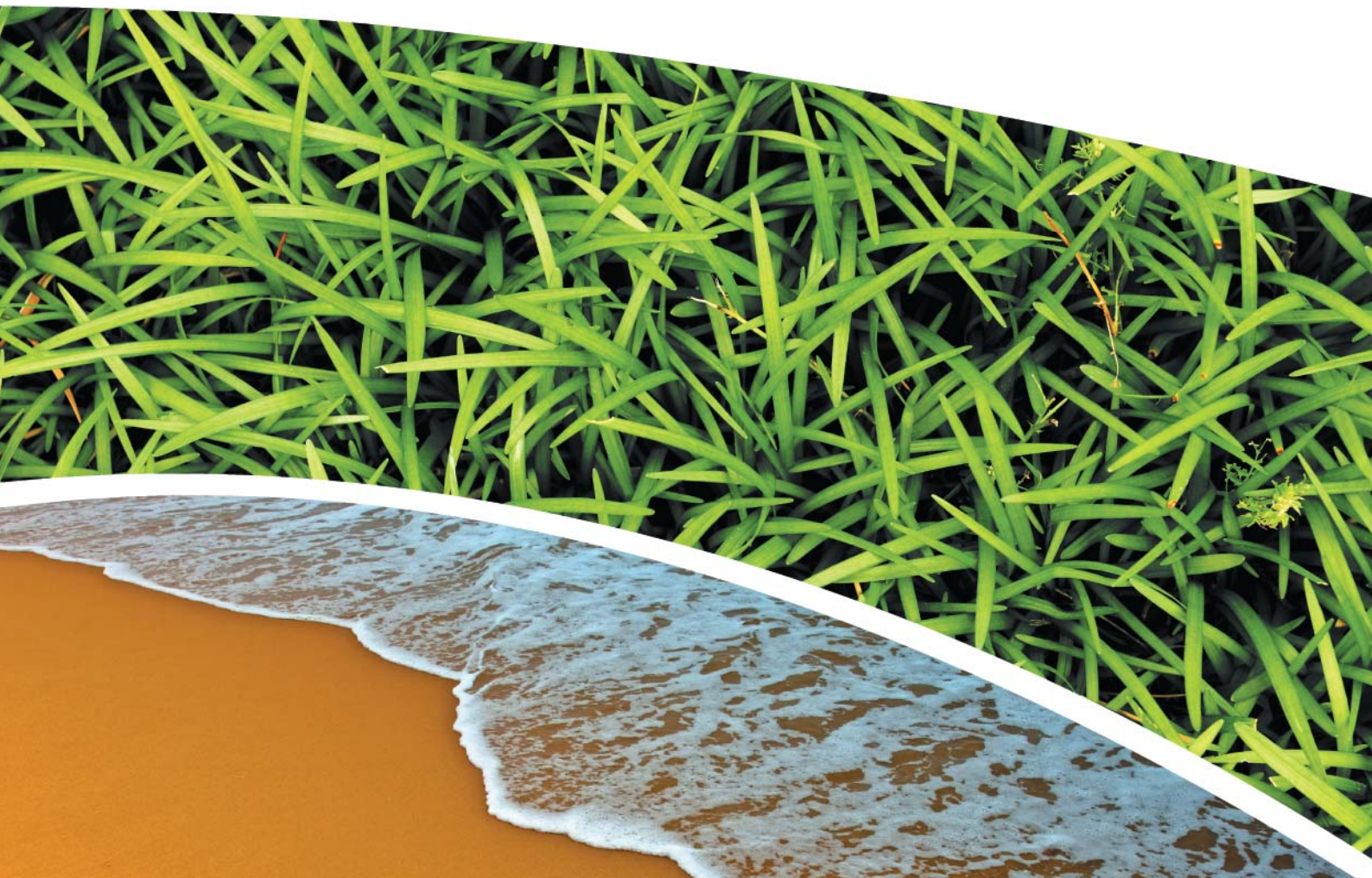
Pine Dale Mine

RCA Australia

RCA ref 6880-870a/0

18 February 2015

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL



RCA AUSTRALIA
ABN 53 063 515 711

92 Hill Street, CARRINGTON NSW 2294

Telephone: +61 2 4902 9200
Facsimile: +61 2 4902 9299
Email: administrator@rca.com.au
Internet: www.rca.com.au

DOCUMENT STATUS						
Rev No	**Comment**	**Author**	**Reviewer**	**Approved for Issue (Project Manager)**		
				Name	**Signature**	**Date**
/0	Final	Carmen Rocher	Karen Tripp	Karen Tripp		18.02.14

DOCUMENT DISTRIBUTION				
Rev No	**Copies**	**Format**	**Issued to**	**Date**
/0	1	Electronic (email)	Pine Dale Mine – Mr Graham Goodwin; Mr Tom Hurdley	18.02.14
/0	1	Bound report	Pine Dale Mine – Mr Graham Goodwin; Mr Tom Hurdley	18.02.14
/0	1	Bound report	RCA – job archive	18.02.14
/0	1	Electronic report	RCA – job archive	18.02.14

RCA-LE ref 6880-870a/0

18 February 2014

Pine Dale Mine
PO Box 202
WALLERAWANG NSW 2845

Attention: Mr Graham Goodwin

AEMR SUMMARY REPORT
COMPILED FOR PINE DALE MINE
DETAILING ENVIRONMENTAL PERFORMANCE MONITORING
JANUARY – DECEMBER 2014

Robert Carr & Associates Pty Ltd
T/A RCA Laboratories ABN 53 063 515 711
92 Hill St Carrington Newcastle NSW 2294
Ph 02 **4902 9200 Fax** 02 **4902 9299**
Email administrator@rca.com.au
Web www.rca.com.au

Contents

LIST OF FIGURES

LIST OF TABLES

APPENDIX

1 EXECUTIVE SUMMARY

Pine Dale Mine achieved an acceptable standard of environmental performance during the 2014 reporting period, as evidenced by the following:

- Air quality monitoring results recorded during the reporting period for depositional dust, total suspended particulate matter (TSP) and fine particulate matter (PM_{10}) were well below the Environmental Protection Authority assessment criteria in Blackmans Flat and other privately owned properties adjacent to the Mining Leases;
- There were no noise exceedances from mining activities recorded at privately owned properties recorded during the reporting period;
- Blasting impacts were managed within the assessment criteria limits for overpressure and ground vibration with no exceedences recorded during the reporting period; and
- There were no surface water discharge events during the reporting period and monitoring was conducted in accordance with EPL 4911 and the site Water Management Plan.

2 INTRODUCTION

The following report provides a summary of monthly environmental monitoring data for Pine Dale Mine for the year 2014. Summary data is comprised of High Volume Air Samples (TSP & PM_{10}), Depositional Dust, Surface Water, Groundwater monitoring, Noise monitoring and Blast monitoring.

This report satisfies the requirements to monitor environmental parameters as presented in the Pine Dale Mine Environmental Protection Licence (EPL 4911) and Project Approval (PA 10_0041). Monitoring is undertaken in accordance with the site's *Water Management Plan* and *Baseline Water Monitoring Plan* (which are currently under review); the *Air Quality and Greenhouse Gas Management Plan*; *Purple Copper Butterfly Monitoring Programme*; the *Noise Management Plan*; and the *Blast Management Plan*.

A compliance assessment of each environmental monitoring parameter is made in accordance with the relevant assessment criteria outlined in Project Approval (PA 10_0041), the site Management Plans and Environmental Protection Licence (EPL 4911).

At the request of Pine Dale Mine, the results of groundwater quality monitoring have been assessed against the Trigger Levels presented in the Pine Dale Coal Mine *Groundwater Monitoring Program* (Report No. 613/05, Dec 2005). These Trigger Levels have been adopted for use in this report as the Trigger Levels for water quality monitoring presented in the current Pine Dale Mine *Water Management Plan* (Report No. 613/20, July 2011) are under review at present.

3 AIR QUALITY MONITORING

3.1 DEPOSITIONAL DUST AND HVAS PARTICULATE MATTER ASSESSMENT CRITERIA

The Pine Dale Mine Project Approval (PA 10_0041, Schedule 3 Condition 18) and *Air Quality and Greenhouse Gas Management Plan* stipulates that dust emissions generated by the project must not cause additional exceedances of the long term impact assessment criteria listed in **Table 1, 2** and **3** (below).

Table 1 *Depositional Dust: Long Term Assessment Criteria*

Pollutant	Average Period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c]Deposited dust	Annual	[b]2 g/m^2.month	[a]4g/m^2.month

Table 2 *HVAS Particulate Matter: Long Term Assessment Criteria*

Pollutant	Average Period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a]90µg/m^3
Particulate matter < 10µm (PM_{10})	Annual	[a]30µg/m^3

Table 3 *HVAS Particulate Matter: Short Term Assessment Criteria*

Pollutant	Average Period	[d]Criterion
Particulate matter < 10µm (PM_{10})	24 hours	[a]50µg/m^3

- *a Total impact ie, incremental increase in concentrations due to the project plus background concentrations due to other sources);*
- *b Incremental impact (i.e. incremental increase in concentrations due to the project on its own);*
- *c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method;*
- *d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agree to by the Director-General in consultation with DECCW.*

3.1 AIR MONITORING RESULTS – DEPOSITIONAL DUST GAUGE DATA SUMMARY

Depositional dust monitoring is undertaken at 10 locations across the Pine Dale Mine site. A total of six (6) depositional dust gauges are monitored in accordance with the Pine Dale Mine *Air Quality and Green House Gas Management Plan* and Environmental Protection Licence (No. 4911). Two of these gauges are located within the settlement of Blackmans Flat (gauges D1 & D2). A third gauge is located to the east of Blackmans Flat along the Castlereagh Highway (gauge D3). The remaining three gauges (D4, D5 & D6) were installed in November 2006 to coincide with the commencement of mining in Areas B & C. Gauge D4 is located to the north of View St, Blackmans Flat. Gauges D5 & D6 are located to the east of Mining Areas B & C, along Wolgan Road, Lidsdale (refer Drawing 1, **Appendix 1**).

The remaining four (4) depositional dust gauges are monitored in accordance with the Pine Dale Mine *Purple Copper Butterfly Monitoring Program*. These gauges are named PCB1, PCB2, PCB3 and PCB7. Three of the dust gauges are located within the major butterfly population to the east of the mine workings in the Yarraboldy Extension (PCB1-3), whilst the fourth dust gauge (PCB7) is located to the south west of the butterfly habitat area (refer Drawing 1, **Appendix 1**).

Depositional Dust summary results for the period January – December 2014 are shown in **Tables 4** to **13**. Graphical presentations are shown in **Figures 1** and **2**. A discussion of results is presented in **Section 2.3**.

Table 4 *Depositional Dust Data Summary Gauge D1 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	D1	1.0	0.6	0.4
Feb-14	D1	0.8	0.4	0.4
Mar-14	D1	0.7	0.3	0.4
Apr-14	D1	0.6	0.3	0.3
May-14	D1	0.5	0.2	0.3
Jun-14	D1	0.6	0.3	0.3
Jul-14	D1	0.5	0.2	0.3
Aug-14	D1	0.3	0.1	0.2
Sep-14	D1	0.8	0.3	0.5
Oct-14	D1	0.9	0.4	0.5
Nov-14	D1	1.2	0.7	0.5
Dec-14	D1	2.7	1.0	1.7
ANNUAL AVERAGE		***0.9***	***0.4***	***0.5***

Table 5 *Depositional Dust Data Summary Gauge D2 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	D2	1.1	0.6	0.5
Feb-14	D2	0.5	0.2	0.3
Mar-14	D2	0.4	0.05*	0.4
Apr-14	D2	0.3	0.05*	0.3
May-14	D2	0.3	0.1	0.2
Jun-14	D2	0.4	0.1	0.3
Jul-14	D2	0.4	0.1	0.3
Aug-14	D2	0.2	0.05*	0.2
Sep-14	D2	BF	BF	BF
Oct-14	D2	0.8	0.4	0.4
Nov-14	D2	1.1	0.7	0.4
Dec-14	D2	1.3	0.8	0.5
ANNUAL AVERAGE		***0.6***	***0.3***	***0.3***

BF- Broken funnel – stand knocked over. No result available.

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 6 *Depositional Dust Data Summary Gauge D3 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	D3	1.5	1.0	0.5
Feb-14	D3	1.0	0.6	0.4
Mar-14	D3	0.5	0.2	0.3
Apr-14	D3	0.1	0.05*	0.1
May-14	D3	0.2	0.05*	0.2
Jun-14	D3	0.7	0.4	0.3
Jul-14	D3	0.6	0.4	0.2
Aug-14	D3	0.4	0.2	0.2
Sep-14	D3	1.0	0.4	0.6
Oct-14	D3	1.0	0.5	0.5
Nov-14	D3	1.2	0.8	0.4
Dec-14	D3	2.0	1.4	0.6
ANNUAL AVERAGE		***0.9***	***0.5***	***0.4***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 7 *Depositional Dust Data Summary Gauge D4 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	D4	0.6	0.3	0.3
Feb-14	D4	0.4	0.05*	0.4
Mar-14	D4	0.6	0.05*	0.6
Apr-14	D4	0.6	0.05*	0.6
May-14	D4	0.3	0.1	0.2
Jun-14	D4	0.3	0.1	0.2
Jul-14	D4	0.3	0.1	0.2
Aug-14	D4	0.2	0.1	0.1
Sep-14	D4	0.5	0.2	0.3
Oct-14	D4	0.6	0.3	0.3
Nov-14	D4	0.7	0.4	0.3
Dec-14	D4	1.4	0.7	0.7
ANNUAL AVERAGE		***0.5***	***0.2***	***0.4***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 8 *Depositional Dust Data Summary Gauge D5 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	D5	1.9	0.8	1.1
Feb-14	D5	0.4	0.2	0.2
Mar-14	D5	0.4	0.2	0.2
Apr-14	D5	0.4	0.1	0.3
May-14	D5	0.1	0.05*	0.1
Jun-14	D5	0.6	0.1	0.5
Jul-14	D5	0.3	0.2	0.1
Aug-14	D5	0.3	0.1	0.2
Sep-14	D5	0.4	0.2	0.2
Oct-14	D5	EB	EB	EB
Nov-14	D5	1.9	0.7	1.2
Dec-14	D5	1.4	0.9	0.5
ANNUAL AVERAGE		***0.7***	***0.3***	***0.4***

EB – indicates excessive bird droppings were present and the sample was rejected due to contamination.

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 9 *Depositional Dust Data Summary Gauge D6 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	D6	1.0	0.5	0.5
Feb-14	D6	0.3	0.1	0.2
Mar-14	D6	0.2	0.05*	0.2
Apr-14	D6	0.4	0.1	0.3
May-14	D6	0.3	0.1	0.2
Jun-14	D6	1.1	0.3	0.8
Jul-14	D6	0.5	0.2	0.3
Aug-14	D6	0.2	0.1	0.1
Sep-14	D6	0.5	0.2	0.3
Oct-14	D6	0.5	0.3	0.2
Nov-14	D6	0.9	0.6	0.3
Dec-14	D6	1.0	0.6	0.4
ANNUAL AVERAGE		***0.6***	***0.3***	***0.3***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 10 *Depositional Dust Data Summary Gauge PCB1 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	PCB1	1.3	0.8	0.5
Feb-14	PCB1	1.3	0.4	0.9
Mar-14	PCB1	1.0	0.3	0.7
Apr-14	PCB1	0.4	0.05*	0.4
May-14	PCB1	0.5	0.1	0.4
Jun-14	PCB1	0.6	0.1	0.5
Jul-14	PCB1	0.6	0.2	0.4
Aug-14	PCB1	0.5	0.2	0.3
Sep-14	PCB1	0.8	0.3	0.5
Oct-14	PCB1	0.5	0.2	0.3
Nov-14	PCB1	1.3	0.7	0.6
Dec-14	PCB1	1.7	0.8	0.9
ANNUAL AVERAGE		***0.9***	***0.3***	***0.5***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 11 *Depositional Dust Data Summary Gauge PCB2 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	PCB2	0.9	0.4	0.5
Feb-14	PCB2	1.1	0.2	0.9
Mar-14	PCB2	0.7	0.1	0.6
Apr-14	PCB2	0.3	0.05*	0.3
May-14	PCB2	0.3	0.05*	0.3
Jun-14	PCB2	0.1	0.05*	0.1
Jul-14	PCB2	0.4	0.05*	0.4
Aug-14	PCB2	0.3	0.1	0.2
Sep-14	PCB2	RN	RN	RN
Oct-14	PCB2	0.7	0.3	0.4
Nov-14	PCB2	1.0	0.5	0.5
Dec-14	PCB2	1.6	0.6	1.0
ANNUAL AVERAGE		***0.7***	***0.2***	***0.5***

RN – Invalid sample; crucible broken during analysis. No result available.
* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 12 *Depositional Dust Data Summary Gauge PCB3 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	PCB3	1.1	0.3	0.8
Feb-14	PCB3	0.8	0.1	0.7
Mar-14	PCB3	0.5	0.1	0.4
Apr-14	PCB3	0.4	0.05*	0.4
May-14	PCB3	0.1	0.05*	0.1
Jun-14	PCB3	0.3	0.05*	0.3
Jul-14	PCB3	0.4	0.1	0.3
Aug-14	PCB3	0.3	0.1	0.2
Sep-14	PCB3	0.6	0.2	0.4
Oct-14	PCB3	0.5	0.2	0.3
Nov-14	PCB3	0.6	0.3	0.3
Dec-14	PCB3	1.8	0.7	1.1
ANNUAL AVERAGE		***0.7***	***0.2***	***0.4***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 13 *Depositional Dust Data Summary Gauge PCB7 Jan – Dec 2014*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-14	PCB7	1.1	0.5	0.6
Feb-14	PCB7	0.7	0.2	0.5
Mar-14	PCB7	0.9	0.4	0.5
Apr-14	PCB7	0.6	0.1	0.5
May-14	PCB7	0.2	0.05*	0.2
Jun-14	PCB7	0.3	0.05*	0.3
Jul-14	PCB7	0.4	0.2	0.2
Aug-14	PCB7	0.1	0.05*	0.1
Sep-14	PCB7	0.7	0.2	0.5
Oct-14	PCB7	0.6	0.3	0.3
Nov-14	PCB7	1.0	0.5	0.5
Dec-14	PCB7	1.8	0.8	1
ANNUAL AVERAGE		***0.7***	***0.3***	***0.4***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

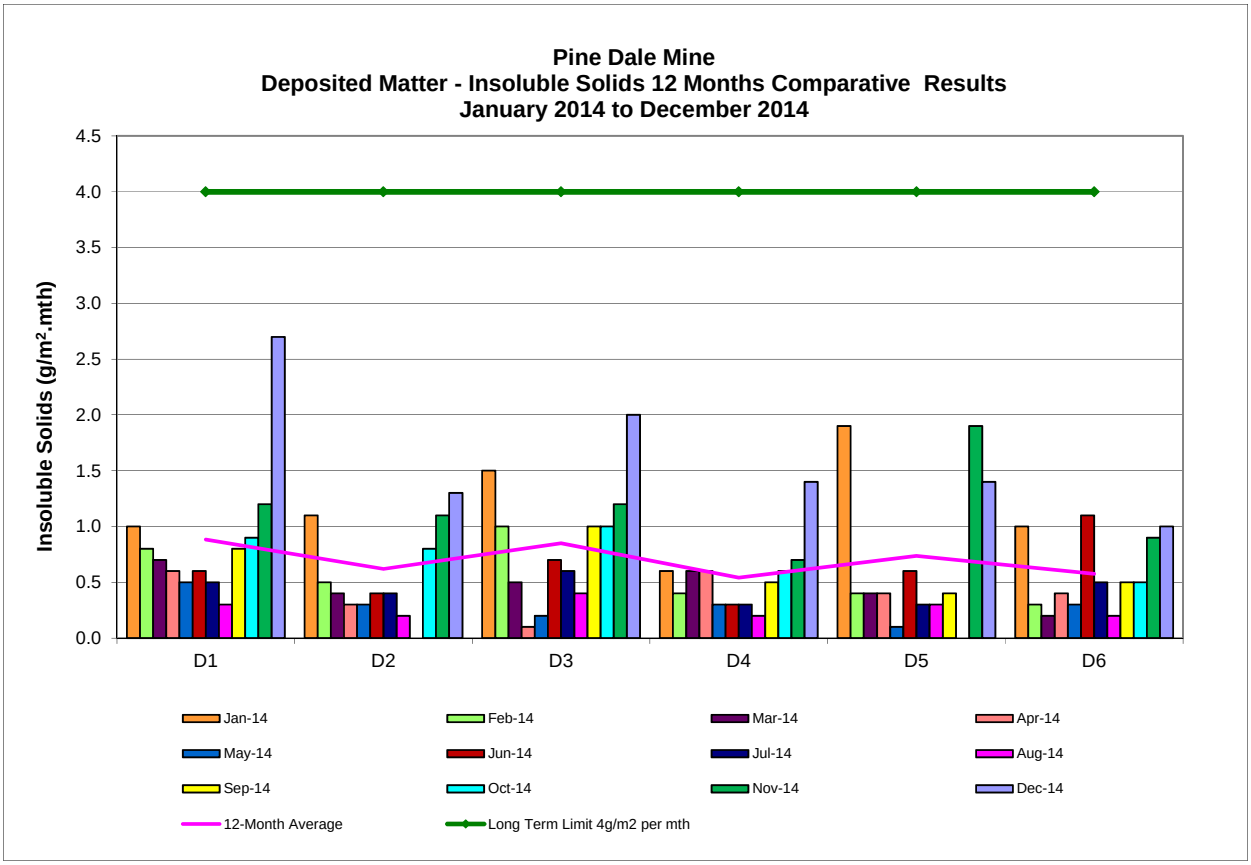


Figure 1 *Depositional Dust Results - Gauges D1 to D6*

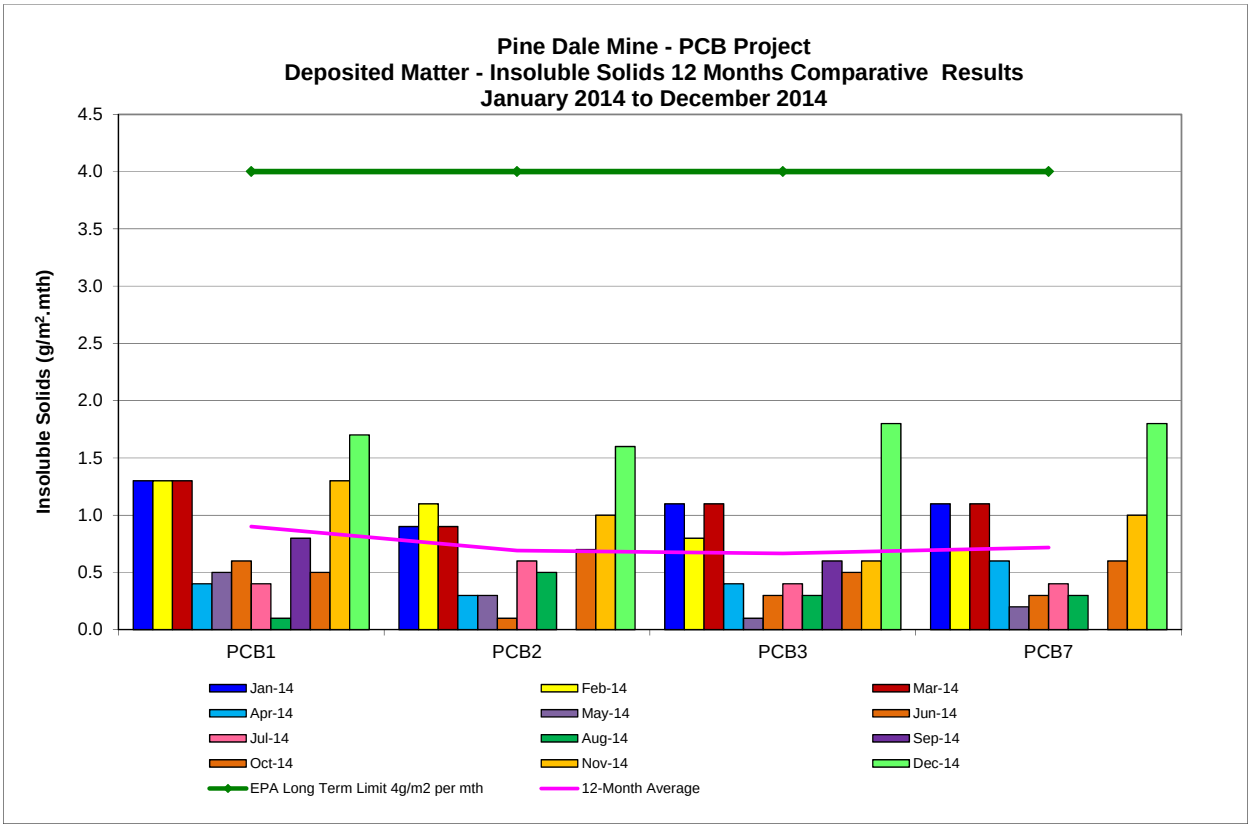


Figure 2 *Depositional Dust Results – Gauges PCB1-3 & PCB7*

3.2 AIR MONITORING RESULTS – HVAS PARTICULATE MATTER DATA SUMMARY

Pine Dale Coal Mine monitors Total Particulate Matter <10µm (PM_{10}) and Total Suspended Particulate matter (TSP) at one location in accordance with the Pine Dale Mine *Air Quality and Green House Gas Management Plan* and Environmental Protection Licence (No. 4911). The HVAS TSP and PM_{10} units are both located adjacent to the mine office at Blackmans Flat (refer Drawing 1, **Appendix 1**).

HVAS Particulate Matter summary results for the period January – December 2014 are shown in **Table 14**. Graphical presentations are shown in **Figure 3**.

Table 14 *HVAS Particulate Matter Summary Jan – Dec 2014*

Run Date	HVAS TSP ($\mu g/m^3$)	HVAS PM_{10} ($\mu g/m^3$)	Run Date	HVAS TSP ($\mu g/m^3$)	HVAS PM_{10} ($\mu g/m^3$)
4-Jan-14	41	6	9-Jul-14	16	5
10-Jan-14	23	14	15-Jul-14	7	3
16-Jan-14	68	9	21-Jul-14	9	6
22-Jan-14	14	22	27-Jul-14	7	3
28-Jan-14	24	24	2-Aug-14	12	4
3-Feb-14	42	16	8-Aug-14	18	10
9-Feb-14	35	15	14-Aug-14	13	7
15-Feb-14	22	34	20-Aug-14	11	4
21-Feb-14	28	5	26-Aug-14	5	2
27-Feb-14	16	13	1-Sep-14	23	9
5-Mar-14	16	20	7-Sep-14	10	2
11-Mar-14	14	19	13-Sep-14	23	3
17-Mar-14	16	14	19-Sep-14	21	7
23-Mar-14	13	15	25-Sep-14	8	3
29-Mar-14	8	10	1-Oct-14	27	7
4-Apr-14	5	9	7-Oct-14	21	6
10-Apr-14	12	7	13-Oct-14	22	8
16-Apr-14	13	9	19-Oct-14	16	8
22-Apr-14	22	7	25-Oct-14	34	15
28-Apr-14	8	4	31-Oct-14	64	23
4-May-14	12	2	6-Nov-14	20	11
10-May-14	11	5	12-Nov-14	23	13
16-May-14	24	6	18-Nov-14	29	13
22-May-14	28	10	24-Nov-14	42	23
28-May-14	13	3	30-Nov-14	21	12
3-Jun-14	9	4	6-Dec-14	7	4
9-Jun-14	11	5	12-Dec-14	9	4
15-Jun-14	7	12	18-Dec-14	41	19
21-Jun-14	13	16	24-Dec-14	23	14
27-Jun-14	8	7	30-Dec-14	72	32
3-Jul-14	16	3			
			Annual Average	***20.4***	***9.5***

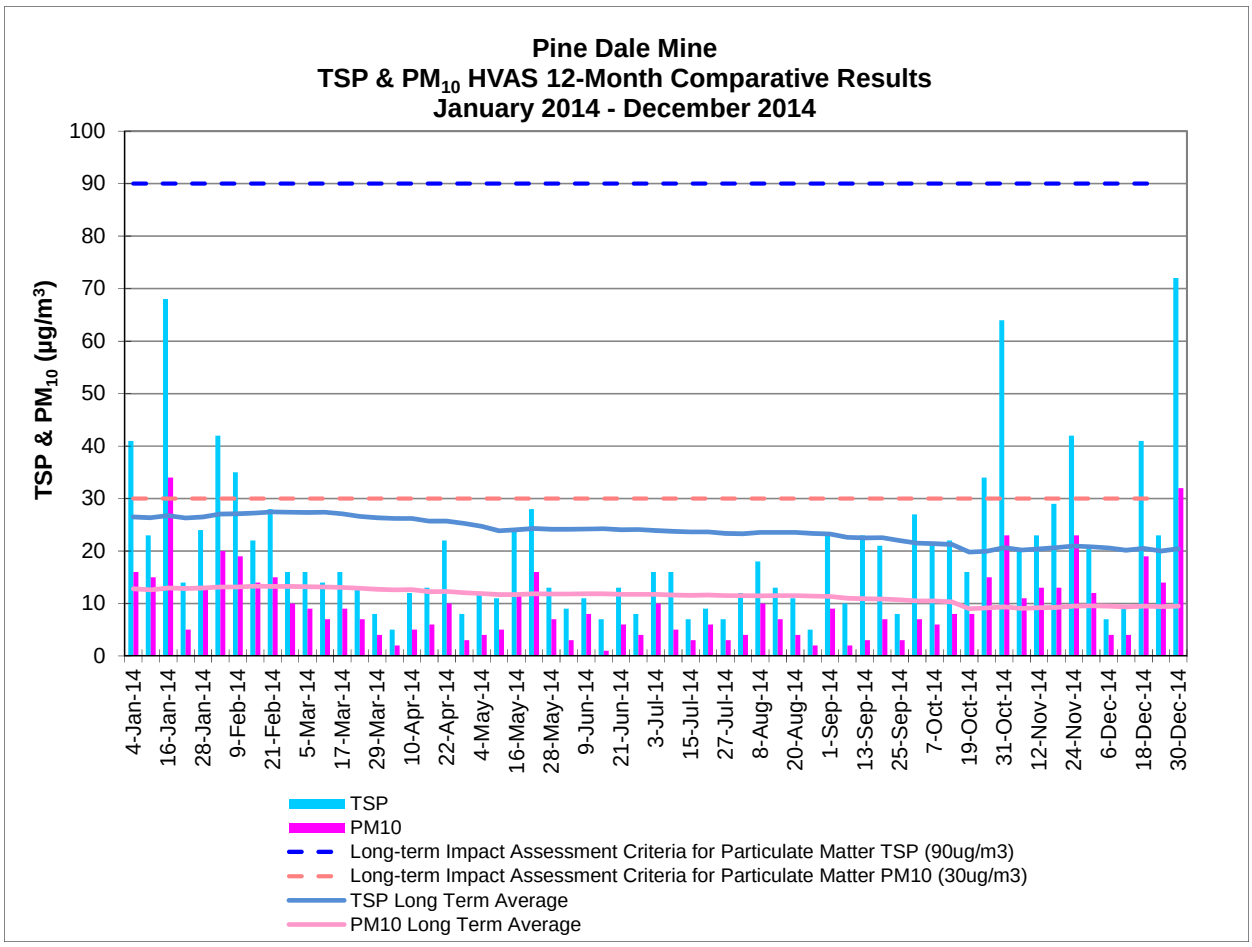


Figure 3 *HVAS TSP & PM_{10} Particulate Matter Summary Jan- Dec 2014*

3.3 REVIEW & INTERPRETATION OF AIR MONITORING RESULTS

3.3.1 DEPOSITIONAL DUST RESULTS

Depositional Dust results for the period January – December 2014 show an average insoluble solids range of 0.5 g/m^2 per month to 0.9 g/m^2 per month for dust gauges D1 to D6. These results fall well below the nominated annual average assessment criteria of 4.0g/m^2 per month, as stipulated in the *Air Quality Monitoring Program*.

During the 2014 monitoring period, there were no instances where the dust gauges showed results which were greater than the maximum increase of 2g/m^2 per month deposited matter, as stipulated in the site's Air Quality Monitoring Program. No result was recorded for dust gauge D2 in September 2014 due to the funnel being broken by a falling branch. No results were available at dust gauge D6 for the month of October 2014 due to excessive bird droppings resulting in the sample being rejected due to the significant amount of contamination.

It should be noted that dust gauges PCB1, PCB2, PCB3 and PCB7 are located in a bushland setting under the canopy of tall trees as the purpose of these gauges, is to determine the level of dust present at each location to aid in study of the Purple Copper Butterfly population.

3.3.2 HVAS PARTICULATE MATTER RESULTS

HVAS Total Suspended Particulate (TSP) results for the period January – December 2014 show an average result of 20.4μg/m^3, which is well below the nominated annual average assessment a criterion of 90μg/m^3 for total suspended particulates. During the reporting period the TSP HVAS recorded 100% data capture, with sampling undertaken in accordance with AS3580.9.3.

Similarly, the HVAS particulate matter results <10μm (PM_{10}) also show results within the required *Air Quality Monitoring Program* assessment criteria. The average PM_{10} result was 9.5μg/m^3, which is below the annual average PM_{10} assessment criteria of 30μg/m^3. All HVAS results were below the OEH 24 hour maximum assessment criteria of 50μg/m^3.

During the reporting period the PM10 HVAS recorded 100% data capture, with sampling undertaken in accordance with AS3580.9.3.

4 GROUNDWATER QUALITY MONITORING

4.1 GROUNDWATER ASSESSMENT CRITERIA

The purpose of groundwater monitoring is to ensure that any impact of the mining operations on the local groundwater can be identified. The site specific Trigger Values for water quality parameters pH and Electrical Conductivity developed for the Pine Dale Mine, as stipulated in the sites' *Water Management Plan* in accordance with Schedule 3, Condition 27(c) of the Project Approval (PA 10_0041) are currently under review, therefore the Trigger Level values presented in the previous version of the sites' *Groundwater Monitoring Program* (Dec 2005) have been adopted for the purpose of compliance assessment in this report. The adopted Action Threshold values are shown in **Table 15**.

Table 15 *Groundwater Trigger Levels*

Bore	pH	Electrical Conductivity (μS/cm)	Dissolved Iron* (Fe, mg/L)	
			Baseline Average (Oct 05 to Dec 06)	Calculated Trigger Level
P6	<4.0 or >8.5	2000	20.3	30.4
P7			0.82	1.1
EP DDH4/GW (Bore D)			NA	NA
EP DDH7/GW (Bore A)			NA	NA
EP PDH1/GW Bore C)			NA	NA
EP PDH3/GW (BH-5)			NA	NA
EP PDH4/GW (BH 6)			NA	NA
EP PDH7/GW (Bore E)			NA	NA
EP PDH8/GW (removed)			NA	NA
Old ventilation shaft			NA	NA
The Bong			NA	NA

NA – baseline data not available for this monitoring period at these locations.

* >50% increase on baseline concentration for Bore P6; and >30% increase on baseline concentration for Bore P7

A summary of the standing water level trigger values, as presented in the sites' current *Water Management Plan* are presented in **Table 16**.

Table 16 *Trigger Levels for Groundwater Depth Levels*

Site ID	10% of Saturated Aquifer Thickness	Minimum Water Level Reported (m AHD)	Trigger Water Level (m AHD)
P7	1.72	885.1	883.38
EP DDH3/GW Irondale Lidsdale Marrangarroo	 0.1 0.17 0.7	 908.34 892.24 890.75	 908.24 892.07 890.05
EP DDH4/GW	0.5	944.38	943.88
EP DDH5/GW Sandstone Irondale Lidsdale	 0 0.2 0.2	 921.23 911.38 898.24	 921.23 911.18 898.04
EP DDH6/GW Irondale	 0.1	 882	 881.9
EP DDH7/GW	0.9	953.66	952.76
EP PDH7/GW	0.12	939.66	939.54

4.2 GROUNDWATER MONITORING DATA SUMMARY

Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the *Groundwater Monitoring Program (December 2005),* the *Water Management Plan (July 2011)* and the *Baseline Water Monitoring Program (July 2011).* Sampling is conducted at a total of three locations within the mine site; a further five locations surrounding the Yarraboldy Extension area; and two locations at the former Enhance Place Mine Site (refer Drawing 1, **Appendix 1**.). Groundwater monitoring is not a requirement of EPL 4911.

Groundwater summary results for the period January – December 2014 are shown in **Tables 17** to **25**. Graphical presentations of standing water levels are shown in **Figures 4** to **6**.

Three of the groundwater bores located off-site have vibrating wire piezometers installed within them, hence, no samples were retrieved from these bores.

Table 17 *Groundwater Monitoring Bore P6 Results Jan - Dec 2014*

Location	Site Bore P6												
Sample Number	01146880014	02146880014	03146880014	04146880009	05146880011	06146880009	07146880009	08146880011	09146880009	1014688009	11146880011	1214688009	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/01/14	18/02/14	18/03/14	15/04/14	16/05/14	17/06/14	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14	
Time Sampled	16:00	15:16	16:02	12:03	8:04	14:28	13:43	14:44	10:36	13:16	15:12	14:30	
Standing Water Level (m)	27.95	27.37	27.12	26.68	26.73	26.70	26.80	26.78	26.98	26.77	26.78	26.58	**Trigger Levels**
Standpipe Height	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Relative Standing Water Level (m)	27.00	26.42	26.17	25.73	25.78	25.75	25.85	25.83	26.03	25.82	25.83	25.63	
Water Level AHD (m)	889.95	890.53	890.78	891.22	891.17	891.20	891.10	891.12	890.92	891.13	891.12	891.32	
Temperature (°C)	15.0	15.0	16.0	15.5	13.0	13.4	14.5	15.0	15.5	16.5	16.2	17.5	
pH	6.72	7.70	6.32	7.72	7.99	6.08	5.91	6.46	6.34	6.24	6.42	5.90	**<4.0 or >8.5**
Conductivity (µS/cm)	1188	1270	1148	1111	1125	1165	1175	1230	1148	1115	1194	1193	**2000**
Turbidity (NTU)	12	20	13	40	9	6	11	11	65	35	27	19	
Dissolved Oxygen (mg/L)	5.4	4.2	4.7	6.5	7.0	3.4	4.2	3.7	5.5	6.4	7.9	6.4	
TSS (mg/L)	30	27	64	50	22	38	20	18	24	36	45	34	
Oil & Grease (mg/L)	<2	<2	<2	< 2	< 2	< 2	< 2	<2	<2	<2	<2	<2	
Bicarbonate Alkalinity	74	66	50	38	62	60	55	70	40	38	36	49	
Total Alkalinity	74	66	50	38	62	60	55	70	40	38	36	49	
Sulphate	502	526	428	502	570	692	551	610	653	522	644	603	
Chloride	26	25	22	20	24	29	23	28	26	35	24	29	
Calcium	116	115	111	116	114	136	128	130	121	120	142	136	
Magnesium	53	53	50	51	58	63	58	60	58	56	57	66	
Sodium	45	40	38	40	41	50	43	49	47	40	45	52	
Potassium	21	21	19	20	18	22	22	20	22	20	19	20	
Cobalt (dissolved)	0.073	0.081	0.07	0.07	0.072	0.078	0.186	0.077	0.07	0.066	0.07	0.073	
Manganese (dissolved)	2.79	3.19	3.11	2.86	3.11	3.46	3.00	2.68	2.94	2.5	2.84	2.87	
Nickel (dissolved)	0.097	0.128	0.112	0.106	0.112	0.113	0.222	0.123	0.117	0.107	0.116	0.12	
Zinc (dissolved)	0.116	0.132	0.089	0.48	0.14	0.061	0.214	0.169	0.089	0.206	0.157	0.104	
Iron (dissolved)	24.3	18.3	20.7	< 0.05	30.3	35.8	30.9	25	26.8	25	29.5	32.2	**30.4**

Shaded Cells - Indicates results are outside the Trigger Level. --- Indicates no sampling required during particular period.

Table 18 *Groundwater Monitoring Bore P7 Results Jan - Dec 2014*

Location	Site Bore P7												
Sample Number	01146880015	02146880015	03146880015	04146880010	05146880012	06146880010	07146880010	08146880012	09146880010	1014688010	11146880012	12146880010	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/01/14	18/02/14	18/03/14	15/04/14	15/05/14	17/06/14	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14	
Time Sampled	16:30	15:46	16:50	11:02	4:26	14:58	14:33	16:09	11:14	14:30	16:16	15:20	**Trigger Levels**
Standing Water Level (m)	8.10	7.80	7.66	7.55	7.86	7.84	7.72	7.72	7.70	7.63	7.76	7.52	
Standpipe Height (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Relative Standing Water Level (m)	7.10	6.80	6.66	6.55	6.86	6.84	6.72	6.72	6.70	6.63	6.76	6.52	
Water Level AHD (m)	887.30	887.60	887.74	887.85	887.54	887.56	887.68	887.68	887.70	887.77	887.64	887.88	**883.4#**
Temperature (°C)	14.5	16.0	15.0	15.0	14.0	13.5	13.0	14.8	15.5	15.0	20.5	15.5	
pH (pH units)	7.18	6.76	6.69	7.72	7.28	6.12	6.30	6.45	6.59	6.23	6.50	6.01	**<4.0 or >8.5**
Conductivity (µS/cm)	857	807	850	813	862	764	727	819	749	738	705	819	**2000**
Total Alkalinity (mg/L $CaCO_3$)	--	198	--	--	226	--	--	225	--	--	184	--	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	--	198	--	--	226	--	--	225	--	--	184	--	
Chloride (mg/L)	--	70	--	--	75	--	--	63	--	--	74	--	
Sulphate (mg/L)	--	93	--	--	95	--	--	111	--	--	107	--	
Calcium (mg/L)	--	43	--	--	42	--	--	44	--	--	50	--	
Magnesium (mg/L)	--	47	--	--	51	--	--	47	--	--	46	--	
Sodium (mg/L)	--	46	--	--	47	--	--	51	--	--	43	--	
Potassium (mg/L)	--	8	--	--	8	--	--	8	--	--	8	--	
Filtered Iron (mg/L)	--	1.02	--	--	3.92	--	--	3.16	--	--	0.18	--	**1.1**

Indicates results are outside the Trigger Level. --- Indicates no sampling required during particular period.

Standing Water Level is considered outside of the Trigger Level if the AHD water level drops below the nominated trigger level.

Table 19 *Groundwater Monitoring Bore Old Shaft Results Jan - Dec 2014*

Location	Site Bore 'Old Shaft'												
Sample Number	01146880018	02146880020	03146880018	04146880013	05146880015	06146880013	07146880013	08146880015	09146880013	10146880013	11146880015	12146880013	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/01/2014	18/02/2014	18/03/2014	15/04/2014	15/05/2014	17/06/2014	17/07/2014	18/08/2014	18/09/2014	20/10/2014	18/11/2014	16/12/2014	
Time Sampled	9:50	14:45	15:27	14:20	13:47	13:46	13:03	14:07	10:02	12:30	14:24	14:07	**Trigger Levels**
Standing Water Level (m)	13.49	13.6	13.4	13.04	12.95	13	13.04	13.05	13.05	13.06	13.07	12.84	
Standpipe Height (m)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	
Relative Standing Water Level (m)	11.79	11.9	11.7	11.34	11.25	11.3	11.34	11.35	11.35	11.36	11.37	11.14	
Temperature (°C)	13.5	16.0	15.0	16.0	15	14.0	14.5	15.5	15.0	16.3	17.5	17.0	
pH (pH units)	6.77	7.08	7.49	7.46	7.54	6.22	6.24	6.34	6.31	6.11	6.30	5.87	**<4.0 or >8.5**
Conductivity (µS/cm)	853	880	941	884	920	887	926	954	940	922	950	1005	**2000**
Turbidity (NTU)	36	25	34	3	56	25	20	7	12	68	11	19	
Dissolved Oxygen (mg/L)	--	4.75	--	--	6.5	--	--	5.3	--	--	6.8	--	
TSS (mg/L)	--	31	--	--	7	--	--	23	--	--	19	--	
Oil & Grease (mg/L)	--	<2	--	--	<2	--	--	<2	--	--	<2	--	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	--	59	--	--	66	--	--	70	--	--	65	--	
Total Alkalinity (mg/L $CaCO_3$)	--	59	--	--	66	--	--	70	--	--	65	--	
Chloride (mg/L)	--	376	--	--	435	--	--	469	--	--	501	--	
Sulphate (mg/L)	--	12	--	--	10	--	--	11	--	--	12	--	
Calcium (mg/L)	--	82	--	--	90	--	--	96	--	--	122	--	
Magnesium (mg/L)	--	38	--	--	44	--	--	43	--	--	47	--	
Sodium (mg/L)	--	31	--	--	33	--	--	36	--	--	34	--	
Potassium (mg/L)	--	16	--	--	16	--	--	17	--	--	17	--	
Filtered Cobalt (mg/L)	--	0.258	--	--	0.218	--	--	0.218	--	--	0.232	--	
Filtered Manganese (mg/L)	--	7.68	--	--	7.92	--	--	6.38	--	--	7.01	--	
Filtered Nickel (mg/L)	--	0.203	--	--	0.194	--	--	0.193	--	--	0.223	--	
Filtered Zinc (mg/L)	--	0.085	--	--	0.116	--	--	0.124	--	--	0.139	--	
Filtered Iron (mg/L)	--	15.1	--	--	22.5	--	--	24.4	--	--	29.6	--	

--- Indicates no sampling required during particular period.

Table 20 *Groundwater Monitoring Bore A (EP DDH77/GW) Results Jan - Dec 2014*

Location	Off-Site Bore A (EP DDH7/GW)												
Sample Number	01146880019	02146880021	03146880019	04146880014	05146880016	06146880014	07146880014	08146880016	09146880014	10146880014	11146880016	12146880014	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/01/2014	18/02/2014	18/03/2014	15/04/2014	15/05/2014	17/06/2014	17/07/2014	18/08/2014	18/09/2014	20/10/2014	18/11/2014	16/12/2014	
Standing Water Level (m)	69.25	69.09	69.12	66.1	**	67.89	68.72	68.87	68.9	68.93	69.16	68.99	**Trigger Levels**
Standpipe Height (m)	0.75	0.75	0.75	0.75	**	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Relative Standing Water Level (m)	68.5	68.34	68.37	65.35	**	67.14	67.97	68.12	68.15	68.18	68.41	68.24	
Water level AHD (m)	955.30	955.46	955.43	958.45	**	956.66	955.83	955.68	955.65	955.62	955.39	955.56	**952.8#**
pH	--	--	7.07	--	--	6.61	--	--	6.83	--	--	6.26	**<4.0 or >8.5**
Conductivity (µS/cm)	--	--	305	--	--	242	--	--	217	--	--	276	**2000**
Temperature (°C)	--	--	16.0	--	--	13.5	--	--	15.8	--	--	17.3	
TDS (mg/L)	--	--	154	--	--	120	--	--	130	--	--	110	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	--	--	110	--	--	101	--	--	86	--	--	84	
Total Alkalinity (mg/L $CaCO_3$)	--	--	110	--	--	101	--	--	86	--	--	84	
Sulfate (mg/L)	--	--	2	--	--	4	--	--	4	--	--	4	
Chloride (mg/L)	--	--	5	--	--	5	--	--	6	--	--	4	
Calcium (mg/L)	--	--	18	--	--	16	--	--	16	--	--	19	
Magnesium (mg/L)	--	--	8	--	--	7	--	--	7	--	--	8	
Sodium (mg/L)	--	--	6	--	--	6	--	--	6	--	--	5	
Potassium (mg/L)	--	--	16	--	--	15	--	--	14	--	--	13	
Filtered Arsenic (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Cadmium (mg/L)	--	--	<0.0001	--	--	0.0002	--	--	0.0002	--	--	0.0001	
Filtered Chromium (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Copper (mg/L)	--	--	<0.001	--	--	0.002	--	--	<0.001	--	--	<0.001	
Filtered Lead (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Nickel (mg/L)	--	--	0.002	--	--	0.005	--	--	0.003	--	--	0.003	
Filtered Zinc (mg/L)	--	--	0.025	--	--	0.072	--	--	0.019	--	--	0.033	
Filtered Iron (mg/L)	--	--	5.7	--	--	3.56	--	--	2.71	--	--	3.4	

--- Indicates no sampling required during particular period.

Standing Water Level is considered outside of the Trigger Level if the AHD water level drops below the nominated trigger level.

** No standing water level measurement could be taken due to water level meter under repair.

Table 21 *Groundwater Monitoring Bore C (EP PDH1/GW) Results Jan - Dec 2014*

Location	Off-Site Bore C (EP PDH1/GW)												
Sample Number	01146880021	02146880023	03146880021	04146880016	05146880018	06146880016	07146880016	08146880018	09146880016	10146880016	111468800018	12146880016	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/01/2014	18/02/2014	18/03/2014	15/04/2014	15/05/2014	17/06/2014	17/07/2014	18/08/2014	18/09/2014	20/10/2014	18/11/2014	16/12/2014	**Trigger Levels**
Standing Water Level (m)	76.45	76.53	76.30	75.83	**	75.93	75.98	76.00	75.98	75.98	75.93	75.78	
Standpipe Height (m)	0.74	0.74	0.74	0.74	**	0.74	0.74	0.74	0.74	0.74	0.74	0.74	
Relative Standing Water Level (m)	75.71	75.79	75.56	75.09	**	75.19	75.24	75.26	75.24	75.24	75.19	75.04	
Water level AHD (m)	891.79	891.71	891.94	892.41	**	892.31	892.26	892.24	892.26	892.26	892.31	892.46	**890.1**[#]
pH	--	--	7.42	--	--	6.97	--	--	7.31	--	--	6.72	**<4.0 or >8.5**
Conductivity (µS/cm)	--	--	336	--	--	306	--	--	288	--	--	327	**2000**
Temperature (°C)	--	--	18.0	--	--	17	--	--	18.5	--	--	19.5	
TDS (mg/L)	--	--	165	--	--	182	--	--	170	--	--	162	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	--	--	141	--	--	144	--	--	132	--	--	138	
Total Alkalinity (mg/L $CaCO_3$)	--	--	141	--	--	144	--	--	132	--	--	138	
Sulfate (mg/L)	--	--	2	--	--	2	--	--	1	--	--	3	
Chloride (mg/L)	--	--	4	--	--	5	--	--	5	--	--	4	
Calcium (mg/L)	--	--	30	--	--	32	--	--	30	--	--	34	
Magnesium (mg/L)	--	--	10	--	--	11	--	--	11	--	--	12	
Sodium (mg/L)	--	--	9	--	--	6	--	--	5	--	--	5	
Potassium (mg/L)	--	--	12	--	--	15	--	--	15	--	--	14	
Filtered Arsenic (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Cadmium (mg/L)	--	--	0.0002	--	--	0.0005	--	--	0.0004	--	--	0.0004	
Filtered Chromium (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Copper (mg/L)	--	--	<0.001	--	--	0.001	--	--	<0.001	--	--	0.002	
Filtered Lead (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Nickel (mg/L)	--	--	0.001	--	--	0.001	--	--	0.001	--	--	0.002	
Filtered Zinc (mg/L)	--	--	0.012	--	--	0.017	--	--	0.023	--	--	0.027	
Filtered Iron (mg/L)	--	--	<0.05	--	--	<0.05	--	--	<0.05	--	--	<0.05	

--- Indicates no sampling required during particular period.

Standing Water Level is considered outside of the Trigger Level if the AHD water level drops below the nominated trigger level.

** No standing water level measurement could be taken due to water level meter under repair.

Table 22 *Groundwater Monitoring Bore D (EP DDH4/GW) Results Jan - Dec 2014*

Location	Off-Site Bore D (EP DDH4/GW)												
Sample Number	01146880022	02146880024	03146880022	04146880017	05146880019	06146880017	07146880017	08146880019	09146880017	10146880017	11146880019	12146880017	**Trigger Levels**
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/1/014	18/02/2014	18/03/2014	15/04/2014	15/05/2014	17/06/2014	17/07/2014	18/08/2014	18/09/2014	20/10/2014	18/11/2014	16/12/2014	
Standing Water Level (m)	37.71	37.56	37.26	34.74	**	34.45	37.98	37.67	37.17	37.84	37.46	37.11	
Standpipe Height (m)	0.71	0.71	0.71	0.71	**	0.71	0.71	0.71	0.71	0.71	0.71	0.71	
Relative Standing Water Level (m)	37.00	36.85	36.55	34.03	**	33.74	37.27	36.96	36.46	37.13	36.75	36.40	
Water level AHD (m)	941.50	941.65	941.95	944.47	**	944.76	941.23	941.54	942.04	941.37	941.75	942.10	**943.9**[#]
pH	--	--	7.90	--	--	6.96	--	--	6.88	--	--	6.76	**<4.0 or >8.5**
Conductivity (µS/cm)	--	--	606	--	--	627	--	--	415	--	--	556	**2000**
Temperature (°C)	--	--	16.0	--	--	15.0	--	--	16.8	--	--	21.0	
TDS (mg/L)	--	--	342	--	--	430	--	--	435	--	--	330	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	--	--	211	--	--	281	--	--	182	--	--	206	
Total Alkalinity (mg/L $CaCO_3$)	--	--	211	--	--	281	--	--	182	--	--	206	
Sulfate (mg/L)	--	--	44	--	--	43	--	--	29	--	--	44	
Chloride (mg/L)	--	--	20	--	--	8	--	--	12	--	--	8	
Calcium (mg/L)	--	--	3	--	--	3	--	--	2	--	--	3	
Magnesium (mg/L)	--	--	1	--	--	1	--	--	<1	--	--	1	
Sodium (mg/L)	--	--	128	--	--	150	--	--	102	--	--	101	
Potassium (mg/L)	--	--	6	--	--	8	--	--	8	--	--	7	
Filtered Arsenic (mg/L)	--	--	<0.001	--	--	0.001	--	--	<0.001	--	--	<0.001	
Filtered Cadmium (mg/L)	--	--	0.0002	--	--	0.0002	--	--	<0.0001	--	--	0.0003	
Filtered Chromium (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Copper (mg/L)	--	--	0.002	--	--	0.002	--	--	0.012	--	--	0.032	
Filtered Lead (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	0.002	
Filtered Nickel (mg/L)	--	--	0.004	--	--	0.002	--	--	0.007	--	--	0.019	
Filtered Zinc (mg/L)	--	--	0.044	--	--	0.022	--	--	0.039	--	--	0.118	
Filtered Iron (mg/L)	--	--	0.89	--	--	0.23	--	--	0.09	--	--	0.12	

Indicates results are outside the Trigger Level. --- Indicates no sampling required during particular period.

Standing Water Level is considered outside of the Trigger Level if the AHD water level drops below the nominated trigger level.

** No standing water level measurement could be taken due to water level meter under repair.

Table 23 *Groundwater Monitoring Bore E (EP PDH7/GW) Results Jan - Dec 2014*

Location	Off-Site Bore E (EP PDH7/GW)												
Sample Number	01146880023	02146880025	03146880023	04146880018	05146880020	06146880018	07146880018	08146880020	09146880018	10146880018	11146880020	12146880018	**Trigger Levels**
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	20/01/2014	18/02/2014	18/03/2014	15/04/2014	15/05/2014	17/06/2014	17/07/2014	18/08/2014	18/09/2014	20/10/2014	18/11/2014	16/12/2014	
Standing Water Level (m)	17.08	17.03	15.4	15.08	**	14.42	15.23	15.26	14	15.34	17.06	15.33	
Standpipe Height (m)	0.73	0.73	0.73	0.73	**	0.73	0.73	0.73	0.73	0.73	0.73	0.73	
Relative Standing Water Level (m)	16.35	16.30	14.67	14.35	**	13.69	14.50	14.53	13.27	14.61	16.33	14.60	
Water level AHD (m)	938.55	938.60	940.23	940.55	**	941.21	940.40	940.37	941.63	940.29	938.57	940.30	**939.5**[#]
pH	--	--	7.98	--	--	5.71	--	--	5.87	--	--	4.69	**<4.0 or >8.5**
Conductivity (µS/cm)	--	--	136.5	--	--	103	--	--	83	--	--	99	**2000**
Temperature (°C)	--	--	16.0	--	--	13.5	--	--	13.5	--	--	18.0	
TDS (mg/L)	--	--	72	--	--	34	--	--	69	--	--	62	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	--	--	17	--	--	22	--	--	17	--	--	16	
Total Alkalinity (mg/L $CaCO_3$)	--	--	17	--	--	22	--	--	17	--	--	16	
Sulfate (mg/L)	--	--	6	--	--	6	--	--	6	--	--	6	
Chloride (mg/L)	--	--	7	--	--	8	--	--	8	--	--	6	
Calcium (mg/L)	--	--	1	--	--	1	--	--	<1	--	--	2	
Magnesium (mg/L)	--	--	2	--	--	2	--	--	1	--	--	2	
Sodium (mg/L)	--	--	8	--	--	9	--	--	7	--	--	8	
Potassium (mg/L)	--	--	6	--	--	6	--	--	6	--	--	5	
Filtered Arsenic (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Cadmium (mg/L)	--	--	0.0003	--	--	0.0008	--	--	<0.0001	--	--	0.0003	
Filtered Chromium (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Copper (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Lead (mg/L)	--	--	<0.001	--	--	<0.001	--	--	<0.001	--	--	<0.001	
Filtered Nickel (mg/L)	--	--	0.002	--	--	0.002	--	--	0.001	--	--	0.001	
Filtered Zinc (mg/L)	--	--	0.061	--	--	0.107	--	--	0.011	--	--	0.015	
Filtered Iron (mg/L)	--	--	0.93	--	--	3.19	--	--	0.07	--	--	2.17	

Indicates results are outside the Trigger Level. --- Indicates no sampling required during particular period.

Standing Water Level is considered outside of the Trigger Level if the AHD water level drops below the nominated trigger level.

** No standing water level measurement could be taken due to water level meter under repair.

Table 24 *Groundwater Monitoring Bore - EP PDH3/GW Results Jan - Dec 2014*

Location	Enhance Place Bore EP PDH3/GW											
Sample Number	01146880016	02146880016	03146880016	04146880011	05146880011	06146880011	07146880011	08146880013	09146880011	10146880011	11146880013	12146880011
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Date Sampled	20/01/2014	18/02/2014	18/03/2014	15/04/2014	16/05/2014	17/06/2014	17/07/2014	18/08/2014	19/09/2014	20/10/2014	18/11/2014	16/12/2014
Standing Water Level (m)	23.91	23.94	23.83	23.72	23.85	23.09	23.81	23.83	23.84	23.8	23.84	23.8
Standpipe Height	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Relative Standing Water Level (m)	23.19	23.22	23.11	23	23.13	22.37	23.09	23.11	23.12	23.08	23.12	23.08
Water Level AHD (m)	892.81	892.78	892.89	893	892.87	893.63	892.91	892.89	892.88	892.92	892.88	892.92

Table 25 *Groundwater Monitoring Bore - EP PDH4/GW Results Jan - Dec 2014*

Location	Enhance Place Bore EP PDH4/GW											
Sample Number	01146880017	02146880017	03146880017	04146880012	05146880012	06146880012	07146880012	08146880014	09146880012	10146880012	11146880014	12146880012
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Date Sampled	20/01/2014	18/02/2014	18/03/2014	15/04/2014	16/05/2014	17/06/2014	17/07/2014	18/08/2014	19/09/2014	20/10/2014	18/11/2014	16/12/2014
Standing Water Level (m)	24.12	24.1	23.27	23.34	23.9	22.3	23.24	22.92	23.3	23.2	23.3	23.29
Standpipe Height	0.71	0.71	0.71	0.15	0.74	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Relative Standing Water Level (m)	23.41	23.39	22.56	23.19	23.16	22.10	23.04	22.72	23.10	23.00	23.20	23.19
Water Level AHD (m)	892.67	892.69	893.52	892.89	892.92	893.98	893.04	893.36	892.98	893.08	892.88	892.89

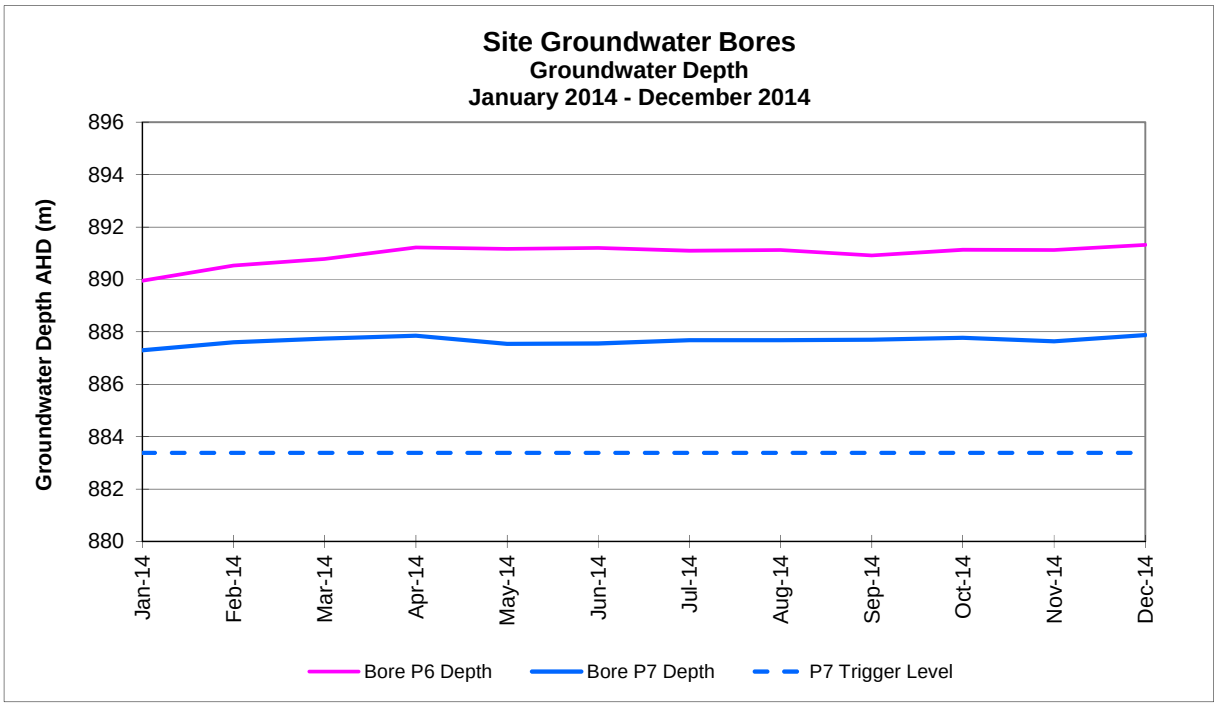


Figure 4 *Site Groundwater Monitoring Bore Depths 2014 – Bores P6 and P7*

Note – there is no trigger level depth for Bore P6 nominated in the Water Management Plan.

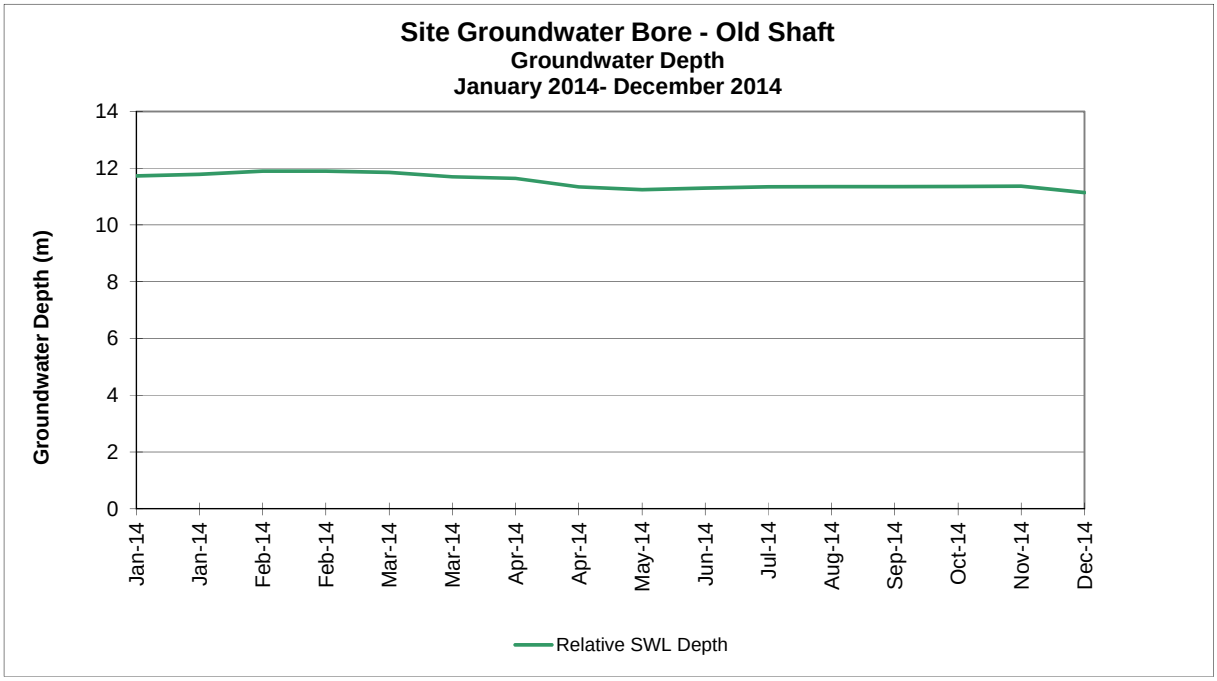
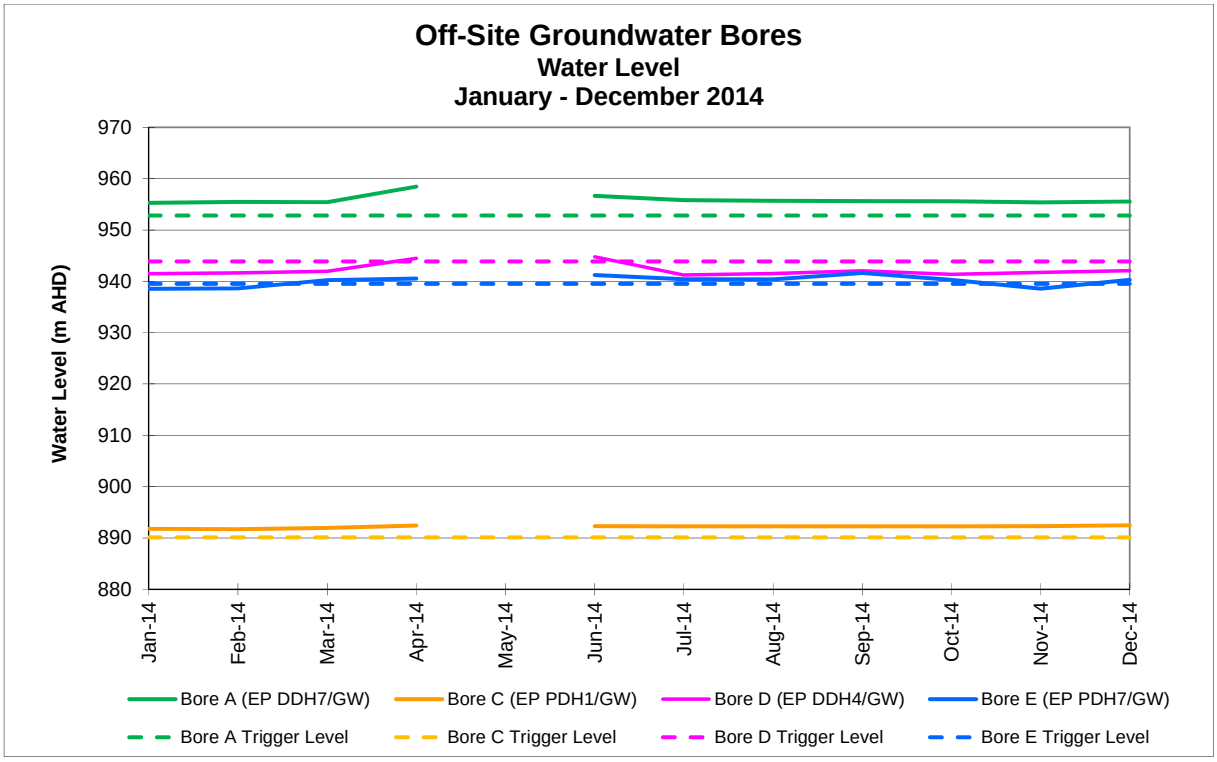


Figure 5 *Site Groundwater Monitoring Bore Depths 2014 – Old Shaft*

Note – there is no trigger level depth for the Old Shaft bore nominated in the Water Management Plan.



Note: no depth measurements could be made in May 2014 due to depth meter under repair.

Figure 6 *Off-Site Groundwater Monitoring Bore Depths 2014*

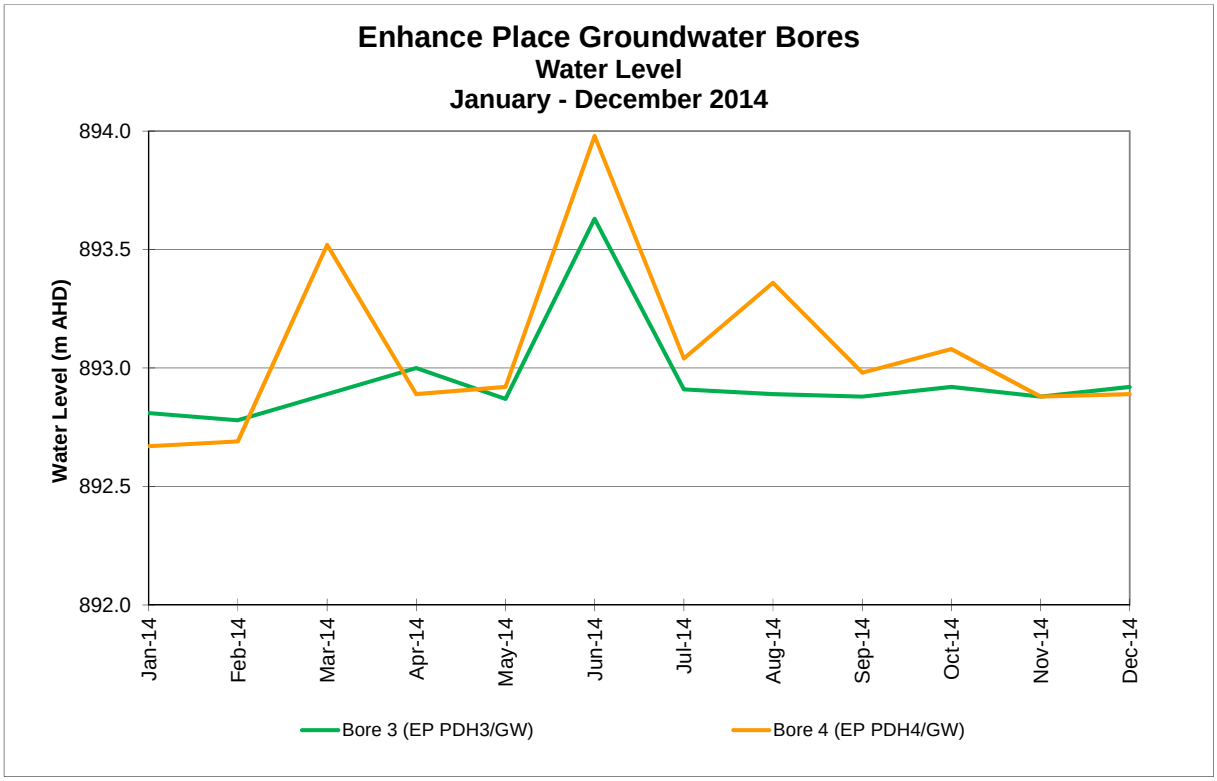


Figure 7 *Enhance Place Groundwater Monitoring Bore Depth 2014*

Note – there are no trigger level depths for the Enhance Place bores nominated in the Water Management Plan.

4.3 REVIEW & INTERPRETATION OF GROUND WATER MONITORING RESULTS

4.3.1 SITE GROUNDWATER BORES

Groundwater samples collected from the on-site groundwater bores during the January – December 2014 period generally show water quality results which are consistent throughout the monitoring period. Water quality within the site bores was shown to be compliant with the trigger levels for key water monitoring parameters pH and EC, as nominated in the *Groundwater Monitoring Program*. Trigger levels for filtered iron were generally compliant for Bores P6 and P7 throughout 2014. The filtered iron Trigger level was exceeded at Bore P6 in June, July and December; and at Bore P7 during the May and August monitoring events. The concentration of filtered iron generally fluctuated between 20mg/L to 30mg/L at Bore P6. The concentration of filtered iron at Bore P7 fluctuated between 0.18mg/L to 3.92mg/L during the 2014 monitoring period. The most likely cause of the fluctuations observed in the filtered iron concentrations within bores P6 and P7 is considered to be the presence of Iron Reducing Bacteria. This naturally occurring bacteria is commonly found in groundwaters, suface waters and soils.

All site bores exhibited standing water levels which were consistent throughout the 2014 monitoring period. There was a slight increase in water level from January to April 2014; however the water level has generally remained stable since May 2014. Trigger levels for water depth were shown to be compliant for the entire monitoring period during 2014 at Bore P7. There is no Trigger level for Bore P6 and Old Shaft.

4.3.1 OFF-SITE GROUNDWATER BORES

The results of monitoring water quality within the off-site groundwater bores are generally shown to be consistent throughout the 2014 monitoring period. Groundwater samples collected from the off-site bores were shown to be compliant with the trigger levels for the key water monitoring parameters pH and EC.

All off site bores generally exhibited standing water levels which were consistent throughout the 2014 monitoring period. Trigger levels for water depth were shown to be compliant at all of the off-site groundwater bores during the 2014 monitoring period with the exception of Bore D (EP DDH4/GW) and E (EP PDH7/GW). Bore D exhibited water levels which were slightly below the Standing Water Level trigger from January to March and July to December. Bore E exhibited water levels which were slightly below the Standing Water Level trigger from January to February and during November 2014.

4.3.1 ENHANCE PLACE GROUNDWATER BORES

The two monitoring bores located at the former Enhance Place mine exhibited standing water levels which fluctuated throughout the 2014 monitoring period. These bores do not have any water level triggers nominated in the *Water Management Plan*.

5 SURFACE WATER QUALITY MONITORING

5.1 SURFACE WATER ASSESSMENT CRITERIA

The purpose of surface water monitoring is to ensure that any impact of the mining operations on the surface water bodies / streams can be identified, and to show compliance with relevant legislative requirements. The surface water assessment criteria presented in the sites' *Water Management Plan* in accordance with Schedule 3, Condition 27(b) of the Project Approval (PA 10_0041) are currently under review and have therefore not been included in this report. The surface water assessment criteria nominated in Environmental Protection License (EPL 4911) are shown in **Table 26**.

Table 26 *EPL Surface Water Assessment Criteria*

Surface Water Site	pH	Total Suspended Solids (mg/L)	Oil & Grease (mg/L)
EPL 2	NA	NA	NA
EPL 3	NA	NA	NA
EPL 13	6.5 – 8.5	30	10
EPL 14	NA	NA	NA

NA – no concentration limits defined in EPL 4911.

5.2 SURFACE WATER MONITORING DATA SUMMARY

Surface water monitoring for the Pine Dale Mine is undertaken in accordance with the *Baseline Water Management Plan,* the *Water Management Plan* and Environmental Protection Licence EPL 4911. Surface water sampling is undertaken at nine monitoring locations within and surrounding the mine site (refer Drawing 1, **Appendix 1**.).

During the period January to December 2014, monitoring was undertaken on a fortnightly, monthly and quarterly basis for routine samples associated with the *Water Management Plan* and site EPL. Pine Dale Mine was placed under Care and Maintenance in April 2014 after which time the monitoring of surface waters was continued on a monthly and quarterly basis.

Surface water summary results for the period January – December 2014 are shown in **Tables 27** to **44**. Graphical presentations are shown in **Figures 7** to **9**.

No samples were collected EPL Point 13 (discharge to concrete lined section of Neubeck's creek), as there was no discharge from the mine during the 2014 monitoring period.

Table 27 *Surface Water Monitoring Location EPL Point 2 Results 2014*

Location	EPL Point 2			
Sample No	02146880018	05146880009	08146880009	11146880009
Sampling Month	Feb	May	Aug	Nov
Date Sampled	18/02/2014	16/05/2014	18/08/2014	18/11/2014
Time Sampled	11:20	08:27	14:30	14:48
pH (pH units)	6.98	7.68	7.12	6.81
Conductivity (µS/cm)	3160	1368	589	2398
Sulphate (mg/L)	1620	502	208	1370
Iron filterable (mg/L)	0.32	0.07	0.06	0.21
TSS (mg/L)	<5	<5	12	<5
Turbidity (NTU)	1.71	7.1	16	1.8

Table 28 *Surface Water Monitoring Location EPL Point 3 Results 2014*

Location	EPL Point 3			
Sample No	02146880009	05146880004	08146880004	11146880004
Sampling Month	Feb	May	Aug	Nov
Date Sampled	18/02/2014	15/05/2014	18/08/2014	18/11/2014
Time Sampled	16:56	14:46	16:24	14:58
pH (pH units)	7.91	7.12	7.07	6.82
Conductivity (µS/cm)	1064	1551	764	2275
Sulphate (mg/L)	1680	680	301	1310
Iron filterable (mg/L)	0.32	0.41	0.13	1.26
TSS (mg/L)	<5	<5	11	<5
Turbidity (NTU)	1.7	2.1	18	3.7

Table 29 *Surface Water Monitoring Location EPL Point 14 Results 2014*

Location	EPL Point 14			
Sample No	02146880019	05146880010	08146880010	11146880010
Sampling Month	Feb	May	Aug	Nov
Date Sampled	18/02/2014	16/05/2014	18/08/2014	18/11/2014
Time Sampled	11:52	7:53	10:03	12:20
pH (pH units)	7.24	7.41	7.88	8.48
Conductivity (µS/cm)	1093	1051	938	1230
Sulphate (mg/L)	59	134	206	71
Iron filterable (mg/L)	<0.05	<0.05	<0.05	<0.05
TSS (mg/L)	6	8	18	2.5
Turbidity (NTU)	5.58	6.2	18	3.62

Table 30 *Surface Water Monitoring Location S1 Results 2014*

Location	Surface Water S1									
Month	January	January	February	February	March	March	April	April	May	June
Sample Number	01146880003	01146880007	02146880003	02146880007	03146880003	03146880007	04146880031	04146880002	05146880002	06146880002
Date Sampled	6/01/14	20/01/14	3/02/14	18/02/14	3/03/14	18/03/14	2/04/14	15/04/14	15/05/14	17/06/14
Time Sampled	8:04	10:12	8:21	11:16	9:10	15:48	8:30	12:21	12:01	14:05
Temperature (°C)	15.8	17.5	15.4	16.5	15.9	17.0	14.6	16.0	14.0	8.2
pH	6.18	7.60	6.88	7.46	6.85	6.12	7.15	6.75	7.92	6.64
Conductivity (µS/cm)	2450	2550	3160	3490	888	1940	2440	2360	1527	1168
Turbidity (NTU)	5	7	7	4	4	2	2	1	2	1
Dissolved Oxygen (mg/L)	---	---	---	9.5	---	---	---	---	11	---
TSS (mg/L)	---	---	---	<5	---	---	---	---	<5	---
Oil & Grease (mg/L)	---	---	---	<2	---	---	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	---	59	---	---	---	---	22	---
Total Alkalinity (mg/L $CaCO_3$)	---	---	---	59	---	---	---	---	22	---
Sulfate (mg/L)	---	---	---	1680	---	---	---	---	659	---
Chloride (mg/L)	---	---	---	246	---	---	---	---	83	---
Calcium (mg/L)	---	---	---	260	---	---	---	---	91	---
Magnesium (mg/L)	---	---	---	203	---	---	---	---	66	---
Sodium (mg/L)	---	---	---	331	---	---	---	---	145	---
Potassium (mg/L)	---	---	---	24	---	---	---	---	15	---
Filtered Cobalt (mg/L)	---	---	---	0.012	---	---	---	---	0.010	---
Filtered Manganese (mg/L)	---	---	---	3.26	---	---	---	---	1.180	---
Filtered Nickel (mg/L)	---	---	---	0.123	---	---	---	---	0.072	---
Filtered Zinc (mg/L)	---	---	---	0.066	---	---	---	---	0.072	---
Filtered Iron (mg/L)	---	---	---	0.32	---	---	---	---	0.1	---

--- Indicates no sampling required during particular period.

Table 31 *Surface Water Monitoring Location S1 Results 2014 (continued)*

Location	Surface Water S1					
Month	July	August	September	October	November	December
Sample Number	07146880002	08146880002	09146880002	10146880002	11146880002	12146880002
Date Sampled	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	13:15	14:28	10:14	12:59	14:46	10:52
Temperature (°C)	7.0	9.5	10.0	14.5	21.1	19.3
pH	6.26	6.95	6.71	6.63	6.89	6.69
Conductivity (µS/cm)	1263	877	1626	801	2518	2277
Turbidity (NTU)	1	17	<1	2	4	1
Dissolved Oxygen (mg/L)	---	11.3	---	---	9.1	---
TSS (mg/L)	---	7	---	---	<5	---
Oil & Grease (mg/L)	---	<2	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	31	---	---	30	---
Total Alkalinity (mg/L $CaCO_3$)	---	31	---	---	30	---
Sulfate (mg/L)	---	289	---	---	1370	---
Chloride (mg/L)	---	32	---	---	189	---
Calcium (mg/L)	---	46	---	---	198	---
Magnesium (mg/L)	---	30	---	---	136	---
Sodium (mg/L)	---	72	---	---	250	---
Potassium (mg/L)	---	8	---	---	16	---
Filtered Cobalt (mg/L)	---	0.004	---	---	0.006	---
Filtered Manganese (mg/L)	---	0.471	---	---	2.38	---
Filtered Nickel (mg/L)	---	0.021	---	---	0.066	---
Filtered Zinc (mg/L)	---	0.021	---	---	0.034	---
Filtered Iron (mg/L)	---	<0.05	---	---	0.31	---

--- Indicates no sampling required during particular period.

Table 32 *Surface Water Monitoring Location S2 Results 2014*

Location	Surface Water S2									
Month	January	January	February	February	March	March	April	April	May	June
Sample Number	01146880004	01146880008	02146880004	02146880008	03146880004	03146880008	04146880032	04146880003	05146880003	06146880003
Date Sampled	6/01/14	20/01/14	3/02/14	18/02/14	3/03/14	18/03/14	2/04/14	15/04/14	15/05/14	17/06/14
Time Sampled	8:12	9:23	8:40	13:24	9:21	10:30	8:47	12:31	2:45	12:17
Depth to Surface from Top Rail of Bridge (m)	3.8	3.76	3.76	3.75	3.77	3.72	3.75	3.68	3.72	3.75

Table 33 *Surface Water Monitoring Location S2 Results 2014 (continued)*

Location	Surface Water S2					
Month	July	August	September	October	November	December
Sample Number	07146880003	08146880003	09146880003	10146880003	11146880003	12146880003
Date Sampled	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	11:58	12:28	9:30	13:10	14:51	10:12
Depth to Surface from Top Rail of Bridge (m)	3.71	3.66	3.76	3.76	3.75	3.74

Table 34 *Surface Water Monitoring Location S3 Results 2014*

Location	Surface Water S3									
Month	January	January	February	February	March	March	April	April	May	June
Sample Number	01146880005	12136880009	02146880005	02146880009	03146880005	03146880009	04146880033	04146880004	05146880004	06146880004
Date Sampled	6/01/14	20/01/14	3/02/14	18/02/14	3/03/14	18/03/14	2/04/14	15/04/14	15/05/14	17/06/14
Time Sampled	8:15	10:20	8:40	16:56	9:23	17:20	8:49	12:35	2:46	15:50
Temperature (°C)	15.2	19.2	16.0	24.0	16.1	17.0	14.8	16.0	12.0	8.0
pH	6.32	7.17	6.85	7.91	6.94	6.84	7.27	6.70	7.12	6.92
Conductivity (µS/cm)	2330	2370	3140	1064	890	1852	2380	2370	1551	1138
Turbidity (NTU)	2	3	2	2	5	3	3	1	2	2
Dissolved Oxygen (mg/L)	---	---	---	8.3	---	---	---	---	10.7	---
TSS (mg/L)	---	---	---	2	---	---	---	---	<5	---
Oil & Grease (mg/L)	---	---	---	<2	---	---	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	---	37	---	---	---	---	16	---
Total Alkalinity (mg/L $CaCO_3$)	---	---	---	37	---	---	---	---	16	---
Sulfate (mg/L)	---	---	---	1680	---	---	---	---	680	---
Chloride (mg/L)	---	---	---	243	---	---	---	---	85	---
Calcium (mg/L)	---	---	---	259	---	---	---	---	94	---
Magnesium (mg/L)	---	---	---	200	---	---	---	---	68	---
Sodium (mg/L)	---	---	---	328	---	---	---	---	149	---
Potassium (mg/L)	---	---	---	24	---	---	---	---	15	---
Filtered Cobalt (mg/L)	---	---	---	0.015	---	---	---	---	0.012	---
Filtered Manganese (mg/L)	---	---	---	2.6	---	---	---	---	1.42	---
Filtered Nickel (mg/L)	---	---	---	0.123	---	---	---	---	0.075	---
Filtered Zinc (mg/L)	---	---	---	0.048	---	---	---	---	0.083	---
Filtered Iron (mg/L)	---	---	---	<0.05	---	---	---	---	0.41	---

--- Indicates no sampling required during particular period.

Table 35 *Surface Water Monitoring Location S3 Results 2014 (continued)*

Location	Baseline Surface Water S3					
Month	July	August	September	October	November	December
Sample Number	07146880004	08146880004	09146880004	10146880004	11146880004	12146880004
Date Sampled	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	15:30	16:24	11:31	13:07	14:58	10:20
Temperature (°C)	8.0	9.0	13.5	19.5	24.6	19.4
pH	6.54	7.07	6.55	6.64	6.82	6.72
Conductivity (µS/cm)	1190	764	1653	805	2275	2111
Turbidity (NTU)	1	18	5	5	4	3
Dissolved Oxygen (mg/L)	---	11.5	---	---	8.7	---
TSS (mg/L)	---	11	---	---	<5	---
Oil & Grease (mg/L)	---	<2	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	31	---	---	6	---
Total Alkalinity (mg/L $CaCO_3$)	---	31	---	---	6	---
Sulfate (mg/L)	---	301	---	---	1310	---
Chloride (mg/L)	---	30	---	---	173	---
Calcium (mg/L)	---	43	---	---	214	---
Magnesium (mg/L)	---	28	---	---	148	---
Sodium (mg/L)	---	64	---	---	256	---
Potassium (mg/L)	---	7	---	---	17	---
Filtered Cobalt (mg/L)	---	0.004	---	---	0.022	---
Filtered Manganese (mg/L)	---	0.544	---	---	3.43	---
Filtered Nickel (mg/L)	---	0.022	---	---	0.095	---
Filtered Zinc (mg/L)	---	0.021	---	---	0.1	---
Filtered Iron (mg/L)	---	0.13	---	---	1.26	---

--- Indicates no sampling required during particular period.

Table 36 *Surface Water Monitoring Location S4 Results 2014*

Location	Surface Water S4											
Month	January	February	March	April	May	June	July	August	September	October	November	December
Sample Number	01146880010	02146880010	03146880010	04146880005	05146880005	06146880005	07146880005	08146880005	09146880005	10146880005	11146880005	12146880005
Date Sampled	20/01/14	18/02/14	18/03/14	15/04/14	15/05/14	17/06/14	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	16:45	16:00	16:45	10:50	3:48	15:00	14:40	16:02	11:00	14:45	16:05	15:10
Temperature (°C)	24.5	21	17.5	15	11.5	7.3	6.5	10.0	10.0	17.1	25.1	22.0
pH	7.7	6.8	6.9	7.2	7.4	7.9	7.8	7.0	7.7	7.8	7.9	7.8
Conductivity (µS/cm)	934	1121	790	383	549	531.0	499	308	408	441	771	513
Turbidity (NTU)	9	33	7	7	4	4	11	33	9	13	15	9
Dissolved Oxygen (mg/L)	---	8.0	---	---	11.4	---	---	11.2	---	---	8.4	---
TSS (mg/L)	---	17.5	---	---	<5	---	---	19	---	---	<5	---
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	378	---	---	234	---	---	107	---	---	376	---
Total Alkalinity (mg/L $CaCO_3$)	---	378	---	---	234	---	---	107	---	---	376	---
Sulfate (mg/L)	---	174	---	---	28	---	---	27	---	---	<10	---
Chloride (mg/L)	---	12	---	---	7	---	---	10	---	---	5	---
Calcium (mg/L)	---	25	---	---	10	---	---	4	---	---	19	---
Magnesium (mg/L)	---	18	---	---	8	---	---	3	---	---	14	---
Sodium (mg/L)	---	189	---	---	93	---	---	44	---	---	146	---
Potassium (mg/L)	---	36	---	---	18	---	---	11	---	---	28	---
Filtered Cobalt (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---
Filtered Manganese (mg/L)	---	0.014	---	---	0.024	---	---	0.013	---	---	0.016	---
Filtered Nickel (mg/L)	---	0.003	---	---	0.001	---	---	0.001	---	---	0.003	---
Filtered Zinc (mg/L)	---	0.007	---	---	0.005	---	---	<0.005	---	---	0.01	---
Filtered Iron (mg/L)	---	0.78	---	---	0.17	---	---	0.32	---	---	0.55	---

--- Indicates no sampling required during particular period.

Table 37 *Surface Water Monitoring Location S5 Results 2014*

Location	Surface Water S5											
Month	January	February	March	April	May	June	July	August	September	October	November	December
Sample Number	01146880011	02146880011	03146880011	04146880006	05146880006	06146880006	07146880006	08146880006	09146880006	10146880006	11146880006	12146880006
Date Sampled	20/01/14	18/02/14	18/03/14	15/04/14	15/05/14	17/06/14	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	16:55	16:10	16:50	10:58	3:53	15:10	14:43	15:57	11:05	14:50	16:10	15:13
Temperature (°C)	24.5	22.5	21.0	17.5	11.5	8.0	7.5	9.5	12.5	17.6	25.5	24.0
pH	7.82	7.26	7.04	7.13	7.34	6.82	7.13	6.88	7.32	7.16	7.41	7.09
Conductivity (µS/cm)	922	1018	901	910	1096	1233	1063	913	640	732	862	869
Turbidity (NTU)	1	2	12	11	1	13	14	15	13	10	3	5
Dissolved Oxygen (mg/L)	---	7.8	---	---	9.6	---	---	11.2	---	---	8.2	---
TSS (mg/L)	---	1.5	---	---	<5	---	---	6	---	---	<5	---
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	131	---	---	77	---	---	112	---	---	126	---
Total Alkalinity (mg/L $CaCO_3$)	---	131	---	---	77	---	---	112	---	---	126	---
Sulfate (mg/L)	---	333	---	---	436	---	---	311	---	---	314	---
Chloride (mg/L)	---	34	---	---	49	---	---	35	---	---	26	---
Calcium (mg/L)	---	67	---	---	73	---	---	53	---	---	63	---
Magnesium (mg/L)	---	43	---	---	48	---	---	36	---	---	35	---
Sodium (mg/L)	---	80	---	---	97	---	---	93	---	---	80	---
Potassium (mg/L)	---	18	---	---	16	---	---	15	---	---	15	---
Filtered Cobalt (mg/L)	---	0.012	---	---	0.033	---	---	0.016	---	---	0.011	---
Filtered Manganese (mg/L)	---	1.56	---	---	2.1	---	---	0.982	---	---	1.02	---
Filtered Nickel (mg/L)	---	0.082	---	---	0.1	---	---	0.054	---	---	0.055	---
Filtered Zinc (mg/L)	---	0.066	---	---	0.123	---	---	0.058	---	---	0.061	---
Filtered Iron (mg/L)	---	<0.05	---	---	0.10	---	---	0.06	---	---	0.07	---

--- Indicates no sampling required during particular period.

Table 38 *Surface Water Monitoring Location S6 Results 2014*

Location	Surface Water S6											
Month	January	February	March	April	May	June	July	August	September	October	November	December
Sample Number	01146880012	02146880012	03146880012	04146880007	05146880007	06146880007	07146880007	08146880007	09146880007	10146880007	11146880007	12146880007
Date Sampled	20/01/14	18/02/14	18/03/14	15/04/14	15/05/14	17/06/14	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	17:00	16:15	16:55	10:45	4:00	15:15	14:47	15:57	10:55	14:05	15:55	15:05
Temperature (°C)	Dry	Dry	20.0	14.5	11.5	8.0	7.5	10.3	11.8	19.0	Dry	25.0
pH	---	---	6.83	6.81	7.23	6.95	7.11	7.10	7.26	7.20	---	7.23
Conductivity (µS/cm)	---	---	1370.0	2360	1536	1254	1252	829	1594	801	---	2106
Turbidity (NTU)	---	---	1	2	1	2	1	23	1	1	---	<1
Dissolved Oxygen (mg/L)	---	---	---	---	11.2	---	---	11.7	---	---	---	---
TSS (mg/L)	---	---	---	---	<5	---	---	13	---	---	---	---
Oil & Grease (mg/L)	---	---	---	---	<2	---	---	<2	---	---	---	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	---	---	14	---	---	32	---	---	---	---
Total Alkalinity (mg/L $CaCO_3$)	---	---	---	---	14	---	---	32	---	---	---	---
Sulfate (mg/L)	---	---	---	---	564	---	---	338	---	---	---	---
Chloride (mg/L)	---	---	---	---	69	---	---	33	---	---	---	---
Calcium (mg/L)	---	---	---	---	78	---	---	52	---	---	---	---
Magnesium (mg/L)	---	---	---	---	56	---	---	32	---	---	---	---
Sodium (mg/L)	---	---	---	---	117	---	---	76	---	---	---	---
Potassium (mg/L)	---	---	---	---	12	---	---	8	---	---	---	---
Filtered Cobalt (mg/L)	---	---	---	---	0.006	---	---	0.005	---	---	---	---
Filtered Manganese (mg/L)	---	---	---	---	1.020	---	---	0.586	---	---	---	---
Filtered Nickel (mg/L)	---	---	---	---	0.045	---	---	0.022	---	---	---	---
Filtered Zinc (mg/L)	---	---	---	---	0.056	---	---	0.023	---	---	---	---
Filtered Iron (mg/L)	---	---	---	---	<0.05	---	---	<0.05	---	---	---	---

--- Indicates no sampling required during particular period.
Dry – No sample could be collected due to sample site being dry.

Table 39 *Surface Water Monitoring Location S7 Results 2014*

Location	Surface Water S7											
Month	January	February	March	April	May	June	July	August	September	October	November	December
Sample Number	01146880013	02146880013	03146880013	04146880008	05146880008	06146880008	07146880008	08146880008	09146880008	10146880008	11146880008	12146880008
Date Sampled	20/01/14	18/02/14	18/03/14	15/04/14	15/05/14	17/06/14	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	16:20	16:39	17:10	10:32	3:25	15:33	15:00	15:34	10:47	13:57	15:45	15:00
Temperature (°C)	25.0	21.5	19.0	14.5	11.5	8.0	8.0	10.0	12.5	17.5	22.7	24.0
pH	7.51	7.61	6.76	7.16	7.30	6.96	6.94	7.02	7.22	6.75	7.32	6.97
Conductivity (µS/cm)	940	3290	903	907	1068	1135	1069	932	635	784	908	843
Turbidity (NTU)	1	1	4	5	1	2	2	7	5	3	2	2
Dissolved Oxygen (mg/L)	---	6.8	---	---	9.1	---	---	11.2	---	---	7.7	---
TSS (mg/L)	---	2.5	---	---	<5	---	---	<5	---	---	<5	---
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	150	---	---	80	---	---	124	---	---	139	---
Total Alkalinity (mg/L $CaCO_3$)	---	150	---	---	80	---	---	124	---	---	139	---
Sulfate (mg/L)	---	306	---	---	422	---	---	322	---	---	294	---
Chloride (mg/L)	---	36	---	---	50	---	---	46	---	---	26	---
Calcium (mg/L)	---	64	---	---	72	---	---	55	---	---	57	---
Magnesium (mg/L)	---	41	---	---	48	---	---	37	---	---	33	---
Sodium (mg/L)	---	82	---	---	96	---	---	97	---	---	79	---
Potassium (mg/L)	---	19	---	---	16	---	---	16	---	---	15	---
Filtered Cobalt (mg/L)	---	<0.001	---	---	0.002	---	---	0.006	---	---	0.002	---
Filtered Manganese (mg/L)	---	1.110	---	---	0.462	---	---	0.589	---	---	2.11	---
Filtered Nickel (mg/L)	---	0.014	---	---	0.043	---	---	0.040	---	---	0.029	---
Filtered Zinc (mg/L)	---	<0.005	---	---	0.042	---	---	0.040	---	---	0.007	---
Filtered Iron (mg/L)	---	<0.05	---	---	0.17	---	---	0.19	---	---	0.11	---

--- Indicates no sampling required during particular period.

Table 40 *Site Surface Water Monitoring Location 'The Bong' Results 2014*

Location	Site Surface Water 'The Bong'									
Month	January	January	February	February	March	March	April	April	May	June
Sample Number	01146880002	01146880006	02146880002	02146880006	03146880002	03146880006	04146880030	04146880001	05146880001	06146880001
Date Sampled	6/01/14	20/01/14	3/02/14	18/02/14	3/03/14	18/03/14	2/04/14	15/04/14	15/05/14	17/06/14
Time Sampled	08:32	10:07	08:43	14:55	09:33	15:40	08:56	12:25	12:30	13:58
Temperature (°C)	16.8	22.5	20.2	21.0	16.5	21.0	17.2	15.0	13.5	18.5
pH	6.05	7.24	6.91	6.07	5.14	5.71	5.29	7.67	7.83	5.95
Conductivity (µS/cm)	846	1159	1128	723	391	386	310	236	742	750
Turbidity (NTU)	5	15	34	7	9	5	4	6	2	2
Pump Flow Rate (L/min)	No Flow	No flow	No flow	No flow	No Flow	No Flow	No flow	No Flow	No flow	No Flow
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	---	1	---	---	---	---	2	---
Total Alkalinity (mg/L $CaCO_3$)	---	---	---	1	---	---	---	---	2	---
Sulfate (mg/L)	---	---	---	339	---	---	---	---	334	---
Chloride (mg/L)	---	---	---	9.00	---	---	---	---	8.00	---
Calcium (mg/L)	---	---	---	70	---	---	---	---	72	---
Magnesium (mg/L)	---	---	---	32	---	---	---	---	32	---
Sodium (mg/L)	---	---	---	23	---	---	---	---	22	---
Potassium (mg/L)	---	---	---	11	---	---	---	---	11	---
Filtered Arsenic (mg/L)	---	---	---	<0.001	---	---	---	---	<0.001	---
Filtered Cadmium (mg/L)	---	---	---	0.0003	---	---	---	---	0.0002	---
Filtered Chromium (mg/L)	---	---	---	<0.001	---	---	---	---	<0.001	---
Filtered Copper (mg/L)	---	---	---	0.003	---	---	---	---	<0.001	---
Filtered Lead (mg/L)	---	---	---	<0.001	---	---	---	---	<0.001	---
Filtered Nickel (mg/L)	---	---	---	0.155	---	---	---	---	0.18	---
Filtered Zinc (mg/L)	---	---	---	0.245	---	---	---	---	0.226	---
Filtered Iron (mg/L)	---	---	---	0.07	---	---	---	---	<0.05	---

--- Indicates no sampling required during particular period.

Table 41 *Site Surface Water Monitoring Location 'The Bong' Results 2014 (continued)*

Location	Site Surface Water 'The Bong'					
Month	July	August	September	October	November	December
Sample Number	07146880001	08146880001	09146880001	10146880001	11146880001	12146880001
Date Sampled	17/07/14	18/08/14	18/09/14	20/10/14	18/11/14	16/12/14
Time Sampled	13:13	14:17	10:09	12:55	14:36	10:50
Temperature (°C)	6.5	11.5	11.8	21.8	29.0	22.8
pH	5.77	5.54	6.24	5.93	7.35	5.55
Conductivity (µS/cm)	503	467	323	207	372	277
Turbidity (NTU)	6	23	4	8	24	18
Pump Flow Rate (L/min)	No flow	No Flow	No flow	No Flow	No flow	No Flow
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	<1	---	---	<1	---
Total Alkalinity (mg/L $CaCO_3$)	---	<1	---	---	<1	---
Sulfate (mg/L)	---	196	---	---	151	---
Chloride (mg/L)	---	4.00	---	---	12	---
Calcium (mg/L)	---	47	---	---	28	---
Magnesium (mg/L)	---	18	---	---	13	---
Sodium (mg/L)	---	11	---	---	10	---
Potassium (mg/L)	---	5	---	---	6	---
Filtered Arsenic (mg/L)	---	<0.001	---	---	<0.001	---
Filtered Cadmium (mg/L)	---	0.0004	---	---	0.0002	---
Filtered Chromium (mg/L)	---	<0.001	---	---	<0.001	---
Filtered Copper (mg/L)	---	<0.001	---	---	<0.001	---
Filtered Lead (mg/L)	---	<0.001	---	---	<0.001	---
Filtered Nickel (mg/L)	---	0.091	---	---	0.054	---
Filtered Zinc (mg/L)	---	0.164	---	---	0.062	---
Filtered Iron (mg/L)	---	0.05	---	---	<0.05	---

--- Indicates no sampling required during particular period.

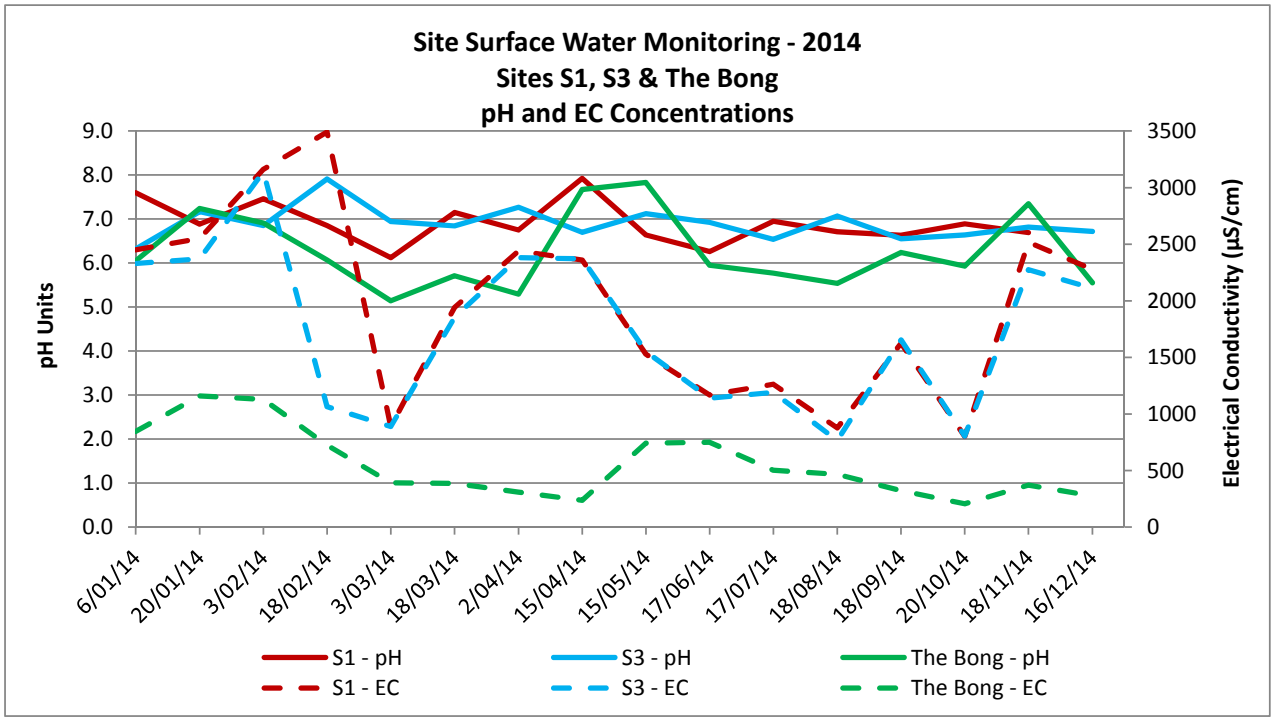


Figure 8 *Site Surface Water S1, S3 & The Bong Monitoring Results 2014*

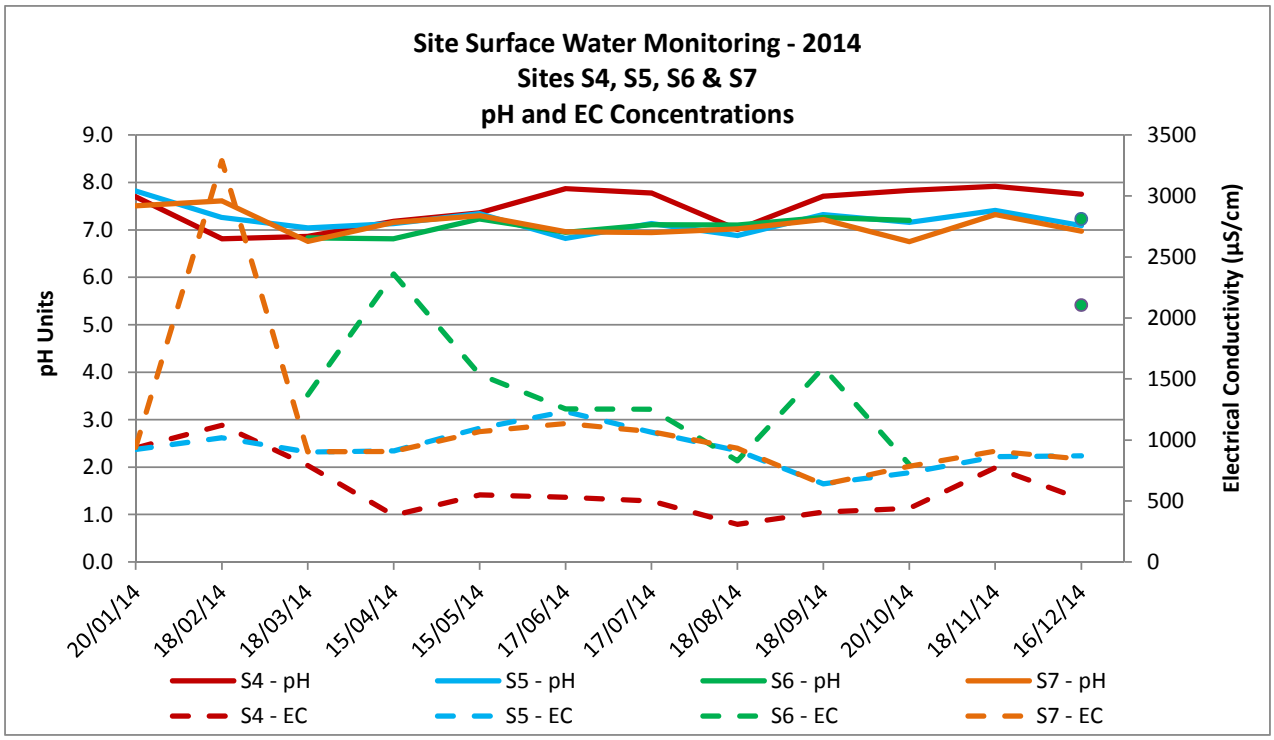


Figure 9 *Site Surface Water S4, S5, S6 & S7 Monitoring Results 2014*

No sample could be collected from S6 during the November 2014 monitoring event as the location was dry.

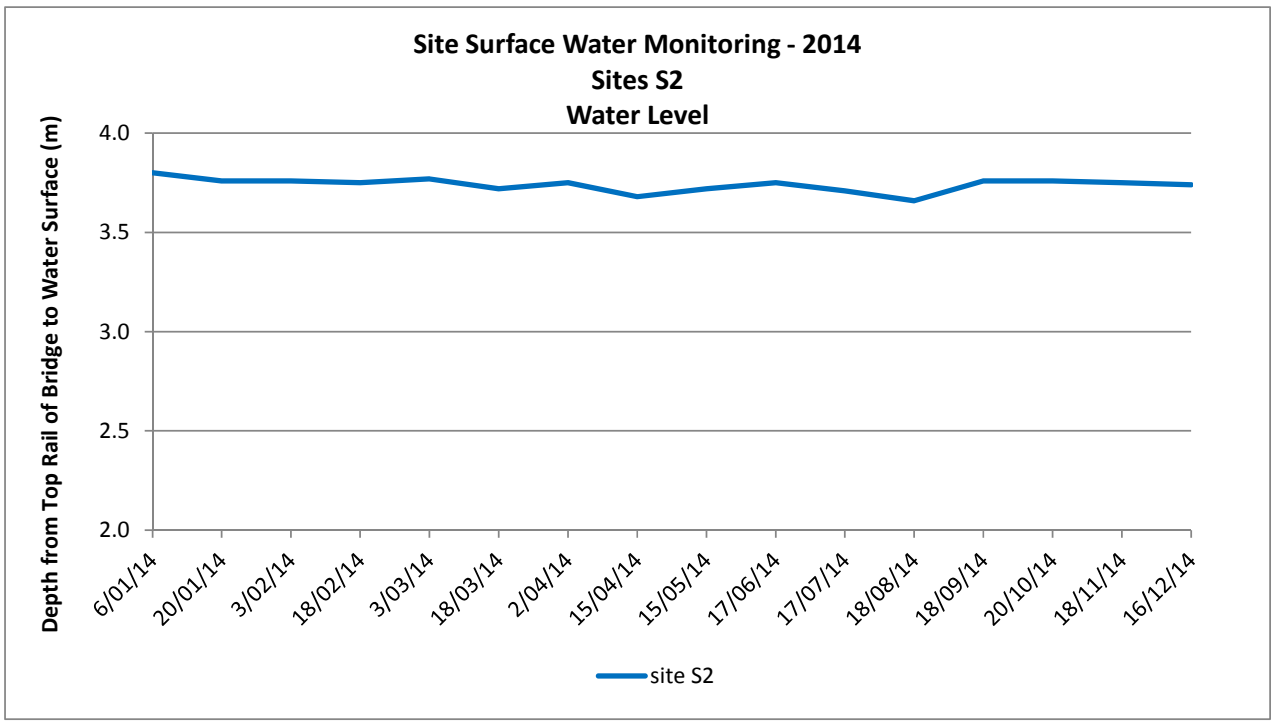


Figure 10 *Site Surface Water S2 - Water Level 2014*

5.3 REVIEW & INTERPRETATION OF SURFACE WATER MONITORING RESULTS

5.3.1 EPL SURFACE WATERS

The surface water samples collected during the period January to December 2014 have no Concentration Limits specified by EPL 4911.

During the monitoring period, EC was shown to fluctuate at the three EPL monitoring sites, whilst pH was observed to be reasonably consistent.

Monitoring at EPL Point 13 was not undertaken during the 2014 monitoring period as there was no surface water discharge from the site to Neubeck's Creek.

5.3.2 SITE SURFACE WATERS

Site surface water samples collected during the January to December 2014 period are generally shown to be consistent over the duration of the monitoring period. The pH results recorded at the majority of monitoring sites is shown to be relatively stable throughout the sampling period, however, the pH recorded at S1 and The Bong was shown to fluctuate slightly.

During the monitoring period, EC was observed to fluctuate across the majority of sampling sites with S4 and S5 observed to be relatively stable. No clear EC trend is evident for the sampling sites. The water level of Neubeck's Creek at monitoring location S2 was stable throughout the duration of the monitoring period. No sample could be collected from S6 during the November 2014 monitoring event as the location was dry.

6 METEOROLOGICAL MONITORING

6.1 METEOROLOGICAL MONITORING REQUIREMENTS

Pine Dale Mine records meteorological data continuously via an on-site meteorological monitoring station in accordance with the requirements of Environmental Protection License No. 4911. The meteorological monitoring requirements of EPL 4911 are presented in **Table 42**.

Table 42 *EPL Meteorological Monitoring Requirements*

Parameter	Units of Measure	Frequency	Averaging Period
Air temperature	°C	Continuous	1 hour
Wind direction	°	Continuous	15 minute
Wind speed	m/s	Continuous	15 minute
Sigma theta	°	Continuous	15 minute
Rainfall	mm	Continuous	15 minute
Relative humidity	%	Continuous	1 hour

6.1 METEOROLOGICAL MONITORING RESULTS

Meteorological monitoring Parameters recorded at the Pine Dale Mine Meteorological Monitoring Station include Wind Speed, Wind Direction, Temperature at 10m height, Temperature at 2m height, rainfall, humidity, solar radiation, sigma theta and evapotranspiration.

Details of weather data recorded for the period January to December 2014 are summarised in **Table 43**. The annual windrose for the 2014 period is presented in **Figure 11**.

Table 43 *Meteorological Monitoring Summary Data 2014*

Month (2014)	Rainfall (mm)	Cumulative Rainfall (mm)	No of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (°)			Relative Humidity (%)			Wind Speed (m/s)			Modal Wind Direction
				Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
January	5.6	5.6	6	20.3	3.9	37.7	19.7	3.9	35.4	34.1	0.0	102.6	57.1	4.7	96.9	1.7	0.0	13.5	ESE
February	85.8	91.4	8	19.2	4.3	36.6	18.6	4.5	34.8	32.0	0.0	101.5	66.6	5.3	96.7	1.6	0.0	13.6	ESE
March	145.2	236.6	22	16.1	3.8	27.1	15.8	3.9	25.3	30.2	0.0	101.7	81.0	35.3	98.1	1.1	0.0	12.8	ESE
April	59.4	296	11	12.9	-0.5	27.1	12.7	-0.3	26.0	25.8	0.0	103.6	79.2	20.0	98.1	1.2	0.0	11.9	WNW
May	13.0	309	8	8.5	-1.7	22.3	8.5	-1.3	20.9	21.0	0.0	101.5	80.8	30.4	97.5	1.3	0.0	13.5	WNW
June	41.0	350	19	6.7	-4.1	17.8	6.6	-4.1	16.8	22.9	0.0	98.7	82.1	38.9	97.8	2.0	0.0	15.8	WNW
July	29.2	379.2	13	5.2	-6.9	17.8	5.3	-6.8	16.9	23.1	0.0	102.1	76.4	19.4	97.2	2.0	0.0	16.6	WNW
August	50.6	429.8	16	6.2	-6.1	17.8	6.1	-6.0	17.1	26.8	0.0	99.3	78.4	16.3	97.9	1.3	0.0	14.4	SSE
September	31.2	461	12	9.7	-3.5	25.8	9.5	-3.5	24.9	27.0	0.0	100.9	69.5	17.3	97.7	1.7	0.0	16.6	W
October	54.6	515.6	6	13.7	-2.3	30.9	13.4	-2.5	29.4	25.5	0.0	99.0	60.1	12.4	96.4	1.7	0.0	15.4	W
November	56.6	572.2	8	17.9	-0.2	37.2	17.5	0	36.3	28.8	0.0	99.8	58.8	11.3	96.8	1.9	0.0	16.5	WNW
December	132.6	704.8	16	18.3	5.4	31.4	17.9	5.6	30.6	30.4	0.0	102.1	68.2	10.2	96.6	1.9	0.0	15.2	NW
TOTAL	**704.8**	**-**	**145**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Minimum	**5.6**	**-**	**6**	**-**	**-6.9**	**-**	**-**	**-6.8**	**-**	**-**	**0.0**	**-**	**-**	**4.7**	**-**	**-**	**0.0**	**-**	**-**
Maximum	**145.2**	**-**	**22**	**-**	**-**	**37.7**	**-**	**-**	**36.3**	**-**	**-**	**103.6**	**-**	**-**	**98.1**	**-**	**-**	**16.6**	**-**

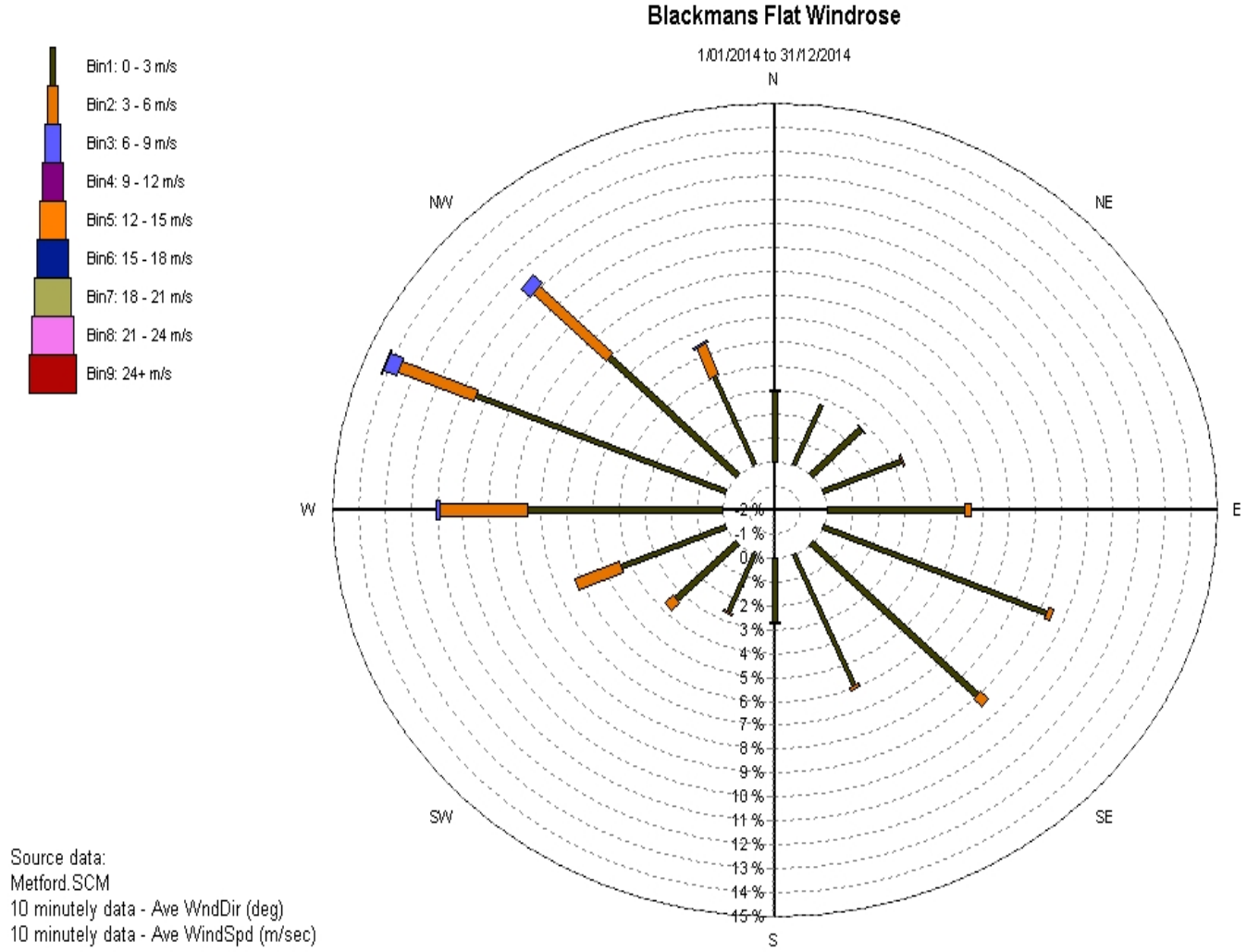


Figure 11 *Pine Dale Mine Windrose Plot - 2014*

6.2 REVIEW OF METEOROLOGICAL MONITORING RESULTS

Pine Dale Mine received 704.8mm of rainfall and experienced 145 rainfall days during the 2014 reporting period. Rainfall during this reporting period was observed to be greater than rainfall recorded in 2013 (576.8mm and 109 rainfall days). The maximum temperature recorded during the reporting period was 37.7°C at 2m during January and 36.3°C at the 10m sensor during November. The lowest temperature recorded occurred in July, with a recording of -6.9°C at 2m and -6.8°C at 10m. Predominant wind directions at the site during 2014 were observed to be from a west-north-westerly, north-westerly and south-easterly direction; however wind directions were shown to fluctuate on a seasonal basis. The maximum wind speed measured at the site was 16.60m/s during July 2014.

7 STREAM HEALTH & CHANNEL STABILITY MONITORING

7.1 STREAM HEALTH & CHANNEL STABILITY MONITORING SUMMARY

Schedule 3 Condition 27(b) of Project Approval PA 10_0041 requires performance criteria and a programme to monitor the stream health, riparian vegetation health and channel stability of creeks and other water bodies that could potentially be affected by the project (Pine Dale Mine). As defined in Schedule 3 Condition 27(b) of the Project Approval, the creeks and other water bodies that could potentially be affected by the project include Neubecks Creek, the Blue Lake and Cox's River.

A Channel Stability and Stream Health Monitoring programme is outlined in Section 4.6.5 of the *Pine Dale Mine Water Management Plan* for the purpose of monitoring channel stability, stream health and vegetation health of Neubecks Creek, ensuring mining operations do not have an adverse effect upon the Neubecks Creek drainage line. In addition to the requirements of the Channel Stability and Stream Health Monitoring programme, the water bodies of Blue Lake and Cox's River have also been included in the monitoring programme, to satisfy the conditions outlined in the Project Approval.

In accordance with the Channel Stability and Stream Health Monitoring programme, routine six-monthly assessments of the Neubecks Creek, Blue Lake and Cox's River were undertaken in February and August 2014 (refer RCA Reports 6880-849, Feb 2014; and 6880-860, Aug 2014 respectively).

Monthly visual assessments and photographic documentation of each site are also undertaken documenting evidence of erosion, newly exposed soils, and vegetation disturbance [refer monitoring fieldsheets presented in **Appendix 2**]. Results of the routine six-monthly assessments are presented in **Tables 45** to **55**. The location of Stream Health monitoring sites are presented in Drawing 2, **Appendix 1**].

It is noted that a stream health assessment of the Blue Lake site was not undertaken, as the site does not fit the requirements of the *Ephermeral Stream Assessment* protocol, which is targeted at streams and drainage lines. However, the Blue Lake is still included in monthly erosion and vegetation disturbance observation inspections.

The performance criteria utilized for the stream health assessment of each monitoring point is derived from the CSIRO *Ephemeral Stream Assessment* protocol and is reproduced in **Table 44**.

Table 44 *Classification of Different Drainage Line States (CSIRO)*

Activity Rating (%)	Classification	Discussion of Classification
80 +	Very Stable	Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate.
70-80	Stable	Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilising to a more stable form, or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.
60-69	Potentially Stabilising	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
50-59	Active	Drainage line is actively eroding and remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.
< 50	Very Active	Drainage line is very actively eroding and immediate remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.

Table Source: CSIRO Ephemeral Stream Assessment (CSIRO, undated)

Table 45 *Classification of Different Drainage Line State – Site SH1*

Location:		**SH1**	
Assessment Date:		**29/08/14**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width>depth.
	Longitudinal Morphology of Drainage Line	3	Flat with a cohesive fine textured 'soil-like' bed.
	Particle Size of Materials on Drainage Line Floor	3	Material on floor is much larger in particle size and/ or denser than material on walls. Surface armouring (e.g. cobbles, competent country rock)
Wall Materials	Nature of Drainage Line Materials	2	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	4	Gently slopes bank/ floodplain, laterally extensive, <5º
	Nature of Lateral Flow Regulation	3	Sparse grassland/ woodland with bare soil bank lip. Moderate flow rate, some highly focused inflow locations.
Classification of Drainage Line August 2014 survey		Score 22/32 69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2014 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 46 *Classification of Different Drainage Line State – Site SH2*

Location:		**SH2**	
Assessment Date:		**29/08/14**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/ riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width>depth.
	Longitudinal Morphology of Drainage Line	2	Flat, continuous, loose sediment with signs of recent/ frequent movement.
	Particle Size of Materials on Drainage Line Floor	3	Material on floor is much larger in particle size and/ or denser than material on walls. Surface armouring (e.g. cobbles, competent country rock)
Wall Materials	Nature of Drainage Line Materials	3	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	3	Moderately sloped bank, 5-10º
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line August 2014 survey		Total Score 22/32 69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2014 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 47 *Classification of Different Drainage Line State – Site SH3*

Location:		**SH3**	
Assessment Date:		**29/08/2014**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/ riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	2	Actively eroding. Slight undercutting, near vertical walls, alluvial fans also eroding. Depth=width.
	Longitudinal Morphology of Drainage Line	3	Flat with a cohesive fixe textured “soil like” bed.
	Particle Size of Materials on Drainage Line Floor	2	Material on floor is slightly larger in particle size and/or denser (more consolidated) than material on walls (e.g. well sorted gravel).
Wall Materials	Nature of Drainage Line Materials	3	Materials that slake and / or disperse are exposed on less than 0.3 meter of wall height.
Bank Edge	Shape of Stream Bordering Slopes	2	Steep bank, 10-30º, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line August 2014 survey		Total Score 20/32 63%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2014 survey		63%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 48 *Classification of Different Drainage Line State – Site SH3A*

Location:		**SH3A**	
Assessment Date:		**6/02/14 & 29/08/14**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	1	Little or no vegetation growing on drainage line walls.
Profile of D/L	Shape and Aspect of Drainage Line Cross Sect.	NA	This section of drainage line coated with spray-concrete.
	Longitudinal Morphology of Drainage Line	NA	
	Particle Size of Materials on Drainage Line Floor	NA	
Wall Materials	Nature of Drainage Line Materials	NA	
Bank Edge	Shape of Stream Bordering Slopes	2	Steep bank, 10-30º, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Final Classification of Drainage Line		NA	Drainage line is considered stabile due to spray-concrete lining.

Table 49 *Classification of Different Drainage Line State – Site SH5*

Location:		**SH5**	
Assessment Date:		**29/08/14**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/ riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	5	Stable. Gently sloping walls, generally low, "S" shaped bed/bank continuum. Width>>Depth (aspect ratio very low).
	Longitudinal Morphology of Drainage Line	3	Flat with a cohesive fixe textured "soil like" bed.
	Particle Size of Materials on Drainage Line Floor	3	Material on floor is much larger in particle size and/or denser than material on walls: surface armoring (e.g. cobbles, competent country rock).
Wall Materials	Nature of Drainage Line Materials	4	Materials that do not slake or disperse are exposed on wall surface.
Bank Edge	Shape of Stream Bordering Slopes	3	Moderately sloped bank, 5-10^{o}
	Nature of Lateral Flow Regulation	3	Sparse grassland / woodland with bare soil bank lip. Moderate flow rate, some highly focused inflow locations.
Classification of Drainage Line August 2014 survey		Total Score 22/32 69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2014 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

7.2 REVIEW & INTERPRETATION OF STREAM HEALTH MONITORING RESULTS

The routine six-monthly assessment of channel stability, stream health and vegetation health of the Neubecks Creek monitoring locations (SH1, SH2, SH3 and SH3A) at Pine Dale Mine indicates the drainage line is classified as potentially stabilising. An assessment of the Cox's River monitoring site (SH5) indicated the drainage line is also potentially stabilising.

The CSIRO Ephermeral Stream Assessment protocol indicates ongoing monitoring of both Neubecks Creek and Cox's River drainage line is required; however, rehabilitation works are not required in the immediate future.

In accordance with the Pine Dale Mine *Water Management Plan*, monitoring of the six Stream Health assessment locations was conducted on a monthly basis throughout 2014. The ongoing monitoring encompasses monthly visual assessments and photographic documentation of each site over time. Results of this monthly monitoring indicate no evidence of erosion, newly exposed soils, or vegetation disturbance.

8 NOISE MONITORING

8.1 NOISE ASSESSMENT CRITERIA

The purpose of noise monitoring is to ensure that any impact of mining operations on the surrounding sensitive receivers can be identified; and to show compliance with relevant legislative requirements. Conditional requirements within Project Approval 10_0041 (Schedule 3, Condition 1) and Environmental Protection License (EPL 4911) are presented in **Table 50**.

Table 50 *Noise Assessment Criteria*

Location		Noise Monitoring Location	Day LAeq (15 min) dBA	Evening LAeq (15 min) dBA
Residences 18, 32 and 33		NM1 - (EPL Ref No.33)	42	39
Residences 20-23, 25 and 27-29		N/A	42	36
Residences 8, 10-12 and14		NM2 - (EPL Ref No.14); NM3 - (EPL Ref No.10)	42	35
Residences 2, 5-7 and 35		NM4 - (EPL Ref No.5); NM6 - (EPL Ref No.2)	35	35
All other residences		NM5 - (EPL Ref No.4)	35	35
During construction and removal of the amenity bund	Residences 8, 10-12, 14, 18, 20-23, 25, 27-29 and 32 - 33	N/A	46	N/A

- *Noise generated by the project should not exceed the above criteria at any residence on privately-owned land or on more than 25% of any privately-owned land.*
- *Day: The period from 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm Sundays and Public Holidays*
- *Evening: The period from 6:00pm to 10:00pm Monday to Sunday*

8.2 NOISE MONITORING DATA SUMMARY

In accordance with the Pine Dale Mine *Noise Management Plan*, Environmental Protection Licence (EPL) No. 4911 and Project Approval (10_0041 Schedule 3-1) conditions attended noise surveys are undertaken on a quarterly basis..

Quarterly monitoring was undertaken at the following intervals during the 2014 period:

- Quarter 1 – January to March, monitoring conducted 20 and 21 January 2014
- Quarter 2 – April to June, monitoring conducted 15 and 16 April 2014
- Quarter 3 – July to September, monitoring conducted on 18 and 19 September 2014
- Quarter 4 – October to December, monitoring conducted on 16 and 17 December 2014

The aim of the attended noise survey is to record any impact of operational noise on the surrounding community. Three consecutive 15-minute surveys are conducted at each of the six monitoring locations. Results of attended noise surveys carried out during the 2014 monitoring period are presented in **Tables 51** to **54**. Meteorological conditions recorded during each noise survey are presented in **Table 55**. Noise survey locations are presented in Drawing 1, **Appendix 1**.

Table 51 *Attended Noise Survey – Quarter 1, January 2014*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Birds & Insects $L_{Aeq\ 15min}$ Contribution	Traffic & Other $L_{Aeq\ 15min}$ Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
20/1/2014	09:20	NM1	47.4	49.7	42.6	34.5	42	40.0	46.3	Pine Dale Mine Birds & Insects Traffic & Other	39 to 48 41 to 59 41 to 56
20/1/2014	09:35	NM1	47.6	50.3	41.8	34.6	42	43.2	45.3	Pine Dale Mine Birds & Insects Traffic & Other	39 to 47 40 to 59 39 to 54
20/1/2014	09:50	NM1	49.3	51.8	44.8	36.3	42	43.9	47.4	Pine Dale Mine Birds & Insects Traffic & Other	41 to 51 39 to 58 43 to 57
20/1/2014	10:19	NM2	49.4	52.0	40.3	NIL	42	40.9	48.8	Pine Dale Mine Birds & Insects Traffic & Other	NIL 34 to 71 38 to 63
20/1/2014	10:34	NM2	47.7	51.1	38.5	NIL	42	38.9	47.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 34 to 64 35 to 60
20/1/2014	10:49	NM2	49.4	52.8	40.3	NIL	42	32.3	49.3	Pine Dale Mine Birds & Insects Traffic & Other	NIL 34 to 48 36 to 60
21/1/2014	07:39	NM3	44.3	48.7	31.7	NIL	42	33.7	43.9	Pine Dale Mine Birds & Insects Traffic & Other	NIL 26 to 57 34 to 56
21/1/2014	07:54	NM3	46.8	49.5	35.2	NIL	42	44.1	43.4	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 67 34 to 55
21/1/2014	08:09	NM3	44.5	48.6	33.2	NIL	42	34.3	44.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 51 33 to 57
20/1/2014	16:10	NM4	40.1	41.4	34.9	NIL	35	37.9	35.9	Pine Dale Mine Birds & Insects Traffic & Other	NIL 32 to 68 33 to 45
20/1/2014	16:25	NM4	42.9	45.6	38.1	NIL	35	41.9	36.6	Pine Dale Mine Birds & Insects Traffic & Other	NIL 33 to 59 35 to 53
20/1/2014	16:40	NM4	41.4	43.4	36.1	NIL	35	36.1	38.6	Pine Dale Mine Birds & Insects Traffic & Other	NIL 34 to 53 37 to 46
20/1/2014	11:27	NM5	33.8	36.3	29.2	NIL	35	33.7	18.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 48 29 to 38
20/1/2014	11:42	NM5	36.0	39.0	30.7	NIL	35	35.6	25.0	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 49 30 to 43
20/1/2014	11:57	NM5	35.1	37.8	28.2	NIL	35	34.9	20.9	Pine Dale Mine Birds & Insects Traffic & Other	NIL 27 to 48 29 to 39
20/1/2014	13:42	NM6	39.4	42.4	33.1	NIL	35	35.8	36.9	Pine Dale Mine Birds & Insects Traffic & Other	NIL 30 to 59 31 to 47
20/1/2014	13:57	NM6	36.4	39.4	30.7	NIL	35	32.5	34.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 56 31 to 48
20/1/2014	14:12	NM6	39.9	41.8	31.3	NIL	35	37.4	36.3	Pine Dale Mine Birds & Insects Traffic & Other	NIL 27 to 64 29 to 53

Table 52 *Attended Noise Survey – Quarter 2, April 2014*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Birds & Insects $L_{Aeq\ 15min}$ Contribution	Traffic & Other $L_{Aeq\ 15min}$ Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
15/4/2014	09:50	NM1	47.9	50.4	42.9	43.2	42(*46)	24.9	46.0	Pine Dale Mine Birds & Insects Traffic & Other	38 to 51 47 to 54 41 to 59
15/4/2014	10:05	NM1	48.8	51.2	43.7	44.4	42(*46)	24.0	46.7	Pine Dale Mine Birds & Insects Traffic & Other	39 to 52 46 to 54 43 to 64
15/4/2014	10:20	NM1	47.6	50.5	42.5	40.5	42(*46)	35.8	46.3	Pine Dale Mine Birds & Insects Traffic & Other	48 to 50 40 to 55 39 to 57
15/4/2014	10:49	NM2	45.6	48.9	35.1	23.3	42(*46)	35.7	45.1	Pine Dale Mine Birds & Insects Traffic & Other	31 to 42 30 to 48 33 to 57
15/4/2014	11:04	NM2	46.6	50.0	36.4	25.7	42(*46)	28.8	46.5	Pine Dale Mine Birds & Insects Traffic & Other	31 to 43 31 to 48 35 to 63
15/4/2014	11:19	NM2	46.5	49.6	37.4	24.3	42(*46)	35.5	46.1	Pine Dale Mine Birds & Insects Traffic & Other	35 to 46 32 to 56 35 to 63
15/4/2014	11:59	NM3	40.2	42.7	35.2	NIL	42(*46)	37.3	37.0	Pine Dale Mine Birds & Insects Traffic & Other	NIL 29 to 55 34 to 47
15/4/2014	12:14	NM3	40.2	43.2	33.4	NIL	42(*46)	35.4	38.5	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 55 31 to 50
15/4/2014	12:29	NM3	42.6	43.5	33.9	NIL	42(*46)	35.3	41.7	Pine Dale Mine Birds & Insects Traffic & Other	NIL 30 to 66 30 to 63
15/4/2014	14:57	NM4	35.6	36.5	31.9	NIL	35	33.0	32.2	Pine Dale Mine Birds & Insects Traffic & Other	NIL 30 to 61 31 to 43
15/4/2014	15:12	NM4	35.3	37.6	32.1	NIL	35	33.1	31.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 31 to 46 32 to 45
15/4/2014	15:27	NM4	35.3	38.0	31.5	NIL	35	31.4	33.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 30 to 43 31 to 48
16/4/2014	07:41	NM5	37.4	40.1	32.6	NIL	35	34.3	34.4	Pine Dale Mine Birds & Insects Traffic & Other	NIL 31 to 49 30 to 51
16/4/2014	07:56	NM5	37.0	39.3	32.1	NIL	35	29.2	36.2	Pine Dale Mine Birds & Insects Traffic & Other	NIL 33 to 50 30 to 50
16/4/2014	08:11	NM5	38.1	40.2	32.0	NIL	35	32.0	36.9	Pine Dale Mine Birds & Insects Traffic & Other	NIL 29 to 54 29 to 55
16/4/2014	08:40	NM6	41.1	44.9	31.4	NIL	35	34.4	40.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 29 to 53 30 to 54
16/4/2014	08:55	NM6	41.6	45.6	31.9	NIL	35	30.1	41.3	Pine Dale Mine Birds & Insects Traffic & Other	NIL 29 to 48 30 to 55
16/4/2014	09:10	NM6	42.1	46.0	31.8	NIL	35	31.6	41.7	Pine Dale Mine Birds & Insects Traffic & Other	NIL 29 to 51 29 to 54

*Noise Impact Assessment Criteria during construction and removal of the amenity bund

Table 53 *Attended Noise Survey – Quarter 3, September 2014*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Birds & Insects $L_{Aeq\ 15min}$ Contribution	Traffic & Other $L_{Aeq\ 15min}$ Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
18/9/2014	09:42	NM1	57.5	62.1	47.4	NIL	42	43.0	57.4	Pine Dale Mine Birds & Insects Traffic & Other	NIL 46 to 64 44 to 69
18/9/2014	09:57	NM1	58.1	62.4	48.4	NIL	42	47.6	57.7	Pine Dale Mine Birds & Insects Traffic & Other	NIL 44 to 67 43 to 70
18/9/2014	10:12	NM1	52.4	55.3	42.6	NIL	42	47.5	50.7	Pine Dale Mine Birds & Insects Traffic & Other	NIL 40 to 68 38 to 64
18/9/2014	10:42	NM2	48.8	52.9	39.8	NIL	42	41.1	48.1	Pine Dale Mine Birds & Insects Traffic & Other	NIL 36 to 67 37 to 60
18/9/2014	10:57	NM2	50.8	54.4	42.1	NIL	42	41.1	50.3	Pine Dale Mine Birds & Insects Traffic & Other	NIL 38 to 65 39 to 64
18/9/2014	11:12	NM2	49.3	52.4	42.4	NIL	42	38.6	49.0	Pine Dale Mine Birds & Insects Traffic & Other	NIL 37 to 55 36 to 58
19/9/2014	07:15	NM3	45.1	48.7	37.5	NIL	42	37.2	44.4	Pine Dale Mine Birds & Insects Traffic & Other	NIL 33 to 55 33 to 62
19/9/2014	07:30	NM3	43.5	46.4	35.2	NIL	42	35.9	42.6	Pine Dale Mine Birds & Insects Traffic & Other	NIL 32 to 58 33 to 58
19/9/2014	07:45	NM3	44.2	48.4	34.9	NIL	42	35.2	43.6	Pine Dale Mine Birds & Insects Traffic & Other	NIL 32 to 53 33 to 55
19/9/2014	08:21	NM4	39.9	42.3	33.4	NIL	42	37.7	35.8	Pine Dale Mine Birds & Insects Traffic & Other	NIL 30 to 59 30 to 55
19/9/2014	08:36	NM4	39.3	41.8	33.1	NIL	42	36.5	36.0	Pine Dale Mine Birds & Insects Traffic & Other	NIL 30 to 54 31 to 56
19/9/2014	08:51	NM4	40.3	41.8	32.0	NIL	42	37.3	37.4	Pine Dale Mine Birds & Insects Traffic & Other	NIL 28 to 60 30 to 60
18/9/2014	15:38	NM5	43.4	46.1	37.8	NIL	35	38.8	41.6	Pine Dale Mine Birds & Insects Traffic & Other	NIL 37 to 60 36 to 55
18/9/2014	15:53	NM5	43.9	46.1	37.8	NIL	35	40.9	40.9	Pine Dale Mine Birds & Insects Traffic & Other	NIL 38 to 61 36 to 53
18/9/2014	16:08	NM5	43.8	45.8	39.4	NIL	35	39.9	41.5	Pine Dale Mine Birds & Insects Traffic & Other	NIL 36 to 61 37 to 50
18/9/2014	14:41	NM6	47.9	50.6	39.5	NIL	35	41.9	46.6	Pine Dale Mine Birds & Insects Traffic & Other	NIL 35 to 69 36 to 63
18/9/2014	14:56	NM6	47.0	50.0	40.6	NIL	35	38.8	46.3	Pine Dale Mine Birds & Insects Traffic & Other	NIL 38 to 58 38 to 58
18/9/2014	15:11	NM6	45.5	48.0	40.4	NIL	35	41.4	43.4	Pine Dale Mine Birds & Insects Traffic & Other	NIL 39 to 60 38 to 58

Table 54 *Attended Noise Survey – Quarter 4, December 2014*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Road Traffic $L_{Aeq\ 15min}$ Contribution	Haul Road Traffic $L_{Aeq\ 15min}$ Contribution	Birds and Other $L_{Aeq\ 15min}$ Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$							
16/12/2014	9:43	NM1	52.0	55.5	44.6	NIL	42	51.9	NM	33.3	Pine Dale Mine Road&Haul Traffic Birds & Other	NIL 41 to 63 43 to 65
16/12/2014	9:58	NM1	51.0	54.0	44.7	NIL	42	50.8	NM	37.5	Pine Dale Mine Road&Haul Traffic Birds & Other	NIL 42 to 66 41 to 63
16/12/2014	10:13	NM1	49.8	52.2	44.6	NIL	42	49.8	NM	28.0	Pine Dale Mine Road&Haul Traffic Birds & Other	NIL 40 to 61 39 to 70
16/12/2014	10:41	NM2	52.5	55.6	46.3	NIL	42	51.9	NM	43.4	Pine Dale Mine Road&Haul Traffic Birds & Other	NIL 43 to 63 44 to 63
16/12/2014	10:56	NM2	52.6	55.3	45.9	NIL	42	52.1	NM	42.7	Pine Dale Mine Road&Haul Traffic Birds & Other	NIL 43 to 65 42 to 64
16/12/2014	11:11	NM2	51.7	54.8	46.1	NIL	42	50.9	NM	44.1	Pine Dale Mine Road&Haul Traffic Birds & Other	NIL 43 to 61 41 to 67
17/12/2014	10:41	NM3	48.6	51.3	42.6	12.2	42	45.0	46.0	29.8	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	47 to 48 40 to 63 42 to 60 40 to 53
17/12/2014	10:56	NM3	50.2	53.1	44.5	44.4	42	41.2	47.5	39.1	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	45 to 58 41 to 61 43 to 60 43 to 60
17/12/2014	11:11	NM3	49.8	52.8	44.1	NIL	42	45.8	46.8	39.9	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL 41 to 58 43 to 61 43 to 60
17/12/2014	09:28	NM4	41.8	43.8	35.9	NIL	35	NIL	37.9	39.5	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL NIL 34 to 56 32 to 58
17/12/2014	09:43	NM4	41.1	42.7	35.2	NIL	35	NIL	37.2	38.8	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL NIL 34 to 54 32 to 62
17/12/2014	09:58	NM4	42.9	45.6	37.2	NIL	35	NIL	39.1	40.5	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL NIL 33 to 60 33 to 58
17/12/2014	08:15	NM5	37.3	39.2	33.6	NIL	35	26.6	30.3	35.8	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL 32 to 46 33 to 51 32 to 50
17/12/2014	08:30	NM5	40.9	38.7	32.4	NIL	35	23.5	31.5	40.3	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL 32 to 42 30 to 48 30 to 74

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Road Traffic $L_{Aeq\ 15min}$ Contribution	Haul Road Traffic $L_{Aeq\ 15min}$ Contribution	Birds and Other $L_{Aeq\ 15min}$ Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$							
17/12/2014	08:45	NM5	35.8	37.2	31.8	NIL	35	23.6	29.8	34.2	Pine Dale Mine Road Traffic Haul Road Traffic Birds & Other	NIL 31 to 49 31 to 54 29 to 57
17/12/2014	07:15	NM6	43.9	47.3	36.8	NIL	35	43.0	34.8	33.0	Pine Dale Mine Haul Road Traffic Road Traffic Birds & Other	NIL 33 to 54 33 to 56 32 to 54
17/12/2014	07:30	NM6	41.5	43.9	37.6	NIL	35	37.8	38.9	26.9	Pine Dale Mine Haul Road Traffic Road Traffic Birds & Other	NIL 35 to 50 36 to 59 36 to 46
17/12/2014	07:45	NM6	39.7	42.6	35.8	NIL	35	35.5	37.1	27.7	Pine Dale Mine Haul Road Traffic Road Traffic Birds & Other	NIL 34 to 50 33 to 48 35 to 44

Table 55 *Meteorological Conditions during Attended Noise Surveys*

Survey Date (2014)	Start Time	Location	Cloud	Temp at 10m	Ground Level Wind Speed At Receiver	Wind Speed at 10m	Wind Direction
20 January	09:20	NM1	8 Octa	21°C	NIL	1.8 m/s	SSE
20 January	10:20	NM2	5 Octa	24°C	NIL	2.0 m/s	NNE
21 January	07:40	NM3	8 Octa	18°C	1 m/s	1.3 m/s	SE
20 January	16:10	NM4	7 Octa	26°C	1.5 m/s	2.6 m/s	ESE
20 January	11:28	NM5	2 Octa	26°C	1.5 m/s	2.0 m/s	SSW
20 January	13:42	NM6	5 Octa	32°C	NIL	2.6 m/s	SSW
15 April	09:50	NM1	6 Octa	15°C	0.5 - 1 m/s	1 m/s	ENE
15 April	10:49	NM2	4 Octa	16°C	0.5 - 1 m/s	1.1 m/s	E
15 April	11:59	NM3	4 Octa	18°C	NIL	1 m/s	SE
15 April	14:57	NM4	8 Octa	16°C	NIL	1 m/s	SE
16 April	07:41	NM5	7 Octa	11°C	1 m/s	1.7 m/s	SE
16 April	08:40	NM6	7 Octa	11°C	1 m/s	1.4 m/s	SSE
18 September	09:42	NM1	0 Octa	9°C	0.5 - 1 m/s	3.3 m/s	WSW
18 September	10:42	NM2	0 Octa	11°C	0.5 - 2 m/s	3.2 m/s	WSW
19 September	07:15	NM3	7 Octa	6°C	NIL	0.25 m/s	ESE
19 September	08:21	NM4	7 Octa	9°C	NIL	1.1 m/s	ESE
18 September	15:38	NM5	6 Octa	11°C	1 – 2.5 m/s	3.5 m/s	SW
18 September	14:41	NM6	4 Octa	13°C	2 – 3.5 m/s	3.5 m/s	WSW
16 December	9:43	NM1	6-2 Octa	25°C	0 - 3 m/s	5 m/s	NNW
16 December	10:41	NM2	1 Octa	27°C	0 – 3.5 m/s	6 m/s	NNW
17 December	10:41	NM3	0 Octa	9°C	3.5 m/s	5 m/s	NW
17 December	09:28	NM4	0 Octa	26°C	3 m/s	3 - 4 m/s	WNW
17 December	08:15	NM5	0 Octa	24°C	0 – 1 m/s	2 - 4 m/s	W
17 December	07:15	NM6	1 Octa	23°C	NIL	0.6 – 1.7 m/s	WSW

8.3 REVIEW & INTERPRETATION OF OPERATIONAL NOISE MONITORING RESULTS

Attended noise surveys of the Pine Dale mine for the 2014 monitoring period were undertaken in January whilst mining extraction was being undertaken, and when the mine was in care and maintenance in April, September and December. The operations observed were considered to be representative of those undertaken on a normal daily basis.

The source coding method was used during attended noise surveys to record the overall noise levels and define the contributing noise sources at each of the six noise monitoring locations. Noise sources audible during the attended surveys were classified into three source categories, namely, Mine noise (from Pine Dale Mine); Birds & Insects; and Traffic & Other noise sources. Contributions from these sources were determined by analysis of the time coded logger data using the sound level meters proprietary software.

8.3.1 FIRST QUARTER 2014

Attended noise surveys of the Pine Dale mine for the first quarter were undertaken on the 20th & 21st of January 2014. During the surveys the mine was observed to be operational within the North-western end of the Yarraboldy Extension with mining extraction activities being undertaken. The operations observed were considered to be representative of those undertaken on a normal daily basis.

The measured $L_{Aeq,\ 15min}$ noise contribution from the Pine Dale Mine, at all Noise Monitoring locations, was below the target noise goal for all 15 minute surveys.

Pine Dale Mine was intermittently audible over the survey periods at noise monitoring location NM1 only in the absence of other noise sources, with contributions ranging from 34 – 36 dB(A).

The noise from Pine Dale Mine was only audible at location NM1.

At Noise Monitoring locations NM1 and NM2 the most significant contributor to the overall acoustic climate was Traffic & Other noise. While at Noise Monitoring locations NM5 Birds & Insects dominated. Noise Monitoring at locations NM3, NM4 and NM6 had similar contributions from both Birds & Insects and Traffic & Other noise.

8.3.2 SECOND QUARTER 2014

Attended noise surveys of the Pine Dale mine for the second quarter were undertaken on the 15th & 16th of April 2014. Pine Dale entered into care and maintenance early April 2014 and so during the surveys the mine was observed to be only conducting rehabilitation work that involved the use of Dozers and Dump trucks. The Dozers were removing dirt from the peak of the amenity bund wall, on the north side of the hall road, and decreasing the gradient of the amenity bund wall. The Dump Trucks were being loaded at the base of the north side of the bunding and then moved the dirt via the pit to the eastern end of the Yarraboldy extension.

The measured $L_{Aeq,\ 15min}$ noise contribution from the Pine Dale Mine, at all Noise Monitoring locations were below the target noise goal for all 15 minute surveys.

At NM1 noise from Pine Dale Mine was intermittently audible over the survey periods with contributions ranging from 40 – 44.5 dB(A). The monitoring has shown no exceedance of the target noise goals from the conduct of short term rehabilitation works in an exposed area.

The noise from Pine Dale Mine was faintly audible at noise monitoring location NM2 and only in the absence of other sound sources.

At Noise Monitoring location NM1 the contributions from both Pine Dale Mine and Traffic & Other noise were similar over the survey periods. At all other noise monitoring locations (NM2 – NM6) similar contributions were observed from both Birds & Insects and Traffic & Other, with sound

from traffic having higher sound levels overall than that from the mine. This suggests that the noise from Pine Dale mine rehabilitation works would go largely unnoticed by residents and is not likely to be considered offensive noise in the prevailing environment.

8.3.3 THIRD QUARTER 2014

Attended noise surveys of the Pine Dale mine for the third quarter were undertaken on the 18th & 19th of September 2014. During the surveys the mine was observed to be non operational and in a state of care and maintenance. The privately owned Angus Place haul road was open and trucks, not associated with Pine Dale mine, were observed to be using the road.

There was no $L_{Aeq,\ 15min}$ noise contribution measured from the Pine Dale Mine, at any noise monitoring location.

At noise monitoring location (NM1) the traffic noise contribution was much higher than past monitoring levels for this location due to council road works directly adjacent. There were a number of council trucks and light vehicles conducting road sweeping and line marking for the entire survey period.

At all noise monitoring locations (NM1 – NM6) both Birds & Insects and Traffic & Other noise sources were similar over the survey period, with sound from Traffic generally having higher sound levels than that from Birds. The weather conditions were slightly windy at monitoring locations NM5 and NM6, with gusts up to 3.5m/s during the survey period, which has raised the measured levels of both the traffic and birds throughout the surveys.

8.3.4 FOURTH QUARTER 2014

Attended noise surveys of the Pine Dale mine operations for the fourth quarter were undertaken on the 16th & 17th of December 2014. During the surveys the mine was again observed to be non operational and in a state of care and maintenance. The privately owned Angus Place haul road was open and coal haul trucks, not associated with Pine Dale mine, were observed to be using the road.

During the survey period at the Barnes residence (NM3) localised weed spraying was conducted within 50 metres of the survey point. The noise contribution of the vehicle mounted spray pumping unit has been marked as a Pine Dale Mine source which gave a $L_{Aeq,\ 15\ min}$ value of 44 dB for the second 15 minute period of the survey. All other surveys showed no $L_{Aeq,\ 15min}$ noise contributions from the Pine Dale Mine, at noise monitoring locations NM1, 2, 4, 5 & 6.

The attended surveys conducted at NM1 & NM2 showed that Road Traffic was the dominant noise source over the survey period with intermittent contributions from Birds & Other sources. At NM3, all noise sources identified were significant contributors to the acoustic climate, with Pine Dale Mine audible during the survey period as discussed above. At NM4 Haul Road traffic and Birds & Other sources were both significant contributors to the acoustic climate. At NM5 Bird & Other noise sources dominated the acoustic climate with Haul Rd traffic also a significant contributor. At NM6, Road Traffic, Haul Rd traffic and Birds & Other were all significant contributors to the acoustic climate.

8.3.5 OVERALL ASSESSMENT FOR 2014

In general the assessable sound levels from Pine Dale Mine were below the assessment criteria for all periods during the year.

It is a requirement under AS 1055 that the noise surveys also document levels of ambient sound resulting from non-mine sound sources. In the surveys conducted for Pine Dale Mine during

2014 traffic and natural sounds, which are represented by the "Overall" LAeq (15 minute) noise levels set out in Table 51 to 55, are usually significantly higher than the sound from Pine Dale Mine.

9 BLAST MONITORING

9.1 BLASTING OPERATIONS ASSESSMENT CRITERIA

The purpose of blast monitoring is to ensure that any impact of blasting operations on the surrounding land and nearby sensitive locations can be identified, and to show compliance with relevant legislative requirements. Conditional requirements within Project Approval 10_0041 (Schedule 3, Condition 8) and Environmental Protection License (EPL 4911) are presented in **Table 56**.

Table 56 *Blasting Operations: Compliance Requirements*

Location	***Airblast overpressure (dB(Lin Peak))***	***Ground vibration (mm/s)***	***Allowable exceedance***
Residence on privately-owned land	115	5	5% of the total number of blasts over a period of 12 months
	120	10	0%

9.2 BLASTING OPERATIONS MONITORING DATA SUMMARY

The monitoring of blasts for Pine Dale Mine is undertaken in accordance with the Pine Dale Mine Environmental Protection License (EPL 4911). Throughout the 2014 monitoring period there were a total of 3 blasts conducted at the site with blasts being undertaken during the months of January and February only.

Blasting results for the period January to December 2014 are shown in **Table 57** and **58**.

Where airblast overpressure or ground vibration levels are too low to be detectable at the monitors, no trigger is set off and therefore no result is recorded.

Table 57 *Blast Monitoring Results Jan - Dec 2014*

Date	Park Street		Noon Street		Summer Street	
	Overpressure (dB)	**Vibration (mm/sec)**	**Overpressure (dB)**	**Vibration (mm/sec)**	**Overpressure (dB)**	**Vibration (mm/sec)**
21/01/2014	NT	NT	87.3	0.08	106.4	0.08
4/02/2014	NT	NT	101.9	0.02	NT	NT
7/02/2014	NT	NT	91.8	0.07	NT	NT

NT - Indicates monitor was not triggered.

Italics- indicate that results are greater than the 95% compliance criteria as specified in the EPL.

Bold italics- indicate that results are greater than the 100% compliance criteria as specified in the EPL.

Table 58 *Summary of Blasting Results and Compliance Performance*

Jan- Dec 2014 Information	*Park Street*		*Noon Street*		*Summer Street*	
	Airblast Overpressure (dB)	**Vibration (mm/sec)**	**Airblast Overpressure (dB)**	**Vibration (mm/sec)**	**Airblast Overpressure (dB)**	**Vibration (mm/sec)**
Minimum	NT	NT	87.3	0.0	106.4	0.1
Average	NT	NT	93.7	0.1	106.4	0.1
Maximum	NT	NT	101.9	0.1	106.4	0.1
% blasts > EPL 95% Compliance Criteria	0	0	0	0	0	0
% blasts > EPL 100% Compliance Criteria	0	0	0	0	0	0

NT - Indicates monitor was not triggered.

9.3 REVIEW & INTERPRETATION OF BLASTING OPERATIONS MONITORING RESULTS

Blast monitoring results obtained during the monitoring period January to December 2014 show that airblast overpressure results were in compliance with both the 95% and 100% assessment criteria as stipulated in EPL 4911.

As displayed in **Table 58**, full compliance was attained across all monitors during 2014 for vibration levels at both the 100% and 95% velocity levels of 10mm/sec and 5mm/sec, respectively.

Across all of the monitoring locations, airblast overpressure levels were recorded to be below the one hundred per cent, 120dB (Lin Peak), and ninety-five per cent, 115dB (Lin Peak), compliance criteria during the reporting period.

10 LIMITATIONS

This report has been prepared for Pine Dale Mine. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the use of Pine Dale Mine. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without written permission from RCA.

The information in this report is considered accurate at the date of issue. Please contact the undersigned if you have any queries on the above.

Yours sincerely

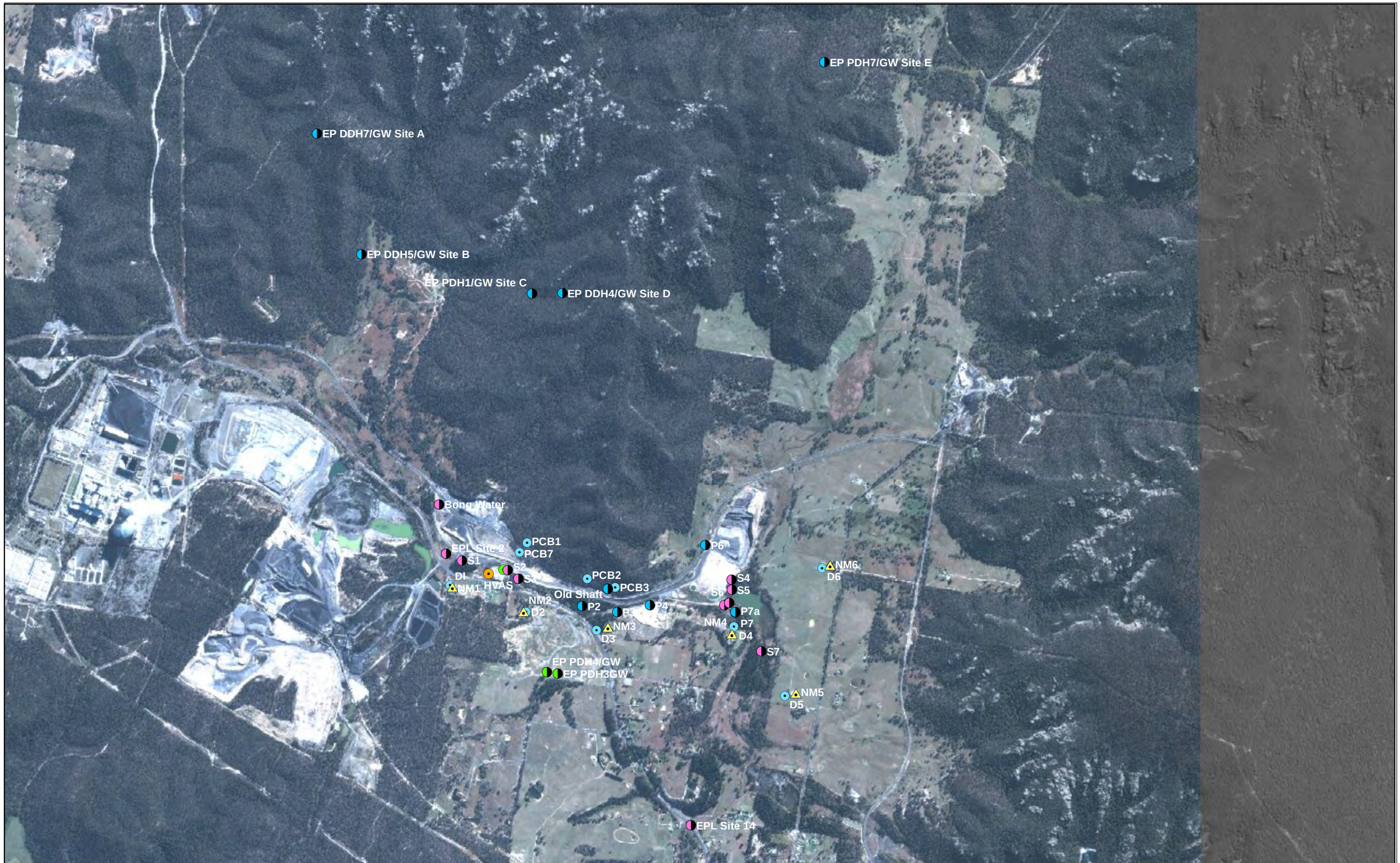
Carmen Rocher
Environmental Engineer
Robert Carr and Associates trading as
RCA Laboratories – Environmental

Karen Tripp
Senior Environmental Scientist / Hygienist
Robert Carr and Associates trading as
RCA Laboratories – Environmental

Appendix 1

Drawing 1 - Environmental Monitoring Locations

Drawing 2 - Stream Health & Channel Stability Monitoring Locations



Legend

- Noise Monitoring Location
- Depositional Dust Monitoring Location
- Enhance Groundwater Monitoring Location
- Groundwater Monitoring Location
- High Volume Air Sampling Location
- Metorological Monitoring Location
- Surface Water Monitoring Location

500 250 0 500 1,000 1,500

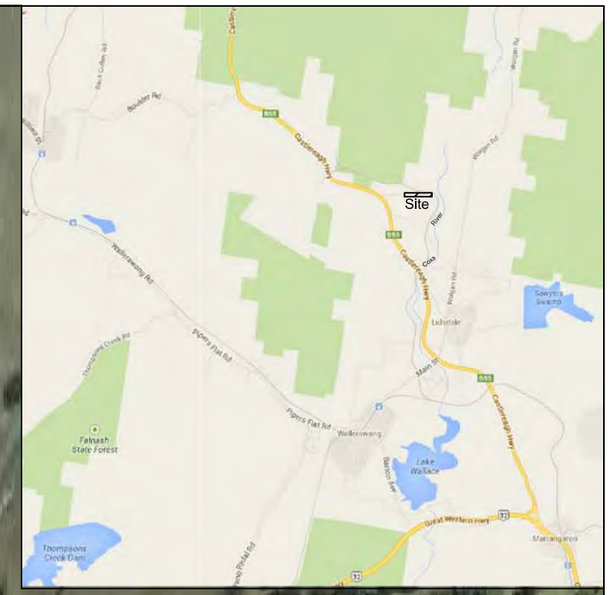
metres

N

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PINE DALE MINE
ENVIRONMENTAL MONITORING LOCATIONS

CLIENT	Pine Dale Mine			PROJECT No	6880-870a/010
DRAWN BY	KT	SCALE	1:30,000 (A3)	DRAWING No	1
APPROVED BY	KT	DATE	10/02/2015	OFFICE	NEWCASTLE



Locality Plan
N.T.S.

Mine Office

SH4

SH2

SH1
Clean Water Diversion

SH3
SH3a
LDP13

Castlereagh Highway

View Street

LEGEND
- Monitoring location
- Licence discharge point location
- Clean water diversion location

SH5

0 50 100 150 200 250
metres

Aerial image taken from Google Earth, 23 May 2006

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

LOCATION PLAN OF CHANNEL STABILITY, STREAM AND VEGETATIVE HEALTH OF NEUBECKS CREEK MONITORING SITES

CLIENT	Pine Dale Mine			RCA Ref	6880-870a/010
DRAWN BY	KS	SCALE	1 : 5000 (A3)	DRAWING No 2	REV 0
APPROVED BY	KT	DATE	10/2/2015	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

APPENDIX C

REHABILITATION MONITORING REPORT

Enhance Place Pty Limited

ABN: 31 077 105 867

Pine Dale Mine

2014 Rehabilitation Monitoring Report



Prepared by

Enhance Place Pty Ltd

Castlereagh Highway

Blackmans Flat NSW 2790

January 2015

Revision history			
Version	**Date**	**Author**	**Authorised by:**
Draft	December 2014	Ben Eastwood	Graham Goodwin
Final	January 2015	Tom Hurdley	Graham Goodwin

Contents

Appendices

List of Figures

List of Tables

List of Plates

1. Introduction

Pine Dale Mine is located in the Western Coalfields of NSW at Blackmans Flat, 17km north west of Lithgow on the northern side of Castlereagh Highway. The site is approximately 3km south east of Mount Piper Power Station.

Pine Dale Mine is managed in accordance with Project Approval 10_0041 and relevant subsidiary licenses and approvals. The Care and Maintenance Mining Operations Plan Approved in January 2015 (C&M MOP) has been prepared in accordance with the above approval documentation and describes the following rehabilitation objectives:

- *"The rehabilitated landform is safe, stable, non-polluting and sustainable;*
- *Rehabilitation maintains or improves species diversity and habitat values of the Yarraboldy Extension Area, particularly the former Yarraboldy Open Cut Mine; and*
- *The agreed post mining land use is compatible with the surrounding land fabric and land use requirements."*

The preparation of this Rehabilitation Monitoring Report has been prepared to satisfy Schedule 3, Condition 55 of Project Approval 10_0041.

This report aims to identify successes and failures of rehabilitation with regard to agreed performance indicators and completion criteria in the C&M MOP. Recommendations have been suggested for areas that could be improved.

2. Performance indicators

Rehabilitation performance criteria has been developed for Pine Dale Mine and included in the C&M MOP. The performance indicators include aspects that could be potential impacted by the current state of the land. Completion criteria for each performance indicator has been developed based on site specific parameters. This report provides a high level review of the rehabilitated areas against the identified completion criteria as currently described in the C&M MOP. The Performance Indicators, Completion Criteria and current status are described in more detail in **Section** Error! Reference source not found.**,** and **Table 5**.

3. Survey Methodology

This chapter describes the survey methods used to measure the performance of rehabilitation at Pine Dale Mine. The land surveyed for the purpose of this report included Area A, Area B, and C, Area 8, temporary rehabilitated areas, *Thesium austral* habitat area and reference sites (Survey Area), see **Figure 1**.

3.1 Mapping

Aerial images of Pine Dale Mine have been used to describe the physical location and extent of each study area in a landscape context. The location of transects (and quadrat 1 from previous studies) are shown on **Figure 1**.

3.2 Transects

Transects have been established within pasture and treed rehabilitation areas for the purpose of quantifying vegetation changes over time. Survey transects have been positioned along observable contours and extend to a length of 50 m, covering a width of 10 m. Each transect is identified in the field by a surveyors peg. Coordinates of transects are included in **Appendix A**.

3.3 Soil analysis

A detailed soil assessment had been completed by SLR Consulting on 10 September 2014 at Pine Dale Mine and results documented in their report dated 10 November 2014 *Soil Assessment and Recommendations for Rehabilitation Areas at Pine Dale Mine* (SLR 2014). Results and findings from the SLR (2014) soil assessment have been relied upon for the purpose of this report. As such no further soil assessment was required to meet the requirements of this report.

3.4 Landform assessment

Landform assessment includes the identification of erosion; drainage impediments; slope; and presence of cracking soils.

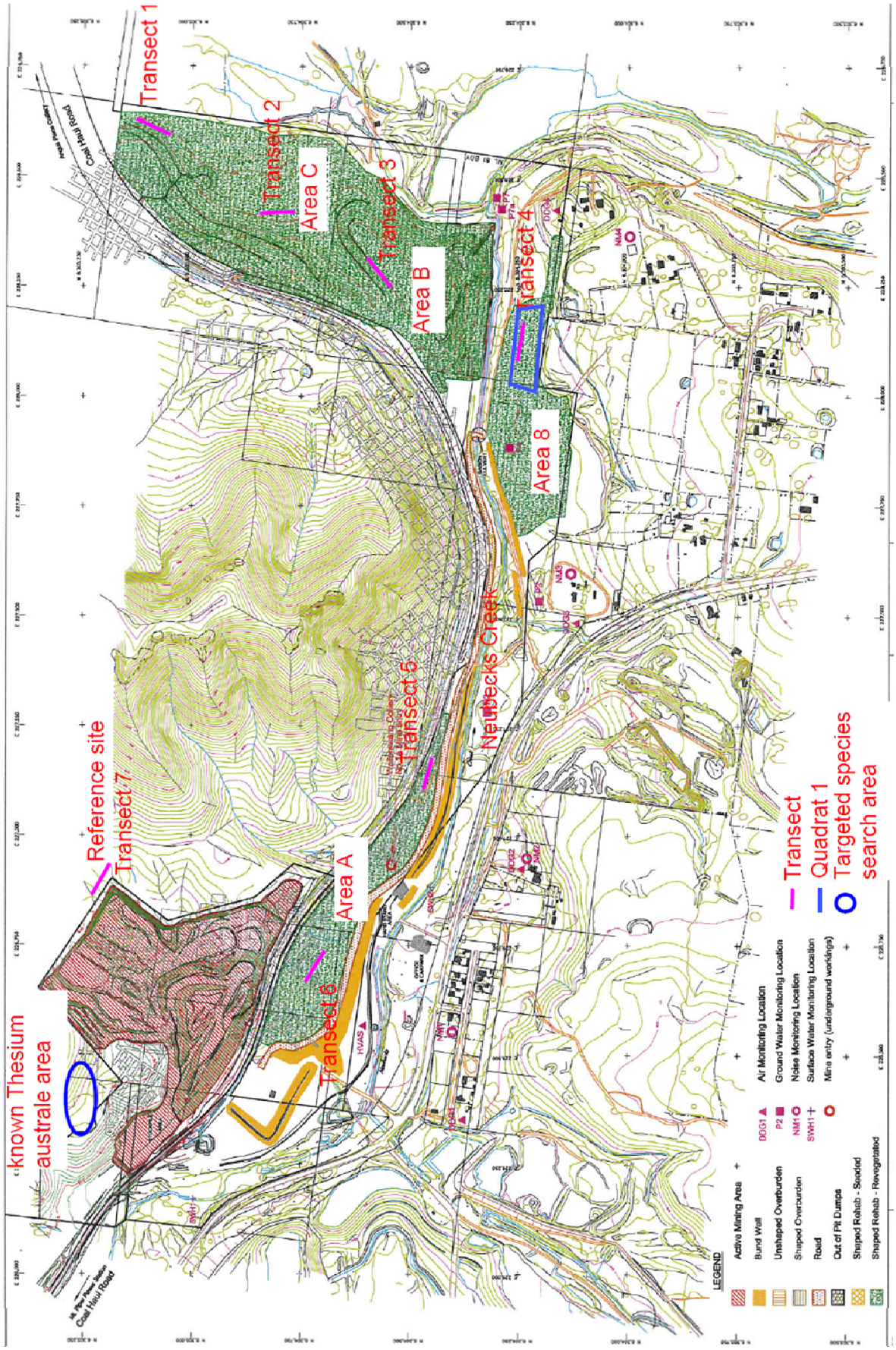
Erosion and sedimentation - Evidence of erosion and sedimentation were observed along and in the vicinity of each transect and assessed in accordance with the Australian Soil and Land Survey Field Handbook (CSIRO, 2009).

Drainage impediments - Drainage structures along and within the general vicinity of each transect were identified in the field and assessed for visible impediments and evidence of erosion and sedimentation.

Slope - Slope angle was estimated in the field by calculating angle over distance along each survey transect. Slope angle class and type was defined in accordance with the Australian Soil and Land Survey Field Handbook (CSIRO, 2009).

Cracking soils - Soil surfaces along and within the vicinity of each transect were observed for surface cracking. Soil samples were extracted to a depth of 20 cm from ten random locations within each pasture transect area. Soil structure, ped shape and ped surface characteristics were examined for evidence of soils prone to cracking.

Figure 1 Pine Dale Mine



3.5 Vegetation assessment

Vegetation assessment was conducted along transects within pasture, treed rehabilitation areas and a native forest reference site. Treed rehabilitation areas were compared to the native forest reference site in terms of vegetation structure and species richness.

Vegetation surveys involved walking the 50m length of each transect while recording species, vegetation structure, percentage ground cover and species richness.

A targeted search for *Thesium australe* was conducted in an area in which the species had been previously observed.

3.6 Native forest reference site

The native forest reference site was established in an area to the north of Pine Dale Mine in which there was no evidence of disturbance. The site has been selected as a representative example of a typical native vegetation community which occurs in the areas. The site is located adjacent to the mining area for the purpose of providing a benchmark of against which the treed rehabilitation areas can be compared. Parameters such as vegetation structure, species richness, density and diversity can then be measured and compared to provide a general measure of performance of rehabilitated areas.

3.7 Habitat assessment

Evidence of avian and mammalian fauna utilising the rehabilitation areas was recorded in terms of scats, traces and sightings. The placement of artificial hollows, crushed timber and rock piles was recorded within treed rehabilitation transects. The presence of tree hollows and logs within the native forest reference transect was noted.

3.8 Photopoint monitoring

Photo point monitoring of quadrat 1 was conducted during previous studies (Cunningham, 2012). Additional photo monitoring points were established along each transect established within treed and pasture rehabilitation areas. Comparison of these and future images aims to show visual changes to vegetation coverage and structure over time.

3.9 Exotic weed surveys

Noxious weeds listed for the study area are described by the Upper Macquarie County Council (NSW DPI, 2013). Targeted searches for noxious weeds were conducted along and in the vicinity of each transect. Identification of target weeds was assisted through the use of field guides and botanical keys.

4. Results and Discussion

Field surveys were conducted on the 26 and 27 of November 2014 by a qualified environmental scientist. The surveys focussed on collecting data to inform the progress of rehabilitation across the study area.

4.1 Weather conditions

Surveys were preceded by a relatively dry winter and spring period. At the time of the survey there had been very little rainfall and it was generally very dry. Average monthly rainfall for the region was variable, with January 2014 records representing the lowest rainfall for that month in nine consecutive years, while April 2014 figures represented the highest records in nine consecutive years. **Table 1** presents regional rainfall data for the period since 2010.

Table 1 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) 2010- 2014

	2010	2011	2012	2013	2014
January	76.6	63	48.2	87.4	9.2
February	107.0	68.2	173.8	149.0	85.0
March	60.8	78.0	187.0	43.2	155.0
April	37.6	23.8	31.6	26.8	63.0
May	54.0	42.4	40.6	23.6	14.0
June	39.8	41.2	70.6	87.0	43.2
July	87.4	18.2	48.8	19.6	33.6
August	84.4	54.8	23.2	22.4	56.4
September	64.0	65.4	40.4	44.0	35.2
October	75.8	36.8	16.6	20.8	51.6
November	101.6	158.0	39.0	68.6	36.8
December	217.0	86.0	61.2	38.4	160.4
Annual	1006.0	735.8	781.0	630.8	743.4

4.2 Soil analysis

A number of recommendations have been made in the SLR (2014) report to improve soil chemistry and pasture composition. The results from this survey are generally consistent with and support the recommendations made by SLR (2014). The recommendations made by SLR (2014) are supported and should be implemented to ensure pasture rehabilitated areas continue to move towards achieving the rehabilitation completion criteria.

There was no surface cracking in soils was observed during the survey.

4.3 Landform

4.3.1 Erosion and sedimentation

The presence and extent of active surface erosion along transects surveyed as part of this assessment is recorded in **Appendix A**.

Pasture rehabilitation areas – There was no significant or active erosion identified within the areas rehabilitated to pasture. The final landform and water management structures constructed throughout the study area appear to be appropriate and in good condition. Some sedimentation was evident within areas of exposed soil but was limited to localised displacement of fine-grained particles.

Treed rehabilitation areas (Area A) - Rill (<300mm depth) and sheet erosion continue to be evident across the treed rehabilitation area (Areas A) and were associated with increased slope and exposed soils in these locations. Improved groundcover following the treatment of acidic soils and reseeding have been effective in stabilising the surface and minimising any further erosion.

Plate 1: General Stability of Rehabilitated Areas

Area A: Improved vegetative cover has minimised further soil erosion in this area.

Area B: Demonstrates high vegetative cover and stable landform with minimum erosion.

Area C: general view over area C, mixed cover success would benefit from soil & pasture improvement

Area 8: low vegetative cover makes parts of Area 8 susceptible to rill errosion.

4.3.2 Drainage infrastructure

The survey was conducted during a relatively dry period, there was no evidence of uncontrolled surface water pooling in the rehabilitated areas. Existing drainage structures were not impaired, as can be seen in **Plate 2**.

Plate 2: Water Structures in Rehabilitated Areas

Area A: Stabilised water drop structure.

Area A: improved vegetative cover has improved the stabilisation of contour drains.

Area B: Stabilised contour drain with good vegetative cover.

Area B: Stabilised water drop structure in good condition

Area C: exposed contour drain subject to erosion and sedimentation with poor vegetative cover.

Area C: Sediment dam holding water will provide for stock in the future.

4.3.3 Cracking soils

There was no evidence observed of surface cracking in soils in any of the rehabilitated areas during the survey.

4.4 Vegetation

Approximately 25.4 ha of the study area has been rehabilitated to pasture which includes areas B, C and area 8. An additional 7.1 ha has been planted with trees and shrubs and is referred to as area A. Pastures were sown in 2010 /2011 with Cox's River Mix, comprising:

- 40% Fescue;
- 25% Cocksfoot;
- 20% Subterranean clover;
- 6% Perennial rye grass;
- 5% White clover; and
- 4% Phalaris.

Flora species identified along and within the vicinity of each transect are listed in **Appendix B**.

4.4.1 Pasture rehabilitation areas

Transects 1 and 2 located in Area C had a varied groundcover between 70-90% and generally the rehabilitated areas on the upper slopes and along the Cox's Rive were better established than the areas located mid slope (see **Plate 3**). Transect 3 in Area B contained higher groundcover up to 90% and is reflective of the rehabilitation technique and using more topsoil in this area (**Plate 4**).

Vegetation in transects 1, 2 and 3 were generally established to a height of approximately 15 cm. Vegetation consisted of a mix of native and exotic grass and herb species (see Error! Reference source not found.) and was consistent with the Cox's River Mix and locally abundant pasture weeds. Approximately 48 flora species were identified within these transects and was consistent with previous survey results.

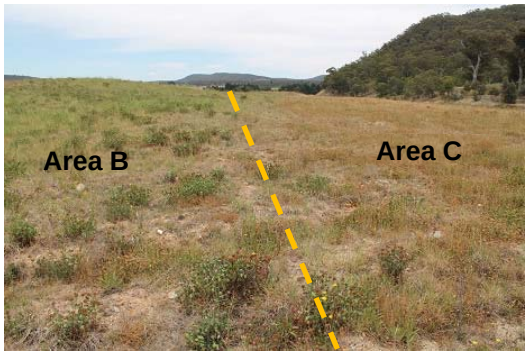
Plate 3: View overlooking Area C

Plate 4: View overlooking Area B

A distinct change in the percentage groundcover and species composition was observed between Areas B and C and can be seen clearly in **Plate 5**. Area B is dominated by arrow leaf clover and native grasses while Area C was dominated by hares foot clover some native grasses and higher percentage of bare ground. Area B has a deeper and more established A horizon in the soil profile compared to Area C.

It appears that Area B has had more topsoil spread across the surface during the final shaping and landform establishment stage compared to Area C. The thin topsoil layer in Area C has likely contributed to this area not establishing as well as Area B.

Plate 5: Transition between Area B and C



Transect 4 is located in Area 8 within a previously established monitoring area (quadrat 1).

It was observed that the rehabilitation in Area 8 was progressing at different rates in the western end compared to the eastern end as shown in **Plate 6** and **Plate 7**.

Vegetation within transect 4, located in the western portion of Area 8, appeared to be relatively more established than the eastern portion. Vegetation density was higher, with <10% bare earth evident. A sparse shrub layer dominated by *Cassinia acuata* grows to approximately 1.2 m height. Juvenile tree species were also sparsely present in the shrub layer; particularly on the margins of the rehabilitation area.

Groundcover was diverse, dominated by a mix of native and exotic grasses to an average approximate height of 60 cm. Herbs were represented by both broadleaf and erect species. 56 flora species were identified within transect 4 (**Plate 6**).

Plate 6: View overlooking Area 8 (eastern portion)

The eastern portion of Area 8 had 85% groundcover and comprised similar species and density to that of the less developed locations in Area C. The eastern portion of Area 8 has a very thin topsoil layer. This is reflective of the rehabilitation technique used in this area.

Plate 7: View overlooking Area 8 (western portion)

Comparison of quadrat 1 data and observations along transect 4 are detailed in **Table 2**.

Table 2 Percentage cover class in quadrat 1 over time

Cover class	Percentage cover at each observation				
	Feb 2010 (Q 1)	Sep 2011 (Q1)	Nov 2012 (Q 1)	Apr 2014 (T4)	Nov 2014 (T4)
Total living cover	97%	99%	95%	90%	95%
Bare surface and litter	3%	1%	5%	10%	5%

4.4.2 Treed rehabilitation areas

Transect 5 is located within quadrat 2 which was monitored as part of the 2012 survey.

The area of transect 5 continues to supported a sparse shrub layer to approximately 2 m height and consists of juvenile Eucalyptus and Acacia species. *Cassinia acuate* is dominant in the area and requires control. Groundcover supported a mix of native and exotic grasses and herbs and accounted for approximately 50% of vegetation cover across the transect area. Approximately 40% of the area was exposed soil which was an improvement from 20% compared to the April survey. There was some surface erosion evident in this area. There were >25 flora species identified within transect 5. The improved performance of this area can be attributed to the treatment of acidic soils, reseeding of the area and weed management undertaken (see **Plate 8**).

Plate 8: View looking west along Transect 5

Comparisons of proposed quadrat 2 data and observations along transect 5 are detailed in **Table 3**.

Table 3 Percentage cover class in proposed quadrat 2 over time

Cover class	Percentage cover at each observation		
	Nov 2012 (Q2)	Apr 2014 (T5)	Nov 2014 (T5)
Total living cover	87.5%	<40%	60%
Bare surface and litter	12.5%	>60%	40%

The area of transect 6 continues to contain scattered individual native tree species to 3 m height. The shrub layer contained scattered juvenile trees and shrubs consistent with those species planted during the initial stages of rehabilitation. The shrub and juvenile tree layer was approximately 2 m in height. Groundcover was dominated by exotic grasses including hares foot clover and herb species with some native herbs establishing throughout the transect area.

Groundcover species accounted for approximately 20% of vegetation across the transect area. An estimated 30% of the area was exposed soil (see **Plate 9**), this is a significant decrease from the previous survey which found greater than 70% of the area was bare ground. Up to 31 flora species were identified within transect 6 which is consistent with previous survey results.

Based on the plant growth response due to the treatment of known acidic soil in this area, reseeding and control of weeds the control methods have been very effective and worthwhile.

Plate 9: Plant growth along Transect 6

Ground cover dominated by Hares foot clover and emerging native Eucalyptus species

Hares foot clover (left), emerging acacia species (centre) and arrow leaf clover (bottom right).

Flowering native Callistemon species in Area A

Native pasture dominated portion of Area A, this area has a thick topsoil layer in the soil profile.

4.5 Native forest reference site

The native woodland reference site is located adjacent to the mining area in a Eucalyptus spp. dominated dry sclerophyll forest with a sparse shrubby understorey to 1.5 m height (see **Plate 10**). Recruitment of tree species was evident in the shrub layer, with juvenile trees ranging in height. Groundcover was dominated by native grasses and herbs. There was little exposed soil and no surface erosion was observed. Up to 45 flora species were identified within transect 7.

Plate 10: Native Woodland Reference Site, Transect 7

4.6 Neubecks Creek

Neubecks Creek passes through mining authorities held by Enhance Place and was surveyed as part of this assessment. The survey found:

a) The banks of Neubecks Creek are generally stable (see **Plate 11**);
b) The survival rate of previous tube stock plantings has been <10%;
c) Blackberry is dominant in some areas and needs further controlling;
d) The pine plantation area east of the crib hut is generally stable and dominated by radiate pine;
e) The water was clear on the day of the survey, fish (likely guppies) and crayfish were observed (see **Plate 12**).

Plate 11: Neubecks Creek typical cross section

Monitoring of Neubecks Creek including water quality and bank stability is carried out on a regular basis in accordance with relevant mining approvals by an independent environmental consultancy. Therefore that monitoring is not undertaken as part of this assessment.

Plate 12: Fish and Pine Plantation Area

Fish species (likely guppies) in Neubecks Creek.

Groundcover dominated by pine needles adjacent Neubecks creek.

4.7 Habitat

There is limited habitat for native fauna in Area A as the vegetation is establishing and the structure of the vegetation community is still developing. A native pigeon and several small woodland birds were observed in Area A. These species were noted in close proximity to the remnant native vegetation located adjacent to the coal haul road.

4.8 Photo point monitoring

Photo point coordinates for each transect are included in **Appendix A**. Photos taken along each transect are included in **Appendix C** and provide a visual reference of vegetation structure and cover at the time of this survey.

Comparison of photos taken during earlier surveys highlights the impacts and changes to groundcover and species composition brought about by seasonal variations. Ongoing monitoring will provide further evidence of the stability of these areas over time.

4.9 Exotic weed species

Weed species identified within and in the vicinity of each transect are recorded in Appendix A and summarised in Table 4.

Table 4 Location of target weed species

Target weed species	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6 (Area A)	Transect 7
St John's Wort *Hypericum perforatum*					X	X	
African Lovegrass *Eragrostis curvula*		X	X	X			
Blackberry *Rubus fruticosus* sp. *agg.*		X	X	X	X	X	
Sweet Briar *Rosa rubiginosa*				X			
Cape Broom *Genista monspessullana*						X	

Apr 2014 survey results, X = Nov 2014 survey results

4.10 Targeted species search

An inspection of the area where *Thesium australe* has been previously observed was undertaken in accordance with the related species management plan. The species was not recorded during this survey, nor was the species identified within the adjacent native forest reference site. A small number of weed species were observed including black berry, St John's Wort and Sifton Bush.

4.11 Fencing

Fencing has been established across the study area. All fences appear to be in good condition.

5. Rehabilitation status

A high level brush review of the general status of rehabilitation against performance indicators and completion criteria are summarised in **Table 5**.

Table 5 Status of rehabilitation completion criteria

Performance indicator	Completion criteria	Status
Pasture species composition	Pasture species planted	Complete. Pasture areas continue to support growth of *Coxs River Mix* species.
Rural Land Capability	Pasture rehabilitation areas are assessed to have a Rural Land Capability Class IV or better	Ongoing Pasture groundcover and weed management has improved. Further pasture management and soil ameliorant required particularly Area C.
Exotic weed species	Adequate control of noxious weeds achieved comparable to local area	Ongoing. Management of noxious weeds is consistent with integrated weed management control methods described in Appendix D.
Species richness, species density	Native trees established and progressing towards maturity	Ongoing. Recent treatment of Area A has been very effective in promoting plant growth.
Woodland birds present	Woodland birds utilising area	Pigeon and small woodland birds observed foraging in Area A.
Evidence of mammals	Mammal species observed or evidence (scats) present in rehabilitated area	No evidence of mammals observed utilising the treed or pasture rehabilitation areas at time of survey. Successful mammal sightings are dependent on survey timing. Note that a lack of observation does not indicate an absence of these species.
Evidence of next generation	Evidence of self-seeding and new growth	Ongoing. Self-seeding and new growth observed across pasture and treed rehabilitation areas.
Canopy, mid storey, understorey and ground cover	Evidence of structural layers developed	Ongoing. Structural layers evident within treed rehabilitation areas.
Artificial hollows, crushed timber and rock piles in rehabilitated areas	Nesting boxes installed Crushed timber spread over native forest rehab areas Rock pile clusters	No nesting boxes observed at time of survey, vegetation unlikely to be mature enough. Crushed timber and rock pile clusters present across treed vegetation areas.

6. Key findings and recommendations

6.1 Key findings

Key findings of field surveys conducted in November 2014 indicate that:

General findings

a) Treatment of soil in rehabilitated areas is required to further support plant establishment;
b) Noxious weeds are present in low numbers in all rehabilitated areas;
c) Very dry conditions during the survey contributed to a decrease in species richness and diversity in pasture rehabilitated areas;
d) The was no Thesium australe observed during the survey in the area to the north of the current mining area;
e) Mining activity is not encroaching on the area in which Thesium australe was previously observed;
f) Fencing within the rehabilitated areas has been installed and is in good condition; and,
g) Water management structures such as contour drains, sediment ponds and drop structures appear to be in cod condition with no significant erosion or breaches observed.

Area A - treed rehabilitation area

a) Some surface soil erosion was observed in Area A which has benefited from the previous soil treatment and increased vegetative cover;
b) The treatment of Area A with mulch, lime and gypsum has been very effective in stimulating new plant growth and supporting established species as such structural development and regeneration within treed rehabilitation areas is developing; and
c) Habitat requirements within treed rehabilitation areas have generally been met.

Areas B and C - pasture rehabilitation

d) Pasture rehabilitation areas B and C are composed of a mix of broad leaf, herb and grass species consistent with Cox's River Mix (sown in 2010 /2011) and locally common pasture species;
e) Contour drains are exposed and subject to erosion; and
f) General landform is stable and free draining.

6.2 Recommendations

The following recommendations for mitigation and management are consistent with intervention and adaptive management measures contained within the Pine Dale Mine Care and Maintenance MOP.

Area A - treed rehabilitation area

a) Implement soil and pasture treatment methods as proposed by SLR Consulting (2014) for Area A;
b) Re-sow exposed surfaces with fast-growing groundcover herbs and grasses;
c) Undertake targeted weed spraying and removal of Cape Broom from Area A; and
d) Continue to monitor performance of rehabilitated area

Areas B, C and 8 - pasture and treed rehabilitation areas

e) Continue to implement integrated weed management control methods for noxious weeds. A weed management schedule is provided in Appendix D;
f) Implement soil and pasture treatment methods as proposed by SLR Consulting (2014) for Areas B, C and Area 8;
g) Spread suitable mulch/topsoil over exposed contour drains in Area C and reseed with recommended pasture species mix; and
h) Control spread of Sifton Bush particularly in Area B.

Neubecks Creek

i) Bank stabilisation monitoring should be continued;
j) Additional tube stock planting should be undertaken with suitable native species and follow up maintenance; and,
k) Targeted weed spraying particularly Blackberry is required.

7. References

CSIRO (2009) *Australian Soil and Land Survey Field Handbook*, CSIRO, Australia

Cunningham, G (2012) *Flora Monitoring Report: Pine Dale Mine – February 2010 to November 2010*, Geoff Cunningham Natural Resource Consultants Pty Ltd, Killara NSW

Enhance Place Pty Ltd (2013) *Pine Dale Mine Care and Maintenance Mining Operations Plan*, Enhance Place Pty Ltd, NSW

First Field (2014) *Pine Dale Mine Rehabilitation Monitoring Report*, First Field Environmental.

IECA (2008) *Best Practice Erosion and Sediment Control* Books 1-6.International Erosion Control Association (Australasia), http://www.austieca.com.au/

NSW DPI (2011) *Noxious and Environmental Weed Control Handbook,* New South Wales Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0017/123317/Noxious-and-environmental-weed-control-handbook.pdf

NSW DPI (2013) *Noxious Weed Declarations for Upper Macquarie County Council*, New South Wales Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed/

SLR Consulting (2014) *Soil Assessment and Recommendations for Rehabilitated Areas Pine Dale Mine*, for Enhance Place Pty Ltd

Appendix A

Survey data

Transect 1		
Easting	Northing	
228621	6305093	
228594	6305048	
Landform and soils		
Slope	Transect located within relatively flat area.	
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.	
Species richness	>30 herb and 15 grass species identified.	
Cover classification (%)	Apr 2014	Nov 2014
Total living cover	90%	90%
Annual living cover		
Perennial living cover		
Litter cover	10%	10%
Bare surface		
Target weed presence 2014		
Hypericum perforatum	Present.	
Echium plantagineum	Present	

Transect 2		
Easting	Northing	
228454	6304718	
228400	6304744	
Landform and soils		
Slope	Transect located within relatively flat area.	
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.	
Species richness	>30 herb and 15 grass species identified.	
Cover classification (%)	Apr 2014	Nov 2014
Total living cover	70%	65%
Annual living cover		
Perennial living cover		
Litter cover	30%	35%
Bare surface		
Target weed presence 2014		
Eragrostis curvula	<10%	
Hypericum perforatum	Present.	
Echium plantagineum	Present	

Transect 3		
Easting	Northing	
228267	6304532	
228306	6304560	
Landform and soils		
Slope	Transect located within relatively flat area.	
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.	
Species richness	>30 herb and 16 grass species identified.	
Cover classification (%)	Apr 2014	Nov 2014
Total living cover	80%	80%
Annual living cover		
Perennial living cover		
Litter cover	20%	20%
Bare surface		
Target weed presence 2014		
Eragrostis curvula	~25%	
Hypericum perforatum	Present	

Transect 4		
Easting	Northing	
228318	6304224	
228249	6304227	
Landform and soils		
Slope	Transect located within relatively flat area.	
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Sparse shrub layer. Groundcover dominated by native and exotic grasses. Mixed herbs present.	
Species richness	Shrub layer consists of <5 species, including *C. acuata, Rosa rubiginosa* and *Rubus fruticosus* sp. *agg.* Diverse groundcover dominated by >35 herb species. 19 exotic and native grass species identified.	
Cover classification (%)	April 2014	Nov 2014
Total living cover	>90 %	90%
Annual living cover		
Perennial living cover		
Litter cover	<10%	10%
Bare surface		
Target weed presence 2014		
Eragrostis curvula	~25%	
Hypericum perforatum	Present.	
Rosa rubiginosa	Present.	
Rubus fruticosus sp. agg.	Present.	

Transect 5		
Easting	Northing	
227846	6304272	
227787	6304251	
Landform and soils		
Slope	Transect located along contour of mid slope moderately inclining to the south.	
Erosion	Rill erosion present along slope. Channels becoming evident beneath logs and perpendicular to slope.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Sparse *Cassinia acuata* dominated low shrub layer. Groundcover dominated by exotic broadleaf herbs and exotic grass species.	
Species richness	Shrub layer consists of <5 species, including *C. acuata* and *Rubus fruticosus* sp*. agg.* Diverse groundcover dominated by >40 broadleaf herb and grass species.	
Cover classification (%)	Apr 2014	Nov 2014
Total living cover	<40%	50%
Annual living cover		
Perennial living cover		
Litter cover	>60% bare earth. Thin topsoil. Thin mulch.	50%
Bare surface		
Target weed presence 2014		
Eragrostis curvula	10%	
Rubus fruticosus sp. agg.	Present	
Genista monspessullana	Isolated individuals	

Transect 6		
Easting	Northing	
226604	6304724	
226647	6304706	
Landform and soils		
Slope	Transect located along contour of upper slope moderately inclining to the southwest.	
Erosion	Rill erosion present along slope. Channels becoming evident beneath logs and perpendicular to slope.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Sparse tree layer to 3 m height. Sparse *Cassinia acuata* dominated low shrub layer. Groundcover dominated by exotic broadleaf herbs and exotic grass species.	
Species richness	Shrub layer consists of <5 species, including *C. acuata* and *Rubus fruticosus* sp. *agg.* Diverse groundcover dominated by >40 broadleaf herb and grass species.	
Cover classification (%)	Apr 2014	Nov 2014
Total living cover	<30%	60%
Annual living cover		
Perennial living cover		
Litter cover	>70%	30%
Bare surface		
Target weed presence 2014		
Eragrostis curvula	5%	
Rubus fruticosus sp. agg.	Present	
Echium plantagineum	Present	

Transect 7		
Easting	Northing	
226801	6305097	
226838	6305039	
Landform and soils		
Slope	Transect located along contour of mid slope gently inclining to the southwest.	
Erosion	No erosion observed.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	*Eucalyptus* spp. dominated dry sclerophyll forest with a grassy understorey of mixed native herbs and grasses. Sparse shrub layer.	
Species richness	More than 5 tree species, dominated by *Eucalyptus* spp. Shrub layer of > 7 native species. Diverse groundcover dominated by *Poa* spp. with mixed native herbs.	
Cover classification (%)	Apr 2014	Nov 2014
Total living cover	95%	95%
Annual living cover		
Perennial living cover		
Litter cover	5%	5%
Bare surface		
Target weed presence 2014		
None observed.		

Vegetation assessment

Transect	Transect 5	Transect 6	Transect 7
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	0	Sparse. To 3 m height.	>5 species, 12-14 m height. 20% canopy cover.
Understorey	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species. *Cassinia acuata.*	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species. *Cassinia acuata.*	>7 species, 1-2 m height, 10% cover
Groundcover	<50%. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 60% cover.	Dominated by Poa spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>10, including *Rubus fruticosus.*	>10	<10
Recruitment	0	0	Present
Organic litter	Thin mulch present.	Thin mulch present.	Well-developed to 2 cm depth.
Logs	Large logs placed along contours on upper slope.	Large logs placed along contours on upper slope.	8 fallen logs of >20 cm diameter present along transect.

Appendix B

Species list

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Acacia dealbata subsp. *dealbata*					X	X	X
Acacia spp.					X	X	X
Acaena sp.				X			
Ajuga australis							X
Amaranthus sp.	X	X	X	X	X	X	
Amphipogon carcinus var. *carcinus*				X			
Angophora floribunda						X	X
Angophora subvelutina						X	X
Aristida sp.				X			X
Astroloma humifusum							X
Austrostipa sp.			X	X			
Bossiaea prostrata							X
Brachyloma daphnoides							X
Brassica juncea	X	X	X	X	X	X	
Brassica rapa	X	X	X	X	X	X	
Bromus catharticus	X	X	X	X	X	X	
Bursaria spinosa subsp. *lasiophylla*							X
Callistemon spp.						X	
Cassinia arcuata				X	X	X	

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Cheilanthes sp.							X
Chloris gayana	X	X	X	X	X	X	
Chrysocephalum apiculatum							X
Cirsium vulgare	X	X	X	X	X	X	
Conyza bonariensis	X	X	X	X	X	X	
Craspedia canens							X
Cryptandra amara var. *amara*							X
Cyperus eragrostis			X	X			
Dactylis glomerata	X	X	X	X			
Daviesia leptophylla							X
Desmodium varians							X
Dianella revoluta							X
Dillwynia philicoides							X
Echinochloa esculenta	X	X	X	X			
Echinochloa frumentacea	X	X	X	X			
Echium plantagineum	X	X	X	X			
Eleusine tristachya	X	X	X	X			
Elymus scaber							X
Eragrostis curvula		X	X	X	X	X	

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Eragrostis sp.	X	X	X	X			
Erodium crinitum			X				
Eucalyptus bridgesiana					X	X	X
Eucalyptus cypellocarpa							X
Eucalyptus dives					X	X	X
Eucalyptus mannifera subsp. *mannifera*							X
Eucalyptus piperita							X
Eucalyptus punctata							X
Eucalyptus rossii							X
Euchiton sphaericus			X	X	X	X	
Festuca arundinacea	X	X	X	X			
Gamochaeta sp.	X	X	X	X			
Geranium sp.	X	X	X	X	X	X	
Glycine sp.			X	X	X	X	
Gompholobium huegelii							X
Goodenia hederacea							X
Helminthotheca echioides	X	X	X				
Hibbertia obtusifolia							X
Hypericum calycinum	X	X					

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Hypericum perforatum	X	X	X	X			
Hypochaeris glabra	X	X	X	X			
Hypochaeris radicata	X	X	X	X	X	X	
Juncus spp.	X	X	X	X	X		
Lepidium bonariense	X	X	X	X			
Lepidosperma laterale							X
Leptospermum juniperinum							X
Leptospermum myrtifolium							X
Leptospermum polygalifolium							X
Leucopogon microphyllus var. *microphyllus*						X	
Leucopogon muticus							X
Leucopogon virgatus							X
Lobelia sp.							X
Lolium perenne	X	X	X	X			
Lomandra longifolia							X
Malva sp.	X	X	X	X			
Medicago sp.	X	X	X				
Melaleuca spp.						X	
Melicytus dentatus							X

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Modiola caroliniana	X	X	X	X			
Panicum simile	X	X	X	X	X	X	
Paspalum dilatatum	X	X	X	X	X	X	
Persoonia linearis							X
Persoonia oblongata							X
Phalaris aquatica	X	X	X	X			
Pinus radiata				X			
Plantago lanceolata	X	X	X	X	X	X	
Poa spp.	X	X	X	X	X	X	X
Polygonum aviculare	X	X	X	X	X	X	
Pultenaea hispidula							X
Ranunculus sp.	X	X	X	X	X	X	
Rorippa sp.			X				
Rosa rubiginosa				X			
Rubus fruticosus sp. agg.				X	X		
Rumex spp.	X	X	X	X	X	X	
Setaria gracilis				X	X		
Sisymbrium officinale				X			
Solanum nigrum						X	

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Solanum triflorum						X	
Solenogyne belliodes							X
Sonchus asper	X	X	X	X			
Sonchus hydrophilus	X	X	X	X			
Sonchus oleraceus	X	X	X	X			
Taraxacum officinale	X	X	X	X			
Trifolium arvense	X	X	X	X	X	X	
Trifolium repens	X	X	X	X	X	X	
Trifolium subterraneum	X	X	X	X			
Verbascum virgatum							
Verbena bonariensis							
Vicia sp.				X	X	X	
Wahlenbergia stricta subsp. *stricta*							X
Xerochrysum bractatum							X

Appendix C

Photo point monitoring

Transect 1: looking south, April 2014 (firstfield 2014)

Transect 1: looking south, November 2014 (Enhance Place 2014)

Transect 2: looking southeast, April 2014 (firstfield 2014)

Transect 2: looking southeast, November 2014 (Enhance Place 2014)

Transect 3: looking southwest, April 2014 (firstfield 2014)

Transect 3: looking southwest, November 2014 (Enhance Place 2014)

Transect 4 looking west, April 2014 (firstfield 2014)

Transect 4 looking west, November 2014 (Enhance Place 2014)

Transect 5: looking west, April 2014 (firstfield 2014)

Transect 5: looking west, November 2014 (Enhance Place 2014)

Transect 6: looking east, April 2014 (firstfield 2014)

Transect 6: looking east, November 2014 (Enhance Place 2014)

Transect 7: looking east, April 2014 (firstfield 2014)

Transect 7: looking east, November 2014 (Enhance Place 2014)

Quadrat 1: February 2010 (Cunningham 2010)

Quadrat 1: September 2011 (Cunningham 2011)

Quadrat 1: November 2012 (Cunningham 2012)

Quadrat 1: April 2014 (firstfield 2014)

Quadrat 1: November 2014 (Enhance Place 2014)

BLANK

Appendix D

Integrated weed management schedule

Species	Control class *	Control method	Summer			Autumn			Winter			Spring		
			December	January	February	March	April	May	June	July	August	September	October	November
African Lovegrass *Eragrostis curvula*	4	Flupropanate 745 g/L (trade name *Taskforce*) 300 mL per 100 L of water (note 14 day stock withholding period) **Non-chemical options:** appropriate grazing management	X	X	X							X	X	X
Blackberry *Rubus fruticosus* aggregate species	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(trade name *Grazon Extra*)** 350 or 500 mL per 100 L water **Non-chemical options:** slashing of young bushes and use of biological control agents	X	X	X									X
St. John's Wort *Hypericum perforatum*	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(trade name *Grazon Extra*)** 500 mL per 100 L of water **Non-chemical options:** appropriate grazing management and use of biological agents	X											X
Sweet Briar *Rosa rubiginosa*	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(trade name *Grazon Extra*)** 500 mL per 100 L of water **Non-chemical options:** mechanical removal or grubbing	X	X	X								X	X

* Noxious weed control class